International Journal of Advanced Research, Volume 5, Issue 1, 2022
Article DOI: https://doi.org/10.37284/ijar.5.1.587

International Journal of Advanced Research
ijar.eanso.org
Volume 5, Issue 1, 2022
Print ISSN: 2707-7802 | Online ISSN: 2707-7810
Title DOI: https://doi.org/10.37284/2707-7810

Original Article

An Assessment of Wild Fauna Species Richness and Tourism Opportunities of Monduli Mountains Forest Reserve in Monduli District-Northern Highlands of Tanzania

Dr. Canisius John Kayombo, PhD[12], Godlisten Eden Koka[2], Nelson Cuthbert Mushi[2], & Victor Sylvester Kaaya[1]*

[1] Forestry Training Institute-Olmotonyi, P. O. Box 943, Arusha-Tanzania.
[2] TFS-Monduli District, P. O. Box 1, Monduli-Tanzania.
* Author for Correspondence ORCID ID: https://orcid.org/0000-0002-8149-895X; Email: kayombocanisius@gmail.com.

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Publication Date:

21 March 2022

Keywords:

Wild Fauna, Tourism Opportunities, Tourism Trails, Monduli Mountains, Forest Reserve.

ABSTRACT

An assessment of fauna species richness and tourism opportunities was conducted at Monduli Mountains Forest Reserve (MMFR) in January 2022. Six (6) clusters, were established on which 10 stops were established at an interval of 1000m (1km) to listen to wildlife for 10 – 30 minutes. The fauna species including insects, birds, and mammals were identified through observation (seeing a fauna, foot prints, feathers or skin, and skull (s), bone (s), dung (s), nest(s)), hearing voices, and information from local stakeholders, and the historical presence of wild fauna as indicated in office reports and events. Also, the opportunities or attractions that can be marketed such as valleys, viewpoints, spurs, mountains ridge tops, steep slopes, areas attractive for campsites and picnic sites were documented. Likewise, tourists foot trails were proposed. In this survey a total of 142 fauna species were identified at MMFR. Out of those, 93 were birds, 37 (insects), and mammals were 12. The identified opportunities play a great role as attractions that can be marketed to earn financial income for the local community and the nation as a whole, and hence sustaining the ecological ecosystem. The proposed tourist's foot trail were; Kisima cha maji, Shimo la tembo, Big game safaris, Musa, Mwandeti, and Enguiki. MMFR is an underlying site for wildlife and tourism centre that has never been explored well yet. It is recommended that: upgrade the forest reserve into nature reserve, education to local community on tourism intervention, and campsites establishment.

APA CITATION

Kayombo, C. J., Koka, G. E., Mushi, N. C., & Kaaya, V. S. (2022). An Assessment of Wild Fauna Species Richness and Tourism Opportunities of Monduli Mountains Forest Reserve in Monduli District-Northern Highlands of Tanzania. *International Journal of Advanced Research*, *5*(1), 30-48. https://doi.org/10.37284/ijar.5.1.587

Article DOI: https://doi.org/10.37284/ijar.5.1.587

CHICAGO CITATION

Kayombo, Canisius John, Godlisten Eden Koka, Nelson Cuthbert Mushi, & Victor Sylvester Kaaya. 2022. "An Assessment of Wild Fauna Species Richness and Tourism Opportunities of Monduli Mountains Forest Reserve in Monduli District-Northern Highlands of Tanzania." *International Journal of Advanced Research* 5 (1), 30-48. https://doi.org/10.37284/ijar.5.1.587.

HARVARD CITATION

Kayombo, C. J., Koka, G. E., Mushi, N. C., & Kaaya, V. S. (2022) "An Assessment of Wild Fauna Species Richness and Tourism Opportunities of Monduli Mountains Forest Reserve in Monduli District-Northern Highlands of Tanzania.", *International Journal of Advanced Research*, 5(1), pp. 30-48. doi: 10.37284/ijar.5.1.587.

IEEE CITATION

C. J. Kayombo, G. E. Koka, N. C. Mushi, & V. S. Kaaya, "An Assessment of Wild Fauna Species Richness and Tourism Opportunities of Monduli Mountains Forest Reserve in Monduli District-Northern Highlands of Tanzania.", *IJAR*, vol. 5, no. 1, pp. 30-48, Mar. 2022.

MLA CITATION

Kayombo, Canisius John, Godlisten Eden Koka, Nelson Cuthbert Mushi, & Victor Sylvester Kaaya. "An Assessment of Wild Fauna Species Richness and Tourism Opportunities of Monduli Mountains Forest Reserve in Monduli District-Northern Highlands of Tanzania.". *International Journal of Advanced Research*, Vol. 5, no. 1, Mar. 2022, pp. 30-48, doi:10.37284/ijar.5.1.587.

INTRODUCTION

Fauna assessment identifies all potential species found on the subject site and where applicable surroundings (Karuah, 2017). The fauna assessment is required when we need to be aware of the existing wild resource in a particular ecosystem (Conacher et al., 2018). Tanzania is mostly nature based, and hence biodiversity conservation is an important way of supporting the tourism intervention (Gereta, 2010). The flow of people in and around a destination presents an important opportunity to enhance tourism's ability to generate significant economic impact**,** especially in rural and remote destinations (Ward-Perkins *et al.,* 2019). Tanzania faces tourism challenges from other countries such as Kenya, Sychelles, Namibia, Botswana, and Mauritius that have diversified tourism by identifying several culture resources that can be marketed. Tanzania is endowed with huge resources found in the wild (Ngonya, 2015). These resources include caves, big stones, rivers, fauna species, flora, mountains, mountain ridge topes, and steep slopes to list a few. Monduli Mountains Forest Reserve (MMFR) being under TFS, conservation of resources is being emphasized, and thus inviting for biodiversity surveys to quantify the available resources. The forest reserves are well managed when the available resources are known for their richness (Ducarme *et al.,* 2021), and even utilized for none-consumptive income generation (Ruffo et al., 2002; Wangui, 2018). Tanzania, with an area of 945,000km^2 has high diversity of fauna accommodated by the protected vegetation (URT, 2016). The MMFR harbours relatively fauna species diversity existing in the bushland, montane forest, wooded grassland, and bamboo forest. MMFR was gazetted as a Catchment Forest reserve under the Tanzania Forest Services Agency (TFS) in the Ministry of Natural Resources and Tourism (URT, 2016). The MMFR was established in 1941 (URT, 2016).

