Title: EDUCATIONAL, INNOVATIVE AND ATTRACTIVE BIODIVERSITY MUSEUM

Country: Tanzania

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Abstract

Wazo Hill Quarry in Tanzania has been carrying out a Quarry Rehabilitation and Renaturation project since 2010 in order to restore nature at quarried sites as well as to promote and educate the public about biodiversity in quarries. In order to contribute at enhancing the efforts being done at Tanzania Portland Cement Company (TPCC), this research project introduced new approaches for educating and raising biodiversity awareness, particularly for students. This aimed at making the biodiversity learning into being not only educative but also exciting and memorable. The approaches included introducing interactive educational materials; developing solar toys as edutainment; conducting biodiversity awareness survey; drawing and essay writing competition. At the beginning of the project, the students' average awareness level on biodiversity was 30.7% whereas after the project intervention the average awareness level was 84.5%. Furthermore, the project contributed at improving documentation and dissemination of the biodiversity existing at the quarry and information of the activities conducted by the Quarry Rehabilitation and Renaturation project. This was accomplished through creating an innovative, educational and attractive museum at the quarry which has 35 fauna species. The project recommends for TPCC to spearhead the sustainability of this project and other biodiversity projects in the quarry.

1.0 Introduction

Tanzania Portland Cement Company Limited (TPCC) is a leading company in the manufacturing, selling and distribution of high quality cement in Tanzania. The company strives to preserve the natural environment thereby conserving resources, reducing emissions and minimizing the environmental impact of its operations of cement production. Cement production involves several activities including the mining/ quarrying of limestone rocks. This activity entails the excavation of the overburden red soils and blasting of the underlying limestone rock. After quarrying the land is left degraded, together with the biodiversity and the ecosystem disturbed. The after-effects of quarrying activities have lead communities to have negative perception of quarries, particularly for companies which do not take responsible actions in restoring nature in their quarried sites. For the case of mining/quarrying companies in Tanzania, TPPC is unique due to the efforts in rehabilitating its quarried areas and its initiatives in conducting environmental awareness campaigns to communities.

However, more efforts are needed to improve the Rehabilitation and Renaturation project at Wazo Hill quarry of TPCC. Therefore, this project aims at educating and raising public awareness on the biodiversity at quarries into being not only educative but also exciting and memorable to students and the local community. Furthermore, it was noted that the documentation and dissemination of the biodiversity existing at the quarry and information of the activities conducted by the Quarry Rehabilitation and Renaturation project was limited to the public. The Quarry Rehabilitation and Renaturation project has mainly focused on flora as compared to fauna, hence this project conducted biodiversity mapping, developed educational materials and documentaries, carried out preservation of species and showcased the existing quarry's biodiversity (museum), as well as participated in networking/collaborating with other environmental activists/stakeholders. This project also aimed to boost creativity in students and promoting innovation by linking green-energy technology and biodiversity. This was achieved through the demonstration of solar toys which featured flora and fauna characters found in the Quarry. Thus, the project aimed at creating an innovative set-up for educating, raising public awareness on the biodiversity of Wazo Hill Quarry and for raising students' interest in studying biodiversity.

2.0 Objectives

The objectives of the project were:-

i. To raise awareness of biodiversity at the quarry to students through entertaining approaches for there is a need to remove the negative perception of the quarry and give the light of the efforts being done by Heidelberg cement, on the case of Wazo Hill to restore nature.

ii. To enhance sustainability of the Quarry biodiversity projects through preparing systematic documentation of biodiversity of the quarry, its display and dissemination.

iii. To add the number of flora and fauna at the quarry – increasing biodiversity.

