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Te Whare Wānanga o Waitaha
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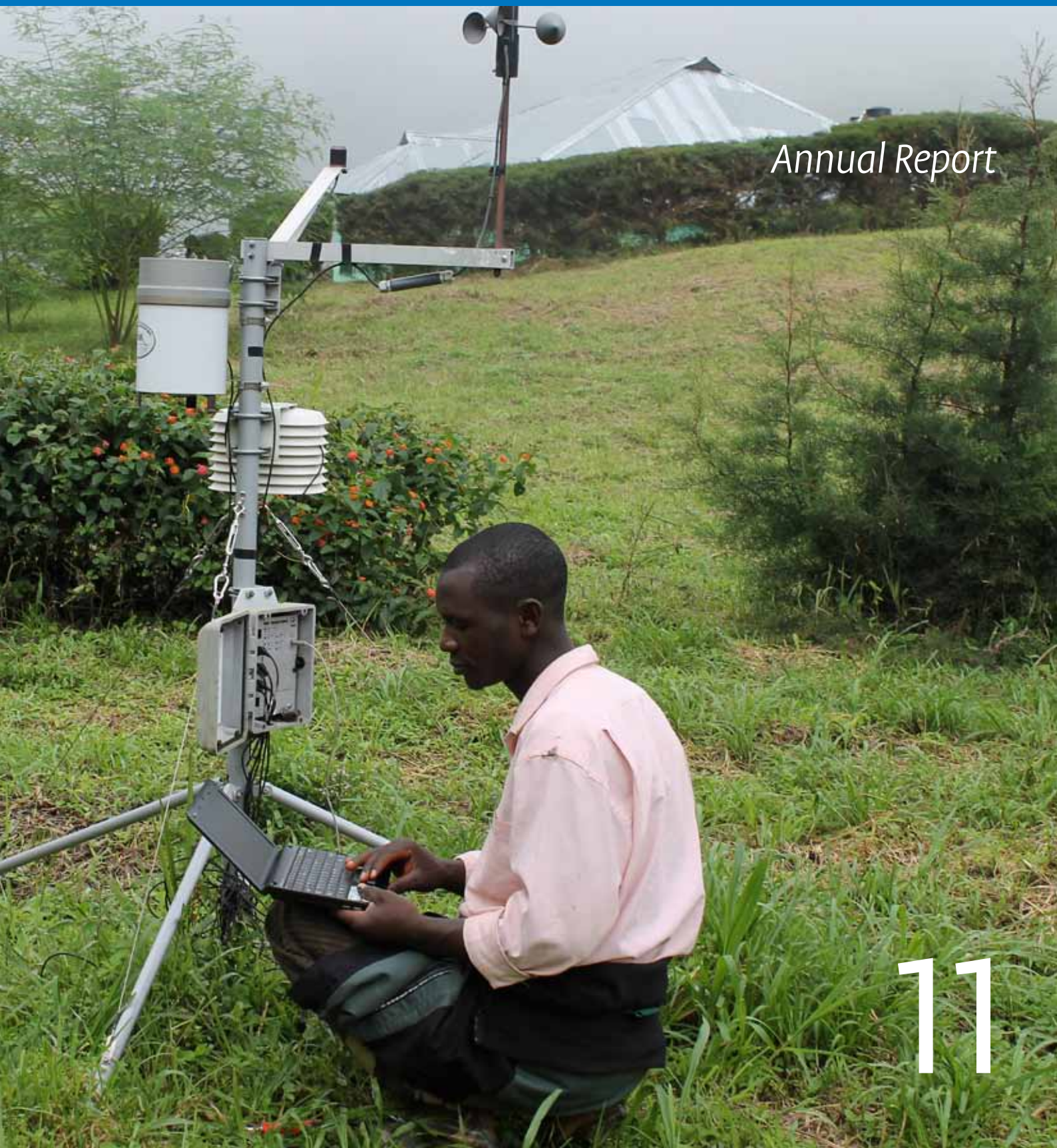
Nigerian Montane Forest Project



Annual Report

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Introduction

2011 has been an extraordinary year, and has had both its highs and its lows.

The re-election of His Excellency Danbaba Suntai as Governor of Taraba State was celebrated by the NMFP. During his first term in office Suntai truly supported forest conservation and the NMFP. For this we are extremely grateful. We wish Suntai the best for his next term.

The devastating earthquake in Christchurch on February 22nd, followed by many significant aftershocks (which are ongoing) was not good for NMFP. Students who were in Christchurch at the time suffered severe disruption to study and consequently theses are a couple of months behind schedule. I was unable to attend and present at the ATBC conference in Tanzania. Reports on progress have been somewhat delayed. The altered undergraduate timetable and other Christchurch commitments meant that I was unable to return to Nigeria until August this year. However all was not lost. On the contrary, Prof. Pierre-Michel Forget very kindly replaced me at the research station during April to advise Babale Aliyu in the setting up of his PhD field experiments. PM's son Raphael also visited and I understand thoroughly enjoyed the experience.

2011 has seen hurdles with funding and visa's finally overcome, allowing Charles Nsor (Gombe State University) and Ralph Adewoye (Forest Research Institute, Ibadan) to enrol at UC with projects based at Ngel Nyaki.

Misa Zubairu –(Project Coordinator) – with the help of Danladi Umar (Manager) have been exemplary in organising the building of the new research block, kitchen and 'wet' lab, and supervising the installation of the improved satellite communications system. This was to the point of installing a 40" flat screen TV in the lounge- much to my surprise but to unanimous approval!

Danladi Umar was my representative at the inaugural meeting of the Taraba State UN-REDD+ Technical Committee. Nigeria joined UN-REDD (Reducing Emissions from Deforestation and Forest Degradation) in 2009 and in March this year Salisu Dahiru, National REDD+ Coordinator, Nigeria presented the Nigerian Readiness program to the UN Policy Board in a meeting in Vietnam. While Cross River State with 50% of Nigeria's forest cover is the demonstrative State for the country, Taraba State is working hard to qualify as a REDD State.

The new term of the State Government saw our extremely supportive Commissioner of the Environment, The Honorable Gebon T. Kataps Esq. transferred to the position of State Attorney General. He is missed by the NMFP. However in August it was my pleasure to meet the new Commissioner of the Environment, The Honorable Kwetaka A. D. Already Kwetaka has demonstrated his enthusiasm for the Taraba State forests. We are looking forward to working with him and to introducing him to Ngel Nyaki and the Project later this year, when we will discuss the problems facing the Reserve and potential solutions.

As always, there are many other people who contribute in varying ways to the success of the NMFP. There are too many of you to list here, but your contributions are always very much appreciated.

Matt Walters has once again produced a beautiful Annual Report- thank you Matt.

Dr Hazel Chapman
Director
Nigerian Montane Forest Project

Cover Photo: *Usman downloading data from one of the Hobo portable weather stations.*

Contents

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 Supervisors

Project Partners

- **A.P. Leventis Ornithological Research Institute (Jos, Nigeria)**
- **Gombe State University**
- **Nigerian Conservation Foundation (NCF)**
- **Nigerian National Parks**
- **Taraba State Government**
- **University of Canterbury, New Zealand (UC)**
- **University of Kansas Natural History Museum**

Project Funders

- **A. P. Leventis Foundation**
- **Gombe State University**
- **The Mohamed bin Zayed Species Conservation Fund**
- **Nexen Inc. and Nexen Nigeria**
- **North of England Zoological Society (Chester Zoo)**

Academic Supervisors

Dr David Blackburn (California Academy of Sciences, San Francisco) Herpetology
Prof. Jenny Brown (UC) Math and statistics
Dr Hazel Chapman (UC) Evolutionary ecology
Prof. Pierre-Michel Forget (Natural History Museum, Paris) Secondary seed dispersal
Assoc. Prof. Jon Harding (UC) Freshwater ecology
Prof. Dave Kelly (UC) Plant ecology
Dr Britta Kunz (University of Wüerzburg Germany) Primatology
Prof. Mike Lawes (James Cook University, Darwin) Primatology/behaviour
Dr Elena Moltchanova (UC) Math and statistics
Dr Justin Morganroth (UC) Forestry
Dr Ximena Nelson (UC) Animal behaviour
Dr Ulf Ottosson (Leventis Conservation Institute, Aplori, Nigeria) Ornithology
Prof. Janet Wallis (American Nigerian University, Yola, Nigeria) Primatology

