

Nigerian Montane Forest Project

Annual Report



Introduction



The NMFP has continued to develop and make progress during 2008.

Highlights include meeting with the Governor of Taraba State, Danbaba Suntai and the Attorney General and Commissioner for Justice, Elijah Nyaro. The Governor has committed his support to the Project, and has assisted us in many ways (see below).

Student numbers are increasing, to the point where we need more accommodation. For visiting researchers and research students the idea is to build a few small chalets on the Project site. However in order to keep the site as unobtrusive as possible, we plan to build an accommodation block in Yelwa village. This will be especially necessary for students visiting on MSc field courses etc where we have up to 12 extra students visiting at one time. The State Government has pledged support for this building, which will also provide accommodation to the new Taraba State University biology students who will use the Research Station on a regular basis.

The research station is now the centre of a large area of fenced off forest edge, protected from cattle grazing and fire. Within this area we are monitoring natural restoration and experimenting with techniques to enhance natural rates of restoration. It is hoped that we will be able to expand our fencing and protect more forest edge. This initiative is funded by The North of England Zoological Society.

NMFP patrollers have been working with the Nigerian Conservation Foundation (NCF) patrollers on a regular basis. The groups go out on day patrols together and cover large areas of the forest. This is a positive move and has led to the sharing of information about hunters and illegal graziers. Hunting is still common in the forest, but not at the very high levels it was a few years ago. The patrols have come across chimpanzees on several occasions as well as a young buffalo.

The nursery school is almost complete, and the village is waiting for the onset of the dry season for final landscaping and finishing touches. It is planned that the Chairman of the Basic Education Board will be present at its opening in December 08 and that he will allocate Government accredited teachers to the school.

Dr Hazel Chapman

Director

Nigerian Montane Forest Project

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Nigerian Montane Forest Project

Mission Statement

To promote national and international commitment to the conservation of Nigeria's montane forests by inspiring excellence in research by postgraduate students and empowering local communities through employment and education.

Aims

1. To combine scientific research with education at both tertiary and local community level in order to develop long term sustainable management of Nigeria's montane forests.
2. To facilitate the involvement of national and international researchers in Nigerian montane forest research
3. To involve the community in the management of montane forest ecosystems
4. To work with the community in other ways, such as developing small businesses and working with schools to develop conservation awareness.

Partners and Sponsors

Project Partners

Aplori A. P. Leventis ornithological Institute Jos

Federal University of Technology, Yola

Gombe State University

Nigerian Conservation Foundation

Nigerian National Parks

Taraba State Forestry

University of Canterbury, NZ



NCF



Major Sponsors

Nexen Nigeria

A. P. Leventis Foundation

North of England Zoological Society

DHL Nigeria



Field assistants outside the field station, January 2008.

People

The success of the Nigerian Montane Forest Project reflects the dedication and enthusiasm of its staff, students and volunteers.

New Staff/Associates

This year we were able to employ three new staff. Hamadu Yusuf and Baban Yola are both now training to become field assistants and Saidu Isa is joining us to train the patrollers. Saidu has had a long history in the Project; he was a guide on the 2002 UC/NCF trek around the montane forests of Taraba State and has subsequently guided members of the Project on several trips to Gangerwal.

We are also very fortunate in having Professor Janette Wallis join the project as our primateologist. Janette is a faculty member of the School of Arts and Sciences at the American University of Nigeria, Yola. Her interest has taken her to many African countries. Presently she directs the Budongo field site in Uganda where her field assistants and students study chimpanzees. Janette has recently been elected as Vice President of Conservation for The International Primatological Society



Prof Janette Wallis investigating the rate of gut retention time in *tantalus* monkeys.



Hamadu Yusuf



Baban Yola



Saidu Isa

Industrial Training (IT) students

This year the NMFP hosted two IT students from Gombe State University. IT students spend six months working in an organisation in order to gain experience in the workplace. Sadique Abdullahi and Sulaiman Mohammad were exemplary students, they were with the project from April to September and contributed to all the field work going on in the project, and also helped organise the herbarium and worked with field assistants in data entry.

Visitors Diary

The Project had a record number of visitors this year.

- The Commissioner for Justice Barrister Elijah Nyaro (May 2008) inspected the Project as part of the Taraba State Government assessment of the Project.
- Prof. Janette Wallis, a primateologist from the Nigerian American University in Yola visited in December 07 and again in May 08. Prof. Wallis has been working with NMFP students involved in primate-related projects.
- Prof Stephen Goldson, an entomologist from AgResearch, New Zealand visited in December 2007. Stephen made a collection of ticks from local cattle, which will contribute towards International research into tick spread disease.
- Ten geography students from Gombe State University, accompanied by their lecturer Dr J.K. Nyangaji paid a visit to the Project in March 2008 as part of a field trip during which they also visited the Gashaka Gumti Primate Project (GGPP).
- In June eight Industrial Training (IT) students from the GGPP in Gashaka spent two days learning about the NMFP.
- Other visitors included Genesis, a student from university of Maiduguri and Harryson. H.Alpha.Principal of C.S.S. of Baissa Kurmi.Local Government Area.

Academic Supervisors

Dr Calustrus Akosim (FUTY) Wildlife management
Assoc. Prof. Jim Briskie (UC) Biology
Assoc. Prof. Jenny Brown (UC) Math and Statistics
Dr Hazel Chapman (UC) Evolutionary Ecology
Dr Raphael Didham (UC) Ecology
Dr Nicole Gombay (UC) Geography
Dr Jon Harding (UC) Fresh water ecology
Professor Dave Kelly (UC) Plant Ecology
Assoc. Prof. David Norton (UC) Forestry
Dr Ulf Ottoson (Leventis Conservation Institute, Aplori) Ornithology
Prof. Janet Wallis (American Nigerian University, Yola) Primatology

News



Sadique Abdullahi and Sulaiman Mohammad entering data as part of their IT experience.

Scholarships/ Fellowships

Samuel Temidayo (Dayo) Osinubi arrived at UC in July to take up his College of Science PhD scholarship. Dayo is working with Hazel Chapman and Assoc Prof Jim Briskie on habitat choice and evolutionary fitness in the double toothed barbet *Lybius bidentatus*. He is currently working at Ngel Nyaki, for his first field season. Dayo completed his MSc study in ornithology and conservation through the A. P. Leventis Ornithological Research Institute (APLORI) Jos. He has since been working with Birdlife International in Ghana and the Nigerian Conservation Foundation (NCF) in Lekki, Lagos.

Danladi Umar, a lecturer in biology at Gombe State University and a fresh water ecologist he is about to take up his three month Fellowship via Dr Jon Harding of the University of Canterbury. Danladi will work alongside Dr Harding to learn new skills and teaching techniques in freshwater ecology. Danladi arrives in New Zealand on November 4th 2008.

Charles Ensor has been awarded a Swedish Ornithological Institute grant to conduct a pilot study to investigate the role of bird pollination in Afromontane forest (May 2008). Later, in November 2008, Charles received a PhD scholarship, funded primarily by DHL Nigeria, to continue this research. Charles completed his MSc study in ornithology and conservation through the A. P. Leventis Ornithological Research Institute (APLORI)

Jos. Since then he has been based in Abuja working on Forestry .

Kennedy Poloma has been granted the first Gombe State University Research Fellowship to study the insects and their role in pollination of montane forest tree species. This will contribute to the pollination web being created as found in Ngel Nyaki forest (May 2008). Kennedy has an MSc in entomology and is a Biology lecturer at Gombe State University.

