

Potency and Conservation of *Aren* (*Arenga pinnata* (Wurmb) Merr.) in Meru Betiri National Park, East Java-Indonesia

Ervizal A. M. Zuhud¹, Primadhika Al Manar^{1*}, Zuraida², Syafitri Hidayati¹

¹Department of Forest Resources Conservation and Ecotourism, Faculty of Forestry and Environment, IPB University, Academic Ring Road, Campus IPB Dramaga, Bogor, Indonesia 16680

²Forest Research and Development Center, Ministry of Environment and Forestry, Bogor, Indonesia

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Abstract

Aren (*Arenga pinnata* (Wurmb) Merr.) is a high ecological and economical value species of Indonesia. *Aren* grows spreading in Indonesia including at Meru Betiri National Park in the province of East Java, Indonesia. The community in Meru Betiri National Park uses *aren* fruit which is called *kolang-kaling*. Even though *aren* grows naturally in this area, the community has not maximized its utilization. This study aims to identify the actual and ideal conditions for *aren* conservation also to analyse the gap between them, and to formulate the conservation actions to realize a sustainable *aren* conservation in Meru Betiri National Park. The data was collected by using vegetation analysis and in-depth interviews with all of the *aren* farmers. *Aren* regeneration in Meru Betiri National Park is categorized stable and seems to be decreased. The use of *aren* by the community is limited only from the fruit as *kolang-kaling*. There is a gap between current and ideal conditions for achieving *aren* sustainability. To achieve the ideal conditions, conservation actions are needed among *aren* farmers by utilizing agroforestry systems, increasing the value of *aren*, intensive coaching for *aren* farmers, and forming a group of *aren* farmer

Keywords: community, conservation efforts, conservation strategy, ethnobotany

*Correspondence author, email: primadhika@gmail.com

Introduction

Aren (*Arenga pinnata* (Wurmb) Merr.) is a species of the Arecaceae family with high economical and ecological values. Community has used *aren* for various needs (Haryoso et al., 2020) such as for sugar, sweets, building materials, baskets, handicrafts, and roofs (Ishak et al., 2013). As a non-timber forest product, community can utilize many parts of *aren* tree such as root, stem, leaf, *ijuk*, *nira* water, starch, and fruit (Sahari et al., 2013; Gunawan et al., 2018). However, *aren* is commonly known useful as food plants (Sumarni et al., 2003; Sovia & Anggraeny, 2019), producing starch commodities (carbohydrates) such as flour, *aren* sugar (palm sugar), and fruit (*kolang-kaling*) (Kemenhut, 2007).

Aren grows in Southeast Asia from South China to Ryukyu Island in northern, Christmas Island in southern, India in western, and to Queensland, Australia in eastern (Pongsattayapipat & Barfod, 2009; Dransfield et al., 2014). In Indonesia, *aren* grows in almost all regions, especially in hills area with high humidity (Sunanto, 1993) such as North Sumatera, West Sumatera, Bengkulu, Banten, West Java, Central Java, East Java, South Kalimantan, East Kalimantan, North Sulawesi, South Sulawesi, East Nusa Tenggara, Maluku, and Papua (Lay & Karouw, 2006).

Meru Betiri National Park (MBNP) in East Java is an *aren* plantation site characterized by a nature conservation area with an original ecosystem. The national park is

managed by a zoning system, consisting with: core zone, *rimba* zone, utilization zone, and other zones (e.g., marine protection zone; traditional zone; rehabilitation zone; religious, culture, and history zone; and special zone) (KLHK, 2015). Yet, in Meru Betiri National Park, *aren* commonly found in its *rimba* zone. This zone is part of a national park that is determined because of its location and conditions which become a potential support of conservation in the core and utilization zone (KLHK, 2015). One of the activities that may be carried out in the *rimba* zone is the utilization of germplasm resources to support cultivation activities, but not for economic activities. Based on these facts, it is necessary to educate the local community for cultivating *aren* in rehabilitation area, so that *aren* utilization can be sustainable.

The community in Meru Betiri National Park uses *aren* fruit which is called *kolang-kaling*. The widespread use of *aren* is feared to cause scarcity considering its long harvesting time, around 7–12 years (Manaroinsong et al., 2006). *Aren* is currently not a priority to be developed, due to a lack of current cultivation technology to proliferate. Limitations of the information and skill about cultivation techniques become the most important factor which creates reluctance among *aren* farmers. Second, the potential of *aren* has not been widely known by the community, especially people who are living around Meru Betiri National Park.