News

Weather Station

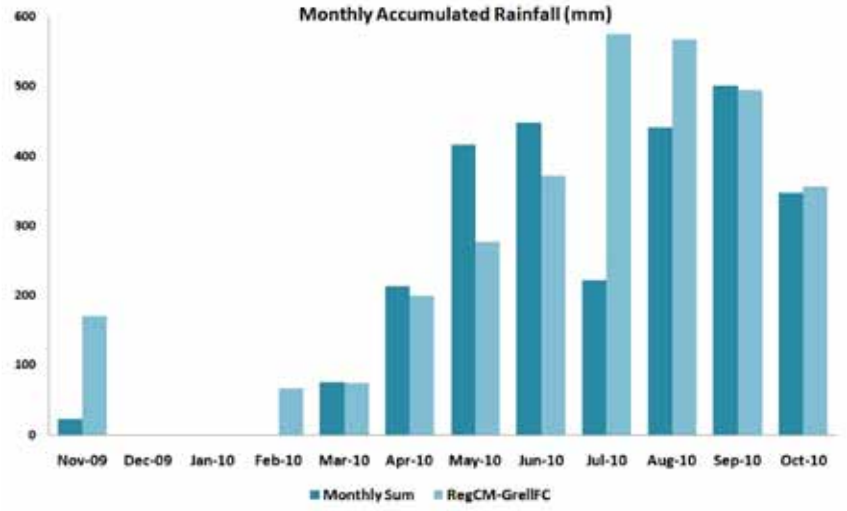
There has been significant progress with research using the Automatic Weather Station (AWS) which was installed April 2009. Climate summaries have been generated and basic climatological information is now being archived for future research. This has given the climate modeling team (Mr. Iman Soltanzadeh and Dr Peyman Zawar-Reza (see photo right) a chance to start initial model simulations for the region. The computer model of choice is called the Regional Climate Model (RegCM; http://eforge.escience-lab.org/gf/). RegCM runs on a parallelized desktop computer and can be used for regional climate prediction of up to 100 years in the future, and assessment of land-cover change on local climate. For example, questions such as: 'Do precipitation patterns change in response to grazing?' can now be researched using this model.

Initial RegCM model outputs have given us great confidence that this methodology is a viable tool for generating datasets that can be used in other disciplines such as ecology. Spatial variation in minimum/maximum temperatures and wind velocity can aid in investigation into seed dispersal and photosynthetic activity.

The figure (see right) shows the comparison between monthly precipitation amounts as measured by the AWS and simulated by RegCM. It is evident that RegCM shows great skill at reproducing the observed amounts. The seasonal pattern in precipitation closely follows the West African Monsoon regime and is well represented in both *in situ* and model data. Due to the coarse resolution of the model - the model produces data for pixels approximately 10's of kilometres in each dimension – it is unable to simulate rain due to local convective showers. This aspect will be improved in future research.

The great advantage of having RegCM data is that simulated data can be provided for geographic regions where measurements are not available. We plan to use this methodology to study the effect of land-cover change on regional climate.

Usman Abubakar, as shown on the cover, is doing an excellent job of downloading the data from the weather stations every month and sending it to Dr Peyman Zawar-Reza at UC. The data is summarised, put on the NMFP website and is being used by researchers. The data is freely available to anyone who needs it - see http://www2.phys.canterbury.ac.nz/~seg50/nigerian_data.html



Putty-nosed Monkey Research

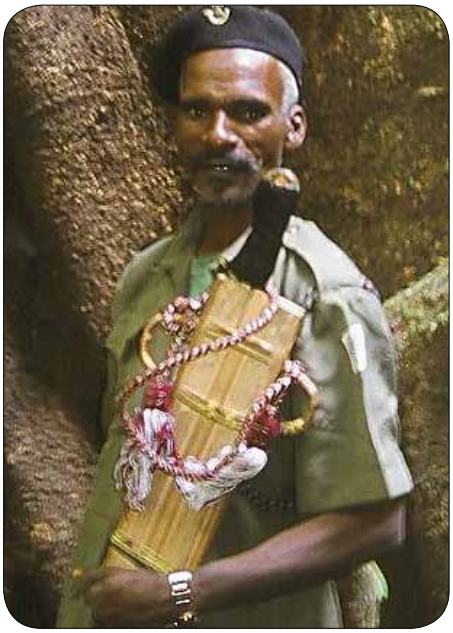
Putty-nosed monkey (*Cercopithecus nictitans*) research is on-going with Musa Bawuro continuing to collect foraging and feeding data of the monkeys at Ngel Nyaki. As well as monitoring seed dispersal by the monkeys, Musa is now involved with a project supervised by Prof. Mike Lawes from Charles Darwin University in Australia. The aim of this new project is to understand the evolutionary significance of the distinct white nose of the putty-nosed monkey.

These monkeys are often observed sweeping their hand across their nose, a gesture reminiscent of swatting away flies. With advice from Mike, Musa is now collecting data to help understand the role of this signalling behaviour, the context of the signal and how the signal is performed and received.

Patrollers and Patrolling

There has been increase in number of patrollers employed by the Taraba State Government to patrol Ngel Nyaki Reserve. The patrollers, some of which are pictured above, have been provided with uniforms, boots, raincoats, cameras, GPS, and radios. Saidu Isa (below), ex Gashaka Gumti National Park is now working with the NMFP and he is in charge of the patrollers. We could not ask for anyone better.

This increased patrolling has noticeably reduced the numbers of poachers and snares in the forest. However Ngel Nyaki still faces many problems. Cattle are entering the forest in the same numbers as they were last year. Burning, associated with the cattle grazing is still happening and the future of the forest is still uncertain. The Forest Conservation Task Force (see 2010 report) has had no noticeable positive influence on conservation of Ngel Nyaki.



Samuel in his Jalingo nursery

Nursery and Forest Restoration

Sadly Augustine Ntim has been out of action since May 2011 with a very severe fracture to his leg following a motorbike accident. Because of this the nursery has become a little run down over the year. However now that Augustine can work again it is being restored and we are collaborating with Samuel Telltuly, Director of Forestry, Taraba State. Samuel is establishing tree nurserys across the State and has passed on some interesting material to us.

UN-REDD+

Report by Danladi Umar

The Taraba State Technical committee on REDD+ was officially inaugurated on 11th March 2011 at the Government House in Jalingo, the State capital. His Excellency the executive Governor of Taraba State Mr Danbaba Suntai was ably represented by the chief of Staff of the Government House.

Shortly after the Inaugural ceremony, members of the REDD+ Technical committee converged at the State Ministry of environment Head quarters for deliberations.

The Governor, in a speech read on his behalf by the chief of Staff, gave assurances of full support to the Technical Committee, to enable it achieve the set objectives, and directed that a road map should be drawn immediately and sent to his office within one week for approval.

At its first meeting, the REDD+ Technical Committee was able to come up with an action plan for the REDD+ programme in Taraba State. A sub committee was constituted to fine tune the action plan and forward it to the Governor for approval.

The Technical Committee also assigned responsibilities to the various stake holders. The NMFP has responsibility to contribute in the areas of research and capacity development.

The Technical Committee members were drawn from; The Taraba State Government Ministries, Parastatals, NGOs, Educational/ Research Institutions, Federal Ministry of environment and the UNDP representatives in Nigeria.

The NMFP site, the large building on the left is the new research building, centre right is the accommodation building.

New Research Block Constructed

Misa Zubairu supervised the building of a new research block and associated structures. The new building is on the site of the original NMFP field station and comprises a herbarium, seminar room, computer room/library, office and store. Nearby is a 'wet' lab for the more unpleasant tasks such as sieving dung for seeds and hatching seed parasites. We also have a new kitchen and maigadi house.

The field assistants gather in the new seminar room.

