

Nigerian Montane Forest Project
Montane Forest Conservation Initiative Nigeria



Annual Report



Cover: View of the field station November 2017. From left to right Usman Abubakar, Elisha Emmanuel, Shemsu and Aliyu Usman

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Introduction



Anastasios (Tasso) Paul Leventis - Patron



Phil Hall (Chair)



John Adeyemi Adeleke



Roger Wilkinson



Danladi Umar



Hazel Chapman

The focus of this year's report is on the latest developments in our science and forest restoration initiatives. 2017 has seen several new international science collaborations and conservation linkages and to this end we have hosted international researchers from the US, UK and Germany.

Our report reflects the enthusiasm and professionalism of all staff. With the leadership of manager Misa Zubairu and his deputy Usman Abubakar, every staff member is proud to be part of the team and takes ownership of their particular role, so that the NMFP is highly functional. All staff employed by the Project appear on page 26.

Of course input from the management team is invaluable and Dr's Danladi Musa and Kennedy Poloma, along with our accountant Ibrahim Sani continue to travel quarterly from Gombe State University to Jalingo or Mambilla for meetings with Misa and Usman. This year Professor Delphine Davis from the biology department of Taraba State University (TSU) has joined the team and we welcome her future input.

Our Advisory Board offer support in many ways; they provide advice, support students, and widen our network. This year I am especially grateful to Tasso Leventis who is funding Elisha Emmanuel as our new science co-ordinator. Elisha, a graduate of the University Jos is an accomplished botanist and already knows the NMFP well. With a new co-ordinator however, comes the loss of Shedrach Konvong, Elisha's predecessor. After two years with the NMFP we will miss Shedrach and wish him well as he begins married life in Jos.

Ambassador Ayo Olukanni has provided invaluable assistance to the smooth running of the project for several years now, first in his capacity as Nigerian Ambassador to Australia/New Zealand and more recently on the ground in Nigeria. He is officially an Associate of the NMFP.

Our funders keep the project going and this year as usual, I am extremely grateful to you all. Of note is the contribution from Nexen, a wholly owned subsidiary of CNOOC, who's continued support is very much appreciated. The New Zealand Ministry of Foreign Affairs and Trade have made a significant contribution in funding our science outreach centre (see page 20).

During 2017 five UC postgraduate students have been working within the NMFP, four PhD students with field based projects at Ngel Nyaki and one MSc lab based in New Zealand. Sadly the current climate in Nigeria affected our IT (work experience) undergraduate student numbers, but we already have a full quota (20+) for next year.

The Project has a new affiliation; we are fortunate in that the Yelwa football team (Page 25) has offered to step in whenever we need extra hands, for example, doing the fire tracing or removing invasive weeds such as guava. In return the project will keep the team supplied with footballs and jumpers.

Given that 2017 has seen unprecedented challenges which have affected staff and students alike, I congratulate the team on their unflinching commitment. We all hope that 2018 will bring a return to normality in Taraba State.

Hazel Chapman

Director, Nigerian Montane Forest Project

Our values

Mission Statement

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

Aims

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

Our networks

Project Partners / Collaborators

A.P. Leventis Ornithological Research Institute (APLORI), Jos, Nigeria
Chester Zoo, England
Gashaka Biodiversity Project, England/Nigeria
Gombe State University (GSU), Nigeria
Mayfield Community Ecology Laboratory, The University of Queensland, Australia
Nigerian Conservation Foundation (NCF), Nigeria
Nigerian National Parks (NNP), Nigeria
Professor Pierre-Michel Forget, Natural History Museum, Paris, France
Royal Botanic Gardens, Kew, England
Smithsonian Tropical Research Institute-ForestGEO, USA
Taraba State Government, Nigeria
Taraba State University (TSU), Nigeria
University of Canterbury (UC), New Zealand

Project Funders

A.G. Leventis Foundation
A.P. Leventis
Chester Zoo
Direct Aid Program (DAP) – Australian High Commission, Nigeria
Ministry of Foreign Affairs and Trade New Zealand
Nexen, a wholly-owned subsidiary of CNOOC Limited
Smithsonian Institute
Taraba State Government
Retired General T.Y. Danjuma

Academic Supervisors

Assoc Prof Hazel Chapman (UC)
Dr Alexander Christianini (Federal University São Carlos, Brazil)
Prof Will Creswell (University of St Andrews, UK)
Prof Ian Dickie (UC)
Prof Pierre-Michel Forget (Natural History Museum, Paris, France)
Dr Daniel Gerhard (UC)
Dr Marie Hale (UC)
Assoc Prof Alex James (UC)
Dr David Kenfack (Smithsonian Institute, Washington D.C. USA)
Dr Shiiwua Manu (APLORI)
Dr Roger Pech (Landcare Research, Lincoln, NZ)

A snapshot of our science



Figure 1 Jennifer in the laboratory at UC.

Postgraduate Student Updates

Seed dispersal and ecosystem services are common themes among postgraduate researchers and current projects investigate ant, bird and rodent dispersal

Ground dwelling ants within an Afromontane forest and their role in seed dispersal

Jennifer Agaldo, PhD student at UC, TY Danjuma Scholar

Field assistants Thomas Patrick and Musa Bawuro

Ants are important dispersers of myrmecochores (plants whose seeds have appendages attractive to ants). Recently however, Neotropical studies have shown that ants can disperse seeds of fleshy fruits more obviously adapted for vertebrate dispersal. Whether or not, and to what extent, this happens in African forests is unknown.

Using pitfall traps along transects from grassland into forest, Jennifer has identified a total of 17 ant species in and around Ngel Nyaki forest reserve, considerably fewer than is normally found in lowland tropical forests. Moreover, most of the Ngel Nyaki species occur in the grassland and forest edge; forest dwelling species were rare. A new record for West Africa, the extremely invasive species *Pheidole megacephala* was recorded in all three habitats.

Of all 17 species recorded, only two, *Pheidole* sp.1 and *Myrmicaria opaciventris* were observed interacting with fruits or seeds (together these

dispersal units are referred to as diaspores). However these two ant species interacted with 12 different diaspore species, half of all the diaspore species investigated. They moved diaspores of six species and cleaned the flesh of four fruit species. Ants were attracted to small diaspores, especially fleshy fruit of intermediate colour (they avoided bright or dark fruits) high in calcium and carbohydrate content.

