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Submission date: 07-Nov-2019 11:57AM (UTC+0700)
Submission ID: 1208820227
File name: jurnal_12.pdf (420.84K)
Word count: 3737
Character count: 19966

IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 12, Issue 1 Ser. II (January 2019), PP 21-27
www.iosrjournals.org

Analysis of Profitability and Economy of Apalication Paludiculture Model of Meranti and Pineapple On Peat Land in Perigi Village Ogan Komering Ilir, Indonesia

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Abstract: *Paludikultur can ultilized of seasonal plants with the ability to grow well on peatlands. This reaearch aimed to implement Analysis of Profitability and Economy of Aplication Paludiculture Model of Meranti and Pineapple in different areas of peatland in the province of South Sumatra. Determine methods used in this research is purpose method (purposive sampling), with consideration to the location of two village namely Village Perigi and Village Sepucuk. Pilot Project Implementation of Paludiculture Model on peatlands in Perigi Village was able to develop a paludiculture model namely Meranti-Pineapple mixture with a scale of 1ha. The results of the financial analysis of Paludiculture model of Meranti-pineapple mixture with positive NPV, IRR 74.37% greater than the discount factor of 6% and the Net BC 6.25> 1.It can be said that is paludiculture model is economically feasible.*

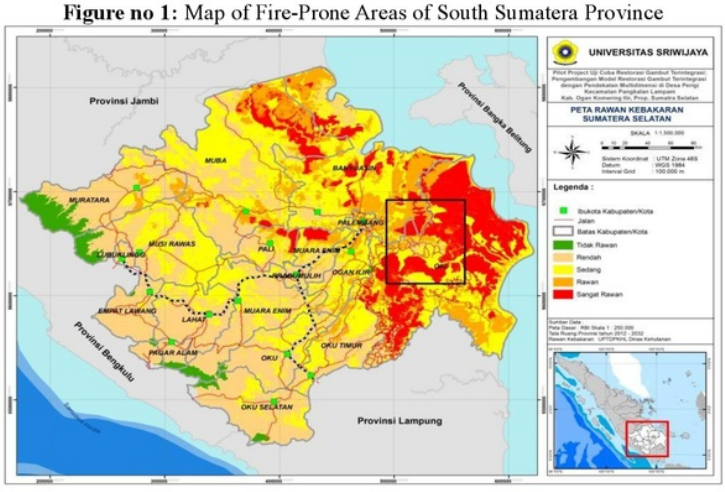
Keywords: *Analysis, Profitability, Paludiculture, Peatland, Meranti, Pineapple*

Date of Submission: 01-01-2019 Date of acceptance: 15-01-2019

I. Introduction

Peat ecosystem is an ecosystem that plays a very important role in maintaining environmental sustainability, particularly in relation to the issue of global warming. According to Surahman, Shivakoti, Soni (2017) land that has geat potential to be developed as farmland one is the peat so that the use of peat is need for protection againts climatic factors. Peatland damage is influenced by various factors, including the opening of peatlands into plantations, the opening of the canal, forest fires and land and inappropriate use, according to the characteristics of the peat itself (Nduru, 2018). Peat fires in 2015 was classified as a very large area that have an impact on the financial loss, the idle land when burned will produce a thick smog that polluting the environment also bringing detriment to society in the form of impairment of health, education and population activities. The number of land and forest fires in South Sumatra reached 128.314 hectares. The burning of land spread over three districts.

Figure no 1: Map of Fire-Prone Areas of South Sumatera Province



The direct impact of forest fires and peat for humans is loss of livelihoods, especially for those who still rely on natural resources. In addition to the economic impact, one of the environmental impact caused by forest fires and peat is decrease of nutrient by the Earth's atmosphere are dwindling, because the balance of nutrients in the soil peat has economic value that can be utilized by humans (Wildayana and Armanto, 2009).

