

School of Biological Sciences
College of Science

Nigerian Montane Forest Project

Annual Report



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Introduction



Cover image: Ali A. Buba talking to TSU student Peter Dominic about the herbal properties of local plants.

We would like to thank everyone who has supported the NMFP in so many different ways over the past year. Your support is as always, hugely appreciated.

2013 has been an eventful and productive year for the NMFP. Of note is that our new Advisory Board (see page 8) has started to meet and the combined wealth of experience, commitment and enthusiasm from the new members is having a real impact on the Project. For example, plans are underway for more staff training, new initiatives are beginning to further support the local community and we are becoming more aligned with Aplori, the A.P. Leventis Ornithological Institute near Jos.

Collaborations between UC, LU and the Federal University of Kashere are developing. The VC of FUK, Professor Mohammed Kabir Farouk and his Dean of Agriculture, Prof. Ahmed Abdu Manga visited both New Zealand universities during April. The visit, sponsored by our Patron Tasso Leventis, was a great success; the nexus of the relationship is the NMFP, whereby early career staff from FUK will do their postgraduate research in ecology/conservation or agriculture under the supervision of academics from UC and LU respectively. This visit was reciprocated in August; Professors Stephen Goldson and Bruce McKenzie (Dean of Science) from LU and myself (UC) visited FUK to further discuss collaborations. We also spent time at the NMFP research site so that McKenzie and Goldson could more fully assess the potential for improved forages as an aid towards forest conservation (see page 28).

In June I was able to meet with Professor Volker Sommer (Director GGPP) in Cambridge. Although Volker is our neighbor in Taraba State we are rarely 'in State' at the same time and so rarely meet in Nigeria. As always Volker was extremely helpful and supportive and I would like to take this opportunity to congratulate him on behalf of the NMFP on receiving the NEZS Gold Medal for dedication to conservation. He certainly deserves it.

Professor Pierre-Michel Forget from the Natural History Museum, Paris, his wife Christina and son Raphael visited UC for six weeks during July–August. P.M. Forget, who is a strong associate of the NMFP was visiting UC as an Erskine Fellow. The Fellowship allowed for some very productive collaboration between Forget, myself and students of the NMFP involved in seed dispersal ecology.

Matt Walters third visit to Ngel Nyaki has ensured our web based biodiversity inventory has taken off : www.biol.canterbury.ac.nz/nmf_project/biodiversity.shtml . This is a major achievement and is in collaboration with Pieter Pelsler (UC) and his PhytolImages website. This checklist is already a major contribution to what is known of the biodiversity of Nigerian Montane landscapes and we will continue to add to it.

For the last few months of this year we are very fortunate to have a science coordinator at Ngel Nyaki, Yadock Biplang Godwill. Biplang is ex Aplori and is inbetween graduating with an MSc . in conservation and starting a PhD. He is working with NMFP field assistants and IT students to ensure a more effective uptake of field data. This is highly significant and has the potential to greatly increase the scientific worth of the NMFP.

We would like to acknowledge our loss of Jenny Ladley (UC ecology technician) to her new role as Field Services Manager. Jenny has provided invaluable help on numerous occasions around the sourcing of ecological equipment for us to take out to Nigeria and we will miss her support and enthusiasm.

Two postgraduate students from UC from the NMFP have graduated this year: Paul Dutton PhD and Kristy Udy, MSc. (1st Class). Danladi Umar has submitted his PhD and is awaiting his oral examination.

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

Associate Professor Hazel Chapman
Director
Nigerian Montane Forest Project

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Acronyms

ABU	Ahamadu Bello University, Zaria
FRIN	Forest Research Institute, Nigeria
FUK	Federal University of Kashere, Nigeria
GGPP	Gashaka Gumti Primate Project
GSU	Gombe State University, Nigeria
UC	University of Canterbury, NZ
LU	Lincoln University, NZ
NEZS	North of England Zoological Society
NCF	Nigerian Conservation Foundation
NNP	Nigeria National Parks
TSU	Taraba State University, Nigeria
UniLag	University of Lagos

Nigerian Montane Forest Project

Mission Statement

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

Aims

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

Partners and Supervisors

Project Partners

- A.P. Leventis Ornithological Research Institute, Jos
- Federal University of Kashere
- Gashaka Gumti Primate Project
- Gombe State University
- Lincoln University, New Zealand
- Nigerian Conservation Foundation
- Nigerian National Parks
- Professor Pierre-Michel Forget, Natural History Museum, Paris, France
- Royal Botanic Gardens, Kew, Surrey, England
- Taraba State Government
- Taraba State University
- University of Canterbury, New Zealand
- University of Kansas Natural History Museum, Kansas, USA

Project Funders

- A. G. Leventis Foundation
- North of England Zoological Society (Chester Zoo)
- Gombe State University
- Nexen Inc. and Nexen Nigeria
- Taraba State Government



Academic Supervisors

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

News



Chionanthus mildbraedii from the family Oleaceae, photographed by Matt Walters for the biodiversity inventory.

Advisory Board

The new advisory board (Tasso Leventis-Patron, John Adeyemi Adeleke, Phil Hall (Chair), Roger Wilkinson, Hazel Chapman and Danladi Umar), have met twice so far this year. First on April 17 in Lagos and then on June 10 in London. The Board is extremely committed and working hard for the NMFP to improve conservation, research and community initiatives.

Visitors to the research station

Research Scientists

Nwaogu Chima MSc. Environmental consultant, Aplori Jos came to Ngel Nyaki to trap and sample the Hartlaub's Marsh Widowbird, *Euplectes hartlaubi*, which is known to be restricted in range to patchy areas around the Mambilla plateau in Nigeria – see page 25 for his report.

Dr Ayodeji Olayemi visited with a team of zoologists from Obafemi Awolowo University, to study the molecular taxonomy and role of small terrestrial mammals in Ngel Nyaki as possible carriers of arenavirus. Dr Olayemi was funded by the European Foundation Initiative for African Research into Neglected Tropical Diseases (EFINTD) – see page 26 for his report.

Matt Walters from the University of Canterbury, NZ. Matt trained field assistants in natural history photography and has instigated our online biodiversity inventory for Ngel Nyaki www.biol.canterbury.ac.nz/nmf_project/biodiversity.shtml. Matt has also written an online report of his visit in the form of a daily blog, www.project-report.info.

Professor Bako, ecologist, Ahmadu Bello University, Zaria, Nigeria/ Dean of Science, TSU visited Ngel Nyaki for preliminary investigations into botanical research and at the same time to develop collaborative links between TSU and NMFP.

Professors Bruce McKenzie & Stephen Goldson, Lincoln University, NZ, to instigate research into pasture agronomy on Mambilla in order to provide better forage for cattle, with the idea being that if cattle do well on forage provided in pasture, they will no longer need/want to enter the forest. This will be in collaboration with FUK. See page 28 for their report.

University field trips

- Professor Akinsoji, UniLag with 15 student members of the Ecology Group.
- Professor Ezra, GSU with 90 undergraduate biology students.
- Dr Elkano Sambo, TSU HOD Biology, with 57 biology undergraduate students.

NGO's

Mr Scott Wilson, Conservation Officer, Chester Zoo. Scott visited Ngel Nyaki as part of a longer visit to Gashaka Gumti National Park and the GGPP. This visit was very important to the NMFP as Chester Zoo is our major Partner in conservation research.



Scott Wilson in Gashaka Gumti National Park.



Visiting biology undergraduate students from Taraba State University.

Mr Naser Khan and Mr Om Parash Mukhum from the Tulsi Chanrai foundation came to Ngel Nyaki to discuss collaboration around community services such as borehole repair and clean water provision. This visit was reciprocated by Hazel Chapman visiting Naser Khan in Abuja to further develop linkages.

Ibrahim Inahoro from NCF came to meet with us to discuss closer collaboration around conservation of the Mambilla Plateau forests.

New collaborations/partners

- The National Parks Service represented by Alhaji Haruna Tanko Abubakar the Conservator-General National Park Service and the Montane Forest Conservation Initiative, represented by A/Prof. Hazel Chapman, signed an updated MOU to work towards the protection, understanding, research and management of Nigeria's montane forests.
- The Board of Trustees of the Royal Botanic Gardens, Kew represented by Dr Martin Cheek and the Montane Forest Conservation Initiative (known as the NMFP) represented by A/Prof. Hazel Chapman signed a Memorandum of Collaboration (MoC). Under this agreement the RBG Kew and NMFP will work together to collect, study and conserve plant material such as herbarium specimens and tissue samples

for science and to create and exchange associated data and images.