An experiment using *Paullinia pinnata* to determine whether cleaning fruit of its pulp gave seeds an advantage in terms of germination times showed that it did; seeds from fruit cleaned by ants germinated faster and their seedlings grew faster than seeds without cleaning.

While ants affected soil physical properties by enhancing porosity, they did not affect chemical properties of the soil. However, soil from ant nests did have a positive effect on plant growth compared to surrounding soil.

To what extent ants are important dispersers of tree species needs farther investigation, but a key finding of this research is that in this geographic locale very few ant species interact with a relatively large number of diaspore species- which is in contrast to the findings of studies elsewhere where many ant species interact with a few diaspore species.



Figure 2 Biplang with field assistants checking camera traps. In addition to Pouched rats they have pictures of the African Golden Cat, Pangolin, Monitor lizards, bush buck and civet cats.

Ecology of the African Pouched Rat *Cricetomys* sp. nov

Biplang Yadok UC PhD student, TY Danjuma Scholar

Field assistants Adams Hassan, Ibrahim Umar, Ali Abdu, Yusuf Tongbuin and Jafar Bapetel

Biplang is working on the feeding ecology of the African Giant Pouched Rat, *Cricetomys* sp. nov. He reports on his thesis below:

Firstly, my results show that *Cricetomys* sp. nov is very much a forest dweller, rarely moving out of the forest areas. Knowing this is important because the species in Ngel Nyaki is new to science and nothing is known of its ecology; most species within the genus are different in that they use grassland or grassland/forest habitat.

Interestingly, and in contrast to many other rodent studies elsewhere, I have demonstrated that the rats use all forest habitats equally in as much as they do not avoid certain areas because of perceived predation risk. Theoretically they should avoid open areas for fear of attack, but

this is not the case at Ngel Nyaki which suggests that predators such as wild cats are no longer abundant. This information thus informs us on the 'health' of the forest and also suggests that these rats may increase in abundance.

Cricetomys is a scatter-hoarder (Aliyu et al 2014), inadvertently dispersing seeds when they are left behind in a cache instead of being eaten. I have taken Aliyu et al's work farther and found that the seed predation/dispersal ratio is unaffected by season (wet vs dry), seed size or seed species. Again, this is in contrast to findings from the Neotropics where scatterhoarding is common. It suggests that food in Afromontane forests is scarce, so that 'anything goes', a predictable outcome given that seed production and diversity is known to decrease with an increase in altitude. The one factor which does impact on seed fate is its nutrient content (fats and proteins). *Cricetomys* preferentially caches seeds high in fat content. The species in Ngel Nyaki forest with the highest fat content is *Carapa oreophila*, adapted for dispersal by now extinct elephants. This suggests that *Cricetomys* is indeed a substitute disperser.

There is still much to learn about *Cricetomys*, e.g. its population dynamics, growth rates and interaction with other competitors. These factors, combined with the information from my research will inform forest managers as to how these rats can best be managed to aid in passive forest restoration. The NMFP is already using the data in forest management at Ngel Nyaki; active restoration through planting of large-seeded species has begun in grassland around the forest edge where we now know rats won't cache seeds.

Despite the relatively small area of my study site my research is nevertheless extremely valuable. At one level it is aimed at conserving a Ngel Nyaki forest itself; if properly conserved Ngel Nyaki will serve as a source of ecosystem services and providers (such as habitat for clean water, crop pollinators, crop pest controllers and medicinal plants). In this overpopulated landscape rivers are drying up and many rare and endangered species are losing habitat elsewhere.

On another level my findings about substitute dispersers can be extrapolated across Africa, I am pioneering African research into substitute dispersal.



Figure 3 Murna recording bird data with field assistants Yakubu and Ahamadu

The value of forest fragments in maintaining avian functional diversity and associated ecosystem services within a West African agricultural landscape

Murna Tela PhD NZ Development Scholarship

Field assistants Yakubu Vugeh, Ahamadu Usman and Usman Bashiru

My thesis aims to determine whether small forest fragments provide ecosystem services to surrounding crop species by being habitat for birds which control insect pests of crops.

I have recently completed my second field season and together with my first (wet season data) I have recorded 203 bird species from 52 families,

with 156 species observed at the forest fragments and 113 species observed in the farmlands.

I used data from point transects to present a general description of the bird community composition in the different habitats surveyed in the Mambilla forest agricultural landscape.

I identified all bird species associated with farmlands and forest fragments as either 'farmland', 'forest fragment', or 'generalist' species (i.e. those which depend on both habitats). All species have been categorised into their trophic functional group.

I am most interested in insectivores, as these are the guild which will control insect pests. In total I observed 68 species of insectivores, 45 of these are present in the farmlands, but all of them use the forest habitat. Most importantly, 72% of these species use the forest fragments for breeding which implies that retention of forest fragments is likely to enhance pest control for Nigerian farmlands.

Using non-metric multidimensional scaling ordination plots, I found that bird species composition in the farmlands provides habitat for a variety of bird species that were known to normally associate with forest habitats, and hence the forest-agricultural landscapes may be an important component for conservation strategies.

I am currently analysing my data to explore whether distance to forest fragment from farmland influences the frequency of insectivores. Additionally, using a series of caged vs open maize plots across the Mambilla Plateau, I am investigating the influence of insectivores on crop productivity.

My hypothesis is that if birds are excluded from contact with the maize plants, more insects will attack the crop and productivity will be reduced.



Figure 4 Ivy and her field assistants recording germinated seedlings for her experiment into negative density dependence.

The role of clumping and inter-specific negative density dependence in shaping species Usman distributions in Tropical Afromontane Forest

Iveren Abiem PhD Nigerian TETF

Field Assistants

Very little information exists on seed dispersal, plant recruitment and the community dynamics of tropical montane forests (Chapman et al., 2016), and this is especially true of Afromontane forests -small forests located within grassland matrices that are continuously under intense pressure from agriculture and pastoral practices. While these forests are floristically diverse and provide vital ecosystem services such as carbon sequestration and watershed protection, they are threatened by agricultural and pastoral practices. In addition hunting has led to a steep decline in the number of vertebrate seed dispersers found in these forests.

