

Nigerian Montane Forest Project

Annual Report



Introduction



2012 is our 10th Anniversary! Well, to be strictly accurate it is 10 years since the idea of the Nigerian Montane Forest Project was conceived during an expedition to the mountains of Taraba State in October 2002. Much has been achieved since then and we will include a short review of this in the following pages.

We are very happy to welcome Tasso Leventis as our Patron. Tasso has supported the NMFP since 2004 and his support has played a major role in the success of the Project. We look forward to developing this relationship.

On a very sad note the NMFP has lost a good friend, and Nigeria, a prominent conservationist. Professor Emmanuel Obot, Executive Director of The Nigerian Conservation Foundation (NCF) died in a plane crash in June. We wish the NCF well in their recovery from this loss.

This year the Project saw the graduation of our first PhD student, Samuel Temidayo (Dayo) Osinube. Dayo came to UC after completing his MSc in ornithology at the A.P. Leventis ornithological and conservation institute of Apori. Dayo is now the Coordinator for the African-Eurasian Migratory Landbird Working Group (AEMLWG) of Birdlife International, based in Accra, Ghana. In this capacity he has every intention of continuing his relationship with the Ngel Nyaki and the NMFP.

The new research block is working well. The improved solar system with two additional solar panels has made life a lot easier and the internet is now available 24 hours a day (when sunlight permits). As well, we are using considerably less generator fuel.



A highlight for the UC contingent of the NMFP was meeting His Excellency, Mr Amb Ayo Olukanni, The Nigerian High Commissioner for Australia when he visited Christchurch with his wife and First Secretary Mrs Florence I. Akinyemi in July. We are extremely fortunate to have such an environmentally aware and supportive High Commissioner.

A personal highlight was my three day visit to Leinde Fadale forest with Alex Knight, part of his survey looking for chimpanzee faeces in Taraba State forests. This was in April, just at the start of the rains.

Finally The NMFP has gained official NGO status under the name ' Montane Forest Conservation Initiative' and is registered in Nigeria with the Corporate Affairs Office with registration number CAC IT No 52759.

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

Cover Photo: Children of Yelwa village now have an opportunity to learn at the Esso-Mobil school, made possible by the Nigerian Montane Forest Project.

Dr Hazel Chapman

Director

Nigerian Montane Forest Project



Professor Emmanuel Obot joined us in Jalingo for the Taraba State Walk for Nature, November 2011.



Meeting with the Nigerian High Commissioner to Australia, June 2012. From right to left: Florence I. Akinyemi, First Secretary; Professor Paula Jameson, Head of School, Biology; Mrs. Olukanni; His Excellency, Ayo Olukanni; Dr Hazel Chapman, Danladi Umar; Taiwo Afisi.

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Nigerian Montane Forest Project

Mission Statement

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

Aims

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

10 Year Anniversary

It is now 10 years since the UC expedition (Figure 1) left Canterbury for Nigeria to “update knowledge on the current extent, and ‘state of health’, of the remote montane forests of Taraba and Adamawa States, Nigeria”. The expedition was funded by Fauna and Flora International, The Whitley Foundation, the Percy Sladen Trust and the Royal Geographic Society.

The full expedition included staff from the Nigerian Conservation Foundation (NCF) and Nigerian National Parks.

We were in the field, ‘on trek’ for a total 50 days during (October–December 2002) and during this time visited all the high plateaus of Gashakla Gumti National Park, the River Nwum and Akwaizaner forests of the Donga Valley and also Ngel Nyaki Forest Reserve. Ngel Nyaki forest is particularly high in plant biodiversity and is a Birdlife International Important Bird Area (IBA). At Ngel Nyaki we met Misa Zubairu and Augustine Ntim, indigenes of Yelwa village, close to Ngel Nyaki forest. Misa and Augustine would prove to be key to the success of the Project.



Above: Hazel Chapman with 2002 UC expedition team (L to R) Steve Olson, Dave Trumm, Laura Sessions and Matt Walters.

Below: On Trek in 2002, visiting a compound between Gangriwal and Filinga.

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Laura Sessions overlooking the forest at Dutsin Lamba, 2002.

By the end of 2003 a research plan had developed based around Ngel Nyaki forest and in 2004 Josie Beck¹ and Arne Matthias² were the first postgraduate students from UC's School of Biological Sciences to base their research work in the forest. We were joined by Ihuma Jerome³⁻⁶ (MSc student) and Stephen Gawaisa (PhD student) from the Federal University of Technology, Yola. The Project was supported by funding from Nexen Nigeria and Nexen Inc., the A. G. Leventis Foundation and a research grant from the UC to Hazel Chapman.

January 1st 2005 saw the beginning of the building of Nexen funded field station and further funding from the Taraba State Government has led to the research station we have today.

The station is listed on the UC web site as one of its field stations, has 22 full time staff, accommodation for 20 people, a laboratory, herbarium and seminar room, We have satellite internet and an automated weather station. To date 22 UC postgraduate students, 19 international researchers (Europe, USA, UK and New Zealand) and six volunteers (USA, Mexico, and New Zealand), as well as literally hundreds of Nigerian undergraduate students and their professors have worked at Ngel Nyaki. Our main sources of funding continue to be the A. G. Leventis Foundation, Nexen, Inc., The North of England Zoological Society and the Taraba State Government. The Nigerian Montane Forest Project has a website, Facebook page with 97 members and YouTube videos. This year the project has been formally registered as an NGO.



2004 we had tents



2006 we had one building for everything



2012 we have specialist buildings.



On Trek, camping on Chappal Hendu in 2002.



UC student Josie Beck in the forest with Musa and Alfred in 2006.



Heading to Leinde Fadale to search for the rare Nigerian chimpanzee, April 2012.



Samuel (Dayo) Osinubi with Paula Jameson, Head of School, Biology, at University of Canterbury Graduation Ceremony, April 2012.

Outputs include:

- 15 completed theses,
- 20 peer reviewed papers in scientific journals
- 22 conference presentations
- 20 oral presentations.

Thanks to the perseverance of Robert Warren from Exxon-Mobil, the Project found funding to build a nursery school for Yelwa village, known as the Esso-Mobil school. The school now has over 300 pupils.

The Project is continuing to develop and several new initiatives are outlined below. Satellite internet makes all the difference in terms of student supervision and allowing us to take advantage of web based initiatives such as The Oxford Plant Observatory (TOPO) and Phytolimages.

Now that we are fully registered as an NGO we should be able to approach more funding bodies. Talks are underway for collaboration with Lincoln University, New Zealand, such that the research station may also serve as a base for Lincoln agriculture students carrying out research into dryland pasture systems.

Partners and Supervisors

Project Partners

- A.P. Leventis Ornithological Research Institute (Jos, Nigeria)
- Gashaka Gumti Primate Project
- Gombe State University
- Nigerian Conservation Foundation (NCF)
- Nigerian National Parks
- Taraba State Forest Service
- 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)
- Taraba State Government



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 Würzburg 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



Augustine (left) and Ali in the plant nursery

Walk for Nature

On November 26th 2011, three representatives from the NMFP, Babale Aliyu, Josh Thia and Hazel Chapman joined the Taraba State Commissioner of the Environment the Hon. Kwetaka Danfulani, Director of Forestry, Samuel Teltule and the Late Professor Obot from NCF, along with many others, on the Taraba State Government Environmental Awareness Campaign in Jalingo 'Walk for Nature'.



Walk for Nature in Jalingo with Taraba State Forestry and NCF.



Kennedy P. Yoriyo helped us obtain NGO status.

NGO Status

The NMFP has gained official NGO status under the name 'Montane Forest Conservation Initiative' and is registered in Nigeria with the Corporate Affairs Office with registration number CAC IT No 52759. A big thanks goes to Kennedy P. Yoriyo for taking this forward.

Upskilling

All NMFP field assistants are continuing to be trained and are always developing new skills. This year it was decided that every field assistant would have their own e mail address and be responsible for sending back the data they collect to their students in NZ. This has worked well and is mutually beneficial. To this end I am working with Bethan Morgan from Wildlife Conservation Society (WCS) Cameroon, on the possibility of a field assistants' exchange.

Augustine Ntim has passed his silviculture course with flying colours.

Misa Zubairu (co-ordinator) is currently undertaking training in book keeping and management in Jalingo. Misa is now using an accounting software package to manage the daily expenditure and is familiar with our auditing procedures.



Every field assistant now has email access and is responsible for sending data to research students.



Misa Zubairu is taking courses in accounting and book keeping.



Lawal Sani Kona visited the NMFP in November 2011 to make a documentary on the Project. The Documentary , which is 30 mins long, was shown on Taraba State Television in November this year.

Links with Nigerian National Parks

The NMFP is in the process of revising and renewing their MOU with Nigerian National Parks. A meeting with the Director General Haruna T. Abubackar (represented by head of research NNP's, Yohanna Saidu), the Director of Gashaka Gumti National Park, Dr. Okeyoyin Agboola' George', CP Admin Suleiman Yahaya the NNP's Barrister and Dr Hazel Chapman was held in Abuja in August 2012. This was a very fruitful meeting and closer collaboration between the NNPs and the NMFP is imminent.