Administratively, the forest reserve is under the Tanzania Forest Service Agency (TFS) whereas at District level, it is under the District Forest Conservator. Below the District, there are forest rangers (URT, 2016). The biodiversity assessment efforts focus on protecting and promoting the return of indigenous flora and fauna, where many nature reserve habitats, species and biodiversity can flourish and thrive (U.S. Mission Geneva, 2010). Many natural habitats are high-valued home for a variety of fauna species, even though little is documented on their existence (Shea *et al*., 2021). MMFR is of high value in fauna species composition and richness. The wildlife including buffalo, elephant, blue monkey, bushbuck, and a variety of birds are regularly seen in the site with attractive natural scenery. Apart from this potential, little is documented on the fauna species richness and tourism opportunities that can be marketed to tourists. This study intended to assess the fauna species richness and the tourism opportunities of Monduli Mountains Forest Reserve (MMFR) in Monduli District-Northern Highlands of Tanzania

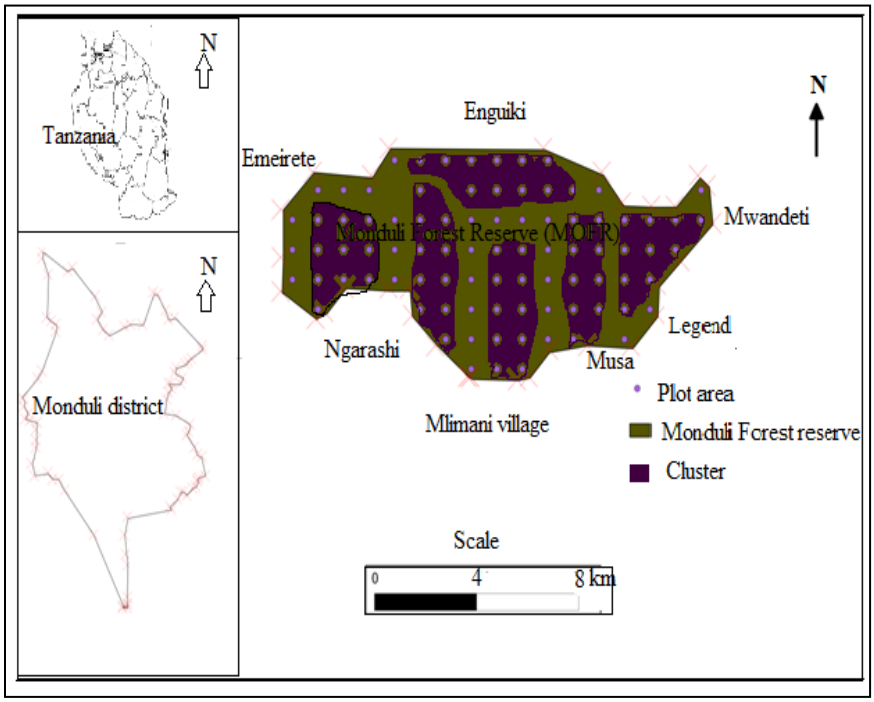
Article DOI: https://doi.org/10.37284/ijar.5.1.587

METHODS AND MATERIALS

Study Site

Monduli Mountains Forest Reserve (MMFR) is situated on the northern highlands of Tanzania where its resources can be marketed without being consumed. The MMFR is in Monduli district, Arusha Region. The forest reserve borders Mlimani, Musa, and Ngarashi villages on the south (Figure 1). On the west it borders the Emeirete village (Figure 1). On the south east it borders Musa village (Figure 1). On the south west it borders the Ngarashi village (Figure 1). On the east the forest borders Mwandeti village, while on the north it borders the Enguiki village (Figure 1). The MFR is located at 3° 14' – 3° 18' S; 36° 24' – 36˚ 31' E in the Northern part of Tanzania in Monduli District which is about 42 km from the famous Arusha Municipality (URT, 2016). It is accessible from Monduli town to the North at Monduli Juu, southeast at Musa and to the East at Mwandeti via Kilima moto along Namanga – Arusha Road. The reserve covers Monduli Mountain at an altitude range of 1615m to 2660 m a.s.l (URT, 2016). The size of the forest is 8,900 with a total boundary length of 40km.

Figure 1: Location of Monduli Mountains Forest Reserve (MMFR)



Climate and Vegetation Types

The MFR receives oceanic rainfall with continental temperatures. The annual rainfall ranges from 750 – 1000 mm in the woodlands and 1200 – 1500mm in the forest (URT, 2016). The prevailing South winds during the rainy seasons bring moisture mainly to the South – Eastern parts of the mountain with the maximum rainfall between 800 and 900 mm. The side of the mountain opposite to the prevailing wind receives less rain and the lands lying behind the leeward – side of the mountain are said to be in the rain shadow. The average temperature ranges from 11.5 ˚C (July) to 15.4 ˚C (Dec.) with short and hot dry period between January and March and long and cold dry period between May and October (URT, 2016). There is a decrease of temperature with increasing elevation, which amounts to roughly 0.6 ˚C per 100m. Relative humidity naturally increases during rain period.

The vegetation types include the montane wooded grassland, bushland, woodland, montane forest, and bamboo forest, and plantation forest patch at Mwandeti village. The wooded grassland is dominated by herbaceous plants with very scattered woody plants including *Digiaria velutina, Kyllinga*

Article DOI: https://doi.org/10.37284/ijar.5.1.587

odorata, Sida massaica, Cynodon dactylon, Harpocarpha snowdenii, Hypoestes forskaoolii, Dactylectenium aegyptium, while the woody plants were *Vachelia sieberiana, Buddleja salviifolia, Senna didymobotrya, Scopia rhymniphylla*, and *Gymnospora accuminata.* The bushland is dominated with many shrubs which are woody plants with several stems that are shorter than the typical trees (Gotmark & Jensen, 2016), with very scattered short trees. The dominant plants include *Rhus vulgaris, Lippia javanica, Toddalia asiatica, Hoslundia opposita, Psiadia punctulata, Buddleja salviifolia, Catha edulis, Crotalaria agatiflora, Hypericum revolutum, Maesa lanceolata, Ekebergia capensis, Deinbolia kilimandscharica, Senna didymobotrya, Vernonia myriantha, Clausena anisata, Turraea robusta, Calodendrum capensne, Dichrostcahys cinerea,* and *Nuxia congesta*.

