

Plant-herbivore interactions and their influences on the distribution of sub-Saharan antelopes in the Ouadi Rimé Ouadi Achim Wildlife Reserve -Chad.



Summary report of the 2nd Field mission – Dry & cold season 2024

October 9 – November 22, 2024

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December 2024

Table of Contents

Introduction.....	3
I. Mission objectives.....	3
II. Mission details.....	4
III. Methods and main preliminary results.....	5
3.1. Herbaceous inventory	5
3.2. Tree inventory.....	6
3.3. Plant extract samples.....	7
3.4. Fecal matter sampling – semi-structured interviews – sample export.....	8
3.4.1. Fecal samples.....	8
3.4.2. Breeders Interviews	8
3.4.3. Shipping fecal matter.....	9
Perspectives.....	9

Plates and Figures

Liste of Plates

Plate 1. Image A) Quadrat 50 x 50 cm; B) Species coverage count by feet	5
Plate 2. Image C) Measure crown covering & height; D) Measure circumference at breast height	6
Plate 3. Images E) Indigofora.sp sample with tube label; F) Drying of samples in freeze dryer.....	8
Plate 4. Image G) Sterilization of samples; H) Cryotube box shipped	9

List of figures

Figure 1. Family distribution by specific density - OROAR - October 2024	5
Figure 2. Species distribution per recovery size - OROAR - October 2024	6
Figure 3. Distribution of families by tree specie –OROAR - October 2024	7
Figure 4. Specific distribution of woody plants by density - OROAR - October 2024	7
Figure 5. Number of individuals sampled by species - OROAR - October 2024	8

Introduction

This summary report presents all the activities carried out from October 9th to November 22nd, 2024, during the second field expedition as part of the doctoral research work of student Caleb Ngaba Waye Taroum. This report sets out the purpose of the mission, a brief reminder of the methodology for collecting the different types of data sought as well as an overview of the data obtained at the end of this second expedition in the Ouadi Rime Ouadi Achim Wildlife Reserve (OROAR). This mission was carried out with the authorization of the competent authorities of Chad (DGRFFP and IRED), under the supervision of the Conservation Biology Laboratory of the University of Neuchâtel and the Institute of Science and Technology of Abeché (INSTA). We actively benefited from the technical support of the ZODIAC laboratory of IRED for: the conservation, packaging and shipping of fecal material to the Conservation Sciences laboratory (The Royal (Dick) School of Veterinary Studies) from the University of Edinburgh (United Kingdom). We also benefited from the administrative and logistical support of the NGO Sahara Conservation, the technical support of Katherine Mertes (SNZCBI), Tim Wachter (ZSL), the Laboratory of Functional Biology of the University of Neuchâtel and Stephanie Brien (University of Edinburgh). The Swiss Confederation Excellence Scholarship sponsors our training at the Doctoral School of Life Sciences (DSLS) of the University of Neuchâtel and we benefited from the financial support of the Segré Foundation under the aegis of IUCN SOS and the Laboratory of Conservation Biology.

I. Mission objectives

- Inventory and sample the woody and herbaceous flora of the reserve during the cold-dry season after the rainy season. This is in order to study the phytosociological characteristics of the ecosystems of the reserve as well as the constitution of ecological niches shared between the reintroduced antelopes (*Oryx dammah* called “Oryx” and *Addax nasomaculatus* called “Addax”) and the four main domestic species sharing the reserve’s habitats (cattle, sheep, goats and camels);
- Collect samples of fecal matter (fresh as a priority) from the above-mentioned mammal species in order to analyze their metabolomic composition. But also, to identify potential zoonoses common to the two wild mammals (Oryx and Addax) and the four domestic ones (cattle, sheep, goats and camels);
- Carry out a questionnaire with the breeders encountered in the reserve in order to establish a map of the transhumance routes and a reference point for the livestock numbers in and around the reserve.

