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Research Article

Economic Valuation of "Parak" Traditional Agroforestry West Sumatera (Case Study in Nagari Paninggahan, Solok Regency)

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Abstract. This study aims to determine the economic value, which is a direct and indirect benefit (tangible and intangible) of Parak in the research area. This research used a case study method, and the sampling was carried out in a purposive manner consisting of 50 sample farmers. The data used in this study are primary data and secondary data. Preliminary data were obtained by direct interviews with respondents based on the questionnaire provided, while secondary data were taken from agencies related to this research. The processing of data obtained in the field shows that Parak plays an important role in supporting the economy of farmers in Nagari Paninggahan either directly or indirectly. The direct use value obtained from the plant is IDR. 46,753,650 (66,316 per cent), from firewood of IDR. 23,070,000 (32,722 percent) and from livestock IDR. 678,550 (0.963 per cent) so that the total direct use income is IDR. 70,502,200 per year of all commodities cultivated by the sample farmers. Meanwhile, for indirect use, such as household/domestic water use, IDR. 13,312,320/year and agricultural irrigation water IDR. 54,052,111/year. The total indirect usage is IDR. 67,364,431,-. Per year. Agroforestry patterns can cover the soil layer well and have an effective influence on soil erosion control to increase the supply of water in the soil. Respondents have also carried out other conservation activities by constructing bench terraces, terracing systems, and other buildings to suppress sedimentation and erosion.

Keywords: *Economic Valuation, Parak, Agroforestry*.

A. INTRODUCTION

Agroforestry, in Indonesia it is often referred to as 'forestry' is a collective term that combines various land management patterns containing agricultural, forestry, and animal husbandry crops (Hairiah & Ashari, 2013). This pattern is widely found in tropical areas of developing countries, including Indonesia, and has been carried out for generations by the community for the last three decades. Land management using agroforestry techniques is believed to provide economic, social, and ecological benefits to farmers' land (Affandi et al., 2017).

In the province of West Sumatra, the community has a distinctive culture in farming, namely by combining cropping patterns that combine irrigated rice fields and various types of annual crops. West Sumatran farmers have also developed mixed tree gardens, known as "Agroforestry", combining commercial crops grown by farmers with plants from natural forests over the cultivated area, known as "Parak".

Parak consists of various species with various types of tall trees and very complete and layered vertical stand structures. In Parak, different forest products are produced that can be sold or consumed, wood for building, fuel, and non-timber products such as vegetables, fruits, medicines, and others (Bong, et al. 2019). Parak is also planted with commercial agricultural crops such as nutmeg, cinnamon, coffee, cloves, candlenut, and young plants such as onions, eggplant, chilli, cucumber and cereals (Martial, 2012)).

Seeing the completeness of the plants planted, it can be said that Parak is a cropping system that has high productivity and can be used to maintain plant diversity, nourish ecosystems, and keep soil water content. There are many uses and values of the existence of Parak for the community and the natural surroundings, in the form of direct benefits and indirect benefits (Samsudin et al. 2020)).

There are two conditions in the current community forest management system. The first condition is that the pattern existed and was run by the community but was removed by various forest management policies. Second, the system still exists today but has no room for development and has not received recognition in its implementation (Roshetko et al. 2007).

For the "Parak" system, which has developed for hundreds of years, which has grown from local community knowledge and has reflected this form of Community Based Forest Management, it still exists and can be developed, for that it needs to be proven by a robust economic calculation, socio-cultural picture complete, complete documentation, systematic promotion efforts and the most important thing is that the community around and in the forest gets space and legitimacy, one of which can be done by calculating its economic value (economic valuation) (Asmin et al. 2017).

An economic valuation can mean value, which literally can be said as a person's perception when interpreting objects. Economic valuation of natural resources aims to make people appreciate the existence of these natural resources, not just take economic value from them (Parmawati, 2019). The concept of economic valuation can be used as an instrument to estimate the monetary value of goods and services. Policymakers can use this assessment to manage natural resources and the environment to be more effective and efficient and to fairly describe the benefits and values of conservation (Indrajaya & Sudomo, 2013).

