We are IntechOpen, the world's leading publisher of Open Access books
Built by scientists, for scientists

6,900
Open access books available

186,000
International authors and editors

200M
Downloads

Our authors are among the

154
Countries delivered to

TOP 1%
most cited scientists

12.2%
Contributors from top 500 universities

CLARIVATE ANALYTICS
BOOK CITATION INDEX
INDEXED

WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com

Chapter

Conservation Management of Planted Mangroves through Evaluating Ecosystem Services in Baros Village Bantul Regency, Indonesia

Djumanto

Abstract

Planting mangrove trees on sandy land in Baros village into forest conservation has many ecological, economic, social, and tourism benefits for the surrounding community. The mangrove conservation in Baros village is artificial conservation managed by the men and women Baros youth. The coastal area of Baros village is often affected by tidal flooding, which causes losses to agriculture, fisheries, and livestock. In the early 2000s, an NGO assisted at research sites in mangrove restoration in a mangrove restoration area in the lagoon of Baros village to prevent abrasion and sea intrusion and protect agricultural areas. Restored mangroves can grow well to bring ecological, biological, economic, and social benefits. The local government of Bantul has designated the Baros mangrove forest as a reserve of a coastal park conservation area. The existence of the tree is beneficial ecological, biological, economic, and social. The Baros village youth group made various efforts to increase mangrove trees' area so that their benefits were sustainable. Managers and the village government and tour guides are expected to accommodate the existence of culture and local wisdom. Also, increasing community participation, fisheries, agriculture, and animal husbandry activities can provide socio-economic benefits for the community and the wider community's welfare.

Keywords: community, diversity, ecotourism, youth group, Yogyakarta

1. Introduction

Yogyakarta is one of the fourth most considerable cities in Indonesia by population, located in the southern part of the Java island. It became the capital of the Republic of Indonesia in January 1946–August 1950. It became a Special Province of Yogyakarta because of its enormous role in the founding of the Republic of Indonesia. It is a province that has many nicknames, namely as a student city, cultural city, tourist city, culinary city, artist city, batik city, palace-city, traditional market city, warm city, bakpia city, and so on.

Yogyakarta has a variety of tourist and cultural attractions that are very interesting to be visited and enjoyed by local and foreign tourists. Tourist attractions in Yogyakarta are quite complete, ranging from ecotourism, natural attractions such as beaches and mountains, historical tourism, religious tourism, shopping tourism, culinary tourism, and cultural tourism. Therefore, Yogyakarta ranks second as a tourist destination after Bali Island. Besides having full tourism potential, it also has several beautiful and challenging natural environments. One of them is the Merapi-Kaliurang lava tour, the off-road jeep Merapi lava tour, which is also an attraction for tourists to visit and try it. Some of these attractions include an excellent warm air climate, stunning views of the sandbanks, a culture that is still profoundly engraved with its people, and the friendliness of its citizens [1].

Bantul is a regency city located on the southern side of the Special Province of Yogyakarta. It has a 16.8 km long beach, which is very interesting as a tourist spot and various other activities. One of the tourist attractions is the sandbank or dune along the south coast with a width of 1–2 km. Residents partly use the dune area as a sultan ground for agriculture, animal husbandry, fisheries, tourist areas, and conservation areas. Local people also plant with evergreen shrimp trees (*Casuarina equisetifolia*) for a protector of crops and shade for visitors or tourists. Also, some areas of the southern coast of Bantul serve as turtle landing areas for laying eggs. Species of turtles that often land are hawksbill turtles (*Eretmochelys imbricata*), curved turtles (*Lepidochelys olivacea*), green turtles (*Chelonia mydas*) and leatherback turtles (*Dermochelys coriacea*). They use Pelangi Beach Depok, Samas Beach, Goa Cemara Beach, and Baru Pandansimo Beach as landing points for laying eggs. Furthermore, some people who are members of nongovernmental organizations carry out turtle conservation by saving and hatching to be released into the sea after they are old enough [2].

Bantul beach also has a natural attraction with the presence of mangrove forest conservation areas in the village of Baros. Administratively, the mangrove forest located in Baros village, Kretek sub-district, Bantul regency. The Baros Mangrove Conservation Area situated between Depok beach and Samas Beach in Yogyakarta. The mangrove forest is a conservation area that was initiated by the family of Baros young women (KP2B) since 2003. The Baros coastal area is planted with several types of mangroves, *namely Avicennia lanata, Avicennia officinalis, Nypa fruticans, Rhizophora mucronata, Rhizophora stylosa*, and *Sonneratia caseolaris*. The plants are used for area conservation due to natural disasters, such as coastal abrasion, crop failure, drought, intrusion, tsunami threats, and high salt levels that make crops wither. Natural hazards that routinely hit Baros beach have made people aware of cheap and durable natural protection. The position of Baros beach, which is at the mouth of the Opak river, causes various types of waste to be stranded on the beach, for example, wood debris. The community processes wood debris waste into high-value decoration. Besides, the Baros youth family collaborated with NGOs of Relung initiatives to carried out mangrove planting and various other coastal plants. With the existence of environmental conservation activities in Baros Beach, Baros's youth family has increasingly gained the community's trust in managing the environment of the Baros village sustainably [3].