3.0 Background information

3.1 Site Description

Wazo Hill Quarry is located at Tegeta area, approximately 25 km north-west from Dar es Salaam city centre, Tanzania. The central coordinates of the site are latitude 6°38'44.2" South and longitude 39°09'26" East, and the average altitude of the site is 100 meters above sea level. The quarry is the highest fossil reef and it is one of the largest carbonate occurrences on the coast of Tanzania. The rich rock material extends for about 2.5 km parallel to Dar es Salaam-Bagamoyo Road, and it has 15M thick coral limestone bed reserve estimated at 20Mt. The quarry site is characterized with a tropical climatic condition due to its location being along the coast of Indian Ocean and also due to its closeness to the equator. Therefore, the area experiences hot and humid weather throughout the year, with approximately 1,000 mm to 1,900 mm of rainfall per annum and an the average temperature ranging from 24°C to 32°C. The mining activities in the site include excavation of the overburden red soils and blasting of the underlying limestone rock. After the mining activities the landscape of the quarried area looks barren while heaps of topsoil is deposited on the edges of mined blocks as source of materials for planned restoration and rehabilitation phase. Water is pounding in depressions created by excavation works and undulations of the bottom of the quarry landscape. The retention of this water together with the retained water in the manmade ponds at the site, serves at attracting aquatic ecosystem back into the quarry. At the quarried site there are few trees, such as baobabs which have been left untouched for protection and aesthetic reasons. There are also exotic trees species such as *Leucaena leucocephala* which have been attracted by the scattered heaps of topsoil from the excavation works. Furthermore, the quarried site has various flora and fauna species including small mammals, birds, amphibians, reptiles, insects and butterflies which are as a result of the ongoing quarry rehabilitation and renaturation project.

3.2. Quarry Rehabilitation and Renaturation project at WHQ

In the year 2010, TPCC embarked on a project to rehabilitate parts of the quarry which have previously been mined. TPCC commissioned an NGO namely UVIKIUTA to lead the implementation of the Quarry Rehabilitation and Renaturation project. The project embraced three main components: (i) Conservation of disturbed ecosystem at TPCC quarry as a result of cement extraction (ii) Promotion of urban forestry through supporting of urban greening and (iii) Capacity building to local people on environmental management through provision of environmental awareness campaign, education and training.

The project has achieved to establish a large tree nursery; raised more than 100,000 tree seedlings; planted over 26,000 trees in the quarry and donated more than 19,000 tree seedlings to various stakeholders such as schools, prisons, hospitals, individual community members and NGOs.

This project is in-line with some of the activities conducted by the Quarry Rehabilitation and Renaturation project.

4.0 Methods

The project started by conducting a pre-feasibility study about the background of the quarry and the rehabilitation project. After physically visiting the quarry, reviewing reports and literature and discussing with stakeholders (TPCC Environmental manager, UVIKIUTA staffs), several gaps were identified to include insufficient of record keeping of the biodiversity existing at the quarry; insufficient documentation of the activities of the rehabilitation projects; less information on fauna compared to flora information; lack of interactive biodiversity educational materials; few biodiversity awareness campaigns at schools' premises, and lack of motivational activities for raising interest on biodiversity to students (competition awards).
The following actions were done towards addressing the above mentioned identified gaps:

(a) Setting up a Biodiversity Information desk/ Museum

(i) Renovation

One room among the offices of UVIKIUTA at the rehabilitated area of the quarry was renovated into being used as a Biodiversity Information desk/ Museum. With the collaboration of two workers from TPCC's Civil department and a group of Volunteers, the room was painted on the walls, floor and ceiling, doors and windows were polished. At making the room attractive and showing the walking layout of the room, small footprints were painted on the floor to serve as walkways to be followed by visitors once they enter into the room. The TPCC's Civil department also assisted with furniture/cabinets which were later used to showcase the preserved fauna species.

(ii) Documentation

The Quarry Rehabilitation and Renaturation Project's reports were reviewed after getting access and approval from UVIKIUTA and TPCC. From the reports, we gathered information about the biodiversity existing at the quarry together with the activities of the rehabilitation projects. The information was all compiled for latter to documented at the museum in a Poster format.

