Annual Report
Nigerian Montane Forest Project

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Conserve.

UC SCIENCE

2014

Contents

Introduction

Anastasios (Tasso) Paul Leventis - Patron

Phil Hall (Chair)

John Adeyemi Adeleke

Roger Wilkinson

Danladi Umar

Hazel Chapman

2014 has been an extremely active and successful year for the Nigerian Montane Forest Project.

Having a science co-ordinator based at Ngel Nyaki has added a new dimension; funded by Tasso Leventis, Biplang Yadock has introduced a culture of efficient data management and has demanded prompt replies and good communication between field assistants and university based students and researchers. Undergraduate IT students have also benefited from Biplang's expertise.

Extremely generous support from retired General T.Y. Danjuma has enabled us to establish a 20 hectare permanent forest plot (see page 6), one of only five Centre for Tropical Science Research (CTFS) plots in Africa and the only montane plot this makes Ngel Nyaki an internationally important forest. Associated with the plot has been the construction of an office building and a road from the field station to the plot. Surveying the plot has proved a major challenge to Gombe based Suleiman Hassan and Associates Ltd. The terrain is extremely steep, no vegetation can be cut to allow line of sight and GPS readings are inaccurate because of canopy movement. However Suleiman has a dedicated and impressive team of young surveyors (see updates on our Facebook page) who are using total stations to accurately delineate and subdivide the plot

Forest restoration is on-going and a considerable additional area of grassland has been fenced off this year from burning and grazing – how this area will be restored into forest is a challenge and will be the topic of research during 2015. In the meantime the forest is protected from fire by a wide firebreak and from cattle intrusion by four new staff whose job is to patrol the grassland 24/7.

Thanks once again to retired General T.Y. Danjuma we have setup two PhD scholarships for Nigerian students to study field research at Ngel Nyaki (see page 18).

The Abraham Foundation (NY) and the Australian High Commission in Abuja have supported the Project for the first time and this confidence shown towards the Project by new sponsors is greatly appreciated. Of course we continue to depend on the loyal support of the A.G. Leventis Foundation, Chester Zoo and Nexen Nigeria.

Our first early career staff from the Federal University of Kashere have arrived at the University of Canterbury. Auwal Abdullahi is a mathematician and his PhD in maths is around modelling secondary seed dispersal using data from Ngel Nyaki. Auwal will collaborate with Biplang (and vice versa) in this project.

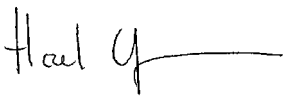
A highly successful three way collaboration between Nigeria, France and New Zealand has seen Dr Babale Aliyu being awarded a PhD from the University of Canterbury. He has now returned to his lecturing position at Gombe State University and will continue to have strong links with the Project.

Three UC MSc students have graduated this year all with A+ MSc projects. Congratulations Alex Knight, Josh Thia and Sasha Roselli, well deserved. These marks reflect the students abilities but also the quality and dedication of their field assistants at Ngel Nyaki.

This years report includes an overview of the wide range of research projects being undertaken at Ngel Nyaki (see Our Science), several research projects have now been running for over ten years which translates into extremely valuable long term data sets.

All this has happened despite increasing difficulties on the ground, so that the support we are receiving is not just financial, also moral. Thank you everyone.

As usual a big 'thank you' to Matt Walters who is responsible for the high quality of this Annual Report.



Hazel Chapman

Director, Nigerian Montane Forest Project

Our values

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.

Our networks

Project Partners / Collaborators

A.P. Leventis Ornithological Research Institute, Jos, Nigeria (APLORI)
Federal University of Kashere, Nigeria
Gashaka Gumti Primate Project (GGPP)
Gombe State University, Nigeria
Lincoln University, New Zealand
Nigerian Conservation Foundation (NCF)
Nigerian National Parks (NNP)
Professor Pierre-Michel Forget, Natural History Museum, Paris, France
Royal Botanic Gardens, Kew, England
Taraba State Government, Nigeria
Taraba State University (TSU), Nigeria
University of Canterbury, New Zealand (UC)
California Academy of Sciences, San Francisco, USA

Project Funders

Abraham Foundation, New York, USA
A.G. Leventis Foundation
Chester Zoo
Direct Aid Programpm (DAP) – Australian High Commission Abuja.
Gombe State University
Nexen Nigeria; Nexen Inc.
Taraba State Government
T.Y. Danjuma
T.Y. Danjuma Taraba State Community Fund

Academic Supervisors

Dr David Blackburn (California Academy of Sciences, San Francisco, USA)
Assoc Prof Hazel Chapman (UC)
Prof Pierre-Michel Forget (Natural History Museum, Paris, France)
Dr William Godsoe (UC)
Dr Marie Hale (UC)
Assoc Prof Alex James (UC)
Prof Mike Lawes (Charles Darwin University, Darwin, Australia)
Dr Elena Moltchanova (UC)
Prof David Norton (UC)
Dr Ulf Ottosson (Leventis Conservation Institute, Aplori, Nigeria)
Dr Mike Plank (UC)
Dr Daniel Stouffer (UC)

Highlight: Monitoring for long term success

TY Danjuma invests in the forests of Taraba State

Forest biodiversity and conservation research in Nigeria has received a major boost with a donation by TY Danjuma to the Nigerian Montane Forest Project (NMFP). This is for the establishment and monitoring of a long-term, large-scale forest research plot at Ngel Nyaki Forest Reserve on the Mambilla Plateau in Taraba State.

The University of Canterbury NMFP, directed by Associate Professor Hazel Chapman, operates a teaching and research facility located on the edge of Ngel Nyaki forest, a hot-spot of natural diversity. The NMFP works with Taraba State Forestry to protect the forest.

The Nigerian Montane Forest Project leads the way in Taraba conservation

The field station, which has been operating for eight years, serves as a research laboratory and teaching centre, with accommodation for scientists and students. Masters and PhD level students from Nigerian universities and institutions, as well as University of Canterbury students, undertake research within the reserve.

Associate Professor Chapman says the research is assisting conservation in Nigeria in critical ways.

"The focus of the research carried out by the NMFP is aimed at the conservation, restoration and management of these unique forest areas and learning more of ecosystem services provided by the plants and animals in them. It is vitally important research, because Nigeria has already lost most of its primary forests and therefore the potential benefit from them to all."

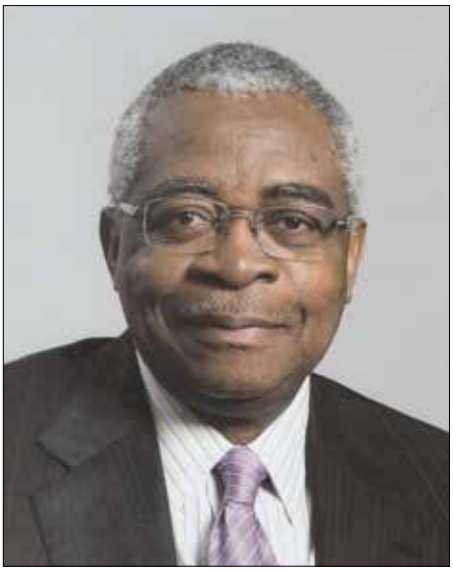
"Half of Nigeria's primary forests were destroyed between 2000 and 2005 and this destruction has by no means stopped. Yet in the mountains of Taraba State there are forests remaining which are important refuges for Nigerian biodiversity."

