The Potential of agro-industry development based on agroforestry in Peusangan Forest, Indonesia

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Abstract. Forest Product Utilization Permit (IUPHH) has the right to manage a production forest is also obliged to keep the production forest functioning properly and not being converted into other uses. The collaboration pattern between the IUPHH management unit and the community around the forest is one of the best ways to monitor and apply the silvicultural method of production forest by creating an agro-industry for the community around the forest. The problem is what type of agroforestry is more dominant and more profitable. The purpose of this research is to find out what types of commodities are suitable to be developed in the area around the Peusangan production forest. This research was conducted by means of direct interviews and questionnaires. Data analysis used Analytical Hierarchy Process (AHP). The results show that the community around the Peusangan production forest is more suitable to develop dragon blood (daemonorops draco) plant agroforestry, either by utilizing / collecting non-timber forest products or cultivating it which has a value of 0.457, this value is very large compared to other commodities, while considering the market availability which has a value weight of 0.587, constitutes the majority consideration.

1. Introduction

Many production forests in Indonesia are not functioning effectively, there are several forms of problems that occur, including, in production forest areas where the wood products are taken, reforestation problems occur. The problem of difficult reforestation occurs due to several causes including the indiscipline of the IUPHH holders in maintaining the harvest block harvesting period, expensive silviculture both in terms of seeding, transportation and supervision so that reforestation does not run well. Another problem that causes deforestation of production forests is that the community living around the forest encroaches the land and converts it into plantation land because the areas where IUPHH owners are logged off are relatively lacking in large plants, making it easier for people living around the forest to clear them and plant other plants, besides that their access is also more easy.
The problem of failed reforestry is more due to the lack of involvement of forest communities in the management of production forests. Communities around the forest can actually be involved together with companies holding IUPHH in managing production forests. Collaboration or community involvement in the management of production forests can be carried out well because each party gets economic benefits, including the community around the forest can make use of non-timber forest products more easily, while on the other hand companies holding IUPHH receive good supervision of the cultivation process of natural tillers and tillers separation evenly from society. Encroachment would be less likely if the community living around the forest received other sustainable economic benefits from production forest management compared to the sale of ex-forest land which was temporary or only once.

Collaborative production forest management with the natural youth, leveling and open surveillance silvicultural system (TPPAPPT) and integrated with community plantations around the introduced forest is very likely to be applied because it is accommodating of all interests. One of the things that is imperative in this method is the development of forest communities in obtaining a source of income for their families through agro-industrial activities adjacent to forests so that it can be done in the form of agroforestry [1].

Choosing the right type of agroforestry in a location is absolutely necessary considering the characteristics of the community around the forest and the characteristics of the forest itself are very specific from one forest area to another [2]. The peusangan production forest does not yet have research on agro-industrial potential that is suitable for development, so it is very necessary to conduct a first study of the potential of an agro-industry suitable for development in the Peusangan forest by looking at agro-industrial preferences that are suitable for development and what factors are very necessary for the development of an agro-industry according to economic experts and business. One method that is often used for decision making based on preferences, both from the user side, in this case the community around the forest and from the side of business feasibility according to experts, is the Analytical Hierarchy Process (AHP) method.

The AHP method is a framework for making decisions effectively on complex problems by simplifying and accelerating the decision-making process by breaking down the problem into its parts. The AHP method helps solve complex problems by structuring a hierarchy of criteria, interested parties, results and based on various considerations in order to develop weights or priorities. This method also combines determined criteria and logic according to the rules of various problems, then by balancing various considerations into suitable results to be applied. AHP method has two input categories and one goal where in this study the goal is the type of agroforestry business.

According to de Forest and Michon [3], agroforestry can be grouped into two systems, namely simple agroforestry systems and complex agroforestry systems. A simple agroforestry system is an agricultural system in which trees are intercropped with one or more seasonal crops. The simplest form of agroforestry that is most discussed in Java is intercropping. Meanwhile, a complex agroforestry system is a permanent agricultural system that involves many types of trees either planted intentionally or naturally. The main characteristic of complex agroforestry is its physical appearance and the dynamics in it which are similar to forest ecosystems, so it is also known as agroforest [4].