The woodland which is an open stand of trees at least 8 m tall, with a canopy cover 40% or more (Beentje *et al.*,1994). The woodland was dominated by *Rhus natalensis, Vangueria infausta, Vepris simplicifolia, Ehretia cymosa, Croton macrostachyus, Albizia schimperi, Vachelia sieberiana, Euclea divinorum*, and *Olea europaea*. Montane forest dominated with: *Albizia gummifera, Bersama abyssinica, Cussonia holstii, Deinbolia kilimandscharica, Euclea divinorum, Gymnosporia accuminata, Gymnosporia undata, Halleria lucida, Heteromorpha trifoliate, Juniperus procera, Olea capensis, Olea europaea, Kiggelaria africana, Crotalaria agatiflora, Ilex mitis, Albizia gummifera, Vepris simplicifolia, Maesa lanceolata, Dombeya torrida, Cassipourea malosana, Casearia battiscombei, Dovyalis abyssinica, Xymalos monospora, Ekebergia capensis, Prunus africana, Fagaropsis angolensis, Angingeria adolfi-friederisii, Ficus thonningii, Ritchiea albersii*. The plantation forest is visible at Mwandeti village area is dominated with *Fraxinus angustifolia*, and *Grevillea robusta* (Plate 5). The vegetation is much degraded because of livestock grazing by local community from Mwandeti village.

Topography and Hydrology

The MMFR is hilly with abundant valleys. The forest reserve covers the top and slopes of Mount Monduli from an altitude of 1615 to 2660 m.a.s.l. (URT, 2016) The deepest of them have a slope of 20 to 30 feet. Five of the biggest valleys are seasonal streams used by the communities for animal and domestic use. The rivers include Musa and Ngarashi discharging for Musa and Sinon-Ngarash respectively. These water sources are used to supply water to Monduli Township and villages adjacent to the forest and downstream. The highest rate of water flow from streams occurs between May and July while the minimum discharge is between September and October at the end of dry season.

Socio-Economic Activities of Local Community Bordering Monduli Natural Forest Reserve

The socio-economic activities of the bordering communities' agriculture crop in, livestock keeping, and few of them employed in governmental and none-governmental organizations. The grown crops include: *Zea mays* (maize), *Phaseolus vulgaris* (beans), *Solanum tuberosum* (Irish potatoes), *Nicotiana tabacum* (Tobacco), and trees grown in form of agro-forestry. The kept livestock are: cows, goats, sheep, chicken, and donkeys. Kept livestock include: cows, goats, sheep, donkeys, pigs, and poultry.

Data Collection

The field surveys were carried out in January 2022. Participatory approach was applied in this investigation. The TFS staff, and community members including village leaders and Village Natural Resources Committee, was involved in the exercise. Ground search techniques were used to assess the fauna species and tourism opportunities. GPS was used to align the transect, mark the plot site, and position of resources of amenity value, consultation, focus group discussion (FGDs) and field investigation, involved identification of fauna and tourism attractions. The fauna species including mammals, birds, reptiles, and insects were investigated. Transects of different lengths were established in MMFR. The selection of transects based on the computed interval. The observers walked along transect and stopped where necessary to record bird species (Whitesides *et al.*, 1988). The data on birds were collected from the set transects and plots established within the MRAFR. Searches for breeding birds were done. The search for

Article DOI: https://doi.org/10.37284/ijar.5.1.587

breeding individuals was done in areas with active breeding activities. Visual observation was used to record butterfly species (Ralph *et al*. 1993). If a species produces vocal cues, observers can estimate distance via aural detection, a common practice among avian surveys (Dacier *et al.*, 2011). The method involved counting the number of flying butterflies that crossed a strip of known length (somewhere between 40 and 80 m) and 20 m wide for 10 minutes in the middle of the day when the insects were flying; this was a 'visual' method. Standard techniques which have been revealed to be effective elsewhere in East Africa including Sherman, a drift fence array with bucket pitfall traps and snap (break back) traps were used to assess the small mammals and reptiles (Howell, 2003).

Data Analysis

The fauna species richness (S) was determined by the total number of species identified from the sample plots. The richness is the total number of biological species identified from a given ecosystem (Aslam, 2009).

RESULTS AND DISCUSSION

Fauna species Richness (S)

A total of 142 fauna species were identified at MMFR in Monduli District. Out of those, 12 were mammals, birds (93), and insects (37) (*Table 1-4*).

Table 1: Fauna species richness (S)

Type of fauna	Richness (S)	Percentage
Mammals	12	8.451
Birds	93	65.493
Insects	37	26.056
Total	142	100

The identified mammals were Loxodonta africana, Tragelaphus scriptus, Neotragus moschatus, Panthera pardus, Crocuta crocuta, Hystrix cristata, Potamochoerus larvatus, Cercopithecus nictitans, Felis serval, Atelerix albiventris neumanii, Orycteropus afer, and Syncerus caffer (*Table 2*).

Table 2: Fauna species identified at Monduli Mountain Forest Reserve [MMFR]

No.	Latin name	Common name	OD	Family	TF
1	*Loxodonta africana*	Bush Elephant	40	Elephantidae	Mammal
2	*Tragelaphus scriptus*	BushBuck	4	Bovidae	Mammal
3	*Neotragus moschatus*	Suni	2	Bovidae	Mammal
4	*Panthera pardus*	Leopard	6	Felidae	Mammal
5	*Crocuta crocuta*	Spotted Hyaena	4	Hyaenidae	Mammal
6	*Hystrix cristata*	Crested Pocupine	4	Hystricidae	Mammal
7	*Potamochoerus larvatus*	Bushpig	8	Suidae	Mammal
8	*Cercopithecus nictitans*	Blue monkey	40	Cercopithecidae	Mammal
9	*Felis serval*	Serval cat	2	Felidae	Mammal
10	*Atelerix albiventris neumanii*	African hedgehogs	2	Erinaceidae	Mammal
11	*Orycteropus afer*	Aardvark	2	Orycteropodidae	Mammal
12	*Syncerus caffer*	Cape buffalo	50	Bovidae	Mammal

OD = observed; TF = type of fauna

The richness of birds (93) (*Table 3*) is because of the available diverse vegetation types that offer food throughout a year-round.