Major research facility boosts conservation training in Nigeria

Each year over 300 undergraduate students visit the NMFP facility on multi-day field trips from Nigerian universities. A number of students also complete six-month internships with the Project, gaining real-world training in biological research methods and the experience in designing and conducting their own research project.

Benefits for the whole community

- Employment and training of local women for data entry and plant identification.
- Employment of data collectors and patrollers in the plots.
- A focus of study for the school-run conservation club.
- Increased in research students and scientists visiting Ngel Nyaki to access the plot.



Lt. Gen. (Rtd.) TY Danjuma GCON

> **"The forests in the mountains of Taraba State are rich in biodiversity and it is my hope that this funding will ensure the future of Ngel Nyaki and the communities around for a very long time."** TY Danjuma

Generous support for the future for Taraba State forests

Assoc. Prof. Chapman says, "In funding our research plot TY Danjuma has given Taraba State and the NMFP a huge boost; it is a truly exciting development.

Data from the plot will contribute to understanding the effects of climate change, carbon sequestration and forest fragmentation."

Dr David Kenfack and a colleague from the Smithsonian Institute in Washington D.C. will visit Ngel Nyaki in 2015.

A population of endangered Nigerian/Cameroon chimpanzee (*Pan troglodytes ellioti*) live in Ngel Nyaki Forest Reserve and recent NMFP research has discovered novel tool use by these individuals.

Preparation for success at the Ngel Nyaki CTFS forest plot

Misa training the "Smithsonian trainees".

Preparation for the TY Danjuma funded Center for Tropical Forest Science (CTFS) plot is continuing on schedule, with both training and logistics progressing to ensure the research is a success right from the start.

Training

Misa is training 8 new staff for plot related work and has selected them to include all tribes in the community (Mambilla, Fulani, Kaka, Kampu and Ndola). They are mainly women from nearby Yelwa village. They will be responsible for plant identification and data collection.

Misa is working with them in the field now to ensure they are ready to accurately identify plants once the CTFS plot is established in November.

They are also receiving training in correctly completing the data collection forms. These forms are standardised across all 53 CTFS plots globally, to enable data to be used by scientists and governments around the world.

Dedicated computers and scanners have been setup in the new purpose built office. The staff are being trained to scan all of the data forms and also enter the data into spreadsheets.

The staff are enthusiastic to begin the plot work and we are confident they will be suitably trained to enable the work to progress smoothly and accurately.

Sidu and Manu cutting the piping for the marking the subpolts. The new office for data management is ready for the plot work. The survey team show Hazel the difficulties of surveying the densely vegetated rugged terrain.The survey team include Lucy Bello, Yahaya Isa, Elkana Ishaya Tal and Adamu Magaji Deba from Suleiman Hassan and Associates Limited, Gombe. This is the most difficult job they have ever encountered.

Logistics

Significant planning has gone into preparing for the CTFS plot, including the construction of a new building and purchasing many supplies.

The new office building is now complete and computers have been setup for the initial training. It will also be used to house the data collected.

Many kilometres of pipe have been cut to the required length. These tubes will be used to delineate subplots with the main 20 hectare plot. Subplots are 20 x 20 metres each and subdivided again into four 10 x 10 metre plots, which are further divided in quarter to produce 5 x 5 metre plots. Each corner of the subplots is marked with a length of colour coded pipe to allow accurate identification of the location within the forest. These 5 x 5 metre subplots enable the data to be collected efficiently and also give a finely resolved indication of the species composition so that changes over time can be analysed.

Four patrollers have been employed to keep cattle and fire out of the plot.

Project news

Gombe State University biology students on a field trip to Ngel Nyaki

Funding success

Ford Conservation and Environmental Grant

The Project has been awarded a Ford Conservation and Environmental Grant to procure equipment for research into seed dispersal. The grant was one of five awarded by the Ford Motor Company as part of a new initiative in Nigeria. Kennedy Polomoa from Gombe State represented the Project at the awards ceremony in Lagos on December 23 2013.

For full details see: www.vanguardngr.com/2013/12/ford-boosts-environmental-protection-nigeria-25000/

Abraham Foundation Grant

The Abraham Foundation is dedicated to conserving the environment and defending wildlife with an emphasis on the protection of endangered species. They believe that conservation can only succeed with the support and involvement of local communities, a view also held by the Nigerian Montane Forest Project.

The Foundation has granted US$5,000 to the Project as a general contribution for operating costs. They have a special interest in the chimps within the reserve.

Find out more about the Foundation at www.abrahamfoundation.org

Australian Direct Aid Programme (DAP)

(DAP) is a flexible small grants programme funded from Australian Governments aid budget. It is administered within Nigeria by the Australian High Commission, Abuja.

The Project was successful in recieving US$23,000 for a grant titled Community Restoration and Conservation of Nigeria's Mountain Forests.

The funding is being used to restore the forest through developing the plant nursery, monitoring seed traps, collecting seeds, and purchasing materials for more fencing of the grassland around the edge of the forest reserve.

UC Vice Chancellors General Staff Development Award

Matt Walters has received a NZ$2,000 award towards a visit to the Royal Botanic Gardens Kew, London, to learn advanced skills in tropical plant taxonomy and science communication. This will enable him to work towards producing a guide to photographing plants for conservation and scientific research. The guide will expand on the brochure he has already produced for the field assistants at Ngel Nyaki, assisting them to collect research data and photographs of the plants.

Whilst at Kew he will also work with botanists to identify additional plants for the species checklist from herbarium specimens collected by Hazel and the late Jim Chapman.

New species confirmed through DNA analysis

Dr Douglas Stone, a taxonomist from University KwaZulu-Natal has used DNA from one of our *Memecylon* species (family Melastomaceae) in his research to improve the *Memycylon* genus phylogeny. We now know that our species should be placed in *Memecylon* (sect. Afzeliana Jacq.-Fél). His work has shown that our plant (herbarium collection number HMC-744) clearly represents a new species, but further study of flowering & fruiting material is needed before it can be formally described and named. The new species is a small tree (about 15 metres tall) growing in Ngel Nyaki forest. Dr Stone published his research in Taxon (Vol. 63, Num. 3) in June 2014.

Broadcast highlights the Project

Hazel was interviewed on Radio New Zealand National in July. The 40 minute live interview with Kim Hill was broadcasted to an estimated audience of 218,000 listeners. The discussion covered the history of the Project and the challenges faced in protecting Ngel Nyaki Forest Reserve. The interview is available online at: www.radionz.co.nz/national/programmes/saturday/audio/2602273/hazel-chapman-forests-in-nigeria

Illustrated plant checklist

An Illustrated checklist of the plants of Ngel Nyaki Reserve has been compiled from the observations and collections of Jim Chapman, Hazel Chapman, Matt Walters and the staff and students of the Nigerian Montane Forest Project.

The checklist is available online via the Project website and has over 270 species listed so far.

Field assistants

We are in the planning stages of botanical and herbarium training through Kew, which may involve collaboration with the Gashaka Gumti Primate Project. We are also actively developing training initiatives through Chester Zoo which includes horticultural training and perhaps even a field assistant exchange.

The field assistants continue to be in close contact with postgraduate students and Hazel Chapman by email and Skype all year round. This improved communication ensures that the projects stay on-track.

Conservation club

The NMFP Conservation Club continues to grow. Ten primary and secondary schools from the community around Ngel Nyaki Forest Reserve have membership. They make regular visits to the field station to observe conservation in action.

In addition we are working with the nursery school (NMFP funded) to instil in small children a pride in their forest from an early age.