Efforts in green growth back by perform ing recovery activities of sustainable peatland can be done through the peat ecosystem restoration shaded by Peat Restoration Agency (BRG) through 3R (Rewetting, Revegetatio and Revitalitation). Swamp forest ecosystem (including peat bog) is forest growing on areas that is permanently inundated with fresh water , unfluenced by the climate, but can be influenced by the tides.Conditions swamp and peat bog water saturated maintained without drainage, even on condition that have been drained, will be sought to carry out the closure of drainage or water lines so that the peat will be wet again (Joosten et al., 2012). Fires that occur in peat in South Sumatera Province that always recur and become a serious problem that should be addressed. The 3R approach strategy implementation depends on the target area that need to be restored. From these targets there are about 400 thousand hectares of area restored in APL area that involves the community. This area is an area that generally has been opened and maintained also become a source of livelihoods. For this region, the approach that can be done is to implement a system of paludikultur and multi-plant agroforestry. According to International Center for Research and Agroforestry (ICRAF), dinamic of agroforestry by planting forest plant in farmland by producing sustainable various output in order to increas the advantage of social, economy and enviromental value (Takaweian *et al,* 2013).

Perigi Village Ogan Komering Ilir South Sumatra is one of the locations in South Sumatra, which traced for point of fire during an extreme fire on peatland. So, it is necesary to take an action in the prevention of forest fires in peatlands in South Sumatra.The existence of the remaining peatland becomes important to be effectively and sustainably restored. Peatland restoration activity is a strategic effort, especially for the development of economic commodities that support community income.The solutions that can be done to overcome the problem of the causes of peatland fires by maintaining peatland in order to remain on wet and humid conditions can be done in several ways, that is: 1) Peat Restoration Model Integrated, 2) Model Paludikultur and Agrofrestry, Associated with the restoration of peat in 2017, Sriwijaya University has brought the Pilot Project in Ogan Komering Ilir district, namely:

1) Pilot Project Implementation Model Integrated Peat Restoration in the village of Perigi Ogan Komering Ilir, Indonesia
2) pilot Project Implementation District Paludiculture And Agrofrestry Model in the village of Perigi Ogan Komering Ilir, Indonesia

After the restoration of peatlands in, peatlands are planted with typical peat commodities, alternative development model used is paludiculture. Paludiculture is planting typical peat bogs vegetaion in the area of cultivation. Ministry of Environment and Forestry (2015), states paludiculture development is able to take advantage of seasonal plants with the ability to grow well on peatlands. This activity can be done by monoculture and polyculture. This research aimed to carry out Economies and Profitability Analysis in Various Model of Paludiculture that developed in different areas of peatland in the province of South Sumatra.

II. Material and Methods

Time and place

This study will be conducted in the village of Perigi Ogan Komering Ilir. Determining the location of this research is done intentionally (purposive), with the consideration that the village of Perigi did paludiculture model development and integration on the restoration of peatlands, while other locations as sources of data that isGardens Conservation and Foorestry Plant village Sepucuk, Forestry Pilot Project Try Restotasi Integrated Peat (3R) Agrosilfovisherydi Sepucuk village.

Research Method

The method used in this study is a survey method. Survey method is a research method that takes a sample of the population using questionnaires as basic data **connection** tool in the form of questions for completing of the data in the process of research and direct interviews to farmers and stakeholders that have implemented the paludiculture model.

Determining Location Method

Location methods used in this study using purpose method (*purposive sampling*), With consideration of the location of the two villages namely Perigi village and Sepucuk village. This is done because the existing plant at the project site in the village of Perigi can not be assessed economically. Thus, Sepucuk Village will also serve the village as a source of research data.

Data Collection Method

Data collected in the form of primary data and secondary data. The primary data consist of surveys and direct interviews with respondents in the reasearch. Relevant respondents given information of paludiculture development and agroforestry in the peatlands. While the secondary data obtained from books and sources also supporting institutions that and are associated with the research.

The collected data is processed and analyzed descriptively. The financial viability is measured based on the eligibility criteria by using the Net Present Value (NPV), Net Benefit Cost (Net BC), Internal Rate of Return (IRR).