(b) Preparation for preserved species

(i) Catching and preserving of species

In collaboration with two Zoology department staffs from the University of Dar-es-Salaam and one staff from UVIKIUTA, the activity of catching fauna species included laying-out traps for small animals using buckets; using mist net, swift net and fish net for invertebrates (butterflies and dragonflies), birds and fish respectively. The preservation was such that the invertebrates were dried, the birds were skinned and staffed with cupboard/cotton while the small animals and fish were treated and fixed in alcohol. A photograph of the preserved species is shown in Annex 1.

(ii) Classification and labeling of the preserved species

The classification and labeling of all the preserved species was conducted with the assistance from the two Zoology department staffs of the University of Dar-es-Salaam. The labels of the preserved species also included the name of the species in Kiswahili, the national language of Tanzania. This was done in order to cuter not only for visitors who use English but also for those who use the local language. A list of

all the preserved species (Annex 2) was compiled and latter posted as one of the documents for display at the museum.

(c) Design and Development of Biodiversity solar toys

The design and development of solar-powered toys was conducted in collaboration with one craftsman, by using waste/broken solar panels and toys which featured flora and fauna characters (Annex 3). This served as learning toolkit for boosting creativity in students and promoting innovation by linking green-energy technology with biodiversity. This was also used to elaborate to students that other countries use their quarried sites as solar farms to generate electricity. The solar toys acted as an edutainment, which is a combination of education and entertainment at the sametime in order to enhance learning. The solar toys were designed to suit the local context, differently from other edutainment such as: computer, video games, TV programs.

(d) Preparation of educational materials

(i) Lecture material

A power point presentation on Introduction to biodiversity was prepared for delivery at schools during the biodiversity awareness campaigns. The presentation mainly focused about what is biodiversity, its importance, the causes for its loss, a case of Wazo Hill quarry and the rehabilitation project. The students are usually taught in chalk and talk mode but this lecture material was prepared to use ICT media and some of the power point slides had animations so as to make the presentation entertaining to students. Taking into consideration the local context, particularly power cuts, availability of projectors and laptops at the local schools, we prepared other learning materials in paper format.

(ii) Activities

Two quizzes were prepared to be used during the lecture of biodiversity, the first quiz was aiming to bridge-in the general concept of biodiversity and cement production whereas the second quiz aimed at assessing students' perception on quarries. Another activity was a Q&A session whereby schools' representatives were asked to share experience on the status of their school's biodiversity and the activities which they conduct to promote biodiversity.

(iii) Questionnaires

In order to assess the level of Biodiversity Awareness of students due to intervention of this project, pre and post biodiversity awareness questionnaires were prepared. The pre-questionnaires were given to students during the visit at their schools while the post-questionnaires were given to students after their visit at the Quarry (Annex 4). Another set of questionnaires were the Evaluation questionnaires, the first one was handed over to students during the awareness campaign at their schools in order to get their feedback about the biodiversity presentation and hence served for future improvement of the lecture material. The second set of evaluation questionnaire which was designed in form of *smiley faces*, was handed over to students during their visitation at the quarry, whereby the students were asked to give feedback about the quarry tour.

(iv) Posters

Posters were designed to assist as visuals/ support learning materials during the awareness campaign at schools and latter they were posted at the museum. These posters were photographs taken by this project and they included the photographs of the cement plant, the quarried site, the rehabilitated area, flora and fauna found at TPCC.

(v) Quarry tour booklet

An educational support material for students during their visit at the Quarry was designed; it served as a simple reference material and a memo of their quarry visit. The 5 pages booklet was designed to be user friendly to students by being more in form of pictures rather than being too wordy.

(e) Conducting awareness campaign at schools

In collaboration with the Jane Godall's Roots and Shoots institute, the identification and introduction to schools' management was achieved. Two secondary schools and one primary school were identified being available to receive the biodiversity awareness lecture. The campaign involved 20 students (10 students from secondary and 10 students from primary school), one teacher and one coordinator from Jane Godall's Roots and Shoots institute. The students were given to fill the pre-biodiversity questionnaires followed by the lecture on biodiversity, activities, elaboration of posters, Q&A session, filling-out evaluation questionnaire and taking a group photograph of all participants who attended the biodiversity awareness campaign (Annex 5).

