School of Biological Sciences

College of Science

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
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Nigerian Montane Forest Project

Annual Report

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Introduction

2010 has been a good year for the NMFP. Thanks to our sponsors and supporters there have been several advancements to both the running and infrastructure of the Project.

A significant development has been the formation of the advisory board (see page 9). The board will helps make decisions, choose the direction of the Project and ensure that the Project is run as well as possible. The fact that two board members (and the Director) are currently based at UC but regularly travel to Nigeria ensure that good communication is maintained at all times.

Another major accomplishment has been the building of a 10 room accommodation block (see page 11). The Project badly needed more living space, and thanks to the vision of the Taraba State Government this has been made possible.

In June this year there was an opportunity for me to visit Chester Zoo for the first time. Chester Zoo (the North of England Zoological Society) is one of our major sponsors. Roger Wilkinson (Scientific Director) invited me to give a lunch time talk about the NMFP. Doing this I met quite a few zoo people and it was extremely helpful to put faces to names I had previously only known through e mail correspondence. I had time for a look around the zoo, which is extremely impressive. It was excellent to see Nigeria and the Nigerian/Cameroon Chimpanzee (our chimpanzee) having such a high profile.

Research through the NMFP is continuing to go well. We were most fortunate to gain funding from the Mohamed bin Zayed Species Conservation Fund towards our work on the chimpanzees and putty nose monkey. Paul Dutton is now seeing the chimps on an almost daily basis, and is collecting much valuable information on their ecology (see page 19). Dr Camilo Guzman has now arrived at Ngel Nyaki and will be able to compliment his seed dispersal modelling with field data (see page 26). The field assistants continue to do well and develop new skills which they learn from visiting scientists and student researchers.

Conservation initiatives have been stepped up, thanks to growing collaborations with Taraba State Government (see page 10). However there are still major threats to Ngel Nyaki and we will continue to work alongside the State Commissioner of the Environment Gebon Timothy Kataps and State Forest Service to help improve forest protection and management.

Once again, many thanks to the VC of Gombe State University Professor Abdullahi Mahadi for the support he provides in so many ways, including the safe transpiration of students from Abuja to Ngel Nyaki. Also to Bubajoda Mafindi, Executive Director of the Basic Education Board of Taraba State, who went way beyond the call of duty assist us in meetings with the Governor.

As always, there are many other people who contribute in varying ways to the success of the Project. There are too many of you to list here, but your contributions do not go unnoticed.

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

Dr Hazel Chapman
Director
Nigerian Montane Forest Project

Cover Photo: *The NMFP and Taraba State Forestry patrollers along with Yelwa village volunteers planting* Ficus *posts as a live fence to demarcate the Reserve boundary.*

Contents

Photos by Hazel Chapman unless otherwise credited.

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**

Sponsors

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

Academic Supervisors

Assoc. Prof. Jim Briskie (UC) Biology
Assoc. Prof. Jenny Brown (UC) Math and statistics
Dr Hazel Chapman (UC) Evolutionary ecology
Dr Terry Greene (DoC) Primate monitoring
Assoc. Prof. Jon Harding (UC) Fresh water ecology
Prof. Dave Kelly (UC) Plant ecology
Dr Britta Kunz University of Wüerzburg (Germany)
Prof. Mike Lawes (James Cook University, Darwin) Primatology/behaviour
Dr Piers Locke (UC) Sociology
Dr Ximena Nelson (UC) Animal behaviour
Assoc. Prof. David Norton (UC) Forestry
Dr Ulf Ottosson (Leventis Conservation Institute, Aplori) Ornithology
Dr Richard Vokes (UC) Sociology
Prof. Janette Wallis (American Nigerian University,Yola) Primatology
Dr David Blackburn (Kansas State University Division of Herpetology, Natural History Museum and Biodiversity Institute, University of Kansas)

Board of Advisors


Hazel

The Project is now well established and quite large – we employ 22 full time staff, have up to 8 postgraduate students at any one time and work with Taraba State Forestry in the patrolling and conservation of Ngel Nyaki Forest Reserve. Our budget is over US$ 50,000 /annum. For this to all run smoothly we need sound governance. To this end, an Advisory Board, comprising 10 individuals was established in April 2010. The Board mainly comprises Nigerian nationals, as a major long term goal of the Project is that it should be sustainable and managed through Nigeria.


Mahadi


Maf'indi


Akosim


Ulf


Hugh


Danladi


Kennedy


Temidayo


Charles

Members

Prof. Abdullahi Mahadi VC Gombe State University. Prof Mahadi is a strong advocate of the Project and has already contributed much in the way of logistical and financial support. Prof. Mahadi will work with the Project to develop links between it and Nigerian Universities. He will also support collaborative efforts to secure funding.

Bubajoda Mafindi Special Assistant to the Governor and the State Chairman of Universal Basic Education. Mafindi has been a vital linkbetween the NMFP and the Taraba State Government. Mafindi was also responsible for the extremely successful commissioning of the Yelwa Nursery School in 2009.

Prof. Callistus Akosim (Federal University of Technology, Yola. FUTY). Prof. Akosim will ensure FUTY and the NMFP continue to have a strong relationship. He will advise on appropriate postgraduate level field courses.

Prof. Ulf Ottosson (Ecologist). Ulf is already strongly affiliated with Aplori Conservation Research Institute (Jos). He will help strengthen relationships between the two organizations. Ulf already provides invaluable technical advice / supervision to NMFP ecology students.

Hugh Campbell (Lawyer). Hugh has supported the Project since it began in 2004. Hugh has lived in Nigeria for over 30 years and will advise the Project on administrative issues.

Danladi Umar (PhD candidate with the NMFP; Lecturer Gombe State University, fresh water Ecology). Danladi was appointed as 'manager' of the Project in 2007. He will continue to provide extremely valuable advice in many matters pertaining to the successful running of the Project.

Dr. Kennedy Poloma (Biology, Head of Department, Gombe State University) Kennedy is in a strong position to liaise with Misa Zubairu (project co-ordinator) over logistical issues, especially in terms of financial transactions. Kennedy is a key link between the NMFP and Gombe State biology students.

Temidayo Osinubi Samuel (PhD Candidate UC, Ex Aplori and Birdlife International). Dayo assists the Project especially in terms of developing national and international links with Ornithologists Dayo also provides scientific and logistical support to scientific visitors.

Charles Nsor (Lecturer at Gombe State University, ex Aplori). Charles has been a stalwart of the Project for several years and offers hands –on advice in terms of local services such as internet providers. Charles is a dedicated conservationist and makes it his duty to share his knowledge with field assistants and students alike.

With this very able and committed advisory board it is anticipated that the NMFP will continue to grow and improve in terms of its overall mission statement.

Conservation Initiatives

Good progress has been made this year regarding the conservation of Ngel Nyaki and neighbouring Kurmin Danko Forest Reserves.

The State Commissioner of the Environment, Gebon Timothy Kataps, has invited the NMFP to work with the Director of Forestry, Samuel Telatule and the Yelwa Forest Officer Mr Joseph Sunkan to ensure the long term future of Ngel Nyaki and Kurmin Danko reserves. To this end the NMFP is administering funds from the State designated for i) paying 50 patrollers wages for Ngel Nyaki and Kurmin Danko, ii) restoring 5 patrol posts which were built in 2006/7 but have never been used and iii) planting the entire reserve boundary with *Ficus* as a demarcation tool.

The patrollers are being trained by rangers from Gashaka Gumti National Park.

Time will tell how effective all of this will be. There has been opposition to the *Ficus* fence by the cattle owners, and sadly the first attempt was a failure as the planted posts were mainly removed. However on the 23rd August 2010 Commissioner Kataps visited Ngel Nyaki with other State Officials to discuss these problems with the village Juaro and other Local Government officials. The demarcation is going ahead again, this time with support from government officials.

Despite the increased number of patrollers, hunting is still an issue. Paul Dutton, working on chimpanzee ecology, is still finding regular evidence of hunters in the reserve and is taking good photographic records. Snares are especially common. We need to find a way of quantifying if, and by how much, hunting is being reduced by the initiatives in place. It is extremely important that hunters be held accountable for their actions.

Paul has also come across large trees in the reserve burnt down in an attempt to collect honey.

Misa Zubairu, co-ordinator of the NMFP, is now sending a monthly report to the Commissioner Kataps regarding infringements into the Reserve by cattle, their herders and hunters .

