

THE SNOWFLAKE GRANT FOR RESEARCH ON PRIMATES

GRANT APPLICATION

Call 2016

PROJECT TITLE

ASSESSING THE SPATIOTEMPORAL AVAILABILITY AND
QUALITY OF CHIMPANZEE FOODS
IN A DRY, OPEN AND SEASONAL HABITAT

INTRODUCTION

This project focuses on studying the ecology of chimpanzees living in a savanna habitat with the goal of providing critical data for the conservation of chimpanzees. Chimpanzees are endangered (IUCN Red List of Threatened Species, 2006) and their numbers continue to decrease due to growing human population size, habitat destruction, hunting and disease. Ten per cent of the chimpanzee global population exists in Tanzania: 2500-3000 individuals (Butynski, 2003, IUCN, Gland, Switzerland) and about 75% of Tanzania's chimpanzees live unprotected outside National Parks, mostly in savanna habitat. These chimpanzees represent a viable population for the future because they exist over a large ecosystem (Masito-Ugalla, about 10,800 km²) with relatively low human impact compared to most chimpanzee habitats in Africa. It is urgent to design successful conservation strategies for these unprotected chimpanzees before human activities increase in the region. Before we can do this, however, we need to improve our understanding of their ecology and behavior in this savanna habitat. Little research has been conducted on chimpanzees living in savannas (the driest, most open and seasonal habitats where the species exist) and they remain poorly understood in comparison with those living in wetter (forested) habitats. There are only three long-term savanna chimpanzee study sites in Africa, one of them is where the present study is proposed to be conducted.

Chimpanzee savanna habitat is highly heterogeneous: a mosaic of different vegetation types that range from open grassland to closed canopy (evergreen) forest. The dominant vegetation type is woodland and patches of evergreen forest (mainly along watercourses: gallery) typically cover only 2-4% of the habitat. Savanna chimpanzees live at remarkably low densities (estimated to be up to 1/50th of some forest populations) and have vast home ranges (more than 10 times larger than forest chimpanzees) presumably because of the low density and high seasonality of their foods.

Savanna chimpanzees (as those in wetter habitats) are omnivorous, they have a complex diet composed of a variety of foods, the majority being fruit. This dietary diversity is assumed to be a direct result of habitat quality and heterogeneity, but neither has been adequately examined at savanna chimpanzee sites. Specifically, the relative importance of woodland versus forest vegetation types as food providers is unclear. Forest patches provide important foods and may be especially valuable to chimpanzees in savanna habitats, despite their small size. Preliminary vegetation data suggest a high variability in plant species diversity and composition in different (even neighboring) forest patches within savannas. So the distribution of chimpanzee foods within forest patches needs to be systematically studied. Isotopic analyses of chimpanzee hairs suggest that the savanna chimpanzees extensively use the woodland for feeding (Schoeninger et al. 1999 *Am J Primatol* 49:297-314). Thus, the relative contribution of woodland versus forest vegetation types to the chimpanzees' diet needs to be determined. Accurately defining food scarcity or abundance periods is crucial in highly seasonal savanna habitats. It is expected that the 6-month dry season of such habitats will cause plant food (especially fruit) availability to vary greatly in time. There is phenology plant food data for our study site, but we lack accurate estimates of food species densities over the landscape to estimate seasonal food abundance.

In short, comprehensive estimates of the availability of foods in space and time have not yet been produced for savanna chimpanzees. This is what the present study proposes to do. Such estimates, however, would be incomplete without nutritional data on foods. To determine the relative importance of different foods in the overall diet and in different seasons, the nutritional quality of foods needs to be estimated. But nutritional data are lacking for savanna chimpanzee foods.

To produce precise estimates on the distribution, abundance and quality of plant foods available to savanna chimpanzees in space and time, it is necessary to obtain two new kinds of data: 1) Floristic heterogeneity of the habitat and variability within the different vegetation types of the habitat (especially within forest vegetation type), and 2) nutritional quality of foods.

The proposed research will help to elucidate the relative importance of each vegetation type in space and time as food providers for chimpanzees, which in turn is needed to determine their value for chimpanzee conservation and initiate better conservation strategies for these unprotected Tanzanian chimpanzees and their habitat.

