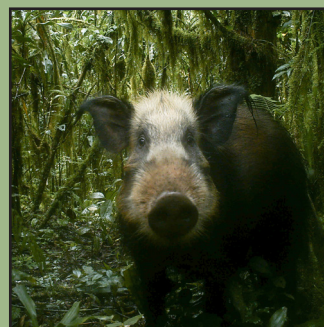




Biodiversity Express Survey

Belete-Gera forest

August 2014



Biodiversity Inventory for Conservation

Biodiversity Express Survey (BES) 3, Belete-Gera forest, Ethiopia, 2014

Biodiversity Inventory for Conservation (BINCO)

<http://www.binco.eu>

Contact:

BINCO vzw
Walmersumstraat 44
3380 Glabbeek
0495/402289
info@binco.eu

Editors:

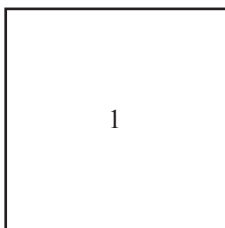
Matthias De Beenhouwer and Jan Mertens

Contributing authors:

Lore Geeraert and Merlijn Jocqué

Publication date:

May 2015



Picture covers:

1. Belete-Gera forest 2. *Acraea serena* 3. *Cnemaspis dickersonae*



4. *Potamochoerus larvatus* 5. *Afrixalus clarkei*

Biodiversity Express Surveys (BES) are snapshot biodiversity studies of carefully selected regions. Expeditions typically target understudied and/or threatened areas with an urgent need for more information on the occurring fauna and flora. The results are presented in an Express Report (ER) that is made publicly available online for anybody to use and can be found at www.BINCO.eu. Teams consist of a small number of international specialists and local scientists. Results presented in Express Reports are dynamic and will be updated as new information on identifications from the survey and from observations in the area become available.

Suggested citation:

De Beenhouwer M., Mertens J., Geeraert, L., and Jocqué, M., (2015) Express Biodiversity Survey in Belete Gera forest, Ethiopia. BINCO Express Report 4. Biodiversity Inventory for Conservation. Glabbeek, Belgium, 24 pp.

Index

Expedition fact sheet	4
Quick overview of results	5
Abstract	5
1. Introduction	6
2. Goal	8
3. Biodiversity survey	8
Amphibians and reptiles	9
Large mammals	11
Birds	13
Butterflies	17
Dragonflies	21
Ground beetles	22
4. Discussion	23
5. References	24

EXPEDITION FACT SHEET

Location

Afalo kebele (7°38'N, 36°13'E) and Quacho kebele (7°46'N, 36°20'E) in Gera Woreda, Jimma Zone, Oromo Region, Southwest Ethiopia.

Date

August 2014: Amphibians and Odonata

August 2014 – January 2015: Camera trapping (mammals) and pitfall trapping (Carabidae)

Expedition Members – Expertise

Matthias De Beenhouwer – birds and mammals

Lore Geeraert – ground beetles

Merlijn Jocqué – dragonflies and amphibians

Jan Mertens – butterflies and amphibians

Cooperation

BINCO vzw – Rufford foundation – Katholieke Universiteit Leuven – Jimma University



Acknowledgements

This expedition was made possible with help of:

Ato Aba Sharo and Ato Sabit for guidance through the forest,

The people of Afalo,

The permission of Gera woreda and the Oromia Forest and Wildlife Enterprise (Jimma),

The ministry of Agriculture, for export permissions

The Rufford Foundation, for financial support

Jimma University and Katholieke Universiteit Leuven, for cooperation and logistic support

QUICK OVERVIEW OF RESULTS

Table 1. An overview of the taxa identified at this point and the survey and collecting techniques used: Opportunistic observations (OO), Active survey (AS), Camera trapping (CT), Pitfall trapping (PT).

Taxa	# Species	Survey Technique
Mammals	25	CT and OO
Amphibians	16	AS and OO
Reptiles	5	OO
Birds	126	CT and OO
Butterflies	>87	AS and OO
Dragonflies	?	OO
Ground beetles	(25)	PT

ABSTRACT

With less than three percent of natural forest remaining in Ethiopia, the need to protect the remaining forest is rapidly increasing. Overexploitation and coffee production are two of the main threats to forest loss. The Gera forest in Southwest Ethiopia lies within the Eastern Afromontane Biodiversity Hotspot and is one of the larger remaining tracts of forest left in the country. The biodiversity within the forest, however, is not well understood, although this is crucial for a better protection of the forest. Therefore, we surveyed different species groups (amphibians, mammals and ground beetles) and combined this with opportunistic observations of birds, reptiles, butterflies and dragonflies to better understand the biodiversity in the forest. The field campaign mainly took place within the Afalo kebele (Jimma zone) in August 2014. Up to now, we identified 25 mammal species, 16 amphibians, 5 reptiles, 126 birds and 87 species of butterflies. Species identification is ongoing and this survey will be updated when more information is available. Already, several species were identified that were not known for this area, showing a considerable range and/or altitudinal extension. Also, several endemic and/or threatened species were found. These findings emphasize the biogeographical importance of this forest within the Biodiversity Hotspot, and the need for more study. With increasing human encroachment at its doorstep, it is time for policy makers to upgrade this forest to a higher level of protection.

1 Introduction

Ethiopia is known as the origin of Arabica coffee (*Coffea arabica* L.), which is endemic to the highlands in the Southwest of the country. Coffee intensification, however, is one of the main causes of natural forest (NF) loss in Ethiopia. In this process, coffee is planted in the understory to increase yields and the canopy is managed to increase light penetration. This secondary forest is a 'coffee forest' (CF) and, while still providing higher ecosystem services and levels of biodiversity than coffee plantations, overall, biodiversity decreases (De Beenhouwer *et al.*, 2013).

