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Community and forest linkages in food, water, fuelwood of community residing nearby Wan Abdul Rachman Forest Park, Indonesia

Zainal Abidin[1*], Muhammad Irfan Affandi[2], Hari Kaskoyo[3], Dewi Lengkana[4], and Eny Puspasari[5]

[1]Department of Agribusiness, Faculty of Agriculture, University of Lampung, Jl. Soemantri Brojonegoro 1, Bandar Lampung 35145, Indonesia. [*]E-mail: zainal.abidin@fp.unila.ac.id
[2]University of Lampung, Jl. Soemantri Brodjonegoro 1, Bandar Lampung 35145, Indonesia. E-mail: irfan.affandi@fp.unila.ac.id
([3]Department of Forestry, University of Lampung, Jl. Soemantri Brodjonegoro 1, Bandar Lampung 35145, Indonesia. E-mail: hari.kaskoyo@fp.unila.ac.id
[4]Department of Science Education, University of Lampuing, Jl. Soemantri Brodjonegoro 1, Bandar Lampung 35145, Indonesia. E-mail: dewi.lengkana@fkip.unila.ac.id
[5]Regional Technical Implementing Unit (RTIU) of Wan Abdul Rachman Forest Park, Jl. Wan Abdul Rachman, Bandar Lampung 35158, Indonesia. E-mail: enypuspa2015@gmail.com

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Abstract

Wan Abdul Rachman Forest Park (WARFP) serves various benefits to Lampung Region such as: water, food, cash crops, energy, and ecosystem services. Since WARFP is located nearby a city, it is under constant pressure from human. This study intends to identify how community is dependent on WARFP in terms of food, economy, water, and energy, especially fuelwood. The study involves 61 forest farmer members of Regional Technical Implementing Unit (RTIU) of WARFP. The study employs a mixed-method approach, combining qualitative descriptive techniques and quantitative analysis. Five components were used to assess the level of dependence, namely: 1) use of forest resources such as water, fuelwood, medicinal plants, and food, 2) economy, 3) environment, 4) access and rights to the forest, 5) participation. The study suggests that forest farmers were highly dependent on WARFP in terms of water, food sources, fuelwood energy, economy, and protection of forest from natural hazards such as flooding and forest fire. The community also enjoy the rights to cultivate forest land under partnership. However, participation from forest farmers are still limited and therefore necessary to be improved.

Key words: family expenditures, non-timber products, partnership, mix method.

Introduction

According to Liddle et al. (2016) and Siamabele et al. (2020), community based natural resource management (CBNRM) has various meanings. They suggested CBNRM as a process where local people or organisation/s manage themselves

of their surrounding natural resources. In this view, local community is the proper institution to manage local resources.

In residential areas that border forest areas, people lives are very much determined by the forest (Poudyal et al. 2018). In general, communities living in areas around forests are poor due to limited resources and non-agricultural work as opportunities for non-agricultural activities are very limited. Study by Sunderlin et al. (2005) and Suyanto et al. (2007) state that there is a causal relationship between forest destruction and increasing poverty in developing countries.

According to Newton et al. (2016) the term forest dependency is a term to describe communities that benefit from forests. More specifically, the term describes poor communities including indigenous, traditional communities in developing countries. This occurs in many part part of the world like in Europe, Africa, Asia, and Latin America. A study by Talpã et al. (2022) in Moldova identified various types of forest products used by the community such as for food, firewood, medicine, fruits, seeds, etc. The study stated that the frequency of taking forest products was 314 times annually with a distribution for taking fuel of 44.59 %, nuts 11.78 %, straw mushrooms 17.58 %, medicinal materials 12.74 %, dog rose 11.15 %, fruits 2.74 %, and seeds 1.27 %. So, the use of forest products for fuel and food is very dominant in Moldova. In Tanzania, a study done by Ntiyakunze and Stage (2022) suggested the important of forest to alleviate poverty. In their study, using multiple linear analysis they proved that variables influencing dependence on forests are: 1) income with a negative coefficient, 2) distance to the forest with a negative coefficient, 3) off-farm activities with a negative coefficient, 4) land size with a positive coefficient, and 5) area with a positive coefficient. These results indicate that the higher the income, distance to the forest, and off-farm activities, the less dependence on forests will be. Other study using multiple regression by Chu et al. (2019) suggested gender, ethnicity, farming experience, area of managed forest, access to non-timber products, environmental services and participation in training have a very significant impact on household income.