Facebook Group

Very successful, we now have almost 350 members from all round the World. Importantly though, a majority are young Nigerians interested in conservation.

Visitors

During March TY Danjuma funded a visit by Phil Hall and three members of Africa Parks. The visit was to see Gashaka Gumti National Park (GGNP) and Ngel Nyaki Forest Reserve, with the idea that Africa Parks may take over the day to day running of GGNP and recognise Ngel Nyaki as an important satellite forest. They were accompanied by a friend of the Project, the Galadima of Nguroje and Dr Danladi Umar of Gombe State University.

APLORI visit in July to Ngel Nyaki: Left to right; Abdul, Manu, Onoja, Dr.Manu, Rahila, Biplang, Simon, Mohamed.

Wakili, Andrew Parker (African Parks), Alade Adeleke (NCF), Ibrahim Inahoro (NCF), the Galadema Nguroje, Phil Hall, Dr. Okeyoyin Agboola George (Director GGNP), Philip Thomas and Dr Danladi Umar.

Federal University of Kashere geography students. This is the beginning of our formal relationship with the university and next year we are looking forward to also hosting botany, zoology and industrial training students

People

Everyone associated with the Project has made a difference and it is only because we have such a committed team that we succeed.

In addition to NMFP employees, Taraba State Forestry Director Samuel B. Telltuly and Forest Management Officer (Gembu) Mr Ira Musa Ambaeshar are integral to the smooth running of the Project. Our committed Forestry Patrollers continue to look after Ngel Nyaki forest and are we are all supported by the good-will of the Juaro of Yelwa.

Two new additions to the project warrant special mention; Ivy and Prince, along with our long-term supporter the Galadema of Nguroje, see below.

Some members of the large team at the field station during April 2014.

Iveren (Ivy) Abiem, an APLORI graduate and lecturer in botany at the University of Jos is overseeing the establishment and enumeration of the plot. Ivy travels from Jos on a regular basis to ensure all is going according to plan.

Through this work and general involvement with botanical surveys Ivy is making a serious contribution to the NMFP.

Prince Umar, a botany graduate from Taraba State University and a former NMFP Industrial Training student, is doing his National Service year in nearby Gembu town. Prince is working part-time with the Project carrying on with our grassland permanent vegetation plot monitoring and the running of the herbarium.

The Galadema of Nguroje as always, has worked with the NMFP throughout 2014 to help in negotiations and smooth running.

Our science

Monitoring grassland vegetation plots. L to R: Prince Umar, Yadock Biplang, Iveren Abiem, Peter Dominic and Augustine Ntim.

Taxonomy and herbarium

Both the herbarium and the virtual herbarium (www.afromontane.canterbury.ac.nz/checklist.shtml) are continuing to grow. Matt Walters has added over 270 species to the plant checklist now called 'An illustrated checklist of the flora of Ngel Nyaki Forest Reserve'. Around 1000 images from Ngel Nyaki have been added to 'Phytoimages' (www.phytoimages.siu.edu) and a similar number to the West African Plants - A Photo Guide. This is an interactive online plant identification guide.

Phenology

We have a series of transects totalling 14 km in length and 4 m wide, along which we have labeled all trees >10 cm DBH. These trees, almost 2000, are scored on a monthly basis for phenology (fruiting, flowering and leaf flush). From these data we are gaining an accurate picture of fruit availability in the forest for every month of the year and how this varies from year to year. Along with other data this underpins many research programmes. Half of our phenology data is collected in the same was as GGPP phenology data and this may provide a good opportunity for collaboration. Here estimates of fruit abundance are made.

Permanent photo points

There are 16 permanent photo points on the edge of Ngel Nyaki Forest Reserve, including Kurmin Danko. The aim of the photo points is to detect changes in forest cover associated with our restoration efforts and as well as measuring the effects of cattle grazing and fire. Annual or biannual photos have been taken since 2006.

Permanent vegetation plots

In late 2013 we established 13 permanent vegetation plots in fenced off grassland. Each plot is 5 x 5 metres square and the 12 plots include a range of grassland types. Within each plot we record all species present and percentage cover. The idea is to repeat the sampling biannually so that we begin to understand how grassland responds to protection from grazing and fire. We are collecting our data in the same format as RECCE plots, an internationally accepted technique for inventory and monitoring in a wide range of environments – the RECCE plot is based on the European Relevé method of vegetation sampling.

Species conservation

Our species conservation work involves habitat conservation as well as understanding particular species ecology and species interactions. We have a research program investigating the ecology of the Nigerian /Cameroon chimpanzee and so far have determined population size (Beck and Chapman 2006), basic ecology (Dutton 2013), diet (Dutton and Chapman 2014); tool use, nesting ecology, seed dispersal (Dutton et al 2014) and population genetics (Knight 2014). The population genetics work is summarized in two papers which are under review in PLOS ONE and Oryx. Key findings from these research projects are that the Ngel Nyaki population of chimps while small (approximately 18 individuals), it harbours genetic diversity not found elsewhere. Now that the population is isolated from nearby populations there is good reason to develop forest corridors to link this population with the Gashaka population to the north east and those of Akwaizanter to the south west. In addition, the movement of a Gashaka chimp into Ngel Nyaki to promote out-crossing is a potential management tool.

We have discovered 'new' chimp tools at Ngel Nyaki, which make it an interesting population, valuable in the investigation of ecology vs culture in terms of tool use.

We are exploring network properties of a sunbird- tree pollination network in order to predict which species are most vulnerable to extinction. A summary of this work is presented below in the format of the thesis layout, as it is an ongoing project. Ngel Nyaki is rich in sunbird

Field assistant Usman along with engineer Olatokunbo Okulaja, their driver and meteorologist Philip Saleh.

species (14) and they vary greatly in terms of local abundance. This research has resulted in additions to the Ngel Nyaki bird checklist, range extensions and an advance in theoretical research into plant-animal network properties.

The putty-nose monkey, *Cercopithecus nictitans martini* is possibly a rare subspecies at Ngel Nyaki (Oates *pers. com*). We are investigating its feeding ecology and ranging behaviour. We also intend to take this farther and look at the effect of the putty-nose on forest restoration.

We have a programme (in collaboration with David Blackburn of the Californian Academy of Sciences) into amphibian conservation. From this we have identified several new species of frog and Denise Ayorro (see below) is working on the population genetics of two key species, in particular looking at gene flow among forest populations.

A new initiative involves the population genetics of rare tree species, building on Josh Thia's MSc research (which was supported by a Chester Zoo student grant). A key finding is the very low level of genetic variation found in the species he looked at. A major conclusion from this work is that perhaps many of the montane tree species in Nigeria have gone through a bottleneck during the Pleistocene ice age which may explain the extremely low diversity. We now have two new PhD students starting to investigate details of specific Red Data Listed species, including ecology to identify any negative effects of inbreeding.

Forest restoration

We have a major forest restoration initiative which involves simply fencing off areas of grassland adjacent to the forest, keeping cattle out and preventing fire. Additionally in some areas we have been actively planting tree seedlings grown in the nursery. Over 2000 tree seedlings have been planted to date and we have records of which have survived, which are the most useful species to plant into grassland, and how best to treat the seed to ensure rapid germination.

We have a research initiative into how to accelerate and improve restoration. An ongoing research-assistant maintained project involves an experiment with four different management treatments of the grassland; perches, burning, grubbing and seeding. These treatments are applied on an annual basis and the grassland is thereafter surveyed for seedlings.