Due to limited accessibility and steeper slopes, mountain forests in general have long been spared from major anthropogenic disturbance. However, the global coffee market increased yearly with 1.2% since 1980 (ICO, 2012) and the Ethiopian population rises with approximately 2.6% yearly (Worldbank, 2013). This forces people to utilize and intensify areas that were previously avoided. One such area is the forest region to the Southwest of Jimma. The Belete-Gera national forest priority area is a forest fragment in the Jimma zone, Oromo Regional State, and is recognized as a Key Biodiversity Area (KBA) within the Eastern Afromontane Biodiversity Hotspot (EABH) (Mittermeier *et al.*, 2004). It is characterized as an Afromontane evergreen forest, dominated by trees like *Syzigium guineense*, *Olea welwitschii*, *Prunus africana* and *Pouteria adolfi-friederici* (Demissew *et al.*, 2004). The forest covers more than 1500km² and ranges between 1400 and 2970 m above sea level (asl.). Mean temperature at 2000 m asl is 18.4°C whereas mean annual rainfall is situated around 1780 mm. Arabica coffee occurs in these forests as a natural wild understory shrub between 1400 m and 2200 m asl (Pers. Obs.). Furthermore, the forest is inhabited by people from different ethnic groups, who extract coffee, honey, spices, bush meat, wood and medicines from the forest (Interviews MDB). Here also, the increasing population growth in and around the Belete-Gera forest increases pressure on forest resources (Hylander *et al.*, 2013). Farmers are stimulated to convert NF to CF deeper inside the forest. On the forest edges, trees are being cut to increase agricultural fields while rising human population and livestock results in an overexploitation of the remaining forest.

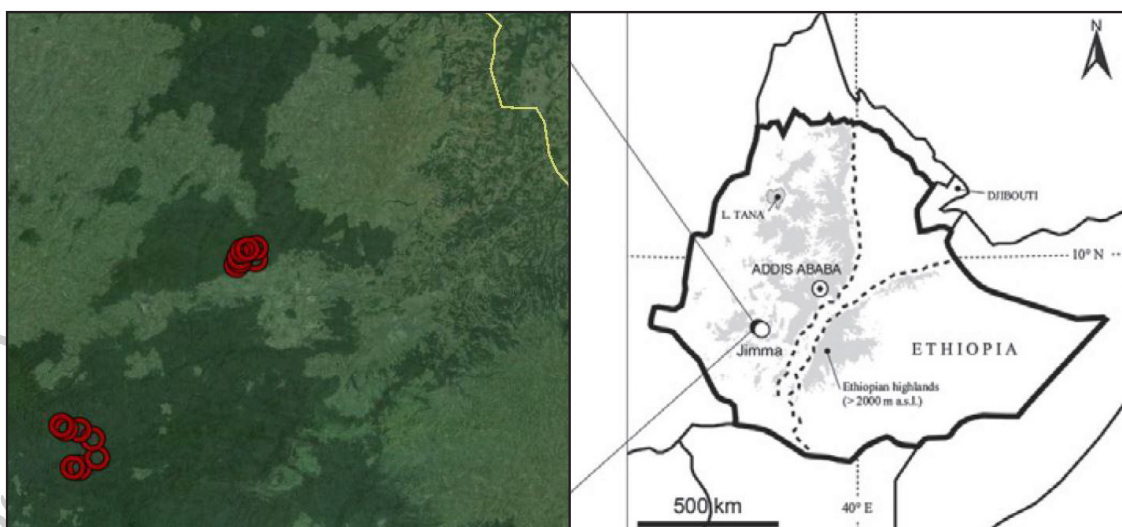


Fig. 1. Left: Detailed map showing the remaining mountain forest and our sampling locations in Afalo (left bottom corner) and Gera (middle) **Right:** Overview of Ethiopia

Little information on the biodiversity in this region is available and specific studies on what species are more affected by the coffee intensification and how communities change are rare (but see Hundera *et al.*, 2013). Recent studies on certain taxa indicate that coffee management decreases plant diversity (Aerts *et al.*, 2011; Hundera *et al.*, 2013). Also, coffee management has been shown to affect the gene pool of wild Arabica coffee (Aerts *et al.*, 2013) and coffee pollinator communities (Berecha *et al.*, 2014). Birds, on the other hand, have been shown not to decrease in species diversity between NF and CF, although bird communities differ significantly (Buechley *et al.*, 2015). Still, the ongoing intensification of NF towards CF poses an unknown threat for many other groups that are not studied so far.

Overall, in a broader context, biological expeditions in Ethiopia have a short history. Early expeditions were focused on mammals and reptiles and revealed a high percentage of endemism (10.5% and 10.6%, respectively) for these groups. More recently, research included orchids and birds (e.g. Demissew *et al.*, 2004; Gove *et al.*, 2008) and amphibians (Largen, 2001). An estimated 40% of amphibians in Ethiopia are occurring nowhere else in the world. Still, Ethiopian amphibians have long been understudied. So far, only one survey of the forested highlands in the Southwest of Ethiopia has been undertaken. Other species records in this area are mainly known from more sporadic observations (Largen, 2001). Invertebrates are known to be understudied worldwide, and this is certainly the case for Ethiopia. Butterflies (Rhopalocera and Hesperidae), for example, are known from 353 species in Ethiopia. This is indeed a low number compared to neighbouring countries in East Africa (e.g. Kenya: 859 spp., Uganda: 1149 spp., Tanzania: 1300 spp.) (Sáfián, 2009).

2 Goal

Due to the current surge in coffee forest intensification in the region we collected standardized biodiversity data on mammals and ground beetles (Carabidae) in the forest of Gera-Belete. These will be used to investigate the effect of coffee intensification on forest community composition and diversity. Active surveys of amphibians and sporadic observations of birds, reptiles, butterflies and dragonflies were accumulated throughout the survey and included in this report.