Fullbright scholar Josephine Beck is heading off to Borneo to study primate acoustics. Her award from Fulbright and the New Zealand Ministry of Research, science and Technology is worth about NZ\$33,000. (June 2008)

Training courses

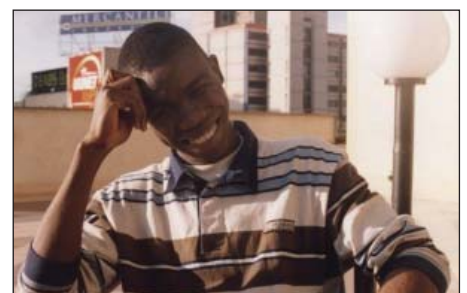
This year Musa Bawuro and Hamma Sima Ibrahim attended computer courses in Serti. The additional three computers at the field station (see below) means that each field assistant will eventually be able to manage their their own data.



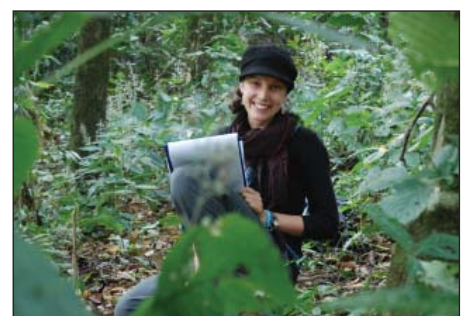
Danladi Umar



Kennedy Poloma



Samuel Temidayo (Dayo) Osinubi



Josephine Beck

Satellite email

The NMFP field station is about to be connected to the internet via a satellite link. Intersky Digital (based in Abuja) is installing the system, which should be running by mid October 2008. Funding for this has come from the State Governor, Mr Danbaba Suntai as a contribution towards the Project in recognition of its role as a tertiary education institute on the Mambilla Plateau. The State Government also donated three desktop computers, photocopy/printers, computing desks and a generator.

The Attorney General and Commissioner for Justice in Taraba State, Elijah Nyaro, has helped the Project greatly in arranging for the NMFP Director and other leaders to meet with the Governor.

New Collaborations

National Agency for Space Research and Development (NASRDA)

In September 2008 the Director, Hazel Chapman met with the Deputy Director of NASRDA, Dr J A Akinyede, to discuss collaboration in terms of mapping Nigeria's montane forests using GIS. It is anticipated that this work (undertaken as PhD research by Ralph Adewoye from the Forest Research Institute and the Forestry Department, University of Jos) will act as a pilot study for the future production of GIS based land resources maps for more of Nigeria.

Bioversity International

Bioversity International is an international research institute based in Rome, with a mandate to advance the conservation and use of genetic diversity. The NMFP has a contract with Bioversity International to collect leaf material of *Prunus africana* as part of a pan-African study of the population genetic diversity of this important species. The aim of the study is to apply genetic diversity information towards the management and regeneration of *P. africana*.



Cross-section of participants at the World Environment Day celebration at the Sardauna Local Government, Gembu.

AgResearch Ectoparasite Research

Rhipicephalus (Boophilus) microplus is an invasive tick species that occurs in south eastern regions of Africa but is yet to be recorded in Nigeria. This tick has the ability to vector significant diseases of cattle. *Rhipicephalus (Boophilus) microplus* is considered to be more dangerous than *Rh. (Bo.) decoloratus* which occurs in Nigeria due to its ability to transmit both *Babesia bovis* and *Babesia bigemina*. In comparison *Rh. (Bo.) decoloratus* transmits only *Ba. bigemina*, the less pathogenic of the two protozoans.

Prof Stephen Goldson, an entomologist from AgResearch, New Zealand made a collection of ticks from local cattle on Mambilla. Dr Scott Hardwick, also of AgResearch identified them. To date no *Rh. (Bo.) microplus* have been found. However, four other species, *Amblyomma variegatum*, *Rh. (Bo.) annulatus*, *Rh. (Bo.) decoloratus* and *Hyalomma truncatum*, of tick have been recorded in samples.



Stephen and Mohammed setting up tick collecting equipment.

Patrolling and Conservation

Joint patrols with NCF

The NMFP patrollers and key field assistants have begun joint patrols of Ngel Nyaki and Kurmin Danko forests with the NCF (Nigerian Conservation Foundation) patrollers. These joint patrols are working well, and together the NCF and NMFP efforts are reducing hunting/poaching in Ngel Nyaki. However, illegal hunting is still very prevalent, as are cattle in the Reserve.

World Environmental Day

World Environment Day, commemorated each year on 5 June, is one of the principal vehicles through which the United Nations stimulates worldwide awareness of the environment and enhances political attention and action. The World Environment Day slogan for 2008 was "Kick the Habit! Towards a Low Carbon Economy". In Gembu it was run by NCF and was well attended. The NMFP donated forty (40) tree seedlings of different species from the nursery at Ngel Nyaki for planting in the Council Headquarters and environs. Our seedlings complimented over 100 seedlings donated by other forest-edge communities.



A joint NCF, NMFP patrol.



The new nursery school, July 08.

Nursery school and bore hole for Yelwa village

The nursery school, funded by a grant to the NMFP through Exxon Mobil, is now complete and just about ready for the first intake of students. The school has four classrooms, an office block and water supply via a bore hole. The Governor of Taraba State, has been invited to open the school in early December 2008. It is planned that Exxon Mobil representatives will attend. Special thanks goes to Robert Warren of Exxon Mobile Nigeria, for his role in fundraising.

As a sequel The State Government Board of Basic Education has been approached for teachers for the school and also for their commitment to ensure the growth and development of the school on an annual basis.

Postgraduate field Course

In December 2007 the NMFP ran its second field course at Ngel Nyaki on Biodiversity and Taxonomy for Federal University of Technology (FUTY) M. Tech. Wildlife Conservation and Management students postgraduate students. This year the course included a visit to Ndongo Ngishi, a village at the bottom of Ngel Nyaki Reserve to highlight the potential conflict between cattle herders, farmers and conservation.



Students from FUTY learn about the nursery at Ngel Nyaki. The nursery is growing several IUCN endangered tree species.

Forest Restoration



Summary

During 2007 and 2008 the Project spent a major proportion of the North of England Zoological Society allocation in the development of the forest nursery as well as investigation into forest restoration. The aim of both of these initiatives is to optimise approaches for ecosystem recovery.

In the nursery studies were carried out to determine the germination potential and germination rate, under different treatments (depending on species) of 40 montane forest tree species. Furthermore 600 tree seedlings have been planted in fenced off grassland adjacent to nearby Ngel Nyaki forest.

In addition experiments have commenced to monitor natural regeneration in a 3 ha fenced-off area close to the field station. Experiments are also underway to determine the influence of cleared areas (low competition) on the probability of naturally dispersed seed germinating and surviving to the seedling stage.

Background and overall aim

Starting in 2006 investigation began into:

- Techniques for the establishment in the nursery of the local montane forest tree species which could later be planted out into fenced off/unburnt grassland habitat.
- The potential for natural restoration of montane forest tree species through seed dispersal into fenced off/unburnt grassland.

Nursery

Every month since November 2006 fruit from forest trees have been collected from as many species as possible. Within each species at least 40 fruit have been collected from six individual trees. Thereafter a photograph illustrating fruit colour and size is taken as well as the seed contained therein. Length and diameter are measured for each of 40 fruit and 40 seeds. Fruit type (drupe, berry etc.) is recorded.