Biodiversity of Butterflies

Dr Oskar Brattstrom University of Cambridge

Celaenorrhinus bettoni: This is a very rare skipper to find in Nigeria, it is previously only known from a few specimens taken at Obudu by Brattstrom and Robert Warren. Observed in ungrazed shrub-land close to the field station on the way down to the forest.

Ankola fan: Another very rare thing in Nigeria, also a skipper, and known from only two specimens again from Obudu. One single specimen caught about 200 meters below the field station level, in a small clearing in the forest.

Bicyclus smithi: A butterfly species I have found common both at Ngel Nyaki and at Obudu but still never seen reported from the area. It is considered to have its last outpost in western Cameroon (it is very common in central and East African forests) but clearly goes into the submontane zone of Nigeria. I also found what appears to be this species in a tiny mountain peak at Afi Drill ranch being very common above 1000m but never seen in the lowlands.

Bicyclus mandanes: A fairly common butterfly that for some reason never seems to have been reported from the sub-montane areas of Nigeria. It is present in lowland forest (preferably of a drier type) over large parts of tropical Africa.

Lachnocnema sp. I caught lots of odd small butterflies of this genus on the highest grassy peaks close to the field station. They don't really look like the closest related species that is occasionally found on Obudu and might be something distinctly different. Can't say much more at the moment and could just be local variation.

Visitors

December 2010
The Nigerian Ecological Society met at Ngel Nyaki and stayed for three days. Professor Obot, Executive Director NCF and Proferssor Eleazor, from Ahmadu Bello University, Zaria were among the delegates.

February 2011
Four officers from the Nigerian Customs and Immigration Service visited the Project to find out more about all the students and overseas visitors visiting their District. The officers were very impressed with what they saw.

March 2011
Claire Coulson, Director of CERCOPAN and Robert Warren (Lagos) visited the Project to assess the possibility of moving the tantalus family (Jack, Audrey and now two kids) from Ngel Nyaki to Calabar.

April 2011
Professor Pierre-Michel Forget from the Natural History Museam Paris, co-supervisor of Babale Aliyu spent two weeks at Ngel Nyaki. He and Babale set up field experiments investigating seed dispersal/removal in different habitats and across species. Forget was accompanied by his son Raphael, a proto-ecologist.

April/May 2011
Dr Oskar Brattstrom from the University of Cambridge visited the research station with the aim of collecting butterflies as part of a wide ranging research program looking speciation in butterflies.

May 2011
Dr Graham Brown and Pius Edward (CERCOPAN) translocated the tantalus to a new home in CERCOPAN

June 2011
Dr Elkana Sambo, HOD of Biology at Taraba State University, visited the Project along with two other biology lecturers and 24 undergraduate students. The visitors were briefed by the Manager, Umar Danladi, and were shown various activities undertaken by the project.

August 2011
Dr Amber Pearson, a Health Geography Postdoctoral Fellow from the Department of Geography, UC, visited the Project specifically to help with the maintenance of the weather station. Amber also worked on a GIS map of the forest transects.

April: Babale Aliyu and Professor Pierre-Michel Forget in the field.

August: Usman and Dr Amber Pearson check the weather station.

May: Dr Graham Brown with the tantalus cages.

June: Dr Elkana Sambo and Taraba State University students.

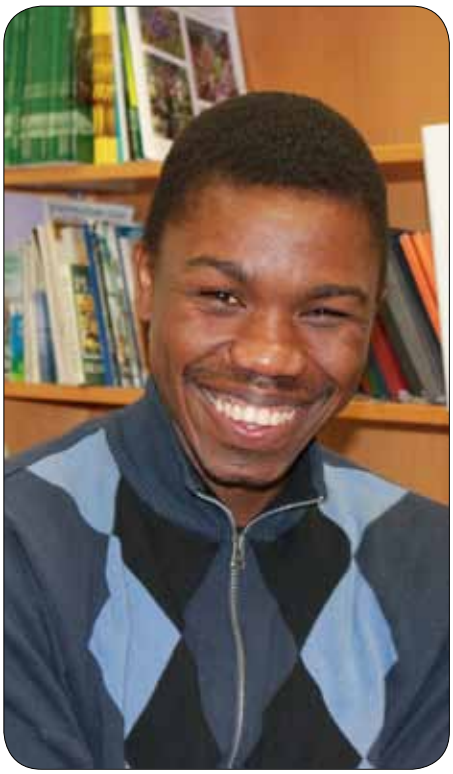
Student Projects

PhD Thesis Abstract

Habitat Effect on the Behaviour and Condition of the Yellow-breasted Boubou (*Laniarius atroflavus*).

Samuel Temidayo Osinubi
(Submitted August 2011)

This project was aimed at investigating behaviour and condition of the Yellow-breasted Boubou, *Laniarius atroflavus*, in response to habitat differences across core, edge and riparian Afro-montane forest habitats. This species is little known and conservation effort will require direction in identifying the habitat of best quality for their survival. The determination of habitat association using correspondence analysis of census data suggested strongest association with the riparian habitat, even though this habitat held the least overall avian biodiversity as determined from a modified Shannon index. Territoriality, vocalisation and time budget showed trends indicating *L. atroflavus* were most abundant and fared best in the riparian habitat. In this habitat, there was a greater density of territories and a smaller mean territory size, better call quality in frequency bandwidth and duration, and increased displaying and foraging time in the riparian habitat. Difference in size, colour and growth-based measures of condition showed difference between sexes, but did not show a strong habitat effect – males were larger than females, yet females appeared to have better quality of yellow breast feathers for equal carotenoid concentration. The effect of nest predation risk as a predictor of habitat quality revealed nests in the riparian habitat had the greatest daily survival probability, and within this habitat nests established at lower heights survived longest. While the evidence pointed towards the riparian habitat being most suitable for *L. atroflavus*, sadly, this habitat was most prone to anthropogenic disturbance. *L. atroflavus* appeared not to hold territories in the core habitat and its IUCN listing as Least Concern was suspected be an over-estimation due to the species' far-carrying call.



PhD Project Proposal

Geospatial mapping and carbon sequestration modelling of Ngel Nyaki forest, Taraba State, Nigeria

Ralph Adewoye
(Enrolled September 2011)

The main objective is to spatially analyze land-use and land-cover changes in and around the highly diversified montane forest of Ngel Nyaki. Also to develop an eco-physiological based algorithm for modeling the CO_2 sequestration using *in-situ* and spatial data for tropical montane forest ecosystems.

Research Output

This real-time, applied research program will provide scientific support for a regionally important conservation project. It will also significantly contribute to the fields of conservation biology, landscape ecology and more importantly the development of the algorithm based eco-physiological modelling of CO_2 sequestration in tropical montane forests. The models developed will be parameterized for the montane forest using location based variables for carbon sequestration estimation.

The carbon sequestration modelling aspect of the research will determine the total carbon sink of the forest (amount of carbon sequestered). It will also provide a database for managers and policy makers of the sequestration potential of the forest and its potential contribution to climate change amelioration in the United Nations REDD program (Reducing Emissions from Deforestation and Forest Degradation). REDD is a climate change mitigation strategy for the protection and maintenance of forests that has gained momentum with conservation organizations, project developers and governments in developing countries. The Ngel Nyaki forest and other montane forests on the Mambilla Plateau could fit into the UN REDD program once the development of appropriate modelling techniques have been achieved.

PhD Progress Report

The effects of land use on benthic invertebrates in tropical highland Nigerian streams

Danladi M. Umar

Globally, tropical streams are under increasing land use pressure. However, the types of land use activities occurring in the tropics are very different from those well documented activities in temperate regions. For example, tea, banana and maize plantations are common land uses in highland areas. These uses are also occurring in the context of additional pressures such as overgrazing, bush burning, deforestation, mining and irrigation. To understand how land uses affect stream communities, an extensive survey of 55 streams was conducted across 10 land uses (continuous tropical montane rainforest, forest fragment, intensive grazing, open pasture, tea, cabbage, maize, banana plantations, eucalyptus forests and mining). Replicate streams within each land use were sampled for physical and chemical parameters and components of the biological community (i.e. FPOM, CPOM, algae and benthic invertebrates). Preliminary results from chemical analysis show significant variation in the amount of nitrate-nitrogen and phosphate-phosphorus across the different land use types. Temperatures in all streams are high by temperate standards. For the stream fauna, over 40 different families of benthic stream invertebrates were identified. Many, including 6 mayflies, 7 caddisflies and 1 stonefly family, may be undescribed. The highest diversity occurred in continuous tropical montane rainforest streams (mean 10 families) and the lowest in streams with cabbage crops (mean 3.8 families). Our results suggest that more intensive use activities strongly affect the diversity and composition of benthic stream communities through nutrient and sediment related effects. The importance of pristine tropical montane rainforest streams in maintaining regional diversity is confirmed.