3 Biodiversity survey

The field campaign started in August 2014 in the village of Afalo (7°38'N, 36°13'16"E), at an altitude of 1816 m asl, from where day (and night) excursions were organized. After four days, the base camp was shifted to a location situated inside more remote forest (7°37'41.39"N, 36°14'3.22"E) at an altitude of 1744 m asl. Here, the surrounding forest was surveyed during five consecutive days. Later, in September and November 2014, smaller trips were organized to the same area and to a smaller forest remnant adjacent to the Quacho kebele (7°46'50"N, 36°20'7"E). In the following section, we will briefly list the observations made during the survey. This section will be updated based on expert opinions and slower identification of invertebrates and amphibians over time. New updates will be uploaded online (www.binco.eu) when this information becomes available.



Amphibians and reptiles

De Beenhouwer M., Mertens J. and Jocqué M.

Amphibians were assessed on visual encounter surveys (VES) mostly at night in August, mid rainy season, in the immediate vicinity of the different base camps. Surveys were focused around small streams, pools and swamps. From September to November, at the end of the rainy season, a drastic decline in amphibian observations occurred. In total 16 species of amphibians were recorded for this region, six (or 37.5%) endemic to Ethiopia (Table 2). Five species were new observations for the region. A relatively low diversity of reptiles was encountered which might be due to the high mean elevation of our surveys (1890 m asl) and the general aversion of local people towards snakes and chameleons (Interviews). Reptiles and amphibians were identified using the guide to Ethiopian reptiles and amphibians (Largen and Spawls, 2010) and updated using the IUCN red list (IUCN, 2014).

Table 2. Amphibians and reptiles identified inside Belete-Gera forest. ‘Obs.’ indicates the minimum number of observations, ‘New’ indicates that the species was not yet known for the area and ‘End.’ indicates that the species is endemic for Ethiopia. IUCN status according to the updated list at www.iucnredlist.org, accessed on 01/03/2015, LC=Least concern, NT=Near threatened, VU=Vulnerable, EN=Endangered and DD=Data deficient.

N°	Species	Common name	Obs.	New/End.	IUCN
Amphibians					
1	<i>Afrivalus clarkei</i>	Clarke’s banana frog	>100	New/End	EN
2	<i>Amietophrynus sp.</i>	Toad sp.	>20		
3	<i>Conraua beccarii</i>	Filfil slippery frog	>20		LC
4	<i>Hemismus marmoratus</i>	Marbled snout burrower	>20		LC
5	<i>Hoplobatrachus occipitalis</i>	Crowned bullfrog	>5		LC
6	<i>Hyperolius acuticeps?</i>		1		LC
7	<i>Hyperolius balfouri</i>		>10	New	LC
8	<i>Hyperolius viridiflavus</i>	Common reed frog	>100		LC
9	<i>Leptopelis sp.?</i>		?	New/End	
10	<i>Leptopelis vanutelli</i>	Dime forest tree frog	>50	End	LC
11	<i>Paracassina obscura</i>	Ethiopian striped frog	>100	End	LC
12	<i>Phrynobatrachus minutus</i>	Ethiopian striped frog - No common name	>100	End	LC
13	<i>Phrynobatrachus natalensis</i>	Natal dwarf puddle frog	>50		LC
14	<i>Ptychadena sp. 2</i>	Grass frog sp. 2	?		
15	<i>Ptychadena sp. 1</i>	Grass frog sp. 1	?	End	
16	<i>Xenopus clivii</i>	Peracca’s clawed frog	>20		LC

N°	Species	Common name	Obs.	New/End.	IUCN
Reptiles					
1	<i>Afroablepharus wahlbergi?</i>	Wahlberg's snake eyed skink?	2	New	
2	<i>Bitis parviocula</i>	Ethiopian mountain adder	1	End	DD
3	<i>Cnemaspis dickersonae</i>	Dickerson's forest gecko	2	New	DD
4	<i>Trachylepis varia</i>	Variable skink	>10		LC
5	<i>Trioceros affinis</i>	Beardless Ethiopian Montane Chameleon	3	End	LC



Large mammals

De Beenhouwer M., Jocqué M., Geeraert L. and Mertens J.

The large mammal assemblage in coffee forest was monitored with 16 camera traps on 48 different locations from August 2014 to January 2015 for a total of approximately 1600 cameratrap days. Opportunistic observations, mostly monkeys, were also recorded during fieldwork. The cameras were placed in both natural and coffee forest with three transects of 8 cameras in each habitat ($3 \times 8 = 24$), separated at about 200m each.

A total of 25 mammal species were recorded. Three species of monkey, one mongoose species and one species of squirrel were only observed visually, other species were observed visually and captured on camera traps (8 species), whereas a third group of species was only observed with camera traps (12 species; Table 3). One species (*Panthera leo*) was only observed by its spoor, yet neither visually nor with camera traps. Therefore, this species is not added to the species list (Table 3). Mammals were identified using the Kingdon field guide to African mammals (Kingdon, 1997).

Table 3. Mammal species identified inside Belete-Gera forest. CT = Camera trap observation, OO = Opportunistic observation. IUCN status according to the IUCN updated list at www.iucnredlist.org, accessed on 01/03/2015, LC = Least concern, NT = Near threatened, VU = Vulnerable and EN = Endangered.