Closer Links with the Nigerian Conservation Foundation (NCF)

The NMFP and NCF are beginning a new phase of closer collaboration, especially in Taraba State with UN REDD in regard to vegetation surveys and carbon stock (C stock) estimates. The NMFP is also participating with NCF in the current National Review of the Nigerian Biodiversity Strategy.

Proposal for Ngel Nyaki to become a Smithsonian Plot.

The Center for Tropical Forest Science (CTFS) is a global network of forest research plots committed to the study of tropical and temperate forest function and diversity.

There are currently 47 plots worldwide in 21 countries, but only four forests in Africa- Congo, Gabon, Cameroon and Kenya. The NMFP is in talks with David Kenfack, Africa Program Coordinator CTFS, to make Ngel Nyaki Africa's 5th plot.

www.ctfs.si.edu/group/About/



Thomas, Misa, Musa and Babale - helping in the documentary.

Herbarium Initiatives



A rapid botanical survey team in the forest. NMFP field assistants and 2012 IT students from Taraba State and Gombe State Universities.

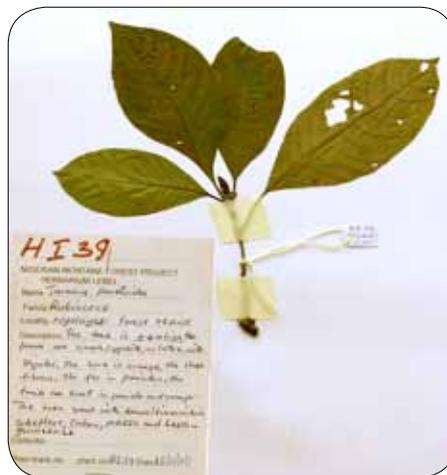
Rapid Botanical Surveys

The NMFP is collaborating with Dr William Hawthorne from the Department of Plant Sciences, University of Oxford to include Ngel Nyaki in The Oxford Plant Observatory (TOPO). The idea behind this initiative is to do Rapid Botanic Surveys all over the world, to show the world's flora on a 'Plant Observatory' website highlighting hotspots and other biodiversity related information.

Several RBS's have been undertaken at Ngel Nyaki and our herbarium collection is being digitized and sent to Oxford.



Above, Hamasumo and Hamadu prepare herbarium specimens. At right, Dr William Hawthorne from the Department of Plant Sciences, University of Oxford



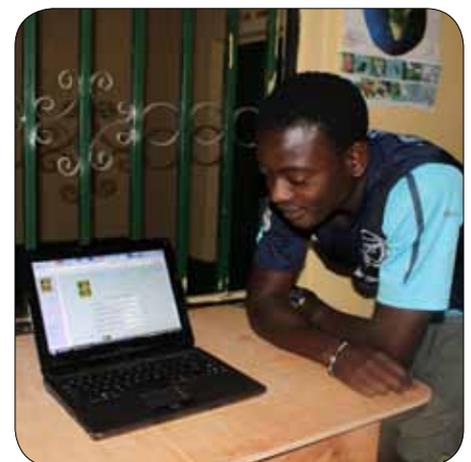
Trema orientalis, collected by Hamasumo Ibrahim.

PhytoImages

The Project is in the early stages of a new collaboration with Dr Pieter Pelser of the University of Canterbury to add our plant photographs to PhytoImages.

PhytoImages (www.phytoimages.siu.edu) is a web interface that provides free access to scientific-quality plant photographs from all over the world. These pictures are presented with their associated meta-data (e.g., locality information, voucher data, latitude/longitude coordinates, captions, Google and VE maps and taxonomic data) and the website

has various functions for searching and developing identification keys. PhytoImages is designed to function as a professionally curated, yet publicly accessible, depository of plant photographs for teaching, research and conservation purposes. Because individual photographs as well as sets of photographs (e.g., by species, genus, family, country, province, key word) are presented on web pages with stable links, PhytoImages can be used as a source of images that are directly linked from external websites (e.g., www.philippineplants.org).



Idriss Musa with the PhytoImages website.

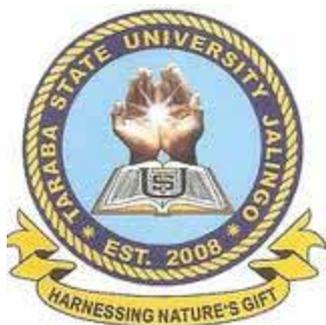
New University Partners



Kashere delegation: Dr Idris Yola (Deputy Dean, Faculty of Science), Dr Sani Gumel (Dean Faculty of Science), Dr Abdullahi Mustapha Bello (Dean Students affairs also HOD Biology Department) and Auwal Abdullahi (Assistant Lecturer from Mathematics Department).

Taraba State University

The Project is developing formal links with the Taraba State University (TSU). This year the NMFP hosted two TSU IT students (see below) for six months. In a meeting with Hazel Chapman in August 2012 the Deputy Vice Chancellor (Academic) of TSU, Dr Yakubu Aliyara, agreed that a formal relationship was important and most particularly in terms of the training of TSU academic staff at UC.



Federal University of Kashere

The NMFP and the University of Canterbury are developing formal links with the new Federal University of Kashere. Kashere is one of nine new Federally funded Nigerian Universities. Dr. Hazel Chapman met with the new Vice Chancellor, Professor Mohammed Kabir Farouk and discussed possible collaborations. As a consequence, on September 4th a delegation from Kashere is visiting the NMFP on Mambilla. The delegation comprises the Dean of the Faculty of Science Dr. Sani Gumel, the Deputy Dean of Science, Dr. Idris Yola, Dr MB Abdullahi –HOD Biological Sciences and Mr Ouwal Abdullahi, PhD candidate NMFP and University of Canterbury.

Lincoln University

Our connection with Kashere University is an opportunity for the NMFP to collaborative with Lincoln University. Kashere University has a remit to specialise in Agriculture and negotiations are underway for an agreement between Lincoln University and Kashere in terms of the training of young Kashere academics. The forest conservation work of the NMFP has the potential to be extended to an agricultural context with expertise from Lincoln focusing on improved pasture and grazing systems.



New Zealand's specialist land-based university

Conservation / Forest Restoration Initiatives



Aisha Fatai Yusuf, IT student from Gombe State University, choosing seedlings from the nursery for her herbivore experiment.

The protection of Ngel Nyaki forest is still not guaranteed. While the NMFP continues to collaborate closely with the State Government around the patrolling and management of the reserve, cattle continue to infiltrate and hunting is still prevalent. However there are battles won- for example the image below is of a man having his chainsaw confiscated by the patrollers. There is no doubt that hunting is far less prevalent in the areas of forest frequented by researchers.



Misa Zubairu, co-ordinator of the NMFP, sends reports to the State Commissioner of the Environment and Urban Development, the Honorable Kwetaka Danfulani on these matters.

The NMFP has continued to fence off more grassland adjacent to the forest edge and this year over 200 tree seedlings from the nursery were planted into these areas. The species

included pioneers and high forest species. The nursery has extended in size and now has two full time staff maintaining it.

Sasha Roselli (UC) is starting her MSc thesis in forest restoration exploring the establishment of tree seedlings in a range of different habitats and different treatments (see 2010 report).

The chief of Yelwa, Jauro Saidu must be commended on his initiative challenging the Fulani who take their cattle into the reserve. Jauro Saidu is working with the Fulani to look for alternative solutions to their cattle grazing.

Conservation Club

The conservation club is working hard to promote conservation awareness around Ngel Nyaki and our local communities including Maisamari, Dujere, Mayo-Nyebbe, Zango and Yelwa village.

The Conservation Club is now led by the teachers of the primary and nursery school, and includes an Arabic teacher.



Thomus Gawan, Mr Ibo, Evelyn, Misa, Mr Kate and Mallam Ali.



Students from the Esso-Mobil nursery school during a Conservation Club visit to the NMFP.

Visitors



Samuel Teltule, Director of Forestry, Taraba State discusses the importance of reforestation with Dr Jedua Davin, Chairman of the Saurdauna Local Government, the Honourable Marafa B. Abba, Godfrey Tafers, Begonia Ruba and Christopher Cooter, Canadian High Commissioner.

TY Danjuma Foundation

Dr Hazel Chapman met with General Theophilus Yakubu Danjuma in early 2011 to discuss funding for the Project. One outcome of the discussion was a visit by Ms Funmi Ajala, the Focal Person for the Taraba State Community Fund of the TY Danjuma Foundation, to the NMFP on the 24/25th November 2011.

She met with Dr Chapman, Misa Zubairu and all of the field assistants. Funmi was accompanied by Musa Adamu and Ishaku Emmanuel (TYDF) and Ms Funmi Oloyede from University of Ibadan.

Birdlife International

Samuel Temidayo Osinubi returned to Ngel Nyaki in September 2012 to discuss collaborations between the NMFP and Birdlife International.

Californian Academy of Sciences

Three herpetologists from the Californian Academy of Sciences, Dr David Blackburn; Dr Jens Vindon and Lauren Scheinberg visited Ngel Nyaki for two weeks to undertake a survey of amphibians (see report on page 17).

