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Deforestation in Forest-Savannah Transition Zone of Ghana: Boabeng-Fiema Monkey Sanctuary

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Introduction

The Boabeng-Fiema Monkey Sanctuary (BFMS) is located in the forest-savannah transition zone in the Bono East Region of Ghana. The transition zone is one of the most widespread ecotone in the tropical regions, rich in biodiversity and sensitive to changes in climate variables such as precipitation (Oliveras and Malhi, 2016). BFMS serves as a habitat to three species of primates (*Colobus vellerosus, Cercopithecus campbelli lowei and Galago senegalensis*). Remarkably, it is the only place in Africa where different monkey species exist in large numbers and coexist harmoniously with humans (Saj et al., 2006; Eshun and Tonto, 2014). The *Colobus vellerosus* is listed as critically endangered on the International Union for Conservation of Nature (IUCN) Red List. In addition, BFMS is a sacred grove and an ecotourism site, serving as an important example of how traditional values in Ghana have contributed to wildlife conservation (Fargey, 1992; Dudley et al., 2013). Though the monkeys are protected, the surrounding forest does not receive a corresponding level of protection (Wong and Sicotte, 2006). There has been a decrease in the closed forests within BFMS, which has been linked to anthropogenic activities in the forests (Kankam and Sicotte, 2013).

Most research conducted in BFMS focused on the primates, with limited attention given to the forest itself. The research addressed this knowledge gap by determining the forest cover types of

BFMS and the changes in the forest cover from 1992 to 2018 using an integration of RS, GIS and field data.

Methodology

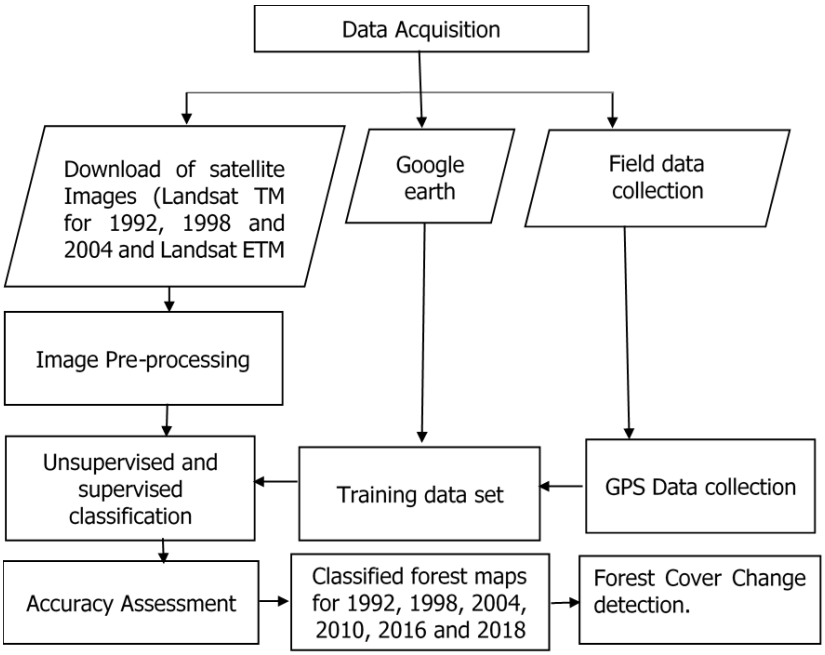

Fig. 1: Flowchart of methodology.

Results and Discussion

The study identified six land use land cover classes: closed forest (multiple trees species in the various storeys that have a continuous canopy obstructing sunlight from reaching the floor), open forest (discontinuous tree layer allowing sunlight to reach the floor), savannah woodland (scattered trees or shrubs with layer of grass), savannah (continuous layer of grass with negligible number of trees/shrubs), farmland and built-up. The total area of the study is 535.68 ha. The analysis revealed the closed forest cover is declining, whereas the open forest cover, built-up areas and farmland are increasing (Fig 2 and Table 1). A regression analysis showed a significant decrease in the closed forest and an increase in open forest cover, built-up areas and farmland.