N°	Species	Common name	ID	IUCN
1	<i>Atilax paludinosus</i>	Marsh mongoose	OO	LC
2	<i>Canis adustus</i>	Side-striped jackal	CT	LC
3	<i>Cercopithecus mitis</i>	Blue Monkey	OO	LC
4	<i>Cercopithecus neglectus</i>	De Brazza's monkey	CT	LC
5	<i>Chlorocebus aethiops</i>	Grivet Monkey	OO	LC
6	<i>Civettictis civetta</i>	African civet	CT	LC
7	<i>Colobus guereza</i>	Black-and-white colobus monkey	OO	LC
8	<i>Crocuta crocuta</i>	Spotted hyena	CT	LC
9	<i>Galago sp.</i>	Bushbaby sp.	CT, OO	
10	<i>Galerella sanguinea</i>	Slender-tailed mongoose	CT	LC
11	<i>Genetta genetta</i>	Common genet	CT	LC
12	<i>Genetta tigrina</i>	Blotched genet	CT, OO	LC
13	<i>Heliosciurus gambianus</i>	Gambian sun squirrel	OO	LC
14	<i>Hylochoerus meinertzhageni</i>	Giant forest hog	CT, OO	LC
15	<i>Hystrix cristata</i>	Crested porcupine	CT	LC
16	<i>Ichneumia albicauda</i>	White-tailed mongoose	CT, OO	LC
17	<i>Lophiomys imhausi</i>	Crested rat	CT	LC
18	<i>Mellivora capensis</i>	Honey badger	CT	LC
19	<i>Panthera pardus</i>	Leopard	CT	NT
20	<i>Papio anubis</i>	Olive baboon	CT, OO	LC

N°	Species	Common name	ID	IUCN
21	<i>Potamochoerus africanus</i>	Warthog	CT, OO	LC
22	<i>Potamochoerus larvatus</i>	Bushpig	CT	LC
23	<i>Sylvicapra grimmia</i>	Bush duiker	CT, OO	LC
24	<i>Syncerus caffer</i>	Buffalo	CT	LC
25	<i>Tragelaphus scriptus</i>	Bushbuck	CT, OO	LC

Furthermore, Demelash Sime, master thesis student Biology at the Jimma University, has worked for his Master thesis on rodent diversity inside the Belete-Gera forest, quantifying the effect of coffee management on their species diversity and community composition. Results are expected by July-August 2015 and will be added to the report.



Birds

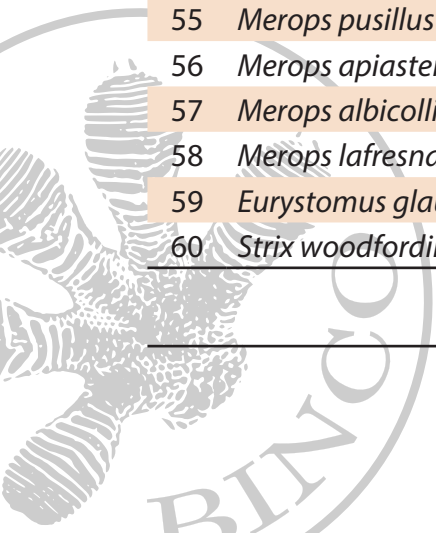
De Beenhouwer M.

Birds were identified on an ad hoc basis throughout the expedition using both visual and vocal observations (Table 4). Birds were noted in and on the edge of the Belete-Gera forest complex. Obviously, more focused efforts incorporating mist netting and point count transects will considerably increase the number of additional species. However, birds were not the focus of this survey as there is already an ongoing project at the Jimma University, which investigates the biodiversity of birds in this forest (Buechley *et al.* 2015). Birds were identified using the Bird guide to the Horn of Africa (Redman, Stevenson and Fanshawe, 2009).

Table 4. Bird species identified inside Belete-Gera forest, and at the forest edges. OO = Opportunistic observation, CT = Camera trap observation. 'New' indicates that the species was not yet known for the area, 'End.' indicates that the species is endemic for the Horn of Africa. IUCN status according to the IUCN updated list at www.iucnredlist.org, accessed on 01/03/2015, LC = Least concern, NT = Near threatened, VU = Vulnerable and EN = Endangered.

N°	Species	Common name	ID	New/End.	IUCN
1	<i>Ardea melanocephala</i>	Black headed heron	OO		LC
2	<i>Scopus umbretta</i>	Hamerkop	OO		LC
3	<i>Ciconia nigra</i>	Black stork	OO		LC
4	<i>Ciconia episcopus</i>	Woolly-necked stork	OO		LC
5	<i>Bostrychia hagedash</i>	Hadada ibis	CT, OO		LC
6	<i>Bostrychia carunculata</i>	Wattled ibis	OO	End	LC
7	<i>Alopochen aegyptiaca</i>	Egyptian Goose	OO		LC
8	<i>Anas sparsa</i>	African black duck	OO	New	LC
9	<i>Gyps rueppellii</i>	Rüppell's vulture	OO		EN
10	<i>Gyps africanus</i>	White-backed vulture	OO		EN
11	<i>Trigonoceps occipitalis</i>	White-headed vulture	OO		VU
12	<i>Torgos tracheliotus</i>	Lappet-faced vulture	OO		VU
13	<i>Haliaeetus vocifer</i>	African fish eagle	OO		LC
14	<i>Macheiramphus alcinus</i>	Bat Hawk	OO	New	LC
15	<i>Elanus caeruleus</i>	Black-shouldered kite	OO		LC
16	<i>Milvus aegyptius</i>	Yellow-billed kite	OO		LC
17	<i>Circaetus pectoralis</i>	Black-chested snake eagle	OO		LC
18	<i>Circaetus cinerascens</i>	Western-banded snake eagle	OO	New	LC
19	<i>Accipiter rufiventris</i>	Rufous-breasted sparrowhawk	OO		LC
20	<i>Accipiter melanoleucus</i>	Great sparrowhawk	OO		LC
21	<i>Accipiter tachiro</i>	African goshawk	OO		LC
22	<i>Polyboroides typus</i>	African harrier-hawk	OO		LC
23	<i>Buteo augur</i>	Augur buzzard	OO		LC