Adulkarim, Isa, Chief judge in Maisamari is being supportive of the forest in terms of prosecutions. Forest Officer Mr Joseph Sunkan is extremely dedicated to the task of protecting the Reserve from all main threats; cattle grazing and associated burning, hunting, burning of trees for honey and "hot" burns infringing into the forest from the grassland above.

The new patrollers on their way to plant Ficus at Kurmin Danko. Photo by Usman Abubakar.

Patrollers planting Ficus after spraying the bondary with herbicide. Sadly, all this effort was to no avail as some of the local Fulani cattle herders have removed all the posts.

Conservation Club

Misa Zubairu (NMFP Co-ordinator) now works alongside Mr Joseph Sunkan (Forest Officer) running the Conservation Club. Saidu Isa, ex-hunter and long time patroller from Gashaka Gumti National Park- now employed by the NMFP – is also involved (see photo at right).

They visit the local villages/ settlements of Maisamari, Dujere, Mayo-Nyebbe, Zango and Yelwa village Below are some pictures of our interaction with people in Mayo Nyebbe, Chairman Musa village and Dujire village.

Misa Zubairu, NMFP Co-ordinator.

Saidu Isa explaining the importance of conservation to the Chairman Ndongo Ngishi and his staff. Photo by Misa Zubairu.

Members of the Alpha Secondary School, Yelwa

Mr Joseph Sunkan (front) during a Conservation Club meeting at Mayo Nyebbe.

Schools belonging to the Club include:

- Alpha Secondary School, Yelwa
- Yelwa Primary School
- Exxon Mobil Nursery School

Developments

New Building

Thanks to the Governor of Taraba State, Danbaba Suntai, the Project is building a new, and much needed, accommodation block (see images). Building began in July 2010, and the roof is now on. The building should be ready for students and visiting researchers by September. The building has 10 rooms. The idea is to covert the original building into a research block, with labs, computers and office space.

All of this has been organized by Misa Zubairu (Project co-ordinator), with support from Dr Kennedy Poloma. All the work has been sourced locally and the furniture will be made by the Gashaka Gumti National Park carpenters.

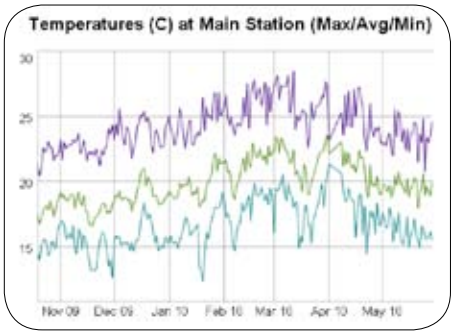
New building with 10 bedrooms and a living-dining room. Photo by Usman Abubaker.

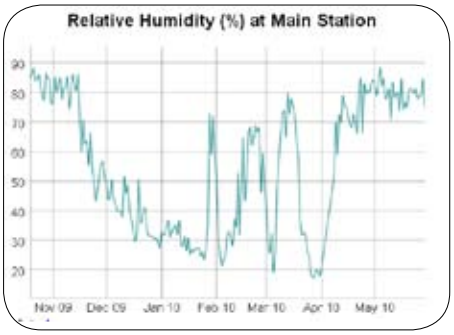
Weather Station

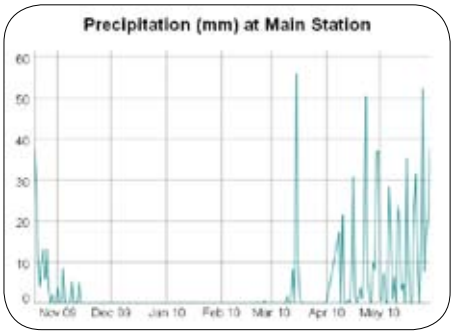
The data from the weather station is now on line and freely available. Usman sends the data to Dr's Steve George and Peyman Zawar-Reza at UC, who keep the website updated.

Available from www.biol.canterbury.ac.nz/NMF_project

The weather station was paid for from a grant from the EU Low Carbon High Growth Strategic Growth Program Fund. Administered through the British High Commission, Abuja.







Graphs showing some of the measurements. The raw data is also available from the Project's website.

Thanks to DHL, Nigeria, for logistical support.

Setting up the main weather station.

Industrial Training Students

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

1. Paulinus Felix Obidah
2. Jedida Akawu
3. Mustapha Musa
4. Sani Saleh
5. Muhammad Ahmad

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

The students are 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.

In particular this year the students worked on increasing the herbarium collection and making a photographic collection of fruit and seed.

Jedida Akawu

Sani Saleh

Mustapha Musa

Paulinus Felix Obidah

Muhammad Ahmad

Tantalus Monkeys

Elizabeth Sperling is working as a volunteer at Ngel Nyaki studying the reactions of local tantalus monkeys to three new neighbours and possibly the 'soft' release of the trio into Ngel Nyaki forest.

Jack, Audrey and their baby, Savannah were brought to Ngel Nyaki in December 2009 by Prof Janette Wallis.

Prof Wallis has been overseeing the care of these monkeys for the last two years while they lived in a cage on the American University of Nigeria (AUN) campus, in Yola.

Because Janette has now left AUN, the monkeys had to be moved to Ngel Nyaki so that we can attempt a soft release into the wild. At present, they are living in a cage at the forest edge and Elizabeth is monitoring their behaviour as they become acquainted with the local tantalus monkey troop that visits daily. We are also getting them accustomed to the local diet.

Liz writes: My project includes observing and cataloging behaviors of three captive tantalus monkeys (Jack, Audrey, and Savannah). Jack and Audrey were found on the AUN Yola campus by Professor Janette Wallis. After the birth of cycloptic Savannah, the three were relocated to magnificent, pleasant Mambilla Plateau. I am preparing them for their eventual release into the forest by feeding them natural foods that the wild tantalus eat, as well as determining the wild troop's home range. I am utilizing ad libitum observation both at the cage and on the movements of the wild troop as they travel through the magical montane forest. Their interactions with Jack, Audrey, and Savannah are terribly fascinating and are providing vital information that should serve to speed their return to their natural habitat. When they are released, continued monitoring of their progress would aid to further understand the effectiveness of captive release programs. Despite the trials and tribulations of the rainy season, I have collected a fair amount of data which will surely benefit any reintroduction project the reserve may conduct in the future.

In addition to studying the behavior of captive monkeys, I am also conducting anthropological fieldwork in the local village. Crop-raiding by monkeys is a long-term problem that is being exacerbated by restrictions on killing wildlife. In order to find a solution, I am interviewing area farmers whose livelihoods depend on the crops that are affected by this destruction. With continued research, I am determined to find a lasting solution that benefits both man and monkey.

Elizabeth Sperling with the tantalus. Photo by Misa Zubairu

Jack, Audrey and baby savahhah.
Photo: Janette Wallis

New cage, January 2010.
Photo: Janette Wallis

Caterpillar Plague

A plague of hairy, itch making, bracken dwelling caterpillars made life very difficult for everyone, including the monkeys, during June and July this year. If anyone knows the species of caterpillar, please let us know.

The nasty caterpillars
Photo by Misa Zubairu

Forest Restoration

Background

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 was to investigate and 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. 600 tree seedlings were planted in fenced off grassland adjacent to nearby Ngel Nyaki forest.

While many of the planted trees have survived, natural regeneration within these fenced-off areas is minimal. Few seedlings have survived to establishment due to a thick grass sward throughout these fenced areas. Controlled grazing has been found to facilitate forest regeneration through removing thick grass sward and improving seedling survival and establishment (Zimmermann et al. 2009). To test whether controlled grazing and burning with some seed addition facilitates seedling survival and establishment in Ngel Nyaki reserve, an experiment is being conducted in these fenced areas of Ngel Nyaki forest.

Objectives

The main objectives of this study are to determine the effects of controlled grazing and burning within fenced exclusion areas next to forest edges. This is being experimentally tested through applying treatments in quadrats along transects starting at the forest edge and extending into the grassland. The treatments are:

i) grazing
ii) burning
iii) burning with seed addition
iv) adding perches to encourage birds into the grassland.

Seedlings present in the quadrats have been identified, numbers of each species counted, and their height measured. A year after the treatments were applied the seedlings will be identified, counted and measured again to determine the effects each treatment has on forest regeneration.

Also, removal of the grass sward around seedlings along the forest edge in the fenced areas may promote survival. This will be tested along with the above treatments as this may be a more effective method of enhancing Ngel Nyaki forest regeneration.

References

Zimmermann, H., D. Renison, I. Leyer, and I. Hensen. 2009. Do we need livestock grazing to promote *Polylepis australis* tree recruitment in the Central Argentinean Mountains? *Ecological Research* **24**:1075-1081.