Baros mangrove conservation ecosystem is a dynamic area that has biotic and abiotic resources. Biodiversity consists of birds, land animals, terrestrial plants, mangroves, aquatic biota, while abiotic natural source includes lagoons, sandy beaches, river mouths. The area behind the mangrove is for agriculture, animal husbandry, and fisheries. Various components interact and are interdependent with each other, which has great potential in supporting the community's economy, so it must be managed optimally and sustainably [3]. The Baros mangrove

conservation area can have a positive impact on the surrounding community, including the following: (a) improve the economy of the surrounding community. (b) They are protecting rice fields from abrasion. (c) Protecting crops from the brunt of sea salt. (d) Opening job opportunities and new business opportunities. (e) Increasing public awareness to protect and preserve the environment, (f) Providing social, economic, and physical comfort. (g) Foster a sense of ownership of mangroves for community members. And (h) open networks with government, NGOs, universities, communities, and stakeholders to manage mangroves.

The conservation mangrove area of Baros is an artificial natural tourism area that has very diverse natural resource potentials, but its management is not yet optimal. It is necessary to study their resource potential, the obstacles faced by managers, and opportunities for their development. This paper aims to identify the benefits of the existence of mangroves, and opportunities to increase their profits and sustainable management strategies while still considering their natural protective and coastal functions. Besides, it is as a reference for policymakers. It can add insight into the importance of mangrove forests as a natural tourist attraction as a place of learning to foster public awareness of the sustainability of mangroves.

This paper was written based on field observations, interviews with the KP2B management, and Baros village officials, research results, and based on literature studies from various sources. Data or information from resource persons is analyzed descriptively to get an understanding of the level of mangrove utilization for the Baros village community and the role of the society in maintaining the sustainability of coastal ecosystems, as well as providing input for Baros mangrove conservation managers.

2. The benefits of Baros mangrove ecosystem

The mangrove forest ecosystem in Baros is an essential natural resource located on the southern coast of the Baros village and the west side of the Opak river estuary. The ecosystem has four main functions, namely, physical, biological, economic, and social services. The physical service is as a windbreak, filtering pollutants coming from upstream rivers and the sea, anchoring waves and rising tides, flood protection, waste repellent, and preventing seawater intrusion to land. The biological function is as a place for the parent and larvae of aquatic biota that is to spawn (spawning ground), nursery ground, and as a place to find food (feeding ground) for fish and other marine biotas. The direct economic function is as a producer of wood for building materials and industrial raw materials, food and medicines, animal feed sources, a place for grazing and raising poultry. The indirect economic function is for tourist attractions, places of education, research, its existence can protect crops. Also, mangroves become primary producers, forming stable microecosystems between marine and terrestrial ecosystems. The social function is the existence of mangroves capable of bridging the formation of social groups of Baros youth families, breeder groups, farmer groups, marketing women's groups [4]. The existence of mangroves on the Baros coast can provide ecosystem services directly and indirectly. For example, direct services filter out dust and salt vapors, provide oxygen, provide shade for visitors, and protect beaches. For example, indirect ecosystem services preserve agricultural, livestock, and fisheries areas, and prevent seawater intrusion.

The existence of mangroves is a characteristic of the coastal area, however the Opak estuary and the Bantul coast until 2003 were in the form of a very dry and

unproductive dune. Furthermore, starting in 2003, some university students in Yogyakarta, NGOs, and the local community planted several species of mangrove trees. Since then, the mangrove area has slowly increased. Mangrove tree seedlings transported from the city of Cilacap, which was 170 km from Bantul. The Species of mangrove seedlings planted were *Rhizophora* sp., *Bruguera* sp., *Nypa* sp., *Soneratia* sp.

The Regent of Bantul in 2014 issued Decree No. 284 of 2014 concerning the Reserve of Conservation Areas for Coastal Parks in Bantul Regency [5]. The Baros mangrove forest area is designated as a conservation area with a total area of 132 hectares divided into three zones, namely the core zone (10 ha), transition zone (94 ha), and buffer zone (28 ha). The Baros mangrove forest's current area is still less than 10 hectares, so a gradual expansion is needed. The development of the mangrove forest area is carried out by planting mangrove seedlings that are propagated in locations or transported from other cities (**Figure 1**).

2.1 The physical existence benefits

The existence of mangroves on the Baros beach will provide many benefits to the surrounding ecosystem directly or indirectly. The direct benefits of the mangrove