The aim of this study is to help understand factors shaping species distribution patterns and diversity. Such knowledge will feed into forest

management decisions and help ensure forest survive.

Specifically, I am investigating the role of clumping (individuals of a species establishing close to one another) and inter-specific negative density dependence (where the abundance of a species is limited by negative interactions that are not species-specific e.g. interspecific competition) in shaping species distributions within Ngel Nyaki forest, a typical Afromontane forest.

My objectives include:

1. To determine if patterns of seedling composition and abundance correspond to seed arrival patterns.
2. To determine if patterns of established seedling composition and distribution reflects the patterns observed for the large-sized trees in Ngel Nyaki Forest.
3. To evaluate the effects of negative density dependence on seedling persistence.
4. To investigate if established seedling composition is driven by conspecific negative density dependence or interspecific negative density dependence.

I am investigating these questions using field observations involving seed and seedling censuses and field and shade house experiments. My field site is the recently established 20.28 hectare Ngel Nyaki Forest Dynamics plot (NNFDP) of the Ngel Nyaki Forest Reserve. Within the plot, I have set up 106 seed traps to estimate seed input and conducted first censuses for recruited and established seedlings.

I have also set up a shade-house experiment to test for negative density dependence in common and rare forest species

This study will provide a comprehensive baseline seedling data for Ngel Nyaki forest and this will allow for comparisons with data from other forests. Also, with the reduction of seed dispersal services in tropical forests because of hunting and land use change, looking for signs of altered recruitment patterns reflecting dispersal limitation is a first step in effective forest conservation and forest restoration.



Figure 5 Field assistants trekking to Yana kurmi to collect seedlings for population genetic analysis. Yana is one of the most well protected sacred forests on Mambilla.

Genetic Analysis of Forest Fragment Genetic Diversity and Connectivity on the Mambilla Plateau, Nigeria.

Lily Brailsford

Usman Abubakar, Idris Musa, Adams Hassan, Alfred Christopher

In last year's report we gave details of Hazel and the field assistant's expedition to collect leaf samples from forest fragments across Mambilla Plateau. Due to very promising results in initial investigations, the field assistants returned to the fragments in June this year to gather further samples. These samples, collected from the common Afromontane tree species *Albizia gummifera* (Fabaceae) and *Clausena anisata* (Rutaceae), are being used to investigate the genetic diversity of and gene flow among the forest fragments. High rates of genetic diversity

are preferable for long-term survival of all species as it provides resistance to disease and a means to adapt to environmental change.

Lily has now processed all samples at the University of Canterbury. This procedure involved extraction of DNA from the samples and looking at differences in the length of specific regions of this DNA, which allows assessment of the genetic diversity possessed by the forest fragments across the Mambilla Plateau. Data analysis suggests that within Ngel Nyaki Forest Reserve both study species host high levels of genetic diversity. This is likely due to the relatively large size of the forest fragment, and is extremely positive news for the long-term viability of Ngel Nyaki. However, smaller forest fragments such as the village kurmis (forest fragments) of Kuma and Yana show evidence of much lower genetic diversity which, if left unmanaged, may affect the survival of these spiritually significant forests in the future.

Another notable result so far is that all the *Albizia* sampled so far are extremely similar in their DNA profiles which is indicative of a plateau-wide population, with seeds being freely dispersed by the wind among the forest fragments. In stark contrast, each patch of *Clausena* appear to be distinct from the others, with very little gene flow among them. This suggests that the birds and primates that disperse the fruits of *Clausena* are seldom crossing the large gaps between forests.

Lily presented these preliminary results at the University of Canterbury's Annual Biology Conference in October and was awarded 1st prize in the Master's student category. The findings of this research also generated a lot of interest at the New Zealand Molecular Ecology Conference in December.



Figure 6 Dr L A Mbaya Gombe State University Head of Department Geography and MR Micheal Abashiya, field trip coordinator, talking to students on a 300 level field trip.

Field Trips

In January 2017 Gombe State University visited with their third year geography class. The students measured soil characteristics and learnt

about the Mambilla landscape and communities.. We have good bookings for 2018 from a range of universities.



Figure 7A Gombe State University undergraduate IT (work experience) students



Figure 7B Taraba State IT students

Undergraduate students

As usual we have hosted cohorts of IT (work experience) students from Taraba, Gombe and Abubakar Tafawa Balewa University (Bauchi State) universities. Due to the troubles fewer students have been than we normally host, but

those who have spent time with the NMFP have enjoyed it very much.

The Bauchi students spend a year with us and so are able to develop a significant research project, see page 12.



Figure 8 Ridwan counting seeds and Idriss recording. The seeds are dropped by birds visiting the trees to perch or feed.

Plant traits which influence passive restoration

Ridwan Jafar, BSc student at Abubakar Tafawa Balewa University

Field assistants Idriss Musa and Ahmadu Usman

As part of our forest regeneration initiative, Ridwan, during his year with us as an IT student, has run an experiment to investigate the role birds play in seed dispersal from forest into grassland. The grassland has been fenced-off from cattle grazing and is protected from fire. The experiment, outlined in our 2016 Annual Report has now been running for a full year and we are currently analysing the data. The work will help us to understand dispersal limitation, filters to regeneration and how tree functional traits influence regeneration.

What pollinates our grassland flowers? Ungrazed grassland-a sink for insect pollinators

Simon Ishaku, BSc student at Abubakar Tafawa Balewa University

My insect-flower interaction study is aimed at investigating what insects are pollinating the herb species in the Afromontane landscape of Ngel Nyaki Forest Reserve and how pollinator density varies between fenced-off and protected

vs heavily grazed grassland within and around the Reserve and how this influences visitation rate to herbs. We assessed the number of flower visitors and pollinators, the behaviour of pollinators (i.e. time spent on each flower visited and the number of flowers visited). Observations were made at grazed sites around the reserve and un-grazed sites within the reserve. Twenty-nine flowering herb species were selected for this study. Four individual plants of each flowering herb species were observed in each of five grazed and un-grazed sites in the mornings and evenings. So far, our observation indicates that plant and insect species found in the grazed sites are subsets of those found in the un-grazed reserve. This, stresses the importance of the reserve in maintaining diversity and in providing ecosystem services such as pollinators.

In the near future, we plan to investigate how changes in pollinator density influence fruit set in these herbs. Factors investigated will include (but not be limited to) flower size and colour, and the abundance of nectar produced.