The seeds are then either

- Sown directly into polypots to a depth of approx. +/- 2cm, 1 seed / polypot (control).
- Scarified by gentle abrasion with sandpaper (treatment 1).
- Soaked for 24 hours in stream water (treatment 2).
- Dipped in to boiling water (treatment 3) prior to sowing as described for the control.

The control (20 seeds) and treatment (20 seeds) are arranged in a random design in the nursery and are moved around once a week.

Initially a control and treatment a) scarification only was carried out and the experiment terminated after 6 months.

The experiment has been checked daily and date of first germination recorded, from which number of days to germination is calculated.

Table 1 is a summary table of the work so far.

Species	% germinating	
	Control	Scarified
<i>Albizia gummifera</i>	0	30
<i>Anthonotha noldeae</i>	100	50
Augustine F	85	0
<i>Beilschmiedia mannii</i>	5	20
<i>Bridelia speciosa</i>	80	80
<i>Campylospermum</i>	40	5
<i>Carapa grandiflora</i>	95	0
<i>Celtis gomphophylla</i>	5	25
<i>Chrysophyllum albidum</i>	30	10
<i>Chrysophyllum albidum</i>	0	0
<i>Clausena anisata</i>	85	0
<i>Dasylepis racemosa</i>	0	5
<i>Dombeya ledermannii</i>	0	0
<i>Entandrophragma angolense</i>	45	0
<i>Entandrophragma angolense</i>	0	160
<i>Eugenia gilgii</i>	30	100
<i>Garcinia smeathmannii</i>	20	70
<i>Guarea</i> sp	0	5
HMC 744 New (species)*	0	0
HMC 825	0	80
HMC744	30	30
HMCB	100	95
<i>Isolona cf deightonii</i>	40	65
<i>Lovoa trichilioides</i>	0	0
Moraceae	35	20
<i>Newtonia buchananii</i>	55	25
<i>Parkia filicoidea</i>	0	0
<i>Pouteria altissima</i>	5	0
<i>Prunus africana</i> (sand vs non)	10	0
<i>Psorospermum corymbiferum</i>	0	10
<i>Psychotria peduncularis</i>	15	5
<i>Pterygota mildbraedii</i>	0	0
<i>Rauvolfia vomitoria</i>	0	0
<i>Rothmannia urcelliformis</i>	100	10
<i>Santiria trimera</i>	5	5
Shrub x	85	0
<i>Sterculia</i>	20	25
<i>Strombosia scheffleri</i>	85	35
<i>Symphonia globulifera</i>	15	55
<i>Synsepalum</i>	0	15
<i>Syzygium guineense</i>	0	90
<i>Trichilia welwitschii</i>	10	45
<i>Trilepisium madagascariense</i>	75	90
<i>Vitex doniana</i>	5	0
<i>Voacanga bracteata</i>	0	0
<i>Zanthoxylon leprieurii</i>	0	0

For species that did not germinate under the control conditions or scarification treatment, the experiment was being repeated with treatments b) (soaking) and c) (boiling). In addition from hereon experiments will be maintained for two years.

As another component of the work 600 seedlings from the above experiment and other work on primates germination experiments were sown into the fenced off area round the field station Table 2 and Table 3.



An experiment into the effect of scarification on seed germination.



The research station manager, Danladi Umar talking to Augustine Ntim and the IT students about the nursery.



Non-fenced (left) vs fenced during the wet season.



Table 2 Seedlings sown July 2007 and number surviving in August 2008.

Species	No. planted	No. surviving
<i>Polyscias fulva</i>	31	30
<i>Ficus</i> sp.	29	23
<i>Deinbollia</i> cf <i>pinnata</i>	39	30
To be identified	26	23
<i>Santiria trimera</i>	25	23
<i>Carapa grandiflora</i>	14	11
<i>Newtonia buchananii</i>	14	12
<i>Eugenia gilgii</i>	29	10
<i>Clausena anisata</i>	19	25
<i>Isolona</i> cf <i>deightonii</i>	17	16
<i>Syzygium guineense</i>	20	14
<i>Garcinia smeathmannii</i>	22	20
To be identified	15	17
<i>Gauria</i>	1	0
To be identified	30	20
Total	331	274



Scarified vs non-scarified seeds.

Table 3 Seedlings sown August 2008

Species	No. planted	Mean height
<i>Macaranga occidentalis</i>	34	45.5
<i>Anthonotha noldeii</i>	17	43.3
<i>Trilepesium madagascariense</i>	34	38.2
<i>Entandrophragma angolense</i>	17	17.4
<i>Carapa grandiflora</i>	46	35
To be identified	16	23
Total	164	

Student Projects

The potential for natural seed dispersal in the restoration of West African montane forest.

Delyse Campbell. MSc UC

Start date November 08.



Delyse with field assistants

Alternative land use is causing widespread deforestation around the world. Tropical areas are particularly vulnerable to such impacts. Increasing carbon emissions and the greater effects of global climate change are altering natural systems at a rate previously unforeseen. The importance of forest restoration has never been more important.

There is increasing interest among restoration ecologists as to the role of natural seed dispersal in restoration ecology. Often (but not necessarily so) natural seed is dispersed into deforested areas, so that if management were appropriate, natural restoration would occur.

One area (typical of many situations) where forest restoration is being considered as a management option is Ngel Nyaki Forest Reserve; North East of Nigeria, Africa. This forest will be used as a model system to investigate natural seed dispersal and its potential as a tool for forest restoration. Ngel Nyaki montane forest, has suffered from severe deforestation, and is now surrounded by heavily grazed and burnt tussock grasslands.

The main aims of the research are firstly, to investigate the potential for naturally dispersed seed (through frugivore/wind mediated dispersal, or secondary dispersal eg. ants or rodents) to enter grassland and secondly to quantify seed, seedlings and saplings at increasing distances away from the forest edge. Experiments will also be carried out to investigate the effect of different treatments 'management techniques' on establishment.

Objective 1

To identify and quantify seed rain of forest species at increasing distances from the forest edge into open grassland.

Objective 2

To determine the potential for natural regeneration in fenced off grassland which is protected from grazing.

Objective 3

To experiment with different treatments (such as burning and grazing) to remove competition and facilitate ecosystem recovery.

Tantalus monkeys *Chlorocebus tantalus* and seed dispersal.

Fiona Agmen BSc Hons (UC)

Start date Dec 07



The research objective has been to determine the role of the Tantalus monkey, *Chlorocebus tantalus* in seed dispersal in and around Ngel Nyaki Forest, Mambilla Plateau, Nigeria. This is the first time that a study on the feeding behaviour of *C. tantalus* has been undertaken in a montane forest. *C. tantalus* is the only primate in the area the regularly crosses open grassland and visits forest fragments, meaning it may play a significant role in forest regeneration. Species' seed dispersal options are limited by frugivores maximum gape width. *C. tantalus* has a large gape width, giving them the potential to disperse large seeded species, as well as a range of smaller seeded species. The information gained from this study will contribute to our understanding of dispersal limitations, and provide information about the potential for *C. tantalus* to re-introduce species from the main forest back into the fragments, aiding in the overall Ngel Nyaki project aim of forest regeneration.

