

Conservation of Segara Kangin Beach Through Identified Mangrove Reforestation in Collaboration with the Wanasari Fisherman Group Bali

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ABSTRACT

The Kampoeng Kepiting Mangrove Forest is located on Tuban area, Kuta Badung regency which is developed for the empowerment of fishermen in Tuban area through utilization of mangrove area and ecosystem in beach. This mangrove area is managed by the Wanasari fisherman group Tuban which has 95 members. Since its establishment in 2008 until 2019, there was an increase in the number of visits to the Kampoeng Kepiting mangrove ecotourism, but since the COVID-19 pandemic, and in 2020 the Kampung Kepiting mangrove ecotourism area experiencing near death with no visits at all. The problem that exists is the reduction in the area of mangrove trees due to the impact of the construction of the Bali Mandara Toll Road from the felling of mangrove tree, and the construction of a flood protection dam upstream. Another problem is the flow of garbage/rubbish from the Kerobokan, Kuta and Legian rivers into the Segara Tuban beach causing the death of newly planted/young age mangroves. With the reduction of mangrove trees, there is a risk of coastal abrasion and reduced oxygen supply because there

is no coastal buffer zone. The STIKI Social Engagement activity was carried out to conserve mangroves trees at Segara Kangin Beach, Tuban. This activity is to put identifier in each plant to identify mangrove seedlings planted, determine their age, identify the ages of trees by providing a label containing planting time and institution. This activity is expected to benefits for the conservation of mangrove trees on the coast of Segara Tuban.

Keywords: Mangrove; Conservation; Identification; Coastal Abrasion.

1. INTRODUCTION

The Kampoeng Kepiting Mangrove Forest is located on the beach immediately in the Tuban Village, Kuta Badung, which has begun to be developed for the empowerment of local fishermen, which focuses on the utilization of mangrove areas and ecosystems. Based on interview result to the head of Wanasari fisherman group, this mangrove area is managed by the Wanasari fisherman group, Tuban Village, which has 95 members, formed on August 7, 2008, with the inauguration number 306/Kpts/Org/5/2008. In managing mangrove areas, Wanasari fishermen have several sub-activities, namely crab cultivation, mangrove

education, and Mangrove Supervisory Group [1]. Since its establishment in 2008 to 2019 there has been an increase in the number of visits to the Kampoeng Kepiting mangrove ecotourism area, but since the COVID 19 pandemic, in 2020 the Crab Village mangrove ecotourism area has experienced suspended animation due to no tourist visits at all due to social restrictions [2]. The problems encountered on the Segara Tuban beach are the reduction in the mangrove forest area due to the impact of the construction of the Bali Mandara Toll Road which has cut mangrove trees in the area around the toll road, the felling of mangrove trees from the construction of a flood protection dam upstream of the mangrove forest entrance. Another problem is the Segara Tuban beach area is the downstream part of the river channel originating from the Kerobokan, Kuta and Legian rivers, the waste flow from the Kerobokan Kuta and Legian rivers empties into the Segara Tuban beach as a mangrove area so that some of the newly planted/young age mangrove seedlings experience death [3]. Currently, there are still several coastal areas around the Bali Mandara Toll Road, with areas without mangrove trees. Some of this area has previously been planted with mangroves, but some dead plants and young mangroves do not grow well along with the muddy and dirty conditions of the area due to the shipment of garbage from the river from Kuta. With the reduction of mangrove trees, there is a risk of beach abrasion because there is no coastal buffer area. Another problem is that when carrying out mangrove nurseries, it is not accompanied by the provision of seed identification so that during seedling maintenance, there is no identification when the seeds are planted and from what institution. The amount of garbage around the Segara Tuban beach area due to shipments from the river that flows through the Kuta area and empties