Agroforestry that may be developed in IUPHH areas in Bireun and Bener Meriah districts is plantations, livestock and agro-tourism, so this research focuses on looking at the potential for developing plantations, animal husbandry and agro-tourism in IUPHH areas based on the preferences of forest communities and Acehnese economists and businesses. The superior agroforestry is then analyzed for the completeness of its development potential.

The Objective of this research is to find out the potential for agro-industrial development based on agroforestry in the area around the Peusangan forest and to obtain superior types of agro-industry to be developed in the area around the forest.
2. Materials and methods
This research was initiated by direct observation in the peusangan production forest area to obtain data and information on potential types of agroforestry to be developed. After the list of potential agroforestry is available, then AHP questionair is made with respondents from economists and business experts as well as communities around the Peusangan production forest.

The partner community will make decisions about the right business to be carried out in the buffer area by the Analytical Hierarchy Process (AHP) method. So it is hoped that the agro-industrial business implemented by the community will be easier and more profitable. AHP is an analysis system that allows researchers to structure a system and its environment in interacting parts, then synthesize these parts by measuring and ranking the effects of these parts on the whole system. Analytical hierarchical processes structure feelings and logic (judgment) in a structured approach to decision making. AHP steps are one of the tools in solving strategic problems [5].

![Figure 1. Schematic of the Analytical Hierarchy Process (AHP) to be carried out](image)

Furthermore, alternatives will be assessed using criteria that have been made by weighting the importance of each criterion achieved by following table 1. After weighting, then each agroforestry activity and criteria, then multiplied by the matrix between the average activity weight and the average weighted criterion, the goal is the one has the largest final weight value. This is done for each position of the buffer area of the IUPHH area.

| Weight | Necessarily                           |
|--------|---------------------------------------|
| 1      | The two elements are equally important, the two elements have the same influence |
| 3      | One element is slightly more important than the other elements, experience and judgment support one element a little more than another |
| 5      | One element is more important than the other, experience and judgment strongly support one element compared to other elements |
| 7      | One element is clearly more absolutely important than other elements, one element that is strongly supported and dominant is seen in practice |

Table 1. Weighting of the criteria in AHP
One element is absolutely more important than the other elements. Evidence supporting one element against another has the highest degree of affirmation possible.

The values between two values of adjacent considerations, this value is given when there are two compromises between the two options.

The Analytical Hierarchy Process consists of 3 basic stages, namely as follows:

1. Decomposition, with this principle the structure of a complex problem is divided into parts in a hierarchical manner. The goal is to define general to specific. The simplest form of the structure will be compared against objectives, criteria and alternative levels. The set of alternatives can be divided into more levels of more detail, covering more other criteria. The top level of the hierarchy is a goal consisting of one element. The next level may have several elements, of which the elements can be compared whether they have almost the same importance and do not have too much difference. If the difference is too large a new level must be created.

2. Comparison of judgments or considerations (comparative judgments), using this principle a pairwise comparison of all existing elements will be built with the aim of producing a scale of relative importance from the existing elements. Assessment can produce an assessment scale in the form of numbers. Pairwise comparison in the form of a matrix when combined will produce priority.

3. Prioritisation synthesis, is done by multiplying the local priority with the priority of the relevant criteria at the top level and adding it to each element in the level affected by the criteria.

Suprayitno [6] and Sya'ban [7] argued that motivation is influenced by farmer characteristics, farmer capacity, the role of extension workers, the role of farmer groups, land availability, markets, and outside influence. In addition, Sumiati [8] and Puspasari [9] conclude that farmer motivation is influenced by several factors, including farmers’ perceptions, farming experience, and cosmopolitan level of farmers in terms of human resources, while the availability of land, market and profitability in terms of economic feasibility.