Specifically the aims have been to:

- 1 Identify which fruit tree species *C. tantalus* feeds on in the fragments and in the forest.
- 2 Test the effect of gut passage through *C. tantalus* on seed germination
- 3 Determine the relative importance (effectiveness) of *C. tantalus* in the dispersal of two large seeded and two small seeded tree species in the fragments relative to other frugivores.
- 4 Investigate the potential for *C. tantalus* to move seed from Ngel Nyaki forest back into depleted fragments.
- 5 Determine the gut retention time of *C. tantalus*

The research was carried out in Ngel Nyaki Forest and surrounding fragments during the dry season of December-January 2007/08. A colony of about 20 individual *C. tantalus* monkeys was located to the north of the Nigerian Montane Forest Project field station. Their feeding behaviour was observed in 15 minute blocks, using binoculars to monitor the group, so as to cause minimal disturbance. Records were kept of the types of individual feeding (i.e. male, female, subadult, juvenile, infant) type of food (species and part of plant) and their location, as well as notes on general behaviour. To date, the colony has been observed for 197.5 hours, with data collected between 7.30am – 12pm, and 3pm – 5.30pm as this is when *C. tantalus* is active. This observation will continue until April to gain additional data. When analysed, this data will show the proportion of fruit compared with other food (eg. leaves or insects) in the diet, and the proportion of time spent feeding in the main forest compared with the fragments.

C. tantalus faeces were collected opportunistically from the surrounding grasslands of the forest and fragments,



Tantalus monkey

and will continue to be collected until April. Faeces were washed and sieved to obtain, identify, count and measure seeds within them. This helps to give a clearer picture of what species *C. tantalus* are consuming as feeding on some plant species may not be obvious by observation. Additionally, seeds collected from faeces are now being used to investigate the effect of gut passage on germination. Germination experiments are being conducted in a shaded outdoor nursery, with three treatments being planted and tested for five species – 20 seeds from *tantalus* faeces, 20 seeds which had been hand cleaned from fruits, and 20 whole fruits to represent dispersal limitation. The pots will be monitored daily for the emergence of new seedlings, with the weekly height of seedlings being recorded.

Using GPS, forest and fragment edges of the area the colony moved in we mapped in order to estimate the extent and rate of animal movement. In collaboration with Dr Janette Wallis from American University of Nigeria, Yola, Nigeria, data were collected on gut retention times using two caged *C. tantalus* housed at AUN. Initially the monkeys were fed 20 plastic markers each, of one colour, placed into a single banana. However, the success rate of markers ingested appeared to be low, with the monkeys visibly spitting out several markers. Therefore a different technique was used of placing two markers in a raisin, and placing the ten raisins into the banana which was then fed to the monkey. The markers were fed over two consecutive days, with three bananas being fed to each individual per day. The cage was monitored from sunrise to sunset, with the time of each defecation event recorded, and the faeces collected and sieved to identify the markers. Analysis of this data gave a mean retention time of 30 hours (SD = 13.0; range: 12.8-66.5), and by combining this information with the above mentioned GPS data, it is hoped to determine the potential for *C. tantalus* to spread species from the main forest to the fragments.

Of the five aims planned to achieve, aims 1, 2, 4 and 5 are likely to be fulfilled once data analysis has been completed. The third aim, examining *C. tantalus* compared to other frugivores, has proven to be impractical due to there being few species fruiting and time constraints.

Reproductive mutualisms in two Afrotropical mistletoe species – *Agelanthus brunneus* & *Globimetula braunii*

Kerry-Anne Weston MSc (UC)

Start date Nov 07



Plant-animal interactions, such as pollination and dispersal systems are under increasing threat from anthropogenic change. To assess the level of threat to these reproductive mutualisms and best manage these threats it is vital to have a species and system-specific understanding of plant reproductive ecology.

The aim of this project is “to investigate the reproductive ecology of two Afrotropical mistletoe species - *Agelanthus brunneus* and *Globimetula braunii*”

The specific objectives of the research are to:

1. Evaluate the breeding system of both mistletoe species
2. Investigate pollination:
 - Assess the relative visitation rates of different flower visitors
 - Evaluate the relative effectiveness of different flower visitors as pollinators
3. Investigate dispersal:
 - Assess fruit ripening and removal rates
 - Identify agents of dispersal

Methods

Pollination

- To assess relative visitation rates of different flower visitors >100 hours of observations at replicate mistletoe plants along the forest edge were carried out. Ripe buds and open flowers on observation plants were counted and subsequently mean visitation rates were calculated for all flower visitors.
- To evaluate the relative effectiveness of different flower visitors as pollinators selected 30 ripe flower buds were selected on each study plant and divided evenly amongst the following three treatments:
 1. Bagged: Ten tagged ripe buds were enclosed inside a bag to exclude all pollinators and assess whether buds were

capable of a) self-opening and b) apomixis or autonomous self pollination resulting in the production of fruit in the absence of pollinators.

2. Caged: A cage was secured around ten tagged ripe buds to exclude avian pollinators but allow insect pollinators access. This treatment enabled the comparative role of insect and avian pollinators to be assessed.

3. Natural: These ten ripe buds were tagged and left accessible to all pollinators as a control to measure natural flower opening and fruit set rates.

Dispersal

- Fruit ripening and removal rates from individual mistletoe plants were then recorded to identify potential dispersal limitation.

Preliminary results

Pollinators

The only pollinators observed visiting the mistletoe plants were honeybees and four species of sunbirds (Table 1.)



Role of pollinators

- *A. brunneus* required pollinators (either sunbirds or insects) to open flower buds exhibiting an obligate flower-opening mutualism, whereas *G. braunii* flowers were able to self-open (in the absence of pollinators) approximately 50% of the time (Figs. 1 & 2).
- *A. brunneus* was able to set fruit in the absence of pollinators (suggesting the ability to self-fertilise or undergo apomixis inside a closed bud), whilst *G. braunii* was totally dependent on sunbird visitation for fruit set (Figs. 3 & 4).

Upcoming work

This field season at Ngel Nyaki hand pollinations on the flowers of both mistletoe species will be carried out to evaluate further the breeding systems and test for

Species	<i>A.brunneus</i>	<i>G.braunii</i>
Western olive sunbird*	+	+
Northern double-collared sunbird*	+	+
Variable sunbird	+	+
Green-headed sunbird	-	+
Honey bees	+	-

Avian Pollination in an African Montane Forest.

Charles Ensor

Summary of report on the Swedish Ornithological Institute supported pilot study for PhD Thesis



Charles looking at a fire lily, April 08.

Abstract

Three Montane forest fragments of varying degrees of degradation were monitored to investigate avian biotic pollinators of two montane forest trees, *Anthocleista vogellii* and *C. macrostachyus*. A total of 24 bird species from ten (10) families and (14) genera across the three habitats were recorded as visitors of *A. vogellii*. Of the 24 bird species only 15 were actually pollinating, 21 bird species from 10 families were found to visit *C. macrostachyus* in all the fragments. Sunbirds were found to be the major agents of avian pollinators.

Statistics revealed no significant difference in number of avian visitors in the three fragments for *C. macrostachyus* and showed a significant effect in *A. vogellii*. Orange Tufted sunbird was the most common and most active pollinators for both plant species. Some bird species showed a tendency towards selecting for a less degraded habitat or fragment than others. Although statistically similar, results show that with time if palliative measures are not taken, there will be a limitation in the number of avian pollinators in some of the fragments due to disturbance. This was evident in the number of individual species recorded in some fragments as opposed to others. There was a significant effect of time of day on bird visit to *A. vogellii* while no significant effect was observed on *C. macrostachyus*.

Vegetation parameters showed a strong correlation with the number of flowers visited by some avian species and interactions were highly significant. Some avian species showed some aggregative response in areas where they occurred with closely related and other flowering plants. Habitat preference could be a selective force in pollinator activities and success.