The initial plans developed for this mission were as follows:

- Carry out an inventory (of woody plants and grasses) on at least twenty-five (25) super-plots of 50 x 50 m distributed randomly so as to cover 95% of the distribution area of Oryx and Addax for the period from September 15th to October 15th, 2024;
- Collect at least 150 plant samples (woody plants and grasses) for metabolomic analyses on the 50 x 50 m super-plots;
- Collect 15 fecal samples for oryx and addax as well as 10 for each of the four targeted livestock species (cattle, sheep, goats and camels);
- Conduct 30 interviews with breeders present in the reserve.

II. Mission details

October 9 & 14, 2024: Work with the Scientific Coordinator of the Research Institute for Development – IRED (Dr. Fayiz) for the development of the transport certificate for fecal material samples as well as for the planning of preliminary sample sterilization operations.

October 15 & 17, 2024: Introduction and granting of the research certificate application by the Director General of Forest, Wildlife and Fisheries Resources (DGRFFP) at the Ministry of the Environment.

October 16, 2024: Greetings to the National Director of Sahara Conservation and to the staff present at the Chadian headquarters. Sharing of the expedition schedule as well as the activities planned upon return from the field.

October 19 – 20, 2024: Land journey from N'Djamena to Abeché.

October 21, 2024: Abeché – Oryx Base (RFOROA) journey via Arada to embark the two eco-guards delegated for the expedition by the OROAR Coordinator.

October 22, 2024: Presentations of the research team to the Oryx Project Chief as well as the mission schedule. Receipt of the usage instructions from the latter.

Start of field work with the research team, after discussions with Dr. Tim Wachter and the recovery of the daily positions of the antelopes to better guide the choice of super-plots.

22 – 27 October 2024: Floristic inventories, collection of fecal samples and interviews with the breeders met.

October 27, 2024: (afternoon) Return to Abeché via Arada to hand over the two eco-guards delegated for the expedition by the OROAR Coordinator to their sector head.

October 28, 2024: Meeting at INSTA Abeché with Pr. Tellah to discuss the protocols of the three Master's students for whom he is responsible and who are involved in the research process.

October 28 – 29, 2024: (afternoon) Return land trip Abeché – N'Djamena.

October 29, 2024: (morning) Submission of fecal samples to the Zodiac laboratory of IRED (N'Djamena) for storage at optimal temperature (-15°C) before sterilization and then shipment to Edinburgh.

October 29, 2024: Obtaining the Import Authorization (ITMP24.1153) from the Animal and Plant Health Agency of the Scottish Ministry, under the cover of Dr. Stephanie Brien.

November 8, 2024: Obtaining the Sample Transport Certificate signed by the Director General of IRED.

October 31 – November 4, 2024: Sterilization of fecal samples at the One Health Laboratory (Tuberculosis) of IRED with student Yousra Mahamat.

November 5, 2024: Report of the expedition to the National Director of Sahara Conservation following a meeting at the NGO headquarters.

November 14, 2024: Packaging of fecal material according to IATA P650 standard.

November 18, 2024: Shipment of fecal material (318 samples) by DHL from N'Djamena to Edinburgh.

November 21, 2024: Receipt of fecal material by Prof. Rob Ogden in Edinburgh.

November 25, 2024: delivery to the functional biology laboratory of the University of Neuchâtel of 130 samples of plant extracts collected from all the grasses and woody plants surveyed during the mission. This brings the total to approximately 300 samples prepared for metabolomic analyses.

III. Methods and main preliminary results

3.1. Herbaceous inventory

It was carried out using the same device as that of the July 2024 expedition. It consists of a super-plot of 50 x 50 m, in each of which, five quadrats of 50 x 50 cm were placed 10 m apart along three transects of 50 m. In total, 25 super-plots were inventoried for a total of 375 quadrats of 50 x 50 cm, inventoried for the systematic botanical identification of herbaceous plants.