Data Processing Method

To observe economic analysis of various paludiculture models in Perigi village using analysis of feasibility project formula. Total cost is gained from summing total fix cost and total variable cost, the formula is :

$$TC = \text{Investment Cost (IC)} + \text{Operasional Cost (OC)}$$
$$OC = TFC + TVC$$

Additional Information :

TC = Total cost
Invesment Cost = cost incured prior to production project
Operational Cost = cost incured after the production project
TVC = Total variable cost
TFC = Total fix cost

Next, the formula of total revenue in this project is :

$$AR = \frac{TR}{Q}$$

Additional Information :

AR = Average Revenue
TR = Total Revenue
Q = Output

Next, the formula of Net Present Value (NPV) is difference of income and cost :

$$NPV = \sum_{t=1}^{n} \cdot \frac{Bt - Ct}{(1=1)t}$$

Additional Information :

Bt = benefit of the first year
Ct = cost of the first year
t = bussiness activity year
i = discount rate

To observe the amount of Internal Rate of Return (IRR) value, then it is essential to hold experiments using a few different discount rate levels, so that it will produce result of NPV approximately zero. If the results of the experiment indicate the value of NPV is negative, it means the discount rate (i) the rate is too high, so that in the future the value of the benefit is more weight, because the PV Costs is greater than the PV Benefits (advantages). If the results of the experiment produce positive NPV value, this means the value of the level of the discount rate (i) too low, so that in the future the benefit are too heavy to be compared with PV costs. Then the experiment results are entered into the IRR formula below :

$$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2} \times (i_2 - i_1)$$

Additional Information :

i1 = discount rate has positif NPV
i2 = discount rate has negative NPV
NPV1 = positif NPV
NPV2 = negative NPV

This criterion indicates the rate of return per rupiah invested in Meranti-Pineapple model enterprise. It was worked out by dividing the sum od dicounted net cash flow by establishment cost at 6 percent rate of interest (Reddy and Ram 1996) in (D.Ryambai et.al, 2012).

$$\text{BC Ratio} = \frac{\text{Present worth of gross returns}}{\text{Present worth of costs}}$$

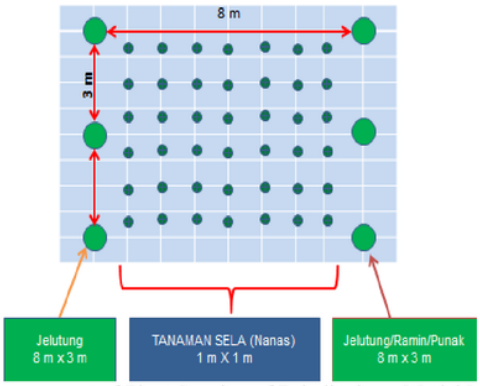
Payback Period represents the lenght of time required for the stream of cash proceeds produced by the invesment to be equal to the original cash outlay, the time required for project to pay for itself. In the present study payback period of Meranti-Nanas after product was calculated by using the following formula.

$$PBP = \frac{\text{Discount total cost}}{\text{Mean discount benefit}}$$

III. Result

Technical Aspects and Production

This research focused on paludiculture model of meranti and pineapple mixture. This is in accordance with the development encountered in the field, that the success of the restoration of peatlands through paludiculture system through agroforestry pattern with intercropping systems have also been carried out by a team of Balai Litbang (LKH) Palembang, in the area of Sepucuk village Ogan Komering Ilir, Indonesia. Based on this success there are some forestry plant that can be recommended which are Jelutung, Meranti, Ramin, Punak while for crops as intercrop can planted Pineapple, Chili, Cherry tomatoes, corn, turmeric and eggplant. Cropping pattern developed in this research is Meranto-Nanas mixture with arrangment that can be seen in picture no 1.



Picture no 2 : Arrangement of Plant Spacing of Paludiculture Model Meranti-Pineapple

In Picture no 2, Meranti plant spacing is 8m x 3m while the pineapple with a spacing of 1m x 1m. The number of trees in one hectare of land with the plant spacing based on the picture above is 368 meranti trees and 11.045 pineapple trees.