One hundred and fifty seed traps are inspected every week. All seeds are identified to determine seed rain into fenced off areas (Barnes and Chapman 2014).

Babale Alyu and coworkers have investigated the role of scatter hoarding rodents in the dispersal of forest tree seeds and the role of these secondary dispersers in forest regeneration. We are particularly interested in large seeded species which have likely lost their frugiferous, primary dispersers. Results clearly show the African pouched rats are the most important rodents in this role. This work is being taken farther by Biplang Yadock who is including work into the ecology of the pouched rat.

Weather station

Our automated weather station is now being maintained by engineers from the Nigerian Meteorological Institute (NIMET). This successful collaboration began with a visit by engineer Olatokunbo Okulaja and meteorologist Philip Saleh to Ngel Nyaki this December.

Olatokunbo Okulaja will ensure the data are successfully analysed and following this they will be used in Nigerian TV weather forecasts. Of course the data will also be freely available to NMFP researchers, farmers and anyone else who requests them. In order to ensure that this is as useful an initiative as possible, we are looking into buying additional soil temperature probes and upgrading the software to be more user friendly.

International collaborations

Field assistants from the Nigerian Montane Forest Project setting up seeed traps for Lachland Charles. Ngel Nyaki has been selected as one of three tropical research sites for this study.

Lachlan Charles

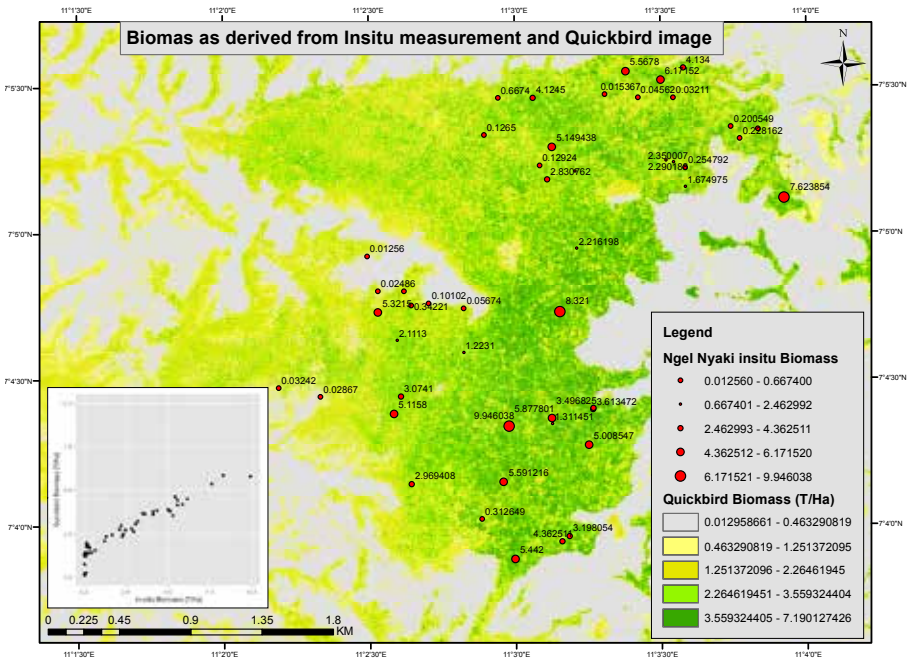
PhD candidate, Mayfield lab, University of Queensland

Lachlan is investigating how characteristics such as fruiting morphology, canopy cover and the height of remnant trees influence avian seed rain patterns in tropical grasslands adjacent to forests. From the literature it seems that characteristics affecting bird visitation vary among tropical regions. In this study Ngel Nyaki is one of four tropical sites, the other three being in Australia, Colombia and Costa Rica/Panama.

Dr Tomasz Stepkowski

Polish Academy of Sciences Poland

Tomasz is scientist investigating the phylogeography of root nodule bacteria in tropical forests, particularly the genus *Bradyrhizobium*. Samples taken from Ngel Nyaki will add to samples collected from tropical Australia and South Africa.



Ralph Adewoye

PhD candidate with Dr Christian Huttich and Prof Christiane Schmullus, Department of Earth Observation at the Friedrich Schiller University, Jena Germany

Ralph is using remote sensing to map the forest biomass of Ngel Nyaki and Gangirwal and to record changes in forest cover since the 1970s.

Ralph and Hammasumo about to depart on thier Gashaka Gumpti trip.

Botanical training

In February and March Hammasumo, our herbarium assistant and Ralph Adewoye joined Lee Davies and Felix Merklinger from RBG Kew, GGPP staff, and scientists from Chester Zoo on a three week collaborative project in Gashaka Gumti National Park. Hammasumo received training in botanical collecting, preserving, and identification during a survey of the flora within the Park. They hiked from Kwano to the top of Gangirwal, the highest mountain in NIgeria at 2400 metres, making collections along the way of plant species.

Lee Davis demonstrating plant collecting techniques.

Outputs

Refereed Papers

- Dutton, P. and Chapman, H. (2014), Dietary preferences of a submontane population of the rare Nigerian-Cameroon chimpanzee (*Pan troglodytes ellioti*) in Ngel Nyaki Forest Reserve, Nigeria. Am. J. Primatol.. doi: 10.1002/ajp.22313
- Dutton, P.E., Chapman, H.M. and Moltchanova E. (2014) Secondary Removal of Seeds Dispersed by Chimpanzees in a Nigerian Montane Forest. African Journal of Ecology 52(4): 438-447
- Aliyu, B., Adamu, H., Moltchanova, E., Forget, P.M. and Chapman, H.M. (2014) The interplay of habitat and seed type on scatterhoarding behaviour in a fragmented Afromontane forest landscape. Biotropica 46(3): 264-267
- Barnes, A.D. and Chapman, H.M. (2014) Dispersal traits determine passive restoration trajectory of a Nigerian montane forest. Acta Oecologia 56: 32-40.
- Barnes, A.D., Emberson, R.M., Chapman, H.M., Frank, T., Krell, K.T. and Didham, R.K. (2014) Matrix habitat restoration alters dung beetle species responses across tropical forest edges. Biological Conservation 170: 28-37.
- Osinubi, S.T., Vugeh, Y., Briskie, J.V., Ottosson, U., Brown, J.A. and Chapman, H.M. (2014) Association with riparian fragments by Yellow-breasted Boubou *Laniarius atroflavus* indicates need for wider-scale forest matrix conservation. Malimbus 36(1): 47-57.
- Nsor A.C., Nicodemus E. and U. Bashiru (2014) First record of Bamenda Apalis *Apalis bamendae* for Nigeria. Bulletin of African Bird Club 21(1) 85-86
- Dutton, P.A. and Chapman, H.M. (2014) New tools suggest local variation in tool use by a montane community of the rare Nigeria–Cameroon chimpanzee, *Pan troglodytes ellioti*, in Nigeria. Primates (early access online) http://dx.doi.org/10.1007/s10329-014-0451-1. (Journal Articles)

Under revision

- Grassham, A.M.; Kunz, B.; and Chapman, H.M. Dispersal of forest seed into grassland matrix by the tantalus monkey in a Nigerian montane forest: implications for forest restoration. Journal of Tropical Ecology. (Submitted African Primates).
- Dutton, P. and Chapman, H. , Molanchova, E. Nesting ecology of the Nigerian /Cameroon chimpanzee, *Pan troglogytes eliotti* in the small montane population of Ngel Nyaki forest reserve, Nigeria. (Submitted American Journal of Primatology).
- Knight, A.; Hale, M. & Chapman, H. M. (2014) Sex biased dispersal in the Nigeria-Cameroon chimpanzee (*Pan troglodytes ellioti*). PLOS ONE (Under revision after reviewers comments)
- Knight, A.; Hale, M. & Chapman, H. M. (2014) Habitat fragmentation and implications for chimpanzee conservation. (Resubmitted to Oryx after reviewers comments)
- Thia, J., Hale, M., Stouffer, D. B., & Chapman, H. M. Historical palaeoclimatic fragmentation may explain the apparent absence of genetic diversity in contemporary populations of Afromontane tree species. (Written and about to be submitted to Molecular Biology).