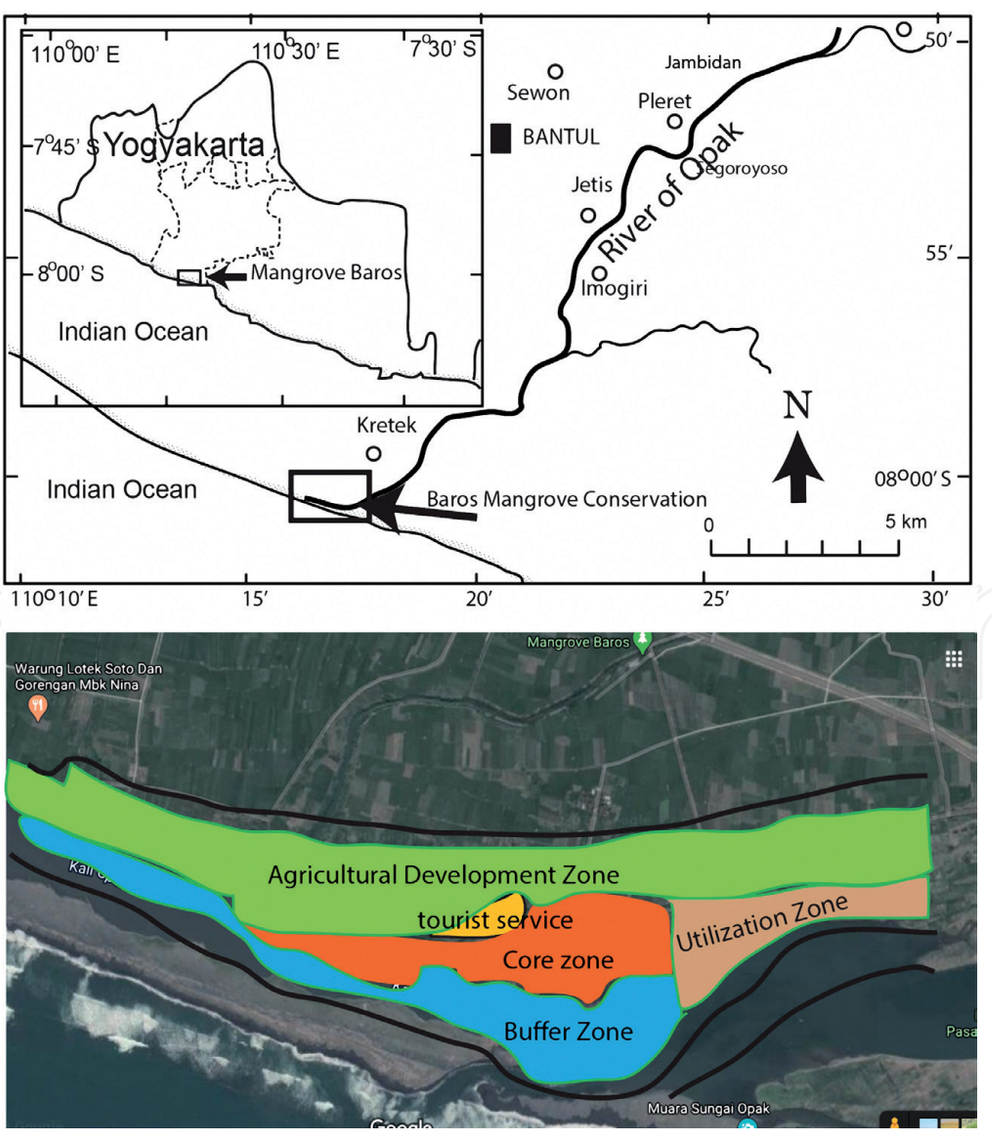

Figure 1.
The map shows the reserving area of coastal garden conservation area in Bantul regency. The zone consists of a 10-ha core zone, a 28-ha buffer zone, and transition 94-ha zone.

ecosystem as a habitat, as a protection, and source of raw materials. Indirect benefits provide a fresh ecosystem, provide food, absorb carbon, and provide nutrients for aquatic organisms.

2.1.1 Mangrove as a habitat

Baros mangrove ecosystem becomes a habitat for various species of native or migratory birds, living temporarily or permanently. Mangroves provide space for birds to breed and maintain their chicks. Species of birds found before mangroves are only a few species, for example, Blekog Sawah (*Ardeola speciosa*), rice field finches (*Lonchura punctulata*), finches (*Pycnonotus aurigaster*), etc. Blekog sawah comes during the growing season, while rice field finches come just before the rice harvest. After the mangrove area planted, various types of birds stopped by permanently or in-migration. Every rice planting season, several species of birds will migrate alternately [5].

The presence of birds in the Baros mangrove area can be an indicator of functional space. The number of bird species increases due to the availability of material to make nests, and there is no disruption to birds. Water birds are the dominant bird species in the mangrove area because mangroves provide habitat for feeding, breeding, and growing chicks. The species of birds that found are Java bondol (*Lonchura leucogastroides*), Peking bondol (*Lonchura punctulata*), and beach trinil (*Trunga hypoleucos*). The bird is active in mangrove trees of *Avicennia alba* and *Rhizophora apiculata*. The number of bird species in the Baros mangrove found as many as 21 families consisting of 48 species [5].

2.1.2 Mangroves as coastal protection

The existence of mangroves can protect the coastline, crops, and groundwater. (1) A robust mangrove root system helps to form a natural barrier against storm surges and floods [6], trapping river and terrestrial sediments [7], thus protecting coastline areas and slowing erosion. (2) The presence of mangrove plants can reduce and affect airflow. The sea breeze that blows hard will decrease its speed after passing mangrove plants. Strong winds that blow directly can break the branches and leaves of vegetable crops. Also, high salt levels contained in the sea breeze will be absorbed by mangrove leaves so that the salt content also reduced [8]. Mangrove plants are resistant to salt, while crops are very vulnerable. Sea breeze with high salt content can kill crops. Salt carried by the sea breeze will stick to vegetables. Salt is absorbing water so that salt attached to plants will absorb plant water, which can cause plants to wither. (3) The existence of mangroves can withstand the flow of seawater through a healthy root system so that saltwater does not intrude on agricultural land. The farm area behind the mangrove is protected and can be used for farming. Farmers can plant crops only once per year before there are mangroves, but now thanks to mangroves, agriculture can be done 2–3 times per year [4].