Even though *aren* grows in this area, the community has not taken full advantage of this species. Therefore, the aims of this study are: 1) to identify the actual condition of *aren* conservation, 2) to determine the ideal conditions for *aren* conservation, 3) to analyse the gap between the actual and ideal conditions, and 4) to formulate the conservation actions to realize a sustainable *aren* conservation in Meru Betiri National Park.

Methods

Time and location This research was conducted in March 2019 at Andongrejo Resort, Meru Betiri National Park, Jember, East Java, Indonesia (Figure 1). Geographically, Meru Betiri National Park is located at S8°20'48"–S8°33'48" and E113°38'38"–E113°58'30". Administratively, Meru Betiri National Park area is located in Jember Regency and Banyuwangi Regency, East Java Province, Indonesia. The topography of this area is hilly with a range of elevations starting from the edge of the sea to altitude of 1,223 m above sea level (the top of Mount Betiri). The rainfall rate on this region is varied between 2,544 and 3,478 mm year⁻¹ with wet months between November and March, and dry months between April and October (BTNMB, 2009).

Data collection Data was collected by using vegetation analysis and in-depth interviews, collaborate with all *aren* farmers in Andongrejo. Vegetation analysis was carried out to identify the potential of *aren* regeneration in Meru Betiri National Park by comparing each level of growth of the *aren*

plants (seedlings, saplings, poles, and trees). The observation plot was selected by using purposive sampling with specific criteria (Sugiyono, 2017) based on the locations of *aren*. The sample plot size is 20 × 20 m. The total area of the observation plot is 0.4 ha, due to the slope of the study site and the limits of the measurements area. The location was a place used by the community to harvest the *aren* fruit.

Aren is commonly found in the rimba zone of the Meru Betiri National Park. The observation plot was made by cutting the contour direction of the first *aren* tree found. Data collection for each growth level referred to Permentan Number 133/2013, i.e. seedling = clear wood¹ 0 < 0.5 m; saplings = clear wood 0.5–1.5 m; poles = clear wood 1.5–3 m; trees = clear wood > 3 m (Kementan, 2013).

In-depth interviews were conducted with 13 *aren* farmers, all of them are male. Female farmers were not found, probably due to the nature of activities in producing *kolang-kaling*. A long time in harvesting and a far distance between the house to the forest are perceived difficult to be conducted by women. In addition, the harvesting activities require stronger energy to climb the *aren* tree. This condition was also reported by Sugihartono (2007), that gender determines a person's level of participation and productivity at work.

During interviews, the questions investigated the local knowledge and perceptions of *aren* conservation (Febriyanti, 2017). By considering the actual condition, some questions were raised to complete the gap between the current and ideal condition, such as the potential of *aren* fruit (kg per month),

