

RESEARCH ARTICLE



Economic impact of community activities in the Ruteng Nature Tourism Park Area, East Nusa Tenggara Province

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Abstract

This study addresses a gap in understanding the specific economic impacts of community engagement in Ruteng Nature Tourism Park (TWA Ruteng) on local livelihoods. While prior research highlights general benefits of tourism, limited attention has been given to the direct economic activities and their outcomes within TWA Ruteng. The objectives of this research are to analyze the economic activities of the Ngkiong Ndora Village community and evaluate their effects on household income. Data collection was conducted through interviews, observations, documentation, and literature review. Participants were categorized into three strata based on land ownership: 34 respondents in stratum I, 60 in stratum II, and 12 in stratum III. The data were analyzed using both quantitative and qualitative methods to provide a comprehensive understanding of economic dynamics. The results reveal that the community engages in land cultivation, wood utilization, and the exploitation of non-timber resources. These activities have a significant positive economic impact, contributing 76.44% to household income and increasing income levels by 76.94%. This study offers novel insights into the interaction between local communities and nature tourism parks, particularly in Indonesia. It highlights the importance of integrating community involvement into tourism development strategies and illustrates how such engagement can yield substantial economic benefits. Additionally, it provides empirical evidence to inform policies that balance conservation efforts with local economic development, ensuring sustainability and improved livelihoods.

Keywords: community engagement, community dependency, economic activity, economic impact.

1. Introduction

The current understanding of protected area management in Indonesia lacks sufficient integration of local community welfare into conservation strategies. While the government's establishment of protected areas aims to safeguard biodiversity, insufficient attention is given to promoting economic prosperity for local communities, which is crucial to sustainable management. The existing frameworks, such as Act No. 5 of 1990, recognize the importance of community welfare through sustainable forest use; however, implementation remains inadequate. This gap is highlighted by the ongoing pressures on protected areas, including illegal activities that undermine their effectiveness. The Directorate General for Conservation of Natural Resources and Ecosystem (KSDAE) (2021) reports that illegal community activities have encroached upon the designated protected area, resulting in 1.8 hectares being converted into open space [1]. Furthermore, a disconnect exists between conservation efforts and the economic needs of surrounding communities, leading to conflicts and a lack of community support for conservation initiatives. Addressing this gap requires a more holistic approach that incorporates local economic development into conservation planning, ensuring that the community benefits from sustainable practices while protecting biodiversity. This could involve enhancing access to forest resources and engaging local communities in ecotourism and other economic activities aligned with conservation goals, ultimately fostering a sense of ownership and responsibility for the protected areas.

The protected area in the East Nusa Tenggara region suffered damage of 61.1 hectares owing to community activities [2]. An example of such a location is the Ruteng Nature Tourism Park (TWA) area. This region was officially classified as a TWA under the Decree of the Minister of Environment and Forestry, specifically the Decree Number SK. 3300/Menlhk-PKTL/KUH/PLA.2/7/2016, on July 13, 2016. The total area of this TWA is 33,093.37 hectares. TWA Ruteng

The sampling technique employs stratified random sampling. The households were stratified by land area, with a total of 353 families. The sample was determined by extracting 30% from each stratum, as described in **Table 1**. This is derived from the stipulations outlined by [11]. Specifically, when dealing with a population of fewer than 100, it is recommended to include the entire population in the sampling process. However, if the population exceeds 100, a representative sample of 10-15% can be selected.

Table 1. Number of respondents based on the stratum of land area owned.

Stratum	Land area (ha)	Population (Households)	Number of respondents
I	area < 0.5	112	34
II	0.5 ≤ area < 1	201	60
III	area ≥ 1	40	12
Total		353	106

Source: Ngkiong Ndora Village monograph data 2021

The research collected data through structured interviews, observation, documentation, and literature review. A qualitative investigation was done to examine community activities in the TWA Ruteng area. Quantitative analysis involves studying the development of ideas or information in social phenomena, such as behaviour, perceptions, and other actions, without undertaking hypothesis testing [12,13]. The research variables identified in the TWA Ruteng community activities include the utilisation of timber and non-timber forest products, and land cultivation. Examining the economic effects of community activities entails quantitatively evaluating the monetary value of the funds generated and the changes in community income.

a. Income contribution

$$K = \frac{dh}{dh+dl} \times 100\%$$

where :

- K : Income contribution
- dh : Forest product income
- dl : Income outside forest products

b. Alteration in income

An analysis was conducted to evaluate the difference in revenue before and after participating in activities in the TWA Ruteng area, using the *Loss of Earnings* model. This approach is employed to evaluate disparities in individuals' income. The modification of the *Loss of Earnings* formulation [14] is as follows:

$$LoE = \sum_{i=1}^n [(Ea2-Ea1)+(Eb2-Eb1)+...$$

where:

- LoE : Loss of Earnings (IDR/yr)
- Ea1, Eb1 : Income before activity
- Ea2, Eb2 : Income after activity
- n : Number of respondents
- i : 1st respondent (1,2,...n)

3. Results

3.1. Community engagement in TWA Ruteng

3.1.1. Land cultivation

The research findings show that residents of Ngkiong Ndora Village participate in agricultural businesses across a large area of land within the TWA Ruteng (**Table 2**). The results showed that people in stratum I, namely those who own 0.5 hectares of land or less outside the forest

area, will cultivate land within the TWA area, with areas ranging from 0.25 to 50 hectares. The dominant cultivated land area is 0.25 hectares, accounting for 55.88%. Stratum II is a community with a land area outside the forest area of 1 hectare. People in this stratum will cultivate land in the TWA Ruteng area, with varying areas (**Table 2**), with the community's most cultivated land being 1 hectare (75%). Stratum III communities will cultivate a range of 1-2 hectares, with the community cultivating 2 hectares.

Table 2. Area of community-cultivated land in the TWA Ruteng area.

Stratum	Cultivation land area	Percentage of respondents (%)
I (area <0,5 ha)	0.25	55.88
	0.30	26.47
	0.50	17.65
		100
II (0,5 ≤ area < 1 ha)	0.2	15
	1	75
	1.2	10
		100
III (area 1 ha)	1	16.67
	1.5	25
	2	58.33
Total		100

The Ngkiong Ndora Village population consistently attempts to preserve its access to cultivated land within the TWA Ruteng, despite the potential disruption it may cause to the TWA area. Coffee is the primary crop grown on cultivated land, accompanied by secondary crops including ginger (*Zingiber officinale*), galangal (*Languosa galanga*), banana (*Musa spp*), and perennial plants such as "mani'i" (*Measopsis eminii engl.*), "redong" (*Trema orientalis*), "ampupu" (*Eucalyptus urophylla*), and "sengon" (*Albizia chinensis*).



Figure 2. View of cultivated land within the Ruteng Recreation Park (TWA Ruteng), showing mixed vegetation dominated by young coffee plants and natural forest trees. This condition illustrates how local communities utilize parts of the conservation area for small-scale farming while maintaining forest cover.



Figure 3. Land-use pattern of community-managed areas within the Ruteng Recreation Park (TWA Ruteng), showing dense growth of coffee plants interspersed with native forest vegetation. This condition reflects the agroforestry practice adopted by local communities, which combines coffee cultivation with forest conservation.

3.1.2. Activities for utilizing timber forest products

The results showed that the people of Ngkiong Ndora Village used HHK for Carpentry and for burning firewood (**Table 3**). Carpentry wood utilization activities are carried out 2 times a year, with an average total collection of 12.63/log/person. The community utilized three types of wood: "dora" (*Dysoxylum sp.*), "teno" (*Melochia umbellata*), and "redong" (*T. orientalis*). The average firewood collection was 6.12 bundles/week/ person, with a range of 2 collections/week within the Ruteng TWA area.

Table 3. Local community usage of timber in TWA Ruteng.

Type of utilization	Collection frequency	Total take	Average collection (unit/person/log)
Carpentry	2/ year	1339/year	12.63
Firewood	2/ Weekly	649/weekly	6.12

3.1.3. Use of non-timber forest products

Non-timber forest products are abundant in Indonesian forests and are consistently used by the population. Research in Ngkiong Ndora Village identified three NTFPs commonly used by the community: pandan (*Pandanus tectorius*), rattan (*Calamus sp.*), and "werek" (*Lygodium circinnatum*) (**Table 4**). The Ngkiong Ndora Village community uses NTFPs for personal use, not for trade.

Table 4. Use of non-timber forest products (NTFPs) from TWA Ruteng by local communities.

Types of NTFPs	Parts used	Frequency taking	Total take	Average take/person	Percentage of respondents (%)
Pandan (<i>P. tectorius</i>)	Leaf	3 times/year	704 ties	9.94	50.35
Rattan (<i>Calameae sp.</i>)	Stem	2 times/year	137 bunches	3.80	26.24
"Werek" (<i>L. circinnatum</i>)	Liana stem	2 times/month	145 bunches	5.8	23.40

The use of pandan (*P. tectorius*) was reported by 71 respondents (50.35% of the total). The material is used to make crafts, including coffee baskets and mats, which are not traded. NTFP collection is carried out only 3 times a year. The rattan NTFP (*Calameae sp.*) is used by only 37 respondents (26.24%). Collection is done only 4-5 times a year to take rope material.

The last type of NTFP is "werek" (*L. circinnatum*). The purpose of using this NTFP is the same as that of rattan (*Calameae* sp.), namely, as a rope material with a collection frequency of 4 times a month. The number of respondents who utilized this NTFP was 33 or 23.40.

3.2. Economic impact of community activities in TWA Ruteng

3.2.1. Income contribution

The income contribution value is used to determine the percentage of income from community activities in the Ruteng TWA to the total income of the community; total income is calculated as the sum of community income obtained from all side job income, livestock business income, and income from the community's coffee plantation [15]. The total average income of the community outside the Ruteng TWA is stratum I (<0.5 Ha) Rp 9,772,500, stratum II (0.5-1 Ha) Rp 8,308,417, and stratum III (>1 Ha) of Rp 8,087,500 per year (Table 5). The highest income from outside Ruteng TWA is stratum I (>0.5 Ha). This is because the community receives a 32.35% contribution of income from the livestock business. Income from the Ruteng TWA area is obtained from community-cultivated land, namely coffee harvests. The amount of community activity income contribution to family income in Ngkiong Ndora Village is 70.08% in stratum I (<0.5 Ha), 79.33% in stratum II (0.5-1 Ha), and 82.94% in stratum III (1 Ha). The total contribution of the three strata is 77.45%.

Table 5. Contribution to community income from activities in TWA Ruteng.

Stratum	Average income (IDR/year)		Total	TWA contribution to community income (%)
	Within TWA	Outside TWA		
I (area <0.5ha)	22,885,000	9,772,500	32,657,500	70.08
II (0.5 ≤ area < 1 ha)	29,524,333	8,308,417	37,832,749	78.03
III (area ≥ 1 ha)	34,883,333	8,079,167	42,962,500	81.19
Total average	29,097,555	8,720,028	37,817,583	76.44

3.2.2. Change in income

This study assessed changes in community income by comparing the average income levels before and after residents' participation in various livelihood activities within the Ruteng Recreation Park (TWA Ruteng). Income measurement focused on identifying the disparity in earnings to understand the economic impact of community involvement in conservation-based activities. Initially, the community's income was primarily derived from non-forest products, indicating limited utilization of forest resources. However, as engagement in TWA Ruteng activities increased, income sources expanded to include both forest and non-forest products. Overall, the total income generated within the TWA Ruteng area reflects a combination of revenues from these two sectors, highlighting the growing contribution of forest-related activities to local livelihoods.

Table 6. Changes in the income of the people of Ngkiong Ndora Village.

Stratum	Before any activity in TWA Ruteng		After the activity in TWA Ruteng		Difference	
	IDR/Year	(%)	IDR/Year	(%)	IDR/Year	(%)
I (area <0.5ha)	9,772,500	37.34	32,657,500	28.79	22,885,000	70.07
II (0.5 ≤ area < 1 ha)	8,308,417	31.76	37,832,749	33.35	29,524,332	78.03
III (area ≥ 1 ha)	8,079,167	30.88	42,962,500	37.87	34,883,333	81.19
Total	8,722,806	100	37,817,583	100	29,097,555	76.94

The research findings, each stratum observed favourable improvements in its income. In stratum I, which has a land area of less than 0.5 hectares, income grew by 70.07% in Indonesian Rupiah (IDR). Stratum II has an area of 0.5-1 ha, accounting for 78.03%, while stratum III has an area greater than 1 ha, covering 81.19% of the total area. The Ngkiong Ndora Village community experiences an annual average improvement value of IDR 29,097,555 following their participation in activities inside the TWA Ruteng.

4. Discussion

4.1 The historical overview of the management of TWA Ruteng

The administration of the TWA Ruteng began in the Dutch colonial period, when the local population recognised the area as a Ruteng forest and marked it with a Dutch border marker called Pal Sula. On December 2, 1983, the Minister of Forestry officially classified the Ruteng forest area (RTK 118) as belonging to both the Ruteng Forest group (RTK 188) and the Munde forest group (RTK 20). The land was designated as a protected forest covering 17,897 hectares and a limited production forest covering 14,388 hectares, as stated in the forestry decision letter Number 89/Kpts-II/1983. The Ruteng forest community uses forest resources for many daily necessities, including food, medicine, fuel, and timber for traditional housing construction [9].

The area's status was changed to TWA Ruteng in 1993, as per the Decree of the Minister of Forestry Number: 456/Kpts-II/93, issued on August 24, 1993. It spans 32,245.60 hectares and is overseen by the Forestry Department through the Integrated Nature Conservation Project (PKAT), which uses an Integrated Protected Area System (IPAS) approach. The TWA Ruteng area was officially declared as the Ruteng Nature Tourism Park Forest region (RTK 118) under the Decree of the Minister of Environment and Forestry Number: SK.3300/Menlhk-PKTL/KUH/PLA.2/7/2016 dated July 13, 2016. This decree covers an expansive area of 33,093.37 hectares [16].

Reconstruction took place on October 28, 1998, establishing the boundaries of the Indonesian forest area. The demarcation of boundaries led to the expansion of the TWA Ruteng, reducing the community's agricultural land. This has led to a higher frequency of individuals accessing the area to engage in agricultural activities. Land cultivation can be deterred by imposing fines on individuals who engage in it. In addition, the management implemented an empowerment program that involved distributing cattle and offering a monetary grant of IDR 15 million. The objective of this program was to foster the local population's independence and ensure the area's long-term viability. The influx of individuals returning to the area results from rising living standards, population expansion, land scarcity, and restricted access. The community recommenced land cultivation activities in 2004 and has been progressing since [4].

4.2 Community engagement in TWA Ruteng

The population of Ngkiong Ndora Village is exclusively indigenous, with residents closely connected to the local area and its surrounding natural resources. The TWA Ruteng-protected block is designated for community activities that involve the utilisation of natural resources. In 2015, 200 hectares of the protected area were designated as a rehabilitation area. This block is created to function as a buffer for the protected block. Community activities across multiple locations have damaged the restoration block. The damage is caused by the community's dependence on forests for activities such as agriculture, timber use, and the use of non-timber forest resources. The very high dependence on the area has led the community to no longer care about the prohibition and to stop carrying out activities in the TWA area [17].

4.1.1. Land cultivation

The residents of Ngkiong Ndora Village primarily rely on agriculture as their major source of income. Approximately 90.56% have limited formal education, namely, completing only elementary school. Communities with low levels of education must be more receptive to innovations to enhance their understanding and knowledge. This is because their only viable option is to engage in farming [7]. Being a farmer is typically regarded as a profession that does not necessitate formal schooling. Ria et.al [18] reported that the residents of Ngkiong Ndora Village have a low socioeconomic status, with an average monthly income ranging from IDR 200,000 to 400,000. The people of Ngkiong Dora Village rely heavily on their own land and the land within the TWA due to their low income.

The community engages in land cultivation within the TWA Ruteng area, which is the primary activity on several plots of varying sizes. An individual involved in agricultural farming in TWA Ruteng typically manages two plots of land on average. Adalina et al. [15] classified land

cultivation extent in protected areas as follows: land area less than 0.25 Ha as narrow, 0.25-50 Ha as medium, and more than 50 Ha as high. The research findings suggest that the inhabitants of Ngkiong Ndora Village participate in agricultural endeavours on vast, substantial tracts of land within the TWA Ruteng. The crop area is divided into three levels. The research findings show that residents of Ngkiong Ndora Village participate in agricultural businesses located within the Ruteng TWA, which are categorized as medium- and very-large areas (**Table 2**). However, the cultivated land area in TWA Ruteng has substantial agricultural activity. The results indicate a substantial dependence of the population on the land within the TWA Ruteng area. The amount of land cultivated by the population in forested areas indicates their significant reliance on this land [19].

The local community near TWA Ruteng acknowledges that the area is government-owned and not designated for cultivation. Nevertheless, because of a scarcity of other options, people are obligated to depend on it to meet their fundamental survival needs [20]. Individuals living near forested regions express concern for the environment, yet still utilise these areas to meet their domestic needs. Amandu and Daniel [21] also found that people living in forest regions generally have low incomes, with an average yearly income of IDR 11,700,000 or less. People will need additional land to meet their housing needs. Around 62% of the local people indicated that participating in exploitative activities, particularly land cultivation, had a substantial effect on their economic conditions, which were predominantly characterised by poverty. Therefore, balancing community livelihoods and conservation of biodiversity is critical for sustainable management of protected areas and livelihood sustainability [22].

Kriswoyo et al. [3], stated that the community surrounding TWA Ruteng engaged in agriculture to meet their economic demands, owing to limited property ownership. The land in TWA Ruteng was productive, and the community followed the example of other towns that had seen positive economic effects on their families. The research findings indicate that the primary motivation for the Ngkiong Ndora Village community to engage in land cultivation is the limited land available, cited by 66.04% of respondents. Additionally, 40.57% of respondents reported being influenced by other communities that had worked on land within the TWA Ruteng. Furthermore, 35.85% of the respondents perceive the land within the TWA Ruteng as fertile.

Fedele et al. [23] found that 30 % of the 1.2 billion people in the tropics were highly dependent on nature for their basic needs. Natural resources have supported the livelihoods of many fringe communities in the area in various ways, including improved income. The community has expressed a desire to increase land ownership to fulfil their residential needs, as the average household consists of five members. The community's average annual income from land outside the TWA Ruteng area is IDR 7,429,434 million. Communities with limited land resources are more inclined to engage in activities within their vicinity to augment household income and fulfil other essential requirements [24].

Based on the management interviews, the community initially cleared the area by strategically cutting down small plants. The management explicitly stated that this activity was to deceive area patrol personnel. During the coffee plant's growth stage, large trees are systematically removed to prevent hindering its development. The field observations suggest that there are easily accessible entry sites for anyone to join the TWA Ruteng and participate in land-related activities. The management's pursuit of heightened security has resulted in the implementation of unfettered access to the TWA Ruteng. Based on the discussion with the Head of Region II Conservation Resort, it was stated that Region II TWA Ruteng employs seven security personnel to cover a total area of 8,428.83 hectares. Furthermore, the proximity of the forested area to the neighbouring community settlements enables quick accessibility for individuals. The distance to the area is around 3 kilometres, and the road conditions are conducive to easy traversal.

4.1.2. Activities for utilizing timber forest products

The research findings indicate that community activities involving woodworking with forest products are conducted on average 12.63 times per year (**Table 3**). Ngkiong Ndora Village residents know that logging operations in the TWA Ruteng cause ecological harm.

Nevertheless, they continue to engage in these activities because they rely on wood sourced from the TWA Ruteng for carpentry purposes. In the TWA Ruteng area, the community engages in woodworking and wood-gathering operations on cultivated land. Logging on cultivated ground within protected zones is prohibited by legislation. The utilisation of carpentry wood for communal undertakings in the TWA Ruteng region is deemed illegal and has resulted in disputes with the area manager [9].

The research findings indicate that the community's firewood collection activity is low-level, with an average collection rate of 6.12 bundles per week (**Table 3**). According to Aissiyah et al. [25], firewood collection in protected areas falls into the high category when total collection exceeds 40 bundles per week. Conversely, it falls into the low category when the total wood collection is 20 or fewer bundles per week. The community utilizes calliandra (*Calliandra calothyrsus*), "larang" (*Weinmannia blumei*), and "redong" (*T. orientalis*) as their primary sources of firewood.

Despite the relatively low rating of the activity category for collecting firewood, it still contradicts conservation management policies, specifically Government Regulation Number 28 [26] regarding the Management of Natural Reserve Areas and Protected areas, as it is conducted in rehabilitation blocks and protected blocks. In addition, firewood collection tasks involve more than just gathering small twigs. They entail cutting down living trees, allowing them to dry, and removing them from the region after a week.

4.1.3. Use of non-timber forest products

The research findings indicate that the use of NTFP in the TWA Ruteng area is comparatively minimal. This is derived from the community's collective consumption of NTFPs. Mahendra et al. [27], found that the average yield of NTFPs in protected areas was relatively low, with an average extraction range below 10.14. Rahman et al. [28] found that their use within protected areas influences the proportion of participants who use NTFPs. In addition, categorized communities' reliance on NTFPs in protected areas into three levels: low (<30%), medium (30-59.99%), and high (>60%). These findings indicate that the residents of Ngkiong Ndora Village have a limited reliance on rattan (*Calameae sp.*) and "werek" (*L. circinnatum*). On the other hand, pandan (*P. tectorius*) is categorized as having a moderate level of reliance. The use of mats as a foundation for resting and sitting, along with the necessity for baskets in the coffee harvesting process, results in the extensive use of these NTFPs by the local population.

4.3. Economic impact of community activities in TWA Ruteng

4.1.4. Income contribution

The research findings indicate that the residents of Ngkiong Ndora Village derive much of their income from activities within the TWA Ruteng. Specifically, 70.08% of their revenue comes from stratum I (< 0.5 ha), 78.03% from stratum II (0.5 ≤ area < 1 ha), and 81.19% from stratum III (1 ha) (**Table 5**). The money obtained from within forest regions accounts for over 66.7%, a significant contribution [29]. Contrary to the findings of Adalina et al. [30], land cultivation operations in protected areas contribute only 42.29% to society. This is corroborated by the community engaging in several supplementary occupations.

The contribution level is directly correlated with the extent of community-managed land in the TWA Ruteng. The community reported a direct correlation between the extent of cultivated land in the TWA Ruteng and the quantity of plants they grow, which affects their revenue. According to Simeon and Desalegn (2024), there is a significant correlation between the extent of land ownership and socio-economic factors [31]. Greater land ownership within a community leads to improved socio-economic conditions [32]. Amadu and Daniel [21], also found that owning a big expanse of land in forested areas benefited income. Specifically, increasing cultivated land by 10% led to a corresponding increase in revenue.

Suherman [33] found that the extent to which farming contributes to community revenue can indicate a community's reliance on land. The collective mean contribution to income from community activities is 76.44%. Community dependence can be measured as the proportion of income derived from community activities within protected areas. They classify a dependency level of above 20% as belonging to the dependent category. This shows the

residents of Ngkiong Ndora Village continue to rely on the TWA Ruteng area for their sustenance [19].

4.1.5. Change in income

The community engages in a range of activities in forest regions to generate multiple sources of revenue. Diversifying revenue sources is a strategic approach to address income volatility. In this scenario, the community will proactively generate a transformation in their income. This study measured changes in income by measuring the disparity between the mean income value prior to and following individuals' engagement in activities at TWA Ruteng. The community income in the TWA Ruteng is derived solely from non-forest product revenue. The money generated from operations in the TWA Ruteng area encompasses the overall revenue derived from both non-forest and forest products.

The research findings indicate that each stratum experienced a significant increase in income, with percentages of 70.07%, 78.03%, and 81.19% of the total land area (**Table 6**). The community activities, particularly land cultivation, in the TWA Ruteng area positively affect the community's income. Riyanto et al (2020), asserted that community activities in forest areas have a substantial effect on the neighboring communities that rely on forest resources [34].

An area designated for the community is important for meeting basic living requirements and generating a tangible economic impact on the household. The community's perception of the favorable economic impact will increase activity in the area, exerting pressure on the TWA Ruteng area. When establishing a management concept for TWA Ruteng, it is important to consider the community's strong dependence on the land within the area. This will ensure that the idea meets the needs of the surrounding population and effectively conserves the region. An alternative approach might be to establish conservation partnerships. According to Regulation No. P.6/KSDAE/SET/Kum.1/2018 by the Directorate General of Conservation of Natural Resources and Ecosystems, the recommended conservation partnership approach for Ngkiong Ndora Village is ecosystem restoration. The proximity of the TWA to the local community facilitates various economic activities, including agriculture, ecotourism, and the utilization of natural resources, which are critical to meeting household needs. This conservation cooperation is expected to be implemented soon to improve the community's welfare by allowing them to use forest resources while adhering to sustainable forest management principles.

5. Conclusions

Community activities in the TWA Ruteng significantly contribute to the local economy, improving community livelihoods. The contribution of TWA Ruteng to community income is very high, at 77.45%, and the value of income change is 76.62%. The economic benefits have boosted activity in TWA Ruteng, raising concerns about the depletion of natural resources. Effective protected area management should prioritize community involvement to ensure conservation efforts align with local economic interests by fostering partnerships between local communities and conservation authorities, thereby creating a mutually beneficial relationship that supports sustainable development while conserving natural resources.

Author Contributions

YRS: Conceptualisation, data collection, data analysis & interpretation, writing-review & editing; **LS:** Supervision, conceptualization, methodology review & editing; **AS:** Supervision, conceptualization, methodology, review & editing.

AI Writing Statement

The authors did not use any artificial intelligence-assisted technologies in the writing process.

References

1. Direktorat Jenderal Konservasi Sumber Daya Alam dan Ekosistem Rencana Strategis Direktorat Pengelolaan Kawasan Konservasi 2020-2024 2021.
2. Kementerian Lingkungan Hidup dan Kehutanan Pemantauan Deforestasi Indonesia Tahun 2021-2022 2023.
3. Kriswoyo; Jimmy, P.; Ludji, M.R.K. Peranan Tiga Pilar Dalam Penyelesaian Konflik Tenurial Di Taman Wisata Alam Ruteng, Flores, Nusa Tenggara Timur. *J. Bumi Lestari* 2019, 19, 36–48, doi:10.24843/blje.2019.v19.i0.
4. Iswandono, E.; Ervival, A.M.Z.; Agus, H.; Nandi, K. Conservation and Human Welfare: A Case Study of the Manggarai Tribe in Ruteng Mountains, Indonesia. *Int. J. Sci. Basic Appl. Res.* 2015, 24, 1–9.
5. Badan Pusat Statistik Kabupaten Manggarai Timur Indikator Kesejahteraan Rakyat Kabupaten Manggarai Timur Tahun 2023 2023.
6. Iswandono, E.; Ervival, A.M.Z.; Agus, H.; Nandi, K. Integrating Local Culture into Forest Conservation: A Case Study of the Manggarai Tribe in Ruteng Mountains, Indonesia. *J. Manaj. Hutan Trop.* 2015, 21, 55–64.
7. Kadir, A.; Awang, S.A.; Purwanto, R.H.; Poedjirahajoe, E. Analisis Kondisi Sosial Ekonomi Masyarakat Sekitar Taman Nasional Batimurung Bulusaraung. *J. Mns. dan Lingkung.* 2012, 19, 1–11.
8. Badan Pusat Statistik Manggarai Timur Dalam Angka 2022.
9. Iswandono, E. Budaya Konservasi Masyarakat Manggarai Studi Kasus Di Daerah Penyangga Taman Wisata Alam Ruteng-Nusa Tenggara Timur; Balai Besar KSDA NTT: Kupang, Indonesia, 2018;
10. Leonardo, D.; Anton, S.S.; Jacob, M. Strategi Pengelolaan Taman Wisata Alam Gunung Meja Melalui Penataan Kawasan. *Cassowary* 2020, 3, 153–191.
11. Arikunto Pengembangan Instrumen Penelitian Dan Penilaian Program; Pustaka Belajar: Yogyakarta, Indonesia, 2017;
12. Moleong, L.J. Metode Penelitian Kualitatif; 36th ed.; PT Remaja Rosdakarya: Bandung, Indonesia, 2017;
13. Sugiyono Metode Penelitian Kuantitatif; Alfabeta: Bandung, Indonesia, 2018;
14. Kementerian Lingkungan Hidup Peraturan Menteri Negara Lingkungan Hidup Nomor 15 Tahun 2012 Tentang Panduan Valuasi Ekosistem Hutan 2012.
15. Adalina, Y.; Dodik, R.N.; Dudung, D.; Leti, S. Kondisi Sosial Ekonomi Masyarakat Di Sekitar Taman Nasional Gunung Halimun Salak. *J. Penelit. dan Konserv.* 2015, 12, 105–118.
16. Kesatuan Pengelolaan Hutan Konservasi Ruteng Rencana Pengelolaan Jangka Pendek KPHK Ruteng 2019.
17. Nelson, J.; Nur, M.; Rosmalima, A.R. Community's Forest Dependency and Its Effects towards the Forest Resources and Wildlife Abundances in Sarawak, Malaysia. *Int. J. Sustain. Dev. World Ecol.* 2015, 22, 401–412.
18. Ria, B.A.; Ludji, M.R.K.; Fadlan, P. Analisis Faktor-Faktor Perambahan Hutan Pada Kawasan Resort Konservasi Wilayah II Taman Wisata Alam Ruteng Di Desa Ngkiong Ndora Kecamatan Lamba Leda Timur, Kabupaten Manggarai Timur, Provinsi Nusa Tenggara Timur. *J. Wana Lestari* 2023, 5, 001–015.
19. Handayani, O.K.; Nyoto, S.; Tutur, S. Nilai Ekonomi Pemanfaatan Kawasan Konservasi Bagi Masyarakat Sekitar Resort Bodogol, Taman Nasional Gunung Gede Pangrango. *Media Konserv.* 2015, 20, 45–54.
20. Vallino, E. The Tragedy of the Park: An Agent-Based Model Of Endogenous And Exogenous Institutions For Forest Management. *Ecol. Soc.* 2014, 19, 35–54.
21. Amadu, O.F.; Daniel, C.M. The Impact of Forest Product Collection and Processing on Household Income in Rural Liberia. *For. Policy Econ.* 2024, 158, doi:10.1016/j.forpol.2023.103098.
22. Wei, F.; Li, H.; Peng, W.; Deng, H. Balancing Community Livelihoods and Biodiversity Conservation in Protected Area: A Case Study From Yunnan, China. *Environ. Sci. Policy* 2018, 89, 1–11.
23. Fedele, G.; Donatti, C.I.; Harvey, C.A.; Hannah, L.; Hole, D.G. Mapping Human Direct Use of Nature for Basic Needs across the Tropics. *Environ. Res. Lett.* 2021, 16, 1–13, doi:10.1088/1748-9326/abe11a.
24. Suleiman, M.S.; Wasonga, V.O.; Mbau, J.S. Non-Timber Forest Products and Their Contribution to Household Income around Falgore Game Reserve in Kano, Nigeria. *Ecol. Process.* 2017, 6, 23, doi:10.1186/s13717-017-0090-8.
25. Aisyiyah, A.; Lies, R.W.F.; Much, T.T.H. Pemanfaatan Rumput Dan Kayu Bakar Untuk Kebutuhan Subsisten Masyarakat Di Taman Nasional Gunung Merbabu. *J. Mns. dan Lingkung.* 2019, 26, 20–27.