Conference Presentations

- Aliyu, B., Adamu, H., Moltchanova, E., Forget, P.M. and Chapman, H.M Incorporating seed fate into the conservation management of Afromontane forests. ATBC 2014 Cairns 20–24th July
- Hutchinson, K. Why the white nose? Sexual signalling in the putty-nose monkey. Annual Biology Conference UC Conference, October 23rd 2014
- Nsor, C., A small sunbird-tree visitation network suggests rare species contribute more to nestedness. Annual Biology Conference UC Conference, October 23rd 2014
- Nsor, C., Interaction strength and relative contribution of sunbird species to the structure of a sunbird/tree pollination web in a West African montane forest. AETFAT (The Association for the Taxonomic study of the Flora of Tropical Africa). Stellenbosch, Cape Town SA 13–17th January 2014.
- Godson, G. Taraba State University Biology Department: How the Pouched Rat disperses seed in Ngel Nyaki Forest. IT talk.

Much of the data analysis in the outputs from the NMFP has been carried out by Dr Elena Moltchanova of the Mathematics and Statistics Department at UC. Elena advises and supports students in the analysis and interpretation of their data. Her expertise in Bayesian statistics has allowed us to analyse complex data sets using sophisticated statistical models.

Industrial Training students

This year the NMFP hosted seven IT students, five from Taraba State University and two from Gombe State University

The students are third year undergraduates who spend six months at the field station (GSU: April–September; TSU: May–October)

The students work alongside researchers and field assistants. They also begin their own research project while at Ngel Nyaki and will complete it the following year. This will involve several more visits to the field station and often NMFP field assistants are involved throughout the duration of the project.

This year projects include:

Aliyu Usman - TSU Geography Department: reproductive ecology of *Psychotria* species in a Nigerian Montane Forest

Amai Adi Joru - TSU Biology Department (zoology): Plant- ant interactions in *Canthium subcordatum* (Rubiaceae) in Ngel Nyaki Forest Reserve.

Huzaifa Hammanjoda Yero - TSU Biology Department (botany): Tree phenology; *Anthanotha noldeae* and *Newtonia buchannani*

Wasila Mohammed Tukur- TSU Biology Department (botany): Growth rate and survival of tree seedlings planted into the grassland around Ngel Nyaki forest.

Lawrence Umar- TSU Geography Department: Dispersal syndromes in a Nigerian Montane Forest.

Simon Douglas Dogo - GSU , Biology Department (botany): A morphometric study on species of pteridophytes in Ngel-Nyaki forest

Abdullahi Mumin Aliyu - GSU , Biology Department (botany): Taxonomic studies of some species of Myrtaceae in Ngel Nyaki Forest Reserve.

Taraba State University Students: Aliyu Usman, Amai Adi Joro, Huzaifa Hammanjoda Yero, Wasila Muhammed Tukur, Lawrence Umar

Gombe State University students: Simon Douglas Dogo and Abdullahi Mumin Aliyu

T.Y. Danjuma scholars

Thanks to the generous support of TY Danjuma the Project has been able to award two PhD scholarships for Nigerian students to conduct research at Ngel Nyaki. The scholarships cover university fees, travel to New Zealand and a stipend for living expenses.

It is with great pleasure that we can announce the first TY Danjuma Scholars who describe themselves as follows:

Jennifer Arubemi Agaldo.

My first degree was in Botany, after which I did a Masters in Conservation Biology, both at the University of Jos Nigeria.

I hope to become a well-trained ecologist and conservationist and use my knowledge, skills and training to contribute to these fields through study, research and teaching. Given the opportunity, I also hope to contribute to influence environmental policies in favour of prudent and sustainable use of environmental resources in Nigeria.

My PhD research focuses on plant-ant interaction in relation to seed fate and the role it plays in regeneration and restoration in grassland around the Ngel Nyaki Forest Reserve, Nigeria.

Yadok Biplang Godwill

I am a conservation biologist interested in behavioural ecology. I work with the Nigerian Montane Forest Project (NMFP) in Taraba State as the Science Coordinator and also as a Research Associate with A.P. Leventis Ornithological Research Institute (APLORI), Jos. I studied Conservation Biology (MSc) and Zoology (BSc) at the University of Jos. I have had some experience working on projects centered on insects, plants and birds. At the moment I am working on a project that seeks to explore the efficiency of the African Pouched Rat (*Cricetomys* sp. nov) in secondary seed dispersal in Ngel Nyaki forest. The project will involve a series of experiments in the field which will focus on large seeded species. Dispersal of such species were formerly associated only with primates and other large mammals but scientific studies in tropical areas are now investigating the roles of rodents. I am poised to use innovative equipment (e.g. telemetric radio transmitters) and computer programs (R, QGIS, Winbugs and SECR) to produce highly reliable and interesting scientific results.

I plan to use my PhD experience to promote both conservation management and the need for protection of ecosystem services in Nigeria.

Community contributions

This year the NMFP worked with the nursery school to complete the tasks included in the 2013 TY Danjuma Taraba Community Fund grant. This years allocation included the purchase of chairs and playground equipment.

In addition, the NMFP sends its postgraduate and undergraduate IT students (the latter are at the field station for six month periods) to teach at the nursery school on a weekly basis. This has proved very valuable (See 2013 NMFP Annual Report).

The NMFP is actively working with the local bee keepers to access funds to send them on a training workshop, the Tasso Leventis research farms may offer an opportunity for this. In addition, the beekeepers will be helped (through John Adeleke- NMFP Board Member) to sell their honey in Lagos through Shoptite. Shoprite will help to bottle and label the honey. There is much enthusiasm for this initiative, and the NMFP is committed to help the bee keepers.

The NMFP Conservation Club is stronger than ever and makes regular visits to the field station. We are currently fund-raising to provide musical instruments for a Conservation Club band. This will instil a sense of pride in belonging to the club. The 10 schools have up to 100 members each, so there is plenty of fund-raising to be done.

Nursery school children enjoying the new chairs.

Discussions with the bee keepers over about training and a business venture.

Biplang showing Yelwa school children, members of the NMFP Conservation Club, how to use a spotting-scope.

Students

Babale Aliyu has successfully defended his PhD thesis on the dispersal mutualism between small mammals and large seeds.

Completed theses in 2014

PhD

- Babale Aliyu - The interplay of habitat and seed size on the shift in species composition in a fragmented Afromontane forest landscape: Implications for the management of forest restoration.

MSc

- Sasha Roselli- The Role of Seed Dispersal, Seed Predation and Drought in the Restoration of Ngel Nyaki Forest, Nigeria. A+ Thesis
- Josh Thia – The Plight of Trees in Disturbed Forest: Conservation of Montane Trees, Nigeria A+ Thesis
- Alex Knight - The Genetic Structure and Dispersal Patterns of the Nigeria-Cameroon Chimpanzee (*Pan troglodytes ellioti*) A+ thesis.