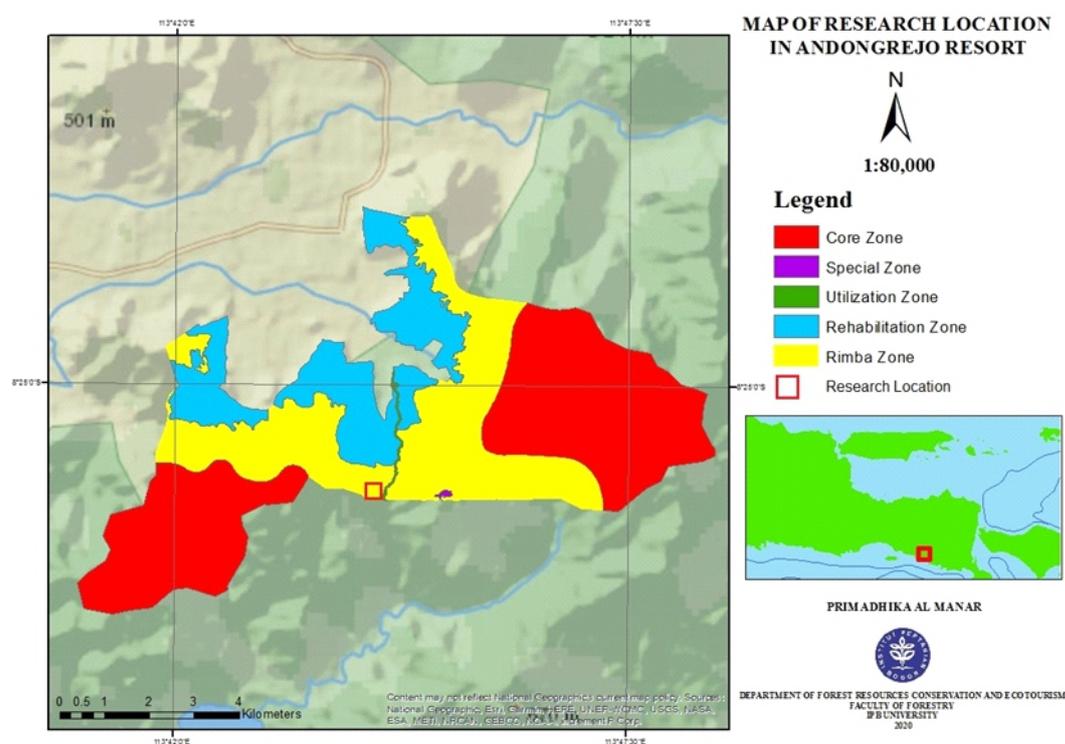


Figure 1 Research site in Andongrejo Resort, Meru Betiri National Park.

¹Measures from the soil line to the highest point without frond bases.

the farmer income from *aren* fruit (IDR per harvest cycle), the cause of *aren* planting failure in rehabilitation zone, and the marketing of *aren* products.

Aren conservation strategies was analysed using the theory of *Tri-Stimulus Amar Pro Konservasi*, according to Zuhud (2007). The precondition for the realization of successful conservation is the creation of attitudes and behaviours that are strongly driven by *Tri-Stimulus Amar Pro Konservasi*: crystallization or the unity of natural stimulus (*stimulus alami*), benefit stimulus (*stimulus manfaat*), and religious-willing stimulus (*sitimus religius-rela*) (Zuhud, 2007). A natural stimulus is a reflection of the truth values of nature, needs, and sustainability of living natural resources by their bio-ecological character. Benefit stimulus is a reflection of the values of interests for humans (economic, social, biological/ecological benefits, etc.). A religious-willing stimulus is a stimulus that encourages someone to be willing to carry out conservation activities such as the highest value in the form of goodness especially the rewards from the creator of nature, spiritual values, universal religious values, merit, happiness, wisdom and culture/traditional, inner satisfaction, and others.

Results and Discussion

***Aren* regeneration in Andongrejo Resort** A vegetation analysis of *aren* conducted on 0.4 ha observation plot in Andongrejo, obtained 208 individuals consisting with seedlings, saplings, poles, and trees. *Aren* density at each growth level is presented in Table 1.

Table 1 shows the density of *aren* at Andongrejo Resort is stable, showed by the number of seedlings are higher than saplings, poles, and trees. *Aren* density at each growth level can be used as an indicator of *aren* natural regeneration level. Differences in the density value of each growth level are caused by variety reproductive ability, distribution, and adaptability to the environment (Arrijani et al., 2006). The density value of a species indicates the number of individual species concerned at a certain unit area. The structure of plant populations changes over time, yet the significant factors of population structure changes is a human activity that is less concerned with replanting of the species (Surasana & Taufikurrahman, 1994).

Aren trees in Andongrejo Resort area are utilized by the

surrounding community who took *aren* fruit. Therefore, since *aren* plants spreading new individuals through the seeds in the fruits, there is a concern about the future numbers of seedlings, saplings, poles, and trees.

Seeds distribution of certain plants is carried out by animals such as birds, monkeys, squirrels, bats, and civets through their feces (Ewusie, 1990). Forest regeneration is naturally greatly assisted by animals with seeds being ingested or swallowed and then spread through animal feces (Setia, 2008). *Aren* seeds are spread by civet through their feces. Civets can help to break the seed dormancy, so that the *aren* seeds can grow and develop to be seedlings. Seeds that have been eaten by wild animals will germinate faster due to the gastric fluid which has a pH of 2 (Weisz, 1959). The liquid in the stomach is acidic, so it can help to soften the hard seed coat. Comparison of *aren* density at each growth level presented in Figure 2.

The state of sampled species regeneration was assessed based on one-time phytosociological data in the following categories: (a) 'good', if the numbers of seedling > sapling > adult; (b) 'fair', if the numbers of seedling > sapling > adult; (c) 'poor', if a species survives in only sapling stage, but not as seedlings (though the numbers of saplings may be less, more or equal than adults); (d) 'none', if a species is absent both in sapling and seedling stages, but present as adults; and (e) 'new', if a species has no adults, but only saplings and/or seedlings (Shankar, 2001). *Aren* regeneration at the research site is included in good category as the total number of seedlings is greater than saplings, poles, and trees.