into the Tuban beach adds to the existing problems. Based on this situation, STIKI Social Engagement was carried out in collaboration with the Wanasari Tuban fishermen group to plant mangrove trees on some of the vacant land. Mangrove planting activities have been carried out by other institutions, but over time some mangrove seedlings grew well and some did not grow well and died due to lack of maintenance and cleaning in the planting area in a sustainable manner. Through the STIKI Social Engagement activity, mangrove seedlings are planted by providing identification in the form of a label to determine when to plant mangrove seeds and the agency that planted them. The purpose of this activity is to plant in the coastal area of Segara Tuban, some of which have not been overgrown with mangroves, through planting mangrove seedlings with label identification, to make it easier to know when to plant seeds and from the agency that planted them. This activity involved lecturers, students and the wanasari fisherman group of Tuban. The outcomes of this activity are increasing the awareness of other young generations and wanasari fishing groups towards the maintenance of mangrove forest ecosystems in the Segara Tuban coastal area, and adding a coastal buffer area around the Segara Tuban beach to prevent abrasion and conserve mangrove forests as a provider of oxygen for the surrounding community.

2. METHODOLOGY

The mangrove conservation activity has been held at Segara Kangin Beach, Tuban Badung Village, Bali from May – June 2021. The target audience of this mangrove conservation activity are Wanasari fishermen and the local society in creating coastal buffer areas from the abrasion process. STIKI Social Engagement activities implemented as mangrove conservation through planting mangrove

seedlings using identification labels on each seedling, to facilitate the identification of seedlings and make easy for identification once doing maintenance. This activity involved lecturers, students and the Wanasari Tuban fishing group. The success indicator of the activity can be seen from the active participation of students and the community in carrying out mangrove conservation, the mangrove seeds that were sown were successfully planted and can be identified properly. The creation of a part of the beach area that contains mangrove trees as a buffer area for abrasion. In addition, students as the younger generation have strong concern and more care about the conservation of mangrove forests for the preservation of nature. The evaluation was carried out related to public awareness about the importance of mangrove conservation, the success rate of seedlings can grow from seeds sown. An evaluation was also carried out whether the planted seedlings were easy to identify from the label that had been attached to each mangrove seedling.

The flow of this activity is described in Fig. 1

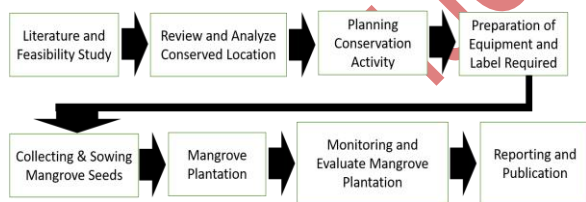


Fig 1: Mangrove Conservation Activity Flow

The activity begins by conducting field studies to find out condition of the location where mangrove seedlings will be replanted. Furthermore, coordinating activities and make a schedule of collecting and sowing mangrove seeds, mangrove plantation with label identifier, monitoring and evaluate mangrove plantation. Label identifier help us to make easier to monitor and evaluate mangrove seeds have been planted and find out whether the planted mangrove seedlings are

growing well or not at a certain time. Label identifier consist of information of planting date and university identity. The last is to create report and publication of this activity.

Table 1. Activity Plan

Activity	Team Role	Partner Participation
Review and analyze site	Team leader and members held coordination with Wanasari fisherman group	Wanasari fisherman group do assistance
Preparation mangrove seeds	Looking for fruit mangroves that will used as seeds, do nursery	Team assist for collection of mangroves seeds, accompany seed nursery
Preparation equipment required	Prepare bamboo and rope and other equipment, Label for identification mangrove plantation	Team to arrange equipment used
Mangrove plantation and rubbish cleaning around mangrove area	Plant mangrove seeds and rubbish cleaning around area	Team planting mangrove seeds and rubbish cleaning around area
Monitoring and Evaluation	do evaluation nursery activities and planting seeds mangrove	Team do evaluation nursery and planting seeds mangrove

Table 1 figure out step by step activity of mangrove conservation, start with review and analyze site, and ends with monitoring and evaluation of mangrove conservation.