- The Federal University of Kashere, Nigeria represented by Professor Mohammed Kabir Farouk (VC) and UC represented by Professor Ian Town (DVC) signed an MoA with a section covering collaboration between FUK and the NMFP.
- An as yet informal collaboration between Lincoln University and the NMFP will allow for the use of the NMFP field station by LU for the training of postgraduate students in agricultural science .



Charles Nsor, Prof. Manga, Prof. Farouk, Assoc. Prof. Harding, Danladi Umr and Ralph Adewoye.



L to R: Mr Naser Khan, Mr Om Parash Mukhum Tulsi Chanrai foundation and UC student Josh Thia.

Research Grants

A number of students have been successful in gaining external research funding:

Josh Thia

- Chester Zoo £ 1000
- NZRS Canterbury Branch NZ \$1000
- Explorers Club US \$1500

Alex Knight

- Mohamed Bin Zaden US \$5000
- Primates Inc. US \$5000

Sasha Roselli

- NZ Institute of University Women NZ \$1000



Hammadu Adamu standing beside one of the fences between ungrazed and grazed grassland. The cattle outside the fence are within the reserve boundary.

Forest restoration

We have continued to fence-off areas around the forest reserve and are experimenting with active regeneration by planting seedlings from our tree nursery. To this end, Augustine Ntim is using his silvicultural training to good effect.

In the last reporting period Augustine had grown over 6000 seedlings of forest tree species in the nursery. Of these, 11 species (4726 individuals) have been planted (with help from the TSF patrollers and NMFP staff and students) into fenced off grassland bordering the forest:

<i>Polyscias fulva</i>	2000
<i>Santiria trimera</i>	800
<i>Carapa oreophylla</i>	550
<i>Sterculia setigera</i>	300
<i>Cordia millenii</i>	8
<i>Syzygium guiniense</i>	70
<i>Pouteria altissima</i>	350
<i>Isolona deightonii</i>	180
<i>Trilepisium madagascariense</i>	78
<i>Entada abyssinica</i>	80
HMC500 'Unknown'	300

In addition many cuttings of *Ficus* species have been 'planted' in order to fill in grassland.

Augustine measured the height of 75 representative transplants from across all species and intends to check their growth annually. On average the seedlings were 30 cm high when transplanted.

The conservation impacts of 5 years of such plantings is beginning to show. More birds are visiting the area, there is more vegetation cover and tree seedlings are naturally regenerating. We now observe duiker and bush buck from the field station balcony- hitherto a very rare event.

One 'problem' has been the increase in grass-cutter rats which eat the base of saplings.

A 2012 IT student, Prince Peter Umeh from TSU, under the supervision of Dr Umar and the NMFP, has completed his project aimed at understanding the effects of fencing off grassland on species composition. His report titled 'The speed of recovery of a grazed montane forest reserve at Ngel Nyaki, Taraba State' is available online.

This report documents the difference in species composition, increase in ground cover and height of vegetation in the grazed versus ungrazed grassland.

This dry season we shall establish permanent plots in the fenced off areas for long term quantitative monitoring of vegetative change. This will supplement our permanent photo points which have been established since 2005.

Staff Training

Field assistants continue to be trained and are developing new skills. The email link between Ngel Nyaki and UC is excellent—there is almost always access to Skype and email—which allows for remote training.

New skills added this year included:

- Plant photography**
 Matt Walters from UC trained Idriss Musa in natural history photography and Idriss is adding botanical images to Dropbox on a regular basis. These images are then identified and uploaded into PhytoImages.
- Dung beetle collection and curation**
 Idriss Musa and Hammadu Adamu were trained in dung beetle collection (remotely) by dung beetle expert Professor Frank Krell. This skill is not as simple as you may imagine ~ but collections are adding up.
- Herb and grass Identification**
 Mr Umar, from Ahmadu Bello University, Zaria, came to the NMFP on contract for two weeks and trained the field assistants in herb and grass identification. Mr Umar has written a report which is lodged in the NMFP herbarium.
- Accounting / book keeping**
 Misa has completed his course and is now training Usman Abubaker and Hamasumo Ibrahim.

Biodiversity studies

We are working with Dr Martin Cheek, Dr Xander der Burgt and Iain Darbyshire, of the Royal Botanic Gardens, Kew to have our collections of over 4000 herbarium specimens named.

To bring all plant species in this geographic area to the attention of the rest of the world, Matt Walters, in collaboration with Dr Pieter Pelsler, is leading a project to develop an online plant checklist. Using our internet facility we are able to share images between the field station and UC for identification. The project links named plant species/genera to photos taken at Ngel Nyaki. Already over 950 identified plant images are available free online at PhytolImages (phytoimages.siu.edu), a web based database of plant images. Field assistant Idriss Musa is dedicated to this task and is in regular contact with Matt.

Our growing checklist is available at: www.biol.canterbury.ac.nz/nmf_project/biodiversity.shtml.

A wider biodiversity checklist is in progress and includes birds, which are going to be linked to a bird equivalent of PhytolImages. Dragonflies, amphibians, fresh water invertebrates etc are also included. This checklist will be an ongoing project using field assistants, citizen science and our Facebook group: www.facebook.com/groups/4829132147.

Weather data

Our fully automated weather station from the Low Carbon High Growth grant from the British High Commission, Abuja, and logistic support from DHL is working well. The high tech weather station links with internet and the weather data is freely available on our web site, www.biol.canterbury.ac.nz/NMF_project. After a recent meeting with the Federal Forestry in Abuja it was agreed that the weather data be sent to the Ministry where it will be used in creating climate change maps for Nigeria. In addition there are plans underway to use the data on the Taraba State TV weather updates.

Taraba State University IT student Aminu Musa is working with Professor Bayobel from Modibbo Adama University of Technology, Yola to analyze the weather data recorded at the research station over the past five years.

Motor bikes

The Project has bought two motor bikes for commuting from the village to the field station. This is particularly helpful for visitors.



Over 950 images of identified plants have been uploaded to PhytolImages so far.



Clerodendrum cephalanthum (Lamiaceae). Researchers are now using the PhytolImages database to identify plants.



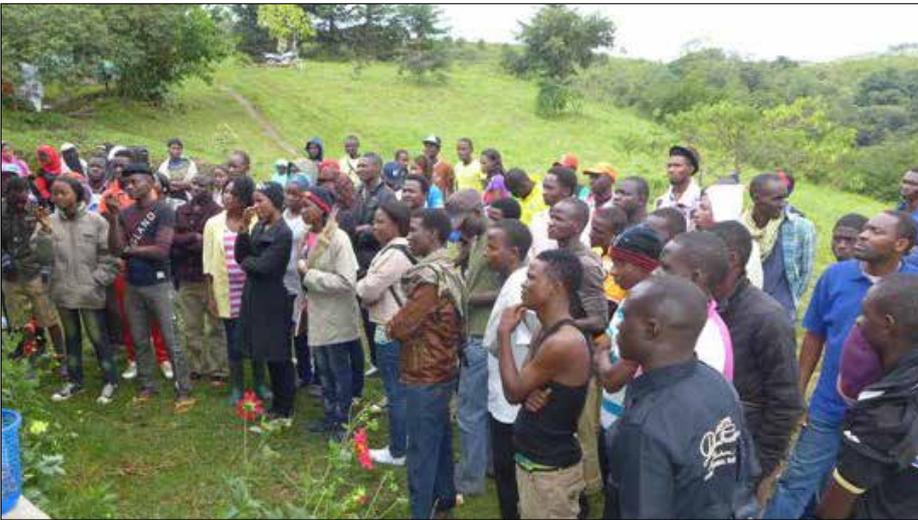
Aminu Musa, IT student from TSU, learning to collect weather data from Usman Abubaker.



Prof. Pierre-Michel Forget visited New Zealand as an Erskine Fellow.



Professors Stephen Goldson and Bruce McKenzie at the field station.



Gombe State University undergraduate students on a field trip to learn about montane forests.



Mr Umar teaching herb and grass taxonomy.



