



Preliminary Report

**Amphibians of Mount Nganha with particular attention to the
habitat preference and distribution of the Critically Endangered
Astylosternus nganhanus (Adamaoua)**

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February 05, 2025

Summary

The Adamaoua plateau is a savannah area located on the northern part of the Cameroon Volcanic Line (CVL), known as Cameroon's “water tower”. It is characterised by bimodal rainfall (a dry season and a rainy season) and provides home for some amphibian species among which *Astylosternus nganhanus* Amiet, 1977, assessed as Critically Endangered (CR) and only known from Mt Nganha. Very little herpetological research has been carried out on Mt Nganha, leaving little information on the ecology, distribution and habitat threats of endemic amphibians from this mountain. This project attempts to identify the preferred geographic range of *A. nganhanus* on Mont Nganha, in order to provide the bases for developing sound conservation measures. So far, we have surveyed thirty-five watercourses day and night in all seasons, examining the distribution and status of the amphibian community. We targeted the ecology of *Astylosternus nganhanus* including calls and habitat characteristic. We noted all potential threats that could cause the decline of *A. nganhanus* around the survey sites. Interacting with the community around our study site, we have been raising awareness among them on the importance of frogs. We made three sampling trips on Mount Nganha and additional investigations are planned in the days ahead.

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Project members

- **Dr. Nono LeGrand Gonwouo (PhD)**, Senior Lecturer University of Yaoundé I
The current chair of the Central African region of the IUCN SSC Amphibian Specialist Group (ASG), Ph.D. Advisor and home based supervisor of fieldwork. He will provide advice during data collection, confirm amphibian species identifications and review our draft reports
- **Dr. Benjamin Tapley (PhD)**, Curator of Herpetology Zoological Society of London
Dr Benjamin have been involved from the onset of this proposal with advice and English corrections of early draft of this proposal.
- **Dr. Kaitlin E. Allen (PhD)**, Postdoctoral Researcher at University of Florida
With initial experience working in the project site, Dr. Kaitlin will help in the characterization of the study area following various anthropogenic activities.
- **Dr. Walter P. Tapondjou (PhD)** Postdoctoral Researcher at University of Florida
Dr. Tapondjou will provide experience in modelling the preferred habitats of threatened species.
- **Dr. Kameni Marina N. (PhD)**, University of Yaoundé I,
Dr. Kameni, the project mentor. With her experience implementing similar projects in Cameroon, we will together plan and implement the awareness raising campaign to change community attitude towards montane forest degradation.

Aims and objectives

1. Establish the distribution and status of the amphibian community composition on Mt. Nganha and determine their habitat characteristics.
2. Determine the ecology of *Astylosternus nganhanus* including calls and habitat in order to distinguish these characteristics for future surveys.
3. Assess the potential threats that could cause the decline of *A. nganhanus* on Mt. Nganha.
4. Raise awareness amongst local populations on the preservation of montane gallery forest a natural habitat for *A. nganhanus* and other amphibians with the aim of preserving an important amphibian species assemblage.

Introduction

The Adamaoua Plateau is a savannah area located on the northern part of the Cameroon Volcanic Line (CVL), known as Cameroon's “water tower”. It is characterised by bimodal rainfall with a dry season that runs from November to March and a rainy season that runs from April to October. This area is home to many amphibian species including *Astylosternus nganhanus* Amiet, 1977, which is endemic to Mount Nganha and has been assessed as Critically Endangered (CR) (IUCN, 2019). Very little herpetological research has been carried out in the wooded savannahs of the northern zone of Cameroon (Cronin et al., 2014), probably because they are relatively remote and difficult to access (Gvoždík et al., 2020), leaving little information on the region's amphibians.

