

School of Biological Sciences
College of Science

Nigerian Montane Forest Project

Annual Report



07

Introduction



2007 has seen the Project develop in many ways. We have run our first postgraduate field course for FUTY students, which everyone enjoyed and was a real success. We have developed a strong collaboration with Gombe State University, which has included the development of several new research projects. The nursery has grown, seedlings have been planted and forest restoration of streamside and grassland nearby the field station is underway.

Stephen Gawaisa has finished his field work and is well on his way to completing his PhD thesis. Funding for a nursery school and bore-hole for Yelwa village will mean a lot to the local community, and building will begin this November.

Dr Hazel Chapman

Director

Nigerian Montane Forest Project



Sadly Jauro Petel of Yelwa village died in July 2007 after being unwell for several months. The Jauro was a good caretaker of Ngel Nyaki forest and always supported the NMFP in every way he could. He is sadly missed by the Yelwa community, and all of us associated with the NMFP.

Cover Photo: Misa Zubairu demonstrates to Students from the Federal University of Technology, Yola (FUTY) how to prepare a plant specimen for the herbarium press.
Photo by Matt Walters, UC.

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Nigerian Montane Forest Project

Mission Statement

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

Aims

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

Partners and Sponsors

Project Partners

Nigerian Conservation Foundation (NCF)

Nigerian National Parks

Taraba State Forestry

Federal University of Technology, Yola (FUTY)

Gombe State University

University of Canterbury, NZ (UC)



NCF



Major Sponsors

Nexen Nigeria

A.G. Leventis Foundation

North of England Zoological Society

DHL Nigeria

American Womans Community, Lagos Branch

People

The success of the Nigerian Montane Forest Project reflects the dedication and enthusiasm of its staff, students and volunteers.

Full-time Staff



From left to right: Miriga (tree climber); Augustine Ntim (nursery); Misa Zubairu (Field station manager); Musa Amadu (senior field assistant); Hammasumo Ibrahim (Phenology transects); Bobo Zubairu (watchman); Hadija Dauda (watchman); Usman Usuf (seed traps); Usman Two (cook).

Visitors

Over 20 people visited the field station during 2007. These included:

Professor. C. Akosim from FUTY who spent two days working in the field with Stephen Gawaissa on his putty nose monkey thesis.

Dr Femi Ogunjemite and his assistant from the University of Akure, who visited Ngel Nyaki as part of a chimpanzee survey for NCF/WWF.

Five biology lectures from the new Gombe State University who are planning postgraduate research projects based at Ngel Nyaki.

Projects

This year the research projects fall into four broad categories:

- 1) plant-animal interactions;
- 2) freshwater ecology;
- 3) medicinal plants and
- 4) GIS.

Institutions

ABU - Ahmadu Bello University, Zaria, Nigeria
Aplori - A.P. Leventis Ornithological Institute, Lamina, Jos, Nigeria
FUTY - Federal University of Technology, Yola, Nigeria
Gombe State University, Nigeria
UC - University of Canterbury, New Zealand
University of Maiduguri, Nigeria
U Pretoria - University of Pretoria, South Africa

Plant-Animal Interactions



Dispersal failure in Afromontane riverine forest fragments as a consequence of forest fragmentation and degradation.

Ihuma Jerome PhD (FUTY)

Most (76%) Afromontane (above ~1500 m in altitude) forests tree species have fleshy fruit with edible pulp which has evolved to effect seed dispersal by animals. Generally speaking the larger the animal species, the fewer there are of them, and the more vulnerable they are to extinction. Likewise large-seeded plant species are more vulnerable to dispersal failure than small seeded ones, as fewer frugivores are able to swallow and disperse seeds. Gape width limits the size of fruit that avian frugivores can swallow, especially for single seeded fruits (drupes).

On Mambilla Plateau fragmentation and land degradation has led to a massive decline in number of many of the wide-gaped frugivores from forest fragments. All primates except the Tantalus monkey (*Chlorocebus tantalus*) are confined to the only large forest on Mambilla, Ngel Nyaki, and there has been a massive decline in large avian frugivores such as pigeons and hornbills visiting the fragments. The only common large-gaped frugivore living in the fragments is the white crested turaco (*Tauraco leucolophus*) which is confined to them and the very edge of Ngel Nyaki forest.

The overall aims of this thesis are to:

- 1) Determine what frugivores (if any) are dispersing the large seeded tree species in the fragments
- 2) Identify dispersal limitation/failure among large seeded tree species in the forest fragments relative to the main forest.
- 3) Investigate the role of the white crested turaco in seed dispersal in the fragments
- 4) Investigate whether there is greater selection by frugivores for smaller seed size in tree species which occur in both Ngel Nyaki forest and the fragments.

The results will be used in management recommendations for the fragments in close proximity to Ngel Nyaki Forest Reserve.

