

SEASONAL PATTERN OF TREE AND VINE LEAFING, FLOWERING AND FRUITING AT GASHAKA GUMTI NATIONAL PARK, NIGERIA

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ABSTRACT

Fruits, flowers and leaves constitute the staple food for wild animals and therefore, serve as indicators of their availability, abundance and performance. In order to fully understand this phenomenon, this study was designed to assess seasonality of fruit tree and vine leafing, flowering and fruiting in a habitat of Gashaka Gumti National Park (GGNP, considered as biodiversity hotspot) using transects, trails and random forest walks. Charts and correlation coefficient were used to analyze the data collected. Results indicate that there was a clear seasonal flowering pattern, with minimal flowering during the rainy season (June – October), and maximum flowering during the dry months (November – May) for both the trees and vines. There was also a corresponding maximum fruiting in the dry months (January – June) and minimal fruiting in the wet months (July – December). Most trees at GGNP lost their leaves moderately in April (1.5 %, n = 925), March (1.3 %) and February (0.9) with the least in June (0.2), November (0.2) and December (0.2) while for the vines, the highest months of leaves shedding occurred in January (2.7 %), October (1.5 %) and April (1.0 %) with May (0.1 %), June (0.1 %) and July (0.1 %) as the least from the bottom. There was continuous fruits availability (Range = 54.5 % - 91.8 %) of green fruits in trees throughout the year (January to December) followed by Yellow-fruits though, relatively low (3.7 % - 23.1 %) while Black-coloured fruits (0.00 % - 1.0 %) and Red-coloured fruits (0.1 % – 2.6 %) were among the less available in fruiting trees.

Key words: Habitat, Phenology, Seasonality, Transect, National park

INTRODUCTION

Conservation of natural resources at optimum level demands for adequate interaction of the resources sharing the ecosystem to ensure maximum reproduction and sustainability. In every ecosystem, a set of environmental factors such as weather conditions, soil properties, and interactions act as basic determinants for the status of individual populations that exist. Plants and their parts constitute the staple food of most animals and on the other hand, animals are significant seed dispersals that restore hope for forest regeneration (Anthony *et al.*, 2007; Turner, 2001; Sommer and Ross, 2011).

Gashaka Gumti National Park (GGNP) comprises of an interspersed of vegetation types (Buba, 2014). Apart from the high plants diversity, the park also harbours flourishing population of primates, ungulates, fishes, birds, insects, reptiles sharing the same habitat over

time and space. Sometimes polyspecific associations are clearly conspicuous with little or no conflict due to foraging, socializing, travelling or resting which might be an indication of the high quality nature of the forest (Akosim *et al.*, 2010). Most wild animals such as primates and ungulates have a direct and important relationship with plants which is dynamic due to seasonal changes but it is pertinent to note that both need each other to remain alive and perform optimally (Akosim and Buba, 2007). Considering the primates only, seven species exist at GGNP namely, chimpanzees, baboons, putty-nosed monkeys, Black-and-White colobus monkeys, Tantalus monkeys, Patas monkeys and mona monkeys.

The subspecies of chimpanzee that exists at GGNP only survives in Nigeria and Cameroon otherwise, known as the Nigeria-Cameroon chimpanzee and scientifically called *Pan troglodytes ellioti* (Morgan *et al.*, 2011).

The staple food of this subspecies of chimpanzee comes from fruits and other plant parts and they spend about 58 % of their time feeding on the aforementioned (Fowler 2006). Each weaned chimpanzee of GGNP constructs a sleeping platform (nest) every night using tree branches and leaves. They also manufacture a set of extractive foraging tools for the extraction of honey, army ants and arboreal ants as part of the subsistence elementary technology or chimpanzee material culture. This study was therefore, designed to examine the phenology of trees and vines in the study area in order to establish information on the seasonality of flowering, fruiting and leafing as this phenomenon may have significant impact on the inhabiting animal populations.

