Forest Status of Kafa Biosphere Reserve

In the frame of "Forest and Community Analysis"

As part of the NABU project:

**„Climate Protection and Preservation of Primary Forests –
A Management Model using the Wild Coffee Forests in Ethiopia as an Example"**

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Contractor: Elisabeth Dresen
geoSYS
Reuterstrasse 50
12047 Berlin, Germany
www.geosysnet.de

Report prepared by: Elisabeth Dresen

Acronyms and Abbreviations

BHD	Breast Height Diameter
BR	Biosphere Reserve
CIA	Coffee Investment Area
DoAD	Department of Agricultural Development
DTM	Digital Terrain Model
EFAP	Ethiopian Forestry Action Plan
EMA	Ethiopian Mapping Authority
EWNHS	Ethiopian Wildlife and Natural History Society
GIS	Geographic Information System
HH	Households
IBC	Institute of Biodiversity Conservation
Kafa BR	Kafa Biosphere Reserve
KFCU	Kaffa Forest Coffee Farmers Cooperative Union
LU	Land Use
LUC	Land-use change
LULC	Land use / Land cover
LULUCF	Land-use, land-use change and forestry
MAB	”Man and Biosphere”
MTS	Multiple Tree Species
NABU	The Nature and Biodiversity Conservation Union
RFPA	Regional Forest Priority Area
NTFP	Non-Timber Forest Product
PRA	Participatory Rural Appraisal
RS	Remote Sensing
SUPAK	Sustainable Poverty Alleviation in Kaffa
TM	Topographic Map
WBISPP	Woody Biomass Inventory and Strategic Planning Project

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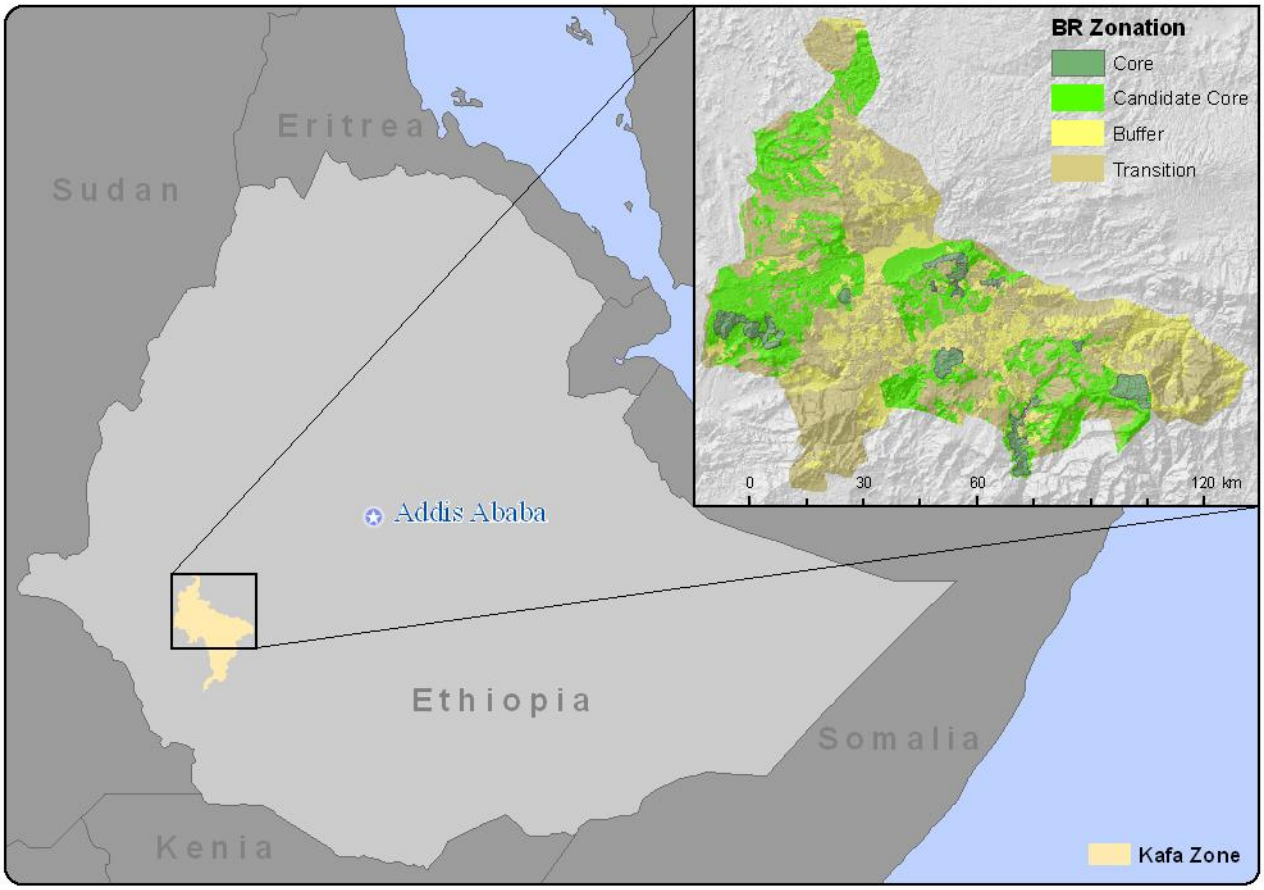
1. Introduction