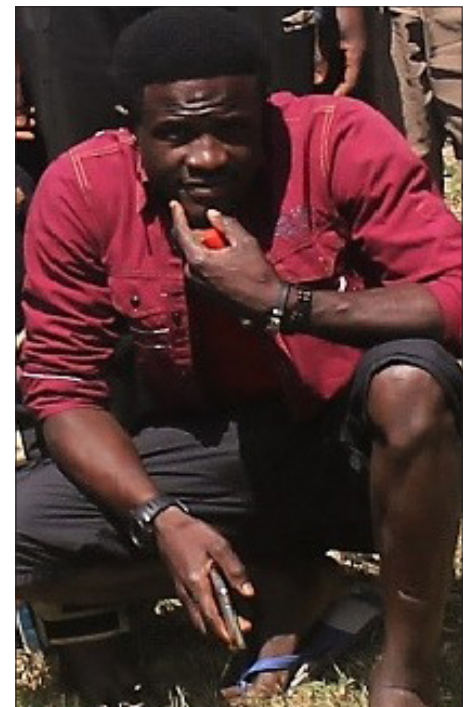


Figure 9 Simon Ishaku, IT student from Abubakar Tafawa Balewa University (Bauchi State) working on pollinators of herbs in grazed vs ungrazed grassland

New Science Collaborations



Figure 10 Dr Tim Hill (University of Exeter) discussing with Silvio Stivanello how best to fit the lightning detector coils onto forest trees.

The effect of lightning strikes on forest trees

Drs Tim Hill and Lucy Rowland (U Exeter), Prof. Manu Haddad (U Cardiff) and Dr Ed Mitchard (Edinburgh U).

The research, funded through the National Environment Research Council, UK involves an investigation into the effect of lightning strikes on tree death in tropical forests. The team have chosen Ngel Nyaki as the research site because of our CTFs Forest Geo Plot and because of the high frequency of lightning strikes Mambilla receives. Over 10,000 trees within the plot will be fitted with collars designed to 'trip' when a lightning strike runs down the tree. The collars are being transported by air from Cardiff and are due to arrive on Mambilla in early February 2018. Preliminary trials have demonstrated the technique to be successful. (see page 15)

Role of clumping in forest structure and composition

Professor Ian Dickie from the Bioprotection CoRE at Lincoln and also UC has recently joined the Ngel Nyaki CTFs ForestGeo Plot research team as associate supervisor to PhD candidate Iveren Abiem (see page 9).

Phylogeny of Afromontane root nodule bacteria

Tomasz Stepkowski Institute of Bioorganic Chemistry Polish Academy of Science, Poznań.

Tomasz has now characterized the soil samples from around the roots of several leguminous trees, sent to him from Ngel Nyaki for analyse of rhizobia. Tomasz and his team have isolated over 100 strains of *Bradyrhizobium* using *Siratro* (*Macropitilium atropurpureum* as a trap plant. Using the *recA* gene marker they have shown the strains to be from several distinct lineages but from one dominant group 'Clade III subclade III'. They are currently sequencing the *nifD* gene, which will give an insight into the symbiotic component of these genome strains.



Figure 11 While we have lost our large bodied frugivores we still have great biodiversity, such as this pangolin. Research in collaboration with Kibale National Park in Uganda will help identify how this loss impacts the forest community structure.

CloudNet Decomposition Research Team

The NMFP is part of a 10 member team led by Dr Patrick Martin of Colorado State University. Rates of litter decomposition at Ngel Nyaki will be incorporated into a database of rates across tropical cloud forests.

Global significance of low cloud on the 'tropical montane forest syndrome'

We have contributed data towards a meta-analysis on this topic for a paper currently under review for the Journal of Tropical Ecology. Lead co-authors include **Katie Heineman, (U Illinois), Becky Ostertag (U Hawaii) and Patrick Martin.**

Filters to forest restoration with and without large frugivores

Professor Colin Chapman (McGill University) and Professor Mike Lawes (Lawes Consultancy).

This exciting new collaboration brings together expertise from East and West Africa. In Kibale National Park, Uganda Colin Chapman has over 27 years of experience in forest conservation and restoration projects. Partnering with Kibale will allow us to initiate comparative projects in questions such as ecological filters to regeneration and how the loss of large bodied frugivores (Nigeria) alters regeneration trajectories as compared with forest communities with which still have elephants, baboons and chimpanzees crossing the forest-grassland boundary (Uganda). We have applied for a collaborative grant to the National Geographic Society and Hazel is visiting Kibale in April 2018 to discuss collaborative research with Professor Chapman.



Figure 12 Dr Tim Hill working with Usman Abubakar on the weather data

Visitors



Figure 13 Dr Kenfack CTFS-ForestGEO Africa Program Coordinator and a PI on the Ngel Nyaki CTFS Plot discussing botanical issues with the Plot field assistants

Collaborators

In July 2017 **Dr Tim Hill (Exeter)** and **Silvio Stivanello** visited the NMFP to begin the lightning strike research (see above). The visit was a success, the coils for the trees worked, they have not been removed by baboons and our Smithsonian team quickly learnt how to fit the coils around large trees. While challenging, the solution to transporting 10,000 coils from the UK to Ngel Nyaki has been solved and the coils are due to arrive in Jalingo early February. Silvio will accompany them (or follow closely behind) and Tim will visit again in April 2018.

Tim has offered to take over the maintenance of our automated weather station, for which I am grateful. He and Silvio serviced the station while here and are bringing out more sensors in their 2018 visit.

In November 2017 **Dr David Kenfack, CTFS-SIGEO Africa Program Coordinator** and joint PI on the Ngel Nyaki Plot spent a week with our 'Smithsonian team' identifying our unknown species in the 20 hectare plot and ensuring our tree identifications were correct. Following this work the number of species in the plot has risen from 76 to 100. Kenfack noted that we had identified over 99% correctly, which was good news. He also reported that the Ngel Nyaki plot is the best in Africa, all kudos to the 'Smithsonian team' and to General T.Y. Danjuma, without whose support we would not have a plot. We are currently working on an identification guide for trees in the plot.