Study Area

The research was carried out at the Gashaka Sector of Gashaka Gumti National Park (GGNP; Dunn, 1999; Sommer and Ross, 2011). GGNP (Figure 1) which covers about

6,670 km² is Nigeria's largest national park and straddles a wide section of the international boundary between Nigeria and Cameroon (06°55' – 08°13' N, 11°13' N – 12°11' E). GGNP demarcates the northern edge of the Cameroonian Highlands and Africa's Gulf of Guinea forests, considered a hotspot of biodiversity (Oates *et al.* 2004). GGNP is divided into the relatively flat Gumti sector in the north and the mountainous Gashaka sector in the south. Habitat types include flat and montane grasslands, Guinea savannah-woodland, riverine and gallery forest, lowland rain forest and montane forest.

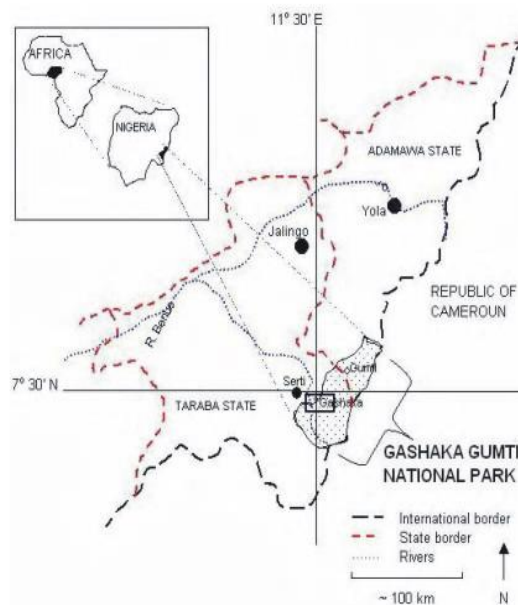


Figure 1. Location of Gashaka Gumti National Park (Source: Warren, 2004)

Climate

Weather data measured at Kwano of GGNP from 2001–2008 (Sommer and Ross, 2011) revealed a pronounced alternation between annual wet and dry seasons with corresponding fluctuations in temperature,

humidity and vegetation cover. The yearly mean rainfall was 1973 mm from ten years of weather data collected in Kwano-Gashaka region. Mean monthly humidity at sunset fluctuates between 59% (February) and 87% (September). The mean minimum temperature

is 20.9°C, the coolest recorded temperature is 14°C and occurs in January and December, the mean maximum is 31.9°C, and the hottest day on record is 43°C which was recorded in March 2001.

METHODOLOGY

The study included 2 straight-line phenology transects of 4 km each (Figure 2), along which main botanical features of the habitat were recorded and about 985 trees, with 815 associated woody climbers (lianas, creepers) were marked and identified (transect width = 4 m) for the purpose of phenological studies. Transect

trees were permanently labeled with professional tree markers (engraved metals) at every 5 meters as subjects for observation and data collection. The dbh was measured for each tree, and the number of woody climbers likewise recorded at the start and repeated at the

end of study. The transect cuts through the north-western part of the study area. Transect direction was determined with the intention to incorporate sections of different elevations as well as varying types of habitat, thus allowing for a relatively unbiased quantification of the vegetation cover. These trees and the associated vines were monitored twice a month for the presence of leaves, flowers, and fruits. During transect walks for data collection, observations regarding fruits such as colour, location, ripeness, eaters and the number of fruits present were evaluated on an exponential scale (1, 10, 100, 1000, 100,000, 200,000 ...). Feeding remains on the ground were noted, and where possible, the frugivores were also noted. A basic herbarium collection and photographs of many common plants supplemented the data based on the floristic composition of the forest.