N°	Species	Common name	ID	New/End.	IUCN
24	<i>Pernis apivorus</i>	European honey-buzzard	OO		LC
25	<i>Buteo buteo</i>	Common buzzard	OO		LC
26	<i>Aquila rapax</i>	Tawny eagle	OO		LC
27	<i>Hieraaetus ayresii</i>	Ayre's hawk eagle	OO	New	LC
28	<i>Lophaetus occipitalis</i>	Long-crested eagle	OO		LC
29	<i>Terathopius ecaudatus</i>	Bateleur	OO		NT
30	<i>Stephanoaetus coronatus</i>	African crowned eagle	OO		NT
31	<i>Numida meleagris</i>	Helmeted guineafowl	OO		LC
32	<i>Pternistis squamatus</i>	Scaly francolin	CT		LC
33	<i>Treron calvus</i>	African green pigeon	OO	New	LC
34	<i>Treron waalia</i>	Bruce's green pigeon	OO		LC
35	<i>Columba guinea</i>	Speckled pigeon	OO		LC
36	<i>Aplopelia larvata</i>	Lemon dove	CT		LC
37	<i>Turtur tympanistria</i>	Tambourine dove	CT, OO		LC
38	<i>Columba arquatrix</i>	African olive pigeon	OO		LC
39	<i>Turtur afer</i>	Blue-spotted wood dove	OO		LC
40	<i>Streptopelia semitorquata</i>	Red-eyed dove	CT, OO		LC
41	<i>Streptopelia senegalensis</i>	Laughing dove	OO		LC
42	<i>Streptopelia lugens</i>	Dusky turtle dove	OO		LC
43	<i>Poicephalus flavifrons</i>	Yellow-fronted parrot	OO	End	LC
44	<i>Agapornis taranta</i>	Black-winged lovebird	OO	End	LC
45	<i>Tauraco leucotis</i>	White-cheeked turaco	CT, OO		LC
46	<i>Clamator levaillantii</i>	Levaillant's cuckoo	OO		LC
47	<i>Cuculus solitarius</i>	Red-chested cuckoo	OO		LC
48	<i>Chrysococcyx klaas</i>	Klaas's cuckoo	OO		LC
49	<i>Chrysococcyx cupreus</i>	African emerald cuckoo	OO		LC
50	<i>Centropus monachus</i>	Blue-headed coucal	OO		LC
51	<i>Campephaga phoenicea</i>	Red-shouldered cuckoo shrike	OO		LC
52	<i>Oriolus auratus</i>	African golden oriole	OO	New	LC
53	<i>Oriolus larvatus</i>	Black-headed oriole	OO		LC
54	<i>Oriolus monacha</i>	Abyssinian oriole	OO	End	LC
55	<i>Merops pusillus</i>	Little bee-eater	OO		LC
56	<i>Merops apiaster</i>	European bee-eater	OO		LC
57	<i>Merops albicollis</i>	White-throated bee-eater	OO		LC
58	<i>Merops lafresnayii</i>	Blue-breasted bee-eater	OO		LC
59	<i>Eurystomus glaucurus</i>	Broadbilled roller	OO		LC
60	<i>Strix woodfordii</i>	African wood owl	OO		LC



N°	Species	Common name	ID	New/End.	IUCN
61	<i>Colius striatus</i>	Speckled mousebird	OO		LC
62	<i>Ceryle rudis</i>	Pied kingfisher	OO		LC
63	<i>Halcyon senegalensis</i>	Woodland kingfisher	OO		LC
64	<i>Apaloderma narina</i>	Narina trogon	OO		LC
65	<i>Lophoceros hemprichii</i>	Hemprich's hornbill	OO		LC
66	<i>Tockus alboterminatus</i>	Crowned hornbill	OO	New	LC
67	<i>Bycanistes brevis</i>	Silvery-cheeked hornbill	OO		LC
68	<i>Bucorvus abyssinicus</i>	Abyssinian ground-hornbill	OO		LC
69	<i>Pogoniulus chrysoconus</i>	Yellow-fronted tinkerbird	OO		LC
70	<i>Lybius bidentatus</i>	Double-toothed barbet	OO		LC
71	<i>Lybius undatus</i>	Banded barbet	OO	End	LC
72	<i>Indicator indicator</i>	Greater honeyguide	OO		LC
73	<i>Dendropicos fuscescens</i>	Cardinal woodpecker	OO		LC
74	<i>Dendropicos abyssinicus</i>	Abyssinian woodpecker	OO	End	LC
75	<i>Ptyonoprogne fuligula</i>	Rock martin	OO		LC
76	<i>Cecropis abyssinica</i>	Lesser striped swallow	OO		LC
77	<i>Psalidoprocne pristopectera</i>	Black saw-wing	OO		LC
78	<i>Motacilla aguimp</i>	African pied wagtail	OO		LC
79	<i>Motacilla clara</i>	Mountain wagtail	OO		LC
80	<i>Pycnonotus barbatus</i>	Common buulbuul	OO		LC
81	<i>Chlorocichla flavicollis</i>	Yellow-throated leaflove	OO		LC
82	<i>Cossypha semirufa</i>	Rüppell's robin chat	CT, OO		LC
83	<i>Cossypha natalensis</i>	Red-capped robin chat	CT	New	LC
84	<i>Zoothera piaggiae</i>	Abyssinian ground trush	CT, OO		LC
85	<i>Turdus abyssinicus</i>	African Mountain trush	OO		LC
86	<i>Sylvia lugens</i>	Brown parisoma	OO		LC
87	<i>Apalis flavida</i>	Yellow-breasted apalis	OO		LC
88	<i>Dioptrornis chocolatinus</i>	Abyssinian slaty flycatcher	OO	End	LC
89	<i>Melaenornis edolioides</i>	Northern black flycatcher	OO		LC
90	<i>Bradornis pallidus</i>	Pale flycatcher	OO		LC
91	<i>Muscicapa adusta</i>	African dusky flycatcher	OO		LC
92	<i>Terpsiphone viridis</i>	African paradise flycatcher	OO		LC
93	<i>Batis minor</i>	Black-headed batis	OO		LC
94	<i>Platysteira cyanea</i>	Brown-throated wattle-eye	OO		LC
95	<i>Pseudoalcippe abyssinica</i>	African hill babbler	OO		LC
96	<i>Zosterops poliogastrus</i>	Broad-ringed white-eye	OO		LC
97	<i>Zosterops abyssinicus</i>	Abyssinian white-eye	OO		LC