3. Results and discussion

The condition of the Peusangan forest is still good even though in the forest periphery there has been encroachment, some farmers around the forest have started to form forest farmer groups whose search is for Non-Timber Forest Products (NTFP), especially deer and dragon blood fruit (daemonorops draco). Some members of farmer groups have started cultivating dragon blood fruit in forest areas, especially in the forest periphery. Communities around the forest are people who are more aware of the dangers of forest destruction, the result of forest destruction will have a direct impact on their settlements so that awareness of protecting the forest is higher. Based on a survey conducted in the Peusangan forest, it shows that forest encroachment is not carried out by communities around the forest but by people from other places who have large capital.

Agroforestry type determination to maintain forest function is carried out by selecting priority criteria and alternatives using the Analytical Hierarchy Process (AHP) method. This method considers human judgments, experiences, perceptions and feelings in the decision making process. The perception entered here is the perception of the respondent who understands the problem to be resolved. The first step to get a decision is to distribute questionnaires and discuss together with residents who use agroforestry to obtain data.

3.1 Analysis of Selecting Criteria for Supporting Agroforestry

Based on the analysis using the Analytical Hierarchy Process (AHP) method, the criterion for the type of agroforestry that has the highest priority is market availability with a value weight of 0.587. This means that market availability is very important for agroforestry businesses according to local farmers.
and economists and business experts, this result is very comparable to direct observations made in peusangan forest. The community around the Peusangan forest is very interested in finding dragon blood NTFPs because of the very large market availability at very suitable prices. The use of dragon blood agroforestry to meet the needs of the dragon blood market can be done by utilizing forest areas.

![Figure 2. Selection Criteria for Agroforestry Types](image)

### 3.2 Analysis of Selection of Agroforestry Types

Land use using an agroforestry system is believed to provide various benefits for people's lives in the form of social, economic, environmental and psychological benefits [10][11]. AHP, namely applying the dragon blood NTFP type of agroforestry.

![Figure 3. Selection of Alternative Agroforestry Types](image)

Perhutani [12] defines agroforestry as an optimal and sustainable use of land, by combining forestry and agricultural activities in the same land management unit by taking into account the physical, social, economic and cultural conditions of the participating communities. Dragon blood plant is very suitable for agroforestry cultivation because of the character of the dragon blood plant that thrives in the forest along with other plants, although it needs to be made separately for the cultivation process but in general it can be done.

The results of interviews with farmers around the forest showed their great interest in collaborating with anyone to conserve forests and be economically beneficial. Farmer groups have started to cultivate dragon blood independently without any help from outside. The limited knowledge of cultivating dragon blood has led farmers to do their own trials so that they can get suitable techniques for their cultivation. Agroforestry management activities include cultivation of dragon blood starting from land preparation, planting, maintenance, harvesting to marketing the results [13] so that farmers have to find partners who will help them at every stage of agroforestry they are working on.
The composition of the soil and the physical environment of Aceh's forests are suitable for thriving. Therefore, dragon blood is considered a valuable non-timber forest product (NTFP) and is recognized and classified as 'very good' due to the amount of dracorhodin [13, 14]. However, the resin extraction process or methodology is still carried out in a very traditional manner. Farmers or local tribes, in principle, harvest seeds in pristine forests by picking them with special 'hooks' or cutting branches instead of 'whole trees' as they used to do in the past.

4. Conclusions
The community around the Peusangan forest is very interested in collaborating in an effort to conserve the forest and utilize the forest for economic purposes. The factor that is very concerned about by farmers around the forest in considering the type of agroforestry business is the availability of a market with an appropriate price, getting an AHP value of 0.587. The type of agroforestry that is more potential to be developed in the area around the Peusangan forest is the dragon blood agroforestry, based on the AHP analysis the tendency is to have more weight on the dragon blood plant, which is 0.457, based on observations it is found that the jernang fruit market is very large and the price is very expensive, the dragon blood agroforestry is starting to exist naturally by the farmers around the forest.

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