Figure 14 Alexander Giwa and his team collecting wild *Solanum* species on a typical September wet and misty day for ethnobotanical studies

Scientists

As part of his MSc thesis **Cleophas Billah** spent several months with the NMFP during 2017 investigating the macrofungi within the forest. Cleophas collected 72 species of wood decomposing macrofungi, comprising 27 Families from 12 Orders: The numbers are an underestimation of diversity however, because as the time of writing some of the taxa have not yet been identified. The fungi are illustrated a resource on our website.

As part of her MSc project out of **Michigan State University, Talitha Tukura** spent time with the NMFP during April 2017. Talitha is a writer story-teller and an avid promoter of creative non-fiction ways of disseminating research and knowledge for audiences outside of academia.

Talitha's research focuses on the multifaceted nexus of economic livelihood and resource management in Nigeria. Upon completion of her degree, Talitha plans to continue work with Eden and other development organizations. Long-term goals for Talitha include being involved in academia to provide guidance and instructions for future generations committed to community sustainability.

In September 2017, **Alexandr Giwa**, taxonomist and herbarium curator for the **National Centre for Genetic Resources and Biotechnology (NACGRAB)**, visited the NMFP with his team as part of an expedition to the Mambilla Plateau to collect wild crop relatives.

The purpose of the expedition was to collect seeds of wild crop relatives including *Solanum cerasiferum*, *S.anguivi*, *Eleusine africana*, *Pennisetum stenostachyum*, *Vigna substerranea* var. *spontanea* and *Oryza schweinfurthiana*. Giwa wrote about Ngel Nyaki "The forested area is extremely wide, we spent 4–6 hours trekking over hills and valleys each day, hunting for the wild species". The group were assisted by NMFP field assistants.

Other localities visited during the expedition included Mayo Salbe, Dorofi, Serti, Uwa, Mao Jairadi, Gembu and other settlements. The species collected from Ngel Nyaki area were *Solanum cerasiferum* and *S.anguivi*.

Conservationist

In February 2017 **Mathias Rittgerott of Rainforest Rescue** visited the NMFP from Germany. Following his visit Mathias was able to write an informed article in Rainforest Rescue magazine, Ragenwald Report 2/17.

www.regenwald.org/uploads/regenwaldreport/pdf/Regenwald_Report_Nr_2_2017_Web.pdf

New Science projects



Figure 15 Adams updating our herbarium catalogue

Millennium Seed Bank Project Herbarium

In a collaborative programme with the **Royal Botanical Gardens, Kew**, we are collecting seeds of Afromontane species for the Millennium Seed Bank project (MSB). Thanks to help with transport from Dr Tim Hill in July we were able to send to Kew thousands of seeds from seven Afromontane tree species. Dr Martin Cheek, our Kew collaborator, was so impressed with the quality of the collections that he invited Mr Shedrach Kongvong (then our science coordinator) to attend a course in Uganda on seed collecting (see page 18). We have now dedicated two seed collectors, Musa Bawuro and Alfred Joseph to this project. The work involves much more than simply collecting and drying seeds; species phenology, their density in the forest, propensity to seed predators and seed dispersers all need to be monitored and recorded.

We are hoping that in March 2018 Xander van der Burgt, from Kew, an expert in West African taxonomy, will visit Ngel Nyaki and work with the herbarium team to update the collections and give advice on our botany generally. This initiative is under the Kew 'West Africa Initiative', led by Dr Martin Cheek.

With the help of Elisha Emmanuel, our new science coordinator, the herbarium is now exemplary. Elisha worked tirelessly with the herbarium team to mount all the unmounted specimens and to order them into families, genera and species. He has also named all the herbs and grasses, so that now we have a comprehensive collection. Each species is collected in triplicate, one set for the NMFP, one for The Royal Botanic Gardens, Kew and one for the Forest Research Institute herbarium in Ibadan.

Training and development



Figure 16 Top left: Iveren presenting her talk at the ForestGEO Analytical workshop. Right: ForestGEO Analytical workshop participants. Bottom left: Participants of the Millennium Seed Bank workshop, Kampala.

ForestGEO analytical workshop

In July 2017 Iveren Abiem, our plot manager, attended the 2017 ForestGEO Analytical Workshop in Puerto Rico entitled, “Integrating functional, phylogenetic and genetic components of diversity for an improved understanding of forest structure, dynamics, and change”. Iveren reports:

The workshop which had about 65 participants was supported by the US National Science Foundation’s “Dimensions of Biodiversity” Program, and the Smithsonian Institution. This is our plot’s first participation in a ForestGEO analytical workshop.

We were divided into six groups based on our proposed areas of interests and the data that participants had from their sites. Areas of interest included demography, spatial analyses, biomass, seed-seedling, phenology, diversity/functional traits.

I was part of the Demography group and was mentored by Drs David Kenfack, Sabrina Russo and Stuart Davies. I was introduced to the usage of the CTFS R package for data analyses which I used for the descriptive analyses of our plot data.

The workshop afforded me the opportunity to meet and interact with top scientists in the ForestGEO network who made very useful suggestions to our work in the Ngel Nyaki plot. It was also an opportunity to develop my data analysis skills.

Millenium Seed Bank seed processing and data management workshop

In September Shedrach Konvong, our past science coordinator attended a workshop ‘Methods in seed processing and data management’ run by the Millenium Seed Bank Project in Uganda, September 2017.

Shedrach reports:

The workshop, jointly organized by The Royal Botanic Gardens Kew and the Millennium Seed Bank Partnership (MSBP) drew participants from across Africa, with a focus on seed banking and management of seed data. The training included lectures on MSBP standards for seed conservation, sampling of biological populations,

as well as hands-on training on seed collection, processing and continued monitoring of banked seeds for maintenance of viability. We went for field work to collect seeds and did some lab work on seed cleaning, seed dormancy breaking, seed quality assessment, germination testing and viability monitoring. We also had interactive sessions in which participants asked questions and presented the challenges they faced at their places of work and suggestions were given by the facilitators on how to improve in such areas. The workshop ended with a training evaluation to test our understanding of the MSBP seed conservation standards and the concept of seed processing and data management. This workshop has given me a firm understanding of seed conservation and how to conserve seeds in line with MSBP standards which are applicable to any form of seed conservation project.