Plate 1. Image A) Quadrat 50 x 50 cm; B) Species coverage count by feet

In total, 1195 grass plants were recorded. The inventoried population is divided into: 06 known families, 11 genera and 20 species including 03 unknown and 04 unidentified taxonomically (Figure 1).

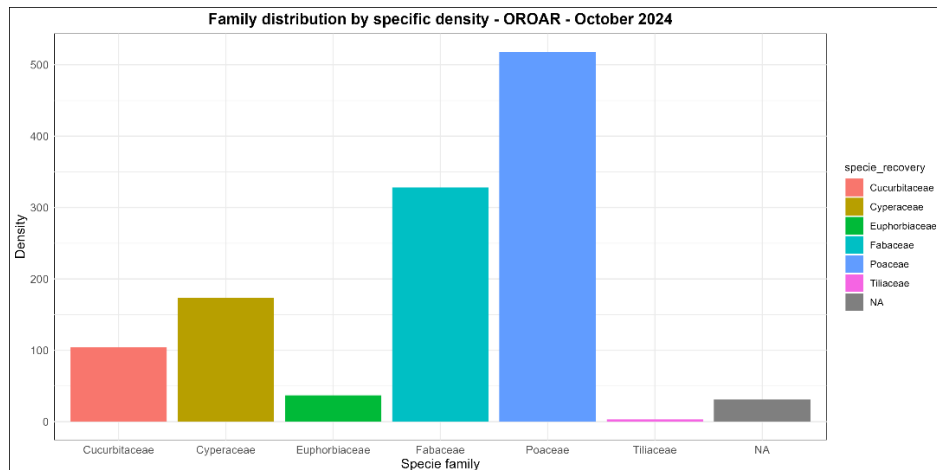


Figure 1. Family distribution by specific density - OROAR - October 2024

At the specific level, there are 20 species of grasses (Figure 2), including 03 botanically unknown and 04 taxonomically unidentified (local Arabic names, gorane, moundang, ngambaye known). Research is underway for the systematic identification of unidentified and unknown species.