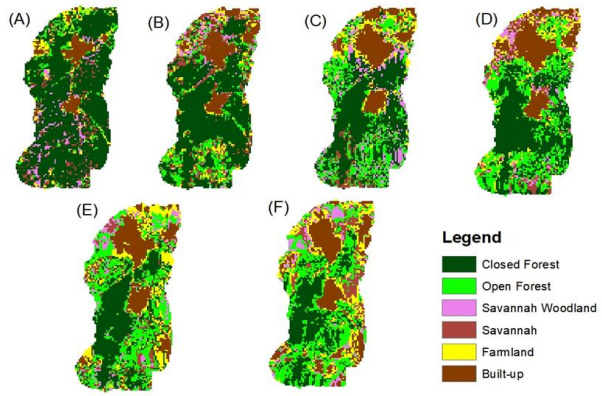

Fig. 2: Classified maps in six different stages: (A) 1992 (B) 1998 (C) 2004 (D) 2010 (E) 2016 (F) 2018.

Table 1: Spatial extent and changes in the different land use land cover classes with respect to years in hectares (ha).

Given year	Closed Forest	Open Forest	Savannah Woodland	Savannah	Farmlands	Built-up
1992	369.72	30.78	26.19	40.50	28.17	40.32
1998	281.52	66.69	23.13	58.05	35.32	70.97
2004	225.63	104.68	50.13	21.69	46.90	87.48
2010	205.02	133.38	26.82	32.58	46.28	91.60
2016	162.99	142.65	30.15	35.91	64.98	99
2018	127.53	153.63	33.66	46.98	67.86	106.02
Change 1992-1998	-88.2	35.91	-3.06	17.55	7.15	30.65
Change 1998-2004	-55.89	37.99	27.18	-36.36	11.58	16.51
Change 2004-2010	-20.61	28.7	-23.49	10.89	-0.62	4.12
Change 2010-2016	-42.03	9.27	3.33	3.33	18.7	7.4
Change 2016-2018	-35.46	10.98	3.51	11.07	2.88	7.02
Change 1992-2018	-242.19	122.85	7.47	6.48	39.39	65.7

The decreasing closed forest and increasing open forest in BFMS (Fig. 3 and 4) indicate an alteration in the structure and composition of the forest. This shift leads to a loss of biodiversity, a reduction in carbon stock and the release of carbon into the atmosphere. Additionally, this trend poses as a threat to the sustainability of ecotourism in the study area and Ghana as a whole, as the forest within the sanctuary serves as a habitat and food source for the resident monkeys. Deforestation and forest degradation of the tropical forest account for about 15-25% annual global greenhouse gas emission (Gibbs *et al.*, 2007).

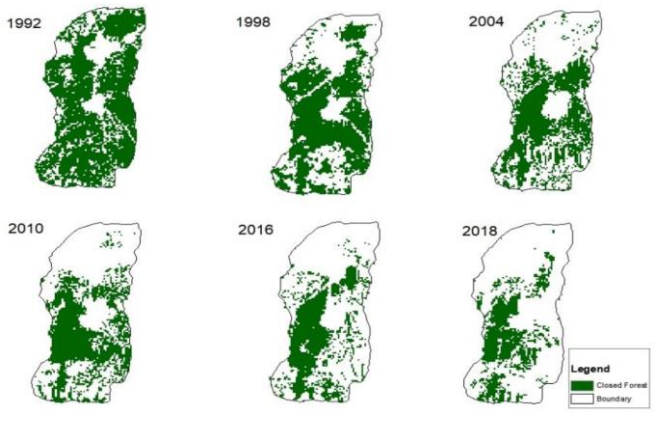

Fig. 3: Change map of Closed Forest.