(f) Implementing the Quarry tours:

- Students' visit at the Quarry

The students' visit at the Quarry involved 21 students who had attended the biodiversity awareness campaign which we had conducted at their schools (Annex 6). The visit was organised in collaboration with TPCC, UVIKIUTA, Jane Godall's Roots and Shoots institute and schools' management. The visit was staged as follows:

(i) Safety Induction Brief:

Welcoming note to students and their teacher, followed by a lecture of Safety in Quarry which was conducted by the TPCC's OHS officer, thereafter there was a quick recap of the lecture on Biodiversity and a brief overview of the Quarry Tour and the Quarry booklet. Lastly the students, their teacher and representative from Jane Godall's Roots and Shoots institute were given PPEs to wear ready to start the quarry tour.

(i) Tour at the Quarried Site:

Viewing the blasted areas; Viewing different types of rocks and soils; Viewing the ponds; Viewing the untouched baobab trees; Brainstorming application/use of abandoned quarry site as solar farms.

(ii) Tour at the Restored/Rehabilitated Site:

Brief lecture on Rehabilitation project; Tour inside the Biodiversity Information room/museum; Viewing flora and fauna/ animals and plants; Demonstration and playing with the solar toys at the Picnic area; Planting of tree seedlings (Restoration activity); Refreshments.

(iii) Evaluation:

After the tour, the students handed over the PPEs and they were given to fill the evaluation questionnaire with regards to the quarry tour.

- Youths and Women's group visit at the Quarry

The visit of youths and women's group at the Quarry involved 7 volunteers, one woman from Chasimba village (a village bordering Wazo quarry), two women from environment activists' group which deals with Mangroves farming and one security guard (Annex 7). These visitors were all adults above 20 years old, so their visit was staged as the students' visit but customized to suite their age and level of education.

(g) Organising a Biodiversity Drawing and Essay Writing Competition

In order to raise awareness, interest and motivation of students on biodiversity, a Drawing and Essay Writing competition was organised in collaboration with TPCC and Jane Godall's Roots and Shoots institute. A Call for the competition was made during the biodiversity awareness campaign at schools, whereby posters of the competition were given to each school's representative to be posted at their respective school's notice board. After the competition's deadline, the entries were evaluated and the award ceremony for the winners was conducted at the schools.

(h) Production of a Documentary video of the project

A professional videographer and photographer took event of the students' visit at the quarry, and thereafter a documentary video of the project was produced and uploaded in Youtube (***https://www.youtube.com/watch?v=9Gn5RV5T2xc***) and at the project page in the QLA website. This served for documentation purposes and raising biodiversity awareness to the public.

(i) Communication and Stakeholders involvement

(i) Raising awareness to the public on biodiversity and Quarry Life Award Competition at: TV station, it was aired the EATV; UVIKIUTA's capacity building training, schools, Michigan State University-USA (Annex 8).

(ii) Communicating progress, publishing results, posting pictures and videos on the project page in the QLA website, together with the presentation to the QLA National and International jury (Annex 8).

(iii) Collaborating with stakeholders in the process of the project, they included TPCC, UVIKIUTA, Schools, Jane Godall's Roots and Shoots institute, general public, media.

5.0 Results:

(i) Assessment of biodiversity awareness among students

The results of the biodiversity awareness survey for students indicated that prior to the biodiversity awareness campaign, 27.2% of students were able to define the term Biodiversity and its importance, whereas after the biodiversity awareness campaign and quarry tour 80.95% of students were able to define the term Biodiversity and its importance. The pre-questionnaire results indicated 31. 8% of students were able to list 3 threats/ causes of biodiversity loss, while 85.71% of the students were able to answer the

respective question in the post-questionnaire. The pre and post-questionnaire results of students were 36.4% and 90.48% respectively with regards to their ability to correctly list down 3 ways of protecting biodiversity. These results show that there is an increase in the level of biodiversity awareness among students (Annex 9) after the project intervention.