Light burn treatment. Photo by Kristy Udy.

Four months later, an early effect of light burn on competition.

Visitors

Ornithologists from the Nigeria Tropical Biology Association

Photo: www.wild-african-art.com/william-t-cooper-art.html

White Crested Turaco

The Project is very happy to be hosting a group of ornithologists from the Nigeria Tropical Biology Association in November/December this year.

The TBA have the motto: Building capacity for young Nigerian conservation scientists

In a letter to the Project the NTBA alumni group expressed their support of the initiative of NMFP of protecting fragment forest as well a threatened and endemic biodiversities in Nigeria montane forests. They offered to plan to contribute to the conservation effort through a two weeks survey of Turaco bird species at NNFR. The outcomes of the survey will be disseminated through the NTBA annual seminar series organised for students in conservation related disciplines in Nigeria. The NTBA also see this as an opportunity to involve tertiary institutions with the aim of sensitising on the significance of montane forest in conservation and possibly initiate collaboration among institutions, researchers and students necessary to enhance the conservation of biodiversity.

The group have been successful in gaining a grant from the TBA Small Grant Scheme titled "Spatial distribution of turacos and their preferred food plants in Ngel Nyaki Forest Reserve, Mambilla Plateau, Nigeria".

Gombe State University students take notes on the research projects going on at Ngel Nyaki. Photo by Usman Abubaker.

Gombe State University Undergraduate Field Trip

Misa Zubairu reports on the Gombe State University Undergraduate field trip to the Project. (14th-16th March 2010):

Report on the University of Gombe State, on excursion from the Department of Geography. The students spent 3 days in Ngel Nyaki. Field station manager Misa introduced the staff, welcomed the visitors and explained the history of Ngel Nyaki reserve. The Gombe and New Zealand student research projects were also explained followed by more about phenology and the other activities undertaken at the fieldstation. The students looked at the data being collected. Gombe State senior lecturer Mbaya explained to them more about Ngel Nyaki. Most of them would like to return here for research in the future.

Interactions Expert from the Muséum National d'Histoire Naturelle

Dr Pierre-Michel Forget of the Muséum National d'Histoire Naturelle in France is an expert on the interactions between tropical forest trees and their seed dispersers.

Forget is visiting Ngel Nyaki during November 2010. During this time he will investigate the *Carapa* species in the Nigerian montane forests (see below- Forget holding a *Carapa grandiflora* fruit from Rwanda). Forget will also interact with research students and field assistants at Ngel Nyaki.

To find out more about Pierre-Michel Forget see http://news.mongabay.com/2010/0307-hance_forget.html

Dr Pierre-Michel Forget. Photo courtesy of: Pierre Michel Forget.

Student Projects

Dispersal of large seed in an Afromontane forest with few large bodied frugivores.

Aliyu Babale, PhD

Primary and secondary large seed dispersal in a West African montane forest

The research will be carried out during dry season in October-January 2010/2011 and 2011/2012 and February-June 2011 and 2012 in Ngel Nyaki forest reserve, Nigeria. The objectives are to determine the primary and secondary dispersers of *Beilschmiedia mannii, Garcinia smeathmannii* and *Carapa grandiflora* seeds and whether primary dispersal enhances seed germination as well as influences secondary dispersal of the focal species. Primary and secondary dispersal of large seed is a significant factor in a sustainable biodiversity. A loss of seed dispersers such as mammals, birds, squirrels, rodents and insects could potentially be extremely damaging to Ngel Nyaki forest and this may contribute to an overall global decline in biodiversity. However in Africa, very little is known about the potential for either small primates or large-bodied birds to replace large primates as primary dispersers. Neither has the role of secondary dispersers been investigated in West African montane forest.

Methods

1. To assess foraging activity: focal tree species will be observed in the morning (630-1100 hrs) afternoon (1300-1630 hrs), focal and scan sampling methods will be used.
2. Seed removal will be investigated using seed experimental plots. Disperser and/or predator activity will be recorded using a camcorder.
3. Seed germination rate will be assessed by comparing seeds collected from faeces of primary dispersers with fresh seeds collected directly from mature fruits of focal tree species.

Outreach Programmes and the Politics of Conservation: The Nigerian Montane Forest Project

Victoria Ashton

MSc Anthropology – UC

Supervisors: Richard Vokes and Piers Locke

My anthropological project at Ngel Nyaki focuses on two areas; the transmission of knowledge and the interaction between conservation programs and local communities. I have been conducting fieldwork both within the reserve itself, and within the village of Yelwa, located near Ngel Nyaki.

I am looking at how knowledge, specifically scientific knowledge, is transferred both within the field station and between the field station and the local community. I began by observing the Ngel Nyaki field assistants as they performed their daily data collection on a number of different projects. The information I learned from the field assistants, combined with future interviews with the researchers for whom the data is being collected, will provide insight into how fieldwork is done at the station and how this relates to the final product that is produced, namely academic literature. I am also interested in how much scientific knowledge is transferred out of the fieldstation, and how much scientific language and information is being passed back to the local community. The types of knowledge I am interested in are both understanding of the purpose of the project and knowledge about the plants and animals within Ngel Nyaki itself. I am also concerned with to what level the NMFP interacts with the local community.

I am also conducting interviews within Yelwa to determine how the NMFP is affecting the lives of the people there, and how they view these effects. Through interviews with a wide range of people who live in the village I am trying to determine the local perceptions of the field station and to ascertain any differences in attitudes between various groups. These groups include tribes, gender, age and station. By looking at local perceptions of the project, it will be possible to find out how successfully the NMFP is transmitting its message and how well the aims of the project are being achieved. It should also make it possible to better address any perceived problems that are present in the community and modify aspects of the project if necessary to better serve both the local people and the overall aim of forest conservation.

Since beginning interviews I have become interested in the local reactions to two specific problems and the solutions that are currently being enacted. The two examples I am looking at in detail are the developing situation with the grazers and the project being developed regarding the raiding of crops by monkeys. These were both mentioned as issues of concern to a significant number of people in the village. As my research continues I will look at the expectations of the people of Yelwa and how their opinions change as notable events occur. I asked about possible solutions to the grazing problem before the government sent agents to discuss the boundary issue, and then requestioned the same people after the meeting to see if there were any changes. I intend to reinterview the same people as the government continues to deal with the boundary dispute, which should provide a better picture of local opinions. The raiding of farms by monkeys provides an interesting look at how the villagers view conservation, and how the reserve is able to combat difficulties caused by increasing wildlife numbers as the reserve becomes more successful. Being present as this project is in its infancy will also provide a good view into the difficulties posed by conservation programs when they may be at odds with some part of the local community.

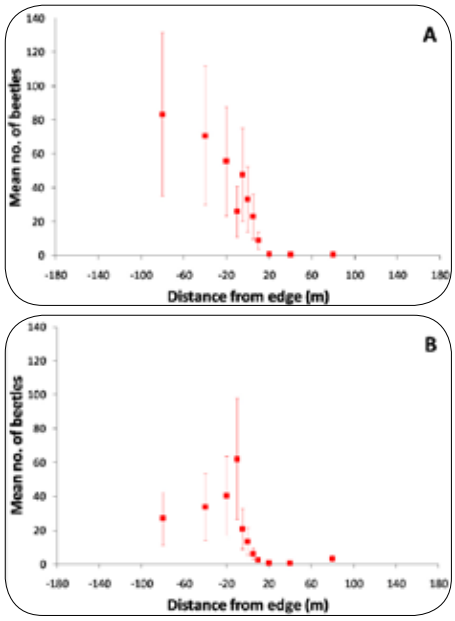
The effects of habitat edges on dung beetle (Coleoptera: Scarabaeidae) community structure and ecosystem function.