2.1.3 Mangrove as source of raw materials

Coastal communities use plants in mangrove ecosystems for various purposes, namely as medicinal materials, firewood, animal feed, building materials, decoration materials. (1) Daruju or Mountain Thistle (*Acanthus montanus*) is a bush that grows in the Baros mangrove ecosystem (**Figure 2**). This plant has a unique shape, large-toothed leaf edges, and sharp edges. The leaves are shiny green and slightly yellowish. People use daruju seeds for stomach worming and cough

Figure 2.
(A) The community uses the leaves and seeds of daruju (Acanthus montanus) as a traditional and herbal medicine for several types of diseases. (B) The daruju that grows on the edge of the lagoon to form thickets as a hiding place for fish larvae.

medicines. Also, shrimp farmers use daruju leaves to treat white disease in their shrimp. (2) Baros residents easily find a lot of dry wood scattered on the beach. The wood comes from the headwaters or the sea carried by the waves. Timber from the headwaters of the river is for firewood, while wood from the sea becomes driftwood. Driftwood is wood that has long been adrift in the sea. Driftwood has a definite, dry, lightweight, and unique shape, so it is suitable for decoration raw materials. They separate wood into driftwood and firewood. Good quality driftwood is used as raw material for handicrafts, while low quality is used as firewood. Conservation area managers forbid anyone from collecting mangroves for firewood. Firewood and driftwood are sold to collectors, making it a household income. (3) Mangrove leaves and grass contain a lot of protein so that it can be used as animal feed ingredients. *Avicennia* sp. can be used for animal feed. In addition, grass that grows around mangroves is also collected as animal feed. Cattle farmers often have difficulty in getting forage feed, especially in the dry season. The presence of grass in the Baros mangrove ecosystem can be an alternative source of animal feed. In Baros, there is a group of breeders with around 35 cows, some of which have green grasslands in the form of grass from the Baros mangrove area. (4) Mangrove wood has a waterproof and robust character, so it is suitable for building materials or ship materials. Large mangrove stems can be used as household building materials. Mangroves that are already high enough can be used as blocks for housing construction [9].

2.1.4 Providing fresh air

Mangrove in Baros is in excellent condition with the color of fresh green leaves, and no damaged mangroves are found. The distance between trees is less than two meters, which is classified as dense and has a high enough biomass potential. A healthy tree has healthy chlorophyll so that during photosynthesis, it can produce a lot of oxygen. Mangrove forests can produce oxygen (O_2), which is essential for life. The existence of mangrove forests in Baros becomes so important and attracts people to visit [9]. Every month there are around 700–1000 people visit the Baros mangrove forest to feel healthy ecosystems and fresh air.

2.1.5 Providing food

Mangrove ecosystems can support food security by providing food that is an aquatic biota that lives in the mangrove ecosystem, and food that is processed using mangrove plant parts. Mangroves can produce substantial amounts of organic material as food. The use of mangroves as a food source can improve family nutrition.

The existence of mangroves becomes very important in the life cycle of various types of fish, shrimp, shellfish, mollusks, and other aquatic organisms. Many kinds of shrimps and crabs that have economic value utilize mangroves as nurseries. Many species live in mangroves or visit temporarily in young stadia using mangroves to find food. The existence of good mangrove forests will support the life and production of marine biota that can be used as a source of food for the community [5].

2.1.6 Absorption carbon

During photosynthesis, mangroves absorb CO_2 gas from the atmosphere and convert it into organic carbon, then stored as carbon biomass in roots, stems, and leaves. The amount of CO_2 used by mangroves has a positive relationship with the total amount of biomass. CO_2 gas that is absorbed is getting more significant when the mangrove plants are getting denser. The results of photosynthesis are used for horizontal and vertical growth. The larger the diameter of the tree, the higher the CO_2 gas absorbed by the tree to be converted into organic material. Mangrove forests store more carbon than most tropical rain forests [10].

2.1.7 Providing nutrients

Mangrove provides organic material and nutrients through the production of litter. Litter production is an important part of the transfer of organic matter from vegetation to the soil. The nutrients produced from litter are essential in the growth of mangroves and as a source of detritus for estuary ecosystems in supporting the lives of various aquatic organisms. Mangrove litter productivity is a source for fishery's productivity in estuaries and contributors of nutrients to the surrounding waters. It makes mangroves play an important role as a nutrient cycle chain for aquatic organisms. Mangrove plants are a potential food source, in various forms, for all the biota that live in the mangrove ecosystem. The basic component of the food chain in the mangrove ecosystem comes from mangrove plants that fall into the litter. Mangrove leaves provide many benefits to the surrounding organisms. Mangrove leaves contribute 81% of the total litter production, while the rest comes from twigs and plant reproductive organs [11]. As much as 5% of the total leaf production is consumed directly by herbivorous organisms, while 95% enters the aquatic environment as detritus. Mangrove dominated by Rhizophora sp. with a high density can produce an average of a litter of 4.05 g/m^2/day. Nutrient potential production from litter produced is C = 0.35, N = 0.009 and P = 0.0008 g/m^2/day [12].

2.2 Biological function

One of the essential functions of mangrove forests is biological functions, namely, their ability to support life around them. The biological function that is carried out by the Baros mangrove forest is as a spawning ground, nursery ground, and feeding ground for aquatic biota, as a natural habitat and to provide food. Some fish species that migrate or settle in the mangrove ecosystem may spawn, care for their offspring, take refuge, or find prey [13].

Species of fish inhabitants of the Baros mangrove ecosystem based on their ability to adapt to salinity are grouped into three, namely the original inhabitants of freshwater, brackish water, and marine species. The number of fish species found in the mangrove ecosystem is 36 species consisting of 3 brackish water species, 11 freshwater species, and 22 marine species [12].

2.2.1 Spawning ground

The Baros mangrove ecosystem experiences changes in salinity that occur every day. Extreme changes in physical parameters affect the number of fish species that can adapt to brackish water. Brackish water species are species that all stages of life exist in brackish waters. Brackish water species are the least amount compared to seawater or freshwater species. This species uses brackish or mangrove water ecosystems to breed, care for, and raise their offspring [3]. This species is most vulnerable to extreme physical and chemical changes in brackish waters. Efforts to improve mangrove ecosystems can save the survival of brackish water species. Brackish water species found in the Baros ecosystem are *Acentrogobius caninus*, *Ambassis interrupta* and *Glossogobius giuris*.