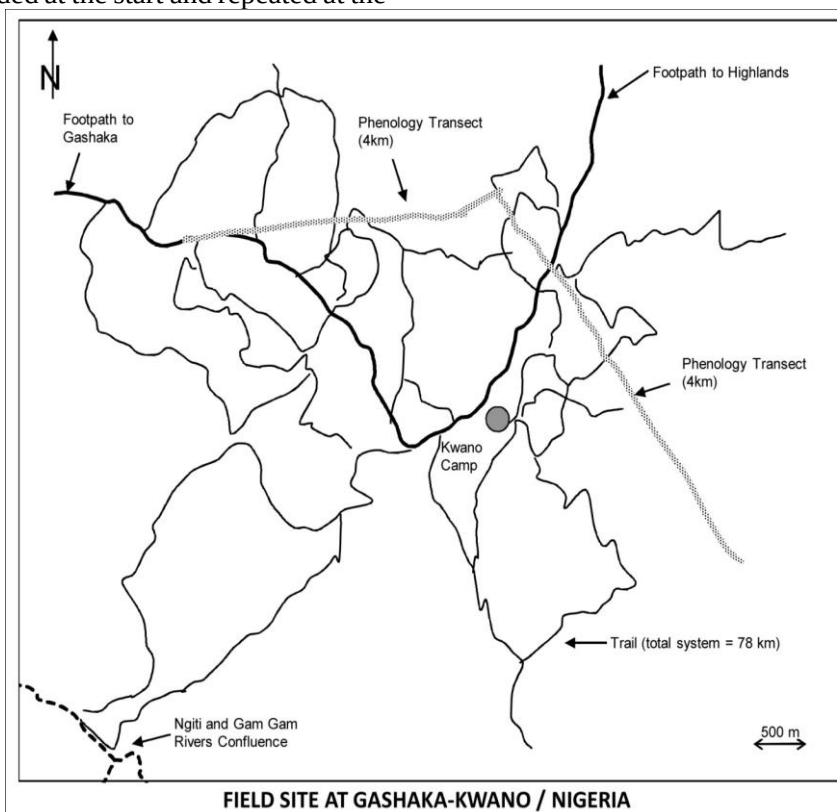


Figure 2. Map of The Study Area Showing the Km Experimental Transects

RESULTS

Trees/Vines Flowering, Fruiting and Leaf Shedding in the Study Area

Flowering of trees were somewhat consistent throughout the year with the least flowering recorded from July to October while for the vines; a peak was noticeable from

November to March with a corresponding low flowering between July and September (Figure 3).

The results in Figure 4 show a corresponding maximum fruiting in the dry months (January – June) and minimal fruiting in the wet months (July – December).

Considering the trees alone, fruiting was consistent with very little fluctuation throughout the year while for the vines, there was clear cut fruiting season from January to June (dry months) with low fruiting rates from July to December.

The results on leaf shedding (Figure 5) show that most trees in the chimpanzees habitat lost their leaves mostly in April (1.5 %, n = 925), March (1.3 %) and February (0.9) with the least in June (0.2), November (0.2) and December (0.2) while for the vines, the highest month of leaves shedding occurred in January (2.7 %), October (1.5 %) and April (1.0 %) with May (0.1 %), June (0.1 %) and July (0.1 %) as the least from the bottom.

The results of fruit colour pattern of fruiting trees (Figure 6) revealed continued

fruits availability Range of 54.5 % - 91.8 % of green fruits in trees throughout the year (January to December) followed by Yellow-fruits, though relatively low (3.7 % - 23.1 %) while Black-coloured fruits (0.00 % - 1.0 %) and Red-coloured fruits (0.1 % – 2.6 %) were among the less available in fruiting trees.

There was also a year-round availability of Green fruits (53.6 % - 95.3 %) in vines (Figure 7). Yellow fruits were also somewhat available throughout the year but the patch size was higher from April – October (10.7 % - 42.1 %), Brown fruits had its peak in December (7.4 %) and were absolutely unavailable in April (0.00 %), while vine fruits in black colour were not observed throughout the seasons.