(ii) Preserved species

A total of 35 fauna species were showcased at the museum as a result of the task of trapping and preserving species which were found within the quarry rehabilitated area.

The preserved species included 2 species of dragonflies, 13 species of butterflies, 4 species of mammals, 5 species of reptilians, 1 specie of amphibian, 8 species of birds, 1 specie of fish and 1 specie of grasshopper.

(iii) Drawing and Essay Writing Competition

The call for the Drawing and Essay Writing competition was well received by the students. A total of 35 drawings and 5 essays were submitted from three different schools. This number of entries was more than the number of students who had participated in the biodiversity awareness campaign at schools (24 students), implying that the awareness had spread such that other students were also motivated to participate in the biodiversity drawing and essay writing competition.

(iv) Restoration activity

During the quarry tour, the students, youths and women's group carried out a restoration activity to increase biodiversity at the quarried site. The restoration activity resulted to the planting of approximately more 100 tree seedlings by the participants of the quarry tour.

(v) Kindergarten students and Interns

This project had not included kindergarten students to be among its target group for the quarry tour; however it was found out that during the project implementation a group of 10 kindergarten students visited our project at the museum. The kindergarten students were excited to see the preserved species, thus the museum served as a learning aid about biodiversity in real life, not only for higher-level students but also to lower-level students. In addition, a group of 4 interns from TPCC Safety department visited and learnt our project at the museum. It was found that the project had resulted into educating and raising biodiversity awareness to students beyond the initial target group.

6.0 Discussion:

The project experiences show that it can easily be replicated in other countries with quarry site when they want to educate and raise biodiversity awareness to community, particularly students. The assessment of the biodiversity awareness among students revealed an increase in the level of biodiversity awareness in students. The Pre-questionnaires showed an average of 30.7% level of biodiversity awareness while the Post-questionnaires showed an average of 84.5% level of

biodiversity awareness. Thus using the above findings it shows that the project had contributed at raising biodiversity awareness in schools. Furthermore, during the assessment of the level of students' biodiversity awareness, it was seen that 71% of the students had answered the questionnaires in Kiswahili language while 29% had answered in English. It was useful that we had set the questionnaires in both languages (Kiswahili and English) before distributing them to students. It will be practical for others to customize the questions in their local language for the students to easily understand and fully express their opinions. The language used in answering the questionnaires could also be influenced by the education level of the students because the 29% students who had answered the questionnaires in English were all from secondary schools. Whereas the 71% students who had answered the questionnaires in Kiswahili the distribution is such that 73% were Primary students and 27% were Secondary students (Annex 10).

The project had been able to trap and preserve 35 species that represents the fauna existing at the quarry as a result of rehabilitation initiatives. However, it should be noted that the quarry has more than 35 species as during the project implementation more species had been observed such as vervet monkeys, beetles, toads, bees and wasp. Many species were not caught due to several factors including weather, project's scope and timeframe, funding, protection and sustainability of species. Another important project experience is that although the biodiversity solar toys had initially being designed as edutainment for students but it was latter discovered that they could also be used to supplement for the species that had not been preserved in the museum. A photograph and description of the species that had not been preserved could be taken and thereafter a solar toy of the respective specie could be designed and be showcased at the museum. This will also be helpful for protection and sustainability reasons, particularly for the endangered species.

Another outcome experienced from the project is illustrated from the Drawing and Essay Writing competition. The students' perception could be observed from their drawings, whereby about two-thirds were drawings of biodiversity in national parks. Tanzania is famous for its richness of many national parks but the students need to be sensitized into thinking of biodiversity existing even nearby their localities. One student had submitted a drawing which had striking features; the drawing was done on a piece of white paper and glued at the back with a cardboard material from an old/used box, and the drawing was attached at the top with a handle of a used packaging material (flour packaging bag). The handle was supported to the drawing with a used-wire and a cloth string. The student's drawing could thus be easily hanged on the wall since it had the handle but most of all, the student had shown to be innovative through her creativity in demonstrating the value of waste and the concept of reuse/recycling . Another student submitted two unique and innovative pieces of work, thinking outside the box the student did a handmade-craft of a bracelet from the following materials: tree seeds, traditional Maasai beads and a used plastic thread. Unlike the rest of the submitted drawings which were done on white papers and painted using pencil colors; this particular student painted her drawing using water colors on a piece of plywood material that she had collected from the wastes at a carpenter's workshop (Annex 11). For future competitions it would be valuable to open room also for craft-works, instead of a Drawing Competition it could be a Call for an Arts & Craft Competition. These