Canadian High Commissioner

The Canadian High Commissioner Christopher Cooter visited the NMFP in early October 2012 accompanied by the Chairman of the Saurdauna Local Government Marafa M Abba; the Director of Forestry, Taraba State, Samuel Teltuley and the ECOWAS representative from Abuja, Begonia Rubio.

Gombe State University

In April 2012 Professor A. G. Ezra, HOD of Biology, Dr. A.K. Lucas, Mr. Daniel Zigila, and Mallam Suleiman Ali and over 70 undergraduate students visited the field station for a biology field trip. They learnt about the biodiversity of montane forests and their conservation.

Taraba State University

Dr Elkana O. Sambo visited with his biology undergraduate students. We are anticipating that next year more Taraba State University field courses will be held at the field station.

University of Lagos

Professor Akijsoji
Dr Nodza Isaac
Mrs Fatsuma Olareru

Federal University of Kashere

Dean of the Faculty of Science Dr. Sani Gumel, the Deputy Dean of Science, Dr. Idris Yola, Dr MB Abdullahi –HOD Biological Sciences and Mr Ouwal Abdullahi, PhD candidate NMFP and University of Canterbury.

Undergraduate Students

In total over 300 undergraduate students from Nigerian universities have visited the NMFP this year.



Ms Funmi Ajala (third from right), the Focal Person for the Taraba State Community Fund of the TY Danjuma Foundation.



Californian Academy of Sciences herpetologists with Denise Arroyo from UC.



Gombe University field trip.

Visiting researchers reports



Cardioglossa schioetzi an IUCN Endangered frog species found at Ngel Nyaki.

Spatial Distribution of Turacos and their Preferred Food Plants in Ngel Nyaki Forest Reserve

Nigeria Tropical Biology Association Alumni Group



Project Leader: Babalola, F.D.

A Project Funded through 2010 Tropical Biology Association (TBA) Small Grant

SUMMARY

The project is a field survey of the relative distribution of turacos and their preferred food plants in the main forest and the forest fragments of Ngel Nyaki Forest Reserve (NNFR). Base on previous study on distribution of turacos, it was assumed that the turacos preferred fruiting food species will be different in the forests of NNFR. Due to this, the data collection was carried out in three sites within the reserve and these include (i) forest

fragment, (ii) within the main forest, and (iii) the edges / boundary of the main forest. To determine the distribution of the turacos preferred fruiting food species, 10 plots with size of 25m x 25m were laid at an interval of 50m in each of the three selected sites. Turacos were surveyed along transects running along the edge of both main forest and forest fragments.

Out of the four reported turacos in the reserve, White-crested Turaco (*Tauraco leucolophus*) and Green Turaco (*Tauraco persa buffoni*) were the only turaco species seen during this survey. Turacos were encountered 16 times during the survey period, meanwhile only 10 of these were recorded during transect walks covering a total transect length of 5600m (5.6km). The encounter rate of Turacos irrespective of species was observed to be 1.78 per km. The White-crested Turaco had an encounter rate of 0.71 individuals per km while the Green Turaco had an encounter rate of 1.07 individuals per km.

Out of the identified 22 fruiting tree species in the forest fragment, 12 (54.5%) were preferred by turacos. Some of the identified turacos preferred fruiting tree species include *Syzygium guineense*, *Psorospermum corymbiferum*, *Bridelia micrantha*, *Allophylus africanus*, *Anthocleista vogelii*, *Ficus sp*, *Croton macrostachyus*, Rubiaceae sp and *Maesa lanceolata*. Among all the sampled

fruiting tree species in the forest fragment, *Syzygium guineense* (family Myrtaceae) had the highest percentage (48.6%) and was preferred by turacos. *Anthocleista vogelii* (family Longaniaceae) (35.7%) and *Garcinia smeathmannii* (family Guttiferae) (12.6%) have the highest percentages at the edge / boundary and within main forest respectively but were not preferred by turacos. The fruiting tree species preferred by turacos that occurred most at the edge / boundary of the main forest was *Ficus sp*. (13.3%) and within the main forest was *Polyscias fulva* (3.9%). Many of the preferred fruiting tree species occurred most in the forest fragment, followed by the boundary of the main forest. Human pressure and encroachment on the forest around and within the reserve in the form of slash-and-burn agriculture, wood collection and intensive cattle grazing have led various degrees of forest degradation and fragmentation.

Many of the turacos preferred food species were found in the forest fragment of NNFR, we therefore recommend that security in the three fragments A, B, C should be further strengthened and human encroachment prevented by the management of NNFR.

Surveys of amphibians and reptiles in and around Ngel Nyaki Forest Reserve

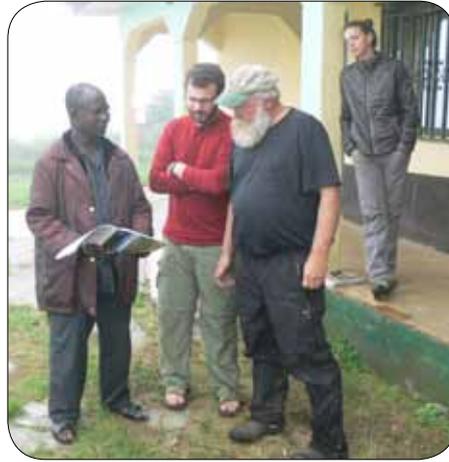
David C. Blackburn, Lauren A. Scheinberg, and Jens V. Vindum

Section of Herpetology,
Department of Vertebrate Zoology
& Anthropology, California
Academy of Sciences

Despite the remarkable amphibian diversity of the mountains and lowlands of adjacent Cameroon, little is known of the amphibian fauna of northeastern Nigeria. There is high degree of amphibian and reptile species diversity in Cameroon, including many species found only on one or several mountains. Thus, it is very likely that northeastern Nigeria similarly harbors a wealth of unstudied and undescribed diversity.

Previous to our work beginning in 2009, only a small handful of species were known from the Mambilla Plateau and nearby regions in Gashaka Gumti National Park, including the Gangirwal. Dunger (1967) recorded *Chamaeleo wiedersheimi* on the Mambilla Plateau. Gartshore (1986) reported two species from the Mambilla Plateau (*Hyperolius riggenbachi*, *Leptopelis nordequatorialis*) and one species from Mayo Selbe to the north of the Mambilla which she assigned to *Petropedetes parkeri* but represents an undescribed species (Blackburn, unpublished data). Later, Böhme & Nikolaus (1989) reported the lizard *Agama agama* (likely *A. sylvanus*) from near Yelwa and *Bufo* (now *Amietophrynus*) *maculatus* and *Leptopelis nordequatorialis* from the Mambilla Plateau. Böhme & Nikolaus (1989) also provided preliminary identifications of frogs collected on Chappal Waddi (~2300 m) but most of the species remained identified only to genus (*Astylosternus*, *Cardioglossa*, *Leptodactylodon*, and *Phrynobatrachus*). Our sampling in 2009 and especially 2012 significantly extends the known fauna of the Mambilla Plateau.

Surveys in 2009 resulted in the discovery of one new species of frog so far only known from nearby Kurmi Danko Forest Reserve (*Phrynobatrachus danko*; Blackburn 2010) as well as specimens of a new species found also in the mountains of Cameroon and the Obudu Plateau (*Arthroleptis palava*; Blackburn et al. 2010). The 2009 surveys also provided evidence



for the presence of the chytrid fungus *Batrachytrium dendrobatidis* that is implicated in amphibian declines and extinctions worldwide though no mortality events were observed during the surveys (Reeder et al. 2011). The 2009 surveys provided the first evidence of a number of amphibian taxa at Ngel Nyaki but the species identity of many remained unclear because only tadpoles were found. Based on both finding adult specimens in 2012 and DNA sequence data from on-going collaborative work based on the 2009 surveys, the identities of several of these species are now known. For example, species identified previously only to genus are now known to represent *Cardioglossa pulchra* and *C. schioetzi*, *Astylosternus rheophilus*, and *Leptodactylodon bicolor*.

Our 2012 surveys revealed a number of amphibian and reptiles not previously observed on the Mambilla Plateau. For some of these species, their presence is expected, including widespread species such as *Kassina senegalensis*, or frogs in the *Hyperolius nasutus* group or *Xenopus fraseri* group. Others were welcome discoveries such as the presence of a still unidentified blindsnake species (genus *Rhinotyphlops*). In addition to preserving specimens for future analyses, we also conducted screens for the presence of the fungus mentioned above and took samples to look for blood parasites in these amphibians and reptiles. Several species seen in and around Ngel Nyaki in 2009 were not observed during the 2012 surveys, including *Phrynobatrachus danko* and *P. steindachneri*. The absence of *P. steindachneri* was surprising and the significance of not finding it in 2012 is still unclear. Ongoing work on the 2009 collections reveals that at least two of the species remain to be described, both of which are found also in neighboring Cameroon (a species of each *Arthroleptis* and *Astylosternus*).

With additional examination of the species found in 2012, other discoveries may await.