UniLag ecology group visited Ngel Nyaki.



Charles Nsor and Adamu Usman mist-netting sunbirds.



Augustine, Thomas, Matt, Sasha, Bobo, Usman with the dragonfly nets.

Industrial Training students



The 'Carapa Team' en route to check plots for seed removal in August. L to R: Hammadu, Elijah, Buhari, George and Thomas.

This year the NMFP hosted six IT students
 Buhari Abubakar (GSU zoology)
 Salim Ahmad Shinga (GSU zoology)
 George Godson Bangu (TSU- biology)
 Peter Dominic (TSU-botany)
 Aminu Muisa (TSU- geography)
 Pius Patrick (Jalingo College of Agriculture)
 The students are third year undergraduates
 who spend six months at the field station
 (April-September GSU); (May-October TSU)



Peter learning plant ID from Hammasumo.



George and Bruce McKenzie weigh *Carapa* seed.



Salim observing primates with Musa.



Bahari attaching string to *Carapa* seeds.



Pius tending to seedlings in the plant nursery.

Community Contributions



The local bee keepers.

Nursery School Teacher Training

This year the NMFP has obtained £7,700 for the nursery school the Project built for the village. The funding is from the TY Danjuma Taraba Community Fund and is being used to train five nursery school teachers as well as improve the school resources. The NMFP identified two excellent teachers from Gombe State University, Drs Adepoju and Danjuma. This relationship has proved invaluable. The five teachers, Ali Buba, Abubackar Hodi, Alisabeth Fedzir, Thomas Benjamin and Evaline Samuel, are learning new teaching techniques, education management. See poster on page 15.

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

Bee Keeping and Honey Sales

The NMFP is actively working with the local bee keepers to access funds to send them on a training workshop. It seems that the Australian High Commission Fund may be appropriate. In addition, the beekeepers will be helped (through John Adeleke- NMFP Board Member) to sell their honey in Lagos through Shoprite. Shoprite will help bottle and label the honey. There is much enthusiasm for this initiative, and the NMFP are committed to help.

Maternity Hospital Support

The NMFP is helping with the local Yelwa maternity hospital- Misa Zubairu, our Project co-ordinator and trained through the NMFP in bookkeeping and accounting, is managing MDG funds for the hospital. This happened because the MDG 'visitors' were so impressed with Misa's financial acumen.



TSW IT students talking about conservation to the nursery school pupils.

Report on the T. Y. Danjuma Taraba Community Fund (TSCF) Grant to the
Nigerian Montane Forest / ESSO MOBIL Nursery School
 in Yelwa village, Mambilla Plateau, Taraba State, Nigeria



April 2013

Dear TY Danjuma,

It is with great appreciation that the Nigerian Montane Forest Project thank you for the contribution you have made through the TSCF to our nursery school.

The TSCF are giving the nursery school 1.7M naira to train its five teachers and equip the school with basic materials for school work and for the playground. The first quarter was received in January and since then all five teachers have been trained extremely well by education academics from Gombe State University. Training was in teaching and record keeping.

This training has set the school to a different level, the children are now well taught with teachers who see a bright future for themselves as part of the school. Moreover the academics from Gombe State who taught the course were immensely impressed with the Yelwa teachers and at least one of them may go on to further training at Gombe State University.



Yelwa School Children.



Dr. Adepoju, in a workshop training with the five teachers.



Thomas receiving his certificate.



Ishaku from the Jalingo TY Danjuma Foundation supervising the training.



Dr Adepoju receiving his allowance from Misa Zubairu of the NMFP for the training of the five teachers.



School Plaque 2009



Ali A. Buba receiving his certificate from Dr Adepoju of Gombe State University Education Department.



From left to right the five teachers Ali Buba, Abubackar M Hodi, Elisabeth Fedzir, Thomas Benjamin and Evaline Samuel.

Nigerian Montane Forest Project

For more information contact Associate Professor Hazel Chapman, Nigerian Montane Forest Project, University of Canterbury, New Zealand, hazel.chapman@canterbury.ac.nz. www.biol.canterbury.ac.nz/nmf_project/



Outputs



Rahila Meriba visiting from Aplori and assisting Charles with his sunbird pollination network research.

Theses Completions

Two more postgraduate students have graduated:

- Paul Dutton PhD –Chimpanzee ecology
- Kristy Udy –MSc Ecology- 1st Class

Submitted and waiting on examiners reports

- Danladi Umar PhD- Fresh water ecology-

Refereed Papers

- Nsor C. First record of Bamenda *Apalis* *Apalis bamendae* for Nigeria. "The bulletin of the African Bird Club (ABC). In press Accepted March 30th 2013.
- Thaher, M., Umar, D., Takaoka, T., and Harding, J. Application of the maximum convex sum algorithm in determining environmental variables that affect Nigerian highland stream benthic communities. *Procedia Computer Science* 18:909-918.
- Nsor, C. and Chapman, H.M. (2013) Birds as pollinators in a West African montane Forest. *Malimbus* 35: 1-13.
- 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.

Under review

- Dutton P. Chapman, H. M. & Moltchanova, E. Secondary dispersal of chimpanzee dispersed seed in a Nigerian Montane Forest. Accepted pending minor revision *African Journal of Ecology* (resubmitted October).
- 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. *Biotropica* (Under review submitted September 2013)
- Barnes, A. and Chapman, H.M. Trait Determinants of Colonising Propogules in the Restoration of Tropical Montane Forests. Under revision for *Acta Oecologica* (Submitted January 2013)
- 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. *Biological Conservation* (under revision re-submitted October 2013)
- Grassham, A.M.; Kunz, B.; Goldson, S.L. and Chapman, H.M. Dispersal of forest seed into grassland matrix by the tanelus monkey in a Nigerian montane forest: implications for forest restoration. Under revision

Conference Proceedings

- Olaleru, F., Chapman, H.M. and Bawuro, M. (2012) *Primates' Foods of the Nigerian Montane Forest Project Ngel-Nyaki, Taraba State*. Ibadan, Nigeria: 3rd Annual Seminar of Nigerian Tropical Biology Association, 25 Sep 2012. In Proceedings of 3rd Annual Seminar of the Nigeria Tropical Biology Association 3 93-97.
- Babalola, F.D.; Amusa, T. O.; Wala, Z. J.; Ivande, S. T.; Ihuma, J.O.; Borokini, T.I.; Jegede, O. O.; Tanko, D. Ibadan. *Survey of and Threats to Turacos Preferred Food Plants in Ngel Nyaki Forest Reserve, Mambilla Plateau, Taraba State, Nigeria*. Nigeria: 3rd Annual Seminar of Nigerian Tropical Biology Association, 25 Sep 2012. In Proceedings of 3rd Annual Seminar of the Nigeria Tropical Biology Association 3 6-11.



Cleome montana (Capparaceae), was found growing in the fenced off grassland.

Conference Presentations

- Barnes A. D.; Emberson R. M.; Krell, F.T.; Didham, R. K. (2012) Trait based ecology attempts to predict variability in species responses to anthropogenic disturbances. British Ecological Society December 20th. University of Birmingham, UK.
- Udy K.L.; Nelson, X; Tylanakis, J. Anthropogenic threats influence the structure of interaction networks. British Ecological Society December 21st. University of Birmingham, UK.
- Charles Nsor, C. Mutualistic networks and network strength- a case study from sunbird pollination networks Ngel Nyaki forest reserve, Nigeria. A.G. Leventis Ornithological Research Institute 10th Anniversary Conference, Apori, Jos 15th of November, 2012.
- Chapman, H.M. Secondary dispersal by the African Pouched rat, *Cricetomys* sp3 in a forest without elephants. A.P. Leventis Ornithological Research Institute 10th Anniversary Conference, Apori, Jos 15th of November, 2012
- Osinubi, S.T. and Chapman, H.M. (2012) Habitat effect on the behaviour and condition of the Yellow-breasted Boubou (*Laniarius atroflavus*). Arusha, Tanzania: 13th Pan African Ornithological Conference, 14-21 Oct 2012.
- Knight, A. (2012) Genetic structure and gene flow in the Nigeria Cameroon Chimpanzee

in and around Gashaka Gumti National Park- Annual Biological Conference, University of Canterbury 17th October 2012. Christchurch, NZ.