students are an exemplar for youths to take action in protecting biodiversity by developing a sense of compassion and commitment to clean the environment by collecting wastes and reuse them.

Another lesson learnt from the competition was on awarding of the winners, whereby the project was able to receive and award other prizes to the winners in addition to the prizes which were earlier mentioned on the competition's advert. The extra prizes were a result of a fruitful collaboration with stakeholders, namely Jane Godall's Roots and Shoots institute and TPCC. Not only did the top three winners receive prizes (medals, T-shirts, certificate, money, sweets, biodiversity books) but also every student who participated in the competition was awarded a certificate and sweets, and a special category prize was given to the student who had submitted crafts, as well as the reward of certificates to 3 teachers from the 3 participating schools together with Biodiversity books and a Poster for each school. Without our expectation at the award ceremony, a group of 10 students on the spot started to individually construct a biodiversity "*Majigambo*"; it was like a poem recited in alteration whereby with pride each student role-played a biodiversity character (a bee, a fish, an earthworm, a butterfly, a tree, a snake, a monkey, a bird, a flower). We were amused and entertained by the combination of acting, reciting and singing from the students when each of them proudly argued for its character, its importance and putting forth a call for its conservation. This also elaborates of the risen awareness and interest on biodiversity amongst the students; it also shows that the students had found the quarry visit educative, exciting and memorable such that they could easily recall the flora and fauna found at Wazo Hill Quarry and be creative enough to perform a "*Majigambo*" about them. A video recording was taken when the students performed the Biodiversity "*Majigambo*" and it has been uploaded in Youtube (*https://www.youtube.com/watch?v=RKjp5GbIFY4&feature=youtu.be*)

Therefore, the added value of the project for biodiversity, the society and the company among others included: the planted tree seedlings; the biodiversity awareness created to students and to the general public, promotion of TPPC to the public for its restoration efforts during capacity building trainings, TV programme; the documentation and the museum; the developed biodiversity learning materials.

7.0 Conclusions:

The project conducted several activities in order to achieve the three key objectives, namely raising awareness of biodiversity at the quarry to students through entertaining approaches; enhancing sustainability of the Quarry biodiversity projects through preparing systematic documentation of biodiversity of the quarry, its display and dissemination; and adding number of flora and fauna/ increasing biodiversity at the quarry. The project had made an innovative, educational and attractive museum, and used it as a centre of attention in addressing the project's goal. The project can be replicable in other countries as well as in other quarrying sites at Tanzania.

For future implementation TPCC is recommended to ensure sustainability of the project by improving the infrastructure of the museum; provide/ disseminate sufficient documentation of the quarry's biodiversity related works in a more professional database; making use of solar toys to complement for the species which are not showcased at the museum; keeping the museum operational by having a curator/keeper; applying edutainment techniques when conducting

biodiversity awareness campaigns; carrying out more public awareness about QLA and showcasing the flora species in the museum too.

Acknowledgement

We are thankful to the following stakeholders for making this project a success: Heidelberg Cement group Tanzania, UVIKIUTA, National and International jury members, Students and Schools' management, Jane Godall's Roots and Shoots institute, Expertise from Zoology Department, Solar technician, Voters.

