

1. Contestant profile

▪ Contestant name:	Nancy Iraba
▪ Contestant occupation:	Student
▪ University / Organisation	University of Dar es salaam
▪ Number of people in your team:	3

2. Project overview

Title:	“ Does Rehabilitation Program Of Birds ” ?
Contest: (Research/Community)	Research
Quarry name:	Wazo Hill



Abstract

Changes in vegetation Structure caused by deforestation disrupts interactions and changes bird community Composition; The rehabilitation programme at Wazo Hill Quarry have been ongoing since 2010; however there was no intensive study that have been done to examine if the rehabilitation program supports the ecology of birds in terms of feeding, nesting roosting and general behaviour; therefore this project focused on assessing if the rehabilitation program at Wazo Hill Quarry supports ecology of bird specie in terms of feeding, nesting, roosting and general behaviour, as a key tool for future rehabilitation activities and Management. This study was conducted by using two sites; Rehabilitated and Undisturbed area by Using Systematic sampling Point counting (Rosenstock et al 2009) and Focused Observation. Total of individual birds observed during the study was 695. Total of 108 bird specie were observed and identified to specie level using East Africa field guides (Stevenson and Fanshawe, 2002). Relative abundance depicted 20 most abundant bird specie in the studied quarry sites (Rehabilitated and undisturbed area), highest being *Uraeginthus angolensis* (6%) lowest being *Serinus mozambicus* (1%). There was no distinct pattern on nMDS plot and ;There was no significant difference in bird specie composition between two sites ($R = 0.001$; $p=0.886$) One way analysis of Similarities (ANOSIM) shown the preferred features by birds in terms of feeding, nesting and roosting in the rehabilitated quarry are the Fleshy fruit plants (annex I), *Leucaena diversifolia*, (Tree specie) *Casuarina equisetifolia* (Tree specie) and Grasslands. ANOSIM test was conducted, and shown a significant difference in preferred features by bird specie composition ($R=0.052$; $p= 0.001$). The study established Wazo Hill Quarry Database for Birds; documenting 108 Bird specie found at Wazo hill Quarry; Furthermore the project that explains in details birds found within the Wazo hill quarry with their pictures that were used for identification during field along with additional information which would add value when kept to the biodiversity museum present at Wazo hill quarry for learning, Strategic Management, awareness of the bird specie at Wazo to the environmental managers, tourist purposes and further future researches.

INTRODUCTION

Birds are very important in most parts of the world due to their roles economically and ecologically. Ecologically, birds are very potential in pollination, controlling seed dispersal which aids in plant regeneration, controlling of population example the insectivores birds feeding on insects and they have a capacity to restore and maintain the diverse of plant communities. Therefore, birds have been potentially serving as important partners in tropical reforestation. In the economic aspect, birds attract tourists and they can play part in increasing income through tourism and bird watching. Now days, birds are vulnerable resources due to expansion of cities and changing of land use for agricultural activities, which destroyed the habitats of most of the birds species. Furthermore, excavation of raw materials such as calcium carbonates for processing cements and other mining activities are disturbing the environments and destroy habitats of living organisms including birds. For instance, the excavation activities in Wazo hill quarries have caused loss of breeding and feeding sites of birds which in turn changes the birds behavior that are found along the site. However, to restore the environment, Wazo Hill quarry have rehabilitation programme which is focusing on planting terrestrial plants, whereby three hectors of the former quarry have been re-cultivated for trees nurseries. Despite of these efforts, it is not well known at what extent the replantation of these trees and other emerging features supports the ecology of birds in Wazo hill quarry. Assessment of increasing or decreasing fauna diversity in relation to ecology of birds is very crucial for

rehabilitation of quarries. This is a good indicator for restoration success of the quarry environment and it will enhance the rehabilitation effort by providing a better understanding of the tree species which can provide the habitat of the diversity of birds in the rehabilitated area.

MAIN OBJECTIVE

This study aim was to determine whether the rehabilitation program at Wazo Hill Quarry Supports the ecology of birds.

SPECIFIC OBJECTIVES

1. To identify, determine relative abundance, Similarity and diversity of bird specie found in rehabilitated and undisturbed area at Wazo Hill Quarry.
2. To asses features found at Wazo hill quarry in relation to supporting ecology of bird specie in terms of feeding, nesting , roosting and general behaviour.
3. To establish database on distribution of bird species and their habitats at Wazo Hill Quarry

METHODOLOGY

The study was conducted from February to August 2018 within the rehabilitated and unrehabilitated sites of the Wazo Hill Quarry. Seven points were established to each site of the study (Rehabilitated and undisturbed) by use of systematic sampling Point focus method for determination of specie abundance and identification. Point focus method is one of the most common methods to survey birds in forest ecosystems (Rosenstock et al 2002)

Objective One :

Identification, Determination Of Relative Abundance And Diversity Of Bird Species In Rehabilitated And Undisturbed Areas

Two methods were used which included **point count** and **mist netting**.