In addition, it has been reported that many amphibian species are threatened by the pressure of intensive human activities leading to the degradation and disappearance of natural habitats, mainly the montane forests of the CVL (Cronin et al., 2014; Doherty-Bone & Gvoždík, 2017; Tchassem et al., 2019, 2021). Some studies (Doherty-Bone et al, 2013; Hirschfeld et al, 2016) have also confirmed the presence of the fungal pathogen *Batrachochytrium dendrobatidis* (Bd, one of the causative agents of the diseases amphibian chytridiomycosis) in this Eco regions. Reeder et al (2011) reported *Bd* infection in *Astylosternus sp* on the Mambila plateau in Nigeria and it has also been reported as a major factor in the decline of amphibian populations in mountainous regions along the CVL (Doherty-Bone et al, 2013; Hirschfeld et al, 2016;).

These various threats could well be decimating savannah species in the northern part of Cameroon. The most impressive mountains in the northern part of the CVL include the Mambilla Plateau, Gotel Mountains, Tchabal Mbabo, Tchabal Gangdaba and Tchabal Nganha (Cronin et al., 2014). The focus of this study was on Mount Nganha (locally called Tchabal Nganha) due to its eastern most location and the reported presence of *Astylosternus nganhanus*, Amiet 1977, which has not been subject to any form of study or conservation action since its description in 1977. Indeed, *A. nganhanus* is only been found on Mount Nganha between 1400-1700m asl and only know from five specimens. This species is found along watercourses in gallery forest and small streams in grasslands (Channing and Rödel 2019). *Astylosternus* are not yet mentioned among the amphibians consumed in Cameroon, but the forest galleries that make up their habitat are undergoing intense deforestation. *A. nganhanus* is also an EDGE species scored of 5.97. Very little is understood about their behaviour and ecology.

Material and methods

Fieldwork sampling

Three field trips were carried out between August and December 2024 on Mont Nganha. We spent 13 days in August, October and December collecting data on amphibians and their habitats. Thirty-five (35) points spread over the accessible area of the mountain were visited. At each point, a 100m transect along a watercourse was covered in 2 hours. The time and geographical position of the observation points were recorded using a GPS (GarminTrex10). Visual and acoustic surveys were undertaken day and night following Heyer et al (1993); and we used methods outlined in Rödel and Ernst (2004) to assess the composition of the amphibian community. Each survey consisted of walking through the different types of habitat present on the slopes of the mountain while noting observations of active amphibians. When necessary, adults were captured by hand and tadpoles were caught using a dip net for detailed identification and were released at the point of capture soon after.

Micro environmental parameter

We noted on a sheet the dominant type of vegetation, human activities around each collection point and the dominant soil type in the watercourse (sand, gravel, stones, clay). Physical parameters (Total Dissolved Solids (TDS), salinity (Sal), conductivity (Cond) temperature (T) and pH) of 28 points were measured using an HM Digital COM-80 Electrical Conductivity (EC); Relative Humidity and ambient temperature were measured also using Ambient Weather WS-HE01.

Identification

Amphibian identifications were based on morphological parameters contained in the Field Guide to the Frogs and other Amphibians of Africa (Channing and Rödel, 2019). A digital caliper (precision ± 0.1 mm) and a precision balance were used for morphological measurements according to Griesbaum et al. (2019); photographs of each species were taken using a digital camera (CANON EOS 1500D). The call of *Astylosternus* was recorded at dusk using a pair of Sony PCM-M10 recorders and a Sennheiser ME66/K6 microphone, then analysed using Raven Pro 1.6.5.

Potential threat Assessment

Interviews were carried out to assess the impact of human activities on the habitats of the various species. The people of the village of Ndjigou hamadjoda were selected for this purpose because of their proximity to the mountain. Fulani, whose main activity is livestock rearing, and the Mboum, who grow cereals, tubers and pulses, are the main representatives. People of working age in these different professions and older people were targeted for interview. We felt it was also important to know whether the fungus (*Bd*) was present and a hundred frogs were swabbed.

The most important outcomes of these fieldworks

I. Amphibian Community Distribution

I.1. Status on the Mont Nganha

We made three trips on Mount Nganha and recorded 410 anuran individuals belonging to 7 families, 9 genera and 16 species (table 1). These species were recorded at 35 points on two flanks of the mountain following the altitudinal gradient (fig 1). Of all the individuals recorded, we counted one Critically Endangered species (CR), ten List concern species (LC) and four undetermined status (Table 1). We hope to enhance our findings on our next trips.