Based on the description above, so that the existence of Parak can be recognized, the researchers are interested in researching: Economic Valuation of Parak as a Traditional Agroforestry of West Sumatra.

B. METHOD

The research was conducted in Paninggahan Village, Junjung Sirih District, Solok Regency. This study uses a case study method that will describe the situation in Parak in the research area. The respondents in this study are farmers who manage and use their land as Paraks. Respondents in this study were taken as many as 50 people by purposive sampling (Wirata, 2005). The data used in this study are primary data and secondary data. Primary data is data that can be obtained directly by interviewing respondents utilizing a list of questions. Secondary data is taken from agencies related to research such as the Statistics Office, Forestry Service, Agriculture Service and others. To calculate the total economic value (TEV), the following formula is used:

$$\mathbf{TEV = UV + NUV}$$

Information:

TEV = Total Economic Value (Total Economic Value)
UV = Use Value (Use Value)
NUV = Non Use Value (Non Use Value)

Direct use value is the value obtained from the production or consumption of goods produced by resources directly. The value of immediate use of Parak comes from the value of plants, livestock, and the value of using wood in the Parak area in Nagari Paninggahan.

Non-Use Value (Non-Use Value), include: a) The hydrological function is derived from the value of water use for households and the value of water used for agriculture; and b) As an erosion inhibitor.

C. RESULT AND DISCUSSION

1. Vegetation Type

The vegetation in Parak is generally diverse, both in structure and composition. The various types of plants and components planted with those that grow naturally result from local wisdom possessed by their ancestors (Michon, et al. 1986). These plant components will form a dense canopy that resembles a forest. Young plants that are short-lived never grow dominantly in a parakeet.

From the research results in the field, it is known that the types of vegetation that exist and are cultivated in Parak in Nagari Paninggahan consist of several compositions, including: (1). vegetation originating from shrubs was then planted with cloves, and cinnamon (40%), (2). the vegetation from reeds was then planted with candlenut, coffee, avocado (30%), (3). sparse forest-origin vegetation is then planted with coconut, Cocoa (20%), (4). vegetation from other trees and shrubs was then planted with kapok, saurian and petai (10%). Table 1 below describes the vegetation cultivated in the Parak community.

Table 1. Types of Plant Vegetation in Parak in Nagari Paninggahan

No	Vegetation Type		Number of Respondents	%
	Original Vegetation	Artificial Vegetation		
1.	Shrubs	Cloves, Cinnamon	20	40
2.	Reed	Candlenut, Coffee, Avocado	15	30
3.	Rare forest	Coconut, Cocoa,	10	20
4.	Other trees and shrubs	Kapok, Surian, Petai	5	10
	Total		**50**	**100**

Source: Data Proceed

Judging from the vegetation of the plants above, people prefer annual plants because annual plants provide good economic value to be maintained and have more significant benefits than seasonal plants and can also be used for household consumption, both for housing and food needs (Asmin, 2020). And illustrates the role of the community in the environment that can be appropriately managed so that there are no people who destroy the sustainability of the forest in Nagari Paninggahan.

2. Direct Benefit Value:

As a form of agroforestry, Parak is a mixed tree garden consisting of various kinds of plants and animals in it. Plants and animals in the Parak provide economic value directly or indirectly to the community. The following describes the value of the benefits of Parak in the research area.

a. Plant Benefit Value.