N°	Species	Common name	ID	New/End.	IUCN
98	<i>Nectarinia tacazze</i>	Tacazze sunbird	OO		LC
99	<i>Chalcomitra senegalensis</i>	Scarlet-chested sunbird	OO		LC
100	<i>Nectarinia olivacea</i>	Olive sunbird	OO		LC
101	<i>Cinnyris venustus</i>	Variable sunbird	OO		LC
102	<i>Lanius collaris</i>	Common fiscal	OO		LC
103	<i>Lanius excubitorius</i>	Grey-backed fiscal	OO		LC
104	<i>Laniarius aethiopicus</i>	Ethiopian boubou	OO		LC
105	<i>Dryoscopus gambensis</i>	Northern puffback	OO		LC
106	<i>Corvus albus</i>	Pied crow	OO		LC
107	<i>Corvus rhipidurus</i>	Fan-tailed raven	OO		LC
108	<i>Corvus crassirostris</i>	Thick-billed raven	OO	End	LC
109	<i>Pholia sharpii</i>	Sharpe's starling	OO	New	LC
110	<i>Cinnyricinclus leucogaster</i>	Violet-backed starling	OO		LC
111	<i>Passer swainsonii</i>	Swainson's sparrow	OO		LC
112	<i>Ploceus cucullatus</i>	Village weaver	OO		LC
113	<i>Ploceus ocularis</i>	Specktackled weaver	OO		LC
114	<i>Ploceus baglafecht</i>	Baglafecht weaver	OO		LC
115	<i>Euplectes hordeaceus</i>	Black-winged red bishop	OO		LC
116	<i>Mandingoa nitidula</i>	Green-backed twinspace	OO		LC
117	<i>Uraeginthus bengalus</i>	Red-cheeked Cordon-bleu	OO		LC
118	<i>Cryptospiza salvadorii</i>	Abyssinian Crimsonwing	OO		LC
119	<i>Lagonosticta senegala</i>	Red-billed firefinch	OO		LC
120	<i>Coccygia quartinia</i>	Yellow-bellied waxbill	OO		LC
121	<i>Lonchura cucullata</i>	Bronze mannikin	OO		LC
122	<i>Vidua macroura</i>	Pin-tailed whydah	OO		LC
123	<i>Vidua chalybeata</i>	Village indigobird	OO		LC
124	<i>Serinus citrinelloides</i>	African citril	OO		LC



Butterflies

Mertens J.

Much like the bird observations, butterfly diversity was mostly assessed opportunistically over the course of the expedition. Identification of the species (only including Rhopalocera and Hesperidae, thus excluding all “moths”) was conducted based on in-situ photographs of live specimens. A butterfly net was used to catch the more agile species in order to increase the chance of identification. As there is no modern identification guide for East-African butterflies, the species list of the African Butterfly Database (Sáfián *et al.* 2009) was used as template to create our own picture-based guide.

Table 4. Butterfly species identified in Belete-Gera forest, and at the forest edge. ‘New’ indicates that the species was not yet known for the area, ‘End.’ indicates that the species is endemic for Ethiopia.

N°	Species	Common name	New/End.
1	<i>Papilio dardanus</i>	Mocker swallowtail	
2	<i>Papilio demodocus</i>	Citrus swallowtail	New
3	<i>Papilio echerioides</i>	White banded swallowtail	
4	<i>Papilio microps</i>		
5	<i>Papilio nireus</i>	Narrow green banded swallowtail	
6	<i>Papilio rex</i>	Regal swallowtail	
7	<i>Belenois aurota</i>	Pioneer white	
8	<i>Belenois raffrayi</i>	Raffray’s white	
9	<i>Belenois sp.</i>		
10	<i>Belenois thysa</i>	False dotted border	
11	<i>Catopsilia florella</i>	Common vagrant	
12	<i>Colias electo</i>	African clouded yellow	
13	<i>Eurema brigitta</i>	Small grass yellow	
14	<i>Eurema hecabe</i>	Large grass yellow	
15	<i>Leptosia alcesta</i>	Flip flop	
16	<i>Mylothris yulei</i>	Fragile dotted border	
17	<i>Nepheronia buquetii</i>	Green-eyed monster	
18	<i>Hypolycaena sp.</i>	Fairy hairstreak sp.	
19	<i>Tuxentius kaffana</i>		End
20	<i>Lycaenidae sp.</i>	?sp1	
21	<i>Lycaenidae sp.</i>	?sp2	
22	<i>Lycaenidae sp.</i>	?sp3	
23	<i>Lycaenidae sp.</i>	?sp4	
24	<i>Lycaenidae sp.</i>	?sp5	
25	<i>Lycaenidae sp.</i>	?sp6	
26	<i>Lycaenidae sp.</i>	?sp7	