Point count method, permanent counting points were established with 50m radius and 100m apart (Jankowski *et al.*, 2009), Seven point counts were placed in each studied sites, first point was established randomly and the rest of the points followed systematic sampling. While standing at the center, identification of birds and counting by listening to sounds of birds and observing was done. Upon arriving at a point, 5 minutes were provided for the birds to settle in case of any disturbances and unusual circumstances (Bryan *et al.*, 1984). Ten minutes were used to count and record all birds observed and heard within the established 50m radius (Terborgh *et al.* (1990) and Robinson *et al.*, (2000)). Unidentified calls were recorded using a digital voice recorder for further identification. Binocular were used to get a closer view, canon 1200D camera with 18-55mm and 75-300mm was used to take photographs for further more identification and accuracy. Since birds are active in the morning the study was done at 0600 to 1030 hours. (Bennum and Howell 2002). Birds were be identified to the specie level and their taxonomic groups using the East Africa Field Guides (Stevenson and Fanshawe, 2002). Date, bird specie habitat and diet type and location.

Mist nesting, This Method was used proportionally in points where birds were not easily seen. These are made of polyester mesh, mesh sizes are approximately of 127mm and are usually suspended between two poles, the nets are virtually invisible. This method was used because it is an important and efficient tool for monitoring species diversity and relative abundance for birds.

Objective Two

To Assess Features Of The Rehabilitated Quarry In Relation To The Supporting Of Bird Species.

This was done by using focused observation of all the features that are found in the rehabilitated area that supports bird species in the rehabilitated area. Each feature was assessed independently, GPS location of each habitat waypoints were recorded using Garmin etrex 10.

Observations were made from 07:00 to 10:00 hours, focusing on each feature found at the rehabilitated area. Plant communities and Shrubs at the rehabilitated quarry area were identified by Field Guide To Common Trees And Shrubs Of East Africa (Najma 2002). The bird species and its relation towards rehabilitation area features such as Water quarry pits and Grasslands were recorded as feeding and general behavior

The features dominant in supporting birds' ecology in feeding were analyzed by using Non-metric Multidimensional Scaling (nMDS) to show similarities and differences between rehabilitated & undisturbed).

Objective Three

To Create A Database That Documents Bird Species Found At Wazo Hill Quarry

The project also focused in the development of an information-management tool to support the rehabilitation activities with birds. It will be known as the Wazo Hill Quarry Bird Database, It has been extended that it covers species as well as sites. The database underpins much of what appears in the Bird of Wazo Hill Quarry book and contains additional information. This was created by using Microsoft excel 2010, where by all identified bird species were recorded, and described the common name, species name, preferred habitat, preferred diet, location and data collectors.

RESULTS

Relative abundance

- Total of 695 individual birds were counted during the study with 108 bird species recorded at both sites ;
- *Uraeginthus angolensis* was the most common representing 6% of all the frequent birds encountered see (Table I)