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Table 3: Birds identified at Mondule Mountains Forest Reserve (MMFR)

	Latin name	Common name	OD	H/S	Ind.	Family	TF
1	*Anaplectes rubriceps*	Red headed Weaver	30	S	10	Ploceidae	Bird
2	*Andropadus nigriceps*	Mountain Greenbul	60	H/S	4	Pycnonotidae	Bird
3	*Anthroscopus caroli*	African Penduline-Tit	20	S	4	Remizidae	Bird
4	*Anthus trivialis*	Tree Pipit	40	H	2	Motacillidae	Bird
5	*Apalis flavida*	Yellow breasted Apalis	100	H	4	Sylviidae	Bird
6	*Apalis thoracica*	Bar-throated Apalis	30	S/H	2	Sylviidae	Bird
7	*Apaloderma narina*	Narina Trogon	150	S	1	Trogonidae	Bird
8	*Apus affinis*	Little Swift	150	S/H	30	Apodidae	Bird
9	*Aquila verreauxii*	Verreaux's Eagle	200	S	6	Accipitridae	Bird
10	*Ardea melanocephala*	Black Headed Heron	120	S	2	Ardeidae	Bird
11	*Batis molitor*	Chin spot Batis	30	S/H	2	Platysteiridae	Bird
12	*Bradypterus cinnamomeus*	Cinnamon-Branken Warbler	80	H/S	15	Sylviidae	Bird
13	*Buteo augur*	Augur Buzzard	60	S	3	Accipitridae	Bird
14	*Buteo oreophilus*	Mountain Buzzard	200	S	2	Accipitridae	Bird
15	*Camaroptera brachyura*	Grey Backed Camaroptera	70	H/S	12	Sylviidae	Bird
16	*Campephaga flava*	Black Cuckoo Shrike	50	S	2	Campephagidae	Bird
17	*Campethera abingoni*	Golden tailed Woodpecker	60	S/H	2	Picidae	Bird
18	*Cercotrichas leucophrys*	White-browed Scrub-Robin	20	S	2	Turdidae	Bird
19	*Chalcomitra amethystina*	Amethyst Sunbird	50	S/H	2	Nectariniidae	Bird
20	*Chysococcyx cupreus*	African Emerald Cuckoo	100	H/S	10	Cuculidae	Bird
21	*Cichladusa guttata*	Spotted Morning Thrush	30	S	1	Turdidae	Bird
22	*Cinnyris mediocris*	Eastern Double-collared Sunbird	30	S	2	Nectariniidae	Bird
23	*cinnyris pulchella*	Beautiful Sunbird	100	S/H	7	Nectariniidae	Bird
24	*Cinnyris venusta*	Variable Sunbird	40	H/S	20	Nectariniidae	Bird
25	*Cisticola cantans pictipennis*	Singing Cisticola	30	S/H	4	Sylviidae	Bird
26	*Cisticola chiniana*	Rattling Cisticola	40	S/H	4	Sylviidae	Bird
27	*Colius striatus*	Speckled Mousebird	60	H/S	20	Coliidae	Bird
28	*Columba guinea*	Speckled Pigeon	150	S	4	Columbidae	Bird
29	*Corvus albicollis*	White-naped Raven	30	S	2	Corvidae	Bird
30	*Corvus albus*	Pied Crow	150	S/H	4	Corvidae	Bird
31	*Cossypha caffra*	Cape Robin Chat	80	H/S	4	Turdidae	Bird
32	*Cossypha heuglini*	White browed Robin	100	H/S	5	Turdidae	Bird
33	*Cuculus solitarius*	Red Chested Cuckoo	50	H/S	13	Cuculidae	Bird
34	*Dicrurus adsimilis*	Fork tailed Drongo	30	S/H	4	Dicruridae	Bird

Article DOI: https://doi.org/10.37284/ijar.5.1.587

	Latin name	Common name	OD	H/S	Ind.	Family	TF
35	*Dryoscopus cubla*	Black backed Puffback	100	H/S	8	Malaconotidae	Bird
36	*Euplectes albonotatus*	White-winged Widowbird	80	S	20	Ploceidae	Bird
37	*Euplectes ardens*	Red-collared Widowbird	60	S/H	100	Ploceidae	Bird
38	*Euplectes capensis*	Yellow Bishop	40	S	4	Ploceidae	Bird
39	*Euplectes gierowii*	Black Bishop	60	S/H	50	Ploceidae	Bird
40	*Euplectes macrourus*	Yellow-mantled Widowbird	60	S/H	40	Ploceidae	Bird
41	*Hedydipna collaris*	Collared Sunbird	30	S/H	4	Nectariniidae	Bird
42	*Hirundo abyssinica*	Lesser striped Swallow	80	S	40	Hirundinidae	Bird
43	*Hirundo fuligula*	Rock Martin	60	S	20	Hirundinidae	Bird
44	*Hirundo senegalensis*	Mosque Swallow	100	S	10	Hirundinidae	Bird
45	*Lagonosticta rubricata*	African firefinch	40	H	2	Emberizidae	Bird
46	*Lagonosticta senegala*	Red billed Firefinch	30	S	2	Emberizidae	Bird
47	*Laniarius aethiopicus*	Tropical Boubou	150	H/S	12	Malaconotidae	Bird
48	*Lanius collaris*	Common Fiscal Shrike	40	S	7	Laniidae	Bird
49	*Lybius melanopterus*	Brown Breasted Barbet	60	S/H	2	Capitonidae	Bird
50	*Melaenornis fischeri*	White eyed slaty flycatcher	50	S	5	Muscicapidae	Bird
51	*Merops bullockoides*	White fronted Bee-eater	100	S/H	3	Meropidae	Bird
52	*Merops oreobatus*	Cinnamon-chested Bee-eater	150	H/S	30	Meropidae	Bird
53	*Milvus migrans*	Black Kite	80	S	2	Accipitridae	Bird
54	*Mirafra rufocinnamomea*	Flappet Lark	70	S	1	Alaudidae	Bird
55	*Muscicapa adusta*	African Dusky Flycatcher	30	S/H	4	Muscicapidae	Bird
56	*Nctarinia reichenowi*	Golden winged Sunbird	50	S/H	20	Nectariniidae	Bird
57	*Nectarinia johnstoni*	Scarlet-tufted Malachite Sunbird	70	S/H	9	Nectariniidae	Bird
58	*Nectarinia kilimensis*	Bronze Sunbird	20	S/H	2	Nectariniidae	Bird
59	*Numida meleagris*	Helmeted Guineafowl	30	S	20	Numididae	Bird
60	*Onychognathus morio*	Red winged Starling	60	S/H	20	Sturnidae	Bird
61	*Parisoma boehmi*	Banded Parisoma	30	S	1	Sylviidae	Bird
62	*Passer griseus*	Grey Headed Sparrow	80	S	12	Passeridae	Bird
63	*Phyllastrephus cerviniventris*	Grey-olive Greenbul	50	S	1	Pycnonotidae	Bird
64	*Phylloscopus trochilus*	Willow Warbler	20	S	3	Sylviidae	Bird
65	*Ploceus jacksoni*	Golden-backed Weaver	50	S/H	10	Ploceidae	Bird
66	*Ploceus baglafecht*	Baglafetch Weaver	80	S/H	11	Ploceidae	Bird
67	*Pogonocichla stellata*	White-starred Robin	30	S	2	Turdidae	Bird
68	*Polemaetus bellicosus*	Martial Eagle	100	S	2	Accipitridae	Bird
69	*Prionops plumatus*	White-crested Helmet-Shrike	60	S	4	Prionopidae	Bird

