



Original Article

## CONSERVATION OF URBAN FOREST IN TANZANIA: COMMUNITY ATTITUDES TOWARDS NJIRO FOREST, ARUSHA

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### ABSTRACT

Understanding community attitudes towards urban forests is of great importance since these attitudes are inherently linked to the long-term sustainability of urban forests management and conservation. We analysed the attitudes of the local community towards the Njiro forest (Arusha, Tanzania) which is managed and used as an experimental beekeeping area by TAWIRI (Tanzania Wildlife Research Institute). Data collection was done between September-October 2018 involving a sample of 163 randomly selected respondents. A semi-structured questionnaire was used to collect the data. Quantitative data were analysed through Statistical Packages for Social Sciences (SPSS). Chi-square tests and contingency tables were used to determine whether there was a significant difference between the expected frequencies and the observed frequencies in one or more categories. Possible influences coming from sociological and demographic factors such as age, gender, education level, occupation were assessed. The majority of the respondents declared to gain ecological benefits from the forest. A significantly larger group of older respondents in comparison with the younger ones ( $p < 0.05$ ) declared to face problems coming from the forest (stray dogs, robbers, illegal waste disposal). Males showed to be more interested in practising beekeeping than females ( $p < 0.05$ ). Respondents with a primary education level were more prone to express agreement with the adopted management strategies in comparison with respondents with higher education ( $p < 0.001$ ). In conclusion, the great majority of respondents declared to support the conservation of Njiro forest, however, employed respondents and females were more positive regarding the hypothesis of abolishing the forest ( $p < 0.05$ ). In order to improve management strategies and support the long-term conservation of the forest, respondents recommended strengthening the protection of the forest by fencing it, providing environmental education to the surrounding community, reinforcing the cooperation with the local community and planting new trees to improve the health of the forest ecosystem.

## INTRODUCTION

The world is increasingly becoming urban. Until the first half of the 19<sup>th</sup> century, the majority of the human population lived in rural areas, but thereafter, new urbanization trends have changed the population distribution. According to the UN report, by 2030 the percentage of urban population will have risen to 60% (United Nations, 2018). Human populations are rapidly increasing especially in developing countries; by 2050, more than half of the global population growth is expected to be recorded in Africa (United Nations, 2018).

Population growth and urbanization are a significant threat to wildlife (Cincotta *et al.*, 2000). When new urban agglomerates or cultivations replace forests growing across tropical areas the impact is of particular concern since these areas often play the role of hotspots by hosting a very high degree of biodiversity (Allnutt *et al.* 2008; Gardner *et al.*, 2009). Indeed, urbanization tends to modify the structure of the ecological niches and habitats of living organisms by both destroying the biodiversity and homogenizing the composition of the community itself (McKinney, 2006; 2008). Several critical factors linked to urbanization tend to work as limiting factors for wildlife. They are fragmentation and isolation of green areas surviving into cities, simplification of plant community structures, and colonization by exotic species, which tend to compete with indigenous ones, air and noise pollution, artificial night lighting, animals/vehicle collisions (Blair and Launer, 1997; Marzluff and Ewing, 2001; Picchi *et al.*, 2013).

Increasing urbanization also poses critical pressure to urban forests by challenging their role as key providers of ecological services (Nowak and Crane, 2000). It is universally recognized that urban forests can mitigate air pollution, reduce temperature, provide carbon sequestration, draining of rainfall and work as recreational areas (Bolund and Hunhammar, 1999; Gill *et al.*, 2007; Fuwape and Onyekwelu, 2011; Patarkalashvili, 2017). The management of biological resources needs careful consideration of the people's attitude towards their conservation and the urban forests are no exception (Kideghesho *et al.*, 2007). Conservation efforts tend

to fail when management strategies of a protected area do not appropriately take into account the opinions and aspirations of the surrounding human community (Odebiyi *et al.*, 2015). Attitudes of people living around a protected area have therefore to be understood and incorporated in the management strategies

This paper reports the results of a survey on the attitudes and perception of the community towards Njiro forest management and conservation. Njiro forest (Arusha, Tanzania) is managed and used as an experimental beekeeping area by TAWIRI (Tanzania Wildlife Research Institute). The conservation of Njiro Forest, that serves as habitat and foraging area for both stinging and stingless bees, is of particular relevance in order to support their populations dynamics and conservation (Steffan-Dewenter *et al.*, 2002; Carvell *et al.*, 2006; Winfree *et al.*, 2007; Wojcik *et al.*, 2008; Hoehn *et al.*, 2008). The study aimed at analysing local community support towards conservation of Njiro forest; perceptions of the local community towards the management and conservation of the forest; community understanding of beekeeping practices and the interest of the local community in being involved in beekeeping.

## MATERIALS AND METHODS

### Study Area

Tanzania is the largest country in Eastern Africa with an area of 937,062 sq. Km. It is located between latitudes 29°27'S and 40°20'S and had a population of 55.5 million inhabitants in 2016. Tanzania is one of the nine countries in the world that altogether will give a demographic contribution of more than half of the projected increase to the global population by 2050 (UN, 2019). Urban forests have survived as green patches in several cities, municipalities and other forms of townships in the country. The study area is included in the Arusha urban district, which includes the regional and economic capital itself (Arusha). The district is crossed by the Great Rift Valley north to south and elevations range from 900 to 1600 m above the sea level.

Arusha has a subtropical highland climate. Arusha City (341,136 inhabitants; 1263 m asl) is located in

North-Eastern Tanzania. It is endowed with 12 urban forests, including Njiro Acacia Forest. This 25-hectare forest is part of Plot No 213 Block A, (Figure 1). The Forest is located 7 km South of Arusha City Centre. Njiro forest is a secondary forest dominated by a variety of Acacia species, such as *Acacia seyal*, *A. polyacantha*, *A. nilotica* and *A. xanthophloea*. It also includes other species, such as *Vernonia exserstiflora*, *Rhus natalensis*, *Albizia harveyi*, *Grewia bicolor*, *Agave sisalana*, *Strychnos spinosa*, *Rauvolfia caffra* and *Albizia petersiana* among others.

The forest area harbours a number of small mammals, more than 60 species of birds and a rich butterfly community (Mrisha, *et. al.* 2011). The forest is surrounded by TAWIRI (Tanzania

Wildlife Research Institute) offices and several other urban settlements. The forest is well patrolled by qualified security guards and demarcated by signboards that restrict trespassing. It is surrounded by people of different cultural identities, both residents and non-residents, living around the forest.

Njiro forest is used for field practical studies by local college and university students, as well as for beekeeping production and research purposes. The forest hosts 14 experimental apiaries inhabited by honeybees belonging to *Apis mellifera scutellata*. In this forest, several stingless bee species have also been recorded. They belong to the following genera: *Melipona*, *Meliponula*, *Trigona*, and *Dactylurina* (TAWIRI, unpublished data).

Figure 1: Location of Njiro Forest Found in Arusha Region

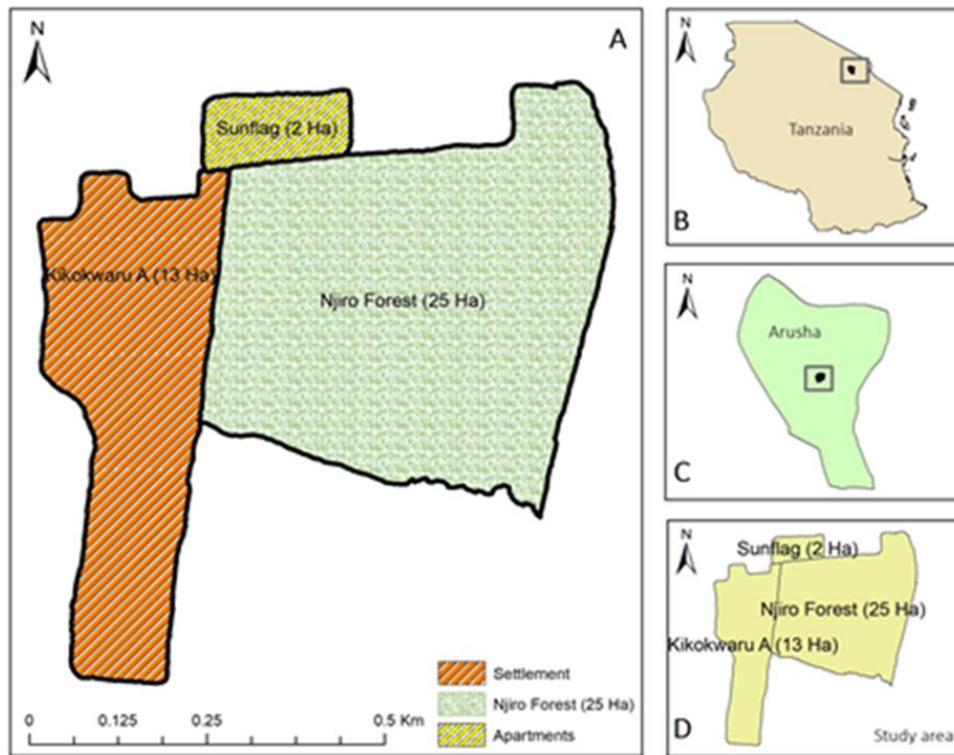
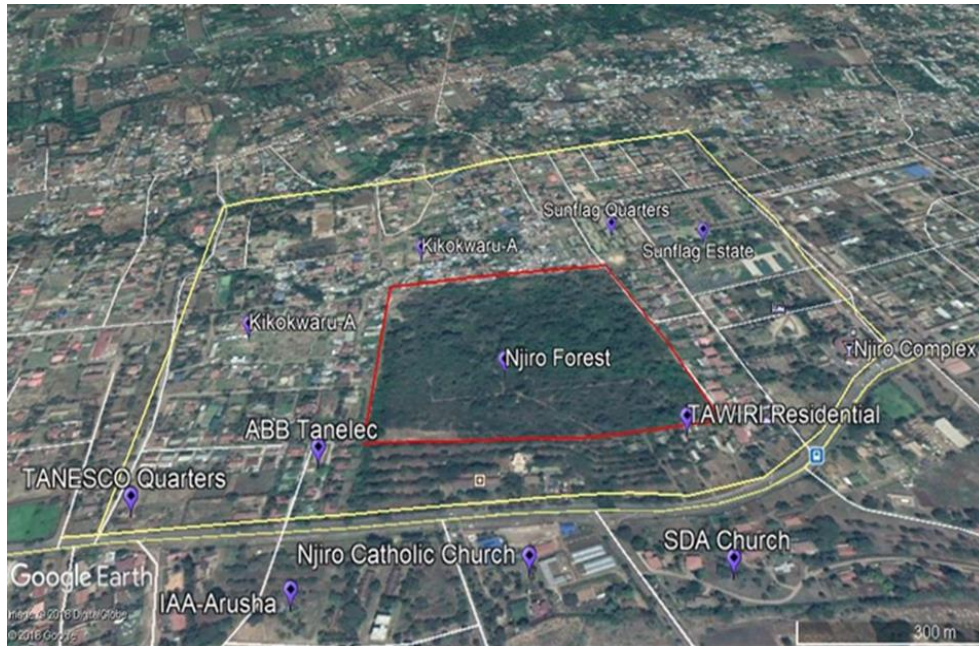


Figure 2: The overlay of Njiro urban forest and its surrounding community



Source: The Image was extracted from Google Earth Software in September 2018

## Data Collection

Questionnaire survey technique was employed for data collection. A sample of members of the community living in the areas around the forest was surveyed by means of a questionnaire between September-October 2018. The areas surrounding the forest are namely Kikokwaru-A, Sunflag quarters, and Sunflag-building-estate. The respondents were selected randomly from these areas. The sample size was determined by Cochran's formula (Cochran, 1963 as quoted in Israel 1992). The equation is given as:

$$n_0 = \frac{Z^2 pq}{e^2}$$

where  $n$  is the sample size,  $Z$  is the abscissa of the normal curve ( $Z$  score),  $p$  is the degree of variability in the population,  $q$  is  $1-p$  and  $e$  is the desired level of precision (sampling error). Household heads (main targets) were interviewed face-to-face. In their absence, any member of the household over 18 years old was interviewed.

## Data Preparation and Analysis

The questionnaire survey involved 163 respondents. Their attitudes were analysed by means of 12 statements, using a 3-point scale: disagreement, agreement and undecided position. Chi-square test was used to assess whether the difference between the expected frequencies and the observed ones was significant. In case of multiple categorical variables, expected and observed frequencies were compared by means of a contingency table, to test the possible influence on respondent's opinion of the following factors: Gender (male/female); Age (<40 years old- / >40 old); Level of education (Primary School/Secondary School and University) and Working condition (employed/unemployed).

## RESULTS AND DISCUSSION

### Demographic and Socio-Economic Conditions

The age of respondents ranged from 20 to 79. The majority of respondents (68.7%) were household's heads. The number of males (*table 1*) was not significantly different from the number of females

( $p > 0.05$ ). Sex distribution within the sample is of great importance, because some attitudes are sex-dependent, especially in African countries (Lazaro *et al.*, 2013). For example, males have easier access to information and usually have a prominent role in the households' decision-making process. In addition, males are highly involved in forest-related activities (i.e. beekeeping) when compared to females (Steriani and Soustas, 2005; Lazaro *et al.*, 2013). On the other hand, males are usually less sensitive and less concerned with environmental protection, compared to females (Zelezny *et al.*, 2000; Chun *et al.*, 2012).

With regard to education (*table 1*), a minority part of the sample (39.3%) had an education level higher than primary school. In addition, the survey revealed a significant rate of unemployment (65.6%). Self-employed (22.9%) depended on business as a major source of income. The main sources of income of respondents can significantly affect the attitudes of stakeholders towards environmental resources conservation. Ntongani *et al.* (2010) for example, found that the expansion of land for agricultural activities had been threatening the conservation of Selous-Niasa Miombo woodland ecosystem in Nachingwea, Tanzania. Given the importance of business as an income-generating activity in the study area, future pressure on land for new settlements and the establishment of business centres could be expected.

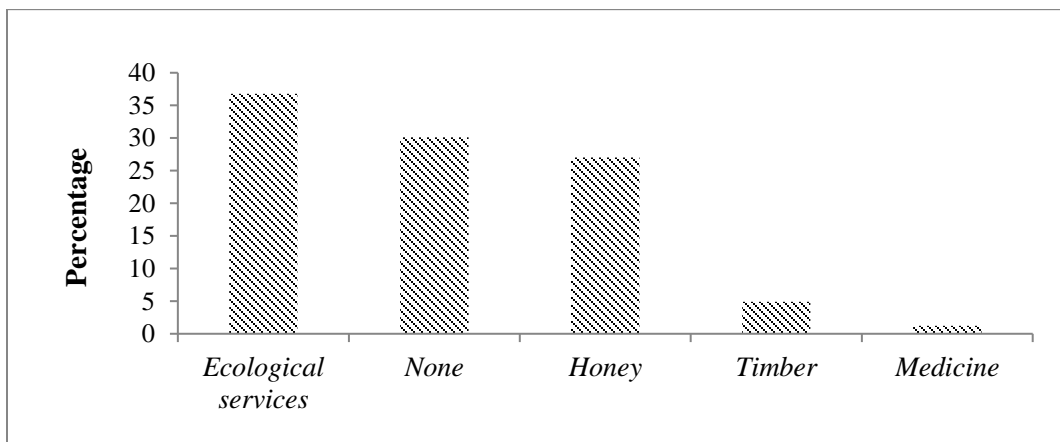
*Table 1: Demographic Characteristic*

Characteristics of respondents	%
<b>Age</b>	
<40	61.3
≥40	38.7
<b>Gender</b>	
Males	54.6
Females	45.4
<b>Education level</b>	
Primary	60.7
Secondary/University	39.3
<b>Occupation</b>	
Unemployed	62.6
Employed	23.9
Self-employed	13.5

**Benefits and problems deriving from Njiro Forest**

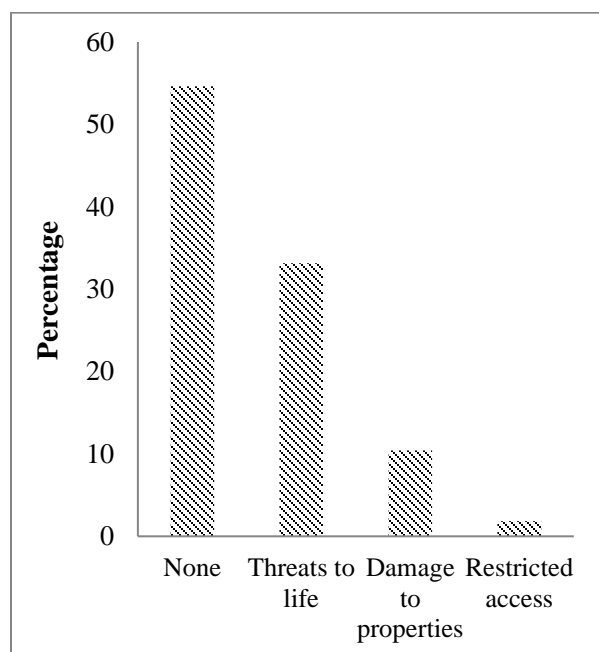
Almost all the respondents (97.5%) declared to be aware of the existence of Njiro forest. Most of the respondents (69.3%) declared to gain benefits from the forest: ecological services, honey, timber, medicines (see *Figure 3*). These findings are similar to the ones observed by Hassan (2015) who observed that the majority of the local community in Dar es Salaam (Tanzania) thinks that conservation of open spaces is costing, but also beneficent. Several researchers all over the World recognized the ecological benefits of green spaces, demonstrating that urban forests and parks work as a beneficial space for physical and psychological wellbeing (Hartig *et al.*, 2014; van den Berg *et al.*, 2018; Wheeler *et al.*, 2018).

*Figure 3: Benefits from Njiro forest*



Problems coming from the forest were reported by (57.7%) of respondents (Figure 4). Danger arising from stray dogs or robbers and the use of the forest as a waste disposal area are the main perceived threats (Figure 4). Respondents claimed that robbers have sometimes used the forest as a refuge to hide from security bodies and laws. As the forest lacks fencing, robbers can easily access to the wood.

Figure 4: Problems deriving from Njiro forest



Populations of dogs freely roaming in public places can facilitate zoonotic disease transmission, such as rabies (Guilloux *et al.* 2018); for this reason, stray dogs can impact public health in urban areas (Guilloux *et al.* 2018). In addition, they can affect wildlife as predators when they forage along urban forest edges (Galetti and Sazima, 2006; Marks and Duncan, 2009).

The members of the local community living in the area surrounding Njiro Forest are the main cause of illegal waste disposal into the forest. Despite the agency responsible for the collection of solid waste usually sets specific days for cleaning the edges of the wood, but that intervention is not enough to solve the problem. Related studies on problems associated with urban forests conducted by Mariana *et al* (2014) demonstrated that also urban forests in Brazil are used for illegal dumping of waste.

### Living Conditions of Respondents Regarding the existence of Njiro forest

A highly significant number of respondents (89.6%) declared to be happy to live near Njiro forest, but this opinion is not supported by economic advantages coming from the forest conservation. Indeed, a substantial number of respondents (47.8%) declared that the forest existence did not improve their life conditions (Table 2) and did not bring development to the area around it (50.9%). On the other hand, respondents mainly expressed the opinion (68.1 %) that forest conservation did not worsen the life condition of the people living around it (Table 2). Employed people were more negative (66.1%) than unemployed ones (48.2%) about the fact that the forest did not improve their living conditions ( $p < 0.05$ ). It can be reasonably hypothesized that green areas included in urban settlements are perceived as a factor limiting the economic development by people involved in the business.

Table 2: Contribution of Njiro Forest on the Living Conditions of Respondents

Njiro forest brought development to the area	%
Yes	30.1
No	50.9
Don't know	19
Njiro forest improved living conditions	%
Yes	38.7
No	47.8
Don't know	13.5
Njiro forest worsened living conditions	%
Yes	19.6
No	68.1
Don't know	12.3

### Knowledge about Bees and Bee Products

Perception of benefits coming from natural beekeeping has a positive outcome for urban forest conservation, as demonstrated by Chanthayod *et al* (2017) as a result of a research carried out in North Lao. A few respondents (8.6%) declared not to know bees while (32.5%) (Table 3) have no

knowledge of beekeeping practices in Njiro forest (Table 3). The younger generation is less aware of beekeeping (61%) compared to the older one (77.8%;  $p < 0.05$ ). The reason of such a difference could be that a large group of young people around the study area are University students; since those students are not native of the area, they have poor knowledge of the area where they live in.

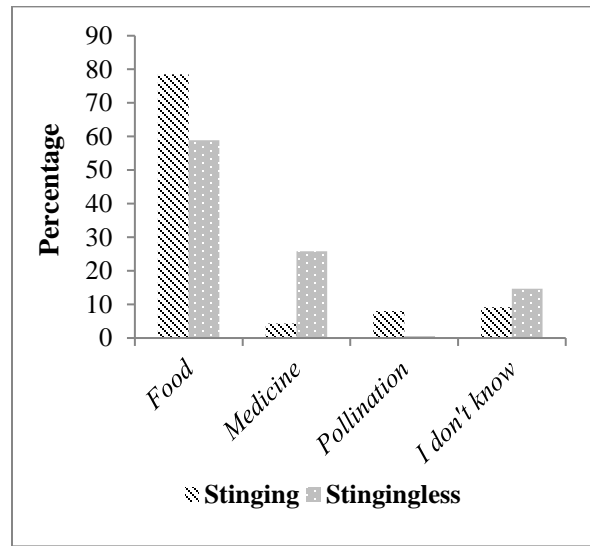
The majority of respondents (63.2%) would like to practice beekeeping, given the chance to do it. The percentage of males who wish to keep bees (71.9%) is significantly higher than the one of females (52.7%;  $p < 0.05$ ). Such a discrepancy has probably to be related to the almost exclusive role of men as beekeepers in African Countries (Ogaba, 2001). Nonetheless, beekeeping should not be considered solely a male activity; there is a need for promoting beekeeping as an income-generating activity also for women. Beekeeping practice should be viewed as a potential driver to empower women to take part in environmental projects (Iddi, 2002).

Table 3: Knowledge about Beekeeping

	%
Do you know bees?	
Yes	91.4
No	8.6
Do you have knowledge of beekeeping?	
Yes	67.5
No	32.5
Do you wish to practice beekeeping?	
Yes	63.2
No	36.8

The majority of respondents recognized honey as the main benefit coming from bees (Figure 5). Stingless bees are even more associated by respondents to the production of honey having healing properties. Probably this knowledge has been passed down to them by their ancestors. A similar result was achieved by Reyes-González *et al.* (2014) who studied the knowledge and use of stingless bees in Mexico. Surprisingly, very few respondents are aware of the important role of bees as pollinators (Figure 5).

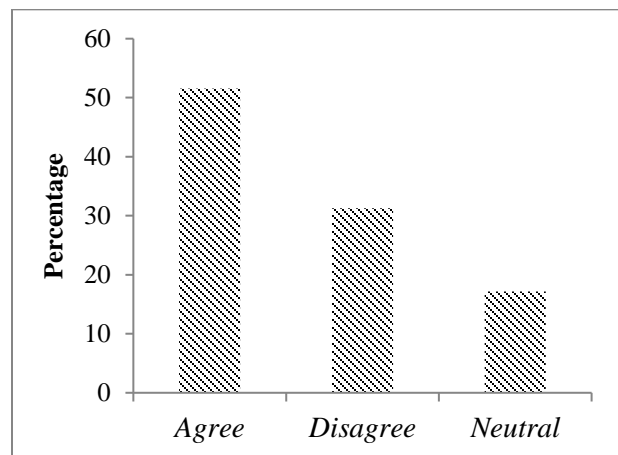
Figure 5: Benefits from stinging and stingless bees



### Opinion on Forest Conservation Strategies

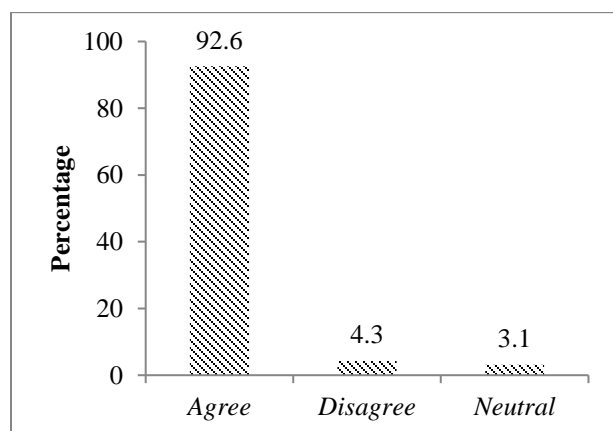
The majority of respondents (53.5%) agreed with management strategies and believed that the forest was well protected and managed (Figure 6). The trend of people who agree with management strategies was supported mainly by respondents having a primary level education (63.1%) compared to respondents having a higher education level (27.5% -  $p < 0.001$ ). This is further evidence that the level of education is a determinant driver for assessing the local community's attitudes on conservation (Steriani and Soutsas, 2005; Thiruchelvam and Kirupakaran, 2010; Mpokigwa *et al.*, 2011; Chun *et al.*, 2012).

Figure 6: Is the Njiro forest management effective?



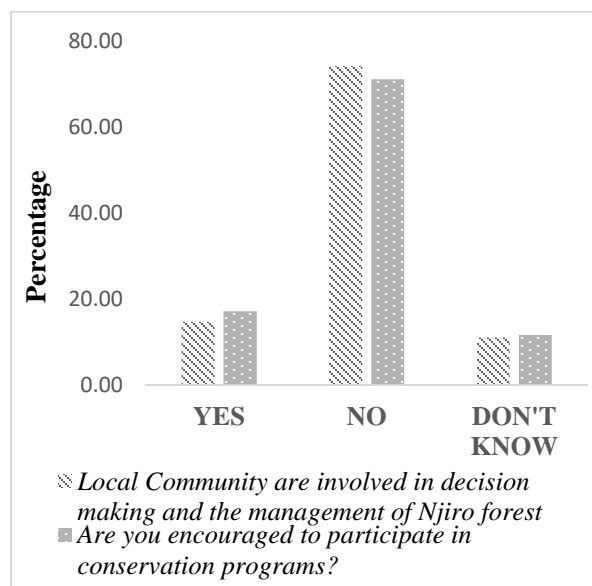
The opinion that Njiro forest is necessary for the protection of the remaining natural resources in the urban setting is largely rooted in the sample of respondents (Figure 7) as well as the idea that people should not be allowed to utilize the resource of the forest (92.6 %).

Figure 7: Njiro forest is necessary for the protection of remaining natural resources



A critical point associated with the forest management is the perception of a poor involvement of the local community in decisions (Figure 8). The majority of the respondents indicated that is neither involved in decision making (74.2%) nor encouraged to participate in conservation programs (71.2%).

Figure 8: Involvement of the local community in decisions on management



A large majority of respondents (85.3%) disagree with the idea of abolishing the forest as they receive ecological benefits from the forest (Table 4). Females (20.3%) and employed people (21.7%) are more supportive of the idea of abolishing Njiro forest and replace it with urban settings compared respectively to males (9%) and unemployed people (9.8%;  $p < 0.05$ ). The main reason why a substantial part of women does not agree with the conservation of the forest is probably the perception of the forest as a source of danger. This negative attitude expressed by females is in contrast with the trend showing a general positive attitude of women to biodiversity conservation (Czech *et al.*, 2001; Uliczka *et al.*, 2004; Agarwal, 2009). The same negative attitude expressed by numerous employed respondents, as previously discussed, could be related to the idea that the forest existence is not useful to promote local economic activities.

Table 4: Njiro forest management and existence

	%
Is the management of Njiro forest effective?	
Agree	51.5
Disagree	31.3
Don't know	17.2
Should be Njiro forest abolished?	
Yes	14.7
No	85.3
Which type of Institution is responsible for Njiro Forest management?	
Government	68.7
Partnership	23.9
Local Community	2.5
Don't know	4.9

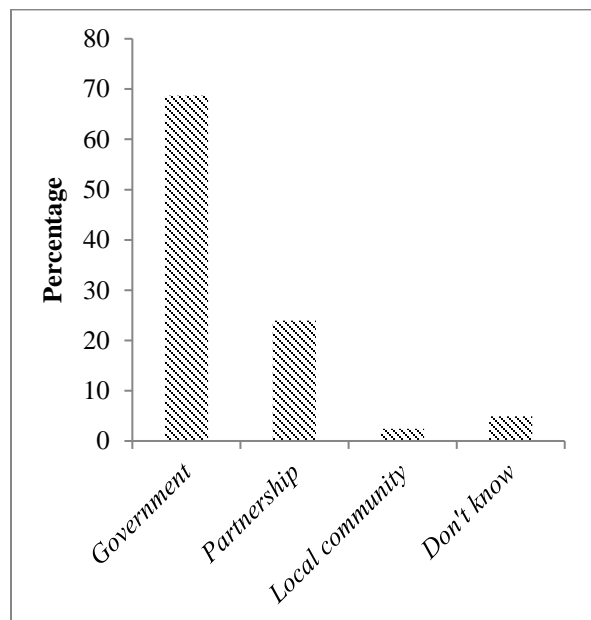
**Institution responsible for Njiro forest management and support to conservation**

The majority of respondents (68.7%) want the government to be directly responsible for the forest management, but some of the respondents (23.9%) would like management based on partnership with the local community (Figure 9). Amoah and Wiawe (2012) reported similar opinions expressed by the local community living next to Kakum National Park in Ghana. Collaborative management should



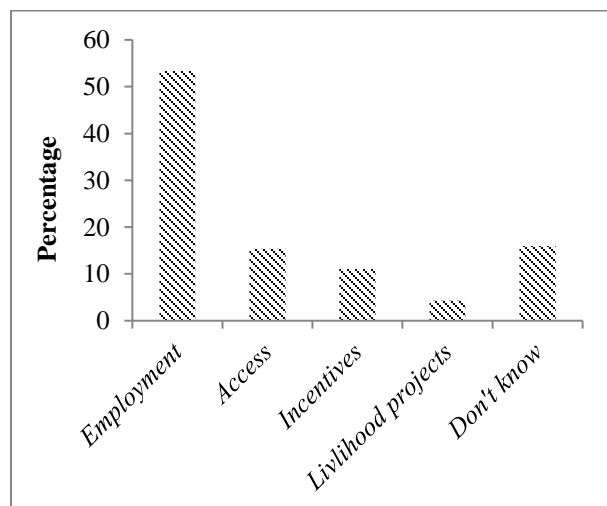
be given the necessary consideration, bearing in mind the fact that most protected area managers are well equipped to carry out their mandates effectively when they are supported by of the local community (Allendorf *et al.*, 2006).

Figure 9: Who should be responsible for forest management?



Respondents were also asked to suggest which type of direct benefit would fully support the management and conservation of the forest (Figure 10). Being employed in the staff of management is the most frequent aspiration desire (53.4%).

Figure 10: What will make you fully support conservation programs?



### Opinions on the Improvement of Njiro Forest

A number of recommendations from the local community were suggested for further improvement of Njiro forest conservation.

Table 5: Opinions on possible actions supporting Njiro forest conservation

Opinion	%
Protection /Fencing	33.1
Environmental education	18.4
Community involvement	8.6
Keep the area clean	8.6
Planting trees	8.0
Business area	5.5
Forest as an area of attraction	4.3
Don't know	13.5

1. *Fencing/protection*: When the forest is located in a highly urbanized area, a fence is an effective tool for limiting illegal human encroachment and deter from illegal waste disposal.
2. *Education on beekeeping and conservation training*: education on the importance of forest conservation and promotion of beekeeping as a local activity capable of generating income is suggested by respondents in order to reinforce the involvement of people in active forest management.
3. *Cooperation*: The management of Njiro forest should be based on good relationships with the local community and its involvement in conservation activities, which can positively affect the local community attitude towards the protected area.
4. *Replant new trees*. The local community thinks that the environmental quality of the forest can be improved. This opinion can support also the suitability of the forest as foraging habitat for bees. There is a need to plant tree species to attract bees, since over 75% of the forest is dominated by invasive vegetation, including many species that are not palatable/attractive to bees. A renewal of wood composition can enrich the carrying capacity of the area in terms of bee foraging.

*Law enforcement:* It is important to have enforceable bylaws, which is the best tool to achieve effective conservation of the forest.

## CONCLUSION

The local community is or are aware of the legislation governing the conservation of Njiro forest in Arusha. The majority of respondents disagreed with the hypothesis that Njiro forest should be abolished. The majority of the local community also agrees with the management pattern that up to now has been adopted, supporting the conservation of the forest as an ecological service provider, a biodiversity reservoir and an important area for beekeeping and research. The public acceptance of Njiro forest protection was positive, but the local community suggests some actions to be planned by the management: fencing the forest, involving the community in decisions on forest management, providing environmental education to the local community. More specifically, it is urged to promote the involvement of the local community in management decision-making; otherwise, future support to forest conservation could seriously decline. In addition, it is fundamental to conduct further research to monitor both the changes in the attitudes of the local community in response to the implementation of actions suggested by the community and extending more research projects on other urban forests located in Tanzania.

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