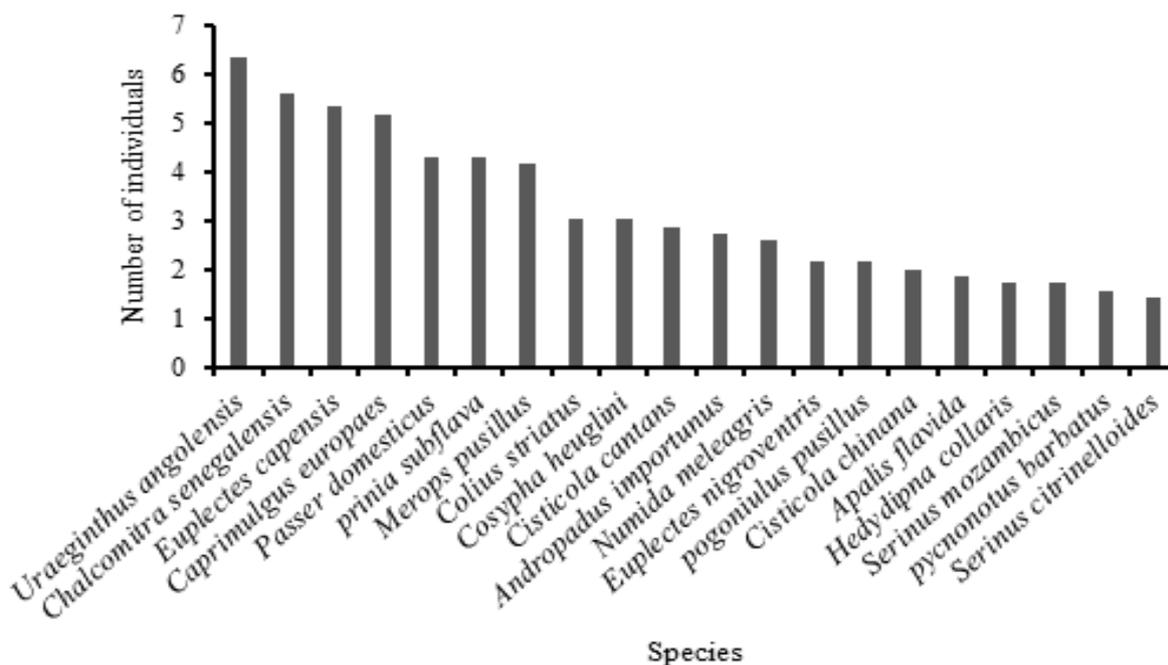


Figure 1: The graph above shows the relative abundance of 20 most abundant species. The highest being *Uraeginthus angolensis* (6%), and lowest being *Serinus citrinelloides* (1%)

Bird species	Rehabilitated	Undisturbed
<i>Andropadus importunus</i>	12	7
<i>Apalis flavida</i>		13
<i>Caprimulgus europaeus</i>	32	4
<i>Cisticola cantans</i>		20
<i>Cisticola chinana</i>	6	8
<i>Colius striatus</i>	9	12
<i>Cosypha heuglini</i>	9	12
<i>Euplectes capensis</i>	11	26
<i>Euplectes nigroventris</i>	12	3
<i>Hedydipna collaris</i>	12	
<i>Merops pusillus</i>	7	22
<i>Numida meleagris</i>		18
<i>Passer domesticus</i>	30	

<i>pogoniulus pusillus</i>	8	7
<i>prinia subflava</i>	8	22
<i>pycnonotus barbatus</i>	2	9
<i>Serinus citrinelloides</i>	4	6
<i>Serinus mozambicus</i>		12
<i>Uraeginthus angolensis</i>	27	17

Table 1: Table showing few of the dominant birds and the numbers that were caught in the rehabilitated and numbers that were caught in undisturbed. The species I have put in bold are the species that were caught in only one of the sites.

Diversity between Rehabilitated and Undisturbed areas

The shannon- wiener and Margalef's diversity index were high in undisturbed and 3.6755 respectively (Table 2); However the Diversity t-test shown there is no significant difference between bird specie found between Rehabilitated and Undisturbed Sites ($t = 0.0016778$ $df = 663.68$ $P = 0.093851$)

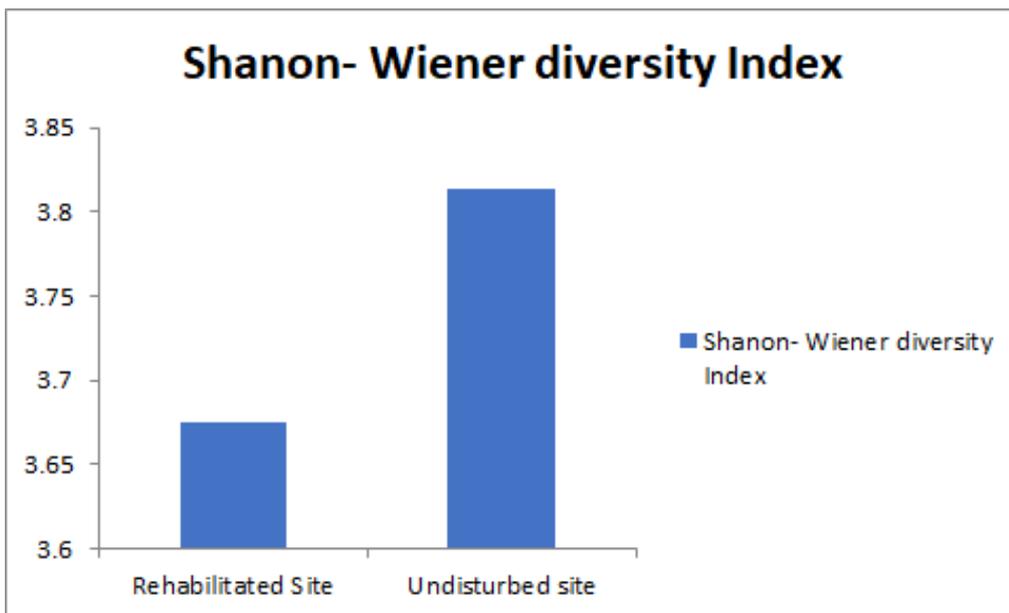


Figure 2: a graph showing the diversity indices for rehabilitated and undisturbed areas