Pollution sensitive taxa, Ephemeroptera, Plecoptera and Trichoptera (EPT) found in streams around the Ngel Nyaki forest reserve include those in Fig.2 Mayflies, Fig.3 Stoneflies and Fig.4 Caddisflies respectively.

Recently concluded and on going work;

1. An intensive study of nine subsets of headwater streams to investigate food web processes was conducted from October 2010 to March 2011.
2. In-stream manipulations and macrocosm experiments, including leaf litter pack experiments were concluded.
3. Stable carbon and nitrogen isotope analysis for the food web investigation is currently being undertaken.

Fig.2 *Isonychia* sp (Ephemeroptera Oligoneuridae)

Fig.3 *Neoperla* sp. (Plecoptera: Perlidae)

Fig.4 *Hydropsyche* sp. (Trichoptera: Hydropsychidae)

PhD Progress Report

Chimpanzee Ecology at Ngel Nyaki Forest Reserve

Paul Dutton

The Nigerian Chimpanzee *Pan troglodytes ellioti* (formerly, *Pan troglodytes vellerosus*) is the most endangered subspecies, with the smallest distribution and smallest population, estimated at 5000-8000. Despite being recognized as a distinct subspecies in 1997, *P. t. ellioti* has been largely neglected by scientists and conservationists and nothing is known about its behavioural diversity in montane habitats. The aim of this research was to study the abundance of chimpanzees in the Ngel Nyaki forest reserve, their abundance, elementary technology, diet, nesting ecology, viability of seeds consumed and removal of seeds from *P. t. ellioti* faeces.

Distance sampling, marked nest count and the standing crop nest count were used to estimate the abundance of chimpanzees in Ngel Nyaki Forest Reserve. These methods proved to be inaccurate in their estimation when compared to direct observation. From direct observation, supported by new nest clump data, we have clearly established the abundance of chimpanzees in Ngel Nyaki forest reserve as 16 weaned chimpanzees and two infants. We have also established an average nest decay rate of 162.5 days.

Currently we are identifying the causes behind nest sight location (and what determines their choice of nest site) as the chimpanzees are selecting nesting locations away from permanent transects. We have identified large variations in tree species diversity and richness within the Ngel Nyaki forest reserve, which could possibly explain nesting site choice. We are currently identifying common variables associated with nest site choice and comparing them with non-nesting tree variables.

A total of 495 fresh faecal samples were collected over the 12 month period (May 2010 to May 2011). 75 items were identified as occurring in the diet of Ngel Nyaki chimpanzees. On average faecal samples contained 91% fruit, 5% foliage, 2% bark and 2% animal. Over 52 species of seeds were distinguished in the 495 faecal samples, with 58% of the annual diet made up of two genera, *Ficus* and *Landolphia*. Only 1.2 % of the 495 faecal samples contained no traces of fruit.

Technology in Ngel Nyaki chimpanzees appears to be seasonal and from evidence appears to occur during seasons of low fruit abundance. Tools are used for many purposes (from excavation of bee nests to anvils used for holding fruits; however, there is an absence of tools for termite extraction, which has also been observed in Gashaka.

Seed removal experiments focused on ten large seed species found in chimpanzee faeces, these included: *Landolphia* sp., *Santiria trimera, Pouteria altissima, Trilepesium madagascariense, Pterygota, Syzigium guineense, Parkia filicoidea, Vitex doniana, Isolona* sp. and an unidentified vine. Three treatments were applied to seeds of each species: 1) rubbed in chimpanzee dung, 2) removed from fresh fruit and dried and 3) fresh fruit. We found high rates of removal for most species with mainly rodents (squirrels, rats and porcupine) involved in removal.

Germination trials focussed on five large seed species found in chimpanzee faeces, these included: *Landolphia* sp., *Syzigium guineense, Margaritaria* sp., *Vitex doniana* and *Pterygota*. Four treatments were applied to each species: 1) gut passed seeds in faeces, 2) gut passed seeds removed from faeces, 3) fresh seeds in faeces and 4) fresh seeds (control). After 12 months we found that *Vitex doniana* and *Pterygota* in all treatments failed to germinate. *Landolphia* sp. was initially highly predated by fungus, but high germination rates occurred over all treatments, and after 12 months high predation rates caused no establishment at all. *Syzigium guineense* was also predated by fungus initially, high germination rates occurred and after 12 months many have established. *Margaritaria* sp. was initially buried by cockroaches, low germination was apparent and then predation by ants caused none to establish.

PhD Progress Report

How frugivore loss, seed size and niche availability lead to a predictable shift in the species composition of fragmented forests: - Implications for the management of forest restoration

Babali Aliyu

Afromontane forests are one of the most threatened ecosystems in Africa because they are located in areas long favoured for human occupation and where human population growth rates are high. In West Africa, the Cameroon Highlands ecoregion, part of the Cameroon Volcanic Line, comprising high plateaus with forest and grassland above 900 m in elevation. This montane archipelago which is scattered along the Nigerian/ Cameroon border have exceptionally high levels of endemism across all taxa, the area has been designated a global conservation priority. Despite this recognition, the area is poorly protected; this is because forest fragmentation and degradation is common, and mainly the result of land clearance for farming and grazing. Fulani pastoralists regularly burn the surrounding grassland late in the dry season and fires encroach into forest; they also cut wood for building and fence posts. In addition illegal hunting of wild animals is reducing their number. For example forest elephant (*Loxodonta africana*) are locally extinct and the local Nigerian/Cameroon chimpanzee (*Pan troglodytes ellioti*) is now endangered.

In general, in fragmented tropical forest habitats frugivores are hunted most on the forest edge and in small fragments, while 'core' forest areas are relatively rich in frugivores. This means that seeds may suffer most from dispersal limitation on the forest edge and in small fragments. In addition, it is the large seeded species which may be most affected because it is the large bodied frugivores which are most prone to extinction.

Seed dispersal by animals is vital for the maintenance of species diversity in tropical forests. Patterns of seed dispersal may affect both community composition and individual seedling survival. In the tropics large numbers of flowering plant species have fleshy fruits, adapted for dispersal by animals.

In the tropics, availability of suitable habitats, dispersal into these habitats, and the ability of populations to establish and persist within these habitats may define species distributions. Seed size may play an important role in this process.

It is therefore anticipated that as forests become more fragmented tree species diversity will decrease and favour large seeded, self dispersing species able to establish in a wide range of niches. The increasing edges may be invaded by small seeded species which are more easily dispersed and adapted to disturbed, relatively open conditions.

Dispersal of seeds by animals into sites suitable for seedlings establishment may be an effective tool for forest restoration and to help mitigate anthropogenic impacts in forest ecological systems. One site (Ngel Nyaki forest) in Nigeria where experiments into the use of natural seed dispersal for restoration are being carried out is on Mambilla Plateau, Taraba State. This forest site is the same site as the focus of my proposal. Here areas of grassland adjacent to the forest edge have been fenced off and protected from burning and grazing. They are being monitored for tree seedling establishment.

The overall aim of this study is to understand the shift in species composition in 'core', 'edge' and 'fragment' montane forest habitats following habitat degradation and hunting of wild animals. This knowledge will then be used in implementing more efficient forest restoration management.

I have used a series of three experiments (initially) to test these hypotheses. Prior to setting up the experiments, three habitats were identified: i) Core, at least 160 m into the forest from the edge; ii) Edge, up to 20 m into forest from the edge and iii) Riparian fragment, isolated/separated (about 100 m) from the forest. Five tree species were selected for the experiments based on seed size and mode of dispersal.