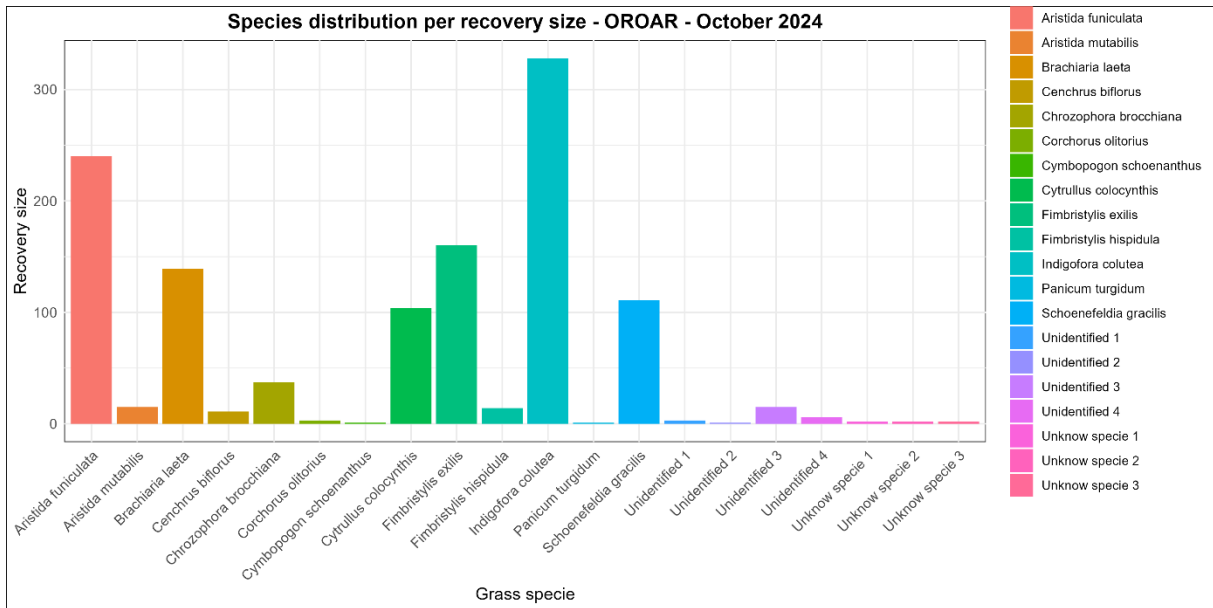


Figure 2. Species distribution per recovery size - OROAR - October 2024

3.2. Tree inventory

The inventory of woody plants was carried out on 25 super-plots of 50 x 50 m. Their geospatial arrangement was done in a “Minimum Convex Polygon » (MCP) equivalent to 95% of the distribution area of antelopes (Oryx and Addax) over the period from September 15 to October 15, 2024. In each super-plot, three 50 m long transects (oriented North-South), equidistant from 10 m each, allowed the inventory. On a total of 75 transects, all individuals of height greater than or equal to 1 m were botanically identified, over a width of 10 m on either side of each of the transects. In order to estimate the natural regeneration rate, the shoots and living stumps identified on the 10 m area on either side of each transect were also recorded as natural regeneration.

The taxonomic identification and dendrometry parameters (height, crown coverage, circumference at breast height) were systematically recorded for each tree base identified. All-natural shoots and tree stumps were also listed during the inventory.

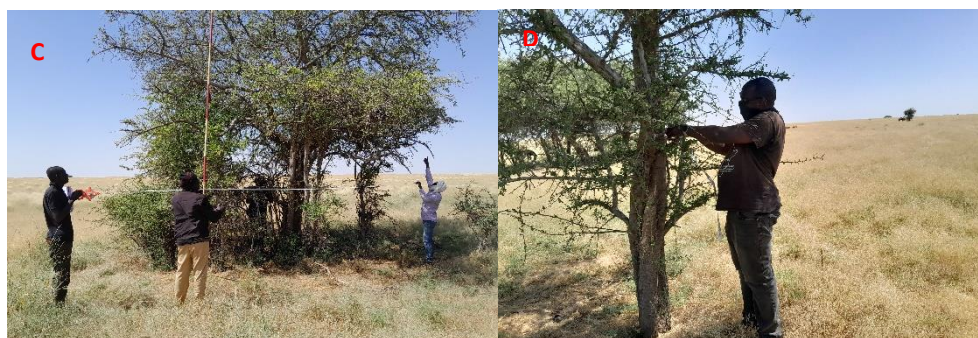


Plate 2. Image C) Measure crown covering & height; D) Measure circumference at breast height

At the end of this inventory, we count: 04 families divided into 04 species and 04 genera. The dominant family is that of the Zygophyllaceae with *Balanites aegyptiaca* as the dominant species (Figure 3). The least represented family is that of the Caesalpinaceae with an individual of *Cassia italica* identified.