Tantalus monkeys and seed dispersal



Fiona Agmen BSc Hons (UC) Start date Dec 07

Along with birds, primates are key dispersers in Afrotropical forests, making up between 25 and 40 % of frugivore biomass. Primates are important because they have a wider gape than most bird species, and so are theoretically able to disperse (through swallowing) larger seed than even wide-gaped bird species. However primate populations are in decline, and so for conservation management it is important to highlight why their continued survival is important for forest ecosystem function.

Ngel Nyaki Forest Reserve and the surrounding riverside forests (from here on referred to as forest fragments) are degraded and increasingly fragmented due to recent increases in human and cattle populations. Hunting has been rife, especially during the 1980's so that the only primate species now regularly crossing open grassland and visiting forest fragments is *Chlorocebus tantalus* (tantalus monkey). In the past other primates such as chimpanzee, putty nose and mona monkeys were common visitors to the fragments.

The aims of this research are to:

- 1) Identify which fruit tree species *C. tantalus* feeds on in the fragments
- 2) Determine the relative importance (effectiveness) of *C. tantalus* in the dispersal of each of these species compared with their other frugivores.
- 3) Investigate the potential for *C. tantalus* to move seed from Ngel Nyaki forest back into depleted fragments.

The results of this work will contribute to our understanding of the vulnerability of forest fragments to frugivore decline and to the importance (or not) of *C. tantalus* in their survival.

The relative role of Chimpanzees in primate assisted seed dispersal



Jaqueline Brown MSc (U Pretoria) Dec 07

Primates are important in seed dispersal within all tropical forests, including Afrotropical forests such as Ngel Nyaki. Primates make up to 40% of frugivore biomass, and are important because they are able to disperse large seeded species and move (even small seed) large distances away from parent plants relative to avian frugivores. In Ngel Nyaki Forest Reserve primates include Chimpanzees (*Pan troglodytes vellerosus*), Putty nose monkeys (*Cercopithecus nictitans*), olive baboon (*Papio anubius*) and tantalus monkeys (*Chlorocebus tantalus*). The population size of the chimpanzees in Ngel Nyaki is now only about fifteen individuals, and they may become extinct if more conservation efforts (such as increasing forest cover) are not undertaken. The main aims of this thesis are to:

1. Assess the role that Chimpanzees play in seed dispersal compared to other primates at Ngel Nyaki forest reserve.
2. Determine whether seeds that pass through the gut of primates have faster germination rates than seeds that do not, and how this may compare between primate species.
3. Estimate the population density of Chimpanzees using dung counts.

Results will contribute to the conservation management of Ngel Nyaki reserve and perhaps act as leverage to protect nearby forest fragments.



Reproductive ecology of the Endangered tree species *Pouteria altissima*

Halima Mohammed Abba Lecturer at Gombe State PhD (FUTY) Nov 07

The aim of this project is to understand the reproductive ecology in relation to both pollinators and frugivores of the IUCN Endangered tree species *Pouteria altissima* (Sapotaceae).

P. altissima has large seed (+/- 1.5 cm in diameter) which is animal dispersed. Flowers are creamy white, open and probably insect pollinated.

The project will focus on both seed dispersal and pollination biology; the main aims are to:

- 1) Identify the seed dispersers of *P. altissima* in Ngel Nyaki
- 2) Determine the relative efficiency of the different seed dispersers
- 3) Identify any dispersal limitation
- 4) Investigate whether there are certain micro sites in which *P. altissima* seedlings are more likely to survive and grow than others.
- 5) Investigate the effect of distance from the parent tree on the likelihood of survival of seedlings, saplings and poles.
- 6) Identify the pollinators
- 7) Identify any pollination limitation

This kind of information will be used in the future management and restoration of Ngel Nyaki forest and its surrounding area.

Aspects of the ecology of the Cameroon Olive Pigeon (*Columba sjostedti*) at Ngel-Nyaki

Adang, Kombe Lucas, BSc, MSc, PhD (ABU)

The Cameroon Olive Pigeon (*Columba sjostedti*) is one of the endemic bird species found in the Montane Forests at Ngel Nyaki. Little is known of the ecology of this species, thus the proposed study is aimed at providing information on some aspects of the ecology of this species at Ngel Nyaki Forests. The ecological aspects of interest are outlined below.

Aspects of interest

1. Food habits
 - (a) Visual observations of the bird's feeding and noting the plant or tree species on which it feeds.
 - (b) Mist-netting the bird to collect crop contents (regurgitates) for analysis of possible or identifiable food items.
 - (c) Collection of faecal samples for analysis of possible or identifiable food items.
 - (d) Possible feeding regimes of the bird on a particular tree species viz a viz competition with other bird species on such food item.
2. Breeding Biology
Try to identify or locate nests of the bird and monitor its breeding biology from courtship or territoriality to fledging.
3. Habitat preference
 - (a) Note where the bird is commonly sighted, i.e. in the fragment or main forest and to postulate reasons for such preference.
 - (b) Record the number of sightings of the bird in a day within the fragments and main forest.
 - (c) Perform ringing experiments to determine the territorial range of the bird within the plateau and its environs, especially the Gashaka Gumti National park.