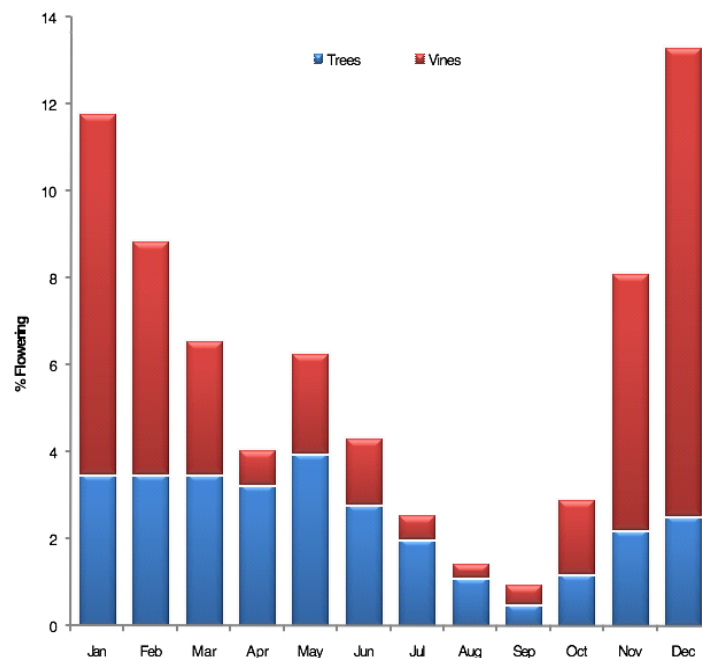


Figure 3: Seasonal Flowering of Trees and Vines in the Study Area

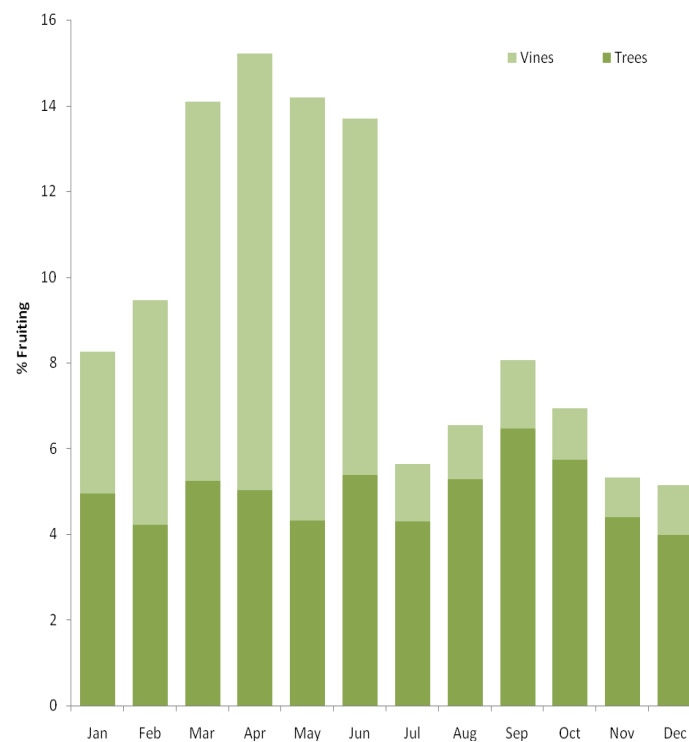


Figure 4. Seasonal Fruiting of Trees and Vines in the Study Area

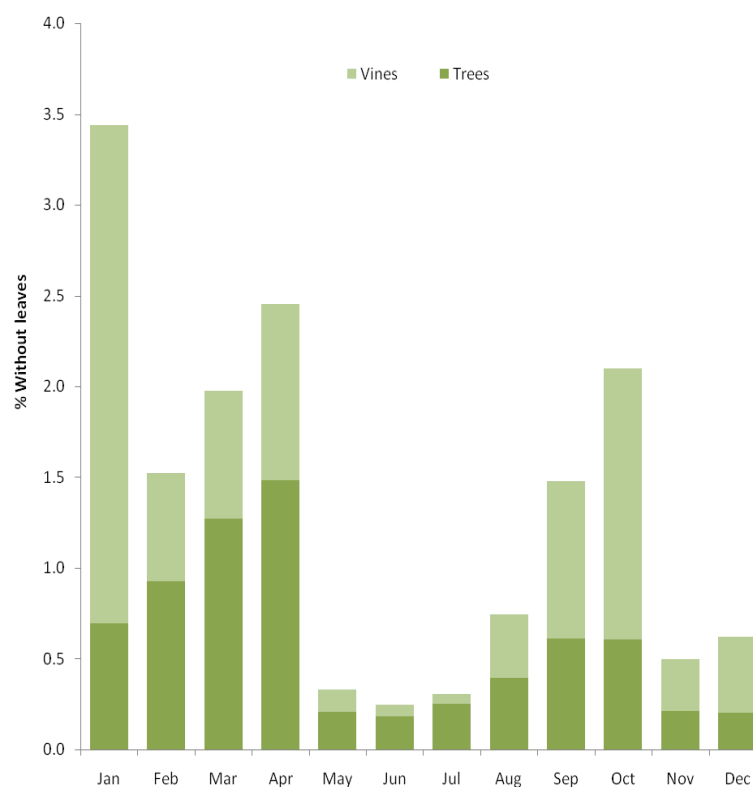


Figure 5. Seasonal Leaves Shedding Pattern in Trees and Vines in the Study Area

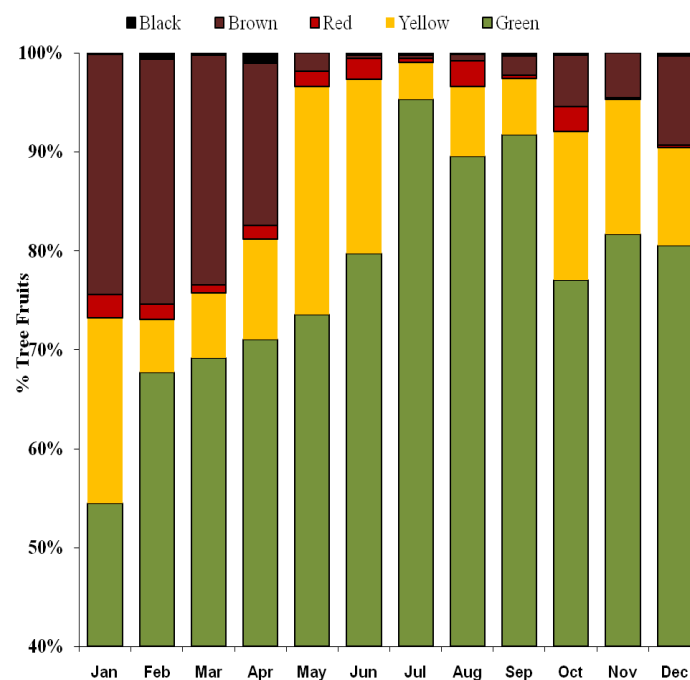


Figure 6. Tree Fruits Colour Pattern in the Study Area

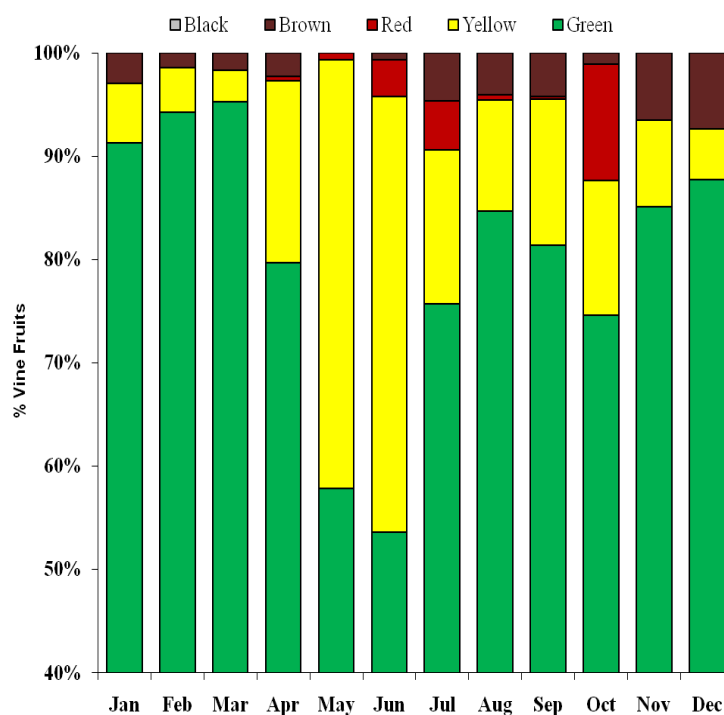


Figure 7. Vine Fruits Colour Pattern in the Study Area

Fruit Ripeness

The results of tree fruits ripeness (Figure 8, Plate, 1) show that most fruiting trees contained unripe fruits in all seasons (49.8 % -

92.0 %). Ripe fruits availability was inconsistent with the highest in January (31.2 %) while old fruits found in the forest floor also constituted part of the available food for the

frugivores in some months (January - April) and were completely unavailable from June to August.

The results of vine fruits ripeness pattern (Figure 9, Plate, 1) indicated constant availability of unripe fruits in all seasons (Range: 73.1 % - 94.7 %). Ripe fruits were in abundance from April to October (Range: 25.8 % - 73.3 %) while old vine fruits were unavailable in February, May, July, August, September, and October (0.00 %) with few in April (1.6 %), March (1.7 %) and November (3.6 %).

The results of fruit remains and eaters (Figure 10; Plate, 1) show that fruits residues were found to be more available in the forest floor in May (29.9 %), June (25.9 %) and October (17.4 %) while July (5.7 %), September (6.9 %) and March (7.4 %) were the least months of fruits remains in the forest floor. Signs of the fruits eaters showed preference to primates (Figure 10) in January (16.7 %), May (15.9 %) and June (10.0 %) while other frugivores were more active in June (16.7 %), May (13.7 %), and October (12.2 %).