In order to describe the current distribution of the five focal tree species and to select experimental sites within the three habitats, a survey of focal species' seedlings, saplings and mature trees was conducted in the dry season (November/December) of 2010. The survey was along 1000 m of transect per habitat.

In order to identify which frugivores in each of the three habitats were dispersing seed, typical of the size used in our experiments, frugivores were observed feeding on *Garcinia smeathmannii* (with seed C. 18 mm diameter) and *Syzygium guineensis* (C. 10 mm diameter). Observations began in March 2011 and are ongoing as fruiting period varies among the species.

An experiment to investigate the rate of secondary seed dispersal of seed of different sizes (three species) was set up in April 2011. *Carapa* sp. nov. was chosen because it has an extremely large seed (<30 mm in diameter) and has evolved for dispersal by the now locally extinct elephant. *G. smeathmannii* (see above) is common throughout the forest. In contrast, *Pouteria altissima* has seed of similar size to *G. smeathmannii* and is also animal dispersed but is confined to the forest "core". Experimental plots were set up to determine seed fate in the three habitats in April 2011. Data collection is ongoing.

To test whether focal tree species are dispersal limited (ie if they are able to survive and establish if seed is available), a multi factorial experiment was set up in each of the three habitats, with five reps per habitat. Each treatment comprised caged vs non-caged and buried vs non buried. Data collection is ongoing; rates of seed removal and germination are recorded weekly and observation for subsequent seedling herbivory or fungal attack is conducted on a monthly basis.

PhD Project Proposal

Pollination Biology of Sunbirds in a Nigerian Montene Forest

Charles Nsor

(Enrolled September 2011)

African montane forest is one of the rarest forest types in Africa and is especially vulnerable because it occurs where human population pressure is high. In the Cameroon Highlands (the focus of this study), montane forests occur above approximately 1500 m elevation and are naturally fragmented and restricted to steep, relatively inaccessible slopes or along the side of streams on high plateaus. These forests support a diverse assemblage of tree species, with a high proportion of afro-montane endemics, several of which are endangered. They are also part of a Birdlife International Important Bird Area (IBA) in part because of their species richness and in part because of their high number of endemic species. Nigerian/Cameroon montane forests are also rich in other taxa, with many undescribed species of reptile and amphibians (Blackburne per. Com.). Such a high level of biodiversity implies an equally diverse network of interactions between plant populations and biotic pollinators.

It is crucial therefore to identify the various tree species that depend on these organisms and the extent to which their survival is challenged when these biotic agents are absent (Kalinganire et al. 2001). Identifying pollination guilds or tree species assemblages, with common pollination modes can reduce this complexity to some extent.

Pollination is an indispensible and essential ecosystem service that maintains gene flow in many cultivated and wild flora in the world. Pollination is essential for fertilization and fruit/seed-set. In recent years, pollination has been recognized by the Convention of Biological Diversity (CBD) as a key driver in the maintenance of biodiversity and ecosystem function.

In Africa, pollination studies have been centred mostly in the Cape region of South Africa. Much of this work is of an evolutionary nature. Very little effort has been invested at the level of community and comparatively little applied work. This underlines the basic state of pollination biology in Africa.

Although some relatively modest attempts have been made to investigate pollination activities in the rest of Africa the subject is skewed in favour of insects. Little has been done to quantitatively analyse the role of birds in pollination and the effect on the overall fitness of plants. It has been reported that in Australia, 110 species of birds pollinate about 250 species of plants. But very few studies have even explored the potential of birds to pollinate non crop plants in Africa, other than South Africa.

This study therefore seeks to focus on the role of sunbirds in the pollination of six afro-montane tree species, and their level of dependence on these very useful but often ignored pollinators. Exclusion experiments, mist-netting, pollen collection and analyses as well as breeding ecology of both plants and their pollinators will be used in this investigation. At the end of this project, we expect to be able to know:

- The relative contribution of each pollinator, its approach and various threats to its survival.
- The level of dependence of the focal tree species, and whether they are pollen limited.
- In addition, this study will develop a pollinator/plant mutualism web, the first of its kind in Africa.

MSc Progress Report

Using trait-based theory for understanding functional losses in dung beetle communities resulting from habitat degradation

Andrew Barnes

Anthropogenically created habitat edges have pervasive impacts on the distribution and persistence of invertebrate species in forest ecosystems. The response of species to edge effects can be highly dependent on variability of species traits (response traits), which may in turn co-vary with traits that are important in ecosystem functioning (effect traits). Therefore, non-random loss of species, due to traits conferring higher susceptibility to extinction, may also result in the loss of functionally important species across a habitat edge gradient.

In tropical ecosystems, dung beetles (Coleoptera: Scarabaeinae) are one of the most functionally important taxonomic groups providing critical ecosystem services such as nutrient cycling and secondary seed dispersal. However, there have been few studies that test for spatially explicit effects of habitat edges on dung beetle abundance, species richness, species traits, or ecosystem function in forest remnants. I compared dung beetle community structure at forest edges, both protected and unprotected from intense livestock grazing in a severely-fragmented montane forest landscape surrounding the Ngel Nyaki forest reserve in Nigeria.

This study has found that the exclusion of anthropogenic threats in the adjacent grassland matrix greatly determines the shape and strength of edge response functions in dung beetle communities which appear to result in major functional consequences. This is demonstrated by differences in overall capture rates of dung beetles and dung removal rates across degraded and regenerating edge gradients (Figure 1).

Furthermore, results suggest that relative abundances of dung beetle species and provision of associated ecosystem functions are strongly determined by trait differentiation among these species (Figure 2).

This study exemplifies the importance of measuring response and effect traits of species for predicting community and ecosystem responses to disturbances in intensively managed anthropogenic landscapes. Furthermore, these results provide clear evidence that the implementation of protected adjacent matrix to prevent the encroachment of anthropogenic threats is imperative for the conservation of Ngel Nyaki forest reserve.

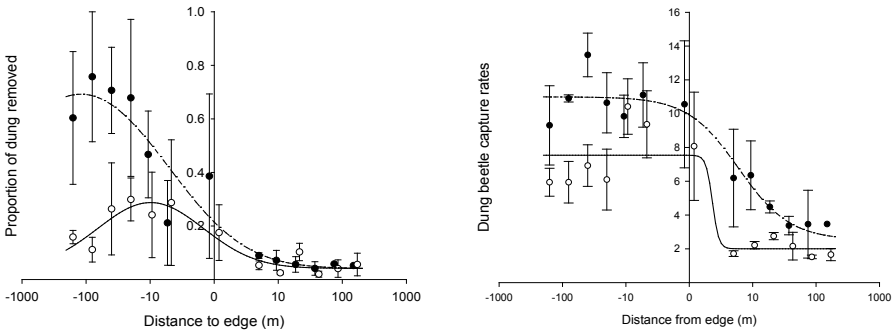


Figure 1. (a) *Mean (± SE) square root-transformed capture rates of dung beetles in baited pitfall traps and* **(b)** *mean (± SE) proportion of dung removed across regenerating (closed symbols) and degraded (open symbols) edge gradients. Negative x-axis values indicate distances into the forest and positive values indicate grassland matrix distances. Fitted lines are the best fit model selected from models of increasing complexity.*

Figure 2. *Causal pathways of the interactive impacts of adjacent anthropogenic disturbances in the matrix with edge effects on trait composition (functional dispersion) and community weighted means of beetle mass, body condition, and dispersal ability (body mass, condition, and wing loading respectively). This is compared with the 'null' non-trait-mediated effect of total dung beetle biomass on dung removal rates. Mixed model approximated R2 values are indicated for endogenous variables (variables with arrows leading into them). Overall model selected using mixed model confirmatory path analysis (Shipley 2009).*

MSc Progress Report

Competition in the dung community: influences on ecosystem functioning

Kristy Udy

There are many processes that contribute to the structure and assembly of communities and how the organisms interact. Interactions between individuals and species that share the same environment are an important part of determining the community make up. Competition has an important role in establishing community assemblages as it determines how many organisms can exploit the same resources and occurs when there is contest over a resource, such as nutrients and/or food, that is limited in space and time. Also, competition can have indirect benefits at the species and guild level as it regulates the numbers of competing invertebrates so promoting coexistence of a diverse range of organisms. An ideal study system for quantifying how competition affects the community is the dung resource as it is well defined in space and time and easily replicated. Competition in this system is over the dung as a resource or the seeds that are present in the dung and can be intense due to limited availability and fast decomposition rate.