This study is intended to investigate degree of dependency of community on Wan Abdul Rachman Forest Park (WARFP) an area set for conservation zone according the Decree of the Minister of Forestry Number 408/Kpts-II/93. This area has high natural resource potential, including various fauna species such as the Sumatran tiger, Sumatran elephant, siamang, monkey, and hornbill, as well as various types of flora such as Medang (*Actinodaphne nitida* Teschn.), Pulai (*Alstonia scholaris* (L) R.Br., Durian (*Durio zibethinus* L.), Gintung (*Bischofia javanica* Blume), rattan, orchids, and ferns. In addition, this area also plays an important role in the conservation of germplasm and supports education, research, science, cultivation, culture, tourism, and recreation activities.

However, current conditions show that several species, such as the Sumatran tiger and Sumatran elephant, are no longer found in WARFP, which is most likely due to habitat destruction. However, based on the installation of camera traps by WWF in 2017, other protected species were found. The WARFP area faces significant management challenges, particularly because, as of 2019, open land accounted for 18,471 ha out of a total area of 22,249 ha – approximately 83 %. This is due to community activities that utilize the

land for plantation crops, especially coffee. The conservation partnership policy is expected to overcome this problem. According to Lampung Provincial Regulation Number 13 of 2019, this area is included in the Provincial Strategic Area which has an important influence on the economy, social, culture, environment, and technology in Lampung Province (Lampung Forest Agency 2020). Kristin et al. (2018) has concluded moderate interaction between community and forest in WARFP. The interaction was mostly in terms of getting benefits from land cultivation inside forest. But, high interactions with forest were shown by farmers who owned medium land cultivation in the forest. Further, farmer with low income tend to be more active in farm activities inside the forest.

Other study by Arianto et al. (2018) summarized the valuation of water service of WARFP forest to community both for domestic used and for paddy using Contingent Valuation Method or Willing to Pay. Their study concluded that in terms of value of water service, the WARFP provided more than IDR 10 billion (€ 527 thousand) annually for Batu Putuk Village.

Since the proximity of WARFP to population and economic centre in Lampung, this park is oof strategic important to the region, especially for Bandar Lampung City, the capital of Lampung Province. On the other hand, community who resides nearby and run smallholder agroforest farming use WARFP as the most important source of livelihoods. This study intends to analyse the dependence of community residing in the border of WARFP in terms of the use of forest resource such as water, fuelwood energy, economy, environment, access on forest, and participating in guarding forest.

Object and Method

Research site and time of study

The study was held in Bogorejo Village, Gedong Tataan Subdistrict, Pesawaran Regency of Lampung Province (Fig. 1). The site is located around 25 km northeast of Bandar Lampung City, capital city of Lampung Province. According to Badan Pusat Statistik (2024), Bogorejo village has area of 1744 ha with a population of 5436 people of which 51 % were male. Further, population density was 3 people per ha.

The reasons to choose the site are explained in following. First, this village has direct border to WARFP and around 45 % of the population has been active farmers in WARFP. The second, forest farmers in the study site has been awarded partnership status by Forestry Agency which allows them to lawfully cultivate land inside forest with condition of farmers should enhance forest condition. The third is that farmers' groups have shown good performance in maintaining forest condition.

According to Lampung Forest Agency (2020), WARFP has an area of 22,249.31 ha in which land covers are grouped into three:

1. Primary forest – 3304.74 ha or 15 %;
2. Secondary forest – 12,968.07 ha or 58 %;
3. Farmland – 5976.5 ha or 27 %.

It is obvious that big part of WWRFP has been used for agriculture activities, predominantly with agroforest farming.

The study was carried out from July to November 2024 which consists of the following steps:

