Plant diversity and tree community structure along an elevation gradient in Apra Hills Sacred Grove, Ghana

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Abstract

The Apra Hills Sacred Grove has one of the best patches of the threatened Southern Marginal Forest of Ghana, yet a study on vegetation has not been undertaken. We evaluated plant diversity and tree community structure in relation to an elevation gradient using 25 m x 25 m plots demarcated along a 1km transect in the grove. Vascular plants within the plots were identified, and trees with diameter-at-breast-height (dbh) ≥ 10 cm were measured. A total of 128 plants taxa were identified, and 21 species of trees were enumerated. Mean tree density was 292.33 ± 14.05 per ha, and dbh-size class distribution of the trees showed an inverted J-shape curve. Overall plant species richness decreased with increasing elevation whereas tree species diversity increased with elevation. But the relationships between elevation and tree species richness, tree density and basal area were statistically insignificant. Future studies on effects of edaphic and anthropogenic factors along the elevation gradients would improve our knowledge about the distribution of the plant diversity as well as their conservation.

Keywords: Apra Hills Sacred Grove, Conservation; Elevation, Southern Marginal Forest, Plant diversity

Introduction

The rate of deforestation in Ghana is among the highest in the West African sub-region (Damnyag et al., 2011). Between 2005 and 2010, the rate of deforestation Ghana was estimated to be 2.19% per annum (FAO, 2010). About 70% of deforestation in Ghana is caused by farming activities (Ahmed, 2008). Other contributory factors to deforestation in Ghana include logging, overharvesting, and exportation of biodiversity (Benhin and Barbier, 2004). The consequences of deforestation include biodiversity loss and socioeconomic repercussions. Biodiversity losses have various impacts including climate change, loss of ecosystem services, floods, and emergence of diseases (Ahmed, 2008). Although the negative impacts of deforestation in Ghana are evident, empirical studies on the cost of deforestation in monetary terms are few (Damnyag et al., 2011).

The Southern Marginal Forest of Ghana (Hall and Swaine 1981) is one of the most threatened forest types in Ghana. It is amongst the driest forest types (annual rainfall (750 -1275 mm), occurring mostly as small-scattered patches (ca. 20 km^2), and it is characterized by low floral diversity, trees with low canopies, few commercial timber species but with several rare tree species (Boshier et al., 2011). Of the two subtypes of Southern Marginal Forest of Ghana (Hall & Swaine, 1981), the one found in the Cape Coast-Winneba area is the most threatened. The other subtype of Southern Marginal Forest can be found in Akosombo area in Sapawsu Forest Reserve of Ghana. According to Hawthorne and Abu-Juam (1995), Southern Marginal Forest of Ghana is of special biological interest but little of it is reserved today.

The Apra Hill Sacred Grove contains one of the best remaining fragments of Southern Marginal Forest of Ghana (Hall and Swaine 198). The grove is in the Cape Coast-Winneba area of the Southern Marginal Forest of Ghana. Understanding plant species richness patterns and factors that affect these patterns can provide a basis for successful conservation and management of plant diversity (Gebrehiwot et al., 2019). Thus, the relationship between plant species distribution patterns along the elevation gradients in the Apra Hills Sacred Grove is important for the conservation of the plant diversity in the grove. Knowledge about

plant diversity and structure of forest is also important for conservation of biodiversity as plants provide resources and habitats for almost all other forest biodiversity (Sutton et al., 1983; Cannon et al., 1998). With the exception, of an ethnomedicinal study about uses of the plants in the grove (Adeniyi et al., 2018), no other previous study exists on the vegetation in the grove.

The aim of this study was to evaluate plant diversity and structure of forest vegetation in relation to elevation in the Apra Hills Sacred Grove in southern Ghana. The specific objectives of the study were to (1) document and analyse plant diversity, (2) determine the abundance, frequency distribution, and dbh-size class distribution of the trees, and (3) evaluate how overall plant diversity and tree abundance differ along an elevation gradient in the grove.