Andrew D. Barnes

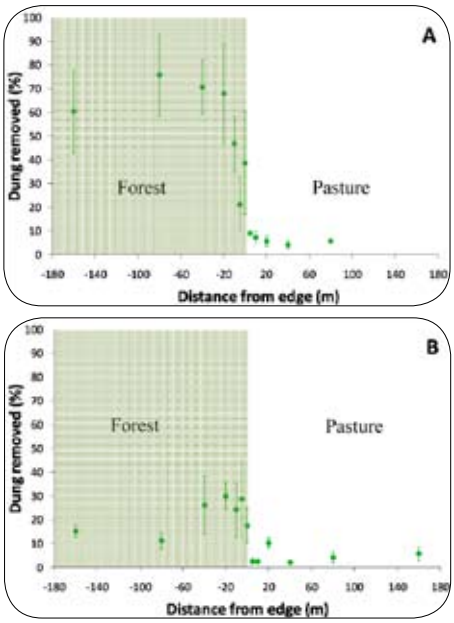
Edge effects can be widely pervasive throughout fragmented landscapes, often producing complex responses of community structure in natural ecosystems1, 2. Such effects are of high concern for the conservation of species and ecosystems3, yet there is still little understanding of how species may respond to these effects depending on their expressed traits and how this may be correlated with ecosystem function. Furthermore, there have been no studies that have found evidence for continuous response functions of dung beetle community structure to edge effects. As edge gradients have significant consequences for biodiversity and the functional structure of communities, the implementation of strategies to reduce potential exacerbating drivers of these effects are of critical necessity. I predict livestock grazing and fires in the adjacent pasture will have an important impact on the intensity of edge effects and resulting distribution of species' traits and ecosystem function of dung beetle communities at Ngel Nyaki forest reserve, Nigeria. The aim of this research is to establish how edge effects may alter community structure and function across an edge gradient and to determine how livestock exclusion may reduce the intensification of such alterations.

Edge effects encompass a wide range of factors that are created or intensified as a result of the introduction of habitat edges4. Such effects include variation in climatic variables (E.g. light, humidity, and temperature), susceptibility to disturbance, and alteration of vegetation4, 5. Adjacent land use may greatly determine the magnitude of edge effects by further altering these variables. In particular, intrusion of livestock in forests can greatly reduce the vegetative understory6. Therefore, I propose that livestock grazing may intensify the magnitude of edge effects on dung beetle communities, thus livestock exclusion will be an important tool for conserving ecosystem structure and function. Recent quantification of vegetative structure, between protected and non-protected edges at Ngel Nyaki Forest reserve, has shown that there is a significant decrease in percent vegetation cover below 1 meter near the forest edge at non-protected edges. These results suggest livestock grazing will potentially exacerbate alterations in structure and function of invertebrate communities across edge gradients. Preliminary results in the distribution of total dung beetle abundance across the forest edge show a clear difference in the response of dung beetle communities between protected and non-protected edges (fig 1). The prevention of interactions between grazing and edge effects and determination of the extent to which this interaction may occur, is critical for the conservation of Ngel Nyaki forest reserve and may potentially provide global applications for other forest reserves.

The response of individual species to disturbance can be highly variable, partly due to trait variation conferring different levels of susceptibility to disturbance2, 7. In particular, extremes of dispersal ability (high or low) may confer higher persistance2, 8 whereas body size is often negatively correlated with species persistence2, 9. Consequently, there may be trait-dependent alteration of community structure across a habitat edge gradient in response to environmental variables induced by the presence of the forest edge. However, there is currently no evidence for such response variability across habitat edges. I will test the hypothesis that edge effects will alter abundance and species richness of dung beetles and drive trait-dependent responses in body size and dispersal ability between and within dung beetle species across the forest edge gradient. This will be carried out by quantifying changes in abundance and diversity of dung beetles across the forest edge at Ngel Nyaki forest using trap catch data which has been collected from September to December, 2009. To test trait mediated



Mean beetle abundance found at different distances from the forest edge for protected (A) and non-protected (B) sites. Points indicate mean number of beetles caught +/- SE.



Percent dung removal from experimentally placed dung at different distances from the forest edge for protected (A) and non-protected (B) sites. Points indicate mean percentage of dung removed across sites +/- SE.

responses in dung beetle species at Ngel Nyaki, I am also using all collected specimens to measure wing area/body mass ratios as a surrogate for dispersal ability and also to quantify body mass dependent responses in species to forest edges. Changes in the distribution of these traits between species will give an indication of the effects of habitat edges on the persistence of species exhibiting particular traits. Furthermore, variation of body size to body weight ratios within species will indicate the effects of edge gradients on individual fitness, inferring habitat edges may also apply significant selection pressure on individual species.

Species traits are also important for their conferred ecosystem function within a community10. For example, body size in dung beetles is correlated with the amount of dung removed from a dung pat11. This results in faster decomposition rates and higher numbers of seeds secondarily dispersed that were present in the dung9, 12. Although the functional response of communities to fragmentation has been extensively measured, there is still little direct evidence for this in response to edge effects. As such, I hypothesise that if species trait distributions are sensitive to edge effects, so will be the functional response of dung beetle communities across an edge gradient. This may occur where species with larger average body size are lost from forest edges as edge environments often confer higher mortality rates10. In the case of dung beetle communities, this may result in decreasing rates of dung removal towards the edge as high abundance of smaller individuals do not provide such high rates of removal10, 13. I measured dung removal rates across the forest edge at Ngel Nyaki forest reserve during the trapping period. So far, I have found a strong response in ecosystem function (dung removal rates) across the forest edge and also a striking difference between protected and non-protected edges (fig 2). Further analysis will shed light on any potential correlations between community structure (taking into account species identity) and removal rates at a given distance from the edge.

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Foraging behaviour of the Nigerian/Cameroon chimpanzee (Pan troglodytes ellioti) in a small remnant of montane forest: assessment of technology, diet and habitat.

Paul Dutton,

The Nigerian Chimpanzee Pan troglodytes ellioti 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 is to study the elementary technology, diet, acquisition and processing of food and social interactions in relation to foraging of P. t. ellioti. This data will provide invaluable information towards ethology, management and conservation of West African chimpanzees. We will assess technology by locating and describing manufactured artefacts and unmanufactured objects and seeking evidence from the surrounding environment as to whether we can establish reasonable details about their presence/absence. Using a combination of faecal samples, artefacts, direct and indirect observations we will assess the diet of the chimpanzees. In a second step, ecological correlates such as food availability and nest counts, and habitat characteristics such as plant and animal composition will be assessed, in order to detect dietary and behavioural induced influencing parameters and also for future habitat suitability. The planned research will be carried out in the Ngel Nyaki and Danko forests and its surrounding

support zone of north-east Nigeria in West Africa.

Chimpanzee abundance

The assessment of chimpanzee abundance has been completed; however the distance sampling method was abandoned after seven months due to the absence of any new nests. The previously established distribution of transects within Ngel Nyaki did not provide a good sampling effort due to the absence of nests and few chimpanzee sightings, therefore, following seven months, a quick sampling method was adopted, the standing crop nest count. This method was applied to the non-surveyed part of Ngel Nyaki and provided us with many new nest discoveries. The data from all the surveys is being compiled and will be used to estimate the abundance of chimpanzees. One important question arising from this study was: Why are the chimpanzees nesting in only one-half of the forest? The most logical reasons relate to food availability and disturbance, both of which are being further explored.

Habitat

Assessment of habitat has commenced and continuing. Density of trees which chimpanzees consume products from has been previously estimated on the established transects in Ngel Nyaki and further density estimates have commenced in Kurmi Danko and during the standing crop nest counts in Ngel Nyaki. Phenology data in Danko commenced in November 2009 and is ongoing.

Nesting ecology

Nest ecology has commenced and variables are still being collected. Slope of the terrain, nest height, tree height, tree species, DBH, position in tree, distance from water, distance from fruit + species of fruit, microhabitat location, temperature, precipitation and decay rate are some of the measurements being collected every time a nest is sighted.

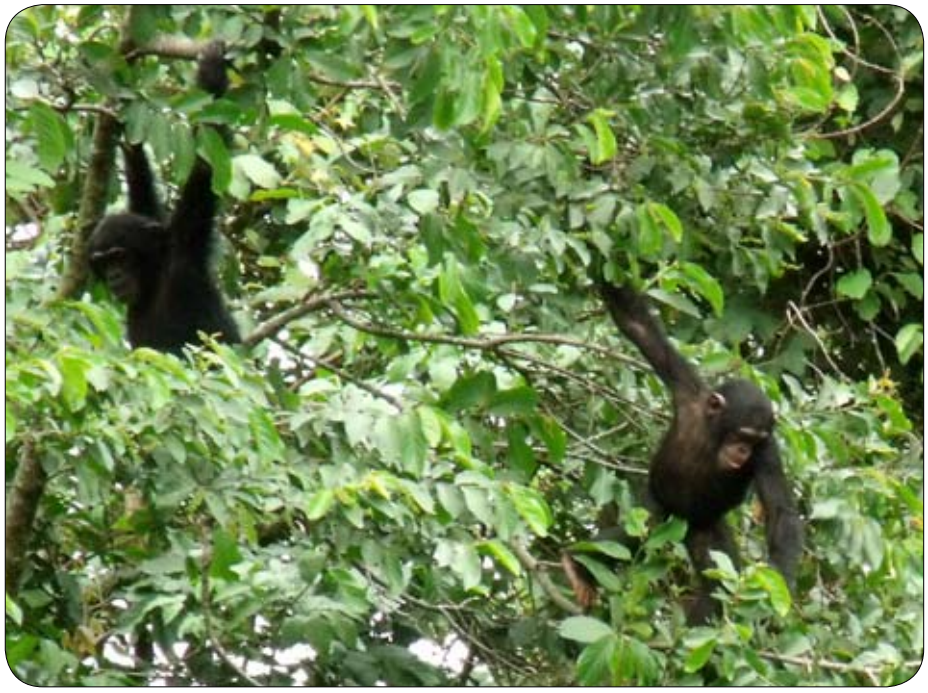
Diet

Dietary analysis has commenced: >240 dung samples have been collected in 10 weeks, contents analysed and weighed down to 0.01g. Faecal collection and analysis is ongoing.