- Umar, D. (2012) Land use change and its effects on fresh water invertebrates in an Afromontane landscape - Annual Biological Conference, University of Canterbury 17th October 2012. Christchurch, NZ.
- Hutchinson, K. (2013) Why the white nose? Sexual signalling in the putty-nose monkey. 405 Talks University of Canterbury August 2013 Christchurch, NZ.

Invited talks

- Chapman, H. M. 'The Nigerian Montane Forest Project' To: New Zealand Royal Society, Canterbury Branch. University of Canterbury, March 26th 2013.
- Chapman, H.M. 'The Nigerian Montane Forest Project' To: Royal Botanical Gardens, Kew, Richmond, Surrey, June 20th 2013.
- Charles Nsor, C., A.P. Leventis Ornithological Research Institute 10th Anniversary Lectures Apori, Jos 15th of November, 2012.
- Chapman, H.M., A.P. Leventis Ornithological Research Institute 10th Anniversary Lectures Apori, Jos 15th of November, 2012

Posters

- Umar, D.U., Harding, J.S., and Chapman, H.M. (2013) Response of benthic invertebrate communities to land use gradients in tropical highland streams in Nigeria. Dunedin, NZ. Freshwater Science Society conference, December 2012. (See the poster on page 30).

Publicity

- Facebook members have now reached 189. The group is very active, with regular posting of research and new sightings. This group is a very effective way to share and also allow distant members to contribute to the research by identifying species from the images.
- Discovering exciting new species - Nexen funds Montane Forest Reserve in Eastern Nigeria "The support from Nexen from the very beginning of the project has allowed us to secure our position and grow into an internationally recognized biodiversity reserve and study centre," says Hazel. For more see: www.nexeninc.com/en/Community/Giving.aspx
- Bradt guide to Nigeria – p. 280- NMFP and details of how to contact Misa Zubairo.

Student Projects



Pollen was collected from sunbirds to build sunbird-flower visitation and sunbird-pollen transport networks.

Do flower-visitor networks really equate to plant-pollinator networks

Nsor Charles Ayuk (PhD student)

Primary field assistant Elijah Nicodemos

Email: charles.nsor@pg.canterbury.ac.nz

Understanding the functional properties of plant-animal pollination networks has historically focused on insects and used flower visitation rates to predict pollination effectiveness because it is difficult to measure pollination effectiveness. Because of this is that plant-pollinator networks are not accurate and better reflect plant-animal visitation networks.

Here we used a null model approach to compare a sunbird-flower visitation network with sunbird-pollen transport network. Our networks were based on the visitation frequency of seven sunbird species to 12 tree species and the number of pollen grains on the bodies of each sunbird species respectively.

To compare the structure of the visitation and pollen transport models we compared the observed nestedness of each network with a value of nestedness obtained from a null model. Nestedness is the tendency for an ecological specialist or rare species to interact with a subset of species that interact with more generalist or common species.

We found a strong positive correlation between the flower visitation and the pollen transport network. However, there was a significant difference in nestedness between the flower visitation and the pollen transport network.

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

Alex Knight (MSc student)

Primary field assistant: Alfred Christopher

Email: akn25@uclive.ac.nz

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 forest fragments. We can investigate if certain fragments have become isolated and are experiencing higher levels of inbreeding. With this information we will be to examine what factors are likely to impede or assist gene flow between the forest fragments.

Update: DNA extraction and amplification has been completed for all samples. From 82 samples 63 had DNA successfully extracted. From these 63 samples, 37 yielded unique genotypes for 5 loci. The number of unique samples typed from the locations are as follows Ngel Nyaki 4, Danko 5, Mayo Fandam 5, Small Fandam 5, Ngiti 7, Leinde Fadali 5, Gangirwal 6. Within Ngel Nyaki forest reserve DNA was extracted from 17 samples in total, 9 of these are unique representing an absolute minimum number of individual chimpanzees present in the reserve.

Preliminary analysis suggests that Ngel Nyaki is isolated from GGNP. The samples at Ngel Nyaki and Kurmin Danko were approaching

significance which suggests admixture between the two locations is limited. There is tentative evidence of sex biased dispersal within GGNP but the signal is only evident in one out of three tests conducted on the preliminary data.

Interaction strength and relative contribution of sunbird species to the structure of a sunbird/tree pollination sub-web in a West African Montane Forest

Biotic and Abiotic Factors Restricting Natural Regeneration in an Afromontane Forest

Sasha Roselli (MSc Student)

Primary Field assistants: Thomas Patrick Sambo Babatel

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One of the long term aims of the NMFP is to restore forest to the whole of Ngel Nyaki forest reserve. Blocks of grassland around the forest edge have been fenced off to restrict fires and grazing, therefore promoting natural regeneration, however this is proceeding very slowly. We know that it is common for farmland to not regenerate after abandonment and this can be due to many of factors which are very site dependant. In order to promote natural regeneration in this forest we must have a solid knowledge of what factors are restricting succession in this particular system. I am doing a variety of studies to try to establish what the main biotic and abiotic factors are that are impeding natural regeneration at Ngel Nyaki Forest.



One of the very few *Cordia millenii* seedlings in Ngel Nyaki forest. *C. millenii* is an important timber tree and we are investigating why it is no longer regenerating in Ngel Nyaki forest.

My study tests three aspects of regeneration limitation. The failure of forest tree seedlings to establish may be due to species effects (eg competition, facilitation), seed limitation, and/or trophic effects (eg predation or herbivory). I have three distinct experiments, each trying to fill in the gaps in our knowledge within each of these categories.

In order for this study to have a practical use, we must be able to develop an applied management plan from our findings. A real focus of this project is therefore to try to understand how our knowledge of this system can be used to develop these low-intensity management options.

The plight of trees in a disturbed landscape: Conservation of Afromontane trees, Nigeria

Josh Thia (MSc student)

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Tropical forests can receive a number of disturbances from the presence of humans. In Ngel Nyaki Forest Reserve the forest has experienced deforestation, fragmentation, loss of large mammalian species, and continual threats from fire and cattle grazing. The longevity of this forest is thus dependent on the ability for tree species to regenerate under these pressures imposed on them.

This project assesses the prospective future of three Afromontane tree species: *Entandrophragma angolense*, *Lovoa trichilioides*, and *Cordia millenii*. Three broad aims: (1)

characterization of population genetic properties in each respective tree population, (2) understanding factors that may influence their regeneration, and (3) understanding the taxonomic relevance of Ngel Nyaki *Cordia*. The last objective is of particular interest because *Cordia millenii* in Nigeria is typically associated with lowland, western areas, whilst this population is found at elevation and in the east; identification of a new species or subspecies would prove invaluable to increasing conservation value of Ngel Nyaki.

I visited Ngel Nyaki from May to August 2013, and had the pleasure of working with Musa, Hammasumo, and Peter—my field assistants. I sampled a significant number of adult trees from each species for cambial tissue and/or leaves; DNA is being extracted from these samples to assess genetic diversity with microsatellite loci. I also undertook a large seedling planting effort that will explore the survival of seedlings and possible factors that might influence establishment of juveniles in each species. Specifically, I am (a) comparing survival differences, and the contribution of herbivory to survival, between *Entandrophragma* and *Lovoa* seedlings, and (b) exploring the contribution of invertebrate and large vertebrate herbivores to the survival of *Cordia* seedlings. Surveys of each species' respective juvenile population indicate that *Lovoa* regeneration in Ngel Nyaki is very good, *Entandrophragma* is moderate to fair, and *Cordia* is doing quite poorly.

Sequence data for the nuclear ITS1 and plastid trnH-psbA loci has been successfully obtained for *Cordia* samples from Ngel Nyaki. I am currently in the process of obtaining

herbarium samples for various West African *Cordia* from various geographic locations for a phylogenetic comparison. Sequence divergence between the Ngel Nyaki *Cordia* with known *C. millenii* samples and other *Cordia* species will allow me to determine the taxonomic significance of the Ngel Nyaki species—i.e. is it *C. millenii*, a subspecies of *C. millenii*, or a new species altogether?

Dispersal of forest seed in degraded Nigerian montane forest ecosystems by the tanzanian monkey, *Chlorocebus tantalus*, and the implications for forest restoration.

Abigail Grassham MSc.

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Abstract from paper submitted to *Primates* June 2013.