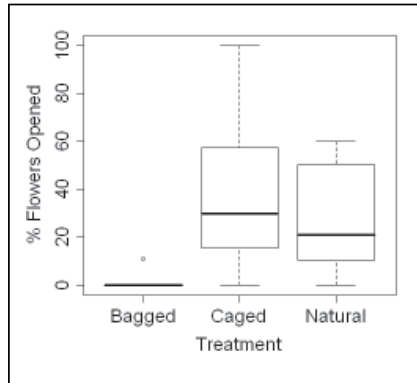


Fig. 1: Mean % flower opening in mistletoe species *Agelanthus brunneus*. Highly significant treatment effect on flower opening (Binomial GLM; $p < 0.001$)

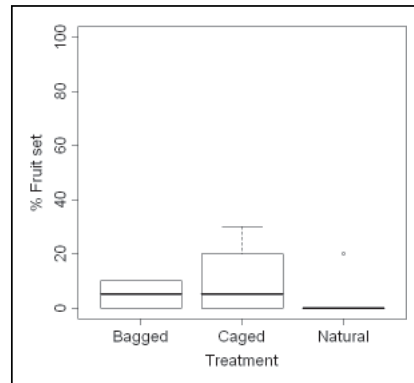


Fig. 3: Mean % fruit set for mistletoe species *Agelanthus brunneus*. No significant treatment effect on fruit set (Binomial GLM; $p > 0.05$)

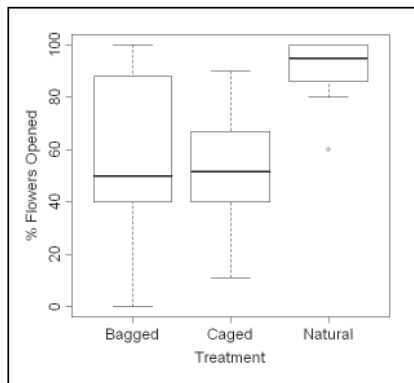


Fig. 2: Mean % flower opening in mistletoe species *Globimetula braunii*. Highly significant treatment effect on flower opening (Quasi-binomial GLM; $p < 0.001$)

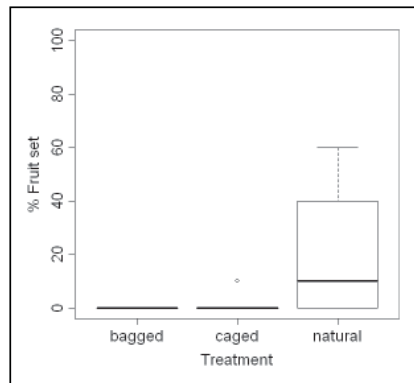


Fig. 4: Mean % fruit set for mistletoe species *Globimetula braunii*. Highly significant treatment effect on fruit set (Binomial GLM; $p < 0.001$)

pollen limitation. There will also be further investigation into the role of individual sunbird species in pollination and the role of dispersers in the germination of seeds will be assessed.

Summary

To date important reproductive mutualisms in the pollination systems of two afro-montane mistletoes *Agelanthus brunneus* and *Globimetula braunii* in Ngel Nyaki Forest Reserve have been identified. The local sunbird population plays a vital role in flower-opening and subsequent pollination of the mistletoes illustrating the overall importance of plant-animal interactions in maintaining plant reproductive services and ecosystem functioning.

Table 1. Summary of Avian activities on the Focal Plant Species

S/N	Species	Genus/Species	Family	No. Ant	No. Cro	Host Tree	Status
1	Northern Double -Collared Sunbird	<i>Cinnyris reichenowi</i>	Nectariniidae	42	5	C/A	Actv .Poll
2	Orange -Tufted Sunbird	<i>Cinnyris congensis</i>	..	258	49	..	Actv Poll
3	Green- Headed Sunbird	<i>Cyanomitra verticalis</i>	..	52	4	..	Poll
4	Pygmy Sunbird	<i>Hedydipna platyura</i>	..	35	8	..	Poll
5	Collared Sunbird	<i>Hedydipna collaris</i>	Poll
6	Copper Sunbird	<i>Cinnyris cupreus</i>	Poll
7	Beautiful Sunbird	<i>Cinnyris pulchellus</i>	..			A	Poll
8	Bannerman's Weaver	<i>Ploceus bannermani</i>	Ploceidae			C/A	Poll
9	Veilots Black Weaver	<i>Ploceus nigerrimus</i>	..			C/A	Poll
10	Village Weaver	<i>Ploceus cucullatus</i>	..	97	15	C/A	Actv Poll
11	Spectacled Weaver	<i>Ploceus ocularis</i>	..			A	Poll
12	Slender billed Weaver	<i>Ploceus pelzelni</i>	..			A	Poll
13	Baglafaecht Weaver	<i>Ploceus baglafaecht</i>	..			A	Poll
14	Common Bulbul	<i>Pycnonotus barbatus</i>	Pycnonotidae	55	19	C/A	Poll
15	Yellow -Throated Leaf love	<i>Chlorocichla flavicollis</i>	..			C/A	Visitor
16	Yellow-Breasted Boubou	<i>Laniarius atroflavus</i>	Malaconotidae			C/A	Visitor
17	Tropical Boubou	<i>Laniarius aethiopicus</i>	..			A	Visitor
18	Double-Toothed Barbet	<i>Lybius bidentatus</i>	Capitonidae			A	Visitor
19	Yellow-Rumped Tinkerbird	<i>Pogoniulus bilineatus</i>	..			C/A	Visitor
20	Speckled Mousebird	<i>Colius striatus</i>	Coliidae			..	Poll
21	Yellow White-eye	<i>Zosterops senegalensis</i>	Zosteropidae			..	Visitor
22	Black- Collared Apalis	<i>Apalis pulchra</i>	Silvidae			..	Visitor
23	African Blue Paradise Flycatcher	<i>Terpsiphone viridis</i>	Muscicapidae			..	Visitor
24	Black-Crowned Waxbill	<i>Estrilda nonnula</i>	Estrildidae			..	Visitor

A preliminary pollinator web in a West African montane forest.

Kennedy Poloma

Post Doctoral Researcher from Gombe State University.

Dr Poloma is concentrating on the entomology of the pollination web. A grant from Gombe State University has allowed him to spend time using the Ahmadu Bello University of Zaria insect collection. Through this almost all the insects observed pollinating have been identified.

Preliminary (1st year) data are being analysed. To date fifteen (15) species of tree, ten trees per species, have been observed for twenty hours each. The length of time each pollinator visits a flower in any 10 min period is recorded. From these data an idea of the will be obtained of relative importance of different insect visitors as pollinators of each tree species. Two full time field assistants, Markson Marcus and Salihu Christopher are employed for this project.



Pollinating insects

Interplay of Habitat Quality & Heredity on Individual Fitness

Samuel Temidayo Osinubi PhD (UC)

This project will assess the influence of habitat quality (availability of food and other necessary resources) on a variety of physiological and behavioural traits that affect the survival and reproductive success of the Double-toothed Barbet, a species widely found in sub-Saharan Africa. Barbets will be studied in a rare and threatened habitat – the Afro-Montane forest areas. The project will compare the feeding, nesting, daily movements and resultant fitness (growth rate and survivability) of barbets between two forest types at the Ngel-Nyaki Forest Reserve in Nigeria – the main forest block and gallery/riparian forest fragments. The objective is to understand how different types of forest habitat affect the barbet fitness. Such information is crucial for understanding the habitat requirements for the conservation of this and other African forest birds.