Materials and Methods

Study area

The study area in Apra Hills Sacred Grove is located in West Effutu Awutu Senya district in the Central Region of Ghana. The study area lies between latitude 5° 35' N and 5° 30' N, and longitude 0° 30' and 0° 35' W and covers

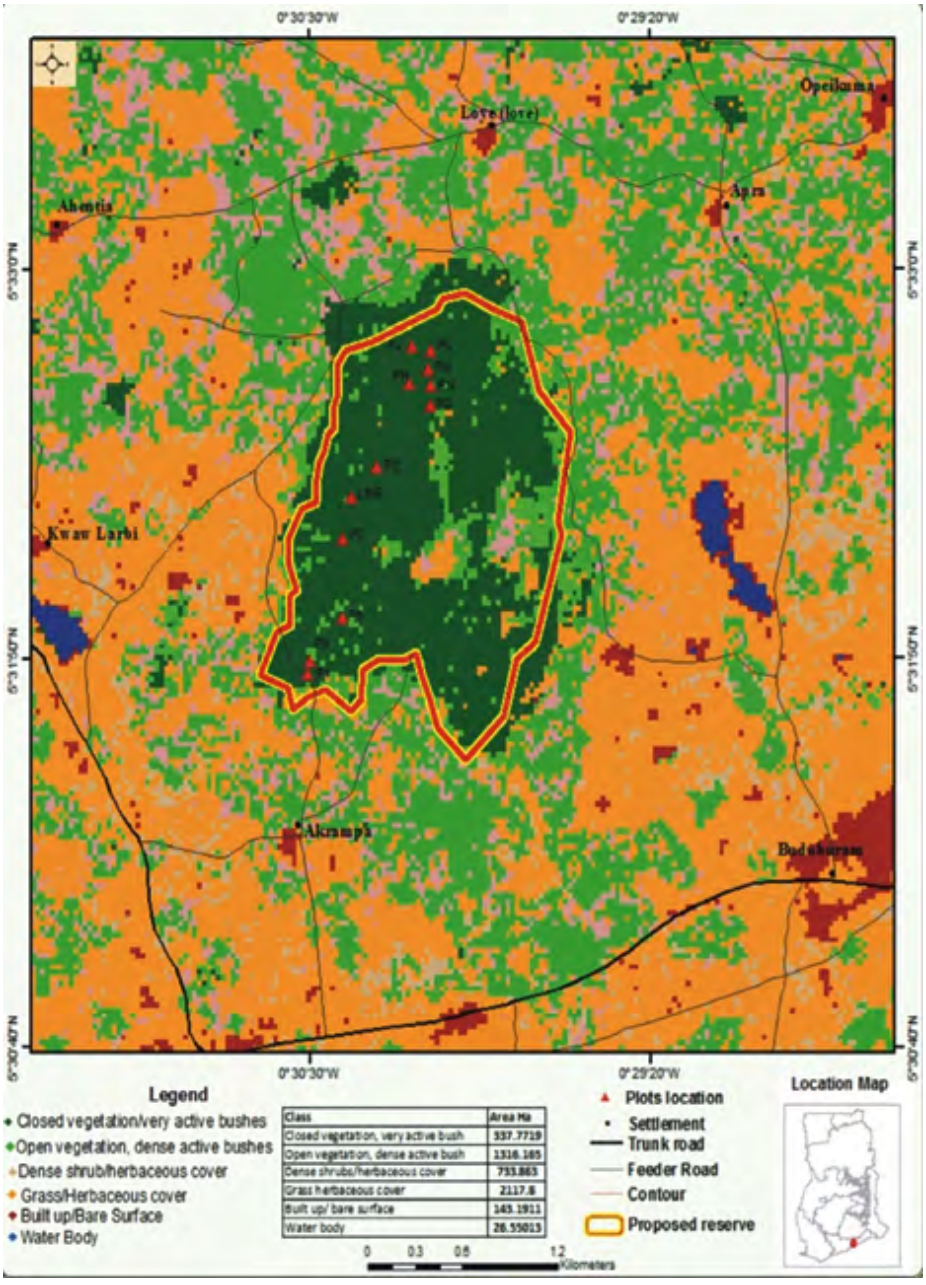

Fig. 1: Map of Apra Hills Sacred Grove showing location in Ghana

a total land area of 226 ha (Fig.1).

About three-fourth of the study area is covered with forest while the rest of the site is made up of previously intensively farmed land and savanna grassland. The Awutu people are the indigenous ethnic group although other groups such as the Ewes are common in the study site (FSR, 1989). The sacred grove is owned and managed by the Awutu Traditional Council with supervisory support from the Ghana Forest Services Division.

Data collection

Sampling of plant diversity was carried out within nine 25 m x 25 m plots separated at least 100 m apart along a 1km transect that started from the bottom to the top of one of the two Apra hills (Table 1). Within each plot, all species of vascular plants present were identified. Trees with diameter-at-breast-height (dbh) ≥ 10 cm at 1.3 cm above ground level within the plots were individually identified and their dbh measured. For trees with large buttresses, dbh was measured at 1.3 above the buttress. The identification of plants was achieved with the assistance of para-taxonomists attached to the Ghana Herbarium (GC) at the Department of Plant and Environmental Biology, University of Ghana. Field identