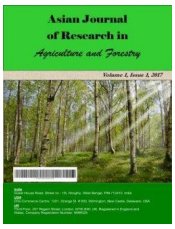

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Community Poultry Project for Conserving the Wildlife Species in Magombera Forest, Tanzania

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Authors' contributions

This work was carried out in collaboration among all authors. Author KN designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors ES and SM managed the analyses of the study. Author SM managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Poaching of wildlife is a major challenge in their conservation, including endemic ones like *Procolobus gordonorum* Matschie. Local communities in Udzungwa and Magombera poach for subsistence and small scale commerce. The Community poultry project adjacent to Magombera forest contributed towards enhancing the conservation of wildlife species through providing community with poultry as an alternative livelihood where meat and income can be generated in legal and convenient methods.
Place and Duration of Study: This study took place in communities surrounding the Magombera Forest in the Morogoro region of Tanzania. The study was conducted from July 2018 to January 2019.
Methodology: Random semi-structured questionnaires with Likert scaling were administered to 119 local community members neighbouring the Magombera Forest. A training workshop in which

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the participants were trained on veterinary and improved rearing practices in order to address the challenges were administered to 52 participants, followed by pre- and post-training evaluation questions that assessed the challenges and opportunity for poultry keeping.
Results: Sixty one percent of respondents reported that they kept chickens before training, after training all showed an inclination to keep chickens for meat and income generation. The respondents reported that challenges for poultry keeping are diseases control, market for products, rearing system and predators and parasites.
Conclusion: Training on poultry production to enhance conservation of biodiversity in Magombera forest is essential. However from this study it is clear that crucial challenges (such as diseases) for successful poultry production, specified by local communities, need to be dealt with first.

Keywords: Poultry; magombera forest; wildlife conservation; Tanzania.

1. INTRODUCTION

Biodiversity conservation worldwide has been facing challenges such as overexploitation, pollution, extinction of species and human population increase [1]. In Tanzania, wildlife poaching for subsistence or commercial reasons, is among of the major causes of resource over exploitation [2]. Magombera Forest, the home of endemic species like the Iringa Red Colobus monkey (*Procolobus gordonorum,* Matschie), has a diversity of wildlife such as Elephant (*Loxodonta* africana, Blumenbach) and Buffalo (*Syncerus caffer* Sparrman) being targeted by poachers [3]. Other wildlife species in the Magombera forest include: Leopard (*Panthera pardus* Linnaeus), Hippopotamus (*Hippopotamus amphibious* Linnaeus), together with a diverse number of reptiles and birds. Poaching has been observed to increase due to demand of local communities to meet their daily basic needs such as food, while enhancing their economic status [4]. Other studies such as [5] have reported that subsistence poaching could be due to protein deficiency in these communities. This suggest that, provision of alternative protein sources and income to local communities neighbouring protected areas are essential [5].

There are different alternative sources of protein and income that can be provided to local communities to reduce their dependence on protected areas [6]. These alternative sources include poultry and other livestock production, crop cultivation, beekeeping, and tourism ventures. Kabir et al. [7] showed that poultry production has several advantages over other livestock keeping. Among these benefits are improved livelihood, high growth rate, market availability, adaptation to different climatic conditions, and production of quality protein with less cholesterol than other livestock keeping [8].

Although poultry production can be used as a conservation tool for wildlife species in Magombera forest, there are still some challenges facing it. Studies such as [7,9,10] revealed that the main challenge for poultry production in Tanzania is diseases due to climate, management and environments. Understanding the challenges of poultry production at a local level is essential for proper and strategic introduction of the project as a tool for conserving wildlife species.

In communities neighbouring the Magombera Forest little has been done to assess the attitude of local communities on the poultry production and its implication in the conservation of this forest. This study thus aimed at elucidating the attitude of local communities on the proposed poultry production, and its implications for the conservation of the Magombera Forest and its biodiversity.

2. MATERIALS AND METHODS

2.1 Study Area

This study took place in the Katurukila (-7.894632, 36.946321), Magombera (-7.819661, 36.94661) and Msolwa (-7.794525, 37.037042) villages neighbouring the Magombera Forest (-7.821984, 36.983364) in the Morogoro region of Tanzania. Locals are involved in subsistence agricultural activities such as cultivation of rice, maize, beans, cowpeas and fruits such as mangoes, while sugarcane is being for commercially produced. Other activities like poaching, lumbering, honey harvesting from the forest are also reported [3].

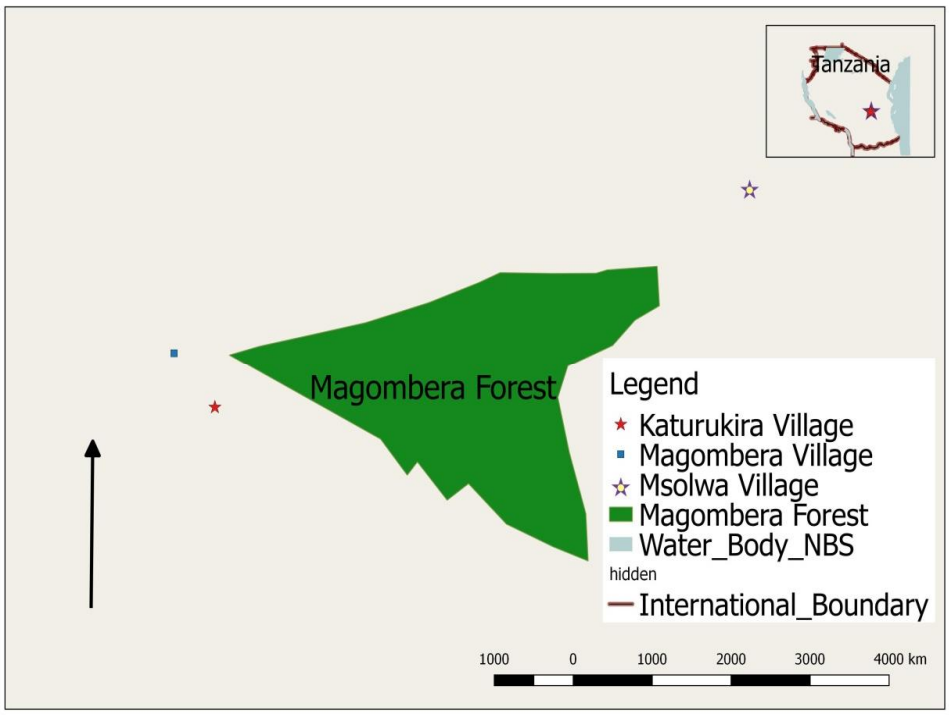

Fig. 1. Map showing the Magombera forest area was created using QGIS version 2.18.15 with the help from Google Earth™

2.2 Methods

Data collection involved both open- and closed-ended questions in self-administered semi-structured questionnaires and field survey. The questionnaire form comprised two main sections.

The first section focused on the benefit of poultry production in relation to the conservation of Magombera Forest. Under this section one open equation was involved while 6 closed with Likert scaling question were formulated. The second section involved understanding challenges facing the poultry production in the villages. Under this section one open question was asked and four closed Likert scaling questions were addressed. The questionnaire was pretested to 23 people in the villages and modifications required were done based on the challenges and feedback from the respondents. In addition, participatory training was conducted to the local communities neighbouring the Magombera Forest. Selection of respondents was randomly using a list of villagers provided by local government leaders. The distribution of the questionnaires to selection the participants were done regardless of the sex, age, occupation or education levels.

A total of 119 questionnaires were addressed distributed to the selected respondents to enquire on their attitude and opinion of the benefits of the poultry keeping, to the local communities and the conservation of wildlife and other biodiversity in the Magombera Forest. Additional information enquired in the questionnaire included the relationship of poultry keeping and the conservation of biodiversity in the Magombera forest. Consent forms were completed by interviewees who participated.

2.3 Data Analysis

The Likert scaling was used for measuring different statements in the questions, whereby 1-strongly disagrees, 2-disagree, 3-don't know, 4-agree and 5-strongly agree, as suggested by Kothali 2007. In addition, the trainees were asked to rank the awareness acquired after training in the following categories: 0-25%, 26-50%, 51-75% and 76-100%.

Raw data were entered into Microsoft excel ready for analysis. Descriptive statistical was used to summarize the data. The variation in attitude for different response into various

measuring statements was tested using the non-parametric statistical friedman test Friedman [11].

3. RESULTS AND DISCUSSION

3.1 Community Poultry Keeping Benefits

The response from the participants varied on their attitude and opinion on the benefit of poultry keeping. Results showed that 5.26%, 31.57%, 36.84% and 26.32% of participants in the interviewed strongly disagreed, didn't know, agreed and strongly agreed respectively on the benefit of poultry keeping by local communities. In terms of benefits to the local communities, the highest scores were observed for employment (3.789±0.249) as well as manure for crop growing and support for conservation of forest (3.737±0.252 each) (Table 1). The variation in attitude among local communities on the benefit accrued from poultry production were statistically insignificant (Q=0.599, P=0.988, df=5).

3.2 The Biodiversity in the Magombera Forest

In addition, poultry production was observed to have a positive impact on the conservation of biodiversity in the Magombera Forest. With availability of poultry production the local communities said that there is no need for poaching, and they were positive in supporting conservation of forest resources (Table 1).

Employment opportunities, source of income and food were identified by this study to be among the benefits obtained from poultry keeping. Findings from Rufiji district (Tanzania) showed that poultry production increased income of families and provide protein to local communities adjacent to the Selous Game Reserve [5]. This is in agreement with other studies such as [7,12], which showed that, through accessibility of food, employment and income from poultry production, family livelihood is improved. During our study, we noticed one chicken costs Tanzanian shillings 15,000/= (equivalent to 7USD) which implies that, if local communities are supported via chicken production in these villages, they are able to generate a basic income that caters for school fees for kids, clothing, food, shelter and health care. This in turn will enhance the conservation of Magombera forest by limiting poaching.

Manure for crop production was also pointed by the local communities around the Magombera forest as a benefit that can be accrued from poultry faming. Poultry manure is well known to contain considerable amount of Nitrogen, Phosphorus, Potassium and micronutrients [13], which are essential for crop production. Ahn et al. [14] also revealed the potential of poultry manure from biogas production. This could be an alternative source of energy for cooking and lightening, instead of using fuel wood obtained from the forest that causes deforestation.

In this study the communities showed positive interest in supporting the biodiversity of Magombera forest. This suggests that, local communities are essential in the conservation of Magombera forest if they will be involved in the conservation. This is in agreement with other finding which have shown that, involvement of local communities in the conservation of biodiversity while providing economic incentive is positive reward to biodiversity [15].

There is positive attitude by local communities on the biodiversity conservation of Magombera forest. However, the awareness will be elevated if the communities will be provided with conservation education for the forest. In Madagascar similar scenario has been observed where, conservation education showed to be essential for improving the awareness of local communities on the biodiversity conservation [16].

3.3 Challenges for Poultry Keeping by the Local Communities Neighbouring Magombera Forest

Out of the 119 responses collected 5.26% didn't know about challenges that relate to poultry keeping, 15.79% noted (agreed) that there are challenges associated with poultry keeping, while 78.95% strongly agreed with the statement that there are existing of challenges related to poultry keeping by local communities around the Magombera Forest. The challenges identified by local communities were; lack of capital to start poultry production, diseases for poultry, poor availability of veterinary services, and limited market for the poultry products (Table 2). The diseases and parasites pointed by the pastoralists in this study were; Chicken Lice (15%), Newcastle diseases (70%), Fowl typhoid (10%), and Worms (5%). The variation in their attitude and response on the challenges facing poultry production was insignificant (Q=1.077, P= 0.783, df=3).

Table 1. The average likert score for the benefits of poultry keeping to local communities neighbouring Magombera forest and the conserved biodiversity in the Magombera forest

C/n	Benefits	Mean±S.E	Max	Range
1	Employment	3.789±0.249	5	4
2	Income	3.632±0.244	5	4
3	Support conservation of Forest	3.737±0.240	5	4
4	Food	3.632±0.232	5	4
5	No need of poaching	3.474±0.309	5	4
6	Manure for crop growing	3.737±0.252	5	4

High number of respondents agreed that rearing of poultry in their village had challenges. The awareness of the challenges by the local communities in the villages is a good entry for the poultry production venture. This paves the way for dealing with the challenges in participatory with local communities the involvement of local communities on the challenges solving is the best way of bottom-up approach which provide sustainable solution for the existing challenges. A study from has revealed that, innovation way mechanisms of involving local communities on the solving problems is crucial for successful dealing challenges [17].

Although in cities and other areas the demand for poultry especially local chicken is high, still market for poultry products from the local communities in these villages was reported to be limited. Lack of awareness of where and when the market of poultry is found can be cascaded on this. In Nigeria it was reported that, the increase in population in the country increases the demand for poultry products. However the market for poultry product in Nigeria still face some [18].

Veterinary services were observed to be challenges in poultry production in this area. This can be associated with 1st financial limitation to buy drugs for diseases treatment. To pay the veterinary service providers, 2nd lack of awareness were the veterinary services can be obtained. In this study it was observed that, lack of capital as among of the challenges to the local communities. Capital is essential for providing not only veterinary services to the production but also, is essential for buying building materials for poultry house, purchase of food, watering, transportation of product to the market and poultry management.

Among the challenges the challenges reported by local communities around the Magombera forest was the diseases and parasites. The listed diseases and parasites in the study area were new castle, fowl typhoid, infectious bursal disease, coccidiosis, fowl cholera, lice, mites worm infestation, fleas, infectious coryza and fowl pox. The prominent diseases and parasite listed by local communities were Newcastle (70%) followed by Lice Fowl typhoid and Worms. Several studies are with agreement with this , where diseases of poultry hinders poultry production through lowering productivity of meat and eggs, reduces fertility and social income [8,19].

Variation in attitude and responses on challenges facing poultry production did no vary significantly among respondents. The insignificant variation can be caused by the data being collected in the same localities where people have the similar attitudes and awareness regarding the poultry production in the study area. This suggests that, future study should expand to include other communities which are surrounding forest conservation areas. This will give good implication on the attitude of local communities on the production.

3.4 Impact of Training on the Poultry Production to Local Communities Neighbouring Magombera Forest

Fifty two individuals received training on poultry production and its benefits in the conservation of biodiversity in the Magombera Forest. A total of 96.15% of respondents showed an interest to start poultry keeping after receiving training. The increase in awareness after training on poultry keeping varied for different reasons. These include the awareness on Poultry Keeping System (74.083±3.58%), Product accrued from Poultry (61.417±3.582%), Diseases Control strategies (63.25±5.215%), Market of Poultry product (76.00±3.616%), as well as Conservation of Magombera Forest and its benefits (81.917±3.06%). The increase in awareness after training was statistical significant (Q = 12.083, P=0.034).

Table 2. The mean score for different challenges mentioned by local communities surrounding the Magombera forest

C/n	Challenges	Mean±S.E	Max	Range
1	Capital to start the Business	4.632±0.175	5	3
2	Diseases to Poultry	4.579±0.139	5	2
3	Availability of veterinary services	4.632±0.175	5	3
4	Market for the Poultry Products	4.737±0.129	5	2

From this result it is clear that, before initiating the poultry production in relationship to biodiversity conservation to local communities it is essential to ensure that thorough training is done. Training provides a road map for successful project implementation. Training to local communities equips them to be able and independently involved in poultry production. Also it enables the local communities to properly understating the importance of forests and be able to provide positive support in conservation efforts.

4. CONCLUSION

To ensure sustainable and profitable poultry production by the local communities, there is a need to collaborate with multiple livestock production stakeholders particularly the veterinarians and/or livestock field officers for controlling the diseases, also processors and traders who will help the farmers to search for the market. Furthermore training to local communities on the poultry production and how to overcome challenges such as diseases, lack of market should be emphasised. Poultry production by local communities will alleviate subsistence poaching.

CONSENT

Consent forms were completed by interviewees who participated.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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