Measurement	Rehabilitated Site	Undisturbed site
Shannon-Wiener Index	3.6755	3.8142
Margalef's diversity	12.6	12.7
Evenness (E)	0.5334	0.5966

Table 2: The different diversity indices (Shannon-Wiener, Margalef's diversity) of bird species in the two study sites.

Similarity and dissimilarities of bird species composition between the two Sites

Bird species composition analysis using Non-metric Multidimensional Scaling (nMDS) plots showed no distinct pattern of bird species found between the two sites (Rehabilitated & Undisturbed). Results of one-way ANOSIM confirmed no significant difference in bird species composition between the two sites ($R = 0.001$; $p = 0.886$).

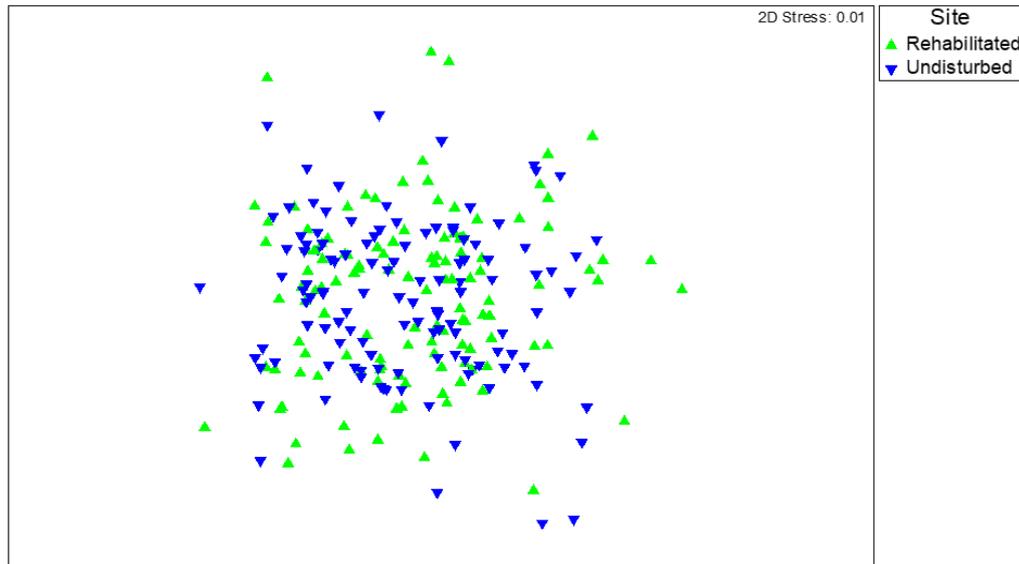


Figure 3: nMDS plot showing no distinct pattern between the rehabilitated and undisturbed areas

d) Similarity and dissimilarity amongst features found in the Rehabilitated quarry in relation to the support of bird species ecology

The preferred habitats are Woodland (*Leuceana diverifolia* and *Casurina equisetifolia*), grassland and flowering plants producing fleshy fruits (Appendix I). The diagram below shows clearly

the habitats dominated with bird species. ANOSIM test says there is a significant difference in preferred habitat by bird composition. ($R = 0.052$; $p = 0.001$)