The study into seed dispersal by the frugivorous tanzanian monkey (*Chlorocebus tantalus* Ogilby 1841) is now complete. While *C. tantalus* is widespread throughout much of Central and West Africa its ecology remains largely unexplored. We therefore investigated aspects of tanzanian monkey ecology with a focus on seed dispersal ecology in Ngel Nyaki forest and compared our findings with those of other Cercopithecines. We have measured factors such as time spent in grassland vs forest, the number of intact seeds found in tanzanian monkey faeces. From this we have quantified the



These three 'sticks' are tools used by chimps to extract honey from subterranean hives. Chimps at Ngel Nyaki use other sticks to catch ants and stones and anvils to remove bitter pith from fruit.

number of seeds dispersed daily from forest into grassland. We have explored the sizes of dispersed seed and followed their successful (or not) germination in grassland habitats. Our work suggests that *tantalus* is not only capable of dispersing at least as many seeds as other Cercopithecines, but is also an important source of seed rain into both forest and grassland habitats, with potential importance in reforestation.

Tool and anvil use by a highland population of *Pan troglodytes ellioti* in Ngel Nyaki Forest Reserve, Nigeria

Dr Paul Dutton

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Submitted to *Primates* (July 2013)

In this study, carried out as part of Paul Dutton's PhD thesis on the general ecology of Ngel Nyaki chimpanzees, we found that the Ngel Nyaki chimpanzee community has their own unique tool kit consisting of several different tool types. We describe a tool type that has never been recorded before, a tool type that has rarely been observed, a tool type that has never been recorded for this chimpanzee subspecies, and another tool type that requires its defined target species to be reviewed. When comparing tool types between Ngel Nyaki and neighbouring Kwano communities we found that of the total eight tool types from both communities only three were common to both: stingless bee digging

sticks, stingless bee probing sticks and ant dippers; however differences were found in their dimensions and secondary modifications. Our results suggest that there is fine scale variation in tool use among populations of *P. t. ellioti* and that these variations may reflect both ecological constraints and cultural variation.

Dietary preferences of chimpanzees (*Pan troglodytes ellioti*) and food availability in Ngel Nyaki Forest Reserve

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Details submitted to *Folia Primatologia* (October 2013)

The dietary preferences of chimpanzees residing in Ngel Nyaki Forest Reserve was investigated using faecal analysis, observations of feeding remains, evidence of tool use and fruiting phenological data between April 2010 and March 2011. A total of 495 faecal samples were collected, with 75 food items identified, of which 52 items were seeds. *Ficus* spp. were the most common species identified, occurring in 61.2% of all faecal samples. Based on faecal analysis and phenological data, Ngel Nyaki chimpanzees do not solely consume fruits based on their availability within the habitat. Detailed results are presented in the paper.

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

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Abstract under review *Biotropica*

In Africa very little is known about scatterhoarding by rodents and its potentially vital role in secondary dispersal and forest regeneration. This gap needs filling particularly as Africa has the second highest rate of deforestation globally and deforestation rates in Nigeria, the location of this study, exceeded that of all other countries. As levels of defaunation in Africa are also high, we were especially interested in the fate of large seed, as these are most vulnerable to the loss of primary dispersers. Our study site was a degraded Afromontane landscape with varying levels of forest degradation/fragmentation. Using thread marked seed we tested the hypotheses that (i) the balance between seed predation and dispersal will favour predation in degraded/fragmented forest relative to continuous forest and (ii) that rates of scatterhoarding will be relatively higher for less palatable than palatable seed species. Our seed species were *Pouteria altissima* Baehni (Sapotaceae) and *Garcinia smeathmannii* Oliver (Clusiaceae) and our habitats were continuous forest (COR) forest edge (EDG) and extremely degraded riparian fragments (FRG). We found that seed removal rates were high among habitats. Distances seed was moved



Hyperolius riggenbachi in action! We found this male calling in one of the riparian forest fragments in Kurmin Danko.

was also different in the three habitats. We found strong evidence to suggest that the African pouched rat, *Cricetomys* sp. nov. was responsible for the scatterhoarding. Details will be available in the paper.

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

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It has been an exciting year for this project. Data from field work were processed and now we have the first amphibian inventory of the Ngel Nyaki and Kurmin Danko forest reserves. It is necessary to note that current distribution of several amphibian species has been biased due to the lack of surveys and collection efforts in Nigeria. Through a species inventory, new species lists and extending known ranges are added to what already is known, but also, they provide the antecedents to obtain more data on habitat and status of poorly known species. Therefore, an inventory is crucial to prove occurrence, and to revise and update distribution and conservation status of amphibian species at the Mambilla Plateau.

A wide range of sampling methods was used to obtain information for as many species as possible. The inventory was generated using active searching, Visual Encounter Survey (VES) and Acoustic Encounter Surveys (AES) techniques, live pitfall traps with drift fence,

and opportunistic records such as roadkills and animals captured by people from villages. Diurnal and nocturnal active searches were conducted in different habitats including forests, riparian forest fragments, grassland, farm, and areas where Eucalyptus has been cultivated.

Pitfall traps with drift fences were unsuccessful on trapping amphibians in most of the habitats; two frogs were trapped in the main forest nearby the field station and another one in a Eucalyptus plantation near the village. The greatest number of species was recorded by visual and acoustic encounter surveys, with all recorded species being detected by these methods.

Apart from those relatively widespread anurans occurring in the savanna and disturbed areas, including species of the genus *Amietophrynus*, the records from Ngel Nyaki and Kurmin Danko include a few remarkable findings. We recorded eight anuran species for the first time on the Mambilla Plateau, representing 35% of the total species found during the inventory. Some species such as *Arthroleptis* cf. *sylvaticus*, *Astylosternus* cf. *diadematus* and *Leptopelis* sp. are of difficult determination, and perhaps the former might represent a new species. In addition, *Xenopus* sp. needs taxonomic clarification with molecular studies as this is part of the *fraseri* group which, at least in specimens from Cameroon, has been taxonomically difficult to settle. *Arthroleptis palava*, perhaps the most common frog species in Ngel Nyaki, was found in every habitat including disturbed areas, Eucalyptus plantations and roads near Yelwa village. Within the forest and riparian

forest fragments, the frog *Astylosternus rheophilus* was the dominant anuran species. *Cardioglossa schioetzi* was relatively common in riparian forest fragments on Ngel Nyaki, on the contrary to Kumin Danko where just a couple of males were recorded. Although this species is associated with riparian forest, a few individuals including tadpoles, were caught in the main forest. The toad species *Amietophrynus maculatus* and *A. villersi* were found in the grassland/savanna and nearby the field station, but also in Yelwa near the tracks and disturbed areas.

There has also been important progress with regard to the population genetic study—and the interesting lab work involved in it. We want to determine the extent of gene flow and patterns of dispersal between populations of *Cardioglossa schioetzi*, *Astylosternus rheophilus* and *Leptodactylodon bicolor* inhabiting forest and riparian forest fragments. In order to obtain such information we decided to use Amplified Fragment Length Polymorphism (AFLPs), a molecular marker that has recently become more popular with zoologist as an alternative to the costly development of microsatellites. AFLPs have been extensively used to investigate population genetics and genome mapping especially in plants, microbes, and fungi, however, in recent years, have been used successfully on amphibians.

To sum up, besides reviewing and updating the conservation status of amphibian species, the inventory will contribute to accrue information on what is known of poorly understood species. It undoubtedly will contribute towards our understanding of species distributions and species rarity in this largely unexplored area of



A photographic guide book to the freshwater invertebrates of Mambilla Plateau is almost completed. This *Neoperla* sp. (stonefly) can grow up to 30 mm long and is only found in high quality streams.

West Africa. On the other hand, we will have, in the near future, tangible results from lab work and will be able to know to what extent populations of these three species of frogs are moving between forest and the riparian forests fragments.