Dung decomposition and removal is an important ecosystem function performed by the associated invertebrate community, it covers a wide range of ecosystem services ranging from nutrient cycling and control of pest species, through to secondary seed dispersal. Dung often contains seeds that have been primarily dispersed by primates. If the seeds are not buried, it increases the risk of seed predation and attack by fungi or pathogens. The most important organisms associated with dung pats in tropical ecosystems are dung beetles (Coleoptera: Scarabaeidae) as they remove the largest amount of this resource and bury seeds that present in the dung. Dung beetles bury dung for breeding attempts and often indirectly bury seeds, therefore enhancing germination. The surrounding land use of forest reserves can profoundly influence the structure of the adjacent forest communities and the resulting associated organisms. Furthermore, this can have flow on effects to altering the functioning of the community.

To test how adjacent land use influences the competitive interactions and functioning of dung beetles in removing dung and dispersing seeds I set up exclusion experiments in areas of Ngel Nyaki forest that are behind protected edges (fenced) and un-protected edges (un-fenced). Also, I have conducted experiments on how much dung removal occurs in natural species assemblages of dung beetles and measured how much is removed with the different forms of adjacent land use. Furthermore, I manipulated the number and size of beetles in a controlled situation to test how functionally important they are.

Objectives and Experiments

The main objectives for this study were to determine how adjacent land use of Ngel Nyaki forest affects the competitive interactions in the dung beetle community and the resulting influences on dung removal and secondary seed dispersal by dung beetles.

Competition within the dung community over the Shared Resource

Competition over resources differs in intensity in areas of differing land use. To test how species identity, diversity and the functioning of the ecosystem is influenced by adjacent land use of Ngel Nyaki forest I conducted exclusion experiments. The treatment was the effect of dung beetles on dung removal and secondary seed dispersal, compared to the rest of the dung community. The results for this experiment show that dung beetles are the most important invertebrate guild in the dung community for dung removal and secondary seed dispersal.

Dung Removal and Seed Dispersal

Burial depth of sequestered dung is important, as the dung often contains seeds and the depth these are buried at determines whether they will germinate. Also, if the seeds present in the dung are not buried they are often rendered unviable by predation events. However, the amount of dung removed and the depth it is buried at depends on the size and numbers of the invertebrates present. Larger, more competitive invertebrates are capable of sequestering a larger portion of a resource than smaller invertebrates that may be competitively inferior. Therefore, the larger invertebrates in a dung community may be functionally more important, depending on their numbers. I found that the size and abundance of dung beetles influences their functionality and competitiveness as larger dung beetles remove more dung and are stronger competitors. Burial depth also was influenced by beetle size as larger beetles buried dung and seeds at greater depths.

Conclusion

The results of these experiments showed how important the effect of fencing is on the adjacent forest and the associated dung beetle community. As my results showed that dung beetles are important secondary seed dispersers and that fencing of the forest increases the amount of seeds buried which can promote forest flora persistence and regeneration.

MSc Progress report

Relationships between the tantalus monkey and forest structure in a West African montane forest.

Abby Grassham

The Ngel Nyaki forest is home to a unique flora and fauna that is being threatened by grazing and burning from local subsistence farming. The tantalus monkey, *Chlorocebus tantalus tantalus*, remains relatively common at Ngel Nyaki and may be able to aid the conservation of the forest's rare and endemic species through its potential role in forest regeneration and restoration via seed dispersal.

The tantalus monkey is a mid-size monkey with an average weight of around 4 kg and lives in multi-male, multi-female groups ranging from 11 to 76 members. They possess a range of traits allowing them to potentially play an important role in forest regeneration and maintaining forest structure. These include approximately half the tantalus diet consisting of fruit and a relatively long gut retention time of 30 hours. They are semi-terrestrial, spending approximately one third of their time on the ground and often venture into open grassland habitats to travel between forest fragments or to forage.

Tantalus Abundance

A series of line transects were walked fortnightly through the forest at Ngel Nyaki. When one or more tantalus were observed during the course of these walks, the perpendicular distance from the transect to the group and the number of individuals observed were recorded. I estimate, using the software, DISTANCE 6.0, the presence of 89 tantalus troops in Ngel Nyaki Forest Reserve, comprising a total of over 1200 individuals.

Habitat Use

Three semi-habituated tantalus troops with home ranges along the northern edge of Ngel Nyaki forest were observed regularly to assess the amount of time tantalus spend in different habitats, particularly grassland. During observation sessions, a scan sample was taken every ten minutes with the number of individuals visible in each habitat (forest, edge, grassland) recorded. As the forest in the home ranges of these troops consisted mostly of narrow riparian forest fingers extending from the main forest, edge was defined as the area covered by the canopy of the outer most row of trees. Observation sessions ran from when the troop was first located until they disappeared into the undergrowth in the middle of the day or settled down in a sleeping site for the night. Each tantalus troop differed in its pattern of habitat use, however, all three troops spent at least a couple of hours in the grassland each day, providing them the opportunity to disperse seeds into grassland, as well as forest and edge habitats.

In addition, tantalus are considered to primarily be a forest edge species and rarely, if ever, venture into the middle of the forest. However, there seems to be no scientific verification of this or indication of how far into the forest they do go. GPS locations of each group encountered during the above transect walks plotted onto a Google Earth image of Ngel Nyaki confirm tantalus to be an edge species.

Seed Dispersal

To find out which seeds tantalus dispersed, how many and into which habitats, tantalus faeces were collected both from sleeping sites and opportunistically during the course of other activities and the habitat the faeces was found in recorded. Back at the lab, each faeces was mixed with water to create a slurry and sieved to remove any seeds present. All seeds larger than 2 mm were counted but seeds smaller than 2 mm were recorded on a presence/absence basis due to their large numbers. Photos were taken of all the seeds found to aid in identification purposes, in addition to a sample of each seed species which was kept. Faeces were collected from all three habitats resulting in 29 seed species collected from tantalus faeces.

Germination Experiment

To determine if tantalus disperse seed into habitats suitable for germination and establishment, a germination experiment was set up. Twelve plots were set up in each of four habitats (forest, edge, grazed grassland and ungrazed grassland – edge following the same definition as for habitat use) with half the plots in each habitat being caged to exclude secondary dispersers and seed predators. The remaining plots were left uncaged to mimic natural conditions. The five most commonly found seeds in tantalus faeces from November 2009 were used for the experiment. These were *Aframomum angustifolium, Croton macrostachyus, Rytigynia umbellulata, Leea guineensis* and an unidentified species of vine. Seeds were mixed with fresh tantalus faeces that had had all 2 mm and larger seeds removed, prior to placing an equal number and species composition in each plot. Plots were visited fortnightly to check for evidence of germination and the number of seedlings of each species was recorded. Germination success was greatest overall in grazed grassland and poorest in ungrazed grassland, suggesting that competition from uncontrolled grasses in the ungrazed grassland may be inhibiting seedling germination in that habitat.

These results indicate tantalus are important seed dispersers transferring seed from forest to grassland habitats where they are able to germinate and establish provided adequate management actions are implemented. Fencing off areas of grassland to protect from fire and grazing on its own may not be sufficient for forest regeneration at Ngel Nyaki. Additional measures such as cutting grass around seedlings to help reduce competition need to be investigated.