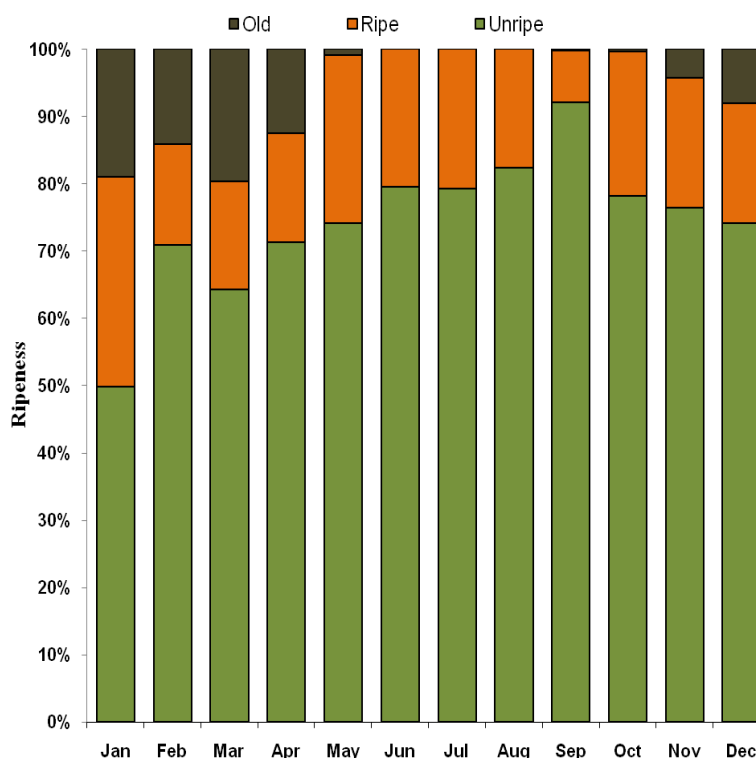


Figure 8: Tree Fruits Ripeness Pattern in the Study Area

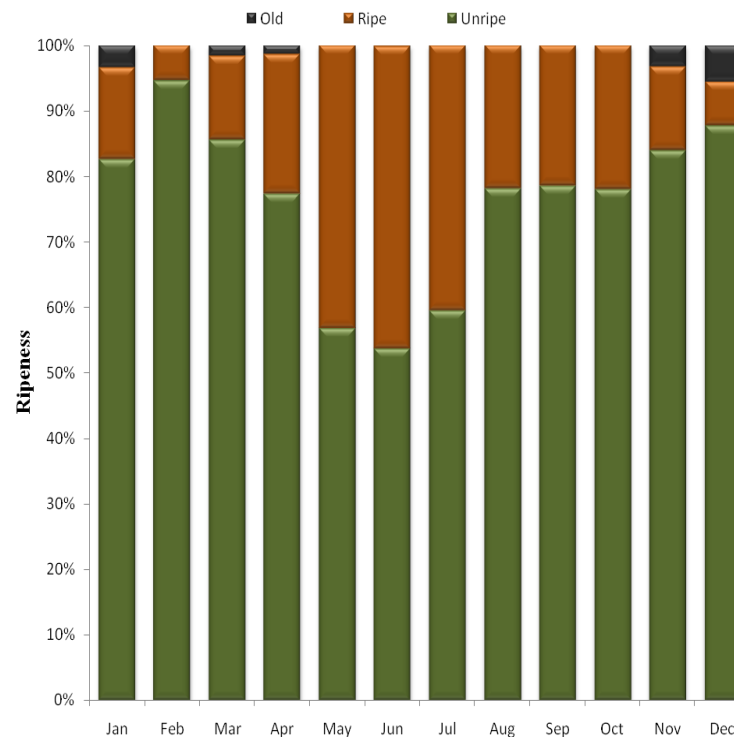


Figure 9. Vine Fruits Ripeness Pattern in the Study Area

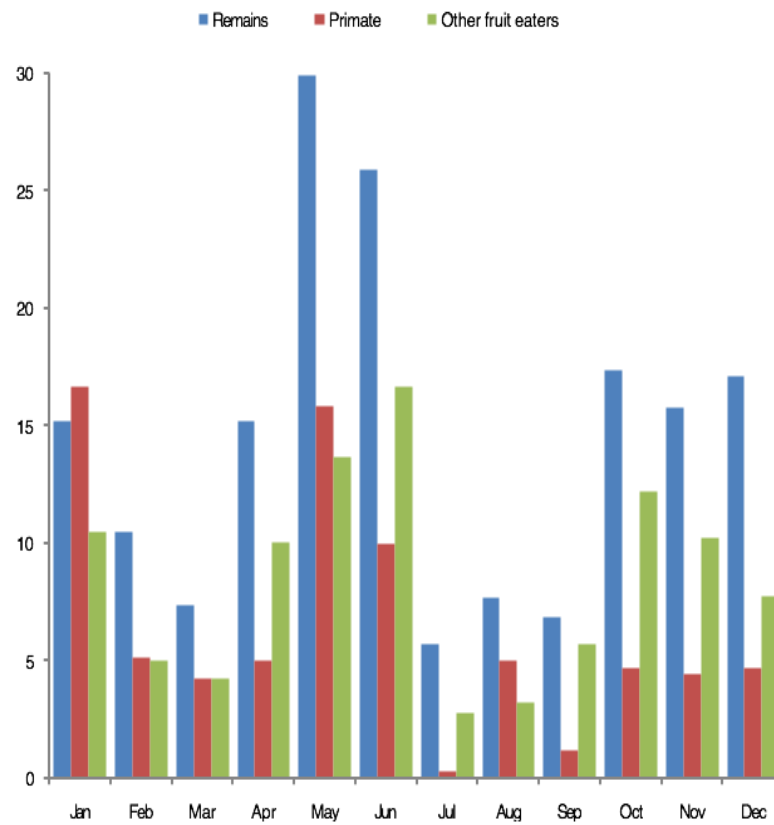


Figure 10. Fruit Remains and Eaters in the Study Area



Plate 1. A Collection of Fruits Eaten by Primates at the Kwano Forest of GGNP

DISCUSSION

Results of seasonal flowering of trees and vines in the study area showed minimal mass flowering during the rainy season (June to October) and maximum mass flowering during the dry months (November to May) with a corresponding maximum mass fruiting in the dry months (January to June) and minimal mass fruiting in the wet months (July to December). The combined effect of genetic differences among species, effect of storms during the rainy season and interruptions by frugivores may have contributed to the flowering and fruiting patterns observed. The pattern of leaves shedding in the study area is such that most trees lose their leaves in February and March with the peak in April. This probably is an adaptive physiological process aimed at water conservation in the plants, in view of the excess dry weather condition of the period (Sommer and Ross, 2011). For the vines, the highest leaves' shedding is experienced in January. Overall, observations on leaves shedding of trees and vines occurred predominantly during the dry season.

Studies on trees and vines fruits colour and ripeness pattern indicated that most trees and vines (ranging from 54.5 – 91.8 % and 53.6 – 95.3 % respectively) maintain green fruits all year round. Similarly, ripeness of fruits through colour-change is not frequently observed throughout the year. This shows that

fruits may be ripe without producing a colour change from green to yellow. This is confirmed by the fact that chimpanzees and other primates begin to consume the fruits before any colour change is noticed. In most cases, the fruits begin to detach and fall to the ground as soon as colour-change from green to yellow, begins to appear, indicating that colour change is an extreme ripeness