Article DOI: https://doi.org/10.37284/ijar.5.1.587

	Latin name	Common name	OD	H/S	Ind.	Family	TF
70	*Psalidoprocne albiceps*	White headed Saw-wing	30	S	13	Hirundinidae	Bird
71	*Psalidoprocne holomelas*	Black rough wing	20	S/H	20	Hirundinidae	Bird
72	*Pycnonotus barbatus*	Common Bulbul	80	S/H	11	Pycnonotidae	Bird
73	*Saxicola torquata*	Common Stone chat	120	S	5	Turdidae	Bird
74	*Serinus burtoni*	Thick-billed Seedeater	10	S	3	Fringillidae	Bird
75	*Serinus citrinelloides*	African Citril	20	S/H	2	Fringillidae	Bird
76	*Serinus striolatus*	Streky Seed Eater	30	S/H	7	Fringillidae	Bird
77	*Stephanoaetus coronatus*	African Crowned Eagle	250	H	1	Accipitridae	Bird
78	*Steptopelia semitorquata*	Red Eyed Dove	60	S	2	Columbidae	Bird
79	*Streptopelia lugens*	African Dusky Turtle Dove	20	S	2	Columbidae	Bird
80	*Streptopelia senegalensis*	Laughing Dove	40	S	2	Columbidae	Bird
81	*Sylvia atricapilla*	Black Cap	50	S	4	Sylviidae	Bird
82	*Tauraco hartlaubi*	Hartlaub's Turaco	150	H/S	17	Musophagidae	Bird
83	*Tchagra australis*	Brown Crowned Tchagra	60	H	2	Malaconotidae	Bird
84	*Tchagra senegala*	Black Crowned Tchagra	100	H	2	Malaconotidae	Bird
85	*Terpsiphone viridis*	African Paradise Flycatcher	60	H/S	6	Monarchidae	Bird
86	*Trachyphonus usambiro*	Usambiro Barbet	100	S/H	2	Capitonidae	Bird
87	*Tricholaema lacrymosa*	Spot flanked Barbet	60	H	2	Capitonidae	Bird
88	*Turdus oliveceus*	Olive Thrush	130	S	1	Turdidae	Bird
89	*Turtur tympanistria*	Tamborine Dove	50	S	10	Columbidae	Bird
90	*Upupa africana*	African Hoopoe	50	S	1	Upupidae	Bird
91	*Uraeginthus ianthinogaster*	Purple Grenadier	10	S/H	2	Emberizidae	Bird
92	*Urocolius macrourus*	Blue-naped Mousebird	40	S/H	6	Coliidae	Bird
93	*Zosterops poliogaster*	Montane White Eye	120	H	3	Zosteropidae	Bird

Key: OD=observed distance; H/S = heard and seen; H = heard; S=seen; TF=type of fauna

Table 4: Insects identified at Monduli Mountains Forest Reserve (MMFR)

S/N	Latin name	Family	Common name	Observed	TF
1	*Amauris echeria echeria*	Nymphalidae	Chief butterfly	1	Insect
2	*Antanartia abyssinica*	Nymphalidae	Abyssinian Admiral butterfly	8	Insect
3	*Antanartia hippomene hippomene*	Nymphalidae	Southern shorttailed admiral butterfly	10	Insect
4	*Anthene amarah*	Lycaenidae	Leaden Ciliate Blue butterfly	3	Insect
5	*Apis mellifera*	Apidae	Honey killer Bee	Hives	Insect

