

IPS - Research Grant Application

Please complete the following application in the space provided. The application, including references and any supplementary materials, should not exceed the space provided. Font should be no less than 12pt. Please direct any questions regarding your application or this award to Dr. Joanna Setchell (joanna.setchell@durham.ac.uk).

Application Due: March 1st

Name

Last: Kassie

First: Addisu

Middle Initial: M

Project

Title of Proposed Project:

Sleeping site selection of Bale monkeys (*Chlorocebus djamdjamentis*) at Kokosa forest fragment in southern Ethiopia

Contact Information

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Provide a 200 word summary of your proposal:

Sleeping site selection is an important aspect primate behavioral ecology where safe sleeping sites and trees are crucial for individual survival and fitness. Several hypotheses have been proposed for the sleeping site selection of many primate species. However, nothing is known on the sleeping site selection of the little-known, endemic and endangered Bale monkeys in southern Ethiopia. Thus, the main aim of this study is to test four non-mutually exclusive hypotheses related to sleeping site and sleeping tree selection: predation avoidance, food access, range defense, and comfort and thermoregulation hypotheses. The study has been carried out from February – September 2014 at the Kokosa forest fragment. The presleeping behavior of monkeys, characteristics of sleeping trees and sleeping sites will be recorded every month. The result of this study will help to examine the sleeping site selection and sleep-related behavior of Bale monkeys which is a key to understand their ecological adaptation, evolution and survival of the species.

3 key words: Bale monkey, sleeping site, predation

1. Describe the rationale and significance of this request and how it relates to theory and/or primatology. (1 page maximum)

Sleeping site selection is an important aspect of the behavioral ecology of primates as they spend about half of their lives at sleeping sites (Anderson, 1998, 2000). The selection of secure sleeping sites and trees are crucial for individual survival and fitness (Phoonjampa et al., 2010). Several factors influence the selection of sleeping sites or trees, including predator avoidance (Albert et al., 2011; Fei et al., 2012), proximity to food resources (Teichroeb et al., 2012), thermoregulation and comfort (Lutermann et al., 2010; Li et al., 2013), range or resource defense (Teichroeb et al., 2012) and parasite avoidance (Heymann, 1995). The choice of sleeping site selection may also be influenced by several other factors, including body size, rainfall, temperature, season, social organization and reproductive state (Anderson, 2000; Li et al., 2006). Even though these factors are not mutually exclusive in influencing sleeping site selection, however, certain requirements potentially play a priority role over the other in preferring specific sleeping sites (Li et al., 2013). Several hypotheses have been proposed to account for sleeping site selection in primates including, the predation avoidance, food access, range defense, thermoregulation and comfort, and parasite avoidance hypotheses. The characteristics of sleeping trees such as tree height, diameter, stability, presence/absence of lianas and safety may affect the preference of sleeping sites and trees (Fan and Jiang, 2008; Phoonjampa et al., 2010). However, several other factors may also influence the sleeping site selection of primates and such factors are also interactive in influencing sleeping site selection (Qihai et al, 2009).

Studying sleeping site selection and sleep-related behavior is essential for understanding ecological adaptations, evolution of human behavior and survival of the species (Anderson, 1998; Fei et al., 2012). For most species of primates, however, factors influencing the sleeping site selection still remain unknown (Fei et al., 2012). Similarly, nothing is known about the sleeping site selection of Bale monkeys (*Chlorocebus djamdjamensis*). The Bale monkey is a medium sized, little-known, an arboreal and diurnal primate species, Vulnerable in the IUCN Red List, and endemic to southern Ethiopian highlands (Butynski et al., 2008; Mekonnen et al., 2010a, 2010b). Bale monkeys have recently been described as bamboo forest habitat specialists in continuous bamboo forests of the Bale Mountains of Ethiopia (Mekonnen et al., 2010a, 2010b). Interestingly, a very recent survey revealed that Bale monkeys continue to persist in small fragmented and isolated forests of southern Ethiopian highlands in the human dominated landscape where bamboo was eradicated several years ago (Mekonnen et al., 2012). The study group at Kokosa forest fragment is well-habituated for human observers as part of the long-term behavioural ecology study of the Bale monkey project. The main predators in the study area are dogs and humans while potential predators include leopards, hyena, common jackals and birds (Mekonnen, unpublished data). The main aim of this study is, therefore, to test the major hypotheses regarding factors that influence the sleeping site and tree selection behavior of Bale monkeys. The main objectives of the study are to assess the presleeping behavior, physical characteristics of sleeping sites and trees, and patterns of sleeping site use of Bale monkeys at the Kokosa Forest.