This project will enable the identification of optimum habitats and key species-specific preferences of barbets. This information will then be used to develop guidelines for the conservation of barbets in marginal habitats. The objectives include:

- To locate foraging sites and identify factors influencing the choice of foraging habitat for the Double-toothed Barbet, *L. bidentatus*.
- To locate nests and identify factors influencing the nest site selection of the Double-toothed Barbet, as well as observe breeding behaviour.
- To assess the extent and direction of daily movement patterns and site fidelity of the Double-toothed Barbet between forest habitat types.
- To assess the level of individual fitness of Double-toothed Barbets within two forest habitat types.
- To observe the influence of forest habitat quality on the reproductive success and reproductive strategies of Double-toothed Barbets.



Double tooth barbet. Photo by Tony Disley.

Evolution of Breeding System in *Anthonotha noldeii*

Merodie Beavan UC Volunteer Project

Though never found elsewhere in West Africa, the tree species *Anthonotha noldeii* is prevalent at Ngel Nyaki and consequently an important species in this ecosystem and for conservation. General observations suggest that flower morphology is variable. *Anthonotha* flowers prolifically but produces very few fruits, perhaps due to predation of immature fruits by monkeys or the costliness of its large seed pods. Very little is known about the ecology of *Anthonotha* so conducted some preliminary research was conducted to investigate its reproductive biology. The following was considered:

1. whether flower morphology differs between trees?
2. to what extent does *Anthonotha* require biotic pollinators?
3. what is the role of birds versus insects in pollination?
4. how many fruits are produced?
5. what the fates of those fruits?

To investigate floral morphology 20 open flowers from 20 trees were randomly collected during a heavy flowering period. Data were collected regarding the number of petals and stamens within each flower and the length of the male and female reproductive parts.

An ANOVA revealed a highly significant difference in style length between trees ($F_{19,379} = 15.39, p < 0.001$). Some trees have mostly longer-styled flowers while others have mostly shorter-styled ones. A few trees have both (Fig. 2). There appears to be two morphs (Fig. 1) where style length is almost always short (<10 mm) or long (>20 mm) (Fig. 3). In contrast (and unusually), stamen length is normally distributed. Thus, there appears to be some sort of stigma-height dimorphism, perhaps indicating an unstable breeding system such as andromonoecy.

In our pollination experiment, flowers that had short styles failed to produce any fruit and consequently appear to be functionally 'male'. In this experiment, 50 flowers in 10 trees were hand self-pollinated, hand cross-pollinated, caged (to exclude birds), bagged (to exclude all pollinators), or tagged but not manipulated (natural fruit set). Fruit set was very low with an average of only 2% of flowers producing fruits across treatments (6% in natural flowers). 'Natural' flowers produced significantly more fruits than caged flowers suggesting that birds are important pollinators for *Anthonotha* flowers (see Fig 4).

A large proportion of *Anthonotha* flowers appear to be aborted. Consequently, the proportion of flower success was investigated

on the same 20 trees examined for floral characteristics. The proportion of long-styled versus short-styled morphs were also examined to determine whether trees with mostly long-styled morphs produce more fruits. Fruits were tagged on these branches and tracked weekly to determine whether a high proportion survive through to maturity and consequently disperse seeds, or whether they are removed by predation. Overall, only 1.1% of flowers produced fruits and trees that were predominately hermaphrodite had higher fruit set. Fruits take several months to mature so data regarding the fates of these fruits is still being collected.

Anthonotha appears to have an unusual and probably unstable breeding system, with low seed output. It is reliant on biotic pollinators, particularly birds, to produce fruit so the decline or extinction of bird pollinator populations (e.g. sunbirds) would likely have a devastating effect on the conservation of this rare species. Further research to investigate its reproductive strategy in more depth would be greatly beneficial in increasing our

understanding of the ecological factors and mutualisms supporting *Anthonotha* and would provide implications for management practices to prevent this special species from going extinct.

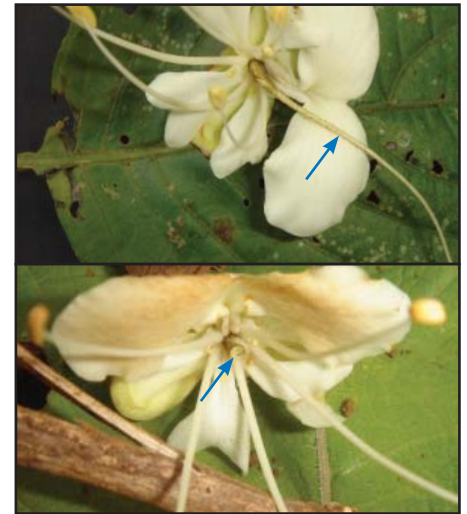


Fig. 1: *Anthonotha noldeii* flowers: long-styled morph - hermaphrodite (top) and short-styled morph - 'male' (bottom)

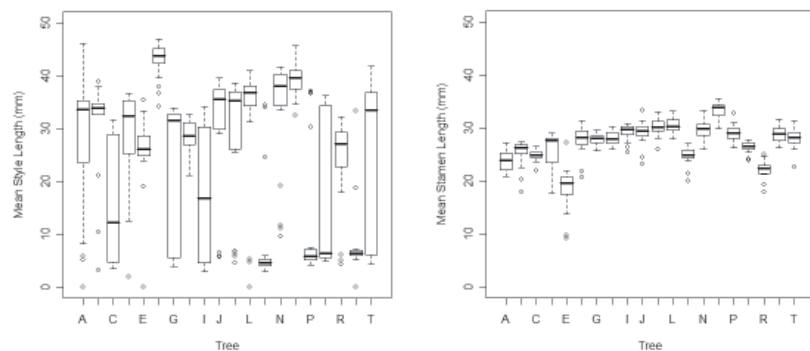


Fig. 2: Distribution of style length (left) and mean stamen length (right) of flowers sampled from 20 trees.

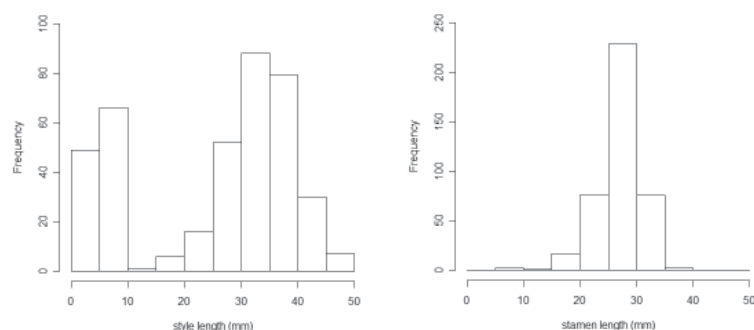


Fig 3: Frequency distributions of styles (left) and stamens (right) from flower samples from each of 20 trees.

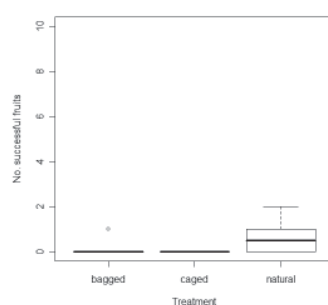


Fig 4: Number of fruits produced out of 10 flowers in each treatment (hand pollinated treatments removed because fragility of flowers caused death in hand manipulated treatments)

Remote sensing and geographical information system application to forest biodiversity assessments of Ngel Nyaki montane forest and its associated fragments

Ralph Adewoye



is waiting on confirmation of funding from at least one of several grants he has applied for, in order to begin his PhD work: Remote sensing and geographical information system application to forest biodiversity assessments of Ngel Nyaki montane forest and its associated fragments

No GIS survey has been carried out around Ngel Nyaki forest reserve, yet this sort of survey would provide valuable base-line data for future biological work.