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Intern Report, Primate Studies

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Natural Resources Conservation, Zoology
Department, University of Lagos, Nigeria

30 January 2012

On arrival in the early hours of 24th January, 2012, I was warmly received by all the staff members that were not in the field: Mr Bobbo Zubairu, the security man on duty, Mary, the cook, Misa Zubairu, the Officer in Charge and others. A room was allocated to me. Courtesy of the Director of the Nigerian Montane Forest Project, Dr Hazel Chapman, accommodation for my one week stay was free of charge.

Misa gave me some briefings and informed me that my field work would commence the following day since Musa, the field assistant who was to work with me, was out on the field.



We sighted putty nose monkeys (pictured above), troops of tanzania monkeys and heard the call of chimpanzees.

I was offered hot tea and hot water for bathing. These really helped me adjust to the cold weather of the 1665 metres above sea level camp site (I later worked on higher altitudes). My mission was to understudy how primate studies are done at the Project and to learn from it. Even though we were unable to sight Mona monkeys (my research primate), we sighted putty nose monkeys, troops of Tantalus monkeys and heard the call of chimpanzees. With the help of Musa, and direct observation, the food the primates eat were identified and photographed. Figs (*Ficus* spp) are presently the most abundant foods. Some of the monkeys sighted were seen in fig trees.

Perhaps spending more days and going to the field some few more times into the deep forest might have afforded me the opportunity to sight Mona troops. It is not unlikely that there are fewer Mona (compared to putty nose) in this forest.

The report is in the following parts:

1. Hospitality

The staff members of the Nigerian Montane Forest Project (NMFP) were quite hospitable and homely. They were open and sincere in all their dealings, and were kind and helpful too. I considered trying to persuade my family for a visit to the Project so that they could

experience the montane's natural beauty.

2. Facilities

I was very much impressed with the facilities: hostel, kitchen, conveniences, internet, water and power supply in such difficult terrain. Research work is easier done under such environments.

3. Forest

What was said to be fragment forest on the NMFP could be a whole forest in some other place. The main forest where we went to work was so big that I could only see the whole from a vantage position. It is blessed with rich biodiversity peculiar to that altitude.

4. Interaction with other researchers

My visit afforded me the rare opportunity of meeting with other researchers. I met Alex, from New Zealand who is working on Chimpanzees. His tenacity of purpose in going to the deep unknown forests of Nigeria really challenged me.

In summary, it has been a wonderful experience studying monkey food on the Mambila Plateau, in Taraba State. Transversing the gentle knolls and valleys with their streams gave me the opportunity to appreciate the efforts of field researchers / workers operating in challenging topographies. The undisturbed forest was where we sighted all but one of the monkeys. In fact the one

sighted on a fragment forest was a lone male putty nose that had been sighted on two other occasions in the contiguous forest. Apart from figs, all the other monkey foods were new to me (I have worked in swamp and rainforests). This shows the uniqueness of the montane forest. There is the urgent need for the state government to support its continuous protection and conservation of its rich and rare biological resources.

Appreciation

I very much appreciate the commitment of all the team members of NMFP for the united vision and sacrifice in securing and maintaining the forest and facilities to help researchers achieve their goals. I am very grateful to Dr Hazel Chapman for her generosity in allowing me to visit and stay in the camp board free. Perhaps in the future, I could still be allowed to enjoy such rare privileges.

Student Progress Reports



Ralph Adewoye

PhD Progress reports

Geospatial mapping and carbon sequestration modelling of West African submontane forests

This research focuses on the United Nations Framework Convention for Climate Change (UNFCCC) objectives on Reducing Emissions from Deforestation in Developing Countries (REDD). I am using spatial mapping and *in situ* non destructive techniques for the estimation of forest carbon stock (C stock) for the sub montane forests of West Africa (Mambilla Plateau, Nigeria). Spatial mapping entails the use of archived Landsat imageries from 1975 to 2011 in combination with QuickBird (high resolution) images of 2006 and 2011 for time series analysis and land use land cover change detections for the study area. Species diversities / tree biomass study plots were set up in the study area during the first field season (October 2011 – February 2012). Landsat and Quick Bird images has been acquired and currently been processed. Results from this study will contribute to the United Nations Framework Convention for Climate Change (UNFCCC) and the Convention on Biodiversity (CBD) data base as well enhance conservation of the remaining fragmented forests of Mambilla Plateau.



Babale Aliyu

PhD progress

The interplay of habitat and seed type on a conditional mutualism in a fragmented Afromontane forest landscape

1. Our knowledge of scatterhoarding by rodents and its potentially vital role in forest regeneration is based largely on single species interactions. How such behaviours and outcomes are context-dependant remains to be explored.
2. Here we explore for the first time the interplay of habitat and seed type on a conditional mutualism. We quantify how land use and seed palatability interact to affect the balance between seed predation and dispersal by rodents. We distinguish between buried and cached seeds, and measure dispersal distances. Our study is particularly novel because it combines information on two understudied groups of organisms, Afromontane forests and bat dispersed seed species.
3. Testable hypotheses around context-dependant outcomes in conditional mutualisms include: the balance between predation and dispersal will favour predation in palatable, relative to less palatable seed species; rates of scatterhoarding will be relatively higher for less palatable than palatable seed species sharing the same habitat; and in habitats where land use is such that fruit is scarce, such as fragmented/ degraded forest, rodents will act more as predators than dispersers relative to habitats with an ample fruit supply.
4. Synthesis our understanding of mammal-seed conditional mutualisms remains tenuous in that the interplay of multiple factors in determining their outcome is rarely investigated; outcomes can range from seed predation to caching or burial, depending on factors such as seed characteristics and seed availability. As land use change can affect all

of these and more factors, it is imperative that we explore such interactions for informed management and conservation decisions.



Paul Dutton

PhD Progress Report

Chimpanzee (*Pan troglodytes ellioti*) Ecology in a Nigerian Montane Forest

The Nigerian Chimpanzee *Pan troglodytes ellioti* (Gray, 1862) is the most endangered of all the four subspecies of chimpanzee. It has the smallest distribution and smallest population size, estimated to be between 5000–8000 individuals. As *P. t. ellioti* was first recognized as a distinct subspecies in 1997, very little is known about its ecology and behaviour. This study is the first investigation into montane populations of *P. t. ellioti*. The aim of this research was to conduct a broad ecological study on the chimpanzees in the montane environment of Ngel Nyaki Forest Reserve, Taraba State, Nigeria. Specifically I estimated chimpanzee abundance and investigated their diet, nesting ecology and elementary technology. I also determined the viability of seeds dispersed by the chimpanzees and removal of seeds (predation/secondary dispersal) from their faeces.

These data will provide valuable information towards chimpanzee management and conservation and will contribute towards the West African chimpanzee conservation

Action Plan. I assessed technology by locating and describing both manufactured artefacts and unmanufactured objects and located evidence from the surrounding environment to establish details about their presence or absence.

I used a combination of faecal samples and artefacts to assess the diet of the chimpanzees. I compared the rate of germination of conspecific seeds which had been passed through a chimpanzee gut with those that had not been dispersed. I set-up a series of experiments to identify preferences

and agents involved in removal of various seed species consumed by chimpanzees. As a second step, food availability, nesting ecology and habitat characteristics such as plant composition were assessed in order to detect variables that induce behaviour.



Alex Knight

MSc thesis Progress Report

Genetic structure and gene flow in the Nigeria Cameroon Chimpanzee in and around Gashaka Gumti National Park

The aim of the project is to examine the genetic structure of the chimpanzee population in and around Gashaka Gumti National Park, Nigeria. Using mitochondrial and microsatellite genetic markers we can estimate migration rates in and out of the park between the various fragments. We can investigate if certain fragments have become isolated and are experiencing higher levels of inbreeding. With this information we will be able to examine what factors are likely to impede or assist gene flow between the forest fragments. Between January 2012, and May 2012, I undertook an expedition to seven forest fragments across the Taraba State Area. These included: three forests inside Gashaka Gumti National Park; Ngiti forest located in the central region of the park; Leinde Fadali and Gangirwal on the eastern flanks of the park near the Cameroonian border; Ngel Nyaki and Akwaizantar forest reserves south west of the national park and two fragments located just outside the park boundaries towards Ngel Nyaki (see figure 1).