Article DOI: https://doi.org/10.37284/ijar.5.1.587

S/N	Latin name	Family	Common name	Observed	TF
6	*Appias epaphia contracta*	Pieridae	Diverse White butterfly	40	Insect
7	*Belenois aurota aurota*	Pieridae	Brown veined White butterfly	1	Insect
8	*Belenois creona severina*	Pieridae	African Common White butterfly	30	Insect
9	*Bicyclus safitza safitza*	Nymphalidae	Common Bush Brown butterfly	3	Insect
10	*Catopsilia florella*	Pieridae	African Migrant butterfly	24	Insect
11	*Celaenorrhinus galenus*	Hesperiidae	Common Orange sprite butterfly	2	Insect
12	*Charaxes varanes varanes*	Nymphalidae	Pearl Charaxes butterfly	2	Insect
13	*Colotis danae annae*	Pieridae	Scalet Tip butterfly	2	Insect
14	*Danaus chrysippus aegyptius*	Nymphalidae	African Monarch butterfly	2	Insect
15	*Dixeia doxo parva*	Pieridae	Black -veined butterfly	4	Insect
16	*Dorylus helvolus*	Formicidae	Red Driver Ants	Swarm	Insect
17	*Eurema hecabe solifera*	Pieridae	Common Grass Yellow butterfly	5	Insect
18	*Eurytela hiarbas angustata*	Nymphalidae	Pied Piper butterfly	7	Insect
19	*Graphium antheus*	Papilionidae	Large striped swordtail butterfly	2	Insect
20	*Heteropsis simonsii*	Nymphalidae	Pale Bush Brown butterfly	2	Insect
21	*Hyalites esebria esebria*	Nymphalidae	Dusky Acraea butterfly	2	Insect
22	*Hyalites encedon encedon*	Nymphalidae	White-barred Acraea butterfly	2	Insect
23	*Hypolimnas anthedon wahlbergi*	Nymphalidae	Variable Diadem butterfly	2	Insect
24	*Lampiides boeticus*	Lycaenidae	Pea Blue butterfly	4	Insect
25	*Leptosia alcesta inalcesta*	Pieridae	African Wood White butterfly	3	Insect
26	*Musca domestica*	Muscidae	Domestic fly	150	Insect
27	*Nepheronia thalassina sinalata*	Pieridae	Cambridge vagrant butterfly	37	Insect
28	*Papilio echerioides echerioides*	Papilionidae	White banded Swallowtail butterfly	7	Insect
29	*Papilio nireus*	Papilionidae	Blue banded Swallowtail butterfly	8	Insect
30	*Papilio phorcas*	Papilionidae	Green banded swallowtail butterfly	3	Insect
31	*Technomyrmex sp.*	Formicidae	Black sugar Ants	100	Insect
32	*Uranothauma delatorum*	Lycaenidae	Butterfly	2	Insect
33	*Uranothauma nubifer*	Lycaenidae	Black Heart butterfly	2	Insect
34	*Xosopsaltria punctata*	Cicadidae	Giant forest Cicada	3	Insect
35	*Xylocopa sp.*	Anthophoridae	Common Capenter bee	3	Insect
36	*Zenonia zeno*	Hesperiidae	Orange Spotted Skipper butterfly	2	Insect
37	*Zizeeria knysna*	Lycaenidae	African Grass blue butterfly	3	Insect

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Monduli Forest Reserve (MMFR) accommodates relatively high insects of birds. The identified insects were 37 (*Table 4*).

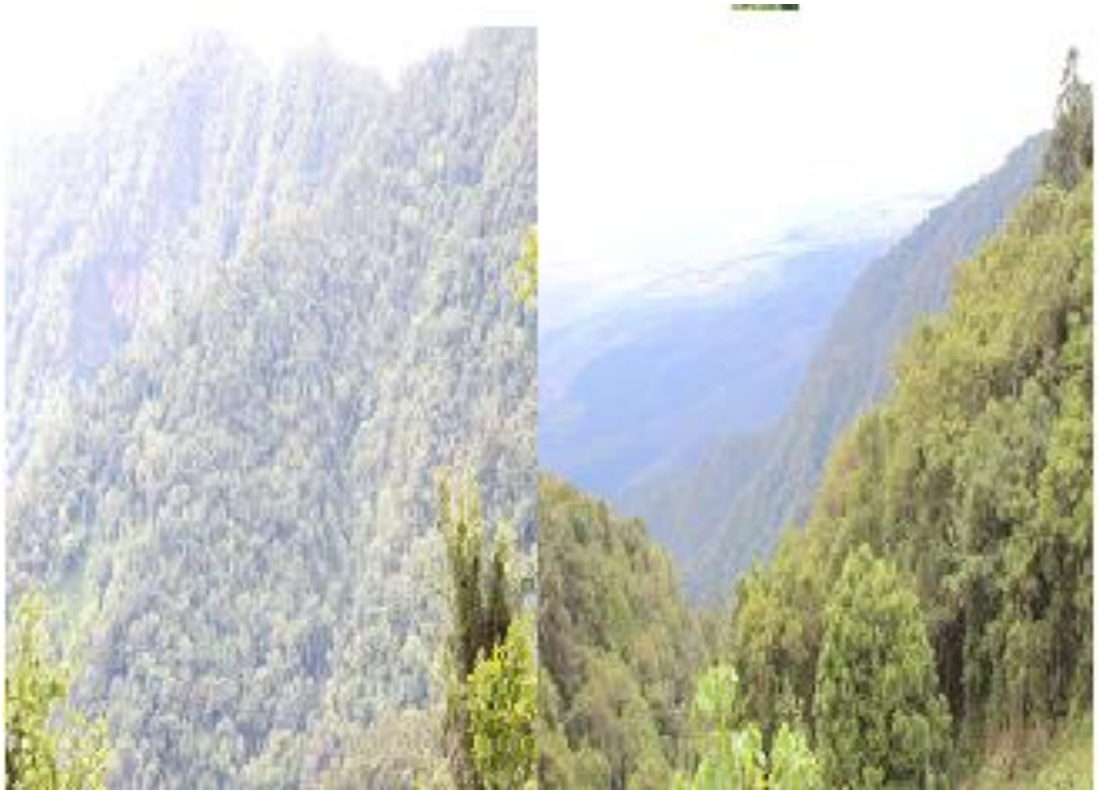
Tourism Opportunities/attractions of Monduli Mountains Forest Reserve (MMFR)

The tourism industry has expanded, allowing individuals to capitalize on resources available creating streams of revenue where there were once none before (Ivanova, 2019).Tourism in wildlife area and wilderness areas, which consist activities like wildlife safari, birding, nature trails, hiking, camping, need to do with utmost care and with harmony with the nature otherwise the tourism in these area which usually consist of wildlife lovers, trekkers, nature lovers but they themselves impose a greater threat to the habitat(Tapper, 2006). This situation calls for identification of tourism opportunities, their locations, and the pathways to where they are located to minimize or avoid unnecessary ecology resources decline. Among identified tourism opportunities include: vegetation zones, a variety of plant species, fauna species, mountain's viewpoints, valleys, mountains ridge tops, water sources, caves, tourists' trails, camp sites, swinging sites (on trees), villages viewpoints, picnic sites, and stones (Plate 1-13).