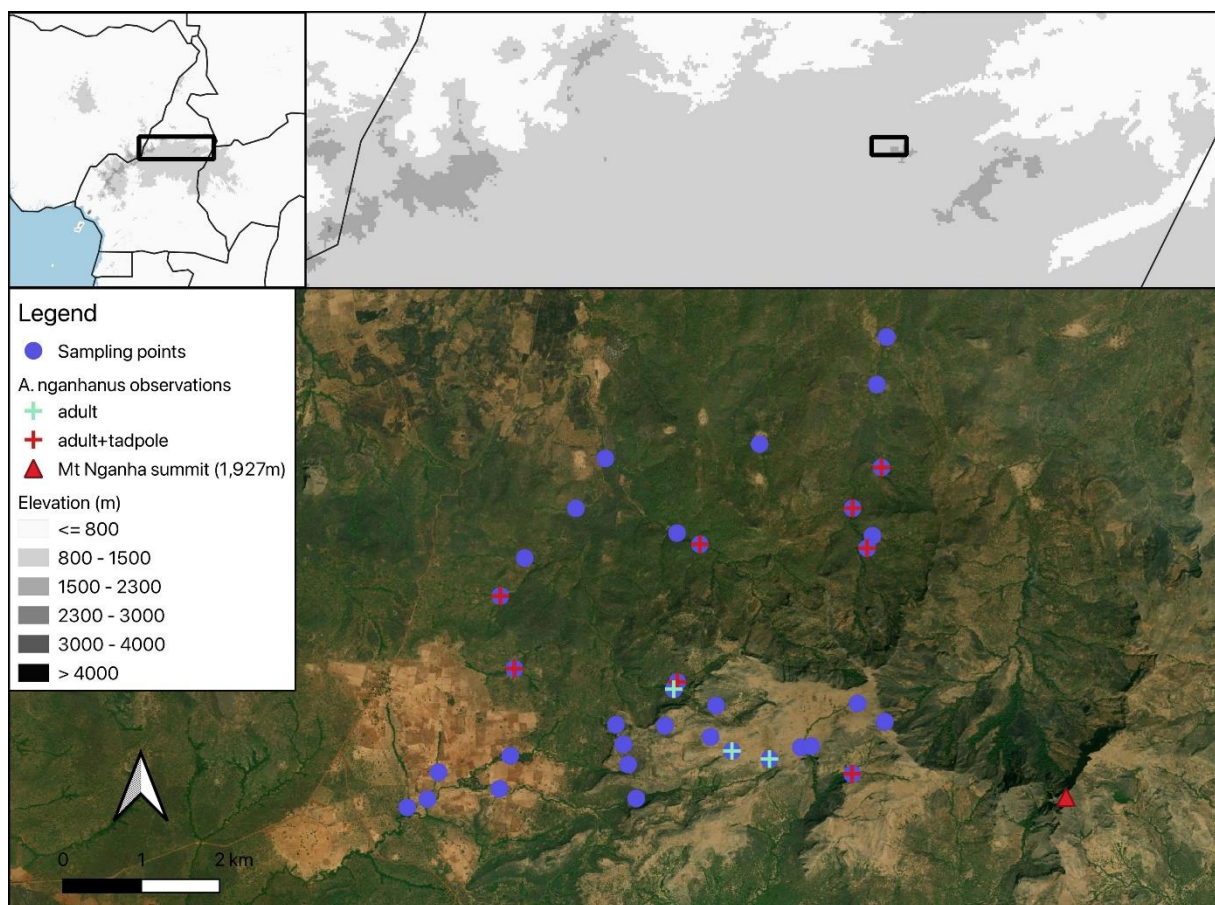


Figure 1: map distribution of sample points

Table 1 : Status and distribution of anurans species on Mount Nganha

Family	Species	IUCN Statuts	Stratum		
			Foot of Mt [1100-1400[Mountain [1400-1600[Summit [1600-1900]
Arthroleptidae	<i>Astylosternus nganhanus</i>	CR	+	+	+
	<i>Arthroleptus poecilonotus</i>	LC	+	-	-
	<i>Leptopelis nordequatorialis</i>	LC	-	+	+
	<i>Leptopelis viridis</i>	LC	+	+	-
Bufonidae	<i>Sclerophrys maculata</i>	LC	+	+	-
	<i>Sclerophrys regularis</i>	LC	+	-	-
	<i>Sclerophrys sp</i>	/	+	-	-
Hyperoliidae	<i>Hyperolius balfouri</i>	LC	+	-	-
	<i>Hyperolius nigriventris</i>	LC	-	+	-
	<i>Hyperolius riggenbachi</i>	LC	+	+	+
Pipidae	<i>Xenopus sp</i>	/	+	+	+
Ranidae	<i>Amnirama longipes</i>	LC	+	+	-
Phrynobatrachidae	<i>Phrynobatrachus sp</i>	/	-	+	+
	<i>Ptychadena pumilio</i>	LC	-	+	+
Ptychadenidae	<i>Ptychadena sp1</i>	/	-	+	+
	<i>Ptychadena sp2</i>	/	+	-	-

I.2 Habitat characterization

Steep slopes and inaccessible crevasses characterize the northern slopes of Mount Nganha. Access is limited to the foot of the mountain, where human activity is restricted to 1080 meters. Cattle migration corridors extend up to 1300 meters. The slope is adorned with wooded savannahs and forest galleries that encircle the watercourses. The southern and eastern slopes are inaccessible because there is no nearby village through which we can access and the slope is very steep from the summit, while the western slope is accessible from the foot of the mountain to the summit.

Fields' crops, human habitation, and a thin layer of savannah and gallery forest characterize the mountain's foot. Agriculture is the primary activity in this region. The mountain area is predominantly wooded savannahs and gallery forests, with cattle passages present. The summit is mainly grassland, with some gallery forest.

Overall, the water bottom is rocky, with occasional pebbles and stones. The average water temperature varies from 14.55°F to 21.67°F. The pH is very close to neutral. pH ranged from 6.55 - 7.39. The average values of the ion abundance index in the water range from 17µS/cm to 68.51µS/cm. Dissolved solids vary on average between 12 and 49 ppm.

