Original Research Article

ASSESSMENT OF UTILIZATION AND MONETARY VALUE OF NON TIMBER FOREST PRODUCTS IN KILOMBERO DISTRICT, TANZANIA

ABSTRACT

Aims: To assess the utilization and monetary values of Non-Timber-Forest-Products in Nyanganje Forest Reserve, Kilombero District, Tanzania.
Study design: Questionnaire survey was carried out in three villages namely Signali, Sagamaganga and Lungongole surrounding Nyanganje Forest Reserve.
Place and Duration of Study: This study was carried out in Kilombero District, Tanzania between June and December 2017.
Methodology: In this study, data were collected from three sampled villages based on the fact that they all lie in the Eastern Arc Mountains and share border with the Nyanganje Forest Reserve. Data collected were analysed using Statistical Package for Social Sciences (SPSS) where qualitative and quantitative variables were analysed.
Results: It was revealed that NTFPs is highly utilized in a study area. Firewood mentioned to be the most utilized by 94% of the respondents, followed by poles (91%), wild fruits (86%), wild mushrooms (84%), wild vegetables (81%), bush meat (77%), honey (59%) and lastly being the medicinal plants (53%). In this study, it was further observed that NTFPs were often a vital source of foreign exchange and revenues in a study area. This was evidenced by the total income accrued from NTFPs activities in Nyanganje Forest Reserve to worth TZS 45,505,300 annually which is equivalent to USD 18,172.
Conclusions: Nyanganje Forest Reserve has valuable NTFPs and if the Government needs to take any decision for alternative use of the forest reserve, the value of these NTFPs to the local communities should be taken into consideration.

Keywords: NTFPs, Nyanganje Forest Reserve, Utilization, Species

1. INTRODUCTION

Non Timber Forest Products (NTFPs) are defined as all biological materials other than timber that may be extracted from the natural ecosystems, managed plantations, agroforestry systems and be utilized within the household, marketed or have social cultural and religious significance [1]. According to FAO [2], NTFPs are all biological materials other than timber, which are extracted from the forest for human use. These materials include foods, traditional medicines, oils, resins, gums, tannins, bamboos, firewood, charcoal and bush meat either at local, national, regional or international level. The importance of NTFPs is being increasingly recognized due to their economic values as well as high cultural value in developing countries [3]. It is estimated that 80% of the people in the developing world use NTFPs for health and nutritional needs [4]. However, many of these NTFPs are important sources of income and employment for rural people and some are even traded at the international level [5-6] NTFPs therefore play a significant and critical role in improving livelihoods to a large part of the world's population [7].

Tanzania is endowed with forests and woodlands resources. According to Monela and Abdallah [8], forests and woodlands in Tanzania occupy a total of 33.5 million ha of the land area. Out of these, 12.5 million ha are set aside and gazetted as protected forests and woodlands reserves. The extensive miombo woodlands which are rich in NTFPs are available in these huge forests in the country [9]. These NTFPs come from variety of plant parts, animals and bee products which are formed into diverse variety set of products. Previous, these resources were considered as minor forest products, even though they have been reported to support the livelihoods of millions of people [10-11]. According to URT [12], over 20 million people in Tanzania depend on NTFPs for household's consumption and income generation. Taking into consideration the importance of utilization of NTFPs by local communities, it is essential to assess the role of such products in poverty reduction. This paper therefore reports the utilization and monetary values of NTFPs in Nyanganje Forest Reserve, Kilombero District, Tanzania. Furthermore, the paper reports monetary value of NTFPs available in the forest reserve.

2. MATERIAL AND METHODS

2.1 Description of the Study Site

This study was conducted in three villages namely Sagamaganga, Signali and Lungongole adjacent to Nyanganje Forest Reserve, Kilombero District. This forest reserve has a total area of 18,988 hectares and is located at 7056' to 804'S and 36039' to 36050'E, at an altitude ranging from 270 to 962 m a.s.l, 15 km north east of Ifakara Township. The Udzungwa Mountains National Parks borders the reserve to the north and west. Access to the site is from the Kiberege to Ifakara road.

2.1.1 Climate

Climate of the area is characterized by oceanic rainfall with oceanic temperature. Estimated rainfall in the area is 1400 mm/year. Rainfall in the area starts from November with peak in April and end in June. The dry season is from June-October and the temperature range from 190C to a maximum of 270C.

2.1.2 Vegetation

There are two main vegetation types in Nyanganje Forest Reserve; miombo woodland and riverine forests. Between 300 - 700 m a.s.l the southern slopes are covered with woodland while the riverine forests are found along valleys and rivers. The height of the canopy of the woodland is 10 - 15 m. The riverine forest has canopy height between 10 - 15 m of an evergreen understory and larger trees up to 30 m.

2.1.3 Soil

Soils of the area, like other Eastern Arc Mountain forest soils are basically fertile sandy loams due to the build-up of nutrients from litter decomposition and protection from erosion and excessive leaching. Extensive areas of bare rocks covered with lithophytes also occur in the area.

2.1.4 Population and Human Activities

Nyanganje Forest Reserve is surrounded with seven villages with a population of 50,727 people [13]. People around this area depend almost entirely on agriculture with some animal husbandry for their livelihood. The agricultural crops cultivated include maize, rice, bananas, sugar cane, potatoes, sweet potatoes, millet, finger millet, tomatoes, legumes, soya, sunflowers, cassava, groundnuts and a range of green vegetables. These crops are grown as a monocrop and sometime intercropped. Common domestic animals in this area include dogs used for hunting, goats and pigs. In addition, people in this area interact with Nyanganje Forest Reserve in

collection of various NTFPs like firewood, poles, medicinal herbs, wild mushrooms, wild fruits and wild vegetables to supplement their daily livelihoods. Timbers are also illegally logged from the forest.

2.2 Data Collection

Both primary and secondary data were collected. Primary data involved household questionnaire survey. Secondary data was acquired from relevant reports in Kilombero District office, Forest Headquarters, Tanzania Forest Research Institute and Non-Government Organizations (NGO's). Other secondary informations were obtained from published manuscripts and text books.

2.2.1 Household Questionnaire Survey

Structured questionnaires with both closed and open-ended questions were used to collect household data. The questionnaires were designed to focus on key issues including main types of NTFPs available in the study area, quantity and value of each NTFP extracted from Nyanganje Forest Reserve by the households. The questionnaires were pre tested in 10 households prior to the actual survey. The pre testing assisted to check for redundancy, meaningfulness, comprehensiveness and clarity of items to ensure applicability of the questionnaires.

2.2.2 Sampling for Household Survey

The actual data collection was preceded by a preliminary survey to determine the total number of sample villages and households required. A sample of three villages namely Sagamaganga, Signali and Lungongole was purposively selected on the fact that they all lie in the Eastern Arc Mountains and share border with the Nyanganje Forest Reserve. Additionally, these villages were accessible. A simple random sampling technique was used to select 40 households in each village as described by Mbeyale, [14] who argued that a sample size of at least 30 units was sufficient irrespective of the population size. In this study however, the household heads were the key respondents during household survey as they are the decision makers for the households in the utilization of medicinal plants as recommended by Kajembe, [15].

2.2.3 Focused Group Discussion

Focused group discussions were employed to encourage collective responses and different opinions about collection and use of NTFPs. The focused group discussions comprised of 10-15 men and women with experiences on the utilization of NTFPs. Key informants including village leaders and elders were also involved to provide information in relation to the different types of NTFPs utilized.

2.2.4 Market Survey

During market survey, information on market price, how prices change across seasons, market capacity and quantities of different NTFPs that reach in the market was collected. This was done at Ifakara Market, along Kiberege to Ifakara Road and at households located in the study area where NTFPs from Nyanganje Forest Reserve were traded. Sellers and buyers of NTFPs were interviewed to give the average amount of the products purchased per day. The amount of these products were determined by converting the local measuring units e.g. one container of 20 litres to conventional units e.g. kilogram.

2.3 Data Analysis

Data collected were analyzed using Statistical Package for Social Sciences (SPSS) where qualitative and quantitative variables were analyzed. Qualitative data were analysed using content technique in which components of verbal discussions from different respondents were

broken down into the smallest meaningful units of information. Quantative data were analysed using descriptive statistical analysis whereby means, frequency and percentages were computed.

2.3.1 Valuation of NTFPs

The value of each NTFP was obtained by multiplying the average market price of each product by its quantity as described by Abdallah, [16].

$V = Q \times P$

Where; V = Gross value
Q = Quantity of NTFP
P = Price of the product

The estimated value of the forest in terms of NTFPs was given by the summation of the individual values. Due to widespread of unemployment, the opportunity cost of labour was assumed to be zero. The present annual value (PAV) of NTFPs was calculated from the data on the annual quantity, using standard formula. On discounting the annual value, the discount rate of 10% was used for one year period as suggested by Kihiyo, [17]. The standard PAV formula used in this study is shown below:-

Where; PAV = Present annual value
AV = Annual value
r = Discount rate (10%)

3. RESULTS AND DISCUSSION

Interviews in the study villages yielded a wide range of information regarding utilization and monetary values of NTFPs as shown in Table 1 and 2. This study revealed that 78% of the households surveyed in a study area were using a wide variety of NTFPs througout the year for their daily subsistence, primary health care and income generation as indicated in Table 1. The NTFPs mentioned by respondents to be utilized in the study area were categorized into 8 major groups namely firewood, poles, wild fruits, wild mushrooms, wild vegetables, bush meat, honey and medicinal plants. In this study, 94% of the respondents were involved in firewood collection which is dominantly used as a source of energy for cooking (Table 1). This could probably be due to the fact that firewood is the only readily available and affordable source of primary energy in the area. These findings conform to those reported by Msemwa [18] who observed that 98% of households surveyed in Kilosa District used firewood in their homes as primary energy source. Likewise, Abdallah [16] reported 84% of the population in Tabora Rural District depend on firewood as a source of energy. Socio economic survey in a study area further revealed various tree species which are commonly used for firewood. These species included *Brachystagia bussei, Brachystegia boehmii, Brachystegia microphylla, Burkea africana, Diplorynchus condylocarpon, Pseudolachnostylis maprouneifolia, Pterocarpus angolensis, Uapaka nitida* and *Vitex doniana*. Grundy et al. [19] observed three most abundant and frequently used firewood species in Zimbabwe. These species were *Brachystegia boehmii*, *Colophospermum mopane* and *Julbernadia globiflora.* Such tree species were also among the firewood species mentioned by local community surrounding Nyanganje Forest Reserve. The species were said to have persistent good fire, high calorific values, no pungent smell and give out very little soot.

Regarding monetary value, it was observed that one head load of firewood with 20 kg sold at a price of TZS 1000 which is equivalent to less than 1 dollar (at an exchange rate of TZS 2,500) and each household extract an average of 99 bundles of firewood per year from the forest reserve as shown in Table 2. In this regards, a total of 8,415 bundles of firewood which are

collected annually from the forest is equivalent to TZS 8,415,000 (USD 3,366). Discounting this actual annual value by social discount rate of 10% resulted into the present annual value (PAV) at TZS 84,150,000 (USD 33,660). These findings differ from those reported by Maximillian [20] who observed annual value of TZS 21,294,000 for firewood in Northern Ruvu Forest Reserve, Kibaha District. These differences might be due to absence of alternative sources of energy in a study area.

Building poles were found to be the most used construction materials for both permanent and temporary houses in the surveyed villages. About 91% of the respondents in the surveyed area were engaged in building pole collection (Table 1). The results are different from those reported by Paulo [21], who observed that 97% of the respondents in Kilwa District were involved in poles collection. The argument for the slightly difference in poles consumption could probably be due to the difference in number of poles consumed domestically. Tree species like *Brachystegia bussei, Combretum adenogonium, Dalbergia melanoxylon, Uapaca nitida* and *bamboo* species such as *Oxytenanthera abyssinica* were reported to be highly favoured for poles in making permanent houses because of their durability, straightness, length and resistance to insect damage as perceived by local people. Similarly, Msemwa [18], in Kilosa District mentioned few similar pole species like those found in Nyanganje Forest Reserve.

Findings from this study further indicated that, a bundle of 15 building poles is estimated to be 40 kg and sold at a price of TZS 1,500 as shown in Table 2. Furthermore, it was observed that each household extract an average of 19 bundles of poles per year from the forest. As a follow up, it was noted that a total of 1,558 bundles of building poles can be extracted from the forest annually fetching about TZS 2,337,000 (USD 935). Furthermore, the annual present value of the poles at social discount rate of 10% was found to be TZS 23,370,000 (USD 9,348). This value of building poles from Nyanganje Forest Reserve, could explain the cost avoided by pole users which is in favour of most low-income earners in the rural areas who prefer using poles instead of bricks for house construction because of the low cost. A study conducted by Msemwa [18], in Kilosa District reported that the annual present value of poles estimated to be TZS 6.2 billion (USD 5.6 million). The difference in the annual values of poles for the two study areas is possibly caused by the difference in the management systems. The consumption of forest products such as poles in Nyanganje Forest Reserve is highly restricted and therefore, there is less quantity of poles which are harvested compared to Kilosa District.

The respondents in a study area reported to utilize wild fruits as the main meal during famine period. Simwanza and Lungu [22] argued that wild fruits play an important role in ameliorating food shortages during hunger periods in Zambia. In this study, about 85% of all respondents interviewed reported to utilize wild fruits as shown in Table 1. Fruits that were frequency mentioned to be harvested included *Annona senegalensis, Parinari curatellifolia, Vangueria apiculata, Rothmannia urcelliformis* and *Vitex doniana*. Findings from this study are however different from those presented by Mapolu [23], who observed that 99% of the respondents in Tabora District utilize wild fruits as a snack. The difference might be caused by low fruit species richness in the study area and inadequate knowledge on the edibility of wild fruits. It was also observed from this study that, the price of wild fruits was TZS 500 per kg as shown in Table 2. It was further observed that each household can collect an average of 17 kg of wild fruits per year. Therefore, a total of 1,309 kg of wild fruits are collected annually from the Forest Reserve which amount to TZS 654,500 (USD 262) in terms of value. The present value of wild fruits using a social discount rate of 10% was estimated at TZS 6,545,000 which is equivalent to USD 2,618 per year.

Wild mushrooms were also mentioned to be highly utilized by the respondents in surveyed villages. In this study, it was revealed that 84% of the households reported to utilize different species of wild mushrooms which were available in Nyanganje Forest Reserve. These mushroom species were *Lactarius edulis, Termitomyces letestui, Amanita masasiensis, Russula cellulata, Amanita loosii* and *Lactarius kabansus*. Nyigili [24], observed eight species of mushrooms in Mbozi District, namely *Amanita zambiana, Cantharellus symoensii, Lactarius kabansus, Lactarius edulis, Russula cellulata, Termitomyces auranticus, Termitomyces letestui* and *Termitomyces microcarpus* which were also among the mushrooms species mentioned in the study area. The presence of various mushroom species in miombo woodlands of Nyanganje Forest Reserve implies that miombo woodlands have abundant and diverse mushrooms populations. According to FAO [25], mushroom is one of the most vital wild vegetables in the natural ecosystems, particularly in the miombo ecosystem.

In this study however, the average quantity of wild mushrooms collected by single household per year was found to be 71 kg and the average unit value was approximated at TZS 1,600 per kg (Table 2). Therefore, about 5,396 kg of wild mushrooms is collected per year in Nyanganje Forest Reserve which fetch about TZS 8,633,600 (USD 3,453). Based on the information in Table 2, the present value of wild mushrooms which was calculated using a social discount rate of 10% was TZS 86,336,000 (USD 34,534). Findings from this study are different from those observed by FBD [26], which was TZS 317.7 million (USD 288,842) per year in the surveyed villages bordering Mount Uluguru Catchment Forest Reserve in Morogoro. The possible explanation for the differences could be due to lack of mushrooms market in the areas bordering Nyangaje Forest Reserve, low income of the people and perhaps feeding habits which does not favour the use of mushrooms.

As regards to wild vegetables, it appears from the current study that, wild vegetables are the most frequently used wild food by many families in the study area. During rainy season, different species of wild vegetables grow in the forests and farmlands. In this study however, about 81% of the respondents interviewed were utilizing wild vegetables from the forest reserve (Table 1). The higher percentage responses in utilizing wild vegetables in the study area might be caused by availability of this resource and enough knowledge on utilization and processing of wild vegetables. The mostly wild vegetable species utilized in the study area were *Manihot esculenta, Amaranthus spinosus, Corchorus trilocularis* and *Solanum nigrum*.

The socio economic survey conducted in a study area further revealed that each household extract an average of 58 kg of wild vegetables annually, and the average unit value was approximated at TZS 800 per kg as shown in Table 2. It can be noted from the Table that, a total of 4,234 kg of wild vegetables is collected from the forest annually which gives a total of TZS 3,387,200 (USD 1,355). When the value was discounted at 10% social discount rate, the present value became TZS 33,872,000 which is equivalent to USD 13,549. Maximillan, [20] reported a value of TZS 50,002,400 annually for wild vegetables in Kibaha District. The low value of wild vegetables in Nyanganje Forest Reserve compared to Kibaha District might be due to lack of market of such forest product and absence of highly preferred species.

This study revealed that meat from wild animals was an important source of protein in the surveyed villages. The main hunters of wild animals were men and most of them found to be reluctant to respond because they knew hunting was illegal. Despite of this, it was revealed that, 77% of respondents in study area utilize bush meat for food and protein supplements per year (Table 1). Animal species commonly hunted included *Bush buck, Clipsyspringer, Giant pouched rat, Bush pig, Duiker, Buffalo, Abort duicker, African hare* and *Impala*. Some of these species hunted in a study area are similar to those found by Lema [27], in Uluguru mountain area. It was

also observed form this study that, about 113 kg of bush meat was utilized each year by local communities surrounding Nyanganje Forest Reserve (Table 2). It was further observed that bush meat was also sold at a price of TZS 2,000 per kg. Therefore, a total of 7,797 kg of bush meat is consumed yearly from the forest reserve, indicating that revenue of TZS 15,594,000 (USD 6,238) per year is saved through hunting. The annual present value of bush meat was TZS 155,940,000 which is equivalent to USD 62,376 at the discount rate of 10%. Findings from this study differ from those observed by Hamza and Msalilwa [28], in Singida Rural District who found that an average of 60 kg of bush meat was consumed per household per year. Variations in amount of bush meat consumed in these places could be caused by availability of the animals and restrictions in hunting.

Results from this study revealed that 59% of the respondents in surveyed villages collected honey from modern beehives for domestic purposes (Table 1). These results differ from those reported by Paulo [21], who observed that 68% of respondents in Kilwa District utilizing honey for food and medicine. These slightly differences might be caused by eating habits and market opportunities for such product, that is a high market for honey, will results into more sales. It was further revealed that a litre of honey is sold at a price of TZS 4,000 and a maximum of 1,537 litres can be collected from the study area per year amounting to TZS 6,148,000 (USD 2,459) as shown in Table 2. When the annual value was discounted by 10%, the present value was TZS 61,480,000 (USD 24,592).

In this study, 53% of respondents (Table 1) in the surveyed villages reported to use medicinal plants for treatment of various diseases such as infertility, pregnancy complications, miscarriage, haemorrhage, pneumonia, back pain and diarrhoea. However, results in Table 2 shows that, an average of 14 kg of medicinal plants could be harvested per household per year and sold at a price of TZS 500 per kg per. In this regards, the current annual value of medicinal plants harvested from the forest reserve amounts to TZS 336,000. When the value was discounted at 10%, the present value became TAS 3,360,000 (USD 1,344).

Table 1: Utilization of various NTFPs by communities in study villages Morogoro, Tanzania

NTFPs	% of respondents (n)
Firewood	94 (85)
Poles	91 (82)
Wild fruits	86 (77)
Wild mushrooms	84 (76)
Wild vegetables	81 (73)
Bush meat	77 (69)
Honey	59 (53)
Medicinal plants	53 (48)
Mean	78 (70)

Figures in the brackets present frequencies of responses and outside brackets present percentages of respondents.

312 **Table 2:** Actual annual values of NTFPs for communities around Nyanganje Forest Reserve, Morogoro, Tanzania

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NTFPs	Units	Average per household per year	Quantity per year	Price/Unit (TZS)	Annual Actual Value (TZS)	Annual Actual Value (USD)	Discount rate (10%)	Annual Present Value (TZS)	Annual Present Value (USD)
Firewood	Bundles	99	8,415	1,000	8,415,000	3,336	0.1	84,150,000	33,660
Poles	Bundles	19	1,558	1,500	2,337,000	935	0.1	23,370,000	9,348
Wild fruits	Kg	17	1,309	500	654,500	262	0.1	6,545,000	2,618
Wild mushrooms	Kg	71	5,396	1,600	8,633,600	3,453	0.1	86,336,000	34,534
Wild vegetables	Kg	58	4,234	800	3,387,200	1,355	0.1	33,872,000	13,549
Bush meats	Kg	113	7,797	2,000	15,594,000	6,238	0.1	155,940,000	62,376
Honey	Lts	29	1,537	4,000	6,148,000	2,459	0.1	61,480,000	24,592
Medicinal plants	Kg	14	672	500	336,000	134	0.1	3,360,000	1,344
Grand Total					**45,505,300**	**18,172**		**455,053,000**	**182,021**

The socio economic study conducted in surveyed villages also yielded information regarding the roles of household members in extraction of NTFPs. In this regards, respondents were interviewed about roles of each household member in the extraction and utilization of NTFPs. This study revealed that the task of extracting a particular type of NTFPs for utilization was done by men, women or children as described in Figure 1.

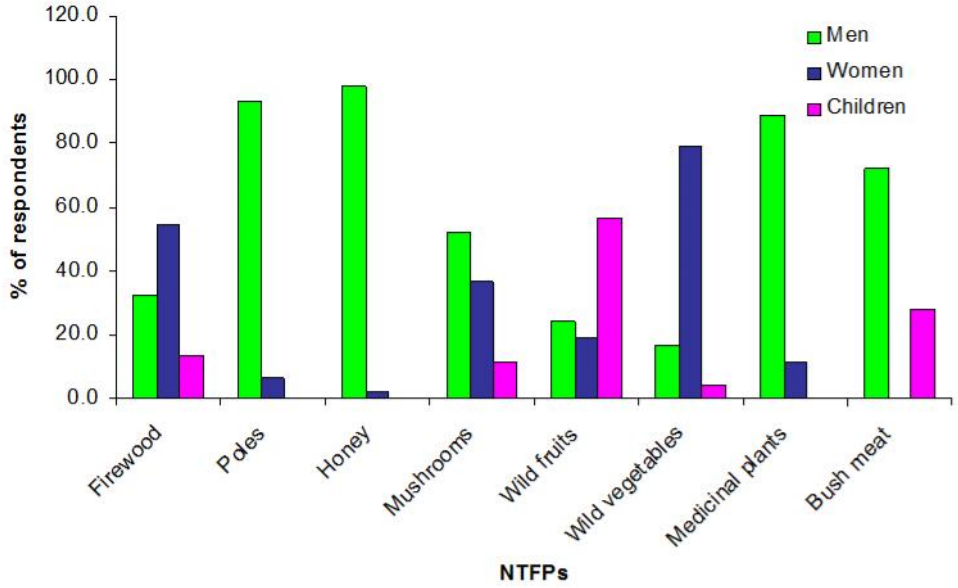

Figure 1: Extraction of NTFPs from study site by different members at household level

It can be noted from Figure 1 that men were the main collectors of NTFPs for utilization. It can be further noted that men were mostly involved in collection of honey, poles, wild mushrooms, medicinal plants and hunting wild animals. Women were responsible for collecting wild vegetables and firewoods. Likewise, children were involved for collection of wild fruits. Similar results were reported by Lema [27] and Kagya [29], in Morogoro Rural District and Meatu District respectively that males were responsible in hunting of wild animals and honey collection while women were largely involved in collection of wild vegetables.

4. CONCLUSION

The study has revealed the roles of NTFPs towards poverty reduction in the study area. This study clearly observed that NTFPs are often a vital source of foreign exchange and revenues as evidenced by the total income accrued from NTFPs activities in the forest to worth TZS 45,505,300 annually which is equivalent to USD 18,172. On discounting this annual income using the discount rate of 10%, annual present value of the NTFPs found to be TZS 455,053,000 per year (USD 182,021). These values are what would have been paid or compensated if the local community around Nyanganje Forest Reserve were to be denied access to such NTFPs. Therefore, Nyanganje Forest Reserve has valuable NTFPs and if the Government needs to take any decision for alternative use of the forest reserve, the value of these NTFPs to the local communities should be taken into consideration. However, appropriate strategic plans should be put forward to organize extraction and utilization of these NTFPs

resources in a sustainable and environmentally healthy manner for the benefits of present and future generations.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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