Natural regeneration in forest stands can occur through natural seed distribution by stands. Naturally the process occurs when the seeds fall down to the forest floor, then it develops into a seedling. Factors that influence seedling development in nature include root development, light conditions, soil conditions, competition, plant composition, biotic factors, such as grazing, fires, and other factors such as rainfall, long dry season, and extreme temperatures (Wanggai, 2009).

***Aren* distribution in Tumpak Gesing Block** *Aren* found in the research site is located mostly on the cliffs. The plant can be grown on steep, almost vertical, and slopes (Muda et al., 2016; Yusof & El Pebrian, 2016). *Aren* found at altitude of

Table 1 Density of *aren* at each growth level

Growth level	Large plot (ha)	Parameter		
		Total	Density (N ha ⁻¹)	Frequency
Seedlings	0.4	86	215	0.8
Saplings		52	130	0.8
Poles		46	115	0.9
Trees		28	70	0.9

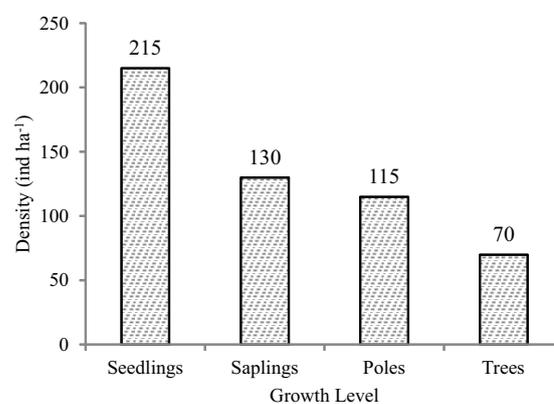


Figure 2 Comparison of *aren* density.

300500 m above sea level which is suitable for the species (Soeseno, 1991). *Aren* generally grows in groups along the Andongrejo-Bandalit route. This is in accordance with the statement that *aren* plants can grow individually or in groups (Alam & Suhartati, 2000). The distribution of a type is influenced by environmental factors where the species grows. *Aren* is generally located on the edge of a cliff and hill, rarely found on soils with gently sloping topography. Air humidity in the research area ranged between 91% and 93% which is included in the category of high so that the location is a suitable habitat for the natural growth of *aren*. *Aren* is spread in almost all regions of Indonesia, especially in humid hilly areas (Sunanto, 1993). *Aren* distribution at Andongrejo Resort is presented in Figure 3.

Plants in their early stages of life have a high sensitivity to the environment (Krebs, 1989). Factors that limit the distribution of the plants include the climate, edaphic factors, and interactions with other plants. Therefore, plant populations in nature generally spread in clusters and only slightly spread in other patterns. *Aren* found at the study site generally spreads in groups. Factors that can influence the spatial patterns of living things are: (a) vectorial factors, produced by environmental actions (soil type, wind, light, and water intensity), (b) social factors, related to the behavior of organisms such as territorial, (c) co-active factors, related to intraspecific interactions, and (d) stochastic factors, resulted from random variations in some of the previous factors (Ludwig & Reynolds, 1988).

Utilization of *aren* Formerly, the community of Andongrejo Village utilizes *aren* to take *nira* water as raw material for making *aren* sugar, but the present study conclude that the community of Andongrejo Village is only taking *aren* fruit

(*kolang-kaling*). The community only utilizes *aren* fruit because it can be directly sold to the middleman and get instant cash for daily needs. Taking of *aren* fruit by the community usually requires quite a long time because it is quite difficult to obtain *aren* fruit that is ready to be harvested. The community that utilizes *aren* have to spend the night in the forest to get *aren* fruit that is ready to be harvested. That is caused a total of *aren* trees that bear fruit is getting smaller while *aren* trees take 7–12 years to bear fruit.

Aren fruit taken by the community has to fulfill an age criteria, means not too old and not too young (*cemukil*). *Aren* fruit that is *cemukil* has a characteristic of not sticky and not too hard. If the *aren* fruit is too old, it will produce a hard fruit texture in the processing. As a result, it is considered has a low quality. On the other hand, if the fruit is too young, the processing of the fruit texture will be too soft and make it difficult to be further processed (Purwati & Nugrahini, 2018). To determine the *aren* fruits that are ready to be harvested, a specific skill is required.