The interplay of habitat and seed size on dispersal

Babale Aliyu

The Cameroon Highlands that run along the Cameroon-Nigeria border are an important source of biodiversity. They are species rich with many endemics, but biota from West Africa have not been studied as extensively relative to other parts of the Afrotropics, or the tropics in general. Threatening these rare and diverse habitats is anthropogenic pressure, which fragments forests and changes local animal communities. This study investigated the impact of humans on seed dispersal and recruitment processes on selected tree species in forests on the Mambilla Plateau—a montane region in Nigeria's south-east. Research was conducted at Ngel Nyaki Forest Reserve, a conservation area established by the Nigerian Montane Forest Project. The reserve comprises a moderately-large forest patch (Ngel Nyaki Forest) and many small riparian fragments embedded in a grassland matrix. Cattle grazing and burning of this grassland are major threats to the survival of forest in this area. Hunting of local wildlife for bushmeat is also of concern, considering many of the region's large-mammalian fauna are now locally extirpated (e.g. elephants) or at low abundances (many primate species). Loss of large-bodied frugivorous species has the potential to negatively impact the recruitment of large-seeded tree species that solely rely on them as seed dispersers. In this study, the ability for scatter-hoarding rodents to act as surrogate dispersers for large-seeded species is tested. While much research has been carried out on secondary rodent dispersal in the Neotropics, work in the Afrotropics is still in its infancy. Because the outcome of plant-rodent interactions (i.e. predated or dispersed) may vary with season, habitat, or traits of the seed species in question, a number of experiments were conducted to quantify how local rodents at Ngel Nyaki may or may not be acting as effective dispersers. Additionally, the benefits of rodent dispersal were examined by creating an experiment that simulated secondary dispersal on seedling recruitment. The results of this study demonstrated that rodents can act as effective dispersers in Afromontane forests, but this is influenced by habitat, seasonal abundance of resources, and palatability of seed species. Furthermore, it was demonstrated that burial of seeds by rodents can increase the establishment probability of a seed by protecting it from removal by other rodents. However, while rodents play a strong role in seed survival, it was also demonstrated that seedling mortality factors (such as herbivory) can also be heavy filters to seedling success. It is hoped that the results of this study will help to inform better management decisions and improve understanding of how the composition of the forest might change in the future.

Field assistant Idriss with Sasha Roselli.

Factors affecting restoration of Ngel Nyaki forest

Sasha Roselli

The restoration of degraded landscapes has become one of our most valuable tools for conservation, however there are many factors which can restrict natural regeneration and impede active restoration attempts. The purpose of this study was to investigate three key processes which commonly limit the establishment of forest tree species into abandoned pasture in tropical forests: i) dispersal limitation, ii) seed predation, and iii) competition from the grass sward.

Seed dispersal

I identified 59 species of birds that were using the grassland habitat. Through 216 hours of focal tree observations I established that isolated trees in the grassland that had larger canopies, and those that were providing a food source (i.e. flowers or fruit) had significantly higher bird visitation rates and average stay lengths. I found evidence of the "perch effect" as patches of remnant trees encouraged more birds into areas of grassland, and the density of seedlings under tree canopies was significantly positively correlated with bird visitations. 95% of the seedlings found beneath tree canopies in grassland were of a different species to that of the tree canopy above them, demonstrating the dispersal of seeds from elsewhere into these microhabitats. 98% of these seedlings are grassland or forest edge species showing forest core species are still dispersal or microsite limited despite the effect of these trees.

Seed predation

Removal rates of seeds from experimentally laid out seed piles varied among seed species, the habitat the pile was in, and the predator guild able to access the piles. Preliminary results indicate that these trends are driven by the ecology of the seed predator. Removal of seeds by vertebrates was highest in the core forest, while ant predation was constant across all habitats. Vertebrates removed the larger seeds (*Entandrophragma angolense* and *Sterculia tragacantha*) while ants preferred the smaller *Celtis gomphophylla* and *Croton macrostachyus*. Overall predation rates in grassland were lower than those in the forest, and the presence of remnant trees did not influence predation rates, a positive sign for regeneration and the survival of seeds dispersed into these areas.

Competition from the grass sward

While the grass sward provides shade for seedlings of forest tree species it is also a harsh environment for them, as the grass competes with seedlings for water. Removing the grass and covering planted seedlings with artificial shading structures significantly increased both the survival and growth of these seedlings.

Recommendations

From this study I was able to make recommendations for a low input restoration program at Ngel Nyaki. Planting seedlings in small islands takes advantage of the natural increase in dispersal of seeds under isolated trees, while low seed predation rates increase the chance of survival of these seeds through to germination. Planting these seedlings under shade will lead to increases both their growth rates and their survival. Once the secondary forest develops, under-planting seedlings of core forest trees will introduce them to the system, as the natural establishment of these seeds appears to be limited in the current environment. This study has also served to remind us how little we know about this particular forest-grassland system, and has led to the development of ideas for further investigations into several more aspects of regeneration.

Josh Thia graduated with an MSc (first class honours), together with two of his supervisors, Assoc Prof Hazel Chapman and Dr Daniel Stouffer, missing is Dr Marie Hale.

Rare Afromontane tree conservation

Josh Thia

The overall aim of this work was to address issues that are relevant to the conservation of Afromontane forests, with a particular focus on those in West Africa. Three focal tree species were chosen for this study based on: (i) their abundance and distribution in the study area, (ii) their global conservation status, and (iii) ecology: *Cordia millenii, Entandrophragma angolense* and *Lovoa trichilioides*). The bulk of research focused on Ngel Nyaki Forest, and other locales in the greater region near Yelwa Village, which is situated on the Mambilla Plateau, south-eastern Nigeria. The Mambilla Plateau constitutes a belt of montane habitats that run along the Cameroon Highlands that collectively—with other African highland regions—forms what is known as the "Afromonante Archipelago": an analogy for Africa's island-like montane areas that share a surprising similarity in floral composition despite their apparent disconnect.

Afromontane forests may have acted as stable refugia during episodes of historical climatic instability. Those of the Cameroon Highlands require urgent protection because they are rich in biodiversity and endemic species but have very little coverage in terms of conservation area. The growing anthropogenic pressure and general lack of understanding of the biodiversity and ecology of species in West Africa, relative to other parts of the Afrotropics, demands a greater effort from conservation biologists to understand what taxa there are to protect and how to protect them.

The montane forests of Africa have experienced a history of expansion and contraction in response to changing climate, such that isolation and fragmentation may be an integral part of their history. Population genetic theory states that fragmentation of forest will result in loss of genetic diversity due to drift, yet the 'Paradox of Forest Fragmentation' posits that some tree species may respond more positively to fragmentation, such that their ecology may buffer them from the negative effects of reduced genetic variation. Studies that investigate population genetic patterns in multiple co-occurring tree species are rare.