The effects of land use on stream communities in highland tropical streams in Nigeria

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Globally, stream invertebrate communities have been shown to respond to habitat degradation as a result of land use changes. The effects of land use changes on stream communities have been well documented in temperate regions, however, their effects in the tropics are relatively unknown, particularly where land use activities can differ markedly (e.g., tea, maize and Eucalyptus plantations). To understand how land use affects stream communities, I surveyed 55 second and third order highland tropical streams across four land use categories, ranging from continuous tropical montane forest to intensive crops/pasture. Streams were sampled in the dry season (October to March) for physico-chemical parameters (i.e., temperature, pH, conductivity, turbidity, current velocity, channel morphometry and riparian characteristics) and ecological characteristics (i.e., FPOM, CPOM, algae and benthic invertebrates). Water temperature

in all streams was high (up to 25°C) while levels of dissolved oxygen were frequently low (15–79%). However, physico-chemical conditions did not show any clear pattern across land use categories. In contrast, benthic invertebrate communities showed a strong response with the highest taxonomic diversity in forested streams (mean 20 taxa) and the lowest in streams within intensive crops (e.g., cabbage crops, mean 8 taxa). Several of the taxa which occurred in forested streams (e.g., mayflies Heptageniidae and Oligoneuridae and brachyuran crabs) were rare or absent in streams with more intensive land use. Leaf litter decomposition experiments were carried out in a total of nine streams, three in forest, three in tea plantations and three in maize fields. Leaf breakdown rates were slow compared with other reports for tropical streams. Significantly lower densities of invertebrates were found in leaf bags incubated in streams draining tea plantations and maize fields than in forest streams. In the same nine streams, food web components were sampled and analysed using gut content and stable isotope (N and C) analyses. The continuous forest food web was more complex than the food webs of the plantation and maize field streams. Stable isotope analysis indicated that primary consumers assimilated a mixture of autochthonous and allochthonous carbon resources, but this varied among sites. Overall, my results suggest that more intensive land use activities strongly affect the diversity and composition of benthic stream communities and ecosystem function through both nutrient and sediment related effects.

Geospatial mapping and carbon sequestration modelling of West African submontane forests.

Ralph Adewoye (PhD student)

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).

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.

The project is making progress with one field season data on tree species diversity.



Cattle grazing round the edge of the riparian forest. One possibility may be to use Kiwi electric fences to keep cattle out.

Industrial Training (IT) student projects

Medicinal properties of trees within Ngel-Nyaki forest reserve

Peter Dominic (Taraba State University) and **Ali Buba** (Yelwa village)

This project involved the extraction of plant phytochemicals such as saponins, alkaloids, coumarin and tannins from the stem, bark and leaves of key tree species within Ngel Nyaki forest reserve. Back in the laboratory at TSU the properties of these phytochemicals will be further investigated by testing for health benefits on albino mice.

Secondary dispersal of *Carapa oreophylla* by the African pouched rat. Does seed size matter?

George Godson (TSU) and **Buhari Abubakar** (GSU), **Hammadu, Thomas, Adam,** and **Suliman** (NMFP).

While we know that large seeds are moved from the forest floor by African pouched rats and are either eaten on the spot, dropped, cached or buried, we do not know how seed size affects these outcomes. In this experiment the fate of large and small seeds of *Carapa oreophylla* was explored using an hierarchical nested experimental design. The experiment included three sites, each at least 1 km apart, three habitats at each site (forest, edge and grassland), and two treatments (large and small seed).

Analysis of five years weather data at Ngel Nyaki, using the weather station data files

Aminu Musa (TSU) and **Usman Abubakar** (NMFP) with supervision from Prof. A.A Adebayo from Modibbo Adama University of Technology, Yola.

This project will be extremely valuable in providing readily available weather data for a plethora of biological studies undertaken at Ngel Nyaki.

Behavioral ecology of putty-nose monkey (*Cercopithecus nictitans*)

Salim Ahmed Shinga (GSU) and **Musa Bawuro** (NMFP)

This study was carried out in order to lay a foundation for future long-term studies into the behaviour of the putty-nose monkey within Ngel Nyaki forest reserve. The study involved collaboration with Kelly Hutchinson (MSc student, UC) and Professor Mike Lawes, Charles Darwin University, Darwin, Australia.

New Project



Putty-nosed monkey, *Cercopithecus nictitans*. The research aims to determine if the white spot of the putty-nosed monkey is used as a sexual signal.

Putty nose monkey behaviour

Kelly Hutchinson (MSc student)

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Putty-nosed monkeys, *Cercopithecus nictitans*, are an arboreal West African guenon species. They live in groups of one adult male, several females and their dependent offspring. Their behaviour has been largely understudied, though recent studies have looked whether their vocalisations are referential and have reported on insect feeding behaviour.

A striking feature of putty-nosed monkeys is their white nose, which contrasts with their otherwise drab colouration. It has been postulated that, due to the anatomical and genetic similarity among *Cercopithecus*, species-specific visual signals help prevent hybridisation. In one-male, high-canopy specialists this manifests as bold, strongly simplified facial and or genital patterns that allow for long range signalling. More specifically in the spot-nosed, red tailed group to the facial pole – such as that seen in putty-nosed monkeys.

In this group stereotyped head movements have been observed and could serve to modulate the visual signal; giving meaning or adding emphasis. Head ‘flagging’ has been found to be correlated courtship and appeasement behaviours. This fits with sexual-selection theory where bold colouration can be co-opted as a sexual signal as it is highly salient and believed to be ‘honest’.

Putty-nosed monkeys have been observed waving their hand in front on their nose, alternatively obscuring and revealing it. This

behaviour could serve a similar modulation role as flagging with elements such as rate allowing for degrees of meaning. It is however still currently unknown whether this behaviour is similarly associated with sexual-signalling or, if it serves any communicative role at all. This research aims to determine if the white spot of the putty-nosed monkey is used as a sexual signal. This would contribute to our understanding of a largely understudied species, as well as the larger fields of sexual communication, and intra-specific primate communication.

If due to difficulties in data collection I fail to achieve this objective, I will instead investigate the feeding ecology of the putty-nosed monkey. This again would help understand their behaviour, which is important as they have been shown to act as a seed disperser in Afro-montane forests. The drive to obtain a nutritious diet, in the most energy efficient manner whilst also avoiding plant toxins, has been shown to influence every aspect of primate biology including ecology, distribution, movement, ranging patterns, behaviour and social organisation. Due to its wide range of influence feeding ecology is a potentially fruitful starting point for understanding putty-nosed monkey behaviour.

Research will be undertaken at Ngel Nyaki reserve over two visits. Guenons tend to have breeding and non-breeding seasons. If this is found to be also true of the putty-nosed monkey, the visits will be timed to ensure both are sampled. This will allow the non-breeding season to serve as a control for behaviour observed in the breeding season. Whilst there,

I will gather data using focal scans on groups of putty-nosed monkeys, noting occurrences of hand-waving and what other behaviours were occurring at the time. The behaviours scored will be determined by observation of the monkeys, as well as from findings of closely related species who have been subject to more thorough study such as the blue monkey (*Cercopithecus mitis*).

Reports from Visitors

Report of field work carried out in the Ngel Nyaki forest reserve

Project leader: Nwaogu Chima

APLORI, Jos

The main aim of the field work was to trap and sample Hartlaub's marsh widowbirds, *Euplectes hartlaubi*, which is known to be restricted in range to patchy areas around the Mambilla plateau in Nigeria. Through Dr Ulf Ottosson, Blood and feather samples were collected for Professor Staffan Andersson of the University of Gotenburg, Sweden whose research focuses on animal communication through colour with particular interest in birds.

I arrived at Ngel Nyaki Forest Reserve on the 18th October 2012, with a warm welcome from Denise Arroyo - a PhD student from the University of Canterbury. The marsh widowbirds were located on marsh land at the outskirts of the reserve with very minimal effort, due partly to help from the field assistants at the Project. They were also easy to identify when sighted as they called loudly and flew high around competing for mating opportunities, this was my first sighting of the birds.

On the 20th of October mist nets were erected where bird activities were most noticeable. This was carried out with Charles Nsor, a PhD student from Canterbury working on avian pollinators, and some field assistants. Trapping began the next day, continuing for nine days, with the net position changing frequently in response to bird movements. Playback devices were also employed to lure birds to the nets.

Blood and feather samples were collected from four male and eleven (11) female marsh widowbirds over the trapping period. Morphometric measurements and pictures of sampled birds were also taken. We also caught and processed a few other bird species which have likely never been ringed in the area. Notable among birds caught is the vulnerable Bannerman's weaver, *Ploceus bannermani*, restricted to the highlands of eastern Nigeria and south western Cameroon.