N°	Species	Common name	New/End.
27	<i>Lycaenidae sp.</i>	?sp8	
28	<i>Lycaenidae sp.</i>	?sp9	
29	<i>Lycaenidae sp.</i>	?sp10	
30	<i>Lycaenidae sp.</i>	?sp11	
31	<i>Acraea acerata</i>	Falls acraea	New
32	<i>Acraea aurivillii</i>	Large alciope acraea	
33	<i>Acraea bonasia</i>	Orange-streak acraea	
34	<i>Acraea encedana</i>	Pierre's acraea	
35	<i>Acraea insignis</i>	Black-blotched acraea	
36	<i>Acraea lycoa</i>	Dimorphic acraea	
37	<i>Acraea oncaea</i>	Window acraea	
38	<i>Acraea oscari</i>		
39	<i>Acraea parrhasia</i>		
40	<i>Acraea rangatana</i>		
41	<i>Acraea safie</i>		End
42	<i>Acraea serena</i>	Dancing acraea	
43	<i>Acraea sotikensis</i>	Sotik acraea	
44	<i>Acraea ungemachi</i>		End
45	<i>Acraea zetes</i>	Large spotted acraea	
46	<i>Acraea sp.1</i>		
47	<i>Acraea sp.2</i>		
48	<i>Amauris echeria</i>	The chief	
49	<i>Amauris niavius</i>	The friar	
50	<i>Amauris sp.</i>		
51	<i>Antanartia dimorphica</i>	Dimorphic admiral	
52	<i>Antanartia schaeneia</i>	Long tail admiral	
53	<i>Aterica galene</i>	Forest glade nymph	
54	<i>Bematistes epaea</i>	Common bematistes	
55	<i>Bematistes poggei</i>		
56	<i>Bicyclus safitza</i>	Common bush brown	
57	<i>Bicyclus sandace</i>	Dark vulgar bush brown	
58	<i>Charaxes candiope</i>	Green-veined emperor	
59	<i>Charaxes sp.</i>		
60	<i>Charaxes junius</i>		
61	<i>Charaxes phoebus</i>		End
62	<i>Danaus chrysippus</i>	African monarch	
63	<i>Danaus dorippus</i>	Dorippus tiger	

N°	Species	Common name	New/End.
64	<i>Euphaedra medon</i>	Widespread forester	
65	<i>Eurytela dryope</i>	Golden piper	
66	<i>Eurytela hiarbas</i>	Pied piper	
67	<i>Gnophodes betsimena</i>	Banded evening brown	
68	<i>Hamanumida daedalus</i>	Guineafowl	New
69	<i>Junonia aemone</i>	Dark blue pansy	
70	<i>Junonia ansorgei</i>	Ansorgei's leaf butterfly	
71	<i>Junonia chorimene</i>	Golden pansy	
72	<i>Junonia orythia</i>	Blue pansy	New
73	<i>Junonia sophia</i>	Little pansy	
74	<i>Junonia terea</i>	Soldier pansy	
75	<i>Junonia wertermanni</i>	Blue spot pansy	
76	<i>Neptidopsis ophione</i>	Scalloped false sailor	
77	<i>Neptis agouale</i>	Common club-dot sailer	
78	<i>Neptis serena</i>	River sailor	
79	<i>Phalanta eurytis</i>	Forest leopard fritillary	
80	<i>Phalanta sp.</i>		
81	<i>Precis octavia</i>	Gaudy commodore	
82	<i>Precis pelarga</i>	Fashion commodore	
83	<i>Precis tugela</i>	Eared commodore	
84	<i>Protagonimorpha parhassus</i>	Forest mother-of-pearl	
85	<i>Pseudacraea lucretia</i>	False diadem	
86	<i>Sevenia sp.</i>	Tree nymph sp.	
87	<i>Sevenia occidentallum</i>	Velvet tree nymph	
88	<i>Sevenia umbrina</i>	Ochreous tree nymph	
89	<i>Tirumala formosa</i>	Forest monarch	
90	<i>Artitropa erinnys</i>	Bush Nightfighter	New
91	<i>Celaenorhinus galenus</i>	Common orange sprite	New
92	<i>Celaenorhinus sp.</i>		
93	<i>Coeliades forestan</i>	Striped policeman	
94	<i>Eagris denuba</i>	Cream flat	
95	<i>Eretis lugens</i>	Savanna elf	
96	<i>Eretis sp.</i>		
97	<i>Metisella midas</i>	Golden sylph	New
98	<i>Spialia sp.</i>		
99	<i>Zophopetes dysmephila</i>	Palm-tree nightfighter	
100	<i>Hesperiidae sp.</i>	?sp1	

N°	Species	Common name	New/End.
101	<i>Hesperidae sp.</i>	?sp2	
102	<i>Hesperidae sp.</i>	?sp3	
103	<i>Hesperidae sp.</i>	?sp4	



Dragonflies

Jocqué M.

Both large, open and small forested streams were present in the forest. Smaller, often temporary, water bodies were observed at different locations in the forest (forest clearings). No permanent water bodies were found. Odonata were collected with a hand net. Identification is ongoing and this part will be updated when more information becomes available.

Ground beetles

Geeraert L.

Ground beetles were sampled using pitfall traps, with six pitfall traps in one plot. Twelve plots in coffee forests were compared with 12 plots in natural forest. Identification is ongoing and this section will be updated when the process is finished. At this moment, 25 morphospecies are distinguished and we are planning to further identify them up to (at least) genus level.



4 Results and Discussion

The Belete-Gera forest study area still contains substantial coverage of natural forest, meriting the status as a Key Biodiversity Area within the Eastern Afromontane Biodiversity Hotspot. The natural forest occurs as patches in a mosaic of increasing coffee plantation intensification. The diversity of habitats including forest edges, agricultural fields, graze land and swamps add to biodiversity in the area. A large number of typical forest species were observed together with a lot of more common species that are typically found in disturbed regions.

In our study comparing the mammal communities between natural forest and manipulated coffee plantations we observed a high mammal diversity in both forest types, most probably because of the relative close proximity of these two habitats. However, some of the more protected large mammals such as forest buffalo and leopard, and elusive mammals such as the crested rat, were almost exclusively caught on camera in natural forest. This indicates the significance of forest habitat where human disturbance is minimal. Coffee forests, on the other hand, harbored mammal species that can be seen as hemerophilic and would only survive in secondary forest (e.g. hyena, white-tailed mongoose).