During this time we collected a total 85 faecal samples from the various fragments (range 6 to 16). DNA is currently being extracted from the faecal samples. At this point in time we have successfully extracted DNA from 34 of 41 samples that have been attempted. A Qiagen mini stool kit has been used for the majority of

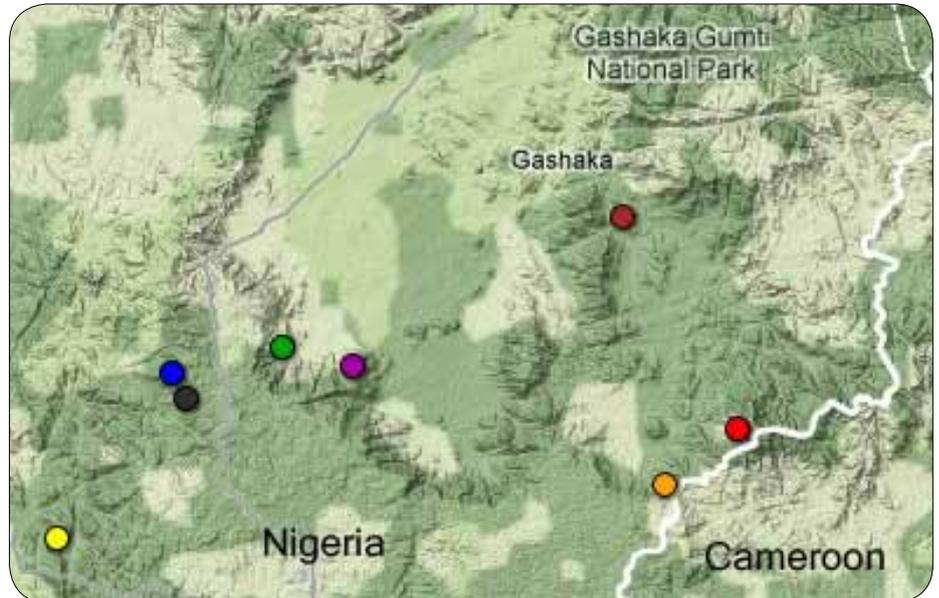


Figure 1: Circles represent all forests sampled between January and May 2012. Brown is Ngiti; red is Gangirwal; orange is Leinde Fadali; green and purple are two fragments on the outside of the park boundary; blue and black are Ngel Nyaki forest reserve; yellow is Akwaizantar. White line is the international boundary.



extractions, but a recent trialling of a protocol developed by Zhiang et al. (2006) has had great success. DNA was successfully extracted from all four trail runs of this protocol. This protocol will continue to be used. From the successful extractions we have sequenced a 370bp fragment from the hyper variable region of the chimpanzee mitochondria in 11 samples and 275bp fragment in 14 samples.

Denise Arroyo Lambaer

PhD

Conserving amphibian diversity- inventory and gene flow studies in fragmented montane forest, Mambilla Plateau, Nigeria.

In 2009 Dr. David Blackburn visited the

Nigerian Montane Forest Project to investigate amphibian diversity and recognized the area as a biodiversity hotspot. That rapid survey produced two new frog species *Arthroleptis palava* and *Phrynobatrachus danko*, highlighting the necessity of having a comprehensive taxonomic survey on amphibian diversity on the Ngel Nyaki Forest Reserve.

The rainy season is the best time of the year to search for frogs, so since July I have been doing a detailed taxonomic survey on amphibian species within and around Ngel Nyaki Forest Reserve. The goal is to have a comprehensive amphibian inventory of this area.

I have been using a variety of methods such as active searching and Visual Encounter Survey (VES) techniques, opportunistic records such as roadkills and animals captured by people from

villages. In addition, I set live pitfall traps with drift fences along different habitats, however, this method did not produce any results. As part of the survey, I have been collecting baseline data on species occurrences, including voucher specimens. This data will facilitate not only on-going characterization of the herpetofauna but also future additional studies of systematics, biogeography, and genetics.

Between 12–27th of July the NMFP was visited by Dr. David Blackburn, Jens Vidum and Lauren Scheinberg from the California Academy of Sciences. We were working all together and some of the Industrial Training (IT) students from Gombe State and Taraba State Universities searching for amphibians and reptiles. These weeks were quite productive; we found a rare species of snake and a new record on the distribution of a frog.

So far, there is a preliminary amphibian inventory which contains 16 species of anurans. Two of these species are listed as Endangered and one as Critically Endangered in the IUCN Red List of Threatened Species. There are some species of frogs that only are found in the main forest such as *Leptodactylodon bicolor* but others such as *Arthroleptis palava* are associated with human-altered landscapes, including farms, grasslands and eucalyptus plantation.

Currently, I am collecting tissue samples of *Cardioglossa schioetzi* which is one of the frogs listed as Endangered. The next step will be the extraction of DNA and by using molecular markers I will measure the gene flow between populations in order to assess the effects of habitat fragmentation and deforestation on anuran dispersal at the study site.

Moreover, Emmanuel Christopher Yinwana an IT student from Taraba State University is working on the abundance of anurans on the main forest and the riparian forests on the Ngel Nyaki Forest Reserve.



Charles Nsor

PhD Progress Report

Sunbird pollination and the fate of strong contributors to a mutualistic network in a West African montane forest.

Pollination mutualisms are essential for the functioning of tropical forests, but they are threatened by forest fragmentation and degradation, which can lead to decline and local extinction of pollinator species. We report a preliminary investigation of the avian pollinators of three West African montane forest tree species, *Anthonotha noldeae* is dependent on birds for pollination while *Anthocleista vogelii* and *Croton macrostachyus* have flowers characteristic of moth and insect pollination respectively. We monitored 15 individuals of each of *A. vogelii* and *C. macrostachyus* for 6 h (making a total of 90 h per species) and 15 individuals of *A. noldeae* for 14.6 h (total 219 h for the species). We recorded all bird visits and identified visitors as pollinators, secondary pollinators and robbers. In total, 25 bird species visited at least one of the three focal tree species and eight of these visited all three tree species. Of these, two species of sunbird from the genus *Cinnyris* pollinated all three tree species: the Northern Double-collared Sunbird *C. reichenowi* and the Orange-tufted Sunbird *C. bouvieri*. A third, the Variable Sunbird *C. venustus* pollinated only *A. vogelii* and *A. noldeae*. The Village Weaver *Ploceus cucullatus* occasionally pollinated *A. vogelii*. Nineteen bird species were considered secondary pollinators, while three species were nectar robbers only. *P. cucullatus* behaved sometimes as a pollinator, sometimes as a secondary pollinator and sometimes as a robber. The frequency of bird visitation (mean numbers of visits/tree/h) was significantly higher on *A. noldeae* than on *A. vogelii* or *C. macrostachyus*. Four species of sunbird

are crucial for the pollination of *A. noldeae* but the possibility exists for its pollination by secondary pollinators should sunbirds decline in abundance. Despite having flower syndromes associated with insect pollination, both *A. vogelii* and *C. macrostachyus* are pollinated by sunbirds and potentially by *P. cucullatus*.



Sasha Roselli

Factors limiting species composition and growth rates of naturally regenerating forest in a Nigerian montane grasslands.

Specific questions I hope to answer:

- 1) Is the species composition of the seeds found in the grassland seed traps representative of the species composition in either the forest edge or interior? If not, what traits of the species govern whether they are fully represented or not? I will look at differences in dispersal mechanism and successional stage of the species.
- 2) Does the use of bird perches in the grassland increase the total number or species variety of seedlings that are growing in the immediate area? Do they increase the percentage of bird dispersed seeds that end up in that area? Is the species competition under perches more or less similar to the species composition in the forest?
- 3) Does the realism of perches (wooden stakes vs real trees) have an effect on the amount or composition of seeds dropped underneath it?
- 4) Does burning or grubbing the rank grass effect the number or growth rate of seedlings establishing in these areas?
- 5) Is the level of soil moisture affecting seedling growth? Is the presence of rank grass around the seedlings reducing the available water through competition or increasing it by protecting the ground from drying out?
- 6) Is the level of available sunlight affecting

seedling growth? Does the rank grass provide competition for light or does it protect the seedlings from too much radiation?

This project aims to discover how managers are able to further facilitate and promote growth of natural regeneration in grasslands. This is particularly important in developing countries where there is limited funding for more intensive projects such as restoration planting. From this we can develop low cost management practices can be used to enhance the natural dispersal, establishment and growth of forest species into grassland. This knowledge will help managers of restoration projects both at Ngel Nyaki and around the world.



Josh Thia

Rare Afromontane tree conservation: using genetics and ecology to guide the management of *Lovoa trichilioides* and *Cordia* spp.

Ngel Nyaki is an especially diverse forest (Brookini et al. 2012) and is a hot-spot for biodiversity considering its size; this diversity comprises 24+ IUCN Red List tree species. However, Ngel Nyaki is vulnerable to anthropogenic threats, which comprise cattle grazing, burning, agriculture and hunting.

My project is concerned with two tree species: *Lovoa trichilioides* (Meliaceae) and a *Cordia* sp. (Boraginaceae), whose putative identity is *-C. millenii*. The IUCN endangered species Red List describes *L. trichilioides* as “vulnerable”, whilst *C. millenii* is described as “least concern”. However, these statuses should not be taken lightly as (1) conservation statuses of these species have not been updated since 1998, and (2) little research has been conducted that is directly related to understanding their ecology. Both *L. trichilioides* and *Cordia* are rare in Ngel Nyaki (preliminary survey), but the environmental consequences of their low

abundances are not understood. Furthermore, studies suggest that *L. trichilioides* is in fact very rare and of conservational concern within Nigeria (Kayode 2005, Adekunle 2006, Kayode 2006, Onyekwelu et al. 2008, Ihenyen et al. 2009). *C. millenii* has also been demonstrated to be negatively impacted by human-mediated disturbances, and despite its “least concern” Red List status, studies have described *C. millenii* as rare (Babweteera and Brown 2009). It is also an important food source for chimpanzees (Babweteera and Brown 2009, 2010), and the Ngel Nyaki *Cordia* has been identified by Dutton (2012, under review) as an important food source of the rare chimpanzee subspecies *Pan troglodytes ellioti* (Beck and Chapman 2008). Ergo, we should consider that low abundance of *Cordia* is of consequence.