Table 1: Average values for water parameters by stratum, standard deviation in brackets

Strata	Elevation	T(°F)	TDS(ppm)	Sal(ppt)	Cond(μS/cm)	pH
Mountain's foot	[1100-1400]	21, 67(2,65)	49,5(34,47)	0,035(0,03)	68,515(48,85)	7,39(0,71)
Mountain	[1100-1400]	21,15(1,53)	14,7(7,48)	0,014(0,004)	19,08(10,46)	6,552(0,69)
Summit	[1600-1900]	14,55(25,69)	12,829(5,82)	0,0114(0,004)	17(7,50)	6,929(0,62)

II. Ecology of *Astylosternus nganhanus*

In all, 49 individuals of *A. nganhanus* were observed throughout the study. We recorded 25 specimens in the rainy season, including 7 females, 8 males and 10 juveniles. In the dry season, 24 specimens were recorded, including two males, one female and 21 juveniles. On the western flank, *A. nganhanus* was found at five points between 1400 and 1800 meters asl. One of the five points retained water until December (last visit to the mountain). This was also the only point where probably tadpoles were found on the western flank. On the northern flank, we recorded *A. nganhanus* from six streams. All six points had water since the last visit (last December) and tadpole were present. Points are distributed between 1100 and 1265 meters asl; this result (table2) will be redefine the elevation zone that can found *A. nganhanus*. *Astylosternus nganhanus* is known to be found between 1400-1700 meters where it is associated with gallery forest and small streams in grasslands of Adamaouan, Cameroon (Amiet, 1977; Channig and Rodel, 2019; IUCN 2019). The probably tadpole and adults are active from sunset. The probably tadpole swim around and at the bottom of the small ponds formed by stones in streams, which is littered with small and medium-sized stones, dead leaves and moss. Five to 30 tadpoles probably belonging to *A. nganhanus* can be observed per square metre at night. The adults stay under the stones, at the level of the small waterfalls. They come out at night and may remain on the rocks or at the bank of the stream. They can also migrate to the peripheral zone and can be found on grassland when it rains or at night during the mating season. During the mating season, the males emit a characteristic call. The mating season is thought to be between July and September. Indeed, during the mating season, males have a single thick