The chimpanzee diet corresponds to seasonal changes in fruit availability and from first observations four major fruiting seasons have finished since we started collecting faecal samples. From the 240 dung samples we have established that Ficus (unknown species), Landolphia, Syzigium and an unknown vine species have made up the majority of the chimpanzee diet over a 10 week period. The chimpanzee diet in Ngel Nyaki so far consists of, >50 species of fruit/seeds, 3 invertebrates, 1 crustacean, bark, grass and small stones.

Technology

Assessment of technology has commenced however very little has been discovered. Verified technology in Ngel Nyaki chimpanzees, to date, is based on three digging tools and two anvils.



The Nigerian Chimpanzee - the most endangered subspecies.

Infra red photo of Nigerian Chimpanzee in Ngel Nyaki forest reserve. Photos by Paul Dutton.

Removal experiments

Removal experiments began to identify if any seeds would be removed from chimpanzee dung. 30 seeds of one species were placed in a defined plot, 10 of these seeds were rubbed in chimpanzee dung, 10 dried and the last ten remained in the fruit to identify preferences of removal agents and to identify influences of chimpanzees on the potential secondary dispersal of these seeds. Eight seeds, consisting of Landolphia, Syzigium, Poteria, Santeria, Parkia, Isolona, Trilepisium and an unknown vine species, were placed in the forest plots for five days and four nights. Each seed in each plot was replicated five times, thus 50 Landolphia seeds rubbed in chimpanzee dung were used over five plots.

A motion-censored infra-red camera was placed on one of the plots and remained for the five days and four nights plus a resting period of two days with no seeds, and moved every week to a new plot with the change in seed species. High removal rates on all seeds (excluding Santeria due to previous predation by beetle larvae) were recorded, with the cameras detecting rats, squirrels and porcupine as the main removal agents.

Germination trials

Germination trials began to identify the viability of seeds passed through the gut of chimpanzees. Four treatments consisting of chimpanzee passed and fertilised (found in chimpanzee dung and remained in chimpanzee dung for the trial), chimpanzee passed (removal of seeds from the dung), fresh and fertilised (fresh seeds fallen from the tree and placed in dung) and fresh seeds fallen from the tree (control). To date three seed/fruit species, consisting of Landolphia, Syzigium and Margaritaria, have identified that seeds passed through the gut of the chimpanzee germinate quicker and are less likely to be attacked by fungus.

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

Abby Grassham, MSc Student

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 4kg1 and lives in multi-male, multi-female groups ranging from 11 to 76 members2. 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 fruit3,4 and a relatively long gut retention time of 30 hours3. 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 forage2,3.

Tantalus Abundance

Fortnightly my field assistant and I walked line transects running from 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. This data will be analysed using the software, DISTANCE 6.0, to gain an estimation of the number of tantalus present at Ngel Nyaki.

Habitat Use

Habitat use was investigated to determine the amount time tantalus spend in different habitats, particularly the grassland. Three semi-habituated tantalus troops with home ranges along the northern side of the forest were observed regularly. During observations 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 we first located the troop until they disappeared into the undergrowth in the middle of the day or settled down in a sleeping site for the night.

We also took GPS locations of each group seen during the course of the transect walks mentioned above. It is commonly thought tantalus are primarily 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. The GPS points will be placed onto a Google Earth image of Ngel Nyaki and the shortest distance from each point to the forest's edge measured.

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 activites and the habitat the faeces was found in recorded. Back at the lab each faeces was mixed with water to create a slurrey and sieved to remove any seeds present. All seeds larger than 2mm were counted but seeds smaller than 2mm 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.

Germination Experiment

The germination experiment was set up to determine if tantalus dispersed seed into habitats suitable for germination and

establishment. 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 were used for the experiment. These were *Afromomum angustifolium, Croton macrostachyus, Rytigynia umbellulata, Leea guineensis* and an unidentified species of vine. Seeds were mixed with fresh tantalus faeces that had had all 2mm 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 number of seedlings of each species recorded. The data will be analysed using survival analysis with right censored data for those seeds which did not germinate.

Preliminary results suggest that tantalus are important seed dispersers who transfer seed from forest to grassland habitats where they are able to germinate, however, the work is still in progress. When all components of the study are complete we should be able to get a good picture of the role of tantalus in maintaining forest structure and in regeneration at Ngel Nyaki, and use that to help inform appropriate conservation actions. As tantalus are fairly widespread throughout much of Africa they may play similar roles in other areas which should be considered in other conservation projects.

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The relative importance of birds and insects as pollinators of a west african montane forest: a case study of ngel-nyaki forest reserve

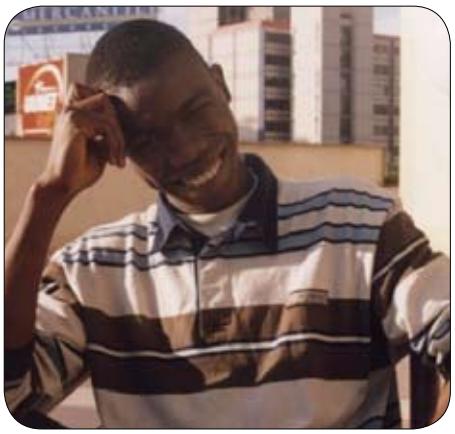
Nsor Charles Ayuk , PhD.

Charles is waiting on his Scholarship from Gombe State University to commence his PhD study. He has been extremely busy this year lecturing for the first time. Charles should now begin his studies in April 2011.

Remote sensing and geographical information system application to biodiversity assessments of Nigerias montane forest fragments

Adewoye Ralph , PhD

Ralph is still waiting for his funding to be released before he can begin his field work.



Habitat choice and evolutionary fitness in the double toothed barbet *Lybius bidentatus*.

Osinubi Samuel Temidayo, PhD

My project is aimed at investigating the dynamics of adaptive behaviour as a response to differences in habitat quality, and how or if this adaptation results in a greater chance of survival for individual birds. The outcome of this project is to assess the efficacy of behaviour as a mark of species-specific habitat quality, and hopefully present a tool for the rapid assessment of the conditions of individuals of a particular species across different locations. The key behaviours I am investigating are territoriality, foraging strategies and vocalisation. The various measures of fitness/survival include size-weight ratio, feather daily growth rate, feather colour using both digital scoring methods and carotenoid analysis, bilateral asymmetry, and blood analysis. Habitat quality is being assessed in terms of food availability and nest predation risk.

I conducted my second field season at the Nigerian Montane Forest Project in Ngel Nyaki Forest Reserve, Nigeria, between October 2009 and March 2010. Before my field season commenced and in preparation for the vocalisation aspect of the study, I participated in the Sound Analysis Workshop organised by the Bioacoustics Research Program of the Cornell Laboratory of Ornithology in September 2009. As a result of this interaction, I was able to secure an equipment loan from the Macaulay Library of the Cornell Laboratory of Ornithology.

My field work was satisfactory in many respects, and even though I was not able to

achieve the recommended sample size for some aspects of the work, the overall output is sufficient for analysis and supports my research question. The data collected for some aspects of the study are sufficient for publication, for which effort is now being made towards analyses and write-up. Having completed the second field season, I am working with the Macaulay Library towards the archiving of the sound recordings, such that these can be cited when referenced in publications. Analysis of the sound recordings is also being conducted at this time. Furthermore, arrangements are in place to enable the carotenoid analysis of feather samples collected in the field. This is to be done with the support and guidance of Assoc. Prof. Kevin McGraw of the Arizona State University, USA. Lastly, the genetic analysis of the blood samples collected will be conducted with the support and guidance of Dr Arvind Varsani.