Genetic diversity patterns of tree populations in Ngel Nyaki Forest and on the Mambilla Plateau

Fragmentation and anthropogenic disturbance threaten the future of forests across Africa by reducing the size of forested habitat and disrupting ecological communities. Decreases in population size are predicted to correspond to genetic diversity declines, which are expected to bode poorly for a population's evolutionary future. Yet the scientific literature regarding the genetic consequences of fragmentation in tree populations demonstrates that the ecological traits of trees can lead to very divergent responses amongst species. Further still, forests in montane Africa are expected to have a history of palaeoclimatic fragmentation, which complicates the effects of contemporary versus ancient fragmentation events on current population genetic processes. This study assessed genetic variation within and among three different montane tree species (*Cordia millenii, Entandrophragma angolense, Lovoa trichilioides*) found on the Mambilla Plateau, Nigeria. Conserved chloroplast SSR primers were used to provide directly comparable estimates of genetic variance of these three species that co-occur in Ngel Nyaki Forest. Additionally, wider sampling of *C. millenii* was conducted to assess how chloroplast variance might be dispersed between forests on Mambilla. Results demonstrated incredibly low diversity for all three species within Ngel Nyaki, and for *C. millenii* on Mambilla. This suggests that tree populations on the Mambilla Plateau may generally be highly depauperate of chloroplast diversity, which could be a product of historical bottlenecks caused by palaeoclimatic range shifts characteristic of Afromontane forest. Conservation efforts thus need to understand where diversity is partitioned across the landscape and how populations are connected via gene dispersal to mitigate

A site within the Reserve where cattle are corralled for the night. Cattle grazing threatens the forest's regeneration.

potential impacts caused by anthropogenic disturbance.

Phylogenetic relationships of West African *Cordia* species

Montane areas have been demonstrated to serve as refuges during palaeoclimatic change and as centres for adaptive radiation and species diversity. Genetic tools can help illuminate the amount of diversity harboured in different montane populations by aiding in the identification of distinct evolutionary lineages. Such lineages may be considered as discrete taxa, or in the very least, considered as separate management units. In this study, the taxonomic classification of Ngel Nyaki's resident *Cordia* species was inspected. While previously described as *C. millenii*, morphological observations (not in this study) hinted at the potential distinctness of this population on Mambilla. Additionally, I address broader questions regarding the evolution of the *Cordia* genus with respect to West African taxa. To do so, a combination of cpSSR analysis and phylogenetic analyses (using ITS1, trnH–psbA, and trnL–trnF sequences) was used. The data suggest that trees identified as *Cordia millenii* on Mambilla are not a unique taxa or evolutionary lineage (based on chloroplast data). The prior hypothesis that all African *Cordia* species belong to a single monophyletic group (the Myxa clade, sensu Gottschling *et al.* 2005) was supported by this study. This work also demonstrates that chloroplast intergenic regions are useful for categorizing *Cordia* into the four general evolutionary lineages in phylogenetic analyses, as outlined by Gottschling *et al.* (2005), which could prove highly beneficial if the preferred ITS1 sequence is unable to be amplified in difficult samples (though they provide less taxonomic resolution than ITS1).

Regeneration of montane forest trees

Successful recruitment of tree populations in disturbed forest can be constrained when anthropogenic activity impacts important biotic and abiotic factors necessary for the establishment of seeds to adult trees. Ngel Nyaki Forest is an example where fire, defaunation (via hunting), and cattle grazing threatens the forest's regeneration. Initially, three tree species (*Cordia millenii, Entandrophragma angolense, Lovoa trichilioides*) were selected to undergo a juvenile population survey to assess how different tree species might be recruiting within Ngel Nyaki Forest. *C. millenii* was identified as doing incredibly poorly, so a number of experiments were conducted to understand aspects of *C. millenii*'s regeneration ecology at Ngel Nyaki. Seed dispersal assessments demonstrated that if unaided by vertebrate dispersers, *C. millenii* seed fails to disperse far from the crown edge (with a high density of seed directly under the crown). Furthermore, removal of *C. millenii* seed by ground-dwelling vertebrates is very low, suggesting a general absence of secondary dispersal for this species. Finally, transplant and exclusion experiments were used to test the importance of habitat, conspecifics, and vertebrate and invertebrate herbivory as factors that impact *C. millenii* seedling survival. Only habitat proved to be significant: seedlings growing in forested habitat had dramatically lower survival rates than those in grassland, which was attributed to lack of sunlight. Taken together, results suggest that large-seeded, primate-dispersed species like *C. millenii* are likely to exhibit constrained recruitment if local primate populations (particularly chimpanzees) are extirpated due to their specific dispersal agent requirements. Regarding reforestation efforts at Ngel Nyaki, the balance between adequate sunlight and cover to prevent desiccation of *C. millenii* seedlings could be provided by isolated trees in grassland. Isolated trees could be used as nursery sites to establish small groves of trees attractive to frugivores (e.g. *C. millenii*), which could aid greater connection of fragments and movement of seeds by encouraging frugivores to move into the grassland. In the long-term, this may facilitate fragment coalescence and increase the forest cover at Ngel Nyaki Forest Reserve.

Alex Knight collecting chimpanzee faeces for population genetic analysis.

Genetics and and Dispersal of the Nigeria-Cameroon Chimpanzee

Alex Knight

The level of genetic differentiation between the community of chimpanzees in Ngel Nyaki Forest Reserve and the three regions analysed in Gashaka Gumti National Park (GGNP) was similar to the level of genetic differentiation among locations within the national park alone. All pairwise FST values were significant which suggests these regions and Ngel Nyaki may potentially contain distinct communities of chimpanzees. While the FST values on their own are not sufficient to imply Ngel Nyaki Forest Reserve is isolated from GGNP when the assignment tests are considered as well there is more evidence for this. The assignment tests show a modest tendency for samples collected in Ngel Nyaki forest reserve to generally have higher log likelihood values for Ngel Nyaki than that of GGNP and vice versa. This pattern is not apparent between pairwise comparisons of log likelihood values for the regions within GGNP. For this pattern to occur Ngel Nyaki Forest Reserve may have only recently become isolated from GGNP.

A combination of the paving of the road running between Ngel Nyaki forest reserve and GGNP sometime since the 1970s and a steep increase in human population pressure since then (Tukur et al. 2005) are a credible cause for this isolation to have occurred. The road is the only paved road on the whole of the Mambilla Plateau and connects to the border with Cameroon. Regular traffic passes along the road in the daytime and human settlements are more common in the vicinity of the road than further away. Arable and cattle farming are both pervasive in the region between Ngel Nyaki Forest Reserve and GGNP. These facts and the timorous behaviour of chimpanzees in the region in response to human activity witnessed during this study and reported by local residents discourage the notion that a chimpanzee might endeavour to navigate this landscape.

This thesis is currently under review for Oryx and PLOS ONE.

Charles Nsor holding a willow warbler caught in his mist net.