2.2.2 Nursery ground

Freshwater and marine fish species found in the mangrove ecosystem are mostly in the larval stage. Eggs that hatch into larvae spawned in the sea or upstream of the river are carried by currents to reach the mangrove ecosystem by utilizing tidal or river flow. The waters of the mangrove ecosystem provide habitat for larvae protection. Besides, the mangrove ecosystem is very fertile so that it can provide food for aquatic biota larvae stage. The proportion of larvae of marine species is more than that of freshwater species. The Baros mangrove ecosystem is essential as a nursery ground for most economically important marine fish, such as snapper, mugil, and sardine [3].

2.2.3 Feeding ground

The number of species and individual fish in the juvenile stage is higher than in the young fish stage. Omnivorous and detritivores groups dominate fish in the immature stage. Mangroves, as first-rate producers, can produce large amounts of detritus from leaves and twigs. Mangrove ecosystems can provide organic nutrients that fertilize brackish water, the more mangrove trees, the higher leaf litter production. The number of leaves that fall will produce more detritus. The more leaf waste is produced, the more food is available. Mangrove ecosystems and health conditions affect the capacity of young fish to feed in mangroves. The healthier mangrove ecosystems, the more able to accommodate fish biomass [3].

Season and water conditions affect the abundance of juveniles in mangrove ecosystems. The number of biomass and young fish species is found more in the rainy season. The amount of available nutrients is more abundant in the rainy season. Likewise, most fish species spawn in the rainy season. The abundance of juvenile fish is also affected by the lunar cycle. In the full moon and new moon, the juvenile number is less.

2.3 Economic function

Baros mangrove ecosystem has an economic function or economic value. The commercial service is the role value of mangrove forests in creating employment for

the community, so they have income. Economic value shows the role of conservation of mangrove resources in producing activities that can be valued. Economic value includes the amount of utilization and nonvalue utilization of resources. Utilization value consists of the direct amount of use, the indirect cost of use, and the value of choice. Nonutilization value includes the value of existence.

Direct use value is the value obtained from the production of goods that is resulting from the direct utilization of resources. The direct use value includes the use of wood and the capture of fishery commodities in the mangrove area. Indirect use-value is the value assigned to the benefit of resources in the environment. Indirect use values, for example, the cost of mangrove areas as a barrier to seawater intrusion, and the amount of a wall as waves, or other environmental benefits felt by the local community. The choice value is the benefit value of a resource that is stored or maintained for future use. The choice value is the value of the biodiversity of mangrove flora and fauna. The existence value is the value given by the community to resources for the various benefits [4].

The total economic benefit value of the Baros mangrove area is $ 14,846 US ha/year. The direct economic benefits value of $ 1738 US ha/year, and the indirect economic benefits value of $ 11,615 US ha/year. The optional benefits value about $ 15 ha/year. The existence value for $ 1478 US ha/year. The highest percentage of economic benefit value is the indirect benefit of the mangrove area at 78.2% [4].

2.4 Social function

Social service is the role of mangrove forests to improve the welfare of life or improve the social welfare problems of local communities. The social function of the Baros mangrove is closely related to the formation of the family of Baros young women (KP2B) in the 80s. KP2B members are all Baros villagers who are in first grade of high school. KP2B, in collaboration with NGO Relung in 2003, initiated the planting of mangrove trees in Baros Village. The purpose of planting mangrove trees is to protect the village from the threat of abrasion, intrusion, and tsunami and to protect plants from blowing sea breezes high in salt, which causes crops to wither.

The family of Baros young women empowers citizens to play an active role in improving their welfare by forming five working groups. Workgroup activities are related to mangrove conservation. The working groups formed are Avicennia working group, Mino Tirtohargo, Andini Lestari-Karya Manunggal, Mangrove Farmer Group Association—Women Farmer Group, and Processing and Marketing Group.

Each working group conducts a business that supports mangrove sustainability. They are namely (1) Avicennia working group does business in the field of processing marine driftwood waste. (2) The Mino Tirtohargo working group conducts fishing activities. (3) Andini Lestari-Karya Manunggal working group conducts business in cattle and duck farming. (4) A joint working group of farmers—women farmer groups carrying out agricultural activities. (5) The processing and marketing working group carries out learning activities and consumption services in the form of traditional food. The actions of each working group are as follows.

Avicennia's working group activity is an effort to process driftwood waste into handicrafts with artistic value. This effort is motivated by concerns about the amount of garbage in the Baros mangrove area. Garbage often covers or breaks young mangroves, thus disrupting mangrove conservation efforts. Driftwood is wood waste that has long been oscillated in the sea and then stranded in mangroves or beaches. Processing driftwood waste is an effort to reduce garbage and to increase income. Driftwood waste processed into handicrafts with high

artistic value. The final product processed driftwood is a type of craft items in the form of wall displays, wall clocks, decorative lamps, tissue boxes, miniature Christmas trees.

The Mino Tirtohargo working group carried restocking of mangrove crab and fishing. The crabs find food, grow and breed in the mangrove area. Mangrove crabs can grow well and reproduce in areas with mangrove areas. Stocking crabs can increase the stock and catch of fishermen. Before doing restocking, fishermen get small crabs in the dry season only. After restocking and mangrove have grown well, fishermen can get crab catch every day. Restocking is also carried out by universities to increase fish stocks and fishermen's catches. The fish stocked is milkfish (*Chanos chanos*) in the year of 2014 at the amount of 20,000 individuals. Milkfish restocking aims to increase fish stocks as fish consumption catch and fishermen income. Milkfish restocking is done by considering that the Baros mangrove area is a suitable habitat for milkfish. Milkfish restocking can balance the population structure of the mangrove ecosystem.