Awards



Figure 17 Misa Zubairu

Management award

In October Misa Zubairu was awarded a 'Certificate of Merit on Better Management' by the Federal Ministry of Education, Abuja to recognise his significant contribution towards education management. This was indeed well deserved and an honour. Misa facilitates all PhD student research at the field station and manages the IT (Industrial Training) student's quotas as well as their day to day activities with the NMFP. This award supports the high regard he is held in by his staff, students and visitors.



Figure 18 Ridwan Jafar

Outstanding research contribution award

Ridwan Jafar has been awarded a special certificate to recognise his "Outstanding research contribution by an IT student to the Nigerian Montane Forest Project". Ridwan has run a multi-faceted project investigating passive restoration in Ngel Nyaki forest reserve. He has recently graduated in Ecology from Abubakar Tafawa Balewa University with First Class degree. Congratulations Ridwan.

Our growing campus



Figure 19 Outside the new outreach centre: In this picture are international researchers Dr Tim Hill (Exeter University UK) and Silvio Stivanello (Cardiff), PhD candidate Murna Tela, and Nigerian undergraduate students doing their six month work experience with the Project.

Science Outreach Centre and Arboretum

This year the Project has seen the building of a science outreach centre and the establishment of an arboretum in the campus grounds. Funded by New Zealand MFAT (Ministry of Foreign Affairs and Trade), the science centre is already a significant improvement to both the learning and research environment offered by the Project to students and established researchers.

School children and Conservation Club members also use the centre, the children use it to watch conservation videos and for lessons in biology given to them by the It (work experience) undergraduates based with the Project.



Figure 20 View of the campus with the new science centre (second from left), Smithsonian office (right of centre).



Figure 21 Samuel selling honey he has produced through his hives.

Volunteers

Aliyu Usman, an ex IT student from Taraba State University is volunteering for a few months in his gap year between graduating with a degree in geography and starting his youth service. Ali is putting his excellent GIS skills to use and mapping our projects.

Besongngem Mbikeng, a graduate of Forestry and Environmental Management from Michael Okpara University of Agriculture, Umudike. Mbikeng is going to spend the next year with us moving forward the honey production community initiative. She will combine field work into bees and their favoured flowers with working with women in the community to determine how best to get our honey business venture started.

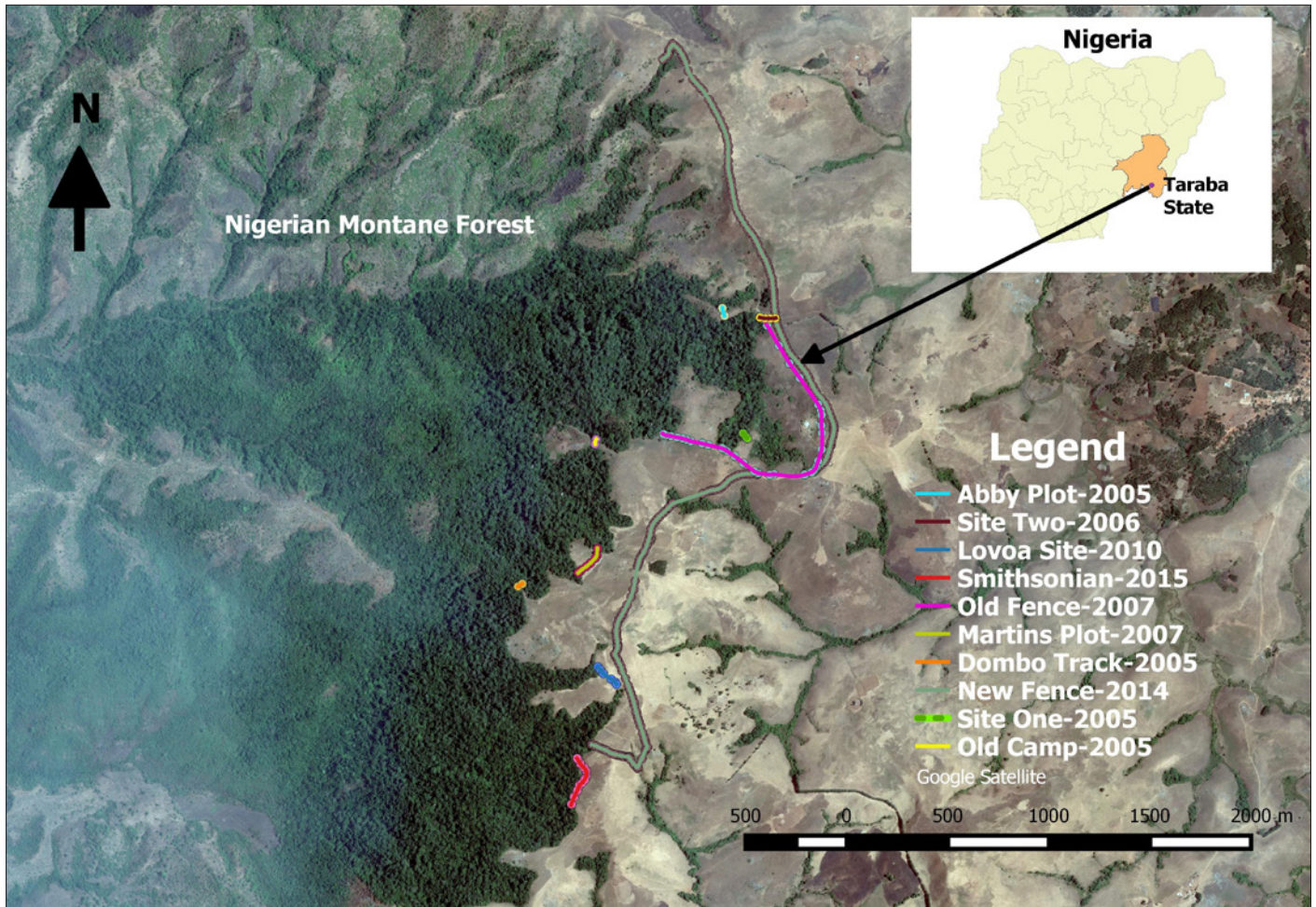


Figure 22 Aliyu Usman



Figure 23 Besongngem Mbikeng

Update on Forest Regeneration



This year has seen thousands more seeds and seedlings planted into the forest edge habitat. Of note is the success of planting the legume (nitrogen fixer) *Anthonotha noldae* seeds directly into grassland. The map above illustrates the areas under active restoration.