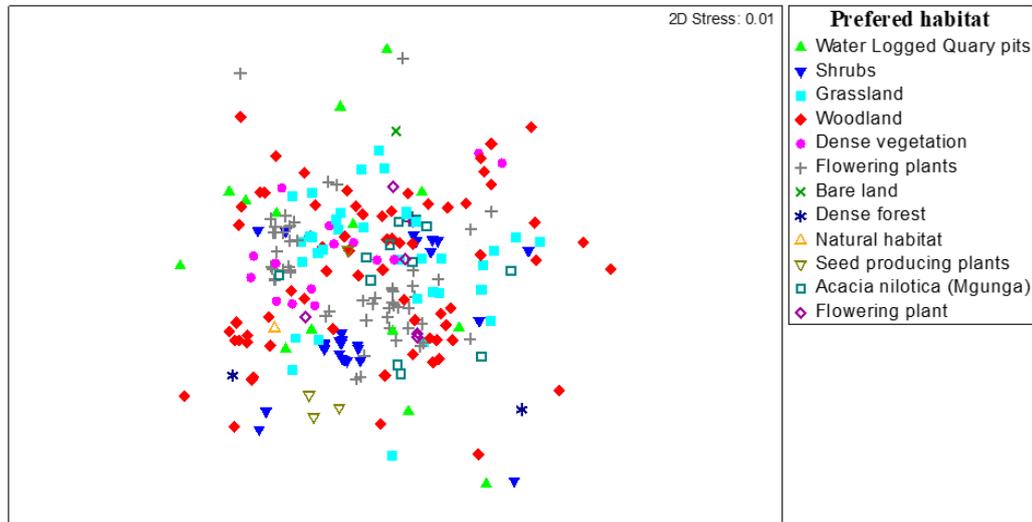


Figure 3: nMDS plot showing similarities and differences of birds and their preferred habitats

DISCUSSION

The rehabilitated area of Wazo hill quarry have attracted 104 bird specie, in terms of feeding, nesting and roosting leaving behind few bird specie that prefers dense vegetation of the undisturbed/ Natural areas *Apalis flavida*, *Cisticola cantans* *Numida meleagris* and *Serinus mozambicus*. This has proven that rehabilitation program have attracted high number of variety biodiversity including bird specie. This agrees with the study which was done in Danum Valley Conservation Area and Ulu Segama Forest Reserve in which Rehabilitation resulted in rapid recovery of birds populations, which attracted 2211 individuals of 91 bird specie (Edwards et al., 2009). This indicates that the rehabilitation program has attracted and restored large number of bird specie inside the quarry. *Uraeginthus angoleis* has shown high relative abundance compared to the other birds due to their ability of exploiting wide ranges of habitats from woodlands, dense vegetation, grasslands to Water logged pits and variety diet (Omnivorous feeders), this argument agrees with (Sinclair and Ryan 2003).

There was higher diversity of bird specie in un d i s t u r b e d a r e a ($H' = 3.8142$, $D =$ area ($H' = 3.6755$ $D = 12.6$ $E = 0.5334$). However , S t a t i s bird specie diversity was higher in undisturbed area due diverse native plant specie compared to the plants found at rehabilitated area that were planted (Mixture of native and non-native) ; this is supported by the study which conveyed Habitats with different vegetation covers influences the diversity of bird specie (Jayson and Mathews, 2002); Moreover, the results also indicate that bird specie found between the two studying sites were similar, stipulating that most of the bird specie found in rehabilitated area were also present in the undisturbed area. However Specie such as *Hedydipna collaris* and *Passer domesticus* were observed only in the rehabilitated area due to their nectar feeding habits, from flowering plants (Underhill et al., 2016) in which the *bougainvillea* nectar producing flowers found in the rehabilitated quarry area are the most loved by these specie; whilst *Apalis flavida*, *Cisticola cantans* *Numida meleagris* and *Serinus mozambicus* were observed only in the undisturbed area, as they

prefer thicket areas as reported by (Underhill et al., 2016). Habitats with various vegetation influence the diversity of bird species (Jayson and Mathews, 2002)

In terms of bird specie composition found in the studied sites of rehabilitated and undisturbed area there is no significant differences because, Birds of Wazo migrate from one place to another within the quarry in search for food, shelter, nesting materials and defence. Although the number of observations in natural area was higher compared to rehabilitated area, but the bird specie composition remains the same, except for the few as stipulated in (Table I).

The rehabilitated area contains features which emerged as a result of rehabilitation program including grasslands, woodlands, flowering plants (Total of 50 plants planted), Water quarry pits, forbs and herbs, Shrubs and Insects. The return of topsoil during rehabilitation program have attracted growth of natural vegetation, dominating being : *Acacia nilotica*, *Lantana camara* (grasses), shrubs, grasslands and variety forbs and herbs features that in turn have supported birds with nesting material, nesting habitat (Ground nests) and food This is agreed by the study which was done with the birds found at the Wetland of kheda district, in which they have been observed to build their nests with materials that comes from the features nearly particularly root, twigs and leaves of plants (Shodhganga), which is the same case with the rehabilitated quarry, most of these nesting materials comes from the dominant trees of *leucaena diversifolia* and *Casurina equistefolia* along with grasslands and the twigs of *Acacia nilotica*

In rehabilitated area, birds were observed to feed on various insects including Dragonflies, butterflies, megaloptera, Caddisflies, bees, Wriggling beetle, Stoneflies, wasps and Spiders who were attracted by the rehabilitation program of replanting trees and aquatic ecosystems enhancement (Ponds) that in turn have attracted insects which supports diet of insectivores birds such as *Cisticola chinana*, *Halcyona Leucophala*, *Halcyon albiventris*, *Serinus citrinelloides*, *merops pusillus*, *crithagra citrinellodes*, *Merops albicollis* and *Terpsiphone viridis*, others have been observed to be Omnivorous (feeding on both Insects and fruits) . Their feeding habits are well stipulated in the Wazo Hill Quarry database for birds.