The process of producing *kolang-kaling* is started by boiling *aren* fruit in clean water for 2 hours until it well cooked. After the *aren* fruit is boiled, the next process is to split the endosperm of *aren* fruit seeds with the skin of *aren* fruit using *golok*. The process of making *kolang-kaling* is carried out by the community directly at the location of taking *aren* fruit, so that *kolang-kaling* is ready to be sold to the middleman. This was done to facilitate the transportation of *aren* fruit harvest from collection location to the village. After *aren* fruit is peeled, the next process is soaking *kolang-kaling* with clean water with a purpose of eliminating the sap (Sunanto, 1993). The sap of *aren* fruit can cause itchy because it contains calcium oxalate crystals that can pierce human skin cells (Widyawati, 2011). *Kolang-kaling* should not be exposed to rain or saltwater to retain its white color

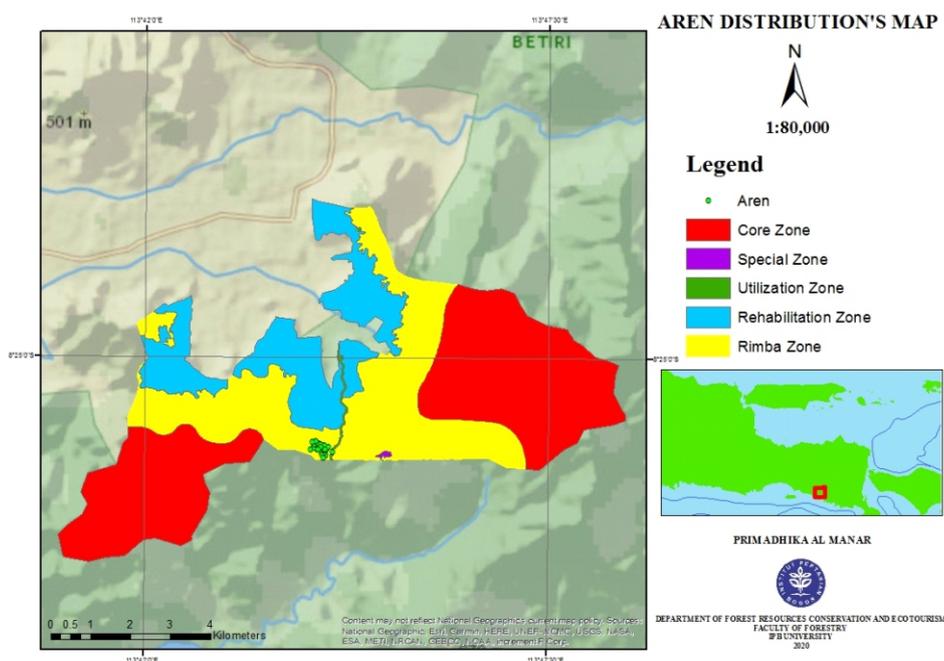


Figure 3 *Aren* distribution in Andongrejo Resort.

(cemeng).

One adult *aren* tree can produce about 5–10 *aren* fruit bunches. Each *aren* fruit bunch could consist of hundreds of *aren* fruits. Harvesting one mature *aren* tree takes 1 month, for a total of 4 times. A large and fertile *aren* tree can produce 1 to 2 quintals of fruit in one harvest cycle. Each *aren* tree is harvested by one *aren* farmer until the end of the harvest cycle, so there is no competition for *aren* tree harvesting between *aren* farmers. The current selling price of *kolang-kaling* is IDR7,000 kg⁻¹ which means from one *aren* tree, the *aren* farmers get economic benefits from IDR700,000 month⁻¹ to IDR1,400,000 month⁻¹. Farmers' income from harvesting *kolang-kaling* is lower when compared to local standard income in Jember (IDR2,355,662.90 month⁻¹), which causes the community only consider taking *kolang-kaling* as a side job.

The utilization of *aren* by the community of Andongrejo Village has not been optimal, because the community of Andongrejo Village only utilize *aren* to produce *kolang-kaling*, whereas all parts of *aren* (such as roots, stems, leaves, fronds, sap, *nira* water, and fruit) can be potentially used. *Aren* root is beneficial as aphrodisiac, skin medicine, and smooth digestion (Febriyanti et al., 2017). *Aren* stems can produce flour (starch) obtained from the extraction of the central part of the stem. *Aren* flour (starch) used as food ingredients including cakes, *cendol*, meatballs, *bakmi* (noodle), *bihun*, *sohun*, and *hun kwe* (Lutoni, 1993). *Aren* leaves can be used as a wrapper for *aren* sugar (Lempang, 2012). Frond of *aren* can be used as flour, Tomohon people use *aren* frond flour as a traditional medicine to eliminate itching and burns on the skin (Sangi et al., 2012). Other parts of *aren* trees that can be utilized are male flowers that produce *nira* water to make *aren* sugar, soft drinks, vinegar, and alcohol (Porobaten et al., 2017). *Ijuk aren* can be used for the manufacture of house brooms and roof of cattle shed (Damanik et al., 2014). *Aren* fruit can be used as foliage that is widely used as a mixture of various types of food and drinks, and can launch bowel movements (Lutoni, 1993).

