

Using geospatial tools to investigate how deforestation affects the transmission of malaria in birds

By Anong Damian Nota

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- This project addresses an unsolved problem in the field of emerging diseases to clarify the ecological factors that can facilitate host switching, an important step in disease emergence.
- What are the effects of large scale deforestation on the transmission of vector borne infectious diseases?
- We are approaching this by studying malaria in rainforest birds threatened by environmental degradation in Cameroon.
- Certain strains of Plasmodium spp are entirely host specific; they infect one species of passerine bird, but not another in same family. Other strains infect many species of birds.
- The ultimate goal of this research is to discern the interplay among hosts, habitat and vector ecology on the potential spread of novel pathogen strains.



Research Approach

- We are working in Manyemen- Cameroon where large scale logging and deforestation by Herakles farms (SG-SOC) is presently going on in Talangaye Forest to replace this with an oil palm plantation.
- We are collecting data before and after deforestation over 3 years on-
- bird abundance and diversity,
- mosquito diversity (morphological identification)
- blood for parasites study in mosquitoes and birds(microscopy, PCR, sequencing)
- Climate data- temperature,Rainfall, humidity (HOBO Data Loggers)
- We could collect on just everything if we had the money!
- Field visits 4 times a year in the dry season and rainy season
- Data analyses(before/After deforestation) ; Modelling;Results; Dessimination of findings

Key results of project so far:

Vectors

- Over 8,941 mosquitoes belonging to 12 genera captured in 2 years in both pristine and fragmented forests and identified using morphological keys.
- Over 20 new species of mosquitoes, undescribed before have been described and named
- These include 5 new species of Aedes, 6 new species of culex and 8 new species of Eratmopodites mosquitoes.
- Manuscripts under preparation and current available identification keys currently updated

Birds

Over 2,657 birds captured by mistnets in pristine and fragmented forests, identified, classified into 17 bird families and blood collected for parasite identification by microscopy & sequencing.

Parasites

- A total of 36.5% of birds captured have been shown to be positive for
- parasites(Plasmodium/haemoproteus, Leucocytozon, trypanosomes, filaria)
- Over 1000 parasite DNA sequenced and new lineages identified.

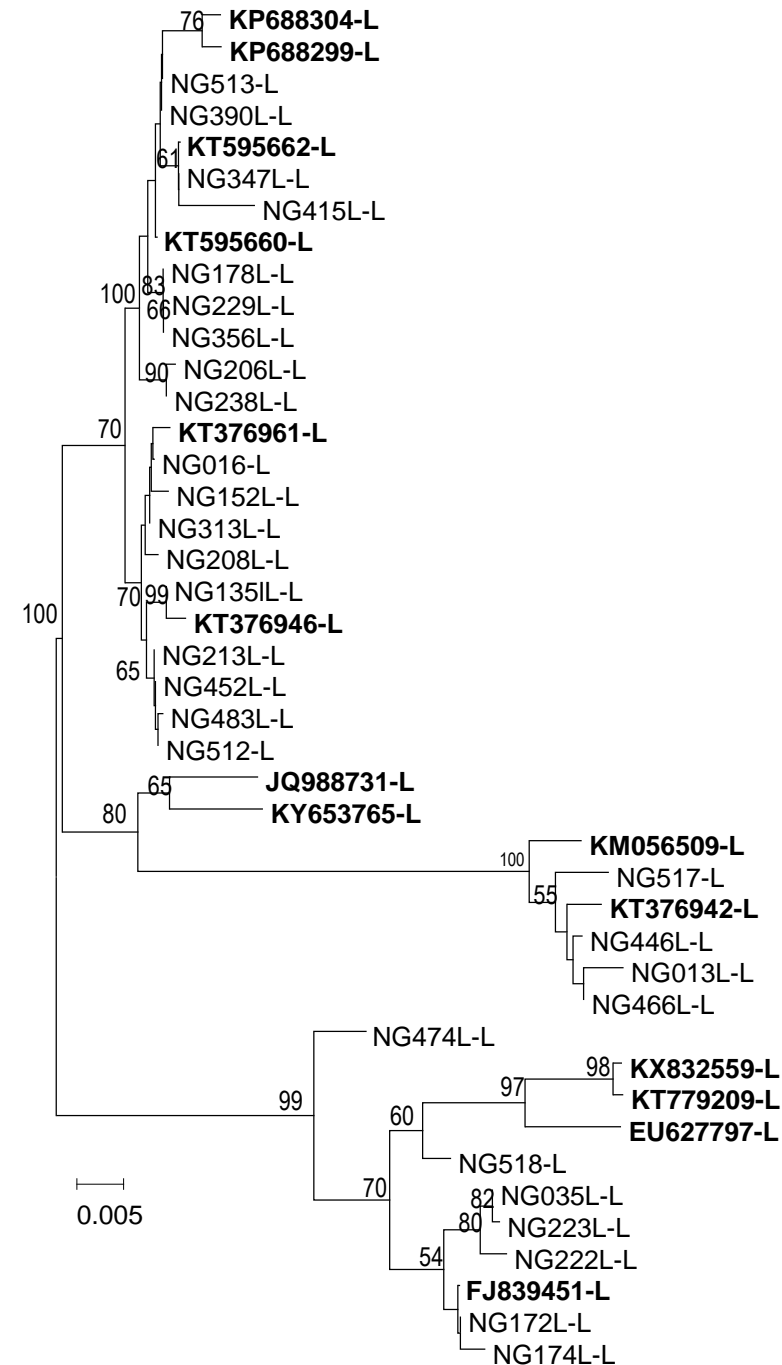
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Evolutionary relationships of Leucocytozoon isolates

The evolutionary history was inferred using the Neighbor-Joining method. The optimal tree with the sum of branch length = 0.24188677 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) are shown above the branches. The tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the phylogenetic tree. The evolutionary distances were computed using the Jukes-Cantor method and are in the units of the number of base substitutions per site. The rate variation among sites was modeled with a gamma distribution (shape parameter = 1). The analysis involved 43 Leucocytozoon sequences with those obtained from the Genbank shown in bold. Codon positions included were 1st+2nd+3rd+Noncoding. All ambiguous positions were removed for each sequence pair. There were a total of 535 positions in the final dataset. Evolutionary analyses were conducted in MEGA6. The vertical lines indicate the major clades.



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Top next steps for project:

1. Collect data from the palm plantations;
2. Complete Data analysis (before /after)
3. Publish available data/ Dissemination

Impact of data and results on stake holder decisions and the development problem:

- Capacity building: 4 MSc students graduated; 4 PhDs currently on the project and 2 MScs to finish this year; Enhanced Collaborations: 2 PhD students have visited the Entomology lab of Anton Cornel at UC Davis for training on advanced mosquito systemics techniques; University of San Francisco (Ravinder Sehgal).

New collaboration established with other conservation projects in Cameroon- birds; Yale – *Aedes albopictus*.

Challenges you have faced in collecting meaningful data:

- Bad roads into the forests; acquisition of reagents; Presently the Anglophone problem in Cameroon with increased violence, lab interruptions, internet connectivity, presently fieldwork halted.



Thanks for your kind Attention