Restoration projects at Ngel Nyaki include:

1. Passive restoration- an investigation into the role of birds and plant traits in determining regeneration trajectories.
2. Managed restoration: a long-term experiment investigating how treatments including a light burn, grass grubbing and sowing seed influence speed of forest regeneration.
3. Large scale planting and sowing seeds of pioneer species into fenced-off grassland.
4. Passive restoration- 125ha of grassland adjacent to the forest edge (see map) have been fenced off and left to regenerate naturally.



Figure 24 Ali and Elisha who mapped the area of grassland we have fenced off for passive restoration (above).

Community Involvement

Nursery School

The NMFP continue to support the nursery school in many ways and we combine this with the conservation club. All IT students from Gombe, Bauchi and Taraba State Universities teach at the school.

This year Misa has written a grant proposal to the T.Y. Danjuma Taraba Community Fund for support with the building maintenance and teaching supplies. In late November the T.Y. Foundation visited us as part of their investigation into the nursery school proposal. We are hopeful for a favourable outcome!

Ndombo Ngishi School

Ndombo Ngishi is a small hamlet at the bottom of Ngel Nyaki forest Reserve. It is extremely poor; with no work, most of the men have left to work elsewhere and the women make the arduous trek up the hill weekly to sell bananas. This year we were able to support their school in a small way by donating a blackboard, books and other classroom essentials.

Conservation Club

We actively engage with students of all ages through our conservation club. Our aim is that the children of Yelwa associate the NMFP with a good place to be. On their frequent visits we show movies in the new science outreach centre, provide coke etc. and generally give the children a good time. Of course this all revolves around talking about the significance of the forest, the ecosystem services it provides and how forest helps to mitigate climate change

Honey Production

The success of our funding beekeeper Afan to train the local Yelwa beekeepers has been a success.

We are hopeful that now Besongngem Mbikeng (see page 21) is on the ground at Ngel Nyaki we will be successful in obtaining funding for the beginnings of our honey industry.



Figure 25 Misa with visitors from the TY Danjuma Foundation. From left to Right Tersoo, Misa, Ishaku and their driver



Figure 26 Shedrach hands out learning materials for the Ndombo Ngishi school



Figure 27 Shedrach teaching to the younger members of the Conservation Club. This was a David Attenborgh video

Outputs



Figure 28 The entire CTSF Forest_Geo team in November

Peer reviewed articles

- Dutton, P., Moltchanova, E., & Chapman, H. M. (2016) Nesting Ecology of a Small Montane Population of the Nigerian/Cameroon Chimpanzee (*Pan troglodytes ellioti*) in Nigeria. **Folia Primatologica**, 87(6), 361-374.
- Nsor, C.A., Chapman, H.M. Godsoe, W. (2017) Does a Species' Extinction–Proneness Predict Its Contribution to Nestedness? A Test Using a Sunbird-Tree Visitation Network. **PloS One**. <https://doi.org/10.1371/journal.pone.0170223>
- Walters, M., Knight, A., Chapman, H. M., Kraberger, S., Stainton D., Christopher, A., Varsani, A., (2017). Novel single-stranded DNA virus genomes recovered from chimpanzee faeces sampled from the Mambilla Plateau in Nigeria. **American Society for Microbiology**, 5(9), e01715–e01716. doi:10.1128/genomeA.01715-16
- Ezukanma, I. O., Oluwatoyin, T., Ogundipe, Nodza, G.I. & Pócs, T. (2017) Bryophyte records from the eastern Nigerian highlands. **Polish Botanical Journal** 62(2): 203–212, DOI: 10.1515/pbj-2017-0030
- Umar, D. M., Harding, J.S. and Chapman H. M. (2017) Response of benthic invertebrate communities to a land use gradient in tropical highland streams in Nigeria' **Tropical Freshwater Biology** 26: 53-77

Accepted pending revision; under second review:

- Aliyu, B., Thia, J., Moltchanova, E., Forget, P.M., Chapman, H.M. Forest disturbance and seasonal food availability influence a conditional seed dispersal mutualism. **Biotropica**
- Arroyo, D., Blackburn, D., Chapman, H.M., Hale, M. Conservation genetics of two threatened frog species from the Mambilla highlands, Nigeria. **PLOS One**

Under review

- Yadok, B., Pech, R., For *Crycetomys* sp nov, Size doesn't matter. Scatterhoarding in the African Giant Pouched Rat. **African Journal of Ecology**.
- Nsor C, Godsoe, W, Chapman H.M. A tree visitation network only remotely resembles a pollination network for Afromontane sunbirds. **Acta oecologia**
- Charles, L., Dwyer, J., Yadok, B., Chapman, H. Landscape position and woody vegetation within the matrix mediates seed dispersal under isolated pasture trees across distinct tropical regions. **Journal of Biogeography** 17-0606.

Other publications

- Chapman, H. M. (2016). New Zealand-based Opportunities for Africa to Enhance its Agriculture (Prof Hazel Chapman, University of Canterbury, New Zealand and Founder and Director, Nigerian Montane Forest Project, Nigeria). In R. Diab (Ed.), **POVERTY REDUCTION Proceedings Report Vol. 12** (pp. 26-28). Pretoria, South Africa: Academy of Science of South Africa (ASSAf). doi:10.17159/assaf.2016/0009
- Yadok, B., Perch, R., & Chapman, H. M. (2017). No apparent effect of predation risk on microhabitat use by African giant pouched rats (*Cricetomys* sp. nov). In **Ecological and Social Dimensions of Tropical Biodiversity Conservation**. Mérida, Yucatán, México.
- Yadok B, Chapman H.M. African giant pouched rats provide hope for Africa's montane forests. Article in University of Canterbury's 2017 Research Report.

Resources

We have added and updated resources on our website (www.canterbury.ac.nz/afromontane/research/biodiversity/) including:

- Fungi identification photo guide
- Additional species added to the plant and animal checklists



Figure 29 Yelwa football club, top of the Mambilla league, 2017.