2. What are your hypotheses and predictions? (1/2 page maximum)

- 1) Predation avoidance hypothesis suggests that predation is the primary factor influencing the choice of sleeping sites and thus primates select sleeping trees that reduce detection by predators, and enhance detection of predators by the monkey. To reduce detection by predators, I predict that the monkeys i) move rapidly and directly to sleeping trees, ii) enter sleeping trees before nocturnal predators become active, iii) keep silent in their sleeping trees and iv) change sleeping sites and trees frequently. To enhance detection of predators and decrease access by predators, monkeys sleep i) on small branches, ii) in emergent trees near the top, iii) big trees, iv) on trees with an open crown, v) on trees without lianas.
- 2) Food access hypothesis states that foraging constraints play a major role for sleeping site selection. I predict that Bale monkeys will select sleeping trees close to feeding sites to minimize travel costs, ii) sleep in their feeding trees or close to their last feeding tree of the day or first feeding tree of next morning
- 3) Range defense hypothesis proposes that primates prefer to sleep in trees near to their neighbor group home range or overlapping ranges to prevent the entrance of their conspecifics
- 4) Comfort or thermoregulation hypothesis suggests that primates prefer to sleep in an area with a lower elevation and warmer microhabitats protected from wind to keep their body temperature warmer and conserve energy. So, Bale monkeys prefer to sleep at a lower elevation and dense forest microhabitats with valleys facing opposite of wind direction to minimize wind and increase comfort.

3. What methods, data and statistics will be used to answer your question(s)? Please be specific. (1/2 page maximum)

Pre-sleep behavior: The time of each individual entering or exiting a sleeping tree for each night/morning, behaviour of up to 6 monkeys after the last feeding bout & before they go to sleep, and sleeping place on the tree and posture will be recorded. The time of sunrise and sunset will be obtained daily from GPSMap 62s.

Characteristics of sleeping trees: The following characteristics of each sleeping tree will be recorded [modified from Phoonjampa et al. (2010); Fei et al. (2012); Hernandez-Aguilar et al. (2013)]: 1) species, 2) DBH, 3) height, 4) height of the lowest branch, 5) size of the lowest branch, 6) height of the sleeping place, 7) diameter of the crown, 8) presence/absence of lianas on the tree, 9) relative height of each sleeping tree, 10) arboreal connection with surrounding trees, and 11) visibility of tree canopy.

Characteristics of sleeping sites: The following characteristics of each sleeping site will be recorded (following Phoonjampa et al., 2010; Seiler et al., 2013): 1) microhabitat around each sleeping site within a circular plot of 20 m radius from the center, 2) GPS location, 3) visibility of canopy cover, 4) elevation, 5) slope inclination, 6) slope face, 7) topography, 8) wind direction, and 10) rainfall and temperature data for each day will be obtained from the nearby camp site.

Data Analyses: Data on sleeping site selection will be summarized. Then, the samples will be tested for normal distribution before choosing a specific statistical test. If the samples are normally distributed, parametric tests will be used and if not, the samples will be tested for non-parametric tests. Statistical tests will be conducted using SPSS 16 and in R, version 2.15.2 (R-Development-Core-Team 2012). Different statistical tests will be employed during the statistical analyses.

4. Please provide a timeline for this project.

February 2014 - September 2014 covering both wet and dry seasons: Data on the sleeping site selection of Bale monkeys including Presleeping behavior, sleeping site characteristics, sleeping trees and related variables will be collected for a total of 7-10 days per month.

5. Budget – Please provide detailed information for all expenditures not to exceed \$1500.00. Do you have additional funds for this project? If so, please list funding sources and amounts.

Budget (in USD): Requested from IPS = 1500 \$

| Expenditure | Unit | Budget Details | | Requested from IPS | Funded from AAU | Total |
|--|----------|----------------|---------|--------------------|-----------------|------------------|
| | | Amount | Rate \$ | | | |
| Personnel: Field per diem | | | | | | |
| Principal Investigator (1 ind) | Days | 60 | 10 | 400 | 200 | 600 |
| Research assistant (1 ind) | Days | 60 | 10 | 400 | 200 | 600 |
| Local guides (1 ind) | Days | 60 | 5 | 200 | 200 | 300 |
| Sub-total | | | | 1000 | 600 | 1500 |
| Transportation | | | | | | |
| Travel for the researchers – fuel, horse and vehicle hire for the team | Lump sum | | | 300 | 300 | 600 |
| Sub-total | | | | 300 | 300 | 600 |
| Equipment and supplies (GPS, binoculars, tents, mattress and raincoat) are available and provided from Addis Ababa University (AAU) and International Foundation for Science (IFS) | | | | | | Available |
| Cooking Equipment | | | | | | Available |
| Consumables | | | | | | |
| GPS batteries, torch and large sized batteries | Lump sum | | | 100 | 100 | 200 |
| Stationery items, photo copies and printing / binding | " | | | 100 | 100 | 200 |
| Sub-total | | | | 200 | 200 | 400 |
| Grand Total | | | | 1500 | 1000 | 2500 |

Funded from Addis Ababa University: 1000 USD

(Optional Section)

Conservation through Community Involvement (CCI)

If you plan to include CCI in your program you may be eligible for an additional award of \$500 to support these initiatives. Please describe your CCI plan below, addressing how these funds will be used and how this will impact conservation in your region. For more information on CCI and suggested CCI practices, please see the Guidelines for Conservation through Community Involvement posted in the publications section of the IPS website. (1/2 page maximum)