Summer Scholarships

Christie Webber

Bird pollination is usually a derived trait, with ancestral species pollinated by insects. Selection for bird pollination can be strong because birds are more effective pollinators than insects; they collect more pollen and carry it further distances. However there is a high cost to this efficiency because birds require relatively high volumes of sugar rich nectar to attract them. In order to ensure that this valuable nectar is not robbed, many bird pollinated species have evolved flowers with characteristics that make them unattractive to insects. For example, red flowers and/or nectar in inaccessible places. On the other hand in some primarily bird pollinated species insects still provide sufficient pollination services for there to be a selective advantage in the flower remaining attractive to them.

A recent study into the reproductive biology of a Nigerian montane forest tree, *Anthonotha noldeae*, has found that despite its non-specialised white flowers, this species only sets seed when it is pollinated by sunbirds. Yet 80% of its flower visitors are insects (Beavon and Chapman 2011). Moreover initial observations during the course of the study suggest that only one sunbird species (*Cinnyris reichenowi*) out of a total of six regular sunbird visitors is an effective pollinator. This suggests that even less than 20% of visitors are active pollinators.

The aims of this study are to a) understand the strength of the mutualism between *A. noldeae* and *C. reichenowi* , b) determine the ability of the other five sunbird visitor species to pollinate *A. noldeae* and c) to investigate the possibility that insects do play a role in pollination when sunbirds are absent or extremely scarce. We will base our measure of dependence of *A. noldeae* on its visitors by measuring seed set after exclusion experiments and controlled pollinations. We will also estimate pollen load and observe location of pollen on the birds bodies.

We hypothesise that flowers in the upper crown of *A. noldeae* (where the previous study was carried out) will be strongly dependant on *C. reichenowi* for pollination, with some additional 'accidental' pollination by other bird species. In contrast, flowers in the inner crown will be pollinated by insects, because it is difficult for birds to enter.

This study is important because understanding the associations between plants and their pollinators is vital for forest ecosystem management. This project will underpin future studies into pollination webs and breeding system evolution, questions identified in Beavon and Chapman (2011).

Josh Thia

Rodents and Secondary Seed Dispersal

Babale Aliyu has discovered that rodents are important in secondary dispersal in Ngel Nyaki forest (see page 16). Indeed *Carapa* sp., which has lost its original seed disperser, the forest elephant, is totally dependent on rodents for seed dispersal.

This project will be an initial investigation into the seed dispersing rodents present within Ngel Nyaki and their behaviour in terms of distance seeds are moved, depth to which they are cached and size of seeds preferred.

Below: A hero rat

Industrial Training Students

The IT students were based at the NMFP field station for six months (April – September 2010). During this period they worked along-side postgraduate students and field assistants to gain experience in a range of conservation issues and field research techniques.

This year the NMFP hosted three IT students from Gombe State University:

Musa Jemima Musa Kala

Hamman Jibril Buduwara

Haruna Mamman Yusuf

The students are in the third year of their undergraduate degree is botany/zoology.

Student Report: Industrial training with the NMFP June-September 2011.

The industrial training was conducted at the montane forest on the Mambilla Plateau, located in the south-east of Taraba State; between longitude 11°00' and 11°30' east and longitude 6°30' and 7°15' north. Towards the east, the Mambilla Plateau is connected with the Cameroon highlands, which extends south-west towards Bamenda, Cameroon.

The montane forest (above 1500 m) comprises of many interesting species of plants and animals. Examples of the montane forest trees are *Newtonia buchmannii, Carapa grandiflora, Parkia filicoidea, Poteria altissima, Entandrophragma angolense,* and *Vitex doniana*. Mammal species include tantalus monkey (*Chlorocebus tantalus*),putty nose monkey (*Cercopithecus nictitans*),mona monkey (*Cercopithecus mona*),chimpanzee (*Pan troglodytes*).

Aims and Objectives

- To provide students with a practical experience during their studies.
- To provide job opportunities to students, in various organizations.
- To use the experience gained from the industrial training in discussions held in the lecture rooms.
- To gain experience in writing reports.

While based at the field station for six months, we were able to study the following:

Puttynose Monkey Observation

The putty nose monkey (*Cercopithecus nictitans*) is an arboreal mammal that has a distinctive white nose while its body is covered in black hair. They live in groups of up to 32 females and a single male. The male are larger in size than the female. They feed on insects, fruits and leaves.

Phenology of Plants

Phenology means the study of the period of seasonal biological activity of plants, including the period of their fruiting, flowering, and shading of leaves. The biological activities of different species of plants were recorded along line transects. During recording, a number was used to represent the percentage of cover observed (1=25%,2=50%,3=75%,4=100) of each of: flower; new leaf; flower bud; mature; immature fruit.

Pollination

Pollination can be defined as the transfer of a mature pollen grain (male gamete) from the anther to the stigma of mature ovules (female gamete). There are two types of pollination, self and cross pollination. Self pollination occurs when a mature pollen grain of a single flower is transferred to the stigma of the same flower containing mature ovules; whereas cross pollination occurs when a mature pollen grain of one flower is transferred to the stigma (containing mature ovules) of another flower of the same species.

The agents of pollination include birds, insects and wind. We observed the bird pollinator of *Anthocleista vogelii*. They were pollinated by several species of sun bird such as green headed sunbird (*Cyanomitra verticlis*), variable sunbird (*Cinnyris venustus*), splendid sunbird (*Cinnyris coccinigastus*) beautiful sunbird (*Cinnyris pulchellus*), while others robbed the flowers thereby destroying them e.g. black-headed weaver (*Ploceus melanocephalus*).

Seed Germination/Dispersal

Germination means the process by which a seed breaks its dormancy under favourable conditions, and gives rise to a seedling. Seed dispersal refers to the process by which seeds are distributed to various habitats either by wind, water or animals.

Five seeds of forest tree species (*Carapa grandiflora, Anthonotha noldae, Syzygium guineese, Garcinia smeathmannii*,

Pouteria altissima) were sown in each of the fragments, cores and edges of the forest. We were able to determine the rate of their germination in each of these forests habitats. *S. guineese* germinated fast in all the forest habitats, followed by *P. altissima*. *S. guineese* (6 to 7 days to germinate), while, *P. altissima* took 8 to 9 days to germinate in all the forest habitats. *A. noldae* took 10 to 15 days to germinate in all the forest habitats, while *G. smeathmannii* took 14 to 16 days.

Freshwater Ecology

This refers to the study of interaction between plants and animal in water that is nearly neutral (fresh). We visited various streams within and outside the montane forest e.g. Mayo Jigawa stream, John Harding stream, Alhaji Yusuf stream, Misa stream, Alhaji Bairo stream. The pH, conductivity, percentage of dissolved oxygen of these streams was recorded, and various samples of macro-invertebrates were collected e.g. Dobsonfly, stonefly, caddiesfly, mayfly.

Tantalus Monkey Observation

Tantalus monkeys (*Chlorocebus tantalus*) have a distinctive black face with a white brow band and cheek tufts, while its body is covered in grey-green. They are mostly found on the grassland, few metres away from the edge of the forest. They live in groups of 10 to 17 individuals.

In addition, other sections of the project that we worked with include fruit dispersal, seed trap.

Personal Projects

Each student was advised to choose a topic of his/her own interest and conduct a research project.

Hamman Jibril Buduwara

I conducted an experiment on insect predators of *Carapa* seeds and fruits. Mature *Carapa* fruits are large in size, they weighs up to 1085 g and approximately 22 cm in length and width of 16 cm. Each *Carapa* fruit contains 10 to 24 seeds.

My aims and objectives was to determine the insect predators of *Carapa* fruit/seed at Ngel Nyaki. Secondly, to determine the influence insects have on *Carapa* seeds, whether they will germinate or not. Thirdly, identify the insect species that predates the *Carapa* seed at the montane forest of Ngel Nyaki.

Methodology

When matured *Carapa* fruits were collected from the forest, its weight was measured with a balance and the total number of seeds in each matured fruit was counted. The seeds were checked. The viable seeds were separated from the infected seeds. The infected seeds were kept in square wire net of 1 m by 1 m in a dark environment; to allow the insects to emerge as adults.

In both of the core and edge forests, ten plots were measured under a *Carapa* tree species. In each of the plots, five cages were made containing a single viable seed. Each cage was 1 m apart. Plots in both the forest core and edge were 25 m away from each other. An observation was done at seven day intervals. If any of these caged viable seeds was infected they were been brought into the netted cage (see photo below).