The role of sunbirds in pollination



Kerry-Anne Weston MSc (UC) Start date Nov 07

When addressing conservation issues currently facing areas of afro-montane forest such as the Ngel Nyaki forest reserve, anthropogenic impacts upon the flora and fauna within the forest must be addressed not only in terms of species loss, but also in terms of disruption to the mutualisms between these species which may be indirectly precipitating or compounding this species loss. An increased understanding of plant-animal interactions such as pollination services may be vital in advising conservation efforts. The first step towards this understanding is to identify the web of interactions linking plants species and their pollinators. Sunbirds are small, largely nectarivorous passerines with long, slender, sharply pointed, decurved bills. There are 131 species of sunbird worldwide, 28 of which occur in Nigeria. The sunbirds are thought to be implicated in the pollination of several tree species of the Nigerian afro-montane forest, however the relative role and consequently the importance of sunbirds as pollinators is largely unknown.

Predicting the main pollinators of flowering plants can be difficult from pollination syndromes alone due to the wide taxonomic range of pollinators servicing most plant species, often resulting in temporally and spatially variable natural selection. Consequently, field observations combined with experimentation are required to test these predictions and identify the role and importance of these interactions in overall ecosystem function.

The specific objectives of this project are to:

1. Evaluate current knowledge on the role of sunbirds/birds as pollinators in afro-montane forests?
2. Assess the relative visitation rates of sunbirds versus other flower visitors to afro-montane forest tree species
3. Evaluate the relative effectiveness of sunbirds as pollinators of afro-montane forest tree species

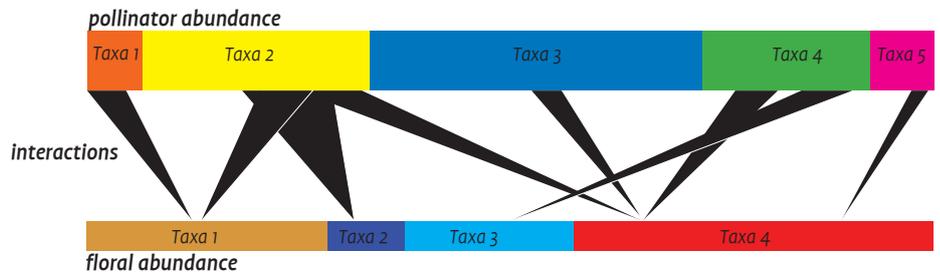
Prof Dave Kelly (UC) and Assoc Prof Jim Briskie (UC) are involved with this project.

A preliminary mutualist web in a West African montane forest



Kennedy Poloma Yoriyo, PostDoc (Gombe State University); A PhD student (Aplori); Merodie Beavon, MSc graduate (UC), Volunteer; and Daylese Campbell, Undergraduate (UC) Volunteer

In order to begin to understand the role of different seed dispersers and pollinator species / groups at Ngel Nyaki we are going to begin to create a mutualist web. To do this we need to identify all the different seed dispersers and pollinators (at least to family level) on all (or as many as possible) of the tree species in Ngel Nyaki forest.



The figure above shows an example of a basic pollinator web.



To do this transects (already cut throughout the forest) will be walked on a regular basis and trees will be observed for seed dispersers and both insect (K. Poloma and D. Campbell) and bird (M. Beavon and D. Campbell) pollinator activity. Because of the difficulties of differentiating between insect/bird visitation and pollination, we shall initially record only visitation. Insects will be collected and identified to genus level wherever possible.

We may have to build viewing platforms at several strategic locations along the transects to give us access to higher trees.

Prof Dave Kelly (UC) and Dr Ulf Ottoson (Aplori) are involved with this project.

Fresh water ecology

The influence of land degradation on fresh water macro invertebrates in streams in and close to Ngel Nyaki forest Reserve



Danladi Umar, PhD FUTY (UC) Nov 07

Almost nothing is known about the stream life of Nigerian Montane forests, or how land degradation is affecting stream ecology in terms of the invertebrate fauna. All over Mambilla Plateau land use is changing, forest cover is being lost around streams, and erosion is increasing.

Within and around Ngel Nyaki Forest Reserve streams are suffering from varying levels of degradation. Within Ngel Nyaki forest itself streams are relatively undisturbed, while streams running across grasslands are often denuded of trees.

The aims of this study are to:

- 1) Identify the macro invertebrate fauna in the streams around Ngel Nyaki
- 2) Investigate the effect of different levels of land degradation on the macro invertebrates
- 3) Design experiments to identify which environmental factors most affect the macro invertebrates.

The results of this work will be used in assessing the environmental impact of overgrazing on Mambilla Plateau.

Danladi is working with Dr Jon Harding from UC on this project.