Several bird species were recorded for the Belete Gera forest, which were not known for this altitude in Ethiopia yet (e.g. Bat hawk). Moreover, several amphibian and bird observations demonstrated a considerable geographic range extension (e.g. Red-capped robin-chat and *Hyperolius balfouri*). In some cases, Belete-Gera forest is only the second location in Ethiopia where species were ever found (e.g. *Afixalus clarkeii* and *Cnemaspis dickersonae*).

Together with the large number of invertebrate species that are recorded for the first time in this forest, these observations indicate how poorly this area was studied by scientists up to now. It also suggests that even the vertebrate diversity in this region is expected to be much higher than currently known (e.g. reptiles and birds). Moreover, records of different amphibians and reptiles show that this forest harbors several species endemic to Ethiopia, or even endemic to the Southwestern highlands (e.g. *Bitis parviocula*, *Paracassina obscura*), or endangered on the IUCN red list (e.g. *Afixalus clarkeii*). These findings emphasize the biogeographical importance of this region and the need to better study and protect this area. The unique biodiversity present in the forest, the ecosystem services provided (e.g. wood and water provisioning, carbon stocks) and the 'wild coffee' genetic diversity (with different future applications in the coffee industry) should provide sufficient incentives to also safeguard this forest from an economical point of view (Aerts *et al.* 2015; Vanderhaegen *et al.* 2015).

Human encroachment occurs from villages inside the forest and from villages around the forest (Pers. Obs.; Hylander *et al.* 2013). With increasing global coffee market and the rising Ethiopian population, we expect that forest encroachment as well as forest conversion will keep on increasing. Indeed, we could readily observe fragments of natural forest that were converted into coffee forest during the time of the expedition (Pers. Obs., MDB; Camera traps). It is therefore time for policy makers to upgrade this forest to a higher level of protection and/or control, or it is expected that this forest, and its unique habitat, species and genetic diversity will continue to degrade at an increasingly rapid rate, affecting also forest villages (e.g. decreased wood provision), surrounding villages (e.g. decreased water provisioning) as well as the whole country (decreased forest cover and wild coffee genetic diversity).

5 References

- Aerts, R., Hundera, K., Berecha, G., Gijbels, P., Baeten, M., Van Mechelen, M., Hermy, M., Muys, B., Honnay, O., 2011. Semi-forest coffee cultivation and the conservation of Ethiopian Afromontane rainforest fragments. *Forest Ecology and Management* 261, 1034–1041.
- Aerts, R., Berecha, G., Honnay, O., 2015. Protecting coffee from intensification. *Science* 347, 139.
- Berecha, G., Aerts, R., Muys, B., Honnay, O., 2015. Fragmentation and Management of Ethiopian Moist Evergreen Forest Drive Compositional Shifts of Insect Communities Visiting Wild Arabica Coffee Flowers. *Environmental Management* 55, 373–382.
- Buechley, E.R., Sekercioglu, C.H., Atickem, A., Gebremichael, G., Ndungu, J.K., Mahamued, B.A., et al., 2015. Importance of Ethiopian shade coffee farms for forest bird conservation. *Biological Conservation*, doi.org/10.1016/j.biocon.2015.01.011.
- De Beenhouwer, M., Aerts, R., Honnay, O., 2013. A global meta-analysis of the biodiversity and ecosystem service benefits of coffee and cacao agroforestry. *Agriculture, Ecosystems and Environment* 175, 1–7.
- Demissew, S., Cribb, P., Rasmussen, F., 2004. Field guide to Ethiopian orchids. Royal Botanic Gardens, Kew, UK. 300 pp.
- Hundera, K., Aerts, R., De Beenhouwer, M., Van Overtveld, K., Helsen, K., Muys, B., Honnay, O., 2013. Both forest fragmentation and coffee cultivation negatively affect epiphytic orchid diversity in Ethiopian moist evergreen Afromontane forests. *Biological Conservation* 159, 285–291.
- Hylander, K., Nemomissa, S., Delrue, J., Enkosa, W., 2013. Effects of coffee management on deforestation rates and forest integrity. *Conservation biology* 27, 1031–1040.
- ICO, 2012. International Coffee Organization – World Coffee Trade, <<http://www.ico.org/countries/ethiopia.pdf>> (accessed 12.12.14).
- Largen, M.J., 2001. Catalogue of the amphibians of Ethiopia, including a key for their identification. *Tropical Zoology* 14, 307–402.
- Largen, M.J., Spawls S., 2010. Amphibians and Reptiles of Ethiopia and Eritrea. Frankfurt am Main: Edition Chimaira.
- Kingdon, J., 1997. The Kingdon field guide to African mammals. Black Publishers Ltd., London, UK, 476 pp.
- Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G. et al., 2004. Hotspots revisited: Earth's biologically richest and most endangered terrestrial ecoregions. *Conservation International*, pp. 241–273.
- Redman, N., Stevenson, T., Fanshawe, J., 2009. Birds of the Horn of Africa: Ethiopia, Eritrea, Djibouti, Somalia, and Socotra. Princeton field guides, 495 pp.
- Sáfián Sz., Collins, S.C., Kormos, B. Siklósi, A., 2009. African Butterfly Database version 1.0 – www.abdb-africa.org (accessed 26.02.15).
- Vanderhaegen, K., Verbist, B., Hundera, K., Muys, B., 2015. REALU vs. REDD+: Carbon and biodiversity in the Afromontane landscapes of SW Ethiopia. *Forest Ecology and Management* 343, 22–33.
- World Bank, 2013. World Development Indicators. The World Bank <<http://wdi.worldbank.org/table/3.2>> (accessed on 28.01.15).