ANNEXES

Annex 1: Preserved species

Annex 2: List of the preserved species

Families and species of butterflies

S$^{N.}$	Family	Scientific Name	Common English Name
1	Papilionidae	Papilio demodocus	Citrus swallowtail or Christmas butterfly
		Graphium colonna	Black Swordtail
2	Nymphalidae	Danaus chrysippus	Plain Tiger or African Monarch
		Charaxes acuminatus	Pointed Pearl Charaxes or Mountain Pearl Charaxes
		Acraea sp.	Brush-footed butterfly
		Eurytela dryope angulata	Golden piper
3	Pieridae	Eronia cleodora	Vine-leaf Vagrant
		Belenois creona	African Common White
		Belenois thysa thysa	False Dotted Border

Families and species of birds

S$^{N.}$	Family	Scientific Name	Common English Name
1	Cisticolidae	Cisticolidae	Green-backed camaroptera
2	Pycnonotidae	*Andropadus importunus*	Zanzibar Sombre Greenbul
		Pycnonotus barbatus	Common Bulbul
3	Alcedinidae	*Halcyon albiventris*	Brown-hooded kingfisher
4	Ploceidae	*Ploceus velatus*	Vitelline masked weaver
5	Passeridae	*Passer domesticus*	House Sparrow
6	Columbidae	Columbidae	Emerald- spotted wood-dove

Families and species of dragonflies

S$^{N.}$	Family	Scientific Name	Common English Name
1	Libellulidae	*Brachythemis sp*	Dragonfly
		Palpopleura lucia	Lucia widow

Families and species of reptiles

S$^{N.}$	Family	Scientific Name	Common English Name
1	Agamidae	*Agama mossambica*	Mozambique Agama
2	Colubridae	*Lamprophis fuliginosus*	Brown house snake
		Philothamnus punctatus	Speckled Green snake
3	Lamprophiidae	*Psammophis sp*	Snake
4	Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated plated lizard

Families and species of mammals

S$^{N.}$	Family	Scientific Name	Common English Name
1	Erinaceidae	*Atelerix albiventris*	African hedgehog
2	Soricidae	*Crocidura sp*	White- toothed shrews
3	Herpestidae	*Mungos mungo*	Banded Mongoose
4	Muridae	*Mastomys sp*	Mullimammate rat

Families and species of amphibians

S$^{N.}$	Family	Scientific Name	Common English Name
1	Microhylidae	*Phrynomantis bifasciatus*	Banded rubber frog
2	Cichlidae	*Oreochromis nilotius*	Nile tilapia

Annex 3: Biodiversity solar toys

Annex 4: Questionnaires (English and Kiswahili version)

Biodiversity Awareness Pre-Questionnaire

Gender: Female Male Age: Class: School:_____

Q1. Have you ever heard of the term 'biodiversity'?
_____Yes _____No

Q2. What does 'biodiversity' mean?
_____

Q3. List 3 reasons why biodiversity is so important?

1. _____
2. _____
3. _____

Q4. List 3 causes of biodiversity loss?

1. _____
2. _____
3. _____

Q5. List 3 ways in which we can help to protect biodiversity?

1. _____
2. _____
3. _____

Dodoso la awali kuhusu Ufahamu wa Bioanuai

Jinsi: Kike Kiume Umri: Darasa: Shule:_____

SW1. Je, umewahi kusikia neno 'bioanuai?
_____Ndio _____Hapana

SW2. Nini maana ya neno 'bioanuai'?
_____

SW3. Orodhesha sababu 3 za umuhimu wa bioanuai:

1. _____
2. _____
3. _____

SW4. Orodhesha sababu 3 hatarishi kwa bioanuai, zinazofanya bioanuai kupotea au kupungua:

1. _____
2. _____
3. _____

SW5. Orodhesha njia 3 ambazo tunaweza kufanya ili kuhifadhi na kusaidia kulinda bioanuai:

1. _____
2. _____
3. _____

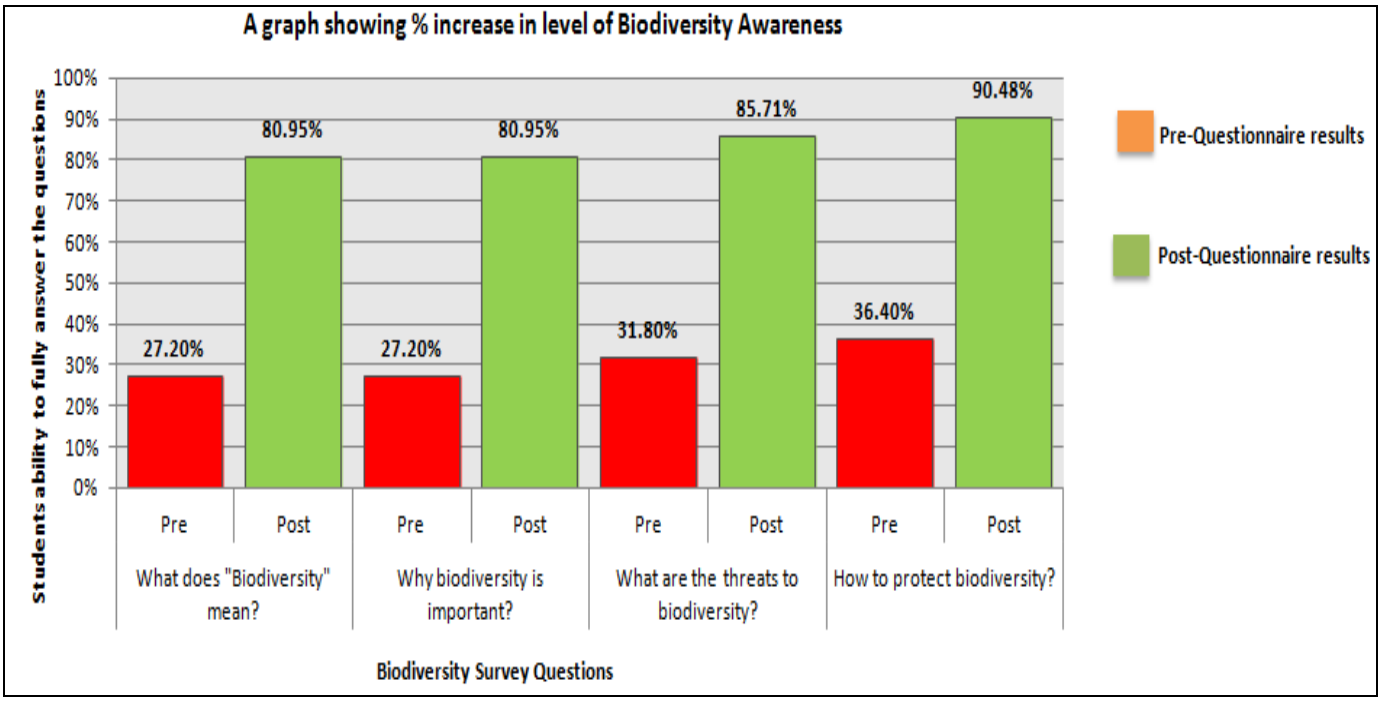
Annex 5: Biodiversity awareness campaign at schools

Annex 6: Students visit at the Quarry

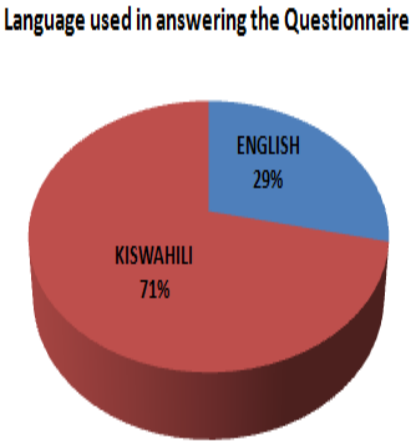
Annex 7: Youths and Women's group visit at the Quarry

Annex 8: Communication and Stakeholders involvement

Annex 9: Assessment of biodiversity awareness among students



Annex 10: Language used in answering questionnaires



School * Language Crosstabulation

Count

		Language		
		Kiswahili	English	Total
School	Primary School	11	0	11
	Secondary Schools	4	6	10
Total		15	6	21

Annex 11: Crafts submitted at the drawing and essay writing competition