nuptial pad and spines on the lower jaw in the pectoral and gular regions (Amiet 1977); we noted these characteristics during fieldwork in August. The call of *A. nganhanus* with a frequency between 0 and 30 KHZ was analysed using Raven Pro 1.6.5 (fig 2).

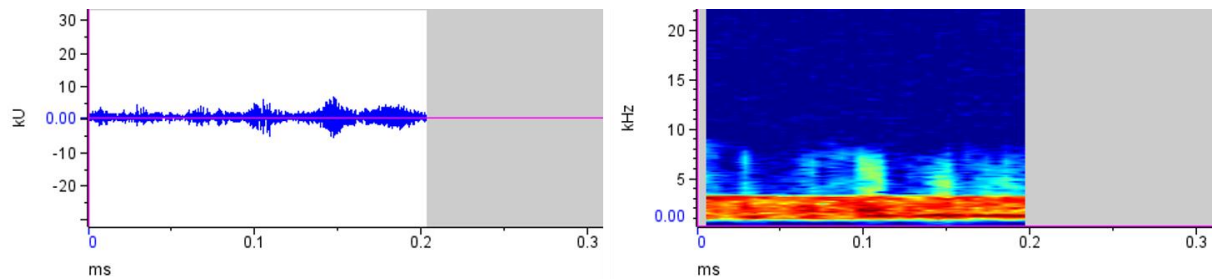


Figure 2: frequency and duration of *A. nganhanus* call



Figure 3: tadpoles and female *A. nganhanus*

II.1.1 Habitat characteristic of *Astylosternus nganhanus*

A thin canopy that maintains humidity even during the dry season covers the watercourses where *A. nganhanus* has been found. Watercourses that may harbour *A. nganhanus* also have

rocky cascades under which the species can take refuge and make calls without being exposed or hindered by the water current. The tadpole are found in pools of water near trees and large stones under which they take refuge. The bottom of the small pond is generally rocky and the water is clear, making it easy to see the movements of the larvae at night using flashlights.



Figure 4: habitat of *A. nganhanus*; a) grassland, b) gallery, forest, c) small pond with tadpoles

We note a difference in the mean values of TDS and conductivity recorded in the watercourses harbouring tadpoles and adults of *A. nganhanus* and the watercourses where they were not observed (Fig.1). However, the Mann-Whitney U test showed $U=20$, $p=0.95$, $r= 0.02$ for conductivity and $U=19$, $p=0.84$, $r= 0.06$ for TDS; these data do not allow us to determine a statistically significant difference.

Table 2: Table of physico-chemical water parameters (Total Dissolved Solids (TDS), salinity (Sal), conductivity (cond)), Humidity (Humi) and ambient temperature at the *A. nganhanus* collection's points.

Presence of <i>A. nganhanus</i>	Sampling Points	Elevation	T°(water)° F	Ph	Cond	TDS	Sal	Humi(%)	T°(air)° F
	14	1602.40	61.71	7.57	38.06	25.05	0.02	44	66.05