Some types of plants that exist in the research area are: 1) Cloves are the most widely cultivated plant by farmers in Nagari Paninggahan. This is because commodity prices have started to improve, and farmers are optimistic about growing this plant in the future. Clove seeds are usually purchased at the nearest market, such as at Paninggahan Market, Sumani. Meanwhile, some farmers breed themselves; the seeds are taken from long-lived trees and in a state of ripeness in the trunk; 2) As an essential export crop of West Sumatra, Cinnamon has been cultivated by the Paninggahan community for centuries. In parak, cinnamon is an important plant species. Cinnamon will be harvested when the plant is 8-10 years old, with a stem circle of more than 10 cm and a plant height of 15 m. To gather, the tree is cut down, the bark and branches are taken. One tree of this size, on average, can produce 8-12 kg of dry bark. Meanwhile, the wood whose bark has been peeled off is taken as firewood for personal use or for sale (Rahu, et al. 2013); 3) Candlenut is the dominant component of parak in Jurong Subarang Nagari Paninggahan; in addition to the suitable climate and soil conditions, this

commodity was once a program of the local government of Solok Regency in the eighties, known as the "Kemirinisasi Program". Candlenut is planted between a canopy of cinnamon that is not tight; candlenut seeds are usually taken from abandoned paraks. The candlenut tree produces fruit throughout the year; the highest yields are in July and January. The community's candlenut production varies from 50 kg to 80 kg of dry seeds per year; 4) Coffee is a plant that requires shade. For this reason, in Parak Coffee, it is cultivated between less dense cinnamon plants. For the propagation of coffee plants, the seeds are taken from abandoned Parak on the hillside. At the beginning of growth, coffee plants are interspersed with woody plants planted between coffee plants. Coffee is consistently grown side by side with other crops. Due to the declining economic value of coffee, more and more farmers are combining coffee plants with other commercial crops such as fruits and other woody plants (Santhyami, et al. 2018). Aside from being a shade, the tree is also a shade for coffee plants to increase the overall yield of the garden; 5) Coconut is a commodity that is planted by the people of Paninggahan, especially Jorong Koto Baru Tambak, Jorong Koto Baru Tambak, the land is higher than the jorongs in Nagari Paninggahan. Seedlings from coconut trees are mostly taken from plants that are old/mature. Coconut trees are widely used by the people of Nagari Paninggahan for building materials and small stalls; 6) The avocado plant is the flagship plant of Nagari Paninggahan. Avocado is a production plant that is widely planted, and the people of Nagari Paninggahan take the results. They are sent to the island of Java, Medan and several other bloodlines. The taste and quality of the Paninggahan avocado are very worthy of being marketed to local and foreign countries, and some are sent to supermarkets at home and abroad. Types of avocado Paninggahan, among others, avocado mega and avocado ago; 7) Onion is a seasonal crop grown by the Paninggahan community. Onion is the second commodity after rice. From the research in the field, the average Paninggahan community until this period, very much planted shallots starting from Jurong Subarang to Jurong Gando. The onion commodity is currently in the spotlight by the Solok Regency government, a superior commodity worthy of being marketed both locally and abroad; 8) Chilli plants are a commodity that is less dominantly planted by the Paninggahan community. Still, there is a Paninggahan area where chilli plants are dominant, such as the Koto Baru Tambak and Thousands of people (Mutiani & Febriamsyah, 2021). On average, their land is in highland areas such as hills. On the sidelines of the onion and clove plants, chilli was also planted.

Table 2 below describes the economic value of the plants cultivated by farmers in the research area.

Table 2. Economic Value of Parak Farmers' Crops in the Research Area

No	Plant Benefits	Production (kg)	Price (kg)	Reception/Year	Income/year
1.	Clove	22.144	100.000	44.288.000	38.614.400
2.	Cinnamon	9.973	30.000	5.983.800	4.094.400
3.	Candlenut	8.992	6.000	1.079.040	911.700
4.	Coffee	477	22.000	209.880	96.570
5.	Coconut	8.242	2.000	329.680	217.700
6.	Cocoa	875	21.000	367.500	211.100
7.	Avocado	5.455	9.000	981.900	751.460
8.	Onion	16.160	18.000	5.472.000	1.698.200
9	Chili	1.130	18.000	394.200	158.120
Amount				59.106.000	46.753.650
Average				6.567.333	5.194.850