The cloud forests in the Kafa Zone in southwest Ethiopia (division Southern Nations, Nationalities and People's Region) have international importance due to their ecology, biodiversity and economic value (due to significant contribution on the world market of coffee). Furthermore, they contribute to climate protection as significant carbon storage. The preservation of these forests is a major policy concern. International recognition to the unique forest cover with different varieties of wild Coffea Arabica has been given by the acceptance as UNESCO MAB Biosphere Reserve in June 2010.



Map 1: Overview of Kafa Zone and Biosphere Reserve / Ethiopia

The future of the forests in the Kafa zone is strongly related to the future of people living in and from the forest resource. Successive resettlements and spontaneous migration have caused tremendous land use and land cover (LULC) changes. Agriculture expansion, wood collection for construction and cooking and forest grazing threaten the existence of the remaining primary forests.

2. Forest cover in Kafa Biosphere Reserve

i. Forest definition used in Kafa Biosphere Reserve

The forest definition of the Ethiopian government complies with the UNFCCC definition of a forest and can be used for the purposes of the Kyoto Protocol.

The UNFCCC defines a forest as an area of land 0.05–1 hectare in size, of which more than 10–30% is covered by tree canopy. Trees must also have the potential to reach a minimum height of 2-5 meters.
The satellite image interpretation of the SPOT5 sensor (2011) is based on that forest definition. It results in an overestimation of forest cover, because live fencing with e.g. Eucalyptus trees or small woodlots in homegarden are assigned as forest. Furthermore, the land cover / land use classes bamboo forest, natural forest, pine/eucalyptus plantation, coffee investment areas are included in the forest class.

ii. General information on Kafa Biosphere Reserve and forest cover

The BR has an area of 744,919.18 ha of land and according to the census of 2002 (SUPAK data) a population of 718,526 (including whole Decha). Administratively, the BR is divided into ten woredas (Tello, Chetta, and Decha only partly) and 250 rural kebele administrations and 25 urban towns (according to Bureau of Finance and Economic Development Southern Nations, Nationalities and People's Region, Ethiopia).
According to the analysis of recent satellite imagery (SPOT5 of 2011/ ASTER 2010), 47 percent or 349,641 ha of the Kafa BR is covered by natural forest in 2011. This means, that more than 45% of all forest found in SNNPRS (WBISPP 2004) are located in the Kafa BR.

iii. Zonation of Kafa Biosphere Reserve

The Zonation concept is a centerpiece for any planning and management tasks concerning land use. According to the management plan (Dennis Moss Partnership), the key functions are:

- Core Zones, which should serve as refugee for various endemic and /or endangered species, provide opportunities for long and short-term research and monitoring programs, as well as non-consumptive use.
- Candidate Core Zones, which constitute of highly endangered habitats. They are supposed to be included into the Core Zones are far as the feasibility is explored.
- Buffer Zones, which have a very important function as vitally important linkages between the statutory conservation areas, the rehabilitation of degraded river systems to create ecological corridors as part of the buffer. This Zone can therefore play an important role in connecting conservation areas that have been isolated by human activities. In general, the buffer zone should encourage the function of a symbiotic relationship between conservation and nature related economic activities; the aim is to invest a portion of benefits derived from the use of natural resources back into conservation.
- Transition Zones, which have the function of enhancement of the environmental integrity or rehabilitation of unutilized farmland and plantations, aim at restoration and preservation of sites and /or features of historical and cultural significance.

Biosphere Reserve Zones	Size (ha)	Share of area in percent (%)
Core Zone	28,172.12	4
Candidate Core Zone	219,320.39	28
Buffer Area	161,351.85	22
Transition Area	336,069.01	46
Total	744,919.35	100

Table 1: Area distribution of BR Zonation

Accordingly, the Kafa Biosphere Reserve consists of 28,172.12 ha core area (4%), 219,320.39 ha

candidate core (28 %), 161,351.85 buffer area (22 %), and 336,069.01 ha transition area (46 %). In total the BR area has a size of 744,919.35 ha.

The forest cover is distributed on different BR zones in the following:

BR Zone	Forest Area (ha)
Core Zone	28,099.2
Candidate Core Zone	174,385.4
Buffer Zone	85,652
Transition Zone	61,503.6

Table 2: Forest cover in different BR Zones

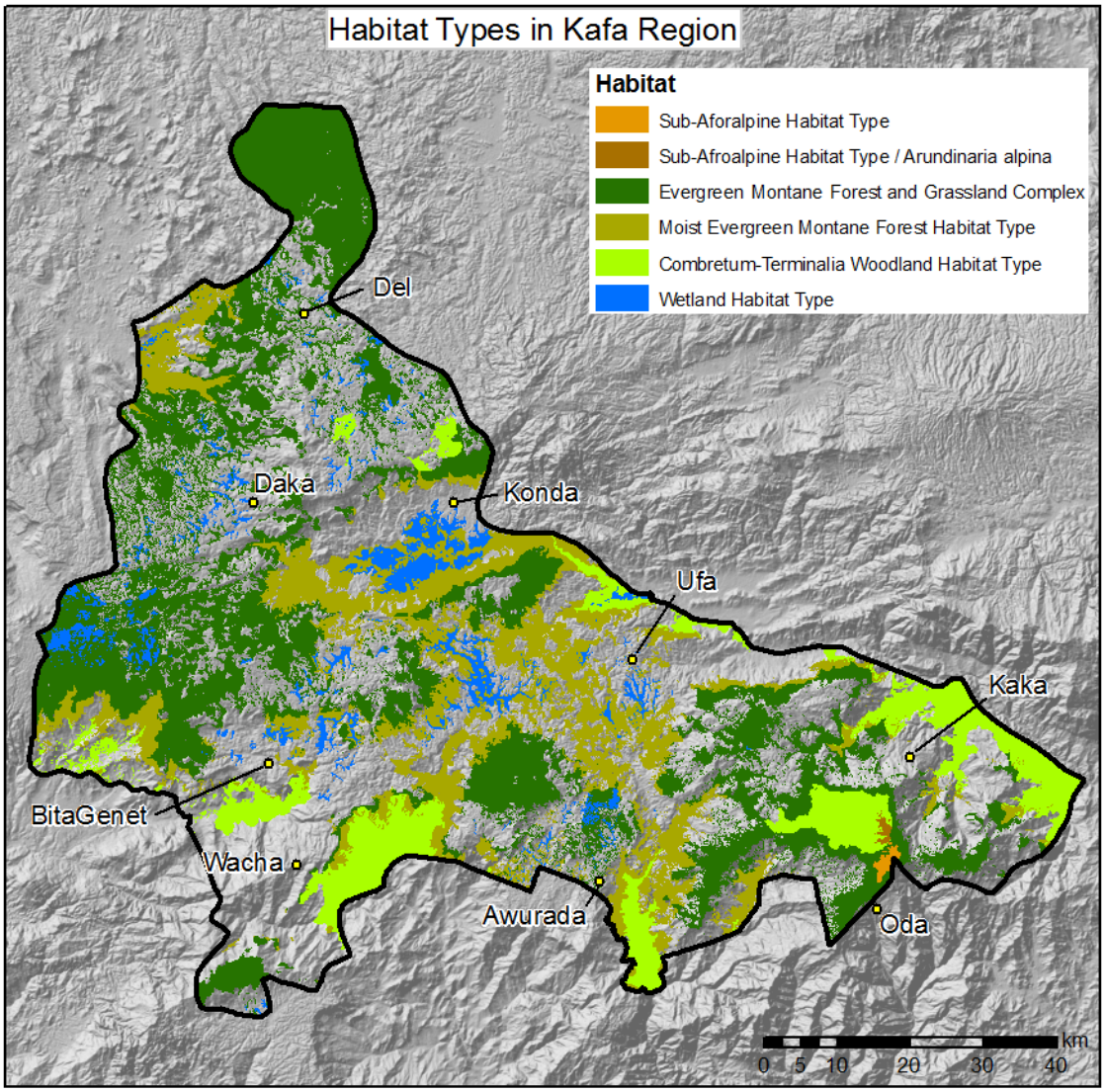
iv. Habitat types within the Biosphere Reserve