The rehabilitation quarry area has a total of 50 planted tree specie that contains flowers, seeds and fruits. Out of them 16 planted specie (**Appendice I**) produces fleshy fruits and flowers which have shown a great preferences to the bird specie in terms of food, due to their production of fleshy fruits which makes it easy for the birds to break the exocarp (Outer part of the fruit) and feed in the inside contents; and most the bird groups have been observed to visit these trees for feeding daily. being Groups of birds dominantly observed are the **Barbets, Sunbirds, Mousebirds, Starling, Bulbul and Crows**

Most Birds are attracted by the sweet scent flowers, for the case of rehabilitated area at Wazo hill quarry, the most loved flowers are the *Bougainvillea* (Boganivellia), *Moringa Oleifera* (Mronge), *Cupresus goveniana* (Mkirismasi) and *Faidherbia albida* (Mkababu).

Plants such as *Citrus Limonia* (Mlimao), *Citrus reticulata* (Mchenza), *Cedrella Odorata* (Mwerezi), *Citrus Sinensis* (Mchungwa), *Adansonia digitata* (Mbuyu), *Rauvolfia caffra* (Msesewe), *Barringtonia racemosa* (Mtomondo) and *Punica Granatum* (Mkomamanga); are less preferred by birds due to the thick exocarp henceforth the bird does not easily reach the inner contents (Mesocarp). Insectivore Birds such as Bee eaters would perch on top of their branches in search for insects.

The Most dominant trees at the rehabilitated quarry that have supports large number of nests includes the *leucaena diversifolia* (Mlusina), *Casurina equistofolia* (Mvinje) this is due their ability of growing fast within a short period of time, and they contain horizontal twigs that are used by birds as nesting material. They are seed producing plants, whose seeds are not preferable by birds for feeding. They have been observed to support 36 canopy nests inside the rehabilitated quarry. Study which was done at Kheda District, shown that birds preferred 76% trees habitat for nesting, roosting, resting and feeding compared to other habitats (Shodhganga 2013)

The abandoned quarry pits which are filled with water (Waterlogged quarry pits) have attracted water loving birds such as Herons, Egrets, Ibis, Nightjars and Hammerkop who feed on aquatic invertebrates and animals as their major feeding grounds.

This project has involved different expertise from different places, including technical support and equipments from University of Dar es salaam along with Ornithologist and frequent Consultations from Department of Zoology and Wildlife Conservation, and local knowledge from UVIKIUTA

Birds advantages inside the quarry.

Ecological relationships between specie

- There is ecological relationships that have been exhibited, known as **Commensalism**, which have been observed between the **bronze mannikin bird** and the **wasps**, their nests are surrounded by wasps who protects the birds from dangerous predators but yet the wasps are neither eaten by the bird nor get any benefit.
- Birds are seed dispersal agents henceforth **supports human activities** by aiding in growth of trees through the replantation activities that are taking place at Wazo Hill Quarry, their presence must be valued as they support rehabilitation activities as well as flower pollination which gives us delicious fruit

This study confirmed that the rehabilitated area is an important habitat for **Eurasian Nightjar**, bird group that have a **demarcated habituation** in the rehabilitated zone, due to presence of water logged quarry pits that favors their diets in feeding on aquatic invertebrates.

ADDED VALUE TO THE SCIENCE OF QUARRY AND THE COMPANY

- The study established Wazo Hill Quarry Database for Birds; documenting 108 Bird specie found at Wazo hill Quarry which has contributed to further knowledge of bird specie and their relating ecological information with the quarry sites around the Wazo Hill Quarry which is submitted to the Environmental officer, of Wazo Hill Quarry. This shows that the rehabilitated area can be a potential place to practise

economic tourism, which can be a source of income to the people and communities around Wazo provided that there will be transport accessibility.