The trip was my first visit to the Mambilla plateau and also my first independent field work after my MSc program. It was a wonderful experience working on the Mambilla plateau and particularly within Ngel Nyaki, which offers excellent research environment and wonderful people.

It would be really interesting to visit again and also to set a proper organised bird



Hartlaub's marsh widowbird in hand



Charles (Left) and Chima (Right) ringing on the upland grassland close to the marsh at the outskirts of the Ngel Nyaki reserve where the marsh widowbirds are found

ringing scheme to allow for biodiversity monitoring and also train local expertise within the reserve to enhance collaboration with researchers who might be interested in carrying out bird ringing projects knowing that there is available assistance within the reserve.

Molecular taxonomy and the role of small terrestrial mammals in Ngel Nyaki as possible carriers of arenavirus

Project leader: Ayodeji Olayemi

Mammalogy Unit, Natural History Museum, Obafemi Awolowo University, Ile-Ife

A project funded by the European Foundation Initiative for African Research into Neglected Tropical Diseases (EFINTD)

Whoever would be able to resist an opportunity to carry out their research at the Ngel-Nyaki Montane Forest Project site? For years the Mammalogy Unit at the Natural History Museum, Obafemi Awolowo University, has yearned for a chance to study the small mammals in this unique topographical area that represents an extension of the Cameroon Mountain range and Mambilla Plateau into Nigeria. These highlands are the result of historic volcanic activity that has created a unique swathe of endemic flora and fauna.

From 2005 our Museum has been involved in the molecular characterization of rodent populations across various ecological zones in Nigeria. These studies have led to the taxonomic revision of several of these populations, ranging from Wood mice to Giant pouched rats, and also the description of new species (reviewed in Olayemi et al. 2011). More recently, in addition to our taxonomic studies we have been running the project, "Ecology of transmission of the deadly Lassa virus from rodents to humans across various flashpoints within Nigeria". Extending this research into the Ngel Nyaki area is vital for us for many reasons.

For instance, Hutterer et al. (1992) suggested that the differences they discovered between a dwarf population within the Mambilla Plateau of Nigeria and the typical Rusty bellied rat, *Lophuromys sikapusi*, are so pronounced that the dwarf form should be recognized as a new species, *L. eisentrauti*. Fresh samples from a study like ours will generate important genetic evidence in the form of DNA sequences that will help clarify contentious taxonomic situations such as this. Sequences from our analyses will also help elucidate zoogeographic and evolutionary patterns connected with this special ecosystem.

Lassa fever, a deadly haemorrhagic disease, is endemic in certain focalized spots within



Nigeria, including various localities in Taraba State such as Jalingo and also Takum (which is a 5 hr drive from Ngel Nyaki). The Multimammate rat, *Mastomys natalensis*, has been implicated as a carrier of the Lassa virus. Since Ngel Nyaki falls within the endemic zone for Lassa fever (though to the best of our knowledge no cases have originated from here), it would be important to test small mammals collected in our survey to provide information about the possibility of future epidemics in this site. Therefore when Dr Hazel Chapman, Director of the Nigerian Montane Forest Project (NMFP), presented us with the opening to carry out our work at Ngel Nyaki, we grabbed it with both hands.

To kick off the rodent studies at Ngel Nyaki we are currently, with various international collaborators, sequencing Giant pouched rat biopsies (genus *Cricetomys*) from this site for the cytochrome b gene. These biopsies, collected by Josh Thia of the University of Canterbury, will lead to the species level identification of this montane population when included in our recently published phylogeny – which was built from collections made across sub-Saharan Africa (Olayemi et al. 2012). These samples are all the more essential because montane forest populations from important sites such as the Mambilla Plateau extending into Nigeria and the Kivu Mountains in Central Africa (where the contentious *Cricetomys 'kivuensis'* can be found) were not included in our recent investigations. Hence their taxonomic statuses remain unresolved.

In March 2013, setting live-capture traps (154 Sherman, 40 Ugglan and 20 BTS traps) over 3 consecutive nights, we collected 42 small



Capturing, collecting and processing the rodents

mammals in the Ngel Nyaki area. Most of these traps were set directly in the forest, but some were also set in houses within Yelwa village along the major paved road leading into the mountains. Other traps were set in a couple of homesteads high in the peaks just outside the forest reserve occupied by the cattle-rearing Fulani. Based on initial, external morphology, these specimens have been identified as the Multimammate rat *Mastomys natalensis* (26 specimens), the Soft-furred mouse *Praomys* sp (14), the Pygmy mouse *Nannomys* sp. (1) and a shrew *Crocidura* sp. (1). Back in the lab biopsies from these animals will be sequenced for mitochondrial DNA employing the Cytochrome b to provide unambiguous species-level identifications. The DNA sequences will also be useful in reconstructing phylogenies that will throw more light on the evolutionary history of Mambilla Plateau small mammal populations in relation to those in other ecological zones within Nigeria.

Biopsies from all the small mammals collected at Ngel Nyaki will also be tested by molecular analyses to detect the presence of the Lassa virus (employing the S gene) or any other arenavirus (employing the L gene). *Mastomys natalensis* was the most numerous rodent in our 3-night survey. This rodent is the most abundant across Africa and in Nigeria is known to be a natural reservoir of the deadly Lassa virus. This aspect of our research will contribute data to our continuing nation-wide effort to map out rodent populations that carry the Lassa virus (or any other arenavirus). Since our work at Ngel Nyaki involved hunting for viruses that are potentially harmful to humans we carried out our sampling and biopsy collection under the strictest safety standards, protecting personnel with safety gear (masks, gloves and gowns) and carefully disinfecting our working area.

Soon, however, our time was up and we were sorry to leave. For our team from Obafemi Awolowo University, Ile-Ife, including technical staff Adeoba Obadare and PhD student Akinlabi Oyeyiola, this was the best field

experience we've had in our work sampling various sites around Nigeria for rodents and arenaviruses. This pristine ecosystem, with the cool mountain air and breathtaking scenery made it seem as if we had travelled out on a holiday. Misa Zubairu, the Montane Forest Field Station Manager, was the perfect host, doing his utmost to facilitate our work. We also had the pleasure of recruiting Sambo, a local resident and employee of the Montane Forest project, to participate in our sampling. A quick learner who always seemed to know what to do when we encountered a need, Sambo's contribution to our work proved invaluable. Prince Umeh, who has had prior field experience at Montane Forest Project, also joined us from some sampling we carried out around Jalingo en route Ngel-Nyaki. So it was like saying goodbye to home and family when we left – we'll definitely be back! Finally, huge thanks to Dr Hazel Chapman who provided us this opportunity, and with whom we hope to have a long and fruitful collaboration.

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Further Investigation into the potential for low-input high-benefit approaches to improving sub-Saharan grassland production for grazing and the protection of Mambilla's forest remnants

Project leader: Stephen Goldson

Lincoln University, New Zealand

Very recently we introduced Professor Bruce McKenzie (Dean of Agriculture at Lincoln University, Canterbury) to the Mambilla Plateau through the Nigerian Montane Forest Project and we also visited Professor Mohammed Kabir Farouk and his staff at the Federal University Kashere. Further there was time for us to make a quick visit to the impressive Leventis training facility near Kashere and were amazed at the quality of what is being done there and the morale of the young students.

The Mambilla visit

Overall the visit was the most useful yet. Having Bruce McKenzie there allowed us to examine the grassland ecosystem in the wet season and offered time to do some literature searches on the afro-montane grassland ecosystem. It is indeed degraded.

The dominant grassland species is a type of very tough tussock belonging to the genus *Sporobolus* which the herders later told us wear out their cattle's teeth after two years.

Interestingly however, we also did find legumes (clover) which is a very good indicator that the soil pH is high enough for legumes and that improved varieties could well work. Maybe these could simply be oversown by broadcasting after burnoff.

Bruce and I also took the opportunity to talk to up to 20 Fulani cattle grazers from the Yelwa Village area about what kind of problems they are having on the Mambilla Plateau. To a person they agreed that the primary issue is lack of feed especially in the dry season and how this in turn takes its toll on stock health.