1. Preparation;
2. Preliminary observation;

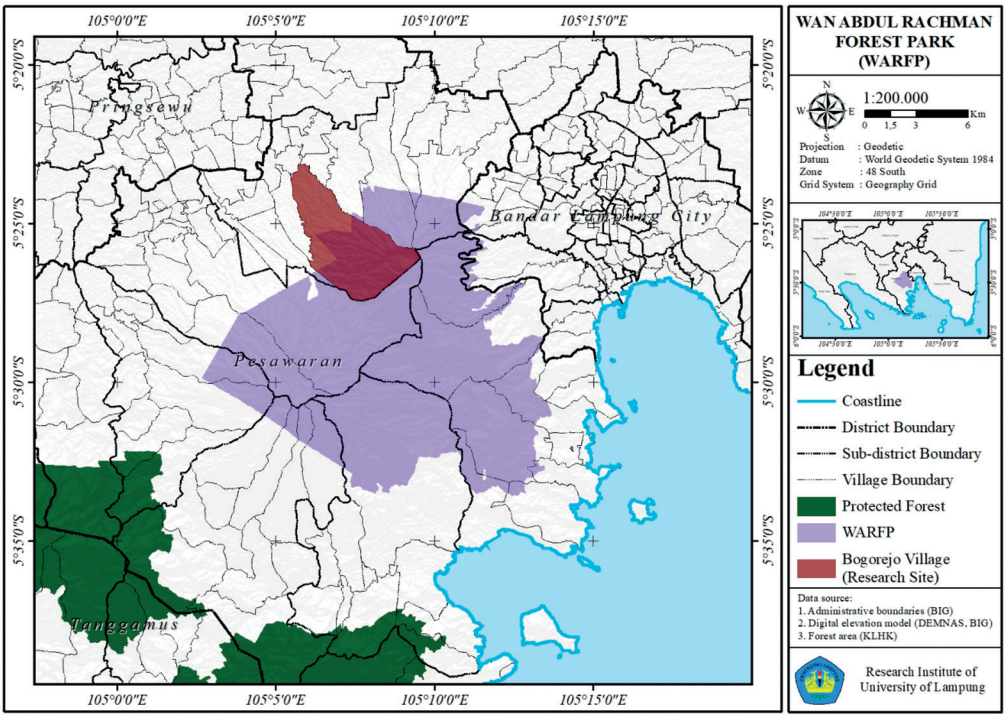

Fig. 1. Map of research site.

3. Developing research instrument (mainly questionnaire);
4. Field data collection;
5. Data analysis;
6. Reporting.

Respondents

Respondents are selected purposively, i.e.: farmers reside nearby of WARFP and are members of Forest Farmers Group (FFG) that has been given as partner by technical unit of WARFP. Partners status is a recognition for their activity and has rights to have access in using and getting benefits from forest. However, they are not allowed to cut trees inside the forest.

Sample size was determined using the approach Isaac and Michael (1995) by formula (1).

$$n = \frac{N \cdot Z^2 \cdot \sigma^2}{N \cdot u^2 + Z^2 \cdot \sigma^2}, \quad (1)$$

where: N = 229 – population of farmers or members of FFG; n – sample size; Z – z distribution with validity of 95%, i.e. Z = 1.96; σ – standard of deviation set at 0.25; u – error estimate at 5.5 %, i.e. u = 0.055.

With this formula, the total sample size is 61. Distribution of respondents are allocated in 8 FFGs as shown in Table 1.

Analysis

The study uses mix method (Creswell and Clark 2007) a combination of 1) descriptive qualitative analysis and 2) quantitative data analysis. Qualitative data analysis is the dependent of community towards for-

Table 1. Distribution of sample/respondents.

FFGs	Members (persons)	Proportion, %	Respondents
E	35	15	9
F	18	8	5
G	15	7	5
K	20	9	5
L	25	11	7
MJ	32	14	8
N	43	19	11
O	41	18	11
Total	229	100	61

est from 5 components as summarised by Angelsen et al. (2011) and FAO (2020):

1. The use of forest resource;
2. Economy;
3. Environment;
4. Access and rights on forest;
5. Participation in forest management.

Each component is scored: 1 – very low to 5 – very high.

The quantitative analysis designed to determine the influence of size of land cultivation inside WARFP to family income, the study employs simple regression. The model is provided by equation (2) (Gujarati 2004, Wooldridge 2012).

$$y = \beta_0 + \beta_1 \cdot x + \mu, \quad (2)$$

where: y – family income per year, IDR per year; – intercept; – error term. β_1 – slope coefficient, representing the change in family income per additional hectare of land cultivated within WARFP; x – size of land cultivated within WARFP, ha.

The reason to use size of landholding inside WARFP as independent variable is due to land status and has caused long term conflict between community nearby forest and government. By giving tenurial status or right to cultivate inside conservation forest, it supports policy of welfare and stability in the region or called forest conserved while enhancing community's welfare.