Medicinal plants

Medicinal properties of trees used as medicines within Ngel Nyaki Forest Reserve



Aliyu Babale, Lecturer at University of Jos, PhD (U Maiduguri) Nov 07

Extract from the stem, bark and leaves of key tree species within Ngel Nyaki forest will be analysed for the presence or absence of phytochemical constituents such as tannins, alkaloids, resins, saponins, triterpenes, coumarin and some steroids. The toxicity of these species will be investigated by administering extracts orally on Swiss albino mice to determine the mortality rate. This will undertaken under laboratory conditions using lethal dose (LD50) in mice.

Anti-microbial / bacterial properties will be tested against type strains of fungi, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas* sp, *Salmonella* sp, *Bacillus subtilis* and clinical isolates of *Staphylococcus* spp., using agar diffusion techniques. The extracts will inhibit the growth or otherwise of the organisms listed above.

Remote sensing and geographical information system application to forest biodiversity assessments of Ngel Nyaki montane forest and its associated fragments



Ralph Adewoye (UC), PhD Nov 07

No GIS survey has been carried out around Ngel Nyaki forest reserve, yet this sort of survey would provide valuable base-line data for future biological work.

Objectives of study

1. Determine the current land cover and land use around Ngel Nyaki Forest using satellite imagery.
2. Identify and delineate Ngel Nyaki Forest and its associated riverine fragments from satellite imagery and aerial photographs.
3. Determine the reduction in forest cover and identify land use changes in the area over the last 30 years.
4. Determine the vegetation diversity within the delineated forest and fragments.
5. Determine the soil properties of the study area under different land use
6. Determine the relationship between soil properties and the vegetation distribution of the study area.
7. Produce a vegetation and soil map of the study area.
8. Make necessary recommendations regarding land use in relation to forest management.

It is envisaged that this project will be the beginning of a more wide ranging GIS survey of Mambilla Plateau.

Dr Hamish Cochrane (UC) is an associate supervisor on this project.

Associate Supervisors

Dr Akosim (FUTY) Wildlife management
Prof Ezealor, Ahmadu Bello University, Zaria
Assoc Prof Jim Briskie (UC) Biology
Dr Jenny Brown (UC) Maths and Statistics
Dr Hamish Cochrane (UC) Forestry
Dr Jon Harding (UC) Biology
Professor Dave Kelly (UC) Plant Ecology
Dr Tella Iyiola (FUTY) Ecology
Dr S.A. Manu, A.P. Leventis Ornithological Institute, Laminga, Jos
Dr Ulf Ottoson, Leventis Conservation Institute, Aplori
Dr Andy Radford, University of Bristol (Biology)

Budget

Grants directly for the project:

\$US	Funding Body	Purpose
10,000	Nexen Nigeria	Running costs
10,212	North of England Zoological Society	Forest Restoration & Pollination Biology
5,000	Leventis Foundation	Running costs
2,413	AWC Lagos Branch	Solar panels & water pump
1600	DHL Nigeria	Student Scholarship
10,000	Gombe State University	Running the program
6,000	Federal University of Technology, Yola	Running the program

Fellowship

Danladi Umar from Gombe State University has been offered a research fellowship from the University of Canterbury to visit the University of Canterbury (NZ) for three months from January to April 2008, and study fresh water ecology techniques with Dr Jon Harding.

Fulbright Scholarship

Josie Beck, who carried out her BSc Hons. research ("An estimation of population size of the Endangered chimpanzee *Pan troglodytes vellerosus* in a Nigerian montane forest: implications for conservation.") during 2004, and who worked with the Project as a volunteer during October-December 2006 has been awarded a Fulbright scholarship. Josie hopes to study primatology at Harvard, but wants to return to Ngel Nyaki sometime in the future for more research.

On the web

The NMFP project has a regularly updated website hosted by the University of Canterbury. In addition there is a Facebook group, to allow past, present and future students and supporters to communicate freely with each other and maintain links with the project.

A large amount of video footage was gathered by Matt Walters during his last trip to the field station. This is being edited into several video clips to be put on YouTube, a video hosting website. This will allow a wider audience to experience the sights and sounds of the wide range of research being undertaken in and around Ngel Nyaki forest.

The project also has a presence on GoogleEarth, allowing everyone on the web to see exactly where Ngel Nyaki is.

These technologies assist in communicating the work being done by the project to a global audience, and help researchers and supporters to develop their own community online.

Notes From the Field



Augustine Ntim tending the plants in the nursery.

Tree nursery

The nursery is growing in size, and we now have a good bank of saplings including both forest and pioneer species. This rainy season (July 2007) we have started planting the grassland and streamside that is fenced off for forest restoration close to the field station. Species include *Syzygium guineense*, *Entandrophragma angolense*, *Pouteria altissima*, *Anthonotha noldeii* and *Prunus africana*.

New tree species

Dr Douglas Stone, an expert on the Melastomataceae has identified one of our collections as being a new species to science; *Memecylon* sp.nov (See photo at right). Doug identified the Ngel Nyaki tree species thanks to Martin Cheek from the Royal Botanical Gardens Kew, who recognized it as being different from any other *Memecylon* he had seen in West Africa.