Vegetation Zones

The vegetation zone on the mountain's slopes, ridge tops, and valleys (*Plate 1*) attract tourists. These vegetation types are such as wooded grassland, bushland, woodland, montane forest, and bamboo forest**.**

Plate 1: Part of vegetations of Monduli Mountains Forest Reserve (MMFR)



Plant Species

Plant taxa are of great interest to ecological researchers, amateur botanists and any other stakeholders interested in watching the various attractive colour flowers of different plant forms (herbs, sedges, grass, shrub, woody climber, and trees) (*Plate 2*).

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Plate 2: Different flowering plants of MMFR

(Drynaria sp (A), Vernonia sp. (B), Scadoxus multiflora (C), Thunbergia alata (D), Carduus nutans (E), Hibiscus vitifolius (F), Pentas lanceolata (G), Helichryssum sp. (H), and Bersama abyssinica (I).

Fauna Species

Fauna species including small and big mammals (*Plate 3*), birds, and insects are obvious opportunities or attractions that can be marketed to interested stakeholders (tourists).

Mammals of Monduli Mountains Forest Reserve (MMFR)

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Plate 3: Mammals of Monduli Mountains Forest Reserve (MMFR)

Mount Meru, Ngaramtoni, and Kisongo View Points

There are the points or areas where visiting stakeholders can see areas which cannot see without getting to those areas. The highest picks of mountains allow people to see the lower undulating hills, the valleys and steep slopes between the spurs, the attractive lower plains, villages, and mount Meru near Arusha city (*Plate 4*).

Plate 4: Viewpoints of Mount Meru, Ngaramtoni, and Kisongo

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Attractive Valleys

Many attractive valleys can be seen at bottom of the steep slope mountains feet in MMFR (*Plate 5*). The valleys are suitable as either resting points while also having either breakfast or just a short break.

Plate 5: Attractive valley at bottom of mountain

Mountains Ridge Tops

Mountain ridge tops attract tourists in Monduli Mountains Forest Reserve (MMFR) (Plate 6). They are covered with enormous species diversity that attract ecologica tourists and just pleasurers stakeholders.

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Plate 6: Mountains ridge tops and valleys

Water Sources

The clear flowing water on streams (*Plate 7*) is among opportunity that can be marketed. The water attracts drinking with no doubt at all because the sources are on the intact unpolluted areas. At Musa the stream water flowers and at some stage it sinks into the ground, a situation that can attract visitors.

Plate 7: Musa stream

Caves

The MMFR has relatively attractive caves on valleys that can attract tourists. The caves are also good habitats for lithophytic plants.

Tourist's Trails

The already existing trails at Mwandeti, Musa, Big Game safaris, Enguiki, Mlimani, and Engarashi villages are opportunities of tourism.

Camping Sites

There have been a number of stakeholders who visit the site every year through the TFS office, but not as a formal tourist site. From camping, tourism provides countless opportunities for individuals to learn about the natural world and experience it first-hand (Mikulić *et al.,* 2017). Areas where tourists

Article DOI: https://doi.org/10.37284/ijar.5.1.587

can camp (*Plate 8*), offer an opportunity towards successful tourism venture.

Plate 8: Camping site

Swinging Attractions

These were big trees, where local people from Musa village have set hanging poles on big trees where they can swing (*Plate 9).*

Plate 9: Big tree on which local people and visitors can swing on

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Big Trees

The big trees of Ficus thonningii, just by looking at them can attract tourists (*Plate10*).

Plate 10: Big trees (*Ficus thonningii*) along Musa proposed trail

Village Plains Viewed from MMFR

The attractive low land plains can be viewed down while at mountains ridges in MMFR (*Plate11*). These plains beatify the site, and therefore improving the quality of the area.

Plate 11: Attractive plain viewed from Mondulu Mountain Forest Reserve (MMFR)

Picnic Sites

There are several areas suitable for picnic sites, under the shade (*Plate 12*), especially during dry season. The tourists can have breakfast, water, or just a short break while ascending the mountain towards the peak**.**

Plate 12: Picnic sites (Attractive site) under threes shade

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Stones

Some stone look like an egg (*Plate 13*), and thus attracting watching them.

Plate 13: Attractive stones (egg shape)

Proposed Tourist Trails

It is recognized that trails play an important role in the environment because: they help to protect habitat for native plants and animals, **r**aise environmental awareness, provide opportunities for individuals to exercise, reduce transportation costs, improve quality of life, and improve community cohesion (Omoogun et al., 2016). Monduli Mountains Forest Reserve has suitable routes that can be used for tourism from both directions (north, south, west, and east). According to this survey, the following already existing foot trails were proposed to be used for tourism intervention (*Table 5*). The trails are being used by local people and other stakeholders from Arusha get into the forest reserve through village leadership without entry fee. This implies that the site is potential and tourism can be conducted without application of extra efforts of awareness creation to local community as the resources are already known.

Table 5: Proposed tourists trails

Name of trail	Starting/Entry point
Kisima cha maji	Mlimani village
Shimo la tembo	Ngarashi
Big game safaris	Big game safaris office
Musa trail	Musa village
Mwandeti	Mwandate village
Enguiki	Enguiki village

Article DOI: https://doi.org/10.37284/ijar.5.1.587

The richness (S) of fauna (142), the identified tourists' opportunities (Plate 1-13), and the proposed already existing informal foot trails that seem to be suitable for tourists provide a clear pathway towards the upgrading of the MMFR to a nature reserve.

CONCLUSION AND RECOMMENDATIONS

Conclusion

MMFR is known for its high diversity of fauna. The fauna richness of 142 including 12 mammals, 93 birds, and 37 insects implies the importance of the area in terms of wildlife that can attract tourism industry as among environmentally sustainability interventions. The identified opportunities including vegetation, viewpoints, a variety of plant species, wild fauns, valleys, stones, caves, picnic sites, camping sites, flowing stream water, mountains ridge tops, and slopes are among opportunities play a great role as attractions that can be marketed to earn financial income, and hence sustaining the ecological ecosystem.