SPECIFIC OBJETIVES

The proposed project is part of an umbrella project that centers on understanding the behavioral ecology of non-habituated chimpanzees in an unprotected savanna habitat in Tanzania and conserving their habitat. Detailed ecological studies are crucial in reaching these goals.

The general objective of the proposed project is to assess the spatiotemporal availability and nutritional quality of foods for the chimpanzees in this dry, open and seasonal habitat.

The specific objectives are the following:

- 1) To evaluate the floristic heterogeneity of the habitat.
- 2) To assess species diversity, community composition and vegetation structure of the different vegetation types within the habitat.
- 3) To determine the spatial and temporal distribution and abundance of foods (especially preferred or keystone foods) within the habitat and within vegetation types.
- 4) To estimate the floristic variability within forest vegetation types.
- 5) To estimate nutritional quality of the diet by assessing the nutritional composition of foods.
- 6) To assess the quality of the different vegetation types of the habitat as food providers and determine the importance of the different vegetation types to chimpanzee's survival in this habitat, especially forest patches.

METHODS

STUDY SITE AND SUBJECTS. The study area, Issa (05°23.34S, 30°35.04E), is located in Ugalla, western Tanzania and comprises 85km². The climate is divided into rainy and dry seasons, lasting six months each. Annual rainfall averages 955 mm. The vegetation is a savanna dominated by open “miombo” woodland and composed of open (woodland, wooded grassland, grassland) and closed (evergreen gallery forests) vegetation types. There are eight primate species besides chimpanzees. Other fauna include elephant, zebra, lion, leopard, spotted hyena and African wild dog. There are a few settlements in peripheral areas. The chimpanzees are non-provisioned and remain non-habituated and, but habituation efforts are ongoing and direct observations are becoming more frequent.

DATA COLLECTION. The following data are proposed to be collected for an annual cycle for the present study:

Vegetation sampling. Plots will be used to evaluate floristic heterogeneity within the habitat and within the different vegetation types. Plot locations will be determined using a stratified random placement technique: the number of plots placed within each vegetation type will be proportional to the percentage of the area the vegetation type occupies within the habitat (Following Potts and Lwanga 2013 *Afr J Ecol* 52:427-337). Additional plots will be set within forest patches to evaluate the high floristic variability of this vegetation type. Diameter at breast height (DBH) will be measured at 1.3m for all stems ≥5cm DBH (using a venier caliper). Tree height will be calculated using a clinometer (Suunto PM-5/360PC; precision 1° and 1%) and distances will be measured with a laser rangefinder (Bushnell Yardage Pro Sport 450; precision 1 m). To sample all life forms, nested sub-plots within each of the 20x20m plots will be established (NAFORMA, 2010): shrubs and lianas ≥5 cm in DBH in a 10x10m plot; herbs, climbers and vines in a 5x5m plot and sedges and grasses in a 1x1m plot. Vegetation data will be collected with the help of an experienced botanist.

Nutritional content of foods. Samples will be collected and processed following Rothman et al. (2012 *Int J Primatol* 33:542–566). Several samples (≥5) of each of the plant food items most frequently eaten by the chimpanzees will be collected (≥30g of dry weight). Different samples will be taken from the same tree at different heights to account for the vertical distribution of nutrients. Non-seasonal food items (e.g. bark, mature leaves) will be sampled every month to account for seasonal variability in nutrient content. Samples will be quickly dried at 55°C using a food dehydrator (Excalibur® 9tray) powered by a solar panel. They will be weighted to the nearest 0.01 g before and after drying and stored in plastic bags with desiccant before being shipped for analysis. Gross energy, protein, fat, starch, dietary fiber will be estimated.

The following data have being collected by the umbrella project since 2008 and will be used in the present project:

Climate (rainfall and temperature). Daily measurements of temperature and rainfall will be used to determine how productivity of food is affected by climate.

Phenology of plant foods. To estimate abundance and seasonal availability of confirmed and likely chimpanzee plant foods, the relative abundance (estimated percentages rounded to nearest 5%) of plant parts (mature leaves, young leaves, flowers, and fruits, pods or seeds) is being recorded monthly for 1,020 trees, shrubs and lianas along transects stratified by vegetation type.