The Andini Lestari working group conducts a cattle breeding business using group cages. The location of cattle farms is in an integrated livestock utilization zone adjacent to the agricultural land and the Baros mangrove area. Andini Lestari's working group has 35 units of cages with three types of cows, namely Simetal, Lemusin, and Java, which are managed in an integrated manner. Cattle are fed grass obtained in the Baros mangrove conservation area, to increase household income.

Manunggal working group works in the field of raising ducks using a cage. It is located in the ranch area to the north of the Baros mangrove forest. Breeders herd ducks during the day in the mangroves, so the ducks get natural food and nutrients. Ducks are herded into cages in the afternoon, so ducks lay eggs at night in pet cages. The eggs are then processed into high-quality salted eggs.

Working groups of Farmers and Women Farmers are active in agriculture. They grow agricultural commodities, which include vegetables, shallots, and rice. Each type of agrarian product has a different treatment and planting period, for example, vegetables 40–50 days, onions 50–60 days, and rice 90–110 days. Rice farming activities are carried out in groups such as plowing soil, planting rice seeds, cleaning weeds, and harvesting rice. The location of agricultural land is in an integrated agrarian zone. This location is behind the mangrove, so it is protected from the sea breeze [3]. The existence of mangroves can protect integrated agricultural areas from exposure to sea breezes and tidal floods.

The Processing and Marketing working group consists of mothers who provide lessons on traditional cooking and guest consumption services. The types of traditional cuisine taught are typical village dishes, namely Cucur, Adrem, Rempeyek Udang, Nasi Wiwit. Baros traditional food is served to support mangrove ecotourism activities. The process of making traditional food is part of the mangrove ecotourism material. Traditional cuisine guides are mothers of traditional cake craft craftsmen.

3. Problems encountered

Baros mangrove forest managers face several obstacles to maintain environmental and forest health. The management of the KP2B organization often faces many obstacles in managing conservation areas, but the most prominent is the management of waste and the quality of human resources. Constraints or problems in managing mangrove conservation areas are mostly from outside, and a small portion is from local locations. Some limitations and solutions are explained below.

3.1 Garbage disturbance

3.1.1 Rubbish characteristics

The Baros Mangrove Conservation Area is in the lagoon of the Opak river and south of the village of Baros. The headwaters of the Opak river are located on the slopes of Mount Merapi, stretching from north to south. This river has a flow length of about 65 km and an area of flow of about ±1398.18 km^2. The river flows through the city with a population density of around 1194 people/km^2, carrying garbage from settlements and agriculture, consisting of various types and shapes. The volume of waste that has accumulated in the Opak river estuary is increasing, making it a scourge for mangrove conservation area managers [14].

Garbage piles at the Opak river mouth come from residents along the riverbank and residents in the village of Baros. Garbage contribution from residents along the riverbanks is estimated at 1800 kg/day or 180 m^3/day, whereas the contribution of rubbish from Baros villagers is estimated at 1000 kg/day or 100 m^3/day. Total garbage accumulation in the river mouth is expected to reach 2800 kg/day or 280 m^3/day. Types of waste consist of plastic, rubber, Styrofoam, cans, wood, glass, cloth. The most dominant type of waste is plastic, then timber, and the least is cloth [15].

Garbage scattered along the coast of Baros originates from upstream rivers and debris carried by seawater. The volume of waste increases when river water overflows during high rainfall. Every rainy season arrives, household rubbish that settles at the bottom of the river then flows with the river flows toward the beach. Waste that flows directly into the sea will eventually be pushed by the waves back to the beach so that, in the end, the beach is full of rubbish. Every high rainfall and abundant river flow, the waste carried from the river to the sea will increase.

3.1.2 Garbage management

The main problem in dealing with garbage is to change the paradigm, behavior, and public awareness. The community views waste as something that is useless and has no value. Society considers waste as everything that is thrown away, rejected, ignored, unwanted material, or worthless. This mindset must be straightened out so that it considers garbage as a valuable object. Those who are involved in the work of utilizing waste are slogan "in your opinion, the things you have disposed of are rubbish, but for us, these items are a blessing for life." We must see waste as raw material or material that has economic value. Abundant waste can be processed into objects that have artistic value or sale value. Communities must be able to manage waste by recycling, reusing, purifying, or purifying [16].

Garbage that scattered along the coast of Baros consisting of organic and inorganic materials. Types of organic waste, such as used wood for household furniture, can be recycled into valuable items. It is improving by changing used materials into useful new articles and of economic value. Recycling can reduce the volume of waste, minimize the use of new materials, reduce the cost of producing goods, increase household income, and create new jobs. Recycling begins with the activity of sorting waste, grouping similar goods, processing into new products. The rest of the recycled material can be used for firewood so that all organic waste is used up. Production goods can be sold to tourists as souvenirs, furniture stores, or exported.

The most inorganic waste is plastic used food envelopes, beverages, and household needs. Plastic has many advantages compared to other materials, for example, cheap, durable, lightweight, resilient, strong, so that dependence on plastic is very high. Each person, on average, discards plastic as waste as much as 0.45 kg/day, while waste production is as much as 0.9 kg/day. Plastic waste reaches 20–25% of all

types of inorganic waste. Plastic waste mostly causes the death of young mangroves by covering leaves or breaking stems. Also, seedling cannot grow if the space is occupied by plastic or other rubbish. Plastic waste management is done by reusing, recycling, and making other products. Reusing plastic waste, for example, used plastic bottles for sowing mangrove seeds, gallon bottles for vertical cultivation of vegetable crops. Plastic waste that is completely unused, it can be melted down to make new products, such as flower pots or other products [9].