Memecylon sp.nov, a new species identified from Ngel Nyaki forest.

Interesting butterfly species

Robert Warren and D. P. Knoop identified *Euxanthe crossleyi*. This species has only been seen twice before in Nigeria, both times in Oban Division, so was previously thought to be confined to lowland, moist forest.

Postgraduate field course

In December 2006 the NMFP ran its first field course at Ngel Nyaki on Biodiversity and Taxonomy for M. Tech. Wildlife Conservation and Management and M. Tech Forest Biology and Ecology FUTY postgraduate students. The course ran for three days and included lectures, workshops and field work.



FUTY postgraduate students photographed during a plant identification workshop, part of their field course.

Community Projects

Nursery school and bore hole for Yelwa village

Special thanks to Robert Warren and Exxon Mobile for donating money for a nursery school and bore hole for Yelwa village. The American Woman's Community (Lagos Branch) also contributed Small World funding towards the project. Building will begin in November 2007, once the dry season has begun and water levels have fallen.

New Collaborations

The NMFP has been included in a Marie Cure Initial Training Network bid led by the University of York ' South and East African Ecosystem Diversity Under Climate Change', with participants from UK, Europe and Africa. UC's contribution (with Dr's Jennifer Brown & Alex James from math) is modelling seed dispersal under climate change. Pending

Dr Alistair Jump (University of York) and Hazel Chapman applied for a British Council Researcher Exchange Programme Award for Alistair to visit the University of Canterbury and the NMFP for a joint project using molecular techniques to measure gene flow among Montane forest fragments. Pending.

Dr Peyman Zawa-Reza (Department of Geology, University of Canterbury) and Dr Hazel Chapman have applied for a British Ecological Society Small Grant for Dr Zawa-Reza to visit Ngel Nyaki in April 2008 and set up some climate stations to help with the phenology and other research projects. Pending.

Dr Ulf Ohosson and Dr S.A. Manu from the A.P. Leventis Ornithological Institute are each involved in student supervision of ornithological projects.

Conferences and Publications

AETFAT Feb 25th- March 3rd 2007 Yaoundé, Cameroon

Spoken paper

Testing the Janzen-Connell hypothesis in a West African Montane forest . Arne Mattheus and Hazel Chapman.

Posters (see pages 18-19)

Chapman H. M. Bekker R. , Barnard J. & Shu G. The botany of Tchabal Mbabo; a contribution towards a Nigerian / Cameroon Transboundary initiative.

J. O. Ihuma, H. M. Chapman , T. Iyiola, J.A ,Brown,. C. Akosim Montane Forest Fragmentation and its effect on tree and frugivore species composition.

Evolution Society of America June 16th-20th 2007 Christchurch, New Zealand

Spoken paper

Is smaller better? Seed size and dispersal probability in a West African Montane forest. Hazel Chapman & Ihumo Jerome

ConserVision 2007 4th-7th July, Hamilton, New Zealand

Spoken paper

'Developing an economic framework for the conservation of Nigerian montane forests' Katie Bicknell & Hazel Chapman

Ecological Society of Nigeria 15-20th October 2007 Vom near Jos, Plateau State , Nigeria

Spoken papers

The role of frugivores in a Nigerian Afromontane Forest Jerome Ihuma, H. M. Chapman, T. Iyiola, J.A., Brown, C. Akosim

The role of putty nose monkeys in seed dispersal in Ngel Nyaki forest Reserve, Taraba State, Nigeria. Stephen Gawaisa, H. M. Chapman, and C. Akosim

Invited talks

American International School, Lagos February 2007 Nigerian Montane Forest Project. Hazel Chapman

ABTI University, Yola, Taraba State, Nigeria. February 2007 Nigerian Montane Forest Project. Hazel Chapman

Federal University of Technology Yola. Faculty Talk. February 2007 Nigerian Montane Forest Project. Hazel Chapman

Lincoln University Seminar Series May 23rd 2007 The Economics of the Nigerian Montane Forest Project. Katie Bicknell and Hazel Chapman

University of Canterbury, School of Biological Sciences Seminar Series. October 11th 2007 Plant-Animal Interactions in a West African Montane Forest. Hazel Chapman

Papers

Ihuma, J. O.; Chapman, H. M.; Iyiola, T., Brown, J.A.; Akosim, C. Nigerian Montane Forest Fragments: Fruit, Frugivores and Seed Dispersal. Submitted July 07; under review **Biotropica**

Chapman, H. M. & Marchant, R. Tropical Afromontane forests and their likely susceptibility to Global Change. Invited Review. Under revision for **New Phytologist**

Beck, J. & Chapman, H.M. An estimation of population size of the Endangered chimpanzee *Pan troglodytes vellerosus* in a Nigerian montane forest: implications for conservation. Submitted July 07; under review **Oryx**.