The aim of this study is to understand how degradation of Ngel Nyaki forest has impacted the populations of *Lovoa* and *Cordia*, in terms of genetic diversity, inbreeding and natural regeneration. Specifically, the questions that we want to ask are: (i) what is the level of genetic diversity in these populations; (ii) what is the level of inbreeding; (iii) could seed predation be limiting the natural recruitment of these seedlings; and (iv) is the Ngel Nyaki *Cordia* sp. new to science? Question (iv) is of particular interest because Ngel Nyaki is an isolated forest that contains relict populations and has been shown to harbor new species of frog (Blackburn 2010, Blackburn et al. 2010) and tree (Chapman pers. com.).

We believe the Ngel-Nyaki *Cordia* could be a new species due to morphological and biogeographical discrepancies with what is described characteristic for *Cordia millenii* (i.e. it has slightly different leaves and fruit, levels of leaf hairiness and occurs at a higher elevation). It is expected that the small size of this population and degradation of the landscape will have negative impacts on genetic diversity; therefore, we also expect that inbreeding could be a significant issue. Studies (Jorge & Howe 2009), and our own preliminary research in Ngel-Nyaki, suggest that habitat degradation can dramatically increase seed predation pressures, and we suspect this will likely be the case for both *Lovoa* and *Cordia*.

This project is valuable because it focuses on conserving two important tree species, and results will be used to inform and carry out management protocols that will best restore them to greater abundance in Ngel-Nyaki and other Afromontane sites. It is hoped that this project will provide more detailed insights into how habitat degradation impacts trees.



Danladi Umar

PhD Progress Report

Response of benthic invertebrate communities to land use gradient in tropical highland streams in Nigeria

Benthic invertebrate communities are known to respond to degradation as a result of land use changes. Although these changes have been well documented in temperate regions, little is known about their effects in the tropics. Crops and land use pressure in the tropics can differ markedly from those in temperate regions, in addition to other land use pressures such as bush fires and deforestation. Between 2009 and 2010 we surveyed 55 first and second order highland tropical streams, across nine land uses, ranging from continuous tropical montane rain forest to intensive grazing. Streams were sampled for physico-chemical parameters and components of the biological community. Catchment and riparian conditions and human water use activities were used to generate a multivariate land use intensity gradient score. Temperatures in all streams were high (21°C) and dissolved oxygen levels generally low (38-66%). Benthic invertebrate communities showed strong response to the land use gradient. For example, mayflies such as Caenidae and Leptophlebiidae were restricted to the forest streams, while Oligoneuridae were found across multiple land uses. Within the Hydropsychidae a single taxa was also restricted to forested streams while a second Hydropsychidae taxa was common in agriculture streams. Similarly, the dragonflies, Aeshnidae and Gomphidae were found mostly in the agricultural streams. Highest taxonomic diversity occurred in continuous rain forest streams (76 families 39 taxa), and the lowest was found in streams with cabbage crops (3 families 5 taxa). Tropical land use farming has significant impact on the benthic invertebrate assemblages in highland streams in Nigeria.

Completed Theses

Andrew Barnes, MSc

The influence of matrix habitat restoration on dung beetle species responses across tropical forest edges

Anthropogenic land-use change has led to the fragmentation of habitats, resulting in the pervasive impacts of edge effects in ecosystems. These effects have presented conservation challenges that call for active measures to restore these degraded ecosystems. We experimentally tested the relative influence of matrix-habitat restoration on edge effects in Afromontane forest dung beetle communities by comparing abundance, richness, similarity, and individual species responses across forest edges adjacent to both degraded and regenerating matrix where external anthropogenic threats had been excluded. Dung beetle capture rates showed strong responses to habitat edges with decreasing numbers of beetles from the forest to matrix habitat. Also, capture rates and species richness were higher across the entire edge gradient in regenerating sites compared to degraded sites. These patterns were also apparent in compositional patterns where forest and matrix communities were the most dissimilar and there was clear compositional dissimilarity between communities in regenerating and degraded sites. Moreover, we found that 9 out of 10 species displayed strong individual responses to edge effects and the capture rates of these species were highly elevated in response to adjacent matrix restoration. Our findings indicate that dung beetles exhibit strong responses to edge effects through a decline in numbers as well as changes in relative species abundances due to variation in individual species responses. Importantly, we have also demonstrated that low-intensity restoration efforts in the adjacent matrix habitat can have high-level positive impacts on dung beetle communities through ameliorating edge effects and imposing beneficial off-site impacts on remnant communities in degraded landscapes.

Abby Grassham, MSc

Many of the world's tropical forests are under threat, with anthropogenic deforestation and degradation occurring at an alarming rate. Seed dispersal is an important process in forest restoration and regeneration, however seed rain is often low in degraded habitats, hindering reforestation efforts. Up to 90% of tropical fruit are dispersed by vertebrates, animal seed dispersers are incredibly important in maintaining forest health. Additionally, frugivores that disperse seeds into degraded areas may be of great importance in aiding natural reforestation. I therefore, investigated the potential role of the frugivorous monkey, *Chlorocebus tantalus tantalus*, in forest regeneration via seed dispersal. I assessed its patterns of habitat use, the quality and quantity of seed dispersal it provides, the effectiveness of current conservation management actions and the density of *C. t. tantalus* at Ngel Nyaki Forest Reserve. I found *C. t. tantalus* utilised forest, edge and grassland habitats, and dispersed seeds of 28 pioneer and forest edge species into these habitats. Moreover, the number of seeds dispersed per faeces was significantly higher in the grassland than the forest with means of 16.4 ± 6.1 and 3.4 ± 0.97 seeds >2 mm in these habitats respectively. Germination of *C. t. tantalus* dispersed seeds was highest in grazed grassland and lowest in grassland protected from grazing and fire, suggesting the current practice of fencing off grassland to protect from cattle grazing may not be sufficient on its own, due to seed-seedling conflict in habitat suitability. These findings combined with an estimated density of 28 ± 10.8 *C. t. tantalus* individuals km^2 suggests *C. t. tantalus* may benefit forest regeneration via its role as a seed disperser, provided appropriate management actions are implemented. This and other frugivorous species may play similar roles in other locations but such roles need to be investigated in order to implement management actions that ensure their seed dispersal benefits are maximised for forest restoration and regeneration.

Samuel Temidayo Osinubi, PhD

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

This project was aimed at investigating behaviour and condition of the Yellow-breasted Boubou, *Laniarius atrolavus*, 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. atrolavus* 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. atrolavus*, sadly, this habitat was most prone to anthropogenic disturbance. *L. atrolavus* appeared not to hold territories in the core habitat and its IUCN listing as Least Concern was suspected to be an over-estimation due to the species' far-carrying call.

Kristy Udy, MSc

The influence of forest reserve protection on the structure, stability, and functioning of dung-associated invertebrate communities

Communities are influenced by many factors, with anthropogenic impacts being one of the strongest. In particular, farming practices such as livestock grazing are common threats to the surrounding ecosystem. These effects are often exacerbated by variation across seasons that can significantly influence community structure and may have filtering effects on the response traits, such as body size, of species. This can result in non-random species loss, which in turn can have further flow-on effects that alter ecosystem processes, resulting in ecosystem-level responses to these drivers. Anthropogenic impacts can also alter the effects of abiotic factors that alter resource quality over different temporal scales. This can mediate the intensity of competition within a community, with competition generally being higher when species within a community occur at high densities. The community based around a resource is made up of species that interact together through trophic and non-trophic interactions. Both of these interaction types can alter the effect of the other and are important for structuring the community. Non-trophic interactions are generally measured by counting the number of co-occurrences of species at a shared resource, thereby inferring the existence of competition. However, this is not always an appropriate measure, as different species may use different parts of the resource. Consequently, when measuring actual competition in a community it may be more effective to visually observe which species interact and how often. Additionally, the structure of trophic interactions between species in food webs can in part be predicted by the ratio of predator to prey body size, and this ratio may also be useful for predicting the outcome of non-trophic interactions.

This study tested the effects of protecting forest reserves to exclude the effects anthropogenic activities in adjacent systems and was conducted in an Afromontane forest in Nigeria using the dung-associated community as a focal study system because it contains species guilds that are commonly used as biological indicators of ecosystem health. Taking season into account, I tested

how protection of forest from livestock grazing and fire threats affected the structure of the dung-associated community and how these factors affected the ecosystem functions of dung removal and secondary seed dispersal performed by this community. I also measured how dung beetle (Coleoptera: Scarabaeinae) abundance and size responded to forest protection and seasonal variation and how these influenced dung removal and secondary seed dispersal. Dung is a highly ephemeral resource, as it can be entirely exploited by associated invertebrates in a matter of hours and is also subject to rapid desiccation, therefore making this an ideal system for quantifying the abiotic and biotic determinants of community structure over time. To investigate how competition levels within a community vary over short timescales I observed how dung desiccation over three days influenced the communities attracted to this resource. I also tested the influence of competition in this community by experimentally altering the size and numbers of dung beetles, which are the most functionally important taxonomic group in this system. Because environmental changes have dramatic effects on insect communities, experiments were also run in both the wet and dry seasons to better understand the relative influence of desiccation changes across seasons. Furthermore, video analysis was used to determine which species competed and how often, and then trapping was carried out to sample the community. The structure of the community was compared between protected and unprotected areas of the forest and sampling was carried out in both the wet and dry seasons to account for strong temporal variation. Food-web metrics were measured to gain an understanding of the interaction network structure and to test whether co-occurrences can be used to infer the response of competitive interactions to anthropogenic activities, such as habitat loss.