Source: Data Proceed

b. Benefits of Wood

In addition to fruit and plant bark, wood in the form of twigs and branches of plants, plants also benefit their owners. The wood used by the Paninggahan community includes coconut trees, candlenut trees, coffee, cloves and cinnamon trees. Coconut tree wood and candlenut trees can be used for building materials such as houses, sometimes livestock, small stalls, and firewood (Rahman, et al. 2016). Meanwhile, clove wood, coffee wood and cinnamon are used by the community as firewood for household needs, and some are sold to collectors. The average price of firewood per bunch is IDR. 2500. The following table 3 below describes the value of the benefits of Parak firewood in the study area.

Table 3. Benefit of Timber Obtained by Parak Farmers

No	Benefits of Wood	Production (Bundle)	Price (Rp)	Revenue (Rp/year)
1	Digunakan RT	6.300	2.500	15.750.000
2	Dijual	2.928	2.500	7.320.000
Total		**9.228**	**2.500**	**23.070.000**

Source: Data Proceed

c. Benefit Value of Livestock

In addition to cultivating seasonal crops and annual crops, farmers also raise livestock and fish. Livestock that farmers in parak mainly keep include goats, cows, chickens, and fish. In some jorongs, buffaloes are kept to plough the fields. Buffaloes are kept and graze on paraks. In addition to animals kept by farmers, wild animals such as pigs, monkeys, lions, tigers, and snakes are the dominant components in the parak. Of the 50 respondents, only 10 respondents keep livestock in Paraknya. The livestock owned by the people of Paninggahan in Parak is cattle (20.00%), goats (30.00%) and fish (50.00%). The following table 4 below describes the livestock kept by farmers in their paraks.

Table 4. Farm Animals Owned by the Community in Park

No	Type of Livestock	Number of Respondents	%
1.	Goat	3	30,00
2.	Cow	2	20,00
3.	Parrotfish	5	50,00
Total		**10**	**100**

Source: Data Proceed

Farmers raise livestock around the contour line of the Junjung Sirih hill. The direct benefit value of animals is illustrated in table 5 below:

Table 5. Farmer's Income Livestock in Nagari Paninggahan

No	Livestock benefits	Production	Price	Average Acceptance	Average income
1	Parrotfish	425/kg	23.000	189.300	152.550
2	Goat	11 tails	2.000.000	440.000	86.000
3	Cow	13 tails	18.000.000	4.680.000	440.000
Amount				**5.306.300**	**678.550**
Average				**1.768.767**	**226.183**

Source: Data Proceed

Based on the results of field research, the calculation of the value of direct use of parak farmers, shows that the value of immediate use makes a significant contribution to farmers' income. A clear picture can be seen in the following summary table.

Table 6. Direct Use of Parak Farmers in Paninggahan

No	Direct Use	Average Income/Year	Percentage
1	Plant benefits	46.753.650	66,315
2	Benefits of wood	23.070.000	32,722
3	Livestock benefits	678.550	0,963
Amount		**70.502.200**	**100,000**

Source: Data Proceed

The summary table above shows that plants provide the most benefits, namely 66,315 per cent, firewood 32,722 per cent and livestock the least. Plants that are planted are generally long-lived annual plants. From these plants, firewood will also be produced from wood branches or from old plants and must be regenerated. In terms of value for money, livestock does provide the most negligible value. This is because only a small number of farmers cultivate livestock in their Paraks (Catacutan & Villamor, 2016). The community Parak is located far from home, so it will be tough to control livestock every day.

3. Indirect Benefits

a. Hydrological Function

The results of household water use calculation based on the water supply cost approach provide values that vary between sample farmers. This situation occurs because of the different distances from water sources and water facilities in the research area. Some people directly use water for household needs because the house's location is close to a spring, and they do not need to pay for water supply, while it requires water supply costs for some areas. The cost incurred by the sample farmers is the cost of supplying the hose. The analysis results conducted on farmers in the research area obtained an average value of water supply of IDR. 30,290,000 /per capita /year, and the average is IDR. 605800.