Chapman, H. M. Bekker, R. , Barnard, J. & Shu, G. The future of Tchabal Mbabo -A Nigerian / Cameroon Transboundary initiative. Proceedings AETFAT Conference Yaoundé. August 2007.

Chapman H. M. The Nigerian Montane Forest Project. Proceedings of the Nigerian Field Society Special Meeting. Kew, London. September 2007.

Montane forest fragmentation and its effect on tree and diurnal frugivore composition in North East Nigeria.



Ihuma Jerome³, Hazel Chapman^{1,2}, Tella Iyiola³ and Callistrus Akosim³.

¹ Director, Nigerian Montane Forest Project; Yelwa, Taraba State, Nigeria.

² School of Biological Sciences, University of Canterbury, New Zealand.

³ Department of Forestry and Wildlife, Federal University of Technology, Yola, Nigeria.

Nigerian montane forests are:

- satellite populations of many Afrotropical endemics.
- of a rare dry type, and harbour many threatened plant and animal species.
- fall within the Cameroon Mountains Endemic Bird Area.
- Forests range in altitude from ca. 1500 m to 2420 m on Gangirwal, Nigeria's highest mountain.
- vary in size from small fragments of less than one hectare, to riverine strips and impressive stands of over 20 km² [1,2].



Figure 1. View over Dutsin Lamba in Gashaka Gumti National Park.

Most of these forests are within Gashaka Gumti National Park, and only one forest – Ngel Nyaki, remains on Mambilla Plateau, where there once was good forest cover. All over Mambilla forest patches are disappearing through wood chopping, burning and cattle trampling [2].

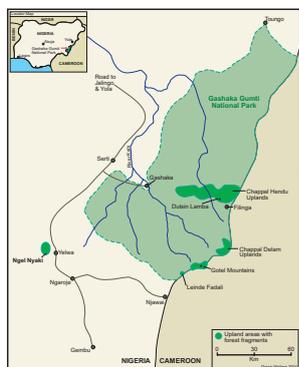


Figure 2. Map showing areas with upland forest fragments.

Ngel Nyaki Forest Reserve is 46 km² in area, comprising 8 km² of montane/sub-montane forest, the rest being grazed and burnt savanna woodland and grassland. Outside the reserve, but within what was the unofficial 'buffer zone', are streamside forest fragments in varying stages of degradation.



Figure 3. Fragment B.

The aim of this research [3] was to investigate the effect of fragmentation / degradation on tree, tree seedling, and diurnal frugivore species composition, in order to:

1. Predict which frugivores might best promote natural regeneration (if forests are given protection from grazing and burning).
2. Identify species which are unique to the fragments so that a case can be made for their inclusion within Ngel Nyaki Reserve.

Methods

The tree species, tree seedlings, and diurnal frugivore community was described for Ngel Nyaki forest (NN) and three forest fragments, A, B and C. The fragments were at increasing distances away from NN, with corresponding increase in degradation and decrease in fragment size (Table 1).

	NN	A	B	C
Distance from NN (km)	0	0.3	1	1.6
Area (ha)	80	2	1.4	0.2
State of degradation*	0	1	2	3

* 0 = none, 1 = burnt and cut over.

Information on woody species composition in terms of relative frequency, relative density, dominance and 'importance' in NN and fragments A, B and C was determined using a plotless sampling technique P.C.Q. [4].

All tree seedlings within twenty 1m² quadrats per site were measured and recorded.

Frugivore species feeding within each site were identified [5] from records taken over a total of 5, 12 hour day, observation per site. On each of the 5 days each frugivore seen was recorded the first time only it was observed.

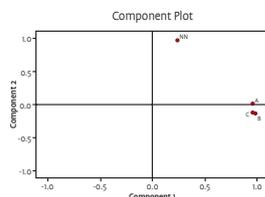
Data Analysis

Principal Component Analysis (PCA), Cluster analysis, and paired t tests were used to analyse the differences in tree and diurnal frugivores species composition between NN and fragments A, B and C.

Results

Frugivore communities

The first two components of the PCA explained 95% of the variation.



There is a clear difference between NN and fragments A, B & C in terms of frugivores composition. However fragments A, B & C are not statistically different from each other as confirmed by t-tests.

Six diurnal frugivore species were observed in all four sites on every sampling day: the red-eyed dove (*Streptopelia semitorquata*), double-toothed barbet (*Lybius bidentatus*), willow warbler (*Phylloscopus trochilus*), garden warbler (*Sylvia borin*), common bulbul (*Pycnonotus barbatus*) and the tree squirrel (*Funisciurus anerythrus*). These frugivores can potentially disperse seed among the sites.