Aspects of Market and Marketing

One aspect that need to be taken into consideration for the development of business this paludiculture model is the availability of market for various agricultural products produced. During this time, as farmers marketing methods of agricultural products is still in a simple and conventional manner that is by waiting for prospective buyers / traders come to the site. With this marketing system, the product marketing activities do not have much impact on economic improvement for farmers. Therefore, the marketing channel system should be improved in order to b more efficient and have the impact on increasing the income of farmers. If it is associated with a product produced from plant of meranti and jelutung, the market risk will not become a problem for farmers, if the product is wood, market of wood product of meranti and jelutung not only nationwide but also internationally. Later, meranti and jelutung will be distributed and cooperate Industry of Foresty Plant and or pulp paper that is needed wood to produce paper and tissue. So farmers are directed to form farmer groups that will cooperate with universities as an educator to open cooperatives as mean of distribution of forest products. While the market for jelutung latex is now hard to find so that farmers and governments must cooperate to open up the market or processing industry jelutung latex for post-harvest preparation. By processing the latex into finished goods for jelutung latex almost equal to latex in general. When the plant is in its infancy, the market for jelutung latex is being prepared.

Aspects Of Financial

The financing pattern of development paludiculture model in Ogan Komering Ilir, Indonesia generally came from the assistance of the Local Government (LG) in cooperation with other parties, including the colleges, Peat Restoration Agency, as well as non-governmental organizations. In following years this

paludiculture model development can be managed on its own capital gains derived from profit of sales of agricultural production previously. However for business development in the future, aside from the capital given at the beginning, farmers can utilized credit funds from bank loans with various proportions depending on the scale of business. In addition to the formal credit institutions, financing sources are also accessible to farmers is non-formal credit institutions by the local community or a neighboring business center area. The credit system is simpler, with no requirements and specific collateral, based solely on the trust factor between the owners of fund and customers.

IV. Discussion

Financial analysis

In this research focused on the paludiculture model of Meranti-Pineapple mixture with a scale of 1 ha. Look at details of the costs of cultivation of paludiculture mode of Meranti-pineapple mixture as shown in Table no 1.

Table no 1: Raising Cost Paludiculture Model of Meranti-Pineapple mixture

No.	Component	Cost (Rp)
1	The investment costs	Rp 50.111.169
2	Maintenance year 1	Rp 11.358.787
3	Maintenance year 2-9	Rp 14.618.787
4	Maintanance year 10	Rp 13.160.000

With the investment costs for the model of Meranti-Pineapple in amount of Rp 50.111.169. Where the meranti tree maintenance in the first year, is fertilized 2 times, 2 times for pesticide application, 2 times for weeding and replanting during the period of one year if there are dead plants. While pineapple just dilkukan stitching in the first year. Pineapple seedlings seedlings planted the first year as many as 8235 seedlings. Costs incurred for maintaining Meranti-Pineapple mixture in year 1 in amount to Rp 11,358,787. Maintenance in year 2 until 9 meranti plant are fertilizing, giving pesticiding and weeding respectively done 2 times within a year. For the pineapple plant, land for cultivation of pineapple is cleaned and made ridges and made a stake as a growing pineapple media. Costs incurred for maintaining Meranti-pineapple mixture year 2 until 9 amounted to Rp 14,618,787. In year 10 maintenance of meranti plant, still given fertilizers and pesticides, and carried out weeding og meranti plants, each carried out 2 times until the wood is ready to be harvested and transported for sale to collectors. Costs incurred for the maintaining of Meranti-pineapple mixture in year 10 is amount to Rp 13.160.000.