Current Students

PhD

- Charles Nsor - Pollinating webs
- Denise Arroyo Lambaer - Frog diversity
- Auwal Abdullahi - Modelling seed choice in scatterhoarding rodents.
- Jennifer Agaldo - ***T.Y. Danjuma Scholar***

MSc

- Kelly Hutchinson - Putty nose monkey and sexual signalling

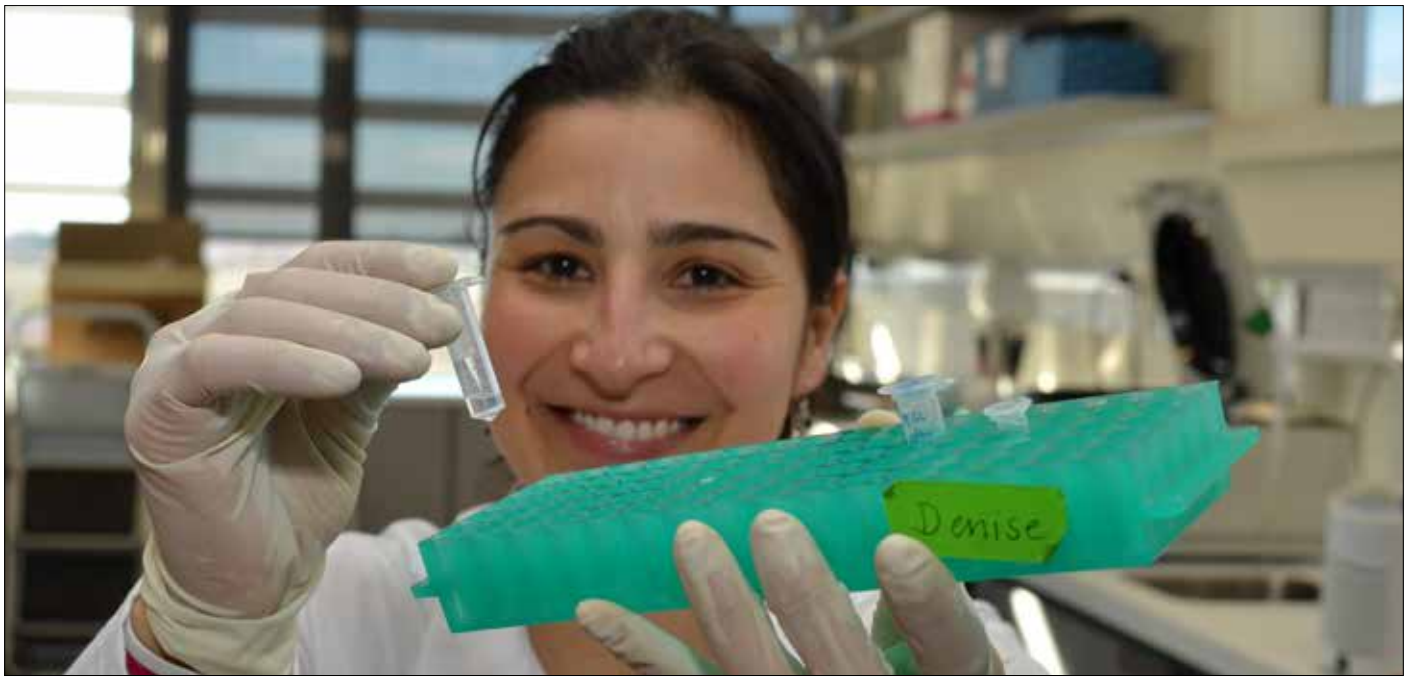
New PhD's (arriving 2015)

- Iveren Abiem - Filters to seedling establishment
- Biplang Yadock - Scatterhoarding as relates to seed dispersal in an Afromontane system - ***T.Y. Danjuma Scholar***

A sunbird-tree pollination network

Charles Nsor

The interactions between species have been described using various properties of network. Nestedness and connectance (the most common network properties) have been suggested to be the main determinants of species survival and network persistence. Here we investigated the relationship between connectance and nestedness, and how they contribute to network stability and species survival. A null model was used to determine the dynamic contribution of species to nestedness. We hypothesized that abundant species will contribute more to nestedness than rare species. Using rarity as a surrogate for survival we investigate the hypothesis that strong contributors to nestedness were the most vulnerable to extinction. Our results revealed a negative correlation between species contribution to nestedness and connectance. A total of 51 links out of 98 possible links were realized accounting for a network connectance of 0.52. Abundant species were significantly more connected than rare species. The most connected species of sunbirds were Variable sunbird (*Cinnyris venustrus*) and Northern-double collared sunbird (*Cinnyris reichenowi*), each interacting with 87% of tree species in the network. The strongest contributor to nestedness was *C. cupreus*, while the weakest contributor was *C. reichenowi*. Paradoxically, these were the least connected and most connected species respectively. Connectance reflected species rarity; contribution to nestedness did not in this study. This implies that species survival "a surrogate" for rarity is more overtly predicted by a species level of connectance than nestedness. Contribution to nestedness differed significantly between rare and abundant species; with rare species (fewer partners) contributing more to nestedness than abundant species with multiple partners. Our results provide an overt reason why strong contributors to nestedness are the most vulnerable to extinction.



Denise Arroyo Lambaer extracts DNA from amphibian species for genetic characterisation

Population genetics of montane forest frogs

Denise Arroyo Lambaer

Little is known about the amphibian species inhabiting the montane forest on the Mambilla Plateau, Nigeria, where anthropogenic activities such as farming and cattle raising are a major threat to native biodiversity. It is urgent to establish conservation priorities for this group, yet essential information necessary for this is missing; no data on the genetic structure of any amphibian species in this part of Africa exists. In this chapter, the use of Amplified Fragment Length Polymorphisms (AFLP) to genetically characterise four poorly known frog species (*Cardioglossa schioetzi, Leptodactilodon bicolor, Astylosternus* sp.1 and *Astylosternus* sp.2) inhabiting the Ngel Nyaki Forest Reserve and surrounds was assessed. Two AFLP primer combinations yielded 1052 fragments out of which 1001 were polymorphic. The maximum number of scored polymorphic peaks was 176, recorded for *Astylosternus* sp1. The average genotyping error rate per locus was 0.148% for the two preferred primer pairs. The Polymorphic Information Content or 'informativeness' of the markers ranged between 0.21 and 0.28 and demonstrated their use for future population genetic studies. Results of this study have showed that AFLP is a valuable tool when no prior molecular/genetic information of species is available. Moreover, the two markers used have proved to be informative enough to be used in for further analysis at a population genetic level for the four target species.

Kelly Hutchinson is investigating hand-waving behaviours of putty-nose monkeys.

Food preferences and behaviour of putty-nose monkey

Kelly Hutchinson

In the last 12 months we have continued work into the role of hand-waving behaviour in sexual signalling in putty-nosed monkeys (*Cercopithecus nictitans*), and have begun investigating their feeding ecology and movement patterns. To achieve this we have undertaken a number of measures. Firstly, we have produced an ethogram cataloguing both the behaviours we have observed and potential behaviours determined from the literature, facilitating consistent recording of data between researchers. We have identified two key troops to be the focus of our research efforts and have continued with the habituation of these troops. On these troops we have performed regular instantaneous scan samples, recording all observed behaviours and food items. In addition to this we have performed focal scans on any monkeys engaged in dyadic interactions, timing these and noting direction. These will be used in investigating aggression and grooming interchange within the troop and whether the nature of this changes in the breeding system. In particular its relation to waving behaviour and solicitation of copulations. To investigate movement patterns and the influences on these we have been using GPS to map the movement of troops. The GPS data is being used to determine the home range of the troops via kernel density analysis in R and ArcGIS. In addition hand drawn maps are used to note the location of any calling behaviour of other unobserved primate species and anthropogenic features in the landscape. Preliminary analysis indicated that the troops were moving to utilise *Ficus* sp. therefore we have recorded the location and characteristics of all *Ficus* trees within the tentative home ranges. We are currently working on determining the species of these trees and have begun fortnightly phenology recordings. These will be used to investigate if the troops are moving in relation to these resources. Finally, we have planned a series of transects through the home range and surrounding area for the dry season. This will be used to determine if the make-up of species in the forest utilised in by the troops is different than that of the forest not utilised by them. We aim to use the data on preference, use and availability to produce a model of putty-nosed movements within our forest.

The field station site in 2014.

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