Competition in the dung community: influences on ecosystem functioning

Kristy Udy

Background

There are many processes that contribute to the structure and assembly of communities and how the organisms interact (Belyea & Lancaster 1999; Kokkoris et al. 1999). Interactions between individuals and species that share the same environment are an important part of determining the community make up (Finn & Gittings 2003; Kokkoris et al. 1999; Laska & Wootton 1998). 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 (Davis 1996). 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 (Finn & Gittings 2003; Hanski & Cambefort 1991). 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 (Davis 1996; Finn 2001; Finn & Gittings 2003). 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 (Estrada et al. 1993).

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 (Andresen 2008; Larsen et al. 2005; Nichols et al. 2008). 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 (Nichols et al. 2008; Vulinec 2002). 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 (Hanski & Cambefort 1991; Vulinec 2002). Dung beetles bury dung for breeding attempts and often indirectly bury seeds, therefore enhancing germination (Shepherd & Chapman 1998). The surrounding land use of forest reserves can profoundly influence the structure of the adjacent forest communities and the resulting associated organisms (Piessens et al. 2006; Tylianakis et al. 2008). 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 will set up exclusion experiments in areas of Ngel Nyaki forest that are behind protected edges (fenced) and non-protected edges (un-fenced). Also, I am conducting experiments on how much dung removal occurs in natural species assemblages of dung beetles and measuring how much is removed with the different forms of adjacent land use. To identify which dung beetle species are attracted to the resource and their numbers I am also placing traps out in areas of Ngel Nyaki forest behind protected and non-protected forest edges. Furthermore, to experimentally determine how much dung each size of dung beetle removes I am manipulating the number and size of beetles in a controlled situation to test how functionally important they are.

Objectives

The main objectives for this study are 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 between Dung Beetles over the Shared Resource

Competition over resources differs in intensity in areas of differing land use. To test how species diversity and the functioning of the ecosystem is influenced by adjacent land use of Ngel Nyaki forest I will conduct exclusion experiments. The treatment will be the effect of dung beetles on the number of seeds removed from the dung resource and the amount removed. To control for the effect of other invertebrates on the amount of dung removed and seeds dispersed I will have two controls, one to exclude everything from the resource and another where nothing is excluded.

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 (Andresen & Levey 2004; Shepherd & Chapman 1998). Also, if the seeds present in the dung are not buried they are often rendered unviable by predation events (Shepherd & Chapman 1998). However, the amount of dung removed and the depth it is buried at depends on the size and numbers of the invertebrates present (Heinrich & Bartholomew 1979). Larger, more competitive invertebrates are capable of sequestering a larger portion of a resource than smaller invertebrates that may be competitively inferior(Heinrich & Bartholomew 1979). Therefore, the larger invertebrates in a dung community may be functionally more

important, depending on their numbers. I will quantify how the size and abundance of the most important invertebrates in the dung community affects their functionality and competitiveness. I will experimentally determine the burial depth of dung by different sizes and numbers of beetles to establish their relative functional importance.

Conclusion

The results of these experiments will show how important the effect of fencing is on the adjacent forest and the associated dung beetle community. As dung beetles are important secondary seed dispersers, fencing of the forest will promote forest flora persistence and regeneration.

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How do varying land uses affect stream communities in highland tropical streams in Nigeria?

Danladi M. Umar, PhD

Tropical streams are under increasing land use pressure. The types of land uses are very different from those occurring in temperate regions. For example, tea, banana and maize plantations are common land uses in highland areas. These uses are also associated with major land use pressure including; overgrazing, bush burning, deforestation, mining and irrigation are all of sources of concern.

The mechanisms by which these African land use activities influence stream communities are not well documented. Therefore, in this research we intend to study how these mechanisms affect stream communities in highland tropical streams in Nigeria.

LR: Hazel, Peyman, Jon, Danladi and Steve at the old camp site Ngel Nyaki forest. Photo by Misa Zubairu.

The specific objectives of the study are to:

1. Investigate how do differing land use activities in the tropical highlands affect the diversity and composition of benthic stream communities?
2. Find out what effects do tropic highland use activities have on the structure and functioning of stream food web?
3. Ascertain what are the key environmental drivers?

New information expected from the research:

1. Identification of benthic invertebrate taxa of the Mambila plateau
2. Develop biotic index for assessing stream health for the region
3. Potential to identify strategies for the conservation and management of aquatic ecosystems.

The Mambila Plateau is situated in the north-east of Nigeria near the Cameroon border. Study streams are located near Gembu and headwaters of the Donga River.

Study site; Mambila Plateau North eastern Nigeria

The study is being carried out in and around Ngel Nyaki forest on the Mambila Plateau, in the remote south-east corner of Taraba state, North eastern Nigeria. Mambila Plateau lies between (longitude 11° 00¹¹ and 11° 30¹¹ East, and latitude 6° 30¹¹ and 7° 15¹¹ North). On the Plateau, the rainy season last for an average of 250 days, from late March to the end of October (Lyambo et al, 1972). The mean annual rainfall exceeds 1780mm, and is highest in June and July, and the daily mean temperature does not exceed 30°C. The plateau is elevated to about 1500m above sea level.

The Plateau is characterised by a large number of small headwater streams which flow through a number of differing land uses (e.g. forests, grazing & crop plantations). Natural streams on the plateau are either in forest (e.g. Ngel Nyaki, Danko and Kurmi) or in grasslands. A number of differing land uses is common, in particular tea and banana plantations occur throughout the plateau, while livestock grazing, Crops (e.g. rice, maize, potatoes, cassava, cocoyam, yam, peanuts and vegetables) are also common.

Since the beginning of the project, a literature review has been conducted of the benthic ecology of tropical streams and the state of our knowledge of land use effects.

We have carried out an extensive survey of a range of streams (55) across varying land-uses (e.g. native forest, mining, grazing, tea, cabbage, maize, banana plantations and eucalyptus forest). 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).

Siphlonuridae, one of the families of May fly in the forested streams of Ngel Nyaki forest.

Sample collection and processing:

All samples collected from Nigeria are shipped to New Zealand for processing at the University of Canterbury.

Preliminary results

Results from the chemical analysis of water sampled show significant variation in the amount of Nitrate-Nitrogen and Phosphate-Phosphorus across the different land use type. For the stream fauna, over 40 different families of benthic stream invertebrates of various taxa including the Ephemeroptera, Plecoptera and Trichoptera (EPT) have been identified. Details of these findings are being prepared for publication.

Upcoming work

1. An intensive study of (6) subset of headwater streams to investigate food web processes would be conducted from October 2010 to March 2011.
2. We will conduct series of experiments, either as in-stream manipulations or macrocosm experiments. These will include leaf litter pack experiment and nutrient diffusing substrate NDS experiment.
3. Stable Carbon and Nitrogen isotope analysis for the food web investigation would be carried out.

Postdoctoral Research

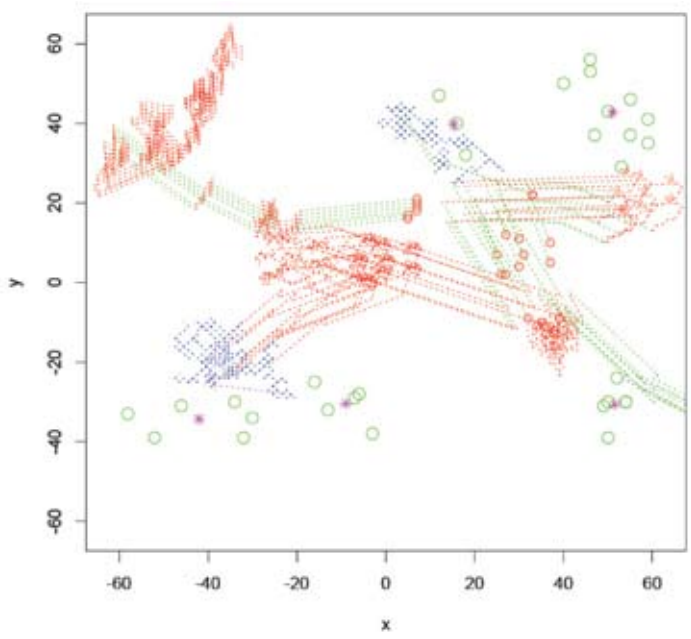
Dr Camilo Guzman

In January 2010 Dr Guzman and Dr Hazel Chapman applied for NZ Marsden funding to model seed dispersal movement by primates, with a view to understanding seed rain in relation to forest restoration. The grant was to cover a postdoctoral stipend for Camilo and research associated costs. We were not successful in our application (there is very low success rate), but Camilo has volunteered to continue on with the work, until such time as we we find funding. To this end Camilo is arriving in Nigeria in early September to spent two months at Ngel Nyaki, validating the models He has been working on over the last two months.