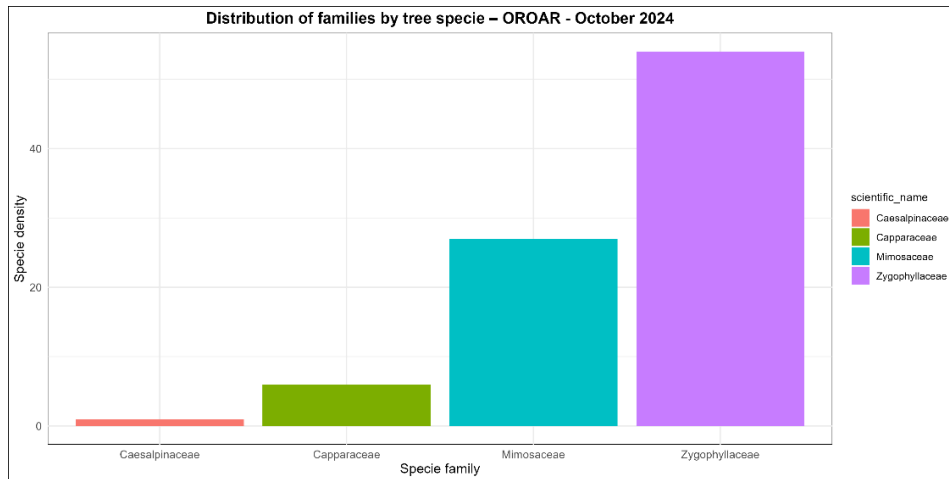


Figure 3. Distribution of families by tree specie – OROAR - October 2024

Balanites aegyptiaca stands out with a population of 54 individuals out of 88 inventoried, followed by the species *Acacia ehrenbergiana* with 27 individuals out of the total population (Figure 4).

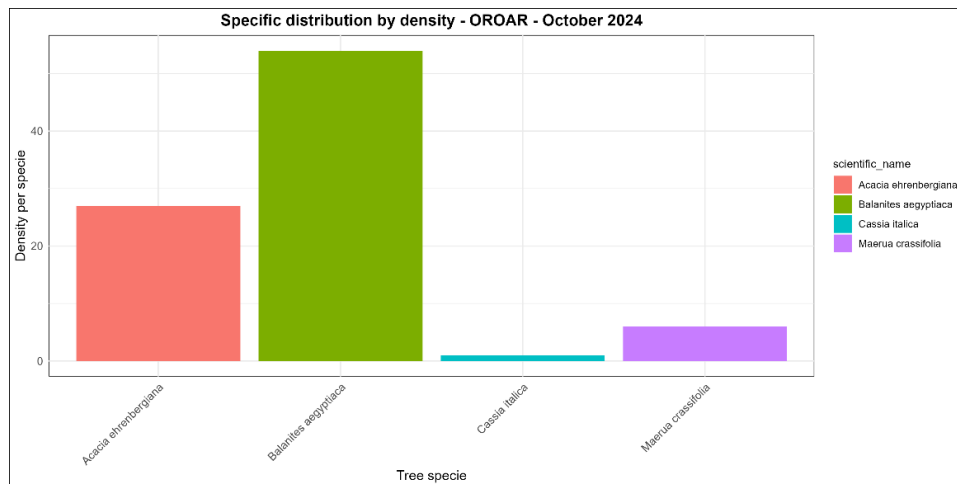


Figure 4. Specific distribution of woody plants by density - OROAR - October 2024

3.3. Plant extract samples

On all 25 super-plots (50 x 50 m) surveyed, plant extracts (leaves, flowers or stems for grasses) were sampled. In the case of grasses, sampling was done by elimination from one quadrat (50 x 50 cm) to another. In the first quadrat (out of 15 quadrats) of each super-plot, an extract of an individual of each identified species is systematically sampled. Then, for the other 14 quadrats, only the individuals of the newly identified species are sampled. In total, 375 quadrats of 50 x 50 cm were surveyed for the 25 super-plots visited.

All samples were taken using gloves sterilized with ethyl alcohol to avoid any alteration of the genome of the species collected. For trees, the extracts were also collected using sterilized pruning shears. Each of the plant extract samples was packaged in sterilized paper coffee bags and then dried in 15 ml tubes using silicate gel. A total of 130 plant samples, including 29 for woody plants, were packaged.

All 184 samples collected in July 2024 plus the 130 from the October 2024 mission were all sent to the functional biology laboratory of the University of Neuchâtel for metabolomic analyses.