3. RESULT AND DISCUSSION

3.1 Collecting Mangrove Seeds

The mangrove nursery activity was held from May 1 to May 2, 2021. The nursery activity was attended by 3 lecturers and 16 students, located in Kampong Crab Fisherman Wanasari, Tuban Village. The activity began with short briefing, how to collect mangrove seedlings. In a series of mangrove planting activities, each type of mangrove has a different character. The types of mangroves planted are the main mangroves and those usually planted are pedada/prepat (Sonneratia) and mangroves (Rhizophora). The seed collected must be old condition and not affected by borer pests. This mangrove seedling is collected from the fallen. Good mangrove trees as a source of seedling come from stands aged 10 years and over, while tumu/prepat/bius trees from stands are around 8-10 years old [4]. The characteristics of large mangroves / male mangroves (Rhizophora mucronata) are dark green or brownish in color with elongated cotyledons (rings). Api-api (Avicennia) and pedada/prepat (Sonneratia) trees are good sources from stands of more than 5 years [10]. These two seedling are usually collected from have fallen out from the tree.



Fig 2. Collecting Mangrove Seedling

The characteristics of the old api-api (Avicennia marina) mangrove are yellowish white with slightly peeling seedling skin, while the api-api (A. alba) is yellowish brown. The ripe seedling (Sonneratia alba) is dark green in color, while the pedada (S. caseolarist) is yellowish [5]. In collecting seedling, from collecting to sorting, this activity is carried out together with students and fishing groups. Thus they will understand what kind of seedling is worth planting.



Fig 3. Mangrove Seedling

Selected mangrove seedlings are collected in the form of seeds that are perfectly shaped and not broken. Sorting seedling has been done by student accompanied with members of fisherman group.



Fig 4. Sorting Mangrove Seedling

3.2. Mangrove Nursery

The mangrove nursery activity was held in 2 days start from May 1 to May 2, 2021. The nursery activity was attended by 3 lecturers and 16 students, located in Kampong Kepiting Tuban - Bali. The existence of a nursery will be beneficial, especially if the planting is carried out at a time when the peak season for fruiting is not carried out or when plants are replanted. Mangrove seedling and preparations should be sown before planting. Direct planting, especially on the seafront, is difficult to implement because the fruit/seeds are too small so they are easily carried by currents [6]. In nursery activities, the equipment that needs to be prepared in mangrove nurseries is described in Table 2.

Table 2. Equipment For Mangrove Nurseries

Equipment	Remark
Nursery location	A flat place to arrange the seeds in polybags
Muds	Media for planting mangrove seeds
Polybag plastics 10 x 15 cm	Mangrove seedling soil container
Rope	Binding 2 – 3 seeds planted in each polybag
Mangrove seedling	Sown seeds

Mangrove seedlings that have been sorted are planted in polybags with soil.

In Fig. 5 show the seeds that have been put in polybags, then neatly arranged at the nursery while waiting for the seeds to sprout for about 1 month, ready to be planted.



Fig 5. Mangrove Seeds Planted in Polybags



Fig 6. Mangrove Seeds Neatly Arranged at the Seeding Location

Fig 6 shows the arrangement of mangrove seedlings at a neatly arranged seeding location. In this activity, the number of mangrove seedlings sown at the nursery was 434 seedlings on the first day of May 1, 2021, and 423 seedlings on the second day of May 2, 2021. Seedlings planted in polybags were of good quality, containing 2-3 seeds in each polybag. After a period of two months after the mangrove nursery, the mangrove seedlings begin to grow and are ready for planting. Before planting, several physical factors must be considered to support successful planting, wave season and the suitability of plant species with their environment [7]. Planting should be done at low tide to facilitate planting and the distance between plants can be immediately known whether uniform or not. To determine the condition of the tides,

several days before planting, it is necessary to observe the time and duration of the tides and lows. For planting on the seafront, especially in coastal areas facing the open sea, it should not be done in the west season because at that time the waves are big. Planting in the east monsoon will be better because the waves are relatively small, so the risk of seeds/seeds being lost by small sea waves [8]. Large mangroves (*R. mucronata*) grow well in deep mud and are resistant to waves and wind. This species is suitable for planting on the front of the coastline, especially on beaches where the waves are quite large. Mangroves (*R. stylose*) can be planted in locations that contain a lot of sand and coral debris. Prepat (*S. alba*) is suitable for planting in areas that are dominated by sand but contain mud and are exposed to tides on average 20 days/month [11]. The activities of planting mangrove seedlings that are ready to be planted have finished about 100 polybags and about 300 mangrove seedlings. The planting activity was carried out on June 6, 2021, which was attended by 22 students and 3 accompanying lecturers. The activity began with an opening by the chief executive of the STIKI Social Engagement 2021, then a briefing was held by the Wanasari fisherman management regarding the understanding of mangroves, the benefits of mangrove forests, how to plant mangroves and the behavior that is maintained when planting mangroves.