Community structure was influenced by forest protection, and dung beetles were the most functionally important guild within the dung-associated community. The size and abundance of dung beetles increased in the wet season and in protected areas of the forest, which significantly increased the amount of dung removed and the number of seeds secondarily dispersed. Changes across seasons altered desiccation rates of the dung resource, which were significantly higher in the dry season, resulting in almost completely desiccated dung after three days. As a result, there were large compositional changes in the

dung-associated invertebrate community over days and among seasons, with the highest overall invertebrate abundance found within the first day of dung deposition and during the wet season. As expected, dung removal increased significantly with increasing dung beetle size and densities. However, there was a reduction in per capita dung removal rates, with increasing dung beetle densities. This was most likely due to competition between individuals over the resource. As a consequence of these density-dependent processes, individual removal rates for beetles of a particular size-class were not additive and therefore could not be used to predict community-level removal rates based on individual level functional efficiency. Thus, using body size is an ineffective predictor of community-level function if utilised without taking into account competitive interactions. Furthermore, when community metrics were measured for the interaction networks nestedness of a network differed between protected and unprotected forest and varied with season in the competition network, however no effect of these factors was detected in the co-occurrence network. Therefore, when determining network structure, measuring the actual rates of competition gives more accurate results than numbers of co-occurrences, and the body-size ratio between competing species can be a useful tool to aid in predicting the outcome of competitive interactions or to estimate non-trophic effects in food webs. The body-size ratio between winners and losers of a competition was also a good predictor of an interaction outcome, especially when the ratio in body size was greater than four between competing individuals. Thus, the exclusion of anthropogenic threats from habitat adjacent to forest reserves influences the structure of the community and interactions within it, the size of dung beetles, and significantly increases ecosystem functioning. Additionally, the structure and functioning of dung-associated invertebrate communities are strongly influenced by both abiotic (dung desiccation) and biotic (size and density-dependent competition) factors over small and large temporal scales. Therefore, mitigating anthropogenic threats to ecosystems through protection of reserves had an effect on the structure of associated communities, but was only apparent when quantified with the effect of changing seasons.

IT students



Haliru Bala, Taraba State University, helping set up the herbivory plots for his project.

IT students are students involved in the students' industrial working experience scheme (SIWE) which is compulsory training for every student in their third year. Students are assigned to relevant places as deemed necessary or satisfactory by the Department, for six months.

This year the NMFP again hosted four IT students from Gombe State University: All four students are in the third year of their undergraduate degree in 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.

This year each IT student has been involved in a specific research project. Emmanuel Christopher Yinwana and Isaac Ibrahim Balta have worked on aspects of frog conservation, with mentoring from Denise Arroyo. Haliru Bala and Aisha Yusuf are researching the effects of species and habitat on tree seedling herbivory, as part of a larger forest restoration project. Comfort Luka and Prince Umeh Peter are producing images and herbarium specimens which will contribute to a field guide to the flowers of Ngel Nyaki. In the meantime their images are going into the Phytolimages database.



Aisha Fatai Yusuf and Comfort Luka, Gombe State University.



Emmanuel Christopher Yinwana, Taraba State University, working with Denise Arroyo, UC.



Prince Umeh Peter, Taraba State University.



Isaac Ibrahim Balta, Gombe State University.

Outputs

Papers published

1. F.D. Babalola, T.O. Amusa, Z.J. Wala, S.T. Ivande, J.O. Ihuma, T.I. Borokini, O.O. Jegede & D. Tanko (2012): Spatial distribution of turaco-preferred food plants in Ngel Nyaki Forest Reserve, Mambilla Plateau, Taraba State, Nigeria, *Biodiversity*, 13:2, 100-107 <http://dx.doi.org/10.1080/14888386.2012.692175>
2. Temitope I. Borokini, Fola D. Babalola, Tajudeen O. Amusa, Samuel T. Ivande, Zingfa J. Wala, Oluwabunmi O. Jegede, Dauda Tanko and Jerome O. Ihuma. (2012). Tropical Montane Forest Biodiversity in Nigeria – Case Study of Ngel Nyaki Forest Reserve, Mambilla Plateau. *International Journal of Environmental Sciences* 2: 95-104. www.crdeep.org/wp-
3. Weston, K.A., Chapman, H.M., Kelly, D. and Moltchanova, E.V. (2012) Dependence on sunbird pollination for fruit set in three West African montane mistletoe species. *Journal of Tropical Ecology* 28: 205-213. <http://dx.doi.org/10.1017/S026646741100068X>.
4. Matthesius, A., Chapman, H. and Kelly, D. (2011) Testing for Janzen-Connell Effects in a West African Montane Forest. *Biotropica* 43(1): 77-83. <http://dx.doi.org/10.1111/j.1744-7429.2010.00664.x>.
5. Umar, D.M., Marinov, M.G., Schorr, M. and Chapman, H.M. (2012) Odonata attracted by light - a new topic for myth-busters. *International Dragonfly Fund Report* 43: 1-52.
6. Ihuma, J., Chapman, H.M., Tella, I., Akosim, C. and Goldson, S.L. (2011) Guild of frugivores on three fruit producing species (*Polyscias fulva*, *Syzygium guineensis* and *Pouteria altissima*) in Ngel Nyaki forest Reserve, a montane Forest Ecosystem in Nigeria. *Journal of Research in Forestry, Wildlife and Environment* 3(1): 1-3.
7. Ihuma, J.O., Chapman, H.M. and 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): 718-722.
8. Nsor, C. and Chapman, H.M. (2012) Birds as pollinators in a West African montane Forest. *Malimbus* : in press.

Papers submitted and currently under review:

1. Aliyu, B., Zubairu, M., Moltchanova, E., Forget, P.M. and Chapman, H.M. (2012) The interplay of habitat and seed type on a conditional mutualism in a fragmented Afromontane forest landscape. *Journal of Ecology* (Under review submitted June 2012)
2. Barnes, A. and Chapman, H.M. Trait Determinants of Colonising Propogules in the Restoration of Tropical Montane Forests. *Biotropica* (Under review Submitted June 2012)
3. Barnes, A.D., Emberson, R.M., Chapman, H.M., Frank, T., Krell, K.T. and Didham, R.K. The influence of matrix habitat restoration on dung beetle species responses across tropical forest edges. *Conservation Biology* (under review Submitted July 2012)
4. Grassham, A.M.; Kunz, B.; and Chapman, H.M. Dispersal of forest seed into grassland matrix by the tanzania monkey in a Nigerian montane forest: implications for forest restoration. *Journal of Tropical Ecology*. (Under review Submitted August 2012)

Reports

- Babalola, F.D. Wala, Z.J.; Ivande, S.T. et al. (2011) Spatial Distribution of Turacos and their Preferred Food Plants in Ngel Nyaki Forest Reserve, Mambilla Plateau, Taraba State, Nigeria. Report to Tropical Biology Association. 44pps.

Conference presentations:

1. Aliyu, B., Moltchanova, E., Forget, P.M. and Chapman, H.M. (2012) Fragmentation affects rodent-seed mutualisms in an Afromontane forest. Erlangen, Germany: European Ecological Society Conference, February 22–25th 2012.
2. Dutton, P.; Brown, J. and Chapman, H.M. Fate of chimpanzee dispersed seed in Ngel Nyaki montane forest, Nigeria. Annual Biological Conference, University of Canterbury 24th October 2011. Christchurch, NZ.
3. Dutton, P.; Moltchanova, E. and Chapman, H.M. Ecology of small, montane population of the Endangered Nigerian/

Cameroon chimpanzee Ngel Nyaki forest, Nigeria Jane Goodall Institute, Belgium. April 2012.

4. 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 2011 Annual Biological Conference, University of Canterbury. Christchurch, N.Z.
5. Barnes, A. D., Emberson, R. M., Chapman, H. M. and Didham, R. K. (2011) The effects of forest edges on dung beetle communities in a tropical montane forest. Annual Biological Conference, University of Canterbury 26th October 2011. Christchurch, N.Z. * winner best paper
6. Thia J. (2012) Preliminary work on the secondary seed dispersal networks in an Afromontane forest. Summer Scholarship Conference, Christchurch, NZ. Feb. 10-12th.