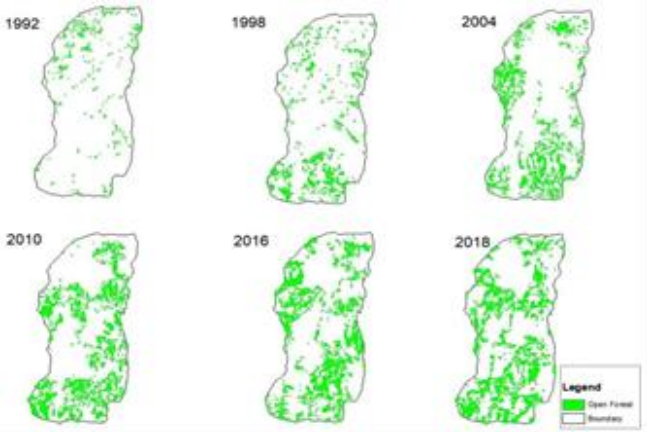

Fig. 4: Change map of Open Forest.

Increase in population in the study area has led to the expansion of farmlands and the conversion of forests into physical structures (Fig. 5 and 6). While, the an increase of farmlands means an increase in food production of the region, farmers in the study area practice slash and burn agriculture, which depletes the soil when done continuously over a short period and is detrimental to the environment. Households in the area consume produce from farmlands and sell the remaining produce to generate income for the family. Yam and groundnuts are the most commonly cultivated crops in the study area. Additionally, most of the houses are built horizontally, which occupies more land as compared to vertical buildings, further contributing to the land-use change.

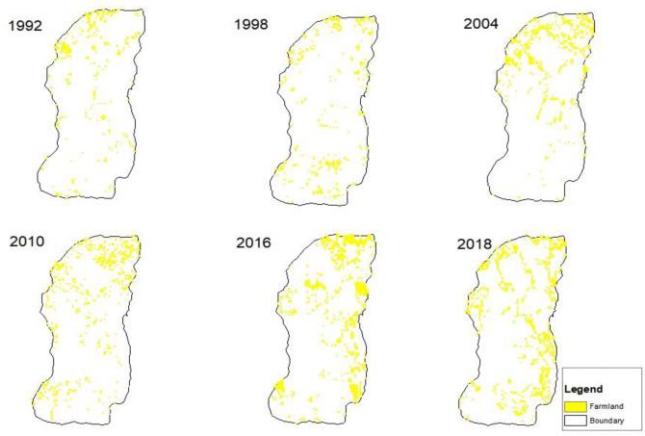

Fig. 5: Change map of Farmland.

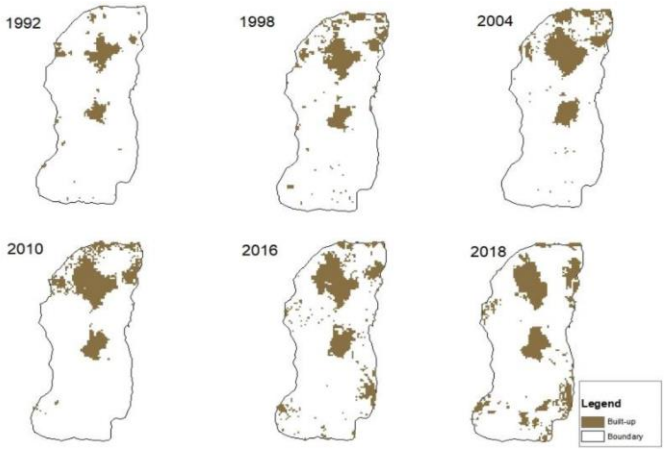

Fig. 6: Change map of Built-Up.

Conclusions and Outlook

Population growth and anthropogenic activities like charcoal burning and farming have led to the changes in the forest cover of BFMS. Sustainable forest management should be integrated into planning to protect the forest. The Forestry Commission and Wildlife Department should educate the local population on the dangers of deforestation and forest degradation and promote alternative source of energy, like woodlots. Farmers should be encouraged to adopt Agroforestry practices. Forestry Commission should intensify monitoring activities to curb the menace of illegal activities (illegal felling of trees, charcoal burning, etc.).

Additionally, a satellite imagery of higher spatial resolution should be used for classification of the forest cover. Predicting future changes in forest cover will aid in sustainable management.

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