Results and Discussion

Characteristics of respondents

As stated in previous chapter, the research respondents were the Bogorejo Village community who live around the WARFP area and are members of the Gapoktanhut or Aggregation of Forest Farmers Group (AFFG) of Wana Karya. According to the Guideline of Forest Farmer set in the Ministry of Environment and Forestry Regulation No. P. 89 year 2018 Farmers Group (FG) is a group of Indonesian citizen farmers who manage businesses in the forestry sector inside and outside forest areas. The aggregation of FFGs is hereinafter referred to as AFFG (Ministry of Environment and Forestry Republic of Indonesia 2018).

Tables 2a and 2b summarise some socio-economic characteristics of the respondents. It suggests that majority of respondents were male and the majority were born in the research site. In terms of age, the youngest respondent was 22 years while the oldest 73 year, and the median age was 54 year. This suggests that respondents are at stage of heading to aging farmers shown with median age.

Table 2a. Quantitative characteristics of respondents.

Variable	Minimum	Maximum	Median
Age, years	22	73	54
Land rights inside WARFP, ha	0.08	4.03	1.00
Number of family members (persons)	1	4	3

Table 2b. Categorical characteristics of respondents.

Variable	Category	Frequency
Education level	elementary school	39 (64%)
	junior high school	15 (24%)
	senior high school	5 (8%)
	not attending school	2 (4%)
Gender	Male	54 (89%)
	Female	7 (11%)
Place of birth	in village	53 (87%)
	outside village	8 (13%)

In terms of education, majority of respondents has completed elementary school (64 %) and very few (8 %) has completed senior high school. Furthermore, in terms of land tenure ship inside WARFP, the data suggests the land rights were ranging from very small (0.08 ha) to quite large (4.03 ha). However, the rights to cultivate is limited only to undertaking agroforest system. They are not allowed to cut trees or clear land for growing food crops, such as paddy, cassava, or maize.

Analysis of community dependent on WARFP

1. The use of forest resources

Sources of clean water

Clean water sources consist of four types, i.e.: well, pipe water, creeks, and springs. The most dominant source of clean water is pipe water. Source of water for pipe water service is from WARFP. The pipe water system is actually clean water services provided by community for community. The system is benefitting from abundance sources of water inside forest area. Abidin et ai. (2023) study on analysis of water consumption in area nearby WARFP suggests that supply of water from protected forest has been far more than what communities daily needed. Their study suggests that the use of surplus water is very minimum. Abidin et al. (2024) concluded that community in nearby WARFP obtained surplus in water supply as their consumption is less that what they daily obtained. Further, water from WARFP was essential as source of water needs. The data suggests of high dependency of community to WARFP in terms of water. Sources of water of community are presented in Table 3.

Table 3. Sources of clean water.

No	Main source of clean water	Location	Percentage
1	Well	hamlet	11
2	Pipe water	WARFP	69
3	Creeks	hamlet	3
4	Spring water	WARFP	17
	Total		100

From Table 3, it is concluded that the majority of respondents use pipe and spring water coming from WARFP. This revealed water from WARF has been important source for community living nearby. The picture of the community's dependence on water and forests is described well by Wohlleben (2023) and sketches how local people nearby forest has used waters serves by forest ecosystem. Gilmour (2014) explained in detailed about the relationship of forest water and community. He explained about the relationship between forest and water yield and provision of water downstream. He concluded that the better the forest, the better water yield and hence more water service of forest to community. His explanation is consistent with this in which community is guarding forest that has served them with constant water supply.

Source of fuelwood

Although officially management of WARFP discouraged farmers to use woods from

WARFP, in reality most farmers (59 %) collect fuelwoods from WARFP for family fuelwood needs on weekly based. They took dried or fallen tree branches and transported them either on foot, bicycles, or on motorbike (Fig. 2). Type of branches mostly used was rubber trees. Each month, they collect woods at around 0.5 m^3.

Fig. 2. A farmer collect fuelwood using bicycle.

In terms of energy spending such as for gas, gasoline, electricity, and fuelwood, monthly spending was about € 9.32. In addition, spending for fuelwood is very small, i.e. 5 %, thanks to availability of woods in WARFP. In this sense, forest helps farmers to provide cheap source of energy.

The dependence of community and fuelwoods as source of domestic energy is very common in many countries as suggested by Brears (2023) and more comprehensively studied by Raihan and Tuspekova (2022). This study implied that policy of WARFP to discourage community to collect wood branches for fuelwood should not be rigorously implemented. Family expenditures for energy are quite high. Therefore, giving access for fuelwood from forest will help community reduce their family expenditures.