- Furthermore the project emerged an Output of a list of birds found within the Wazo hill quarry with additional information which would be an added advantage in facilitating increased diversity of birds, which is very important due to their enormous advantages including pollination, cleaning up the environment through scavenging upon carcass (bird of prey), source of food, biological control and seed dispersal which enhances trees growth.
- Will be an added advantage to the biodiversity museum present at Wazo hill quarry for learning, designing Strategic Management for their sustainability by the company, researchers and other stakeholders, since we have now seen to what extent has the rehabilitation program shown positive correlation with increasing birds diversity, List of features identified in this project (**fleshy fruits trees** as mentioned in Appendice I, grasslands emerged due to return of topsoil, and the presence of planted dominant tree specie with fastest growth rates , the *leuceana diversifolia* and *casurina equistofelia* must be enhanced for future rehabilitation activities),
- The project has Contributed to the awareness of rehabilitation program in relation to the bird specie at Wazo Hill, which is a crucial information to the environmental managers, for economic tourist purposes and further future researches. This can be a start for a wazo hill quarry library which would document intensively every specie found in the quarry

FINAL CONCLUSION

The Rehabilitation program done by TPCC has shown a positive impact and success towards increasing number of birds. This has shown good indication of potentiality for rehabilitated quarry areas to be used for various economic activities such as bird watching purposes, research projects for students and other stakeholders and tourists activities. Birds in their diversity constitute part of the natural environment and play functional role on flower pollination, seed dispersal that supports growth of trees for rehabilitation purposes, controlling insects population , Source of food chain, environmental health indication and agents in breaking seed dormant.

Rehabilitation program has not only improved birds population but also other fauna such as butterflies, small mammals, dragonflies, and other insects which all depends on one another for survival. In coming research should focus on studying more on these fauna, so as to have as much information as possible for each organism to be documented up to specie levels for successful future rehabilitation activities.

Due to insufficient funds, I failed to produce hard copy of the book for Wazo hill which had documented 108 bird specie, that could be used for local people around Wazo to understand better biodiversity of birds around, henceforth it shall be available only in Softcopy.

Birds are important organisms for they aid in Seed dispersal, health indication and can be very essential in facilitating bird watching for tourism purposes This project proves that rehabilitation activities have been able to restore the biodiversity of birds to a large extent, and this because the environment have been made suitable to suit their needs in terms of feeding, nesting, roosting , resting and interactions largely being supported by fleshy fruits plants (appendice I), dominance of *leuceana diversifolia* and *Casurina equistefolia*, plants and Grasslands. Water quarry logged pits have attracted high number of water loving birds that feeds on aquatic animals.

ACKNOWLEDGEMENT

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To be kept and filled in at the end of your report

<p>Project tags (select all appropriate):</p> <p>This will be use to classify your project in the project archive (that is also available online)</p>	
<p>Project focus:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Beyond quarry borders <input type="checkbox"/> Biodiversity management <input type="checkbox"/> Cooperation programmes <input type="checkbox"/> Connecting with local communities <input type="checkbox"/> Education and Raising awareness <input type="checkbox"/> Invasive species <input type="checkbox"/> Landscape management <input type="checkbox"/> Pollination <input type="checkbox"/> Rehabilitation & habitat research <input type="checkbox"/> Scientific research <input type="checkbox"/> Soil management <input type="checkbox"/> Species research <input type="checkbox"/> Student class project <input type="checkbox"/> Urban ecology <input type="checkbox"/> Water management <p>Flora:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Trees & shrubs <input type="checkbox"/> Ferns <input type="checkbox"/> Flowering plants <input type="checkbox"/> Fungi <input type="checkbox"/> Mosses and liverworts <p>Fauna:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Amphibians <input type="checkbox"/> Birds <input type="checkbox"/> Insects <input type="checkbox"/> Fish <input type="checkbox"/> Mammals <input type="checkbox"/> Reptiles <input type="checkbox"/> Other invertebrates <input type="checkbox"/> Other insects <input type="checkbox"/> Other species 	<p>Habitat:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Artificial / cultivated land <input type="checkbox"/> Cave <input type="checkbox"/> Coastal <input type="checkbox"/> Grassland <input type="checkbox"/> Human settlement <input type="checkbox"/> Open areas of rocky grounds <input type="checkbox"/> Recreational areas <input type="checkbox"/> Sandy and rocky habitat <input type="checkbox"/> Scree <input type="checkbox"/> Shrub & groves <input type="checkbox"/> Soil <input type="checkbox"/> Wander biotopes <input type="checkbox"/> Water bodies (flowing, standing) <input type="checkbox"/> Wetland <input type="checkbox"/> Woodland <p>Stakeholders:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Authorities <input type="checkbox"/> Local community <input type="checkbox"/> NGOs <input type="checkbox"/> Schools <input type="checkbox"/> Universities