Meanwhile, the average domestic or household use of water for each dependent in the family is 13,312,320/litre/year. With an average of 522,051.76/litre/year. From the total water benefits of all respondents of 13,312,320 m, it can be obtained that the average water use per hectare is 266,246.4/ha.

b. Agricultural Irrigation Water

To calculate the value of agricultural irrigation water used the cost of production factors approach. At the research location, farmers who own rainfed rice fields do not buy water but only rent water pumps to manage their Parak. The rental value of water pumps to irrigate Parak fields varies, which is between IDR. 800,000 per ha to IDR 1,500,000 per ha. This cost is used to estimate the value of irrigation water that flows through the farmers' fields, covering an area of 0.89 ha. Based on the value of the irrigation water, the average per respondent was IDR. 1,364,780/ per hectare. Thus, the total value of agricultural irrigation water in the sample farmer plots is the area of the sample farmer farm x irrigation value x area of irrigated rice fields (44.5 ha x 1,364,780 ha x 0.89 ha = IDR. 54,052 .111) or a value per hectare of IDR. 1.081.042/ha. The following table 6 below describes the Paraxic Hydrological Function in the study area.

Table 6. The Hydrological Function of Parak in Paninggahan

No	Indirect use	Total Value (IDR/ha)
1	Household domestic water	13.312.320
2	Agricultural Irrigation Water	54.052.111
Amount		**67.364.431**

Source: Data Proceed

Based on the analysis above, the economic value of Parak is obtained as follows:

TEV = UV + NUV

137.866.631 = 70.502.200 + 67.364.431

So the total benefit value of the farmers in one year is IDR. 137,866,631, which comes from the value of direct benefits and the value of indirect benefits. This shows that economically Parak has a high enough value and can support the welfare of farmers in the research area.

c. The Role of Parak in Flood and Erosion Control

Forest management by regulating forest areas is essential to reduce the risk of flooding and erosion. Likewise, with the Parak area in the Paninggahan village, considering that the Parak with a canopy from the tree canopy can cover the land well and prevent erosion, the Nagari government sets a minimum Parak area of 25-30% of the site in the hills of Junjung Sirih. Parak in the Junjung Sirih hill area can carry out its role of storing groundwater during high rainfall.

The Paninggahan community implements a two-pattern system in Parak, namely the monoculture pattern (only woody plants, sometimes only one type of woody plant or a mixture of various kinds of woody plants) and poly-culture or agroforestry, which combines forestry, agricultural and livestock plants. Agroforestry patterns can cover the soil well so that it has a practical effect on controlling flooding and erosion and can also increase groundwater supply. Respondents in the research area have also made various conservation efforts by constructing bench terraces, terracing systems, and creating other buildings to suppress sedimentation.

At the edge of the terraces, the sample farmers strengthened by planting grass, lamtoro and horticultural crops such as bananas and pineapples. Grass plants, besides having a function to enhance the terrace, are also used as a source of animal feed (cow, buffalo or goat) managed by farmers. Animal manure can be used as fertilizer for crops which can improve soil fertility.

D. CONCLUSION

From the results of data analysis, it can be concluded that: a) Judging from the economic factor that the amount of direct use of the benefits of the plant is IDR. 46,753,650 (66,316 per cent), from firewood of IDR. 23,070,000 (32,722 per cent) and from the farm of IDR. 678,550 (0.963 per cent) so that the total direct use income is IDR. 70,502,200 per year of all commodities cultivated by the sample farmers; b) The total indirect usage is IDR. 67,364,431. Indirect use between household/domestic water use is IDR. 13,312,320/year and agricultural irrigation water IDR. 54,052,111/year; and c) Parak plays a role in controlling erosion and flooding. The community has made conservation efforts, such as making bench terraces, terracing systems, and making other buildings and planting reinforcing plants such as grass, lamtoro, pineapple, banana and others.

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