Objectives of study

To:

1. Determine the current land cover and land use around Ngel Nyaki Forest using satellite imagery.
2. Identify and delineate Ngel Nyaki Forest and its associated riverine fragments from satellite imagery and aerial photographs.
3. Determine the reduction in forest cover and identify land use changes in the area over the last 30 years.
4. Determine the vegetation diversity within the delineated forest and fragments.
5. Determine the soil properties of the study area under different land use
6. Determine the relationship between soil properties and the vegetation distribution of the study area.
7. Produce a vegetation and soil map of the study area.
8. Make necessary recommendations regarding land use in relation to forest management.

It is envisaged that this project will be the beginning of a more wide ranging GIS survey of Mambilla Plateau.

Medicinal properties of trees used as medicines within Ngel Nyaki Forest Reserve.

Aliyu Buba Lecturer at University of Jos PhD (U Maiduguri) Nov 2007

Summary

Extract from the stem, bark and leaves of key tree species within Ngel Nyaki forest will be analysed for the presence or absence of phytochemical constituents such as tannins, alkaloids, resins, saponins, triterpenes, coumarin and some steroids. The toxicity of these species will be investigated by administering extracts orally on Swiss albino mice to determine the mortality rate. This will undertaken under laboratory conditions using lethal dose (LD₅₀) in mice.

Anti-microbial / bacterial properties will be tested against type strains of fungi, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas* sp., *Salmonella* sp., *Bacillus subtilis* and clinical isolates of *Staphylococcus* spp., using agar diffusion techniques. The extracts will inhibit the growth or otherwise of the organisms listed above.

Aliyu Buba has spent time at Ngel Nyaki collecting plant material and is currently analyzing his data.

The role of putty nose monkeys (*Cercopithecus nictans*) in forest restoration.

Tengku Rinalfi Putra Ibn Tengku Azizan PhD (UC) Start date November 2008



The study will build on the work of Stephen Gawaisa. It will be carried out in two parts. The first part is a survey to determine the number of putty nose monkey in groups and individuals in the study area as well as to identify the group structure and behavior.

This will then be followed by the focal study of seed predation by the monkeys and will involve detailed documentation of feeding behaviour, dispersal of plants seeds and survival of dispersed seed in order to determine the effect of putty nose monkeys on forest regeneration.

Fulani pastoral practices around the Ngel Nyaki Forest Reserve

Martin Korndoerfer MSc Environmental Science UC Start Date October 2008



Introduction

The Ngel Nyaki Forest Reserve is located on the western edge of the Mambilla Plateau, Taraba State in eastern Nigeria. This Forest is one of few remaining fragments of Afromontane forest on the Plateau that was once very widely distributed. Pressures of an ever-increasing population presence on the plateau with its slash-and-burn agriculture and cattle rearing have led to forest being restricted to a small remnants found in steep gullies along streams and on other marginal land.

Environmental assessments from the 1960s even then reported high cattle stocking rates on the Mambilla Plateau and saw the results of overgrazing like gullying and landslips. In the process of making the Ngel Nyaki forest a protected reserve, farming and grazing was banned within its perimeter. However, slash-and-burn agriculture, pasture burning and intensive grazing is still occur along the boundaries of the reserve. The current fire regime is especially worrisome, as fire does not stop at boundaries; only vegetation in gullies is safe and therefore able to regenerate.

Furthermore, frequently cattle are spotted within the reserve perimeter and conspicuous damage through trampling and browsing has been recorded. The herders found in the reserve are sometimes produce pieces of paper that apparently authorize them to use the reserve for grazing, but which is nevertheless illegal and concerns local authorities. Herders that are caught and arrested are regularly released after the relevant officials are paid a bribe.

Therefore, for the continued protection of the reserve it is crucial that knowledge is gained about the pastoral management practices of the Fulani, about the specific movements of

cattle (especially dry-wet season alterations) and the reasons for such management practices and cattle movements. It can be expected that these drivers will include biophysical and socio-economic reasons, which is why for sustainable management both have to be understood and factored-in.

Objectives

The main objectives of this thesis will be:

1. investigating the status quo of pastoral management among the Fulani in this area
2. mapping the area with GIS and remote sensing (land ownership, cattle movements, rivers, landmarks, towns etc.)
3. analysing the biophysical and socio-economic drivers behind cattle grazing patterns

Specifically will test the hypotheses:

Next to nothing is known about the grazing patterns of the Fulani cattle in the area although these impact severely on conservation efforts in the area it is urgent that these gaps be filled. As for the grazing patterns, little is known about the wider pastoral management practices among the Fulani and therefore an advance in knowledge would greatly benefit the sustainable management of the conservation project and the region. Through creating lasting electronic maps employing GIS and remote sensing methods this research will greatly assist future research and management efforts.

Methods

- remote sensing: quickbird and landsat images to look at vegetation change
- GIS: quickbird images to digitize land features into electronic GIS layers (rivers, towns, tracks, roads etc)
- Biophysical: establish proxies for sustainable cattle stocking densities through measuring of soil fertility on land owned by different Fulani families
- Measure stream flow rates / water availability for each family
- Measure soil moisture

➔ Last three points may explain biophysical drivers behind cattle grazing patterns

- Interviews that may explain other than biophysical drivers of grazing patterns as well as address the environmental awareness / awareness of environmental degradation.

Natural Resource use and Livelihoods of Villagers on the Mambilla Plateau, Nigeria: Yelwa Village as a case study

Tammy Korndorfer MSc Environmental Science UC ,Start Date October 2008



Introduction

Today the world is home to more than 6 billion people and by 2050 global population is estimated to be approximately nine billion (Population Division DESA, 2001). Prior to the 18th Century, and advent of industrialization the world population is estimated to have been less than 10 million in total and even in the 1950s only as high as 2.5 billion (Bongaarts, 1994). This rapid human increase has resulted in both environmental and social problems, which in turn has resulted in corresponding effort to redress these problems. Unfortunately, in many instances such initiatives have been seen to be in conflict with efforts to reduce social problems such as poverty (Redford et al., 2003, Adams et al., 2004, Fischer et al., 1997).

One area of conflict is the creation of protected areas to preserve biodiversity or natural resources. The creation of such protected areas has been one of the main methods used to protecting biodiversity, however this often necessitates the evictions of local people, and reduction in the resources available to communities (Roe and Elliott, 2004). Since the 1980s it had been increasingly recognized that the needs of local people should be considered in protected area planning. Conservation approaches such as "Conservation with Development" (where control over the conservation project or protected area remains with the 'outsider' authorities) and "Community Based Natural Resource Management" (where local organizations are given more direct control over resources) have gained popularity (Redford et al., 2003, Brockington, 2002, Kellert et al., 2000). The term "Pro-Poor Conservation" has emerged to describe conservation strategies that are designed both to reduce poverty and protect biodiversity (Adams et al., 2004, Roe et al., 2003).

Whether working together or not, both environmental and community aid organizations benefit from an understanding of what natural resources rural livelihood are dependent on. For environmentalists, understanding how humans are interacting with natural resources is essential in understanding where resources or human livelihoods are vulnerable, how the effects of increasing population growth will affect natural resources, and where a common purpose is shared between local communities and conservationists. When there is a question of establishing community-based conservation projects, understanding what the needs and ambitions of the community in respect to their resource management are before establishing projects is highly desirable, rather than assuming that conservationist and community goals are in full accordance (Redford and Sanderson, 2000).