Thirteen species of frugivores, 5 of which were primates, were only recorded from NN: slender billed greenbul, *Andropadus gracillirostris*; Naked-faced barbet, *Gymnobucco calvus*; Yellow-rumped tinkerbird, *Pogoninus bilineatus*; Yellow spotted barbet, *Buccanodon duchallii*; Great blue turaco, *Corythaeca cristata*; Green turaco, *Tauraco persa*; piping hornbill, *Ceratogymna fistulata*; blue duiker, *Cephalophus monticola*; Olive baboon, *Papio anubis*; Putty nose monkey *Cercopithecus nictans*; Mona monkey *Cercopithecus mona*; Black and White colobus, *Colobus guereza*, West African chimpanzee, *Pan troglodytes verlorosus*.

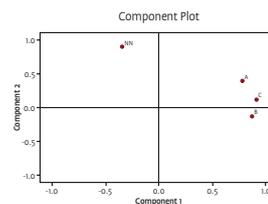
Seven species of avian frugivores were recorded more frequently in the fragments than in NN: Double-spurred francolin, *Fracollinus bicalcaratus*; African thrush, *Turdus pelios*; White crested turaco, *Tauraco leucolophus*; Bannerman's weaver, *Ploceus bannermani*; Simple leaflove, *Chlorocichla simplex*; Baglafaecht weaver, *Ploceus baglafaecht* and the western grey plantain eater *Crocinifer piscator*. The latter two species were never recorded in NN, but were confined to the fragments and *T. leucolophus* was only ever found on the forest edge, it roosts in the fragments.



Figure 4. Putty nose monkey (*Cercopithecus nictans*), a frugivore found in Ngel Nyaki forest.

Vegetation Analysis

The first two components of the PCA explained 85% of the variation, and as with the frugivore communities, NN stood apart from each of the three fragments in terms of tree species composition.



With the cluster analysis set at 3 clusters, cluster 1 comprised 19 tree species which were almost exclusively confined to NN: *Belvischmedia mannii*; *Anthothis noldii*; *Campylospermum flavum*; *Carapa grandiflora*; *Chrysophyllum albidum*; *Deinbollia pinnata*; *Garcinia smeathmannii*; *Hannaia klaineana*; *Isolona delightonii*; *Newtonia buchananii*; *Pouteria altissima*; *Rothmannia ucelliformis*; *Strombosia schefferi*; *Synsepalum sp*; *Tabernaemontana contorta*; *Voacanga bracteata*; *Xymalos monospora*; *Zanthoxylum lepteuril*.

Cluster 2 comprises species which are most common in fragments A and B, and NEVER occur in NN. Some of them are typical montane forest species: *Albizia gummifera*; *Anthothis vogelii*; *Clausena anisata*; *Dombeya ledermanni*; *Entada abyssinica*; *Ilex mitis*; *Nuxia congesta*; *Pittosporum viridiflorum*; *Rauvolfia vomitoria*; *Rubiaceae*; *Symphonia globulifera*.

Cluster 3 comprises species which tend to be most common in the extremely degraded fragment C, and never, or only rarely, in NN: They are widespread, pioneer species. *Allophylus africanus*; *Bridelia micrantha*; *Canthium vulgare*; *Croton macrostachyus*; *Maesa lanceolata*; *Psorospermum coymbiferum*; *Spygyllum guineense*; *Trema orientalis*.

Seedling regeneration

No seedlings of tree species restricted as adults in NN (see above) were found in any of the fragments A, B or C. Almost all the seedlings in the fragments were of pioneer species such as *Canthium vulgare* and *Trema orientalis*.

Conclusions

- Both tree species composition and frugivore communities are significantly different between Ngel Nyaki forest and the three forest fragments A, B & C. However the fragments, despite differing in area and state of degradation, are not significantly different to each other in terms of tree species composition or diurnal frugivore community.
- Six species of avian frugivores (see above) feed within NN and in the fragments, and were observed flying between the sites. These are the most likely potential dispersers of small fruited forest species between NN and the fragments A, B and C.
- No evidence of seed dispersed from NN into fragments A, B and C in terms of seedling regeneration was found. All tree seedlings in the fragments were of pioneer species already present as adults in the fragments.
- The fragments are home to taxa which do not occur within NN forest: Especially noticeable for conservation reasons are the white-crested turaco (*Tauraco leucolophus*) and montane forest woody species *Pittosporum viridiflorum*, *Ilex mitis* and the RDL *Eugenia gilgii*.
- If these fragments continue to be destroyed by wood chopping, burning and cattle grazing, the white crested turaco and at least one RDL montane forest tree species will become locally extinct.

Acknowledgements

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The botany of Tchabal Mbabo

A contribution towards the Nigerian / Cameroon Transboundary initiative

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Introduction

A project to protect the montane environment spanning the border between Cameroon and Nigeria began in 2003. BirdLife International ran the project in partnership with the Governments of both countries.

The geographic area incorporates Gashaka Gumti National Park (6,670 sq. km.) in Nigeria, and the far smaller (30,000 hectares) Tchabal-Mbabo in Cameroon, which has no formal protection.

The idea was to create a large transboundary protected area with the full participation of the local people.

The project began with a series of rapid biodiversity and socio-economic surveys of Tchabal Mbabo by BirdLife International.