Conservation efforts Conservation efforts of *aren* have been carried out by Meru Betiri National Park management, the program is planting *aren* in rehabilitation zone. Unfortunately, *aren* planted by Meru Betiri National Park management are mostly dead. According to the interview result, the death of *aren* trees planted occurred due to the limitation of water irrigation. The planning of *aren* planting program in rehabilitation zone needs to be reviewed to achieve the expected results. Preparation of planting programs should consider the availability of water on the land and the types of plants that are selected by the community, as a result that the community has the desire to care for the plants. Furthermore, assistance and intensive coaching to the community is required.

The community of Andongrejo Village has unconsciously conserved *aren* species together with the ecosystem. Conservation of *aren* carried out by selecting *aren* fruit which is ready for harvest and they only take *aren* which is located on a sloping area. Logically, *aren* found at a steep location is difficult to take however by leaving the species in steep or hills mean the importance of the presence of *aren* trees as a

conservation function plant, erosion prevention trees or landslides, that need attention to be seriously developed or cultivated by various parties (Mulyanic & Romdani, 2017).

Conservation strategy Considering the current condition of the utilization of *aren* in Andongrejo, a conservation strategy is formulated. Andongrejo Village community has used *aren* for a long time as a commercial plant. In the past, the community utilized *aren* to take the *nira* water to be processed into sugar. However, currently, the community only utilizes *aren* fruits as *kolang-kaling*.

According to Puspaningrum (2015), the main job of the community around Meru Betiri National Park was *aren* farmer. Nevertheless, the utilization of *aren* has not become the main occupation anymore because the community has begun to shift as field farmers who plant rice, corn, chilli, and other horticultural crops. The surrounding community utilizes *aren* directly from nature, yet without its cultivation. This can result the natural population of *aren* seems to be smaller and threatened. The population tend to run out due to nothing cultivation effort. Harvesting *aren* fruit is also considered to have an indirect negative effect on the productivity of *nira* water and *aren* regeneration (Martini & Roshetko, 2012).

Based on the interview result, the ideal conditions expected by the community are the existence of *aren* plant cultivation, optimally utilizing *aren*, increasing the community interest in *aren*, the system of selling *aren* products directly to buyers, and cooperation and assistance from the government and national park managers. To achieve these ideal conditions, it is necessary to conserve *aren*. The precondition for the realization of successful conservation is the creation of attitudes and behaviors that are strongly driven by *Tri-Stimulus Amar Pro Konservasi*: crystallization or the unity of natural stimulus (*stimulus alami*), benefit stimulus (*stimulus manfaat*), and religious-willing stimulus (*stimulus religius-rela*) (Zuhud, 2007). Conservation actions that can be taken to achieve ideal conditions based on current conditions that refer to the *Tri-Stimulus Amar Pro Konservasi*, among others *aren* cultivation with agroforestry systems, increase the value of *aren*, intensive coaching of *aren* farmers, and forming a group of *aren* farmers (Figure 4).

The main problem in the development of *aren* is the lack of interest in the surrounding community to utilize *aren* optimally. That is because the condition at the research location of the *aren* plant grows naturally is on sloping land which is quite steep. This condition makes some people less interested to go to the location of the *aren* plant since they must pass valley or ravine. *Aren* commodity development strategies must think of *aren* cultivation that can be done by the community so that people do not only rely on *aren* that grows naturally in the forest. Most people have not cultivated *aren* properly and only rely on *aren* that grows naturally without any serious maintenance and is focused on the usual use, as well as with the government, so far the government's programs and policies in developing *aren* are still very limited (Widyawati, 2011). The development of *aren* cultivation requires collaboration from various parties such as the community, the government, and the management of