Talks

- **Iveren Abiem** gave two presentations to the 65 attendees of the ForestGEO Analytical Workshop in Puerto Rico “Integrating functional, phylogenetic and genetic components of diversity for an improved understanding of forest structure, dynamics, and change”:
 - i) ‘Ngel Nyaki Forest Dynamics Plot’
 - ii) “the effect of edge on the plant species distribution and composition in the Ngel Nyaki plot”
- **Jennifer Agaldo**
 - i) “Will Ants Plant Tomorrows Forests? Ant-diaspore interactions in a Sub-Saharan montane Landscape”. University of Canterbury 2017 Annual Biology Conference (ABC) October 2017.
This talk won Jen the prize of the 3rd best PhD presentation award for 2017.
- **Biplang Yadok** presented two talks:
 - i) Feeding ecology of the African Giant Pouched Rat *Crycetomes* sp. nov in an Afromontane forest. Annual Conference of the Society for the Association of Tropical Biology and Conservation (ATBC) in Mexico- July 2017.
 - ii) Foraging ecology of the African Giant Pouched Rat *Crycetomes* sp. nov in an Afromontane forest. University of Canterbury 2017 Annual Biology Conference (ABC) October 2017.
- **Lily Brailford** presented three talks:
 - i) Evidence for reduced genetic diversity within two common Afromontane tree species with contrasting dispersal mechanisms. The 20th annual NZ Molecular Ecology conference, Caitlans Dec2-3 2017,
 - ii) Fragmentation is negatively affecting genetic diversity in already diversity-challenged Afromontane tree species. University of Canterbury 2017 Annual Biology Conference (ABC) October 2017.
 - iii) Assessing Afromontane Forest Genetic Diversity on Mambilla Plateau, Nigeria. Graduate Women’s Association Awards Evening. University of Canterbury, New Zealand. August 2017.
- **Hazel Chapman** presented two talks:
 - i) An overview of the Nigerian Montane Forest Project. School of Biology, University of Northampton (January 2017)
 - ii) An overview of the NMFP with a detail on tree recruitment failure. University of Cambridge (UK) Centre for Conservation Science Seminar Series (January 2017).

Publicity

- The Nigerian Montane Forest Project featured in the Chronicle Magazine Nov/Dec 2017. UC’s little-known research station in Nigeria has been studying the ecology of a unique forest type and boosting the economy of the local community for the past 12 years.
- As Fate Would Have It: The Story Of The Nigerian Montane Forest (Ngel Nyaki) – An Interview With Dr Hazel Chapman. <https://edusounds.com.ng/fate-story-nigerian-montane-forest-ngel-nyaki-interview-dr-hazel-chapman/>
- The Nigerian Montane Project in Ngel Nyaki forest on the Mambilla Plateau empowers young people, this gives joy.
 - @AminajMohammed (UN Deputy Secretary-General, Former Minister of Environment, Nigeria)

Celebrating our people

Many people help make the Project run, often times they are behind the scenes. Here we celebrate our staff who contribute to the success of the team.



Misa Zubairu
Manager



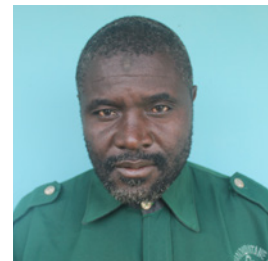
Usman Abubakar
Assistant Manager



Saidu Isa
Chief patroller & security officer



Bobbo Zubairu
Security officer /Field Station



Manu Abubakar
Security officer/Field station



Dauda Baduku
Security officer/forest regeneration



Japhet Njidda
Security officer/forest regeneration



Augustine Tayo
Security officer/forest regeneration



Usman Didi
Security officer/forest regeneration



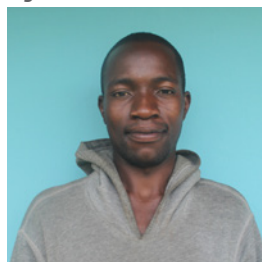
Hammasumo Ibrahim
Herbarium



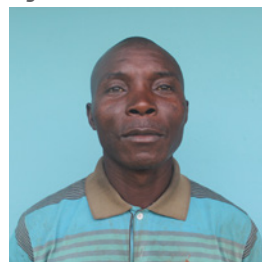
Augustine Ntim
Nursery



Idriss Musa
Botanical photographer



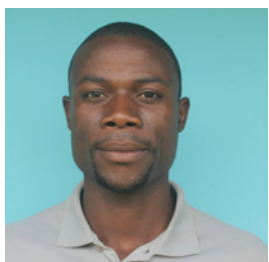
Muhammed Usman
Computer operator



Musa Bawuro
Seed collection



Rabi Buba
Cleaner and cook



Elijah Nicodemus
Pollination



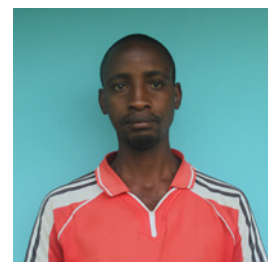
Adams Hassan
Phenology



Ali Bapetel
Phenology



Jafaru Bapetel
Phenology



Ahmadu Usman
Ornithology



Usman Bashiru
Ornithology



Yakubu Vugeh
Ornithology



Ali Abdul
Seed dispersal



Ibrahim Umaru
Seed dispersal



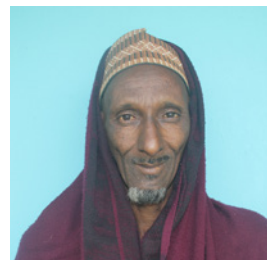
Thomas Patrick
Seed dispersal



Yusuf Tongbuin
Seed dispersal



Alfred Christopher
Primates and seed collection



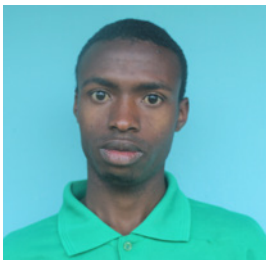
Ali Buba
Medicinal plants



Abubakar Musa
CTFS ForestGeo plot



Ahmadu Salihu
CTFS ForestGeo plot



Auwal Sajo
CTFS ForestGeo plot



Comfort Moses
CTFS ForestGeo plot



Faith Febdzir
CTFS ForestGeo plot



Helen Andrew
CTFS ForestGeo plot



Joel Idi
CTFS ForestGeo plot



Dahiru Zubairu
CTFS ForestGeo plot



Enoch Zaccheus
CTFS ForestGeo plot

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