3.3 Implementation of Mangrove Seed Planting

After a period of two months after the mangrove nursery, the mangrove seedlings begin to grow and are ready for planting. Before planting, several physical factors must be considered to support successful planting, namely tidal conditions, wave season and the suitability of plant species with their environment [7]. Planting should be done at low

tide to facilitate planting and the distance between plants can be immediately known whether uniform or not. To determine the condition of the tides, several days before planting, it is necessary to observe the time and duration of the tides and lows. For planting on the seafront, especially in coastal areas facing the open sea, it should not be done in the west season because at that time the waves are big. Planting in the east monsoon will be better because the waves are relatively small, so the risk of seeds/seeds being lost by small sea waves [8]. Large mangroves (*R. mucronata*) grow well in deep mud and are resistant to waves and wind. This species is suitable for planting on the front of the coastline, especially on beaches where the waves are quite large. Mangroves (*R. stylose*) can be planted in locations that contain a lot of sand and coral debris. Prepat (*S. alba*) is suitable for planting in areas that are dominated by sand but contain mud and are exposed to tides on average 20 days/month.



Fig 7. Briefing Before Mangrove Plantation

Preparatory activities are carried out before planting mangrove seedlings. Preparatory activities are in the form of preparing bamboo to support the planted seeds, attaching labels to seeds and preparing seeds to be planted.



Fig 8. Setting Up Mangrove Planting Equipment

into sacks to be disposed of and then avoid the garbage that is buried at the location of planting mangrove seedlings.



Fig 9. Mangrove Plantation

Table 3. Equipment For Mangrove Plantation

Equipment	Remark
Spacing Line	Measure the distance so that the path of the plant and the distance between the desired plants is uniform
Bamboo slats	The seeds are tied to the stake so they don't get carried away by the waves, a sign of a new plant
Pointed bamboo stick	For making plant holes and is needed when planting in rather hard mud soil
Rope	To tie the seeds that have been planted on stakes (bamboo) so they don't get carried away by the waves and sea currents

Mangrove planting areas are located on muddy beaches and in areas where mangrove trees are scarce. After that, the grower group immediately planted the seeds/seeds at the marked points. If the mud is hard enough, it must first be drilled by a bamboo stick carrier. Mangrove planting activities are carried out by making a 15 cm hole and planting mangrove seedlings. The planted mangrove seedlings are then supported by plugged bamboo sticks and then the seeds are tied to the bamboo.

Mangrove planting activities are carried out by exploring the sea in the mangrove forest area to get to the location of mangrove forest planting. The preparation of mangrove planting activities begins with making holes for planting seedlings, inserting bamboo to support the seedlings and removing the polybag seeds so that the seeds can be planted in the holes that have been made. Furthermore, polybags are collected and polybag waste is put



Fig 9. Mangrove Plantation

Labels are attached to the seeds that have been planted to identify the planting date and the institution which have done planting activity.



Fig 10. Label Identification

The mangrove seed planting activity resulted in around 300 mangrove seedlings being successfully planted in the Segara Kangin coastal area of Tuban.



Fig 11. Mangrove Plantation in Segara Kangin Coastal

3.4 Activity Result

Based on the results of community service carried out from May to July at Segara Kangin beach, Tuban Village, Kuta District, Badung Regency, we have planted 857 mangrove seedlings. From the mangrove seeds that have been sown, around 300 mangrove seedlings have sprouted. Planted

seedlings can be re-identified by placing a label sticker on each seed that informs the agency that planted it and the date of planting the mangrove. In addition, this activity provides awareness to the public, especially students and fishing community groups about the importance of mangroves for coastal conservation from abrasion and as a oxygen provider for the survival of life.

4. CONCLUSION

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