6. Literature cited

- Albert, A., Savini, T., and Huynen, M.C. (2011). Sleeping site selection and presleep behavior in wild pigtailed macaques. *Am. J. Primatol.* **73**: 1222-1230.
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- Butynski, T.M., Gippoliti, S., Kingdon, J. and De Jong, Y. (2008). *Chlorocebus djamdjamentis*. **In**: IUCN 2012. IUCN Red List of Threatened Species. Version 2013.2. <www.iucnredlist.org>. Downloaded on 10 February 2014.
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- Mekonnen, A., Bekele, A., Fashing, P.J., Lernould, J., Atickem, A. and Stenseth, N.C., (2012). Newly discovered Bale monkey populations in forest fragments in southern Ethiopia: Evidence of crop raiding, hybridization with grivets, and other conservation threats. *Am. J. Primatol.* **74**: 423-432.
- Phoonjampa, R., Koenig, A., Borries, C., Gale, G.A., and Savini, T. (2010). Selection of sleeping trees in pileated gibbons (*Hylobates pileatus*). *Am. J. Primatol.* **72**: 617-625.
- Seiler, M., Holderied, M., and Schwitzer, C. (2013). Effects of habitat degradation on sleeping site choice and use in Sahamalaza Sportive Lemurs (*Lepilemur sahamalazensis*). *Int. J. Primatol.* **34**: 260-280.
- Teichroeb, J.A., Holmes, T.D., and Sicotte, P. (2012). Use of sleeping trees by ursine colobus monkeys (*Colobus vellerosus*) demonstrates the importance of nearby food. *Primates* **53**: 287-296.

7. CV (principal investigator)

Name: **Addisu Mekonnen**

Date of birth: March 22 /1976 G.C.; Nationality: Ethiopian

Language: mother tongue – Amharic; English - fluent (spoken & written)

Educational Background:

PhD candidate at the Centre for Ecological and Evolutionary Synthesis, University of Oslo, Norway starting from January 2012 (Funding from external sources for field).

M.Sc. in Ecology and Systematic Zoology from Addis Ababa University - July 2008.

B.Sc. in Biology from Addis Ababa University - July 1998.

Experiences (Recent): **Lecturer** at Addis Ababa University, Faculty of Life Sciences, Department of Zoological Sciences since March, 2009.

Current Research: Principal investigator & Project leader for the Bale monkey research project since 2007. Primate research & conservation branded at WAZA:

<http://www.waza.org/en/site/conservation/waza-conservation-projects/overview/primate-research-and-conservation>

Publications

Alemneh Amare, Afework Bekele, Peter J. Fashing, Tariku Mekonnen, Tadesse Woldemariam and **Addisu Mekonnen** (in prep). Feeding ecology, activity and ranging patterns of De Brazza's monkeys (*Cercopithecus neglectus*) in the Yayu Biosphere Reserve, Ethiopia. *Int. J. Primatol.*

Kelil Abu, **Addisu Mekonnen**, Afework Bekele, and Peter J. Fashing (in prep.). Feeding ecology and activity patterns of the rare Arsi gelada monkey (*Theropithecus gelada* unnamed subsp.) in Indetu, eastern Arsi, Ethiopia. *Primates*.

Addisu Mekonnen, Afework Bekele, Peter J. Fashing, Anagaw Atickem and Nils Chr. Stenseth (in prep.). Distribution pattern and conservation status of Boutourlini's blue monkeys (*Cercopithecus mitis boutourlinii*) along the western Rift Valley of Ethiopia. *Primates*

Dereje Tesfaye, Peter J. Fashing, Afework Bekele, **Addisu Mekonnen**, and Anagaw Atickem (2013). Ecological flexibility among Boutourlini's blue monkeys (*Cercopithecus mitis boutourlinii*) in Jibat Forest, Ethiopia: A comparison of habitat use, ranging behavior, and diet in intact and fragmented forest. *Int. J. Primatol.* **34**: 615–640.

Addisu Mekonnen, Afework Bekele, Peter J. Fashing, Lernould, J., Anagaw Atickem and Nils Chr. Stenseth (2012). Newly discovered Bale monkey populations in forest fragments in southern Ethiopia: Evidence of crop raiding, hybridization with grivets, and other conservation threats. *Am. J. Primatol.* **74**: 423–432.

Addisu Mekonnen, Afework Bekele, Peter J. Fashing, Graham Hemson and Anagaw Atickem (2010a). Diet, activity patterns, and ranging ecology of the Bale monkey (*Chlorocebus djamdjamensis*) in Odobullu Forest, Ethiopia. *Int. J. Primatol.* **31**: 339–362.

Addisu Mekonnen, Afework Bekele, Graham Hemson, Eyob Teshome and Anagaw Atickem (2010b). Population size and habitat preference of the Vulnerable Bale monkey (*Chlorocebus djamdjamensis*) in Odobullu Forest and its distribution across the Bale Mountains, Ethiopia. *Oryx* **44**: 558–563.

Send this application AS ONE PDF DOCUMENT to: Dr. Joanna Setchell (joanna.setchell@durham.ac.uk)