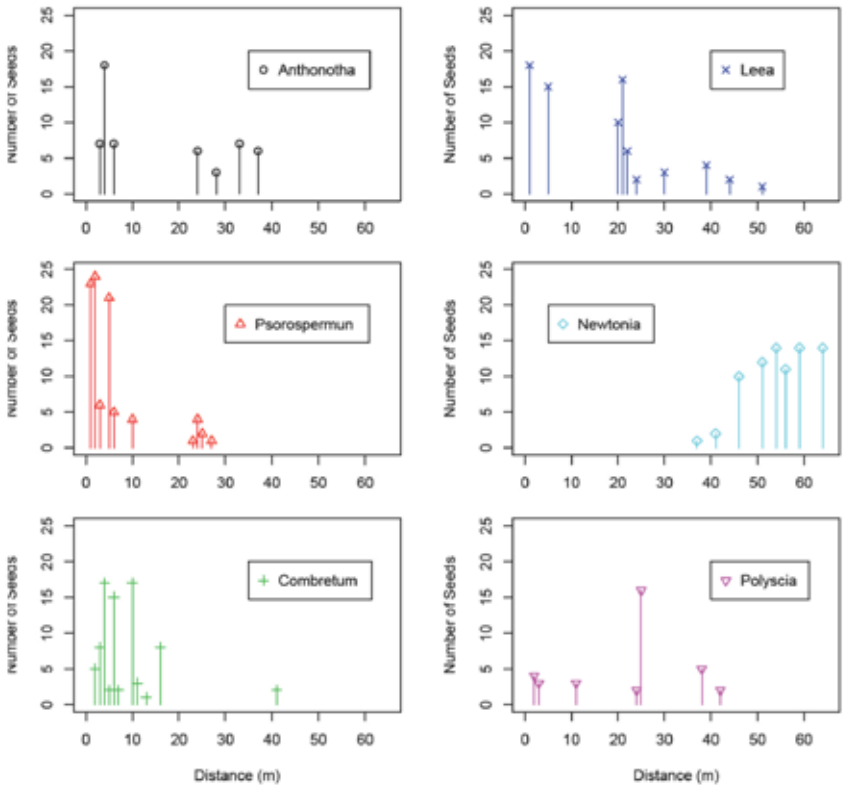
Our proposal was based on the fact that a major obstacle in modelling frugivore dispersed tree species is that few models consider animal behavior and none allow for behaviour as relates to secondary dispersers and/or seed predators. Our aim is to create the first seed dispersal model to include animal behaviour of primary and secondary dispersers and seed predation as parameters. We are basing our model on empirical data collected from primarily primate dispersed forest tree species.

Camilo has begun by using diffusion models to help understand the dynamics of seed dispersal and serve as "null" models to test simulations. He has created a stochastic simulation model which is spatially explicit and event driven, describing i) frugivore, ii) secondary disperser and iii) seed predator behaviours as well as iv) tree fruit availability. The functional form and parameter values are guided by behavioural observations in the field as well as data for fruit production and seed densities of dispersed and non-dispersed seeds, and direct estimates of seed dispersal distances.

In addition Camilo is analyzing the seed trap data That we have been collecting at Ngel Nyaki foir over 5 years. We are beginning to understand natural dispersal distances of a range of tree species. This data will be combined with tree functionality to provide management advice for regeneration of these forest types.



Example of a forest of 100 x 100 m showing the movement of several groups of dispersers (red dots) having the different types of movements according to the elements in proximity. Trees are represented by green dots and the centre of trees clusters by purple stars. The different types of movement are: random walk (blue lines), Levy flights (red lines), regroup (purple line) and separate (green lines).



An example from this analysis: Number of seeds and distance from nearest mother tree. Data from 150 seed traps over 5 sites.

Outputs

Spoken papers

- **Chapman, H. M.**, Goldson, S.L., Beck, J. and Brown, J. A. Post-dispersal seed removal and seed germination of *Cercopithecus nictitans* dispersed seed in a West African montane forest. FSD2010 June 13th–18th Montpellier, France.
- **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.
- **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.
- **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.
- **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.
- **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.
- **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 .
- **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.
- **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.

Posters

- 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. Wellington: 59th Entomological Society of NZ, 11th-14th April 2010.
- Osinubi, S.T., Chapman, H., Briskie, J., Ottosson, U. and Brown, J. (2010) Habitat Influence on Territorial and Mate-guarding Calls of the Yellow-breasted Boubou (*Laniarius atroflavus*). Sao Paulo, BRAZIL: 25th International Ornithological Congress (IOC), 2010.

Refereed Papers

- Chapman, H.M., Goldson, S.L. and Beck, J. (2010) Postdispersal removal and germination of seed dispersed by Cercopithecus nictitans in a West African Montane Forest. *Folia Primatol*, 81, 1, 41-50. ** This paper was chosen as Editors Choice and is freely available on the web.*
- Mattheus, A., Chapman, H.M. and Kelly, D. (2010) Testing for Janzen–Connell effects in a West African Montane Forest. *Biotropica*. 10.1111/j.17447429.2010.00664.x
- Blackburn D. A. A new puddle frog (Phrynobatrachidae: Phrynobatrachus) from the Mambilla Plateau in eastern Nigeria. *African Journal of Herpitology* 59: 33-52
- Blackburn D.A. (2010) A new squeaker frog (Arthroleptidae: Arthroleptis) from the mountains of Cameroon and Nigeria. *Herpitologica* 66: 335-348

Completed Theses

- Gawaisa, Stephen. How important are putty nosed monkeys (*Cercopithecus nicitans*) in montane forest seed dispersal? PhD.
- Campbell, Delyse. The potential for natural seed dispersal in the restoration of West African montane forest. MSc. Submitted.
- Korndoerfer, Martin Exploring land-use and its effects around Ngel Nyaki and Kurmin Danko Forest Reserves, Nigeria. MSc. Submitted.

The Effects Of Forest Edges On Dung Beetle Communities In A Tropical Montane Forest

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Living On The Edge

Land use has been implicated as the largest global driver of biodiversity loss, largely due to associated habitat loss and fragmentation. The resulting production of habitat edges have pervasive impacts on the distribution and persistence of invertebrates[1]. Land use change is of particular concern in African tropical montane forests as populations are increasing dramatically throughout these areas. Therefore , this study focuses on the impacts of livestock and fire on forest edges around a unique Afromontane forest in Nigeria

Study Site & Design

The effects of anthropogenically created edges on dung beetle community structure has, thus far, not been investigated across a continuous edge gradient. This presents an important gap in our knowledge of the potential effects of surrounding land use on the intensification of edge effects and resulting impacts on dung beetle communities. Dung Beetle communities were sampled at forest edges, both protected (A) and unprotected (B) from intensive livestock grazing in a severely fragmented montane forest landscape surrounding the Ngel Nyaki forest reserve in Nigeria.

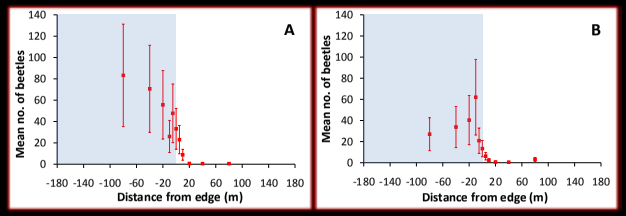
Using pig dung baited pitfall traps, dung beetles were sampled at distances of -160, -80, -40, -20, -10, -5, 0, 5, 10, 20, 40, 80, and 160 metres from the forest edge. Traps were at least 50m apart to maintain independence.

Location of Ngel Nyaki forest reserve on the Mambilla Plateau, Nigeria. The inset rectangle shows the location of the main figure[2].

Diversity & Abundance Distributions

Total abundance of dung beetles will be measured per trap at each distance from the edge. Additionally, species diversity and richness will be measured across the edge gradient. This will give an indication of the impact of edge effects and the interactions with matrix/edge condition on the composition of dung beetle communities. This data can then be used to analyse correlations with ecosystem function.

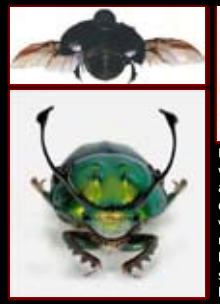
Preliminary findings shown below, present a clear trend in overall abundances of dung beetles in response to distance from the edge. Values are mean abundance ± SE. Additionally, there is a striking difference in abundance distributions between protected (A) and non-protected (B) edges.