Different habitat types can be found in the Biosphere Reserve, according to the Institute of Biodiversity Conservation (cited in Kafa Biosphere Reserve application, 2009), namely:

- Sub-Afroalpine Habitat Type (altitudinal range > 3,200 m.a.s.l.)
- Evergreen Montane Forest and Grassland Complex (altitudinal range 1900 – 3.300 m.a.s.l.)
- Moist Evergreen Montane Forest Habitat Type (altitudinal range 1500 - 1900 m.a.s.l.)
- Combretum-Terminalia Woodland Habitat Type (altitudinal range 900 - 1900 m.a.s.l.)
- Wetland Habitat Type (altitudinal range 900 - 2600 m.a.s.l.)

v. Spatial delineation of habitat types

With different geoprocessing operations, the distribution of habitat types was estimated and looks as follows:



Map 2: Habitat Types in Kafa Biosphere Reserve

The spatial distribution of habitats show that the Sub-Afroalpine Habitat Type only occurs to a minor extent in the south-east (Woreda Tello / Kebeles Shosha, Migera; Woreda Adiyo / Kebele Mecha) while wetlands are more present in Woreda Bita, Gawata, and Gimbo.
The share of different habitat types in the Kafa Biosphere Reserve looks as follows:

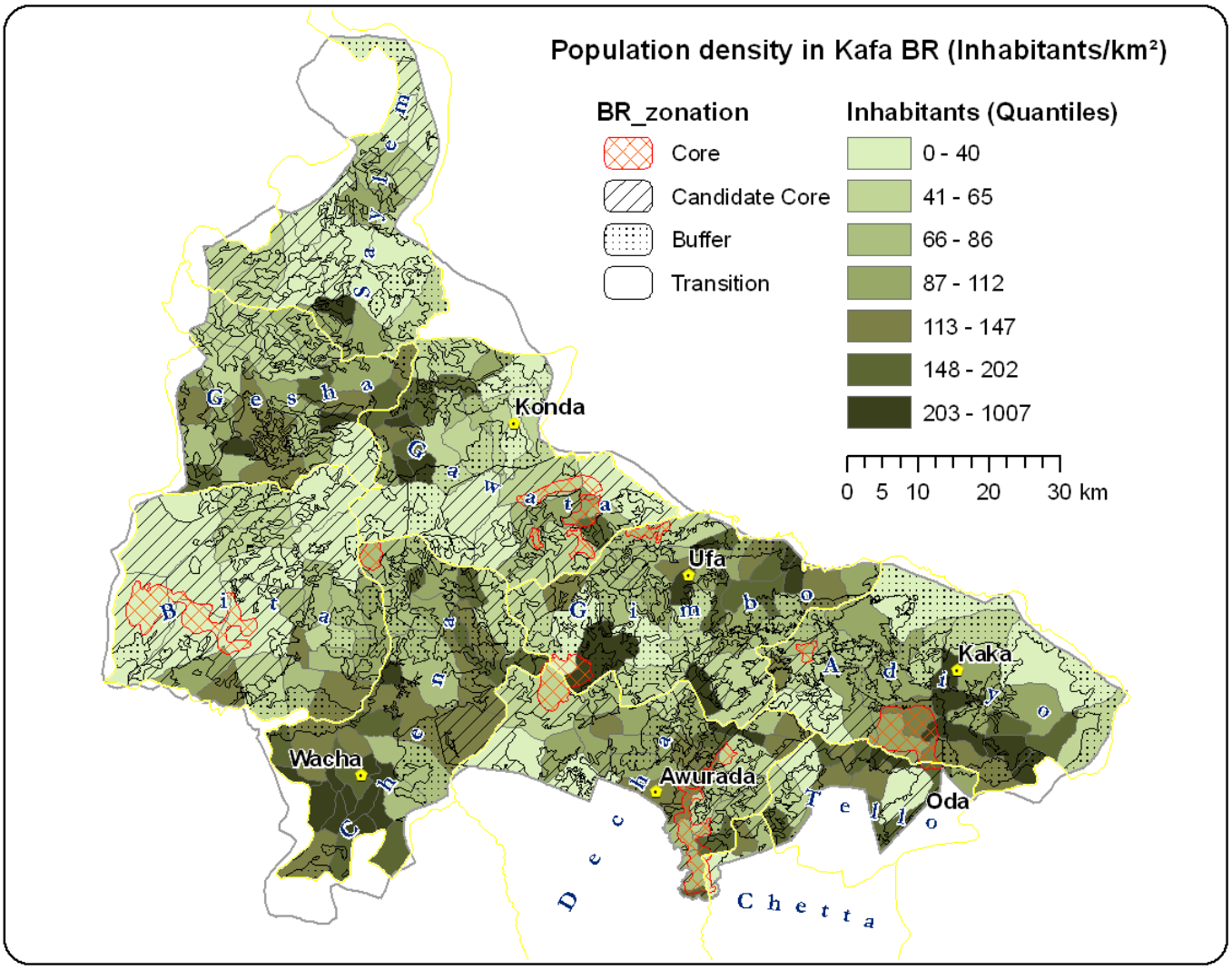
Habitat Type	Area (ha)	Area (%)
Sub-Afroalpine Habitat Type	826.67	0.2
Sub-Afroalpine Habitat Type / Arundinaria alpina	492.67	0.1
Evergreen Montane Forest and Grassland Complex	214986.55	52.1
Moist Evergreen Montane Forest Habitat Type	107393.28	26.1
Combretum-Terminalia Woodland Habitat Type	61307.48	14.9
Wetland Habitat Type	26832.69	6.6

Table 3: Distribution of habitats in Kafa BR

vi. Share of forest and population density

As core zones are assigned only for low impact uses, it seems to be very important to support populated areas close to core zones, with e.g. additional wood resource, or more efficient

management practices such as agroforestry.
The map below should give an impression on population density (Kebele level) (Inhabitants / km²) and Biosphere Reserve zonation.