In response we made the point that no amount of improved plant species in the pasture sward would make any difference if animals were able to selectively graze them to extinction (there are stories of failed attempts in the 1970s). Therefore some sort of rotational grazing system must be tried and



Staff at Leventis training school



Wet season over-grazing on the Mambilla Plateau

this would most likely involve cost-effective New Zealand-developed solar-powered electric fence technology. The people that we talked to assured us that they would adopt such technology if it was demonstrably useful. The other benefit of this of course is that this approach could be used to keep the cattle out of the forest remnants.

The conversation that was held generated far more than polite attention to the extent the herders on the spot offered help-in-kind and even cash. They then agreed to write a letter of strongly in support of the ideas being put forward.

Throughout the discussion we emphasised that this development and demonstration work would be done by Nigerian postgraduate

students/junior staff from Kashere University (and possibly others) enrolled at Lincoln and doing their field work from the NMFP field station. This is definitely not a question of overseas people coming in and telling people what to do.

In short, the relatively modest goal that has emerged comprises low-cost inputs to enhance existing systems and protect the forest remnants.

The visit to the Federal University of Kashere

The visit to Federal University of Kashere hosted by Professor Mohammed Kabir Farouk (Vice Chancellor), and Professor Ahmed Abdu Manga (Dean of Agriculture, Federal University,

Kashere). This was an unqualified success.

Professors Farouk and Manga ran two very well-attended staff meeting where he introduced Bruce, Hazel and myself to both his academic and management staff. Both of these groups have increased very markedly in the last eight months. Farouk and Manga explained that they had learned a great deal from the visit to Canterbury and Lincoln Universities and was particularly taken by how well the Nigerian students had progressed having been at Canterbury University. He also made it absolutely clear that he has every intention of fulfilling the partnership deal with both of these New Zealand Universities to train his junior staff and others. On-the-spot Farouk invited his staff to start the process of applying to either Canterbury or Lincoln depending on the subject areas. He also expressed an interest in Lincoln's expertise in both tourism and landscape architecture. All three of us visitors were at various times invited to expand on and endorse the discussion.

These days of conversation made it absolutely clear that Farouk wishes to establish a truly international university at Kashere of the highest academic standard. There are in fact three partner Universities; his own, Florida International University (FIU) based in Miami and the two New Zealand Universities. In the first instance and NZ-visas permitting, each university can expect 8–12 postgraduate students. Farouk's own background is in history and political science and to this effect we had numerous, candid and very interesting conversations with Farouk and his staff.

Hazel Chapman has continued to endorse the use of the Mambilla field station site as a basis agricultural research of the sort discussed in this document, noting the environmental/biodiversity benefits that are likely to accrue

from properly developed research.

Further progress

There is no doubt that what has been planned over the last year is well on track and both Bruce and Hazel have made themselves available for consultation re study in New Zealand. The twin and mutually-reinforcing themes of low-input sustainable agriculture and biodiversity protection is a very satisfactory agenda.

However the inertia for this should not subside. Kashere still confidently awaits the Nigerian Tertiary Education Trust Funds but in the meantime it was agreed that planning must proceed from here on.

Should other funds be available we would suggest that these could be used for the further 'stewardship' of the process underway, including site visits to the research projects and academic visits to the students and their off-shore universities.

Acknowledgement

The generous support from A P Leventis is gratefully acknowledged. As always sincere thanks also to Professor Hazel Chapman for her expert leadership and to Phil Hall for his enthusiastic endorsement of all aspects of this quite extraordinary project.



Sporobulus sp.

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

Danladi M Umar, Jon S Harding, Hazel M Chapman



Introduction

Stream invertebrate communities are known to respond to habitat degradation as a result of land use changes.

Although 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 (e.g. banana, maize, cabbage, tea, eucalyptus) in addition to other land use pressures such as bush fires and deforestation.

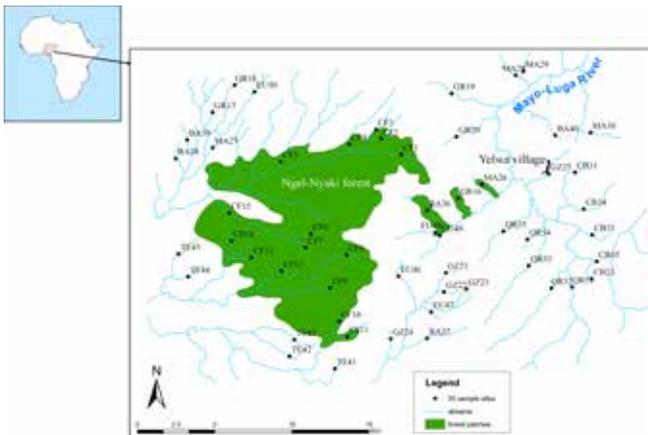
Study questions

- Do different land uses in the tropical highlands affect benthic community composition and diversity?
- How do benthic invertebrate communities respond to these activities?
- What are the key environmental drivers of tropical highland stream communities?



Methods

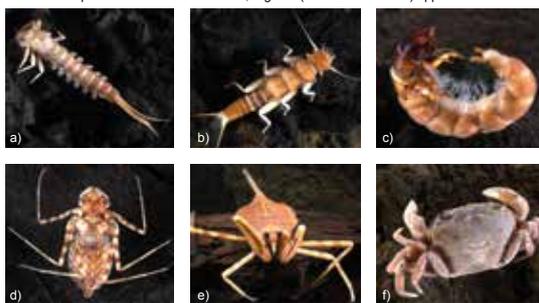
- Surveyed 55 streams across 8 land uses (i.e. continuous forest, forest fragments, banana, maize, cabbage, tea, eucalyptus, grazing)
- Water chemistry (i.e. pH, conductivity, temperature, NO_3^- , PO_4^{3-} , substrate size, riparian management)
- Collected qualitative and quantitative stream invertebrates using Surber sampler and kick nets



Study sites: 55 streams were sampled on the Mambilla Plateau, Nigeria. (11°6' E and 6°7' N) approx 1500 m a.s.l.

Stream invertebrates collected:

- Oligoneuridae
- Perlidae
- Hydropsychidae
- Macromiidae
- Nepidae
- Potamonautidae

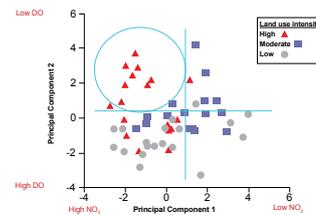


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Results

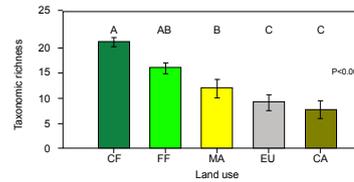
physico-chemical characteristics of streams



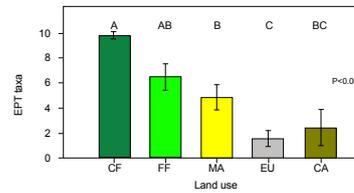
high DO & low NO_3^- in low intensity land use streams, high NO_3^- & low DO in high intensity land use streams

Key to land uses

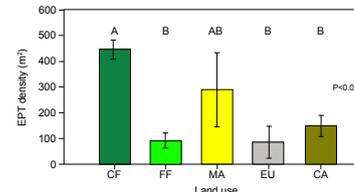
- CF = continuous forest
- FF = forest fragments
- MA = maize
- EU = eucalyptus
- CA = cabbage



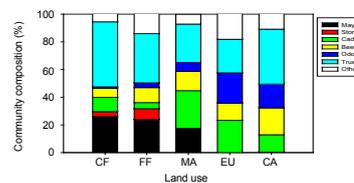
Benthic diversity differs between land uses ($\bar{x} \pm 1\text{SE}$)



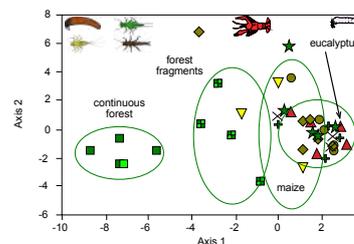
EPT taxa are more diverse in CF & FF land uses



Density varies between land uses



Community composition changes from CF to CA



Invertebrate communities change across land uses

Summary

- Highest diversity in continuous tropical rainforest streams, lowest in cabbage & eucalyptus streams
- Diversity and composition of benthic stream communities differ between land uses, as some mayfly and stonefly species are lost
- Rainforest streams are important in maintaining regional diversity particularly of pollution sensitive species (e.g. Oligoneuridae, Heptageniidae)

Acknowledgements

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