Trait-Dependent Responses

The extinction proneness of a species can often be determined by their traits (response traits). Dung beetles have been shown to exhibit trait-dependent responses to anthropogenic disturbance[3], but there is still no evidence of such responses across habitat edge gradients. Furthermore, anthropogenic disturbance may impact the ecosystem functions carried out by dung beetles (effect traits).

By analysing trait-dependent responses of dung beetles across the forest edge, we may then be able to determine possible correlations between these response and effect traits.

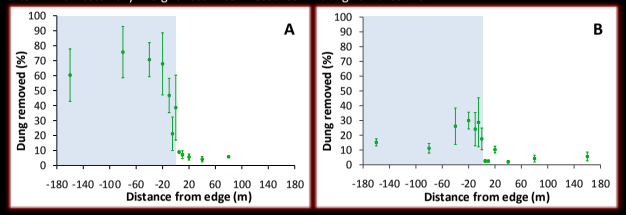


Body mass, body length and width, and wing area will be measured. Body size in dung beetles may be a strong determinant of susceptibility to disturbance. It may also account for much of the variation in ecosystem functioning as larger beetles remove more dung. We will also calculate wing loading (body mass/wing area) which will serve as a surrogate for dispersal ability, as this trait may also be important in determining species' susceptibility.

Ecosystem Function

Dung beetles are extremely important as they perform major ecosystem functions by burying dung. This increases rates of decomposition and thus nutrient cycling is enhanced. Additionally, seeds within the dung are secondarily dispersed, reducing seed predation and facilitating germination. Dung removal rates were measured across the edge to test for the effects of habitat edges on ecosystem functioning

Rates of dung removal were measured at the same sites and distances used for trapping. 40gm pieces of dung were placed on the ground for 24 hours, after which total dry weight loss was measured. Preliminary data for removal rates between protected (A) and non-protected (B) edges are shown below . Values are mean percentages of dung removed ± SE.



Yet To Be Dung...

Results show that dung beetle communities respond strongly to habitat edges. To what degree these responses occur will be identified as other parameters are analysed, such as species richness and species traits. The most important factor determining edge response in dung beetle community structure and ecosystem function, appears to be the degree of edge protection from livestock and fire encroachment. A major goal is to quantify these effects on secondary seed dispersal performed by dung beetles. This would provide insight into the possible ramifications of edge effects in forest maintenance and restoration through the effects on dung beetle communities. This research may potentially identify adverse correlations in community responses by comparing trait-mediated susceptibility with ecosystem functions performed by dung beetles.

Acknowledgements

I thank the Nigerian Montane Forest Project for providing the opportunity to carry out research at Ngel Nyaki forest reserve. I am especially grateful to Idirisa Musa for his assistance in the field and to Kristy Udy for her ongoing suggestions and support throughout this project.

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Habitat Influence on Territorial & Mate-guarding Calls of the Yellow-breasted Boubou (*Laniarius atroflavus*)

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Introduction

The Yellow-breasted Boubou (*Laniarius atroflavus*) is a bush-shrike endemic to the Afromontane forests of the Nigeria-Cameroon highlands[1]. We investigated the influence of habitat on the vocalisation of this passerine.

L. atroflavus was studied in forest core, edge and riparian fragment habitats (fig. 1) to determine: i) the diversity of this species' vocal repertoire, ii) differences in
- call rate
- call duration
- pair responsiveness (duetting and mate guarding)
- bandwidth

across the three habitats.

Figure 1: Photographs showing each of the three habitats: core, edge, riparian.

Study Site

This study was conducted at the Ngelnyaki Forest Reserve in Taraba State, Nigeria. A recording point was established within a *L. atroflavus* territory in each of the three habitats (fig. 2).

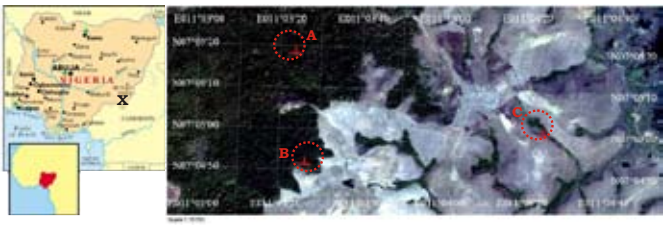


Figure 2: Study site, Ngelnyaki Forest Reserve (marked *X*) close to the Nigeria-Cameroon border, and satellite imagery of the recording points within each of the territories (broken circles) in the *A*, core; *B*, edge; and *C*, riparian habitats.

Early morning records (0530-0700 hr) were made, twice in each territory, between November 2009 and February 2010. This is the breeding season of the *L. atroflavus*.

Equipment

A Marantz PMD 661 recording unit was used and records were made in stereo at a 24-bit sample size and 48-kHz sample rate. Recordings were rendered in mono at a 16-bit sample size and 44-kHz sample rate for a smaller file size and easier analysis.

Analyses

The time of the first call in each recording was determined and the calls within a 10 minute sample period were identified. The selected calls were highlighted in Raven 1.3[2] and spectrogram measurements were collated for each call. The number of calls recorded in each habitat was core=62, edge=43, riparian=53. Measurements were pooled and statistically analysed using R[3]. Where needed, parameters were log transformed to ensure normal distribution.

Results

Calls Repertoire

Three types of calls were identified:
A "single-peaked" call that appears to serve a territory defense purpose with or without the response of the mate (fig. 3).

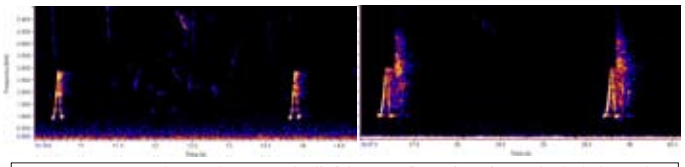


Figure 3: Spectrogram showing the territorial call of the *L. atroflavus*, first of one individual, then with the response of the pair.

A modulated, "twin-peaked" call that appears to serve more for mate-guarding and communication between the pair (fig. 4).

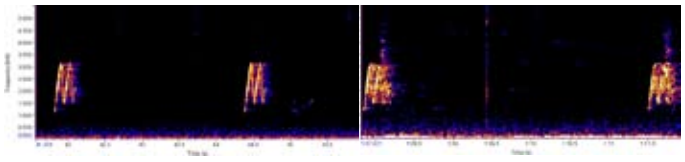


Figure 4: Spectrogram showing the mate-guarding call of the *L. atroflavus*, first of one individual, then with the response of the pair.

A "trill" with lower and higher frequency harmonics that serves as an alarm call between the pair (fig. 5).

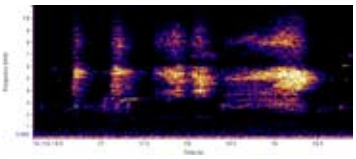
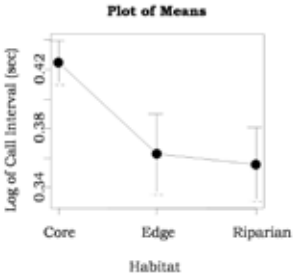
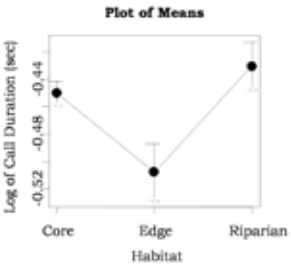


Figure 5: Spectrogram showing the alarm call of the *L. atroflavus*.

Habitat Effect

Call rate, measured as the shortness of intervals between calls, was shortest in the riparian habitat (F=3.3, p=0.04).





The average duration of calls was longest in the riparian habitat (F=6.1, p=0.003).

Mate response was highest in the core habitat (F=54.9, p<0.001), while the inter-quartile bandwidth was greatest in the riparian habitat (F=11.9, p<0.001) though only slightly higher than that in the core habitat.

Conclusion

Habitat does appear to influence some parameters of the territorial and mate-guarding calls of the *L. atroflavus*. The riparian pair exhibited the shortest intervals between the calls (highest call rate) and the longest duration of each call. The frequency bandwidth of their call was also the greatest of the three habitats, though similar to that of the pair in the core habitat. Mate response was highest in the core and remains to be investigated further.

The ongoing study will seek to expand these results and correlate them with fitness, habitat quality and other behavioural data.

Additional Information

The following audio files from the Macaulay archives[4] were used: 161203, 161210, 161223, 161240, 161241, 161270 - and can be publicly accessed.

References

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