Plate 3. Images E) *Indigofera.sp* sample with tube label; F) Drying of samples in freeze dryer

3.4. Fecal matter sampling – semi-structured interviews – sample export

3.4.1. Fecal samples

For this second mission, we were able to collect 76 samples of fecal matter for all six-target species. The sampling principle consists of locating a group and collecting the droppings of an individual or individuals of the group depending on the size of the herd encountered. For each sample, we took care to observe and note the visible body condition of the individual.

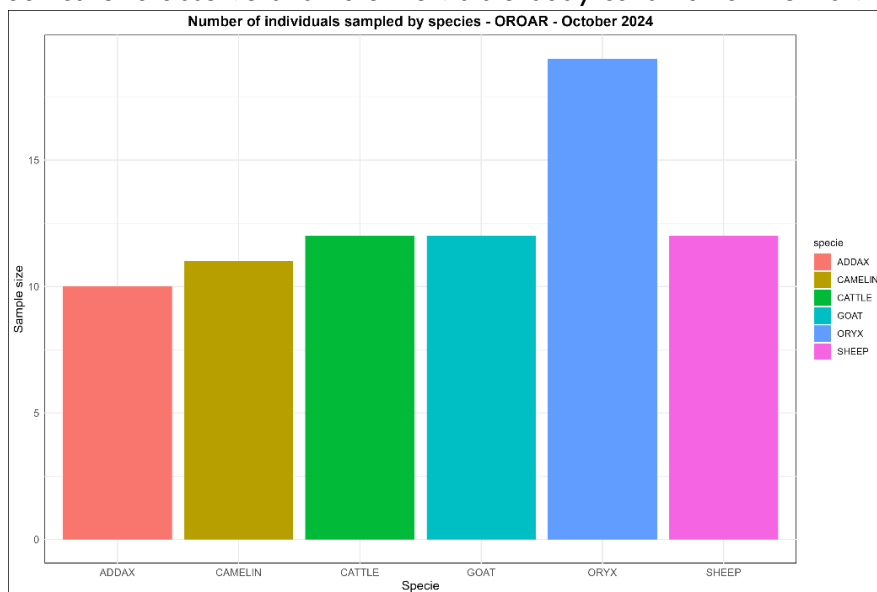


Figure 5. Number of individuals sampled by species - OROAR - October 2024

3.4.2. Breeders Interviews

At least 27 interviews were conducted with the owners and/or keepers of the livestock herds encountered. A variability of the localities of origin was noted, with several respondents coming from the areas of: Melfi (Guéra), the surroundings of the province of Amtiman (Salamat) and even Bousso (Chari-Baguirmi). These new origins of transhumant are added to the local origins of the provinces of Wadifira, Batha, Borkou and Ennedi. The questionnaires focused on: localities of origin, species raised, method of acquisition of livestock (purchases, inheritances, gifts or bequests), transhumance routes and periods, estimation of the size of the livestock owned and the perception of the cohabitation of wildlife with livestock in the reserve. Some questions were also asked about their knowledge of zoonoses and the common diet of livestock and antelopes reintroduced into the reserve.

3.4.3. Shipping fecal matter

A total of 83 samples collected in July 2024 (rainy season), associated with 76 collected in October 2024 (cold-dry season), were conditioned with RNA later in 2 ml cryotubes and then sterilized using a thermoblock at 58°C. Each of the 159 samples was subdivided into four aliquots distributed to the benefit of IRED, Sahara Conservation, the University of Neuchâtel and the University of Edinburgh. That said, a total of 318 samples, corresponding to the aliquots of the University of Neuchâtel and the University of Edinburgh, were shipped via DHL to the Conservation laboratory of the University of Edinburgh directed by Pr. Rob Ogden. Departing from N'Djamena on the 18th, the samples arrived at their destination on November 21, 2024.



Plate 4. Image G) Sterilization of samples; H) Cryotube box shipped

Perspectives

- Perform metabarcoding and metabolomic analyses (January – May 2025).
- Consider conducting a final field mission to carry out floristic inventories in order to obtain a complete range of data on the three seasons in the reserve (April – June 2025)