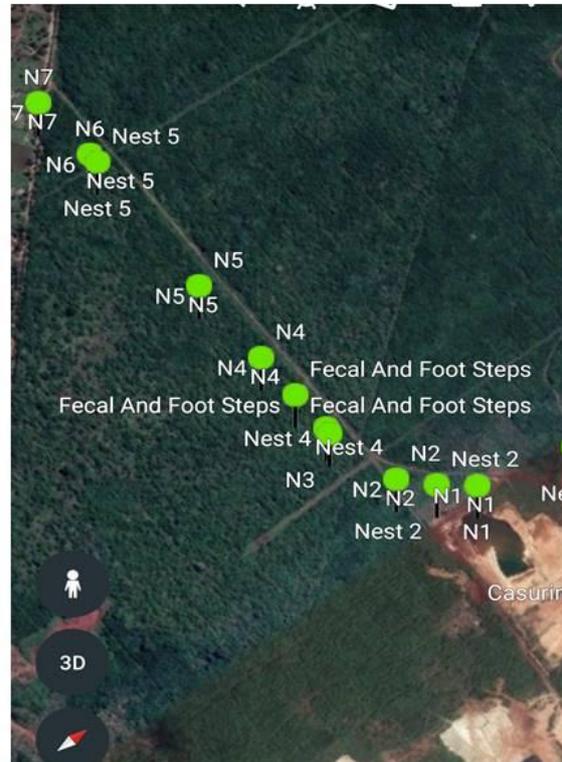
Appendix I : Fleshy fruits plants, Mostly Preferred by birds that are found at the Rehabilitated area of the Wazo Hill quarry

Scientific with their local names in brackets
<p><i>Bougainvillea</i> (Boganivellia), <i>Moringa Oleifera</i> (Mronge), <i>Cupresus goveniana</i> (Mkirismasi)</p> <p><i>Faidherbia albida</i> (Mkababu). <i>Annona Squamosa</i> (Mstafeli), <i>Annona chrysophylla</i> (Mtope Mtope), <i>Artocarpus altitilis</i> (Mshelisheli), <i>Azadirachta Indica</i> (Mwarobaini), <i>Carica Papaya</i> (Mpaipai), <i>Psidium guava</i> (Mpera), <i>Mangifera Indica</i> (Mwembe), <i>Syzygium cumini</i> (Mzambarau) <i>Ficus sycomorus</i> (Mkuyu), <i>Grewia Bicolor</i> (Mkole), <i>Gmelina Arborea</i> (Mfudufudu), <i>Senna Siamea</i> (Mjohoro)</p>

Appendix 2: Some photos from Field work



Map showing points covered at the rehabilitated site



Map Showing points Covered at the undisturbed site.



Photo showing identification of birds specie on site, by use of East Africa Field Guide (Stevenson and Fashawe, 2002)



Photo showing establishment of 50meter radius for point count Method



Photo showing setting up for a mist nest, and Eurasian Nightjar trapped in a mist nest

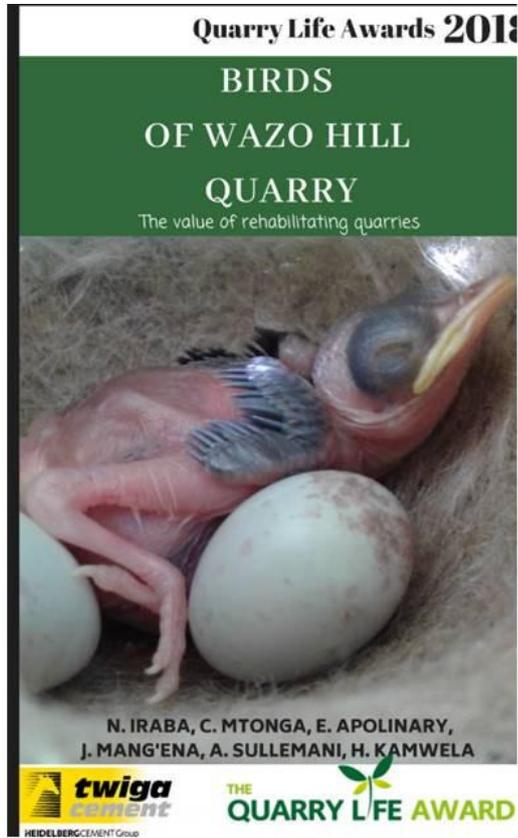


Photo showing “ Book of Wazo Hill Quarry”that documents 108 bird specie found at Wazo hill quarry as an output of the project.