Map 3: Population density in Kafa BR

3. Drivers for forest loss

Recent estimates show that nowadays Ethiopia has less than 3.6 % (EFAP, WBISPP) of its original natural forest cover. The drivers and processes influencing the forest cover loss in the study region are manifold and mostly interlinked. In general, six main drivers and underlying causes of deforestation and forest degradation can be highlighted, namely agriculture expansion, population pressure, resettlement, concessions (for coffee), land property rights and the unsustainable use of the forest resource.

4. Forest status in Kafa BR

The forest in Kafa BR is severely under threat. Especially in flat to undulating terrain, the forest is susceptible for conversion into agricultural land. While 51% of steep terrain (> 26°) is still covered by forest, only 22% of flat terrain is forested. It is highly important to protect the remaining forest in the light of landslide protection. Landslides become more and more a severe thread to human

life and cultural land in the Kafa region.
The conversion of forest into agricultural land leads to fragmentation and isolation. The remaining forest patches are located within a landscape matrix of intensively used agricultural land. The method to estimate the forest fragmentation classifies the natural forest into „perforated“ „edge“ „patch“ and „core“.
Core forest is relatively far from the forest–nonforest boundary. The core category is further subdivided into large (<100 ha), medium (100-200 ha), and small cores (>100ha).
Patch forest comprises coherent forest regions too small to contain core forest. The forest is surrounded by non-forest land cover.
Perforated forest defines the boundaries between core forest and relatively small perforations such as would occur around a small clearing.
Edge forest includes interior boundaries with relatively large perforations as well as the exterior boundaries of core forest regions.
The Satellite imagery (SPOT5 2011/ ASTER 2010) reveals, that 3 % or 3,274 patches of the forest cover in Kafa Zone is extremely threatened due to isolation. The isolation of forest (forest patches) causes a high risk to be deforested because the proportion of edge and forest core is unfavorable. The more forest edge, the more extraction can happen. In this matter, the shape of a patch plays a significant role (recognized as shape index). A compact patch is less likely to be threatened than a patch more long than wide (e.g. riparian forest patches). Apart of the vulnerability towards deforestation, the gene flow of flora and fauna is hampered.

Fragmentation Classification	Percentage forest share 2010	2002
Patch	3	1
Edge	21	19
Perforated	3	3.5
Core small (< 100 ha)	2.5	1.8
Core medium (100 – 200 ha)	1	0.8
Core large (> 200 ha)	69.5	73.9

Table 4: Fragmentation (%) of forest cover in Kafa BR for 2010/2011 and 2002

Another aspect, important for forest protection in Kafa BR is the degree of perforation. Change detection has shown that “holes” in intact forest cover are highly dynamic. The size of a perforation is not a reliable indicator for its dynamic. Thus the calculated number of 3% perforation is not as interesting as the number of found perforations. Within the Kafa BR there are 1,561 perforations found, ranging from 0.1 – 19 ha with a mean of 1.6 ha.
The comparison with the forest fragmentation of 2002 can only show trends, due to the different sensors (different resolution) used for the classification of LULC. In general, from 2002 until 2010 there was a degradation of forest connectivity. Core forest with more than 200 ha declined from 73.9% in 2002 to 69.5% in year 2010. Conclusively, if the forest becomes more fragmented, the forest edge increases as well (19% in 2002 to 21% in 2010). As in year 2002 there were only 1% of forest cover classified as patch and instead of 3,274 patches in 2010 there were only 2,006 patches found in 2002. The increasing forest patchiness might be routed in a dynamic change of perforations (which was higher in 2002) until patches fall apart from the core forest. This leads to isolation (no gene flow) and more utilization pressure (more people depend on this forest patch) and finally to forest degradation and deforestation. Especially the forest patches are very prone to become deforested. Thus, it is important to connect clustered patches to a more compact forest patch with a better shape index and avoid further perforation of the forest.

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