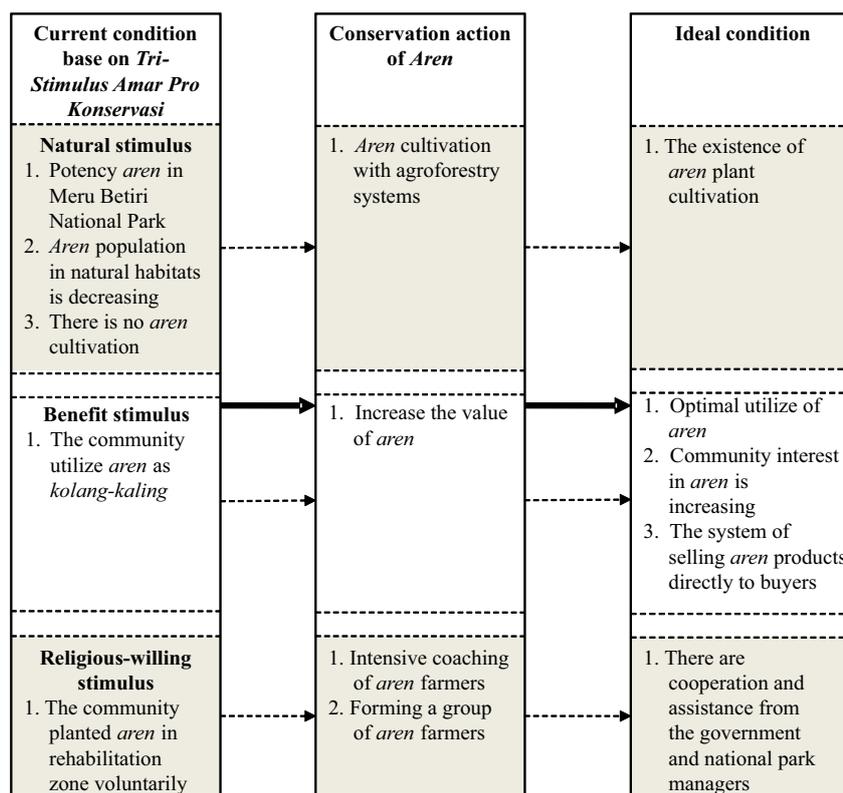


Figure 4 Conservation strategy of *aren* in Meru Betiri National Park.

the national park. Assistance to the community is needed to improve the success of the *aren* cultivation business conducted by the community. The development and cultivation of *aren* plants will have good prospects if it has been programmed well and planned early on.

Aren cultivation by the community can be developed with an agroforestry system, for example, by making a combination of *aren* trees with other plants that have economic value. *Aren* is a plant that is tolerant of other plants (Effendi, 2010). In the development of *aren* agroforestry, the attention must be paid to the nature of *aren* trees that are tolerant of shade. The activity of planting *aren* must be preceded by other plants to shade *aren* plants that will be planted. *Aren* cultivation within agroforestry systems can be combined with plants found in the natural habitat of *aren* and have economic value. *Aren* also can be combined with agricultural crops planted by the community of Andongrejo Village. Agroforestry management between *aren* and agricultural crops provides improved household income in Kampung Makian, South Halmahera (Tamrin et al., 2015).

The thing that must be considered in the efforts of cultivating *aren* is determining the distance of *aren* planting so that the planted plants can grow well. One method in minimizing soil nutrition absorption competition is by planting distance regulation, which is 9 m × 9 m for *aren* (Sunanto, 1993). Plant spacing will affect the effectiveness of nutrient absorption by plants. The denser plant spacing, the more plant population per unit area, resulting in the tight nutrient competition between plants. As a result, plant

growth will be disrupted and production per plant will be declined (Mawazin & Suhaendi, 2008).

Large *aren* plant spacing will have an impact on the surrounding environment such as reducing a number of plant populations and also causing reduced use of sunlight, and nutrients by plants, because some of light will fall to the ground and nutrients will be lost due to evaporation and washing (Erawati & Hipi, 2017). Agroforestry between *aren* plants and plants from their natural habitat can be combined with corn to get the benefits of optimal economic value. Corn can be planted among *aren* that are cultivated to prevent evaporation and leaching of soil nutrient nutrients. In addition, corn are plants that are of interest to the community of Andongrejo Village.

Aren planting was carried out by the community with the Meru Betiri National Park management in rehabilitation zone. However, the plant did not grow well and eventually died. Based on the results of interviews with the manager of the national park, the large of *aren* planting in rehabilitation zone is unknown. It also makes it difficult to monitor the results of planting. To improve the welfare of the community, it is necessary to cultivate *aren* in the rehabilitation zone which is divided based on management blocks for each member of the farmer group.