The project was funded by UNGP-GEFI.



Figure 1. Cameroon mountains endemic bird areas

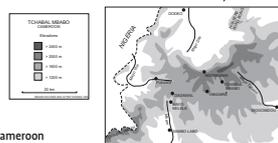


Figure 2. Tchabal Mbabo, Cameroon

Methods

- A 10 day trek of Tchabal Mbabo from Mayo Kelele, Yangaré, Ndongawa, Mayo Deo, and Fungoi (Figure 2).
- All vegetation types were documented, – but especially the montane forests and the transition towards wooded savannahs which contribute to the global importance of Tchabal Mbabo.
- The BirdLife International GIS Lansat land cover map was ground proofed.
- Specimens of unidentified plant species were collected for identification later at Kew. Copies are held at the National Herbarium Yaoundé.
- A photographic record of all vegetation types was compiled.

Results

- Elevation, fire and cattle grazing are all important in determining plant species composition.
- We recognized 16 vegetation units.
- 10 Red Data List species were recorded. *Chassalla laikomensis*, *Dombeya cf ledermannii*, *Helichrysum cameroonense*, *Khaya grandifoliola*, *Milletia conraui*, *Labellia columaris*, *Peucedanum angustisectum*, *Pouteria altissima*, *Prunus africana*.

Threats

- Burning, cattle grazing, wood cutting, and land clearance for farming by the local Fulbé.
- Non resident contractors are devastating populations of *Prunus africana* by bark stripping.
- The timber tree *Hallea stipulosa* is now rare.

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Figure 3. Montane escarpment forest



Figure 4. Montane stream side fringing forest



Figure 5. Montane Hyparrhenia grassland



Figure 6. Montane forest - grassland ecotone



Figure 7. Submontane escarpment and gallery forest



Figure 8. Woody savanna transition forest



Figure 9. Lowland gallery forest

Vegetation Units

In this poster we shall describe the 7 vegetation units of high botanical interest (of 16 units).

1A. Montane escarpment forests

The Tchabal Mbabo forests are of an especially rare, dry type.²

The escarpment forests > 1700 m on Tchabal Mbabo represent unspoilt examples of West African montane / submontane and transition forest. While they are not rich in terms of species numbers, the ecosystem is rich in biodiversity value. These forests complement their Nigerian equivalent³. Eg. Tchabal Mbabo has extensive stands of *Prunus africana*, and there is a more developed forest ecotone than in GGNP. Figure 3.

1B. Montane stream side fringing forests

The stream side fringing forests > 1800 m which dissect the *Sporobolus* grassland are much more extensive than those in GGNP. This ecosystem is probably very similar to what Mambila Plateau (Figure 1) would have looked like 40-50 years ago⁴. The plateau fringing forests are essential for maintaining year round water supply and are habitat for many birds and other animals and insect. Figure 4.

2. Montane Hyparrhenia grassland

Montane grassland free from cattle grazing is rare in West Africa. It has almost become extinct within GGNP, Nigeria⁴ and is absent from the Ijim montane area of Cameroon⁵. Alt. >1700 m. Figure 5.

3. Montane forest - grassland ecotone

The *Gnidia glauca* dominated forest-grassland ecotone is very species rich; it is habitat for light demanding, trampling sensitive plants such as the IUCN Threatened *Peucedanum angustisectum*, which here reaches 1 m in height, and many species of fern. Alt. >1700 m. Figure 6.

4. Water seepages / bogs

Permanently wet water seepage areas are relatively uncommon on Tchabal Mbabo but are species rich, and therefore of high biodiversity interest. They need more study. Alt. >1500 m

5. Submontane escarpment and gallery forests and Hyparrhenia savanna

Both the escarpment and gallery forests are valuable as part of a continuum from lowland to montane ecosystems, and as a reservoir of rare species such as the IUCN Threatened *Dombeya cf ledermannii*. Alt. >1500 m. Figure 7.

6. Woody savanna transition forests

The transition between lowland and montane forest is a very rare situation in West Africa. Thomas & Thomas (1996) suggest that the Tchabal Mbabo transition forest is the best example in this area of Cameroon. A similar transition, differing in detail, occurs in GGNP. Alt. 1500 – 1000m. Figure 8.

7. Lowland gallery forests

Species composition of the gallery forest below +/- 1500 m is similar to the equivalent ecosystem in GGNP. However its extent and its relatively good condition make for a valuable conservation area. Figure 9.

Conclusion

- Despite the acknowledged global biodiversity importance of the Tchabal Mbabo - Gashaka Gumti transboundary area, it has not proved possible to secure the financial support for this important conservation work to proceed.
- Meanwhile, the pressure on the habitats and species in this area continues to increase.
- Funding and implementing the plans drawn up by the Governments of Nigeria and Cameroon in partnership with the BirdLife International Partnership therefore becomes increasingly urgent if the biodiversity of this important area is to be conserved, and the livelihoods of the local people improved.

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