Publicity and outreach

1. September 21st 2012 'Push to Save Protected Forest' The Press Newspaper, Christchurch, NZ <http://www.pressdisplay.com/pressdisplay/viewer.aspx>
2. 15th June 2012 Taraba State Television Broadcast - Valley of unlimited biodiversity- By Awual Sani. DVD will be sent to NEZS. This documentary on the NMFP has also been cut into relevant short segments and is available to view on our Facebook page http://www.facebook.com/hazel.chapman2?ref=tn_tnmn#!/groups/4829132147/
3. 2007- September 2012 - NMFP Facebook now has 96 members.
14. 17th July 2012 This Day (Nigerian Daily) Nigerian Newspaper blog, 1,700 + views <http://allafrica.com/stories/201207170067.html>
16. 16th July 2012 Guest Columnist By Ayo Olukanni 'Nigerians at the very end of the Earth' <http://newsbreaknigeria.com/news/Nigerians+at+The+Very+End+of+The+Earth>
19. 20th March 2011 Our Mission At The Montane Forest Project, By Manager, Umar www.ngrguardiannews.com/index.php?option=com_content&view=article&id=42092:our-mission-at-the-montane-forest-project-by-manager-umar-&catid=175:kaleidoscope&Itemid=702



Characterising Calls of the Yellow-breasted Boubou (*Laniarius atroflavus*) & Potential Habitat Effects

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Introduction

Vocalisation serves an important communication function in birds but most research is limited to temperate species and little information is available on tropical forest species. The yellow-breasted boubou *Laniarius atroflavus* is a range-restricted subspecies (family: Malaconotidae) inhabiting the rugged terrain of the Nigerian-Cameroon Highland biome, which is severely threatened by anthropogenic pressure. Between 2009 and 2010, boubous in the Ngel Nyaki Forest Reserve of Taraba State, Nigeria, were observed and recorded to:

- identify the different calls in their repertoire,
- ascribe possible functions to each call, and
- assess differences in acoustic measures between individuals holding territories in escarpment forest edge and in riparian fragment habitats (fig. 1).

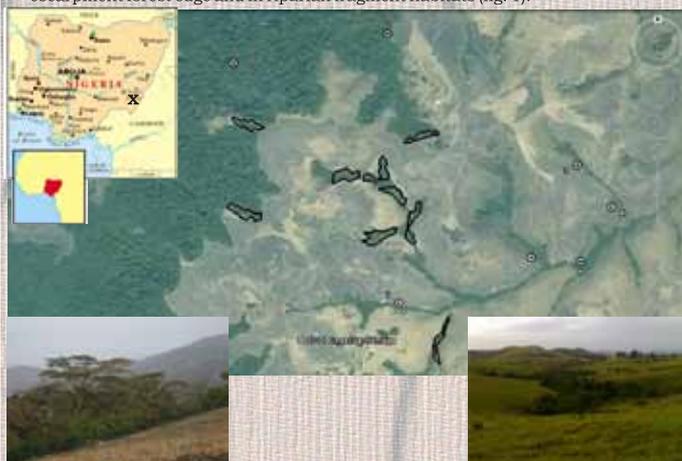


Figure 1: Satellite imagery of the study area, with polygons indicating delineated territories and dots indicating territories with insufficient boundary delineation. Inserts show (counter-clockwise from top) map of West Africa and Nigeria with study site marked (X), photo of edge habitat, and photo of riparian habitat.

Materials & Methods

Records were made using the Marantz PMD661 digital recorder with a ME67/K6 Sennheiser shot-gun microphone, and examined using Raven Pro 1.4 and XBAT (fig. 2). Focal observations and recordings provided information for identifying calls and call functions, and these were conducted whenever boubous were encountered. Environmental recordings were explored for habitat effects, and these records were taken in the morning (0530-0930) within identified territories using an unmanned recording unit.



Figure 2: Recording equipment used for both focal and environmental recordings.

Results & Discussion

Four call types were identified:

- single-peaked call or inverted U profile as described by Grimes (1976) with an average minimum frequency of 0.79 kHz, maximum frequency of 3.08 kHz and each call lasting approximately 0.30 sec; pairs in other territories responded vocally to this call type and did so with a similar call, suggesting it functions as a territorial call (fig. 3i).
- multi-peaked call with an average minimum frequency of 0.96 kHz, maximum frequency of 3.20 kHz and duration lasting approximately 0.44 sec; recorded between members of a territorial pair, suggesting it functions in mate-guarding or to maintain contact (fig. 3ii-iii).
- clicked duet response or described as a 'chook' by Serle (1965); recorded in reply to both the single- and multi-peaked calls, and was observed to be produced by both individuals of the pair. Usually a single reply to each call, but multiple replies to a single call were recorded.
- alarm call; sounded like a rasp and is produced when an observer approached the bird or nest, or when the bird was mobbing a threat (fig. 3iv).

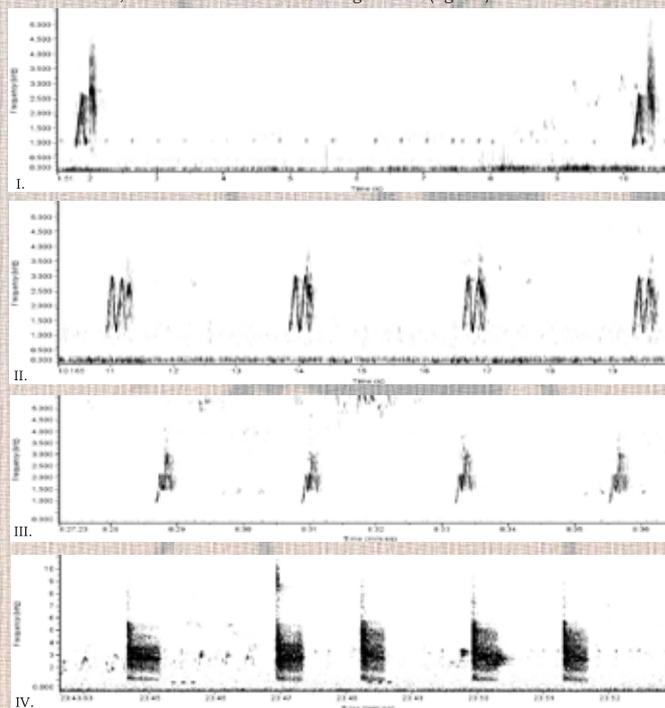


Figure 3: Spectrograms showing (I) single-peaked call with clicked duet response, (II) multi-peaked call with clicked duet response, (III) a variant of the multi-peaked call without clicked duet response, and (IV) alarm call.

Calls recorded in the riparian habitat covered a wider bandwidth range – lower in the minimum frequency – and had a longer duration than calls in the forest edge (table 1). Lower frequency may allow for better sound propagation in the denser undergrowth of the riparian habitat.

Table 1: Differences in acoustic parameters of single- and multi-peaked call types between edge and riparian habitats.

Acoustic measures	Single-peaked calls			Multi-peaked calls		
	Edge	Riparian	Statistics	Edge	Riparian	Statistics
Minimum frequency (kHz)	0.78 ± 0.13	0.74 ± 0.17	$F_{1,676} = 10.38, p < 0.01$	0.98 ± 0.07	0.92 ± 0.13	$\chi^2_{1,N=321} = 26.79, p < 0.01$
Maximum frequency (kHz)	3.48 ± 0.68	3.44 ± 0.66	$F_{1,676} = 0.58, p = 0.45$	3.38 ± 0.36	3.59 ± 0.61	$\chi^2_{1,N=321} = 0.19, p = 0.67$
Bandwidth (kHz)	2.7 ± 0.73	2.70 ± 0.74	$F_{1,676} = 0.004, p = 0.95$	2.40 ± 0.37	2.68 ± 0.68	$\chi^2_{1,N=321} = 4.08, p = 0.04$
Inter-quartile* bandwidth (kHz)	0.74 ± 0.23	0.79 ± 0.30	$\chi^2_{1,N=678} = 8.81, p < 0.01$	0.65 ± 0.19	0.65 ± 0.20	$F_{1,319} = 0.03, p = 0.86$
Duration (sec)	0.33 ± 0.07	0.35 ± 0.14	$\chi^2_{1,N=678} = 1.96, p = 0.16$	0.44 ± 0.06	0.47 ± 0.08	$F_{1,319} = 14.60, p < 0.01$
Inter-quartile* duration (sec)	0.09 ± 0.06	0.10 ± 0.04	$\chi^2_{1,N=678} = 13.05, p < 0.01$	0.13 ± 0.05	0.14 ± 0.05	$F_{1,319} = 3.46, p = 0.06$
Number of calls recorded	393	285		107	214	

*Inter-quartile measurements are the difference between the first and third quartile value of a measured parameter.

Conclusion

L. atroflavus does not have as diverse a repertoire as its closest congeners, but both individuals of a territorial pair can produce the four call types, refuting reports that only males initiate and females respond to duets in this species. Habitat structure does appear to influence the vocalisation of the boubous, with a shift in the lower frequency range. If single-peaked calls serve a territorial function, then birds in the edge habitats appear to communicate their territorial presence to conspecifics than individuals in riparian habitats, while birds in the riparian habitats appear to engage in more calls between the pair, as suggested by more single-peaked calls coming from the edge habitat and more multi-peaked calls from the riparian habitat, respectively.

All recordings are archived and available online at the Macaulay Library of the Cornell Laboratory of Ornithology (<http://macaulaylibrary.org/>).

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