Aren development strategy aims to optimize the utilization of all parts of *aren* plant by the community. If the community only use *kolang-kaling*, the economic income that they can get is IDR700,000 month⁻¹ to IDR1,400,000 month⁻¹. Research conducted by Aulin (2019) shows that the

income of the community who use *nira* water to be processed into *aren* sugar is IDR520,000 month⁻¹ to IDR3,120,000 month⁻¹, depending on the intensity of taking *nira* water. Optimal utilization of *aren* can be achieved if the community has a high interest in *aren* plants, so it is necessary to increase the value of *aren* commodity not limited only as *kolang-kaling*. *Aren* plant is a commodity with high economic value, so it has a great prospective to be developed and improved the economy of a region (Purba et al., 2014). If the community is aware on the economic benefits of *aren*, they will be ready to preserve *aren*. Conservation strategy that can be taken to preserve *aren* is to increase the value of *aren* by optimizing the utilization of *aren*. Realizing that *aren* is an economically profitable commodity, the community will pay more attention to the cultivation of *aren*. *Aren* trees also have an important role in ecological functions. The ecological function of *aren* tree is as a preservative of natural resources, especially land. The roots of *aren* tree are very sturdy, deep, and strong so that they have an important function as a barrier to soil erosion. In addition, *aren* roots can bind water (Yuldiati et al., 2016). *Aren* plants produce biomass above the ground and in very large soils that play an important role in the CO₂ cycle (Effendi, 2010).

Aren is a commodity that has good development prospects because all parts of *aren* plant can be utilized in manufacturing. *Aren* can be developed to meet the needs of the sugar industry in Indonesia, as *aren* produces *nira* water from its tapped male flowers. The development of *aren* plant has good prospects, if it has been well programmed and planned (Widarawati et al., 2017). So far, *aren* in the Meru Betiri National Park area is only utilized in the form of fruits to be *kolang-kaling*, even though *aren* has the potential to be utilized in the form of *nira* water, *ijuk*, leaves, and sago, which can improve the economy of the surrounding community.

The economic benefits of *aren* is obtained from almost all their physical and production parts (Lempan, 2012). Some products from *aren* are needed by the international market so that to increase the value of exports which has an impact on improving the national economy. *Aren* products that have the greatest economic value right now are *aren* sugar. *Aren* sugar has a high selling value and has a fairly large market share, both in the domestic and export markets (Heryani, 2016).

Community education and empowerment are essential to be conducted to achieve the ecological and economic sustainability of *aren* plant in Meru Betiri National Park. At present, the community only carries out the harvesting of *aren* directly in nature and has not yet made an *aren* cultivation efforts. If this is done continuously, then *aren* will be difficult to find in the future, threatened its preservation in nature. The age of *aren* harvest is quite long, between 7-12 years, so that the cultivation of *aren* is needed through education and community empowerment to maintain the sustainability of *aren* in the future (Manaroinson, 2006). Educating the community about *aren* cultivation techniques is needed due to limited information about the cultivation of *aren* trees.

Community empowerment is an effort to improve the economic condition of a community that starts from inadequate and then becomes able rise up from the pitfalls of poverty (Sutaryono, 2008). Community empowerment

activities around Meru Betiri National Park through the optimal utilization and activities of *aren* cultivation, is expected to improve the economy and quality of life of the community. Factors that influence people's behaviour towards the preservation of forest resources consist of internal and external factors. Internal factors include age, income level, length of stay, level of interaction, level of education, level of tenure of agricultural land, and level of interaction with forests. External factors include the level of interaction with officers and membership in farmer groups (Garnadi, 2004; Wahyudi, 2004). Community empowerment requires collaboration from various parties involved in the process of community empowerment such as the government, community organizations (NGOs), community institutions, cooperatives, and assistants (Yansen, 2013).

Conclusion

Aren regeneration in Meru Betiri National Park is categorized stable because the total number of seedlings is higher than saplings, poles, and trees and seems to be decreased. The use of *aren* by the community of Andongrejo Village is limited only in the form of fruit as *kolang-kaling*. There is a gap between current conditions and ideal conditions for achieving *aren* sustainability. To achieve ideal conditions, are needed conservation actions based on *Tri-Stimulus Amar Pro Konservasi* (natural stimulus, benefit stimulus, and religious-willing stimulus) among others *aren* farmers with agroforestry systems, increase the value of *aren*, intensive coaching of *aren* farmers, and forming a group of *aren* farmers.

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