Recommendations

Monduli Mountains Forest Reserve is potential in natural resources diversity that needs to be conserved for the benefit of the present and the future generation. The survey team recommends the following among more others: upgrade the forest reserve into nature reserve, education to local community on the value of conservation of natural resources, encourage agroforestry at local level, participatory forest management, revisit boundaries together with village natural resources committees, and planting water friendly trees at degraded water catchment areas in Mwandeti, and Musa villages, introduce modern beehives to local community to reduce the rate of logging natural trees for local beehives, train local beekeepers on modern beekeeping (use of modern beehives), register the interested groups in honey beekeeping in the forest reserve, conduct further research on bee fodder plants and suitable areas for beekeeping for proper land use suitability, and construction of ranger posts at the selected sites in the forest reserve to serve the patrolling staff and tourists who will need help when climbing the mountain ridges, and camping. Furthermore, the marketable natural forest resources should be marketed through seminars, workshops, and website to create awareness to stake holders.

ACKNOWLEDGEMENT

The assessment of fauna species and tourism opportunities at Monduli Mountains Forest Reserve (MMFR) has been done successful because of the contribution and participation of various stakeholders from Monduli District including Jonas N. Nyange (Game Warden), forest assistants including Stephano Uronu and Kayani Laizer, and Timotheo Joseph (driver) from TFS-Monduli District offered material support. Ward and village leaders from bordering villages of Ngarashi, Mlimani, Musa, Mwandeti, Emeirete, and Enguiki provided material support during data collection.

REFERENCES

Aslam, M. (2009). Diversity, species richness and evenness of moth fauna of Peshawar. *Pak. Entomol*, *31*(2), 99-102.

Beentje, H., Adamson, J., & Bhanderi, D. (1994). *Kenya trees, shrubs, and lianas*. National Museums of Kenya.

Conacher, P. A., Manners, J., & Mullahey, A. (2018). Flora and fauna assessment report proposed rezoning and Subdivision Collingwood drive and matcham road matcham.*Conacher Consulting Pty Ltd*. http://www.yourvoiceOurcoast.com/default/files/2020-06/6_Flora_and_Fauna_Assessment.pdf.

Dacier, A., de Luna, A. G., Fernandez-Duque, E., & Di Fiore, A. (2011). Estimating population density of Amazonian titi monkeys (Callicebus discolor) via playback point counts. *Biotropica*, 135-140.

Ducarme, F., Flipo, F., & Couvet, D. (2021). How the diversity of human concepts of nature affects conservation of biodiversity. *Conservation Biology*, *35*(3), 1019-1028.

Gereta, E.J. (2010). The role of biodiversity conservation in the development of the tourism Industry in Tanzania. *Conservation of Natural*

Article DOI: https://doi.org/10.37284/ijar.5.1.587

Resources. *Some Affairs & Asian Examples*. Tapir Academic Press, Trondheim, Norway.

Gotmark, E., & Jensen, A. M. (2016). Why be a shrub? A Basic Model and Hypotheses for the Adaptive Values of a Common Growth Form. Frontiers in Plant Sciences, 1 (7), DOI: 10.3389/fpls.2016.0195.

Howell, C. R. (2003). Mechanisms employed by Trichoderma species in the biological control of plant diseases: the history and evolution of current concepts. *Plant disease*, *87*(1), 4-10.

Ivanova, M. (2019). Travel Marketing, Tourism Economics and the Airline Product. An Introduction to Theory and Practice. *Journal of Revenue and Pricing Management*, *18*(1), 86-87.

Karuah East Quarry Pty Ltd. (2017). Flora And Fauna Impact Assessment. *Kleinfelder Document Number: NCA18R82411 Project No: 20191201*. Karuah.

Mikulić, J., Prebežac, D., Šerić, M., & Krešić, D. (2017). Campsite choice and the camping tourism experience: Investigating decisive campsite attributes using relevance-determinance analysis. *Tourism Management*, *59*, 226-233.

Ngonya, J. E. (2015). Challenges facing Community Based Tourism in Tanzania: A case study of Arumeru District in Arusha Region (Doctoral dissertation, The Open University of Tanzania).

Omoogun, A. C., Egbonyi, E. E., & Onnoghen, U. N. (2016). From Environmental Awareness to Environmental Responsibility: Towards a Stewardship Curriculum. *Journal of Educational Issues*, *2*(2), 60-72.

Ralph, C. J., Geupel, G. R., Pyle, P., Martin, T. E., & DeSante, D. F. (1993). Handbook of field methods for monitoring landbirds. USDA Forest Service. *General Technical Report PSW-GTR-144. Pacific Southwest Research Station, Albany, California, USA.*

Ruffo, C.K., Birnie, A., & Tengnas, B.O. (2002). *Edible wild plants of Tanzania. Regional Land Management Unit (RELMA).* Technical Handbook No. 27.

Shea, S. A., Fedynich, A. M., & Wester, D. B. (2021). Assessment of the helminth fauna in northern bobwhites (Colinus virginianus) occurring within South Texas. *Journal of Helminthology*, *95*.

Tapper, R. (2006). Wildlife watching and tourism: a study on the benefits and risks of a fast-growing tourism activity and its impacts on species. UNEP/Earthprint.

U.S. Mission Geneva. (2010). The importance of Biodiversity for Development. *U.S. Mission Geneva to International Organization*.https://geneva.usmission.gov/2010/04/20/usaid- biodiversity/

URT. (2016). Revised management plan for Monduli Forest Reserve Monduli District, ArushaRegion. *Ministry of Natural Resources and Tourism, Tanzania Forest Service Agency (TFS)*. Tanzania.

Wangui, V. (2018). *Sustainable wildlife utilization; the non–consumptive way*. Nyika Silika. https://www.nyikasilika.org/sustainable- wildlife-utilization-the-non-consumptive-way/

Ward-Perkins, D., Beckmann, C., & Ellis, J. (2020). Tourism routes and trails theory and practice. *Tourism routes and trails theory and practice.*

Whitesides, G. H., Oates, J. F., Green, S. M., & Kluberdanz, R. P. (1988). Estimating primate densities from transects in a West African rain forest: a comparison of techniques. *The Journal of Animal Ecology*, 345-367.