3.2 Human resources quality

Human resources play an essential role in the successful management of the Baros mangrove conservation area. Conservation area managers need someone who has the determination and love for the environment, innovative and creative. Love of a healthy environment will make someone persistent in saving plants as the lungs of the world. The population of Baros village who completed education to graduate from high school was 42%, while those who graduated from college were 8.8% [4]. The learning average of Baros residents is junior high school graduates, so they are classified as common knowledge. Although the average learning level is moderate, they have high innovation and creativity. Skilled human resources are needed to realize the creation of an independent and sustainable mangrove conservation area. Creative human resources are required to face various challenges in managing mangrove areas.

A manager is a group of people consisting of the head of the Baros youth group, village heads, hamlet heads, and elders to manage the Baros mangrove conservation area. Compact managers can take advantage of mangrove forests optimally and sustainably. Mangrove managers need skilled human resources capable of creating healthy mangrove conservation areas. Improving the quality of HR education is very influential in the successful management of natural resources. Some ways to improve the quality of human resources can be through formal and informal learning. Also, human resource development can be achieved through skills training, certification, or competency testing. Residents can certify as managers of marine and fisheries conservation areas. National standardization professional bodies carry out certification and competency tests for those who need them for free.

4. Mangrove management strategies

The Bantul Regency Government has designated the Baros mangrove forest area as a coastal park conservation area. Conservation areas with reserve status indicate a minimum level of management. The government has not allocated funds to carry out activities and has not formed an organizational management unit following the provisions. Bantul has a mangrove forest conservation area of 132 ha, which is managed by the zoning system. The area of each zone is a 10-ha core zone, a restricted use zone of 28 ha, and the other zone is 94 ha. The next step is to make a management plan for the Coastal Park-Conservation Area in Bantul Regency [17]. The area management plan must be implemented to accommodate the interests of many parties while maintaining the minimum negative impact.

The development of conservation areas is directed to ecotourism activities based on mangrove conservation. Mangrove conservation is managed by continuing to plant mangroves until the plant covers all core zones. However, mangrove planting must consider the representation of mangrove plant species to produce high biodiversity of mangroves. High diversity and plant density can increase the heterogeneity of animals and aquatic biotics. At present, there are 25 species of mangrove

plants, 48 species of birds, and 36 species of fish [4]. Mangroves that need to be propagated are red pedada (*Sonneratia caseolaris*) and perepat (*Sonneratia alba*). These plants quick increase, local plants, so they are adaptable, have many biological and ecological benefits. However, the local community has not been able to seed, and the success rate of plants is low. Conservation area managers as well researchers must collaborate with the government and other parties to increase the diversity of mangrove species via restoration.

The next step is to empower all levels of society to be actively involved in supporting the success of ecotourism. Farmers cultivate various types of plants under local conditions as an attraction. Farmers do livestock activities according to the rules, so it is interesting to be visited and carried out by visitors. Production of traditional food preparations is carried out following health standards, and produces attractive products, and is characteristic of the village of Baros [16].

The next step regulates the zonation of mangrove areas so that the available land use is following its purpose. The goal is that there is harmony between the mangrove area and other designation areas, such as agricultural, livestock, and fishery areas. The existence of mangroves can protect agrarian crops from tidal flooding, seawater intrusion, and a strong sea breeze. Also, mangroves are home to various species of birds that can help farmers cope with pest attacks. Conversely, agricultural activities can support the lives of birds by providing prey hunting grounds [18]. Managers need to invite experts to provide education to local communities about the life of birdlife, fish biota, and mangrove ecology, to create harmony in the mangrove ecosystem with its environment.

Sustainable mangrove management strategies by carrying out ecotourism activities that integrated with other businesses under their designation. Ecological tourism activities that combine various attractions by involving different sectors, namely forestry, agriculture, fisheries, and animal husbandry. The forestry sector presents a scene of observing the diversity of mangroves, the ecological role of mangroves as a buffer for the environment, the variety of bird species. Various attractions can be carried out in the core zone, for example, observing bird behavior, planting mangroves, arranging mangroves, and researching the diversity of aquatic biota. In the field of agriculture, it can present the attraction of farming activities in the utilization zone as well as the observation and introduction of crops. The fisheries sector can show the attractiveness of raising fish in ponds, spawning, breeding, harvesting fish. Fisheries activities in the utilization zone can provide fish restocking, crab restocking, and fishing activities. Animal husbandry activities can present attractions offering livestock activities, for example, feeding, harvesting livestock products [2].

Managers need to do promotions so that the number of tours increases. However, an increase in tourists must be followed by an increase in services. It is necessary to conduct a study of the capacity of tourist visits to achieve maximum capacity and satisfaction. Mangrove managers can collaborate with a competent institution to survey tourist carrying capacity. The results of the study can provide information on the time and number of visits, set the types of attractions, and information on facilities for tourists and tourism service managers. The results of the carrying capacity study were disseminated to stakeholders to get responses.

One of the critical jobs that must be done for conservation area managers is to collaborate with stakeholders that can have a positive impact. Besides, good governance can have a positive effect on management performance and increase revenue and generate economic activity in conservation areas and people's purchasing power. Guidance to the community so that an increase in income will have an impact on raising public awareness in supporting the preservation of regional resources.