Conclusion

The Nigerian Montane Forest Project is a good site for academic learning. I have learned a lot of experience from thee various sections of the project.

Recommendations

We want the patrollers and staff to strictly adhere to their work so as to stop people that may likely hunts the larger animals. In addition, to stop people from cutting down trees so as to have a great biodiversity. Lastly, government should consider them (the field station), so that the people of Nigeria and other countries to have a great site for academic learning.

Acknowledgements

I thank the director of the Nigerian Montane Forest Project, Dr Chapman Hazel, for sponsoring us both financially and academically and also for words of advice. I thank the manager and coordinator of the project, Danladi Umar and Misa Zubairu, respectively for great advice they gave us and also to the entire staff for being cooperative and punctual while working together.

The IT students: Yusuf, Jemima and Jibril.

Haruna Mamman Yusuf

My project topic was on bird and insect pollination in *Symphonia gummifera* and *Maesa lanceolata* respectively. The aims and objectives of which are: 1) To know the species pollinating *S. gummifera* and *M.lanceolata*. 2) To know the average time spent on each flower. 3) To know the average number of flowers visited by a specific pollinator.

Methodology

Five different individuals of *S. gummifera* and *M. lanceolata* were selected in different parts of the forest. The trees were numbered accordingly. Observations were done in the morning at 7 am and evening at 4 pm. Each tree was observed for 30 mins with 3 mins break after 10 mins observation. In order to balance the timing of observation, the first tree observed in a day will be the last to observed the next day. The following was recorded: Bird/insect species, time arrived, time departed, number of flowers pollinated, and duration.

Conclusion

Nigerian Montane Forest Project is an excellent place of learning where one can get practical experience of his/her studies. I learnt so much here.

Acknowledgement

I would like to express my sincere gratitude to the Director, Dr Hazel Chapman, the Manager, D.M. Umar, our Coordinator, Misa Zubairu and the entire staff of the project for their support. I am not forgetting the sponsors who are contributing towards the development of the project. Thank you.

Musa Jemima Musa Kala

My project topic was on The role of puttynose monkey in seed dispersal. The aim and objectives of which are: 1. To know the fruits and seeds eaten by this monkey. 2. To know the distance these seeds are taken away from the parent plant. 3. To know the number of seeds dispersed in each dung.

Methodology

Puttynose monkey dung was collected in a polythene bag and the distance of possible plants with fruits are measured from where the dung is found. The dung was washed in a sieve to see, identify and count the number of seeds found in it.

Conclusion

The Nigerian Montane Forest Project is an excellent place of learning where one can get practical experience of his/her studies. I saw both plant and animal species that I had never seen in my life in this forest.

Acknowledgement

I would like to express my sincere gratitude to the Director, Dr, Hazel Chapman, the Manager, D.M. Umar, our Coordinator, Misa Zubairu and the entire staff of the project for their support. I am not forgetting the sponsors who are contributing towards the development of the project. Thank you.

Outputs

Refereed Papers

- Beavon,M. A. and Chapman, H. M. (2011) Andromonoecy and high fruit abortion in *Anthonotha noldeae* in a West African montane Forest. *Plant Systematics and Evolution*. http://dx.doi.org/10.1007/s00606-011-0488-1.
- Ihuma J. O., Chima U. D. and Chapman H. M. (2011) Tree species diversity in a Nigerian montane forest ecosystem and adjacent fragmented forests. *ARPN Journal of Agricultural and Biological Science*, 6(2), 17-22.
- Ihuma, J. O., Chima, U. D. and Chapman, H.M. (2011) Diversity of fruit trees and frugivores in a Nigerian montane Forest and adjacent fragmented forests. International *Journal of Plant, Animal and Environmental Sciences*., 1(2) 6-15.
- Ihuma, J.O.; Chapman, H.M.; Chima, U.D. (2011) Recruitment of woody plant species juveniles in Ngel Nyaki Forest Reserve and its potential for forest regeneration. *International Journal of Science and Nature* 2 (4) Online.
- Korndoerfer T. (2011) Herbal Medicine in a 21st Century African Village. *The Australian Journal of Medical Herbalism*, 21(3)
- Nsor, C. and Chapman, H. M. (2012) Birds as pollinators in a West African montane Forest Malimbus In press March 2012.
- Reeder, N.M.M., T. Cheng, V.T. Vredenburg, and D.C. Blackburn. (2011). Survey of the chytrid fungus *Batrachochytrium dendrobatidis* from montane and lowland frogs in eastern Nigeria. *Herpetology Notes* 4: 83–86.
- Weston, Kelly and Chapman (under revision) The role of sunbirds in the reproductive biology of Afromontane mistletoes. *Journal of Tropical Ecology*.

Conference Presentations

1. Osinubi, S.T., Chapman, H.M. , Briskie, J., Ottosson, U. and Brown, J. A. Habitat Influence on Territorial and Mate-guarding Calls of the Yellow-breasted Boubou (*Laniarius atroflavus*). August 19th 2010 Departmental Seminar, School of Biological Sciences, University of Canterbury, N.Z.
2. Grassham, A.M., Chapman, H.M. and Kunz, B. Relationships between the tantalus monkey and forest structure in a West African montane forest. September 2nd 2010. Showcase Postgraduate Conference, Christchurch, N.Z.
3. Barnes A.D., Emberson, R. M., Chapman, H.M. and Didham, R. The effects of forest edges on dung beetle communities in a tropical montane forest. 26–29 September 2010 The Australian Entomological Society's 41st Scientific Conference. Perth, Australia.
4. Grassham, A.M., Chapman H.M. and Kunz, B. Relationships between the tantalus monkey and forest structure in a West African montane forest. 26th October. Annual Biological Conference, University of Canterbury. Christchurch, N.Z.
5. Umar, D.M., Harding,J.S and Chapman,H.M. How do land uses affect stream communities in highland tropical streams in Nigeria? 26th October 2010 Annual Biological Conference, University of Canterbury. Christchurch, N.Z.
6. Barnes, A. D., Emberson, R. M., Chapman, H. M. and Didham, R. K. (2010) The effects of forest edges on dung beetle communities in a tropical montane forest. Annual Biological Conference,University of Canterbury 26th October 2010. Christchurch, N.Z .
7. Umar, D.M., Harding, J.S and Chapman, H.M. How do land uses affect stream communities in highland tropical streams in Nigeria? 22-26 Nov. 2010 New Zealand Freshwater Conference Christchurch, N.Z.
8. Grassham A. M., Chapman, H. M. , Kunz, B. and Brown, J. A. 23–25 November 2010. Relationships between the tantalus monkey and forest structure in a West African montane forest. New Zealand Ecological Society Conference. Biodiversity:2010 and beyond. Dunedin, N.Z.

Lectures

- Hazel Chapman To Aplori A. P. Leventis Ornithological Institute Jos January 2011.'
- Hazel Chapman To Lagos Nigerian Field Society August 2011

Publicity

- Interview (Hazel Chapman) in Mongabay July 26th 2011. Saving (and studying) one of Nigeria's last montane forests. http://news.mongabay.com/2011/0726-hance_chapman.html
- ABTC website Front piece July 27th 2011-08-03 "Environmentally, it has been named one of the worst in the world. Yet, not all forest news out of Nigeria is bleak: the success of the Nigerian Montane Forest Project in one of the country's remaining forests is one such beacon of hope, and one example of how the country could move forward. Read More at Mongabay.com"
- Carapa .org (http://www.carapa.org/en/) 27th July 2011 Tells the story of the new *Carapa* species at Ngel Nyaki.
- A UTube video was made of the Project and its research by P. M. Forget: www.youtube.com/watch?v=dAUs2TI23yI&feature=related
- Paul Dutton, working with the Ngel Nyaki chimps for his PhD participated in JGI (Jane Goodall Institute) conferences in Brussels, Belgium May 2011. Paul has also submitted images and recordings of the Ngel Nyaki chimps on request to All The World's Primates http://alltheworldsprimates.org/Home.aspx

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