	23	1174.94	65.3	7.8 3	165.5	115	0.0 8	46	71.8
	27	1255.95	64.4	7.5 8	188.6	135	0.0 9	44	67.8
	29	1202.13	64.2	7.2 9	199.2	144	0.1 0	45	65.8
	32	1182.36	63.9	7.6 9	212.0 0	155	0.1 1	50	62.7
	34	1226.74	67.8	7.6 2	164.6	118	0.0 8	40	72.4
	35	1261.65	68.9	6.8 5	73.0	54.7	0.0 4	46	67.5
<i>A. nganhanus</i> not detected	23	1145.36	67.05	7.9 0	152.0	116	0.0 8	38	82.09
	24	1081.66	64.4	7.8 8	133.2	97.3	0.0 7	60	64.3
	25	1176.40	68.7	8.0 6	181.4	130	0.0 9	33	75.0
	26	1125.37	64.0	7.8 3	167.8	122	0.0 9	36	65.5
	30	1080.08	66.7	8.1 4	196.4	143	0.1 0	48	68.2
	31	1097.37	63.9	8.0	192.3	136	0.1 0	44	64.8

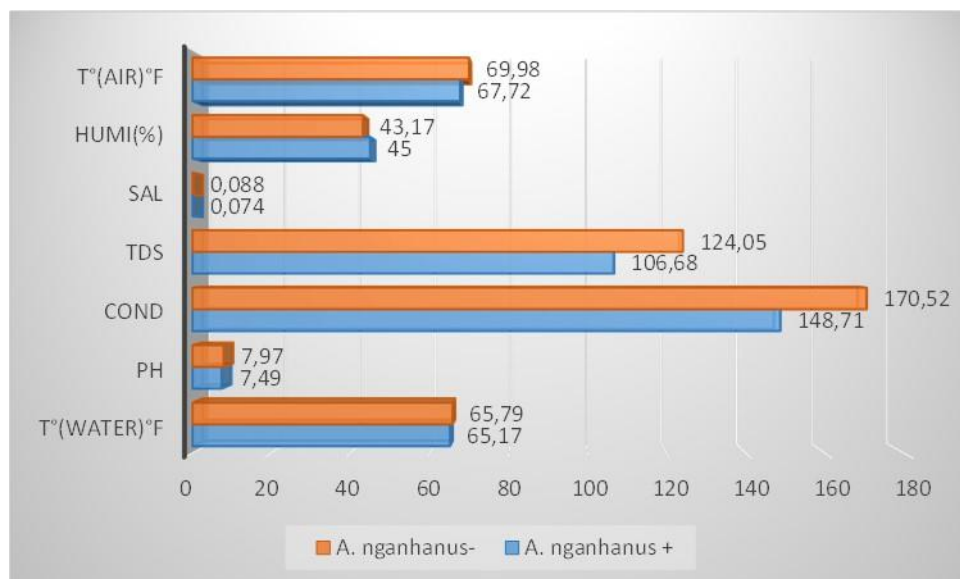


Figure 5 : Average values of physico-chemical parameters and ambient water in streams with *A. nganhanus* (+) and streams without *A. nganhanus* (-)

III. Potential threats

A survey of the western flanks revealed that small-scale agriculture, subsistence timber extraction, and human settlements activities occur at the mountain's foot (fig 6). We did not record the presence of *A. nganhanus* in any of the watercourses near dwellings and agricultural fields in the western flank. Additionally, a few points in the transitional savannah layer between potentially threatening activities and the mountain have not been found to have *A. nganhanus*. However, around the points where *A. nganhanus* has been reported, there is a periodic presence of cattle and brush fire (fig 6). These cattle make seasonal migrations between the mountain's foot and summit. Two of the five surveyed points are used by cattle during the rainy season, two others are crossed by cattle passage, and one is not very accessible. On the northern flank, three of the six surveyed points are crossed by cattle passage; one is on hundred meters from the agricultural field, while the others are not very accessible. The target species was found at low elevation on the northern flank, where human activities is less intense. On the other hand, it was not found on the western flank at the similar elevation. Human activities would represent a considerable threat of target species