Table no 2: Financial Analysis of Paludiculture Model of Meranti-Pineapple mixture

Component	Quantity	Total
a. Meranti Wood Production		
Thinning	64 m3	
Harvesting	159 m3	
Pineapple	17 466 kg	
b. Meranti wood revenue		Rp 89,126,531
c. Pineapple revenue		Rp 53,621,568
d. Income		Rp 56,849,292
NPV		Rp 264.290.684
IRR		74.37%
PP		2.1
Gross BC		2,69
Net BC		6.25

Table no 2 further explained that, before the harvest of meranti the first thing to carry out is thinning of 30 percent of the amount of wood that is going to be harvested from368 trees capable of production wood with a stem volume 212 m3, so result abtained 64 m3 with thinning wood selling price of Rp 400.000 /m3, while in the harvesting of wood, the end of the meranti to recycle in year 10 is 159 m3 with selling price of wood Rp 400.000 / m3. While the pineapple production until year 10 of assumsing 90 percent of pineapple can be harvested from 1 is assumed to be 7.161 kg, obtained a yield of 6.455 kg, harvest 2 6.445 kg and harvest 3 5800kg, leaving the total production up to 17.466 kg with pineapple selling price Rp 6,000 / kg. So the total revenue of meranti wood in 1ha scale amount is Rp 89.126.531 when the diameter of the tree has reached 28,2 cm / 10 years is while the tree height has reached 1.310 cm. Total revenues of pineapple on a scale of 1 ha that mixed with meranti is Rp 53.621. 568 following the end of cycle of meranti until year 10. Sothat the revenue received for 10 years is in the amount of Rp 56.849.292. NPV value on the economic feasibility of the Paludiculture model of Meranti-Pineapple mixture is positive this indicates that the development of

Paludiculture model of Meranti-Pineapple mixture provide benefit, the value of IRR is 74.37% which greater than the discount factor used in this research of 6% means that the development of Paludiculture model of Meranti-Pineapple mixture will give the revenue equal to the costs incurred if the interest rate amounted to 74.37%, BC Net value of 6.25 if the value of Net BC> 1, then the business is profitable.

Table no 3: Sensitivity Analysis On Some Possible Situation of Paludiculture Mode of Meranti-Pineapple Mixture

No.	Component	NPV	IRR (%)	Net BC
1	Investment costs increased 100%	Rp 227.542.603	48.36%	4.08
2	Operating costs increased 100%	Rp 166.622.876	48.42%	4.31
3	Price Lowered by 39%	Rp 530 570	6.17%	1.01
4	Production Lowered by 39%	Rp 530.570	6.17%	1.01
5	Production costs increased 52% prices and production fell by 71%	Rp 1.408.126	6.42%	1.03

Based on the table above, through sensitivity test, model of Meranti-Pineapple is still economically viable. Although the cost of investment and operating costs increased by up to 100%, the NPV value is not touch the minus number. The selling price is lowered by 39% still feasible economically with positive NPV, IRR of 6.17% greater than the discount factor is 6% and the Net BC> 1 by 1.01. With the same values apply to the decrease in production of 39%. While in testing the worst situation by increasing the cost of production by 52%, prices and production reduced by 71% together, the NPV remains positive with the IRR of 6.42% and the Net BC 1.03,

Picture no 2: Meranti and Pineapple plant


V. Conclusion

Pilot Project Implementation of Paludiculture And Agroforestry Model on peat land in the village of Perigi is able to develop a paludiculture model is Meranti –Pineapple with a scale of 1 ha. With the results of the financial analysis of Paludiculture of Meranti-pineapple mixture with positive NPV, IRR 74.37% greater than the discount factor of 6% while Net BC 6.25. It can be said that paludicultur and agrofoestry model of Meranti-Nanas mixture and economically feasible. The results analysis of paludiculture mode of Meranti-pineapple mixture, although investment costs and operating expenses are increased by up to 100%, the model is still feasible. Indeed it can be said that development of paludiculture model n peat land in the activities of the Pilot Project Implementation of Paludiculture and Agroforestry Model and economically feasible. While in testing the worst situation by increasing the cost of production by 52 percent, revenue is reduced by 71 percent, NPV value remains positivewith IRR value of 6,42 percent and Net BC 1,03.

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Masita Anisa." Analysis of Profitability and Economy of Apalication Paludiculture Model of Meranti and Pineapple On Peat Land in Perigi Village Ogan Komering Ilir, Indonesia." IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 12.1 (2019): PP- 21-27.

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