For community aid or development projects, understanding what resources are required and how they are managed is essential to effective policy making and aid work (Salafsky and Wollenberg, 2000). Defining poverty itself is not as obvious as it appears (Adams et al., 2004, Chambers, 1995, Bebbington, 1999), and vulnerability to poverty has been proffered as a better area of focus (Ellis and Freeman, 2005, Chaudhuri et al., 2002). The close link between rural communities and natural resource sustainability means that understanding the natural resource requirements is an effective step in understanding the vulnerabilities of rural communities.



Small farm near the forest edge.

Objectives

The purpose of this research is to identify what natural resources are integral to the functioning of Yelwa village. A secondary objective is to identify what resource management strategies are employed within the village community.

Research Question: (in lieu of a hypothesis)

What Natural resources are the livelihoods of the Yelwa village community dependent on, and how are these resources managed?

Contribution of the research:

The purpose of the thesis is therefore to identify what natural resources are utilized by Yelwa village: a village situated near a forest reserve on the Mambilla Plateau, Nigeria. While important in furthering the theoretical understanding of community resource requirements and management in the Nigerian context, it will also be of practical value to the Nigerian Conservation Foundation, which is responsible for managing the reserve, and the Nigerian Montane Forest Project, a research group working on ecological issues in the area. The benefits for these organizations lie in furthering understanding of (and therefore potentially their relations with) the local communities, and also facilitating understanding and possible co-operation in resource management between local communities and biodiversity conservation organizations, as is part of the recommendations for the management for forests in the region in Chapman et al., (2004).

Finally, while the communities themselves are already likely to have a clear understanding of what resources they require and how they manage these resources, because this is such a fundamental part of village life, this is not likely to be in a format that is readily demonstrable to outsiders. While it is likely that the research will not be telling people anything new, having their natural resource requirements compiled into a demonstrable format is likely to be of value to them in future negotiations with officials of all types (aid workers, policy makers, and environmentalists).

Some anthropological work in the area has been done previously, looking at ways in which the creation of protected areas has restricted access to certain natural resources and subsequently disadvantaged the local communities. This work is recognized and it is intended to demonstrate that while the creation of a protected area has in some ways negatively affected the livelihoods of villagers, they are still dependent on regional natural resources, and the vulnerability of those resources underpins the vulnerability to poverty of the community.

Participant observation

It is planned to stay with a village "host family" for 1-2 weeks, then rent a hut within the village for the remainder of the research (approximately 6 months with periods of absence to access internet and other resources not available at Yelwa village).

Sampling Interviewing Plan

1. Sampling will begin with exploratory studies involving unstructured interviews.
2. Semi structured, recorded interviews will be developed, based on the findings of the exploratory study.

3. Structured interviews looking at historical resource use, and collection sites using the methods such as marking areas of resource collection on topographic maps/ aerial photographs.

Report by Industrial Training (IT) Students from Gombe State University

Sadique Abdullahi and Sulaiman Mohammad, April-September 2008.

Nigerian Montane Forest Project (Ngel-Nyaki)

The Industrial Training (I.T.) is conducted in Ngel-Nyaki Forest reserve on a montane forest on Mambilla plateau, Taraba State, Nigeria. It is the most diverse forest on Mambilla plateau, about 146 vascular plant species were collected by JDC (endemic, endangered, some new to West Africa in 1970's and red data listed species), comprise of many wild animal and it is one of the Important Bird Area (IBA) by Bird Life International (BLI).

The reserve experiences an average rainfall of 250 days (mean annual rainfall is 1,780 mm) and the temperature never exceeds 30°C. The reserve is about 46 km².

During I.T. we worked in several sections of projects which include:

- Nursery and Weather Station
- Phenology and Line transect
- Pollination
- Seed Trap
- Tantalus observation and Herbarium

Some objectives of I.T.

- To give a student(s) an experience relevant to his/her course of study.
- To provide industrial working skill.
- To improve stability, produce paper and make a PowerPoint presentation.
- Provide job opportunity.

Conclusion and recommendation

NNFP (Ngel-Nyaki Forest Reserve) is very good, essential, educative and necessary for I.T. student and researchers of natural sciences. We actually learn a lot. We would like to express our sincere gratitude to the Director of the project, Dr. Hazel M. Chapman, University of Canterbury, New Zealand.



Sadique (left) and Sulaiman measuring stream flow and water depth as part of a study into stream ecology led by Danladi Umar.

Outputs

Spoken papers

Nigerian Field Society, Lagos. April 2008. Nigerian Montane Forest Project Hazel Chapman

American Society of Primatologists. July 2008. West Palm Beach, FL Digestive Retention Time In Tantalus Monkeys (*Chlorocebus Tantalus*). Janette Wallis, Fiona Agmen and Hazel Chapman.

University of Canterbury, School of Biological Sciences MSc talks Mistletoe mutualisms in Ngel Nyaki forest, Nigeria. Kerry-Anne Weston.

University of Canterbury, School of Biological Sciences Seminar Series. October 9th 2008 Plant-Animal Interactions in a West African Montane Forest Hazel Chapman

The New Zealand Ecological Society Annual Conference November 18th-23rd, Auckland. Mistletoe pollination in Ngel Nyaki forest. Kerry-Anne Weston.

Gombe State University December 2008 New Zealand; its agriculture and some of its research Stephen Goldson

Papers

Beck J and Chapman H. 2008. A population estimate of the endangered chimpanzee *Pan troglodytes vellerosus* in a Nigerian montane forest: implications for conservation. *Oryx*.43 (3): 1-4.

Darbyshire, I., Vollesen, K. and Chapman, H. (2008) A remarkable range disjunction recorded in *Metarungia pubinervia* (Acanthaceae). *Kew Bulletin* In Press.

Chapman, H.M. (2008). The Nigerian Montane Forest Project and Nigerian Montane Forests. Nigerian Field Society Occasional Paper.

Chapman, H.M. (2008). The Nigerian Montane Forest Project. *Tropinet* 19: No.1 7-9
Ihuma, J. O.; Chapman, H. M.; Iyiola, T., Brown, J.A.; Akosim, C.

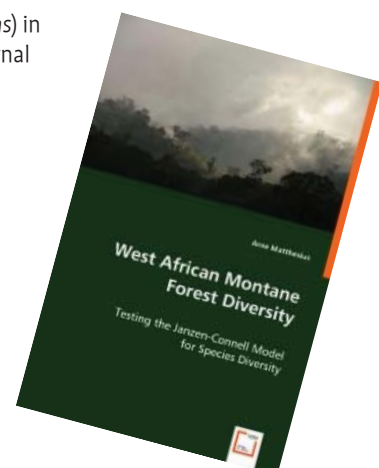
Nigerian Montane Forest Fragments: Fruit, Frugivores and Seed Dispersal. Submitted September 08; under review *African Journal of Ecology*

Chapman H. M. and Beck J (2008) The role of the putty-nosed monkey (*Cercopithecus nictinans*) in post-dispersal seed removal and germination in a West African montane forest. *Tropical Journal of Ecology*. Under review

Books

Mattheus A 2008 Testing the Janzen-Connell model for species diversity in a West African montane forest. VDM Verlag. Stalkholm Germany.

Order your copy from Amazon.com



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