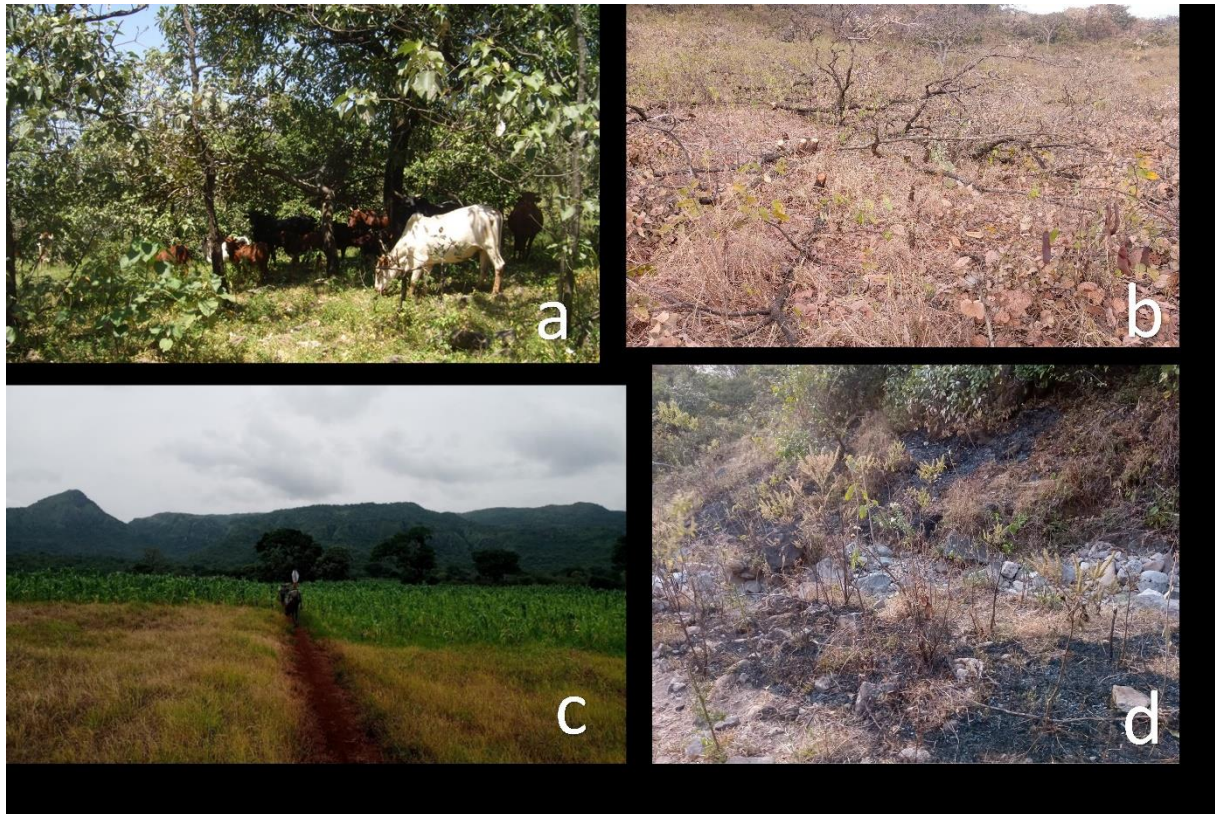


Figure 6: human activities that threaten the *A. nganhanus* habitat; a) grazing, b) deforestation, c) field agriculture, d) brush fire

IV. Awareness raising amongst local populations

Next March, we will cover this section. We conducted interviews with 90 members of the local community to understand their local activities and attitudes toward amphibians. We aim to complete data encoding soon so that we can analyse and evaluate their habits and enhance their education about the significance of conservation, particularly the preservation of natural habitats.

Difficulties:

- Road conditions that extend journey times; we took the decision to leave 4 hours earlier than the first descent to reduce the number of day on road.
- Presence of primates; this requires a camp guard when the team is out prospection; which expands the field team. We have divided the budget for the guides and porters to help cover the cost of camping guard and assistant.

Next field trips:

The three remaining sampling trips (February, April and June) will provide us with more data on the richness and distribution of amphibian species in general and *A. nganhanus* in particular in our study area. This will enable us to better appreciate the habitats of *A. nganhanus* on the Mountain and to define the activities threatening the site. Awareness-raising activities will be carried out following these results.

Acronyms:

IUCN: International Union for Conservation of Nature

CR: Critically Endangered

LC: Least Concern

VU : Vulnerable

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