of the fruits. Results also show that fruits residue at the floor of the forest was abundant in May, June and October which also corresponds with peak periods of fruiting. This is probably an indication that the more the food availability, the more the selective habits: a situation whereby both ripe and unripe fruits are being removed and only the ripe and quality ones are consumed while the unripe are released to the forest floor and constitutes a waste to the primates but useful to other forest floor frugivores.

Observations of this study indicate that the habitat is ecologically balance in terms of plants food production hence its label as a biodiversity hotspot (Oates *et al.*, 2004). In addition, the phenology of the habitat indicates the availability of adequate cover for both the nesting behaviour and arboreal life of wild animals inhabiting this forest. Therefore, it could be concluded that the study area provides the important habitat requirements of food and

cover for conservation of wildlife in the study area.

The above result is corroborated by the earlier observations, which indicated that trees and vines flowering and fruiting take place mostly in the dry season. The low incidence of flowering and consequently low fruiting in the wet season may be attributed to rain and wind storms and exacerbated by the competitive foraging on flowers by the Black and white colobus, Putty nosed and Mona monkeys. These observations agree with the report of Yamagiwa and Basabose (2009) on a similar study carried out in Bousso, Guinea.

CONCLUSION

Studies of GGNP's habitat phenology show a relatively steady flowering, fruiting and leafing throughout the year. Leaf shedding, flowering and fruiting were however, slightly influenced by seasons which may not have any significant effect on supply rate to the inhabiting animals. Therefore, the forest of GGNP can be considered as a major player at ensuring ecological balance in terms of food and cover supply and should be given conservation priority to allow for sustainability of animal resources.

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