Source of food

Source of food were coming both from WARFP and the village. However, staple food such as rice, cassava, sweet potatoes, and corn were not grown in WARFP. Very few farmers did grow cassava or sweet potatoes within WARFP. Provision of staple food was mainly from village or sub-district markets. The study summarized community's dependent of staple food from WARFP that is presented in Table 4.

Therefore, community's dependent on staple food commodities from WARFP is considered very low.

However, a study by Maulita et al. (2022) reiterated the following plants related with food are grown well in WARFP. Among of them are fruit trees such as durian (*Durio zibethinus*), Duku (*Lansium domesticum* Corrêa), avocado (*Persea americana* Mill.), banana (*Musa* sp.), and rambutan (*Nephelium lappaceum* L.) (Lampung Forest Agency 2020). They are

Table 4. Summary of respondents' dependence on staple food from WARFP.

No	Level of dependence on staple food from WARFP	Range	Number of respondents
1	Very low	< 20 %	37 (61 %)
2	Low	20–40 %	0 (0 %)
3	Moderate	41–60 %	3 (5 %)
4	High	61–80 %	14 (23 %)
5	Very high	>80 %	7 (11 %)

considered important income sources but also for food as those fruits are highly marketable. Banana for example, is important commodity not only for local food, but also for local banana chips industries of nearby cities. Other commodity such as cocoa is important for income sources and also for food as Murniati et al. (2022) pointed out in their study recently. Therefore, vegetables and fruits plants grown in WARFP are important and farmers are highly depended on those plants.

Source of medicinal plants

In 2019, Mayangsari and Bintoro (2019) have identified 29 types of medicinal plants that are potentially beneficial to human as well as can be used for commercial purpose. They are widely grown in the area but not so many farmers are able to identify the benefits of those plants. Among important plants included: cogongrass (*Imperata cylindrica* (L.) P.Beauv.), temulawak (*Curcuma zanthorrhiza* Roxb.), billygoat-weed (*Ageratum conyzoides* L.), ebolo (*Crassocephalum crepidioides* (Benth.) S.Moore), and Kosters curse (*Clidemia hirta* (L.) D.Don).

The study noted that 66 % of respondents recognized some medicinal plants grown widely in WARFP. Furthermore, 67 % have used medicinal plants for personal needs while 33 % of farmers did not use the plants. Therefore, the dependence of farmers from medicinal plants is moderate. In Kenya, the number of farmers use medicinal plants for medicine is a lot higher. More than 75 % farmers in Western Kenya used medicinal plants taken from forest for medicine (Ojunga et al. 2023). Hence, further education for introducing medicinal plants to farmers is imperative.

2. Economy – family income and expenditures

Family income consists of the following sources: a) farming, b) non-farming, and c) off-farming. The study suggests that average income from farming was about 986 € per year in which farm income from WARFP contributed 92 % to it. This suggests high dependent of community from forest in terms of income as also shown by other study as stated in Suyanto et al. (2007) and Chu et al. (2019).

Influence of land permits on family income was analysed using simple regression model. Analysis concluded that income is significantly affected by landholding size, meaning larger landholding within forest results in higher family income. Statistics in Table 5 provide evidence that granting land rights in specific areas for farming – particularly agroforestry – supports community welfare while ensuring forest conservation.

Further, size of landholding inside forest has highly significantly influenced on family annual income, as shown in Table 6.

Table 5. Simple regression model between size of landholding inside forest and annual family income.

Anova	df	SS	MS	F	*p*-value
Regression	1	$1.36785 \cdot 10^{16}$	1.36785E+16	58.20541695	2.3222E-10
Residual	60	$1.41002 \cdot 10^{16}$	2.35003E+14		
Total	61	$2.77786 \cdot 10^{16}$			

Note: df – degrees of freedom, SS – sum of squares, MS – mean square, F – F-statistic, *p*-value – probability value.

Table 6. Influence of land cultivation inside WARFP on family annual income.

Variable	Coefficient	Standard Error	t-Statistic	*p*-value
Intercept	0	–	–	–
Land cultivation in WARFP (X_1)***	13,147,102.4	1,723,250.226	7.63	$2.11 \cdot 10^{-10}$

Note: *** significant at $p < 0.001$.

The contribution of independent variable in explaining family income is summarized in Table 7.

Table 7. Regression statistics.

Regression statistic	Value
Multiple *R*	0.702
R Square	0.492
Adjusted *R* Square	0.476
Standard Error	15,329,812
Observations	61

In addition, the R^2 value was 0.49, suggesting that 49 % of variation annual income was explained by land cultivation inside forest.

Family expenditure has been used to indicate the ability of family to purchase goods and services needed for family. There are two categories of family expenditure: food and non-food. The study suggests that average monthly food and non-food expenditures are presented in Table 8.

Table 8. Monthly family expenditures on food items.

No	Items	Expenditure, €	Share, %
1	Staple food (rice)	18.21	33
2	Side dishes	9.42	17
3	Vegetables	5.92	11
4	Fruits	0.99	2
5	Cooking oil	0.88	2
6	Drinks	0.21	0
7	Spices	0.10	0
8	Sugar	0.58	1
9	Cigarettes	6.96	12
10	Others	12.65	23
	Total	55.92	100

Note: 1 euro (€) = IDR 18,911.

The study reveals that staple food accounts for the highest proportion on food followed by other expenses (include eating outside the home) and side dishes. From Table 8, it is revealed that spending on cigarettes is relatively high – about 12 % of monthly spending. The majority of respondents (83 %) were active smokers. This number is consistent with national statistics, which reported that approximately 29 % of the Indonesian population are smokers (Indonesia Center of Statistics 2024).

In terms of non-food expenditures, the study summarised expenditures are shown in Table 9.

Table 9. Monthly family expenditure on non-food items.

No	Expenditure	Monthly, €	Share, %
1	Energy	9.31	17
2	Education and related spending	4.52	8
3	Health-related	0.52	1
4	Neighbourhood contribution	2.98	6
5	Transportation for all family	31.89	59
6	Soap, toothpaste, cosmetics	4.15	8
7	Helping families	0.70	1
	Total	54.07	100

Table 9 suggests that total monthly expenditure of family is approximately around € 55. The three items contributing most to family expenditures are transportation, energy, and education. Tables 8 and 9 show that total monthly expenditures amount to € 110 with food and non-food expenditures being almost equal, although food expenditure was slightly higher.

Furthermore, monthly expenditure *per capita* was about € 37, it is lower than monthly expenditure *per capita* of the Pesawaran Regency at around € 61 *per capita* (Badan Pusat Statistik 2024). Using monthly expenditure standard, people in the research site is above poverty line. The set of poverty line was € 27 per month *per capita* according to Badan Pusat Statistik Provinsi Lampung (2024).

Local market is crucial for ensuring that community products both from WARFP and in the village can be sold easily with no barriers. The study area has close access to local market as well as bigger market in Bandar Lampung, capital city of Lampung Province. With good road system, farmers can choose alternative local markets that offer the best for their products. In addition, most farmers used motorbike for transporting their agricultural products, such as coffee, rubber, and cocoa.

However, as typical of marketing of agricultural products, it usually positioned farmers in weak bargaining. Commodities such as rubber, cocoa, coffee are internationally traded and the information of price are available online and real-time.

For example, rubber farmers in this village could contact big buyers using cell phone asking information about price and usually they answer shortly. This is also happening for coffee or cocoa farmers which could be easily sold to the local merchants.

3. Dependent on forest environment

Protection from natural hazard

Respondents have expressed their thanks that living nearby forest has been protected from natural disasters. During rainy season, farmers reported no flooding in the village. During dry season, the environment is still green and water from forest was adequate to satisfy community's need.

To avoid forest fires, forest farmers group team up with Technical Unit of WARFP were doing intensive monitoring to anticipate such an incident of forest fire. In the last 3 years, accidents of forest fires have been reduced to very minimal number. According to officer of Regional Technical Implementing Unit (RTIU), in 2022, 2 forest fire incidents occurred during dry season in Bogorejo Village. That was because one farmer unintentionally set small fire for farming preparation but it turned to bigger fire. In 2023 and 2024, forest fire incidents were down to none.

Good quality of environment

The community overwhelmingly felt very lucky living nearby WARFP in terms of good quality environment they benefit. Community enjoys the forest that they access on daily basis. The study found out that 92 % agreed that environmental condition has been improving as WARFP forest was improving. They feel the improvement also increases their living conditions.

With good environment, community feel their life is better not only in terms economy, but also environmental aspect. There is strong connection of economy and environment according to locals. For example, production of rubber inside WARFP has always been good.

4. Access of ownership

The WARFP is a conservation forest and therefore a state-owned property. The community holds no ownership rights over this land. However, according to Lampung Forest Agency (2020), approximately 76 % of the WARFP area has been cultivated by farmers. At the same time, the removal of farmers from within the forest was neither socially nor politically acceptable.

Instead, the Government of Indonesia employed social forestry model and set regulation of Ministry of Forestry No 83/2016 on social forestry. In it, partnership in conservation forest is regulated in order to educate and empower community residing nearby forest. Settlement inside the forest is no longer permitted. However, community is still given access of their old parcels, as long as they grow trees/agroforestry and not to harvest forest.

Community could also be given rights to use water resources from the forest as long as it is not for commercial use. The partnership has created the so-called win-win solution for government and for farmers in WARFP. In the past, community and officers of forest park has been at odd due to strict regulation stating that in conservation forest, farmers were not allowed to access and take benefits of forest. With this partnership, community has been granted access and took benefits from forest. In partnership, forest farmer groups in WARFP have also obligation to control and monitor forest on regular basis. Farmers have to report should any illegal activities in the forest occur, such as illegal logging. This in turns have reduced the incidents of illegal logging in the area. Such positive outcome of partnership also reported in other region in Indonesia. Henceforth, partnership in conservation forest increase community engagement and trust as well as welfare.

5. Participation in guarding forest

Facing budget and personnel constraints, the Technical Unit of WARFP has had to work closely with nearby forest farmers to ensure forest integrity and conserve local flora and fauna. At the same time, the RTIU of WARFP has created opportunities for farmers to pursue new economic prospects, such as supporting palm sugar production, providing ecotourism education, offering training in tree grafting, and assisting with participatory mapping.

The majority of farmers (67 %) knew well WARFP boundary. On average, farmers went to WARFP 5 times to do farming activities as many regular farmers, except this case the farm inside conservation forest. The respondents refused to answer their respond should any illegal activities occurred in their area. This is very concerning because the partnership was designed to secure farmers access to conservation forest and in return farmers are expected to help government in monitoring the forest situation. Summary of community dependence on WARFP is presented in Table 10.

Conclusion

The study found that the community residing near the forest was dependent on WARFP. They are highly dependent on water, fuelwood (energy), medicinal plants, food, income sources, and good quality of environment. Rights to cultivate lands inside WARFP not only enhance welfare but also maintain forest conditions. Forest farmers also enjoyed forest protection from natural hazards such as

Table. 10. Summary of community dependence on WARFP.

No	Components	Notes	Level on dependence (1–5)
1	Use of forest resources:		
	a. Water	Close to 70 % of community fulfil water needs from WARFP.	5
	b. Fuelwoods	Use of fuelwood is limited due to office of WARFP regulation which did not allow for using fuelwood from forest. However, many farmers regularly use fallen tree branches for fuelwood.	4
	c. Foods	Staple foods (rice, corn, and cassava) are not from WARFP. However, banana, some fruits such as: durian, jackfruit, papaya, avocado are mostly from WARFP.	3
	d. Medicines	29 types of medicinal plants identified by Mayangsari and Bintoro (2019).	3
2	Economy:		
	a. Income sources	Coffee, chocolate, rubber, and durian are among important sources of family revenues.	5
	b. Local market	Nearby, local markets are open on weekly based where farmers could buy and sell non-wood forest products and imported goods. Farmers could also sell their product directly to bigger market in Bandar Lampung city or to exporters.	5
3	Environment:		
	a. Protection from natural disasters such as landslide, flooding, wind, and forest fire	Good forest provides protection to community nearby from flooding, landslide, and forest fire.	5
	b. Good quality of water and air		5
4	Access and ownership:		
	a. Access rights	All members of the community have been granted access to WARFP to obtain benefits such as obtain fruits, food, and water.	5
	b. Access to non-wood resources		4

No	Components	Notes	Level on dependence (1–5)
5	Participation on forest management	Active in controlling forest team with government unit. This community engagement helps reduces incidents of poaching, illegal cutting, and incidents of forest fire in the dry season. However, only few farmers, leader who actively monitor the forest situation. Community engagement is still limited.	3
	Total score		49
	Average		4.4 (high)

flooding and forest fires. However, participation to control and monitor forest is still limited. The study could be used as the basis for policy makers to continue facilitate people engagement in forest management in WARFP.

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