Dietary composition. Fresh feces are collected not invasively from chimpanzee sleeping sites and by direct observations. Feces are analyzed following McGrew et al. (2009 *Primates* 50:363–366). Data on the following characteristics of plant foods are recorded (following McGrew et al. 1988 *Am J Primatol* 16:213-226): part eaten (fruit, flower/inflorescence, seed/pod, leaf/shoot, stem/stalk, bark/cambium, underground storage organs); life form (tree, shrub, herb, liana, climber or vine) and vegetation type.

ETHICAL CONSIDERATIONS. The research protocol in this study complies with the International Society of Primatologists principles for the ethical treatment of primates and regulations to conduct research in wildlife areas in Tanzania.

PROJECT FOCUS, RESOURCES, PROVISIONAL INDEX AND PROJECT AGENDA

This project focuses on understanding the ecology of chimpanzees in a savanna habitat with the goal of providing essential data for the conservation of this endangered ape. These results of this project will improve management strategies by providing ecological data essential to identify priority areas and design protected areas for the long-term conservation of chimpanzees in Tanzania.

In addition, this research will contribute to understand the factors that influence chimpanzee ranging patterns and the species behavioral flexibility and range of adaptations. Furthermore, the data obtained from this project will be useful to help modeling the adaptations and behavior of early hominins. Together with bonobos chimpanzees are our closest evolutionary relatives. It has been proposed that chimpanzees living in savannas provide, in addition to genetic closeness, the ecological similarity for modeling early hominin behavior and adaptations because paleoecological reconstructions for some *Australopithecus*, *Paranthropus* and early *Homo* sites indicate they lived similar habitats to those of savanna chimpanzees.

To conduct the proposed research, data needs to be collected in the field (in Tanzania) for one annual cycle. The umbrella project has a permanent research station in western Tanzania since 2008 and thus the necessary experience of field conditions and logistics, knowledge of the methods to collect the proposed data and resources for successfully completing the proposed study are available.

Results from the proposed project will be presented to Government agencies (e.g. Tanzania Wildlife Research Institute - TAWIRI) and Regional and District Forestry and Wildlife officers administering areas where chimpanzees occur in Tanzania. In addition, results will be shared with chimpanzee conservation NGOs working in the area (e.g. Jane Goodall Institute Tanzania, Wildlife Conservation Society).

The data resulting from the proposed project are planned to be published in high impact journals in primatology and conservation biology. Manuscripts are planned to be submitted within one year after data collection ends. It is expected that at least three main publications will be produced. In addition, results are intended to be presented at the annual meetings of the American Society of Primatologists and at the biannual meetings of the International Primatological Society and the European Federation of Primatology.

| Time table | Activity |
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| From 1 st January 2017 | Project begins. Study set up, field assistant training, data collection begins |
| February- March 2017 | Vegetation sampling work with botanist |
| 31 st of December 2017 | Data collections ends |
| 1 st of January 2018 | Data analysis and write up begins |
| 31 st of January 2018 | Report submission to the Zoo Barcelona Fundació |
| 1 st of February – 31 st of December 2018 | Manuscripts write up and submission |
| December 2018 | Recommendations for chimpanzee conservation provided to Tanzanian Government agencies and Regional and District Forestry and Wildlife officers |

BUDGET

| BUDGET | Amount in Euros |
|--|------------------------|
| Botanical Sample Collection and Identification | |
| Salary – 1 Botanist Fieldwork and Identification (30€/day x 30) | 900 |
| Salary – 1 Field assistant (8€/day x 30) | 240 |
| Food – 1 botanist and 1 Field assistant (3€/day x 2 x 30) | 180 |
| Subtotal for Botanical Sample Collection and Identification | 1,320 |
| Nutritional Sample Collection and Analysis | |
| Salary – 1 Field assistant (8€/day x 365) | 2,920 |
| Food – 1 Field assistant (3€/day x 365) | 1,095 |
| Macronutritional assays (300 samples x 10€/sample) | 3,000 |
| Food dehydrator (Escalibur 9tray) | 310 |
| Desiccant materials | 120 |
| Subtotal for Nutritional Sample Collection and Analysis | 7,445 |
| TOTAL | 8,765 |