26. Pemerintah Republik Indonesia Peraturan Pemerintah Nomor 28 Tahun 2011 Tentang Pengelolaan Kawasan Suaka Alam Dan Kawasan Pelestarian Alam 2011.
27. Mahendra, G.; Harnios, A.; Tutut, S. Nilai Ekonomi Pemanfaatan Hasil Hutan Bukan Kayu Di Resort Padali Taman Nasional Ujung Kulon. *Media Konserv.* 2018, 23, 303–310.
28. Rahman, M.D.; Bishwajit, R.; Md Shahidul, I. Contribution Of Non-Timber Forest Products To The Livelihoods Of The Forest-Dependent Communities Around The Khadimnagar National Park In Northeastern Bangladesh. *Reg. Sustain.* 2021, 2, 280–295.
29. Utami, H.W.; Handoko, B. Kontribusi Komoditas Kopi Dalam Meningkatkan Perekonomian Di Desa Amadanom, Kecamatan Dampit, Kabupaten Malang. *J. Econ.* 2022, 7.
30. Adalina, Y. Harvesting Non-Timber Forest Products in Mount Halimun Salak National Park by Kasepuhan Sinar Resmi Indigenous People, West Java. In *Proceedings of the Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia; 2017; Vol. 3*, pp. 75–80.
31. Simeon, M.; Desalegn, M. Impacts of Land Use Land Cover Dynamics on Ecosystem Services in Maze National Park and Its Environs, Southwestern Ethiopia. *Heliyon* 2024, 10, 1–16.
32. Sukardi Analisis Pendapatan Masyarakat Desa Untuk Kelestarian Hutan Lindung (Studi Hutan Desa Pattaneteang Kabupaten Bantaeng). *J. Hutan dan Masy.* 2017, 9, 44–53, doi:10.24259/jhm.v9i1.2047.
33. Suherman Persepsi Masyarakat Kawasan Penyangga Terhadap Pengembangan Kawasan Taman Nasional Ujung Kulon. *J. Sci. Res.* 2016, 1, 051–064.
34. Riyanto, S.; Wahyu, A.; Hilma, N. The Impact of Change in Protected Forest Utilization in RPH Mangunan on Income of Pine Sap Tappers. *J. Ilmu Kehutan.* 2020, 14, 62–70.