5. Conclusions

Mangrove forests can directly act as coastal protection, storm barriers, strengthen coastal areas for sea wave disturbance, and control coastal erosion. Mangrove restoration measures can build resilience in coastal communities, reduce storm disruption, tidal flooding, and high wave disturbances, and protect surrounding agricultural, livestock, and fishery areas. Mangrove conservation areas can provide welfare and provide new jobs for the surrounding community, as a source of food, food, medicinal materials, and habitat for terrestrial and aquatic animals. Healthy mangrove areas can provide ecosystem services that can generate economic activities for the community and stakeholders.

The management strategy of Mangrove Baros is by implementing ecotourism, integrated with other companies that are mutually beneficial, arrangement of the tourist area so that it can attract visitors by providing tracks to explore the mangrove area, provision of complete public facilities, transportation, health, and safety facilities, and the addition of various attractions that are interactive with visitors. The attractions are adjusted to the interests of visitors.

Conservation managers need to accommodate research and development interests related to the area to support management activities. The use of conservation area resources considers all benefits and does not harm the inhabitants. Agricultural activities, fisheries, and livestock in conservation areas are managed to the maximum to provide socioeconomic benefits to the community. Collaboration with partners is crucial to create economic activities and increase stakeholder income.

Acknowledgements

The author would like to thank Mr. Dwi Ratmanto for providing information about the management of conservation areas in the Village of Baros. This paper is part of research activity on fish communities in the mangrove conservation area of Baros Village, Yogyakarta Special Province.

Conflict of interest

The authors declare no conflict of interest.

Author details

Djumanto
Aquatic Resources Management Laboratory, Department of Fisheries, Faculty of Agriculture, Gadjah Mada University, Indonesia

*Address all correspondence to: lely4192@yahoo.com

IntechOpen

© 2020 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/3.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

References

[1] Suparwoko W. Tourism development in Indonesia. In: Towards Responsible Tourism: A Community-Based Approach to Tourism Development in Indonesia. Saarbrücken, Jerman: Lambert Academic Publishing (LAP); 2012. pp. 62-68

[2] Budiantoro A. The sustainable ecotourism potential development with special reference to Oliveridley Sea turtle (*Lepidochelys olivacea*) along Bantul beaches, Indonesia. IOP Conference Series: Earth and Environmental Science. 2019;**391**:1-11. DOI: 10.1088/1755-1315/391/1/0120692

[3] Purwaningrum H. Development of mangrove forest ecotourism Baros village, Titihargo village, Kretek district, Bantul regency. Journal of Tourism and Economic. 2020;**3**(1):31-40

[4] Trialfhianty TI, Suadi D. Economic valuation of mangrove resource in baros coast Tirtohargo village sub-district of Kretek. Kawistara. 2014;**4**(2):111-224

[5] Qiptiyah M, Broto BW, Setiawan H. Bird's diversity in mangrove area of Rawa Aopa Watumohai National Park. Wallacea Forestry Research Journal. 2013;**2**(1):41-50

[6] Zhang K, Liu H, Li Y, Xu H, Shen J, Rhome J, et al. The role of mangroves in attenuating storm surges. Estuarine, Coastal and Shelf Science. 2012;**102-103**:11-23

[7] Victor S, Golbuu Y, Wolanski E, et al. Fine sediment trapping in two mangrove-fringed estuaries exposed to contrasting land-use intensity, Palau, Micronesia. Wetlands Ecology and Management. 2004;**12**:277-283. DOI: https://doi.org/10.1007/s11273-005-8319-1

[8] Takle ES, Chen TC, Wu X. Protection from wind and salt spray. In: Coastal Protection in the Aftermath of the Indian Ocean Tsunami: What Role for Forests and Trees? Proceedings of the Regional Technical Workshop; 28-31 August 2006; Khao Lak, Thailand. 2006. pp. 65-80

[9] Wahyuni I. Analysis of production and potentials of mangrove little hara elements in natural reserve dua Serang, Banten. Biodidaktika. 2016;**11**(2):66-76

[10] Donato D, Kauffman J, Murdiyarso D, et al. Mangroves among the most carbon-rich forests in the tropics. Nature Geoscience. 2011;**4**: 293-297. DOI: 10.1038/ngeo1123

[11] Rafael A, Calumpong HP. Comparison of litter production between natural and reforested mangrove areas in Central Philippines. AACL Bioflux. 2018;**11**(4):1399-1414

[12] Suryaperdana Y, Soewardi K, Mashar A. Relationship of mangrove environment to the shrimps and milkfish production in silvofishery area of Blanakan, Subang, West Java. Bonorowo Wetlands. 2012;**2**(2):74-85

[13] Mahyudin RP. Sustainable waste management strategy. Enviroscienteae. 2014;**10**(1):33-40

[14] Yusfi RN, Damanhuri TP. Study of solid waste characteristics and recycle potential in Cikapundung riverbanks. Journal of Environmental Engineering. 2012;**18**(2):155-166

[15] Kusumasari B, Alam Q. Bridging the gaps: The role of local government capability and the management of a natural disaster in Bantul, Indonesia. Natural Hazards. 2012;**60**:761-779. DOI: 10.1007/s11069-011-0016-1

[16] Jackson B, Sparks JLD, Brown C, Boyd DS. Understanding the co-occurrence of tree loss and modern slavery to improve efficacy

of conservation actions and policies. Conservation Science and Practice. 2020;**183**:1-13. DOI: 10.1111/csp2.183

[17] Anonymous. 2014. Decree of the Regent of Bantul, Number 284 in 2014, Concerning Reserving Coastal Area Conservation Area in Bantul District.

[18] Ferichani M, Prasetya DA. System of rice intensification increases rice productivity on saline soil. Paddy and Water Environment. 2017;**15**:649-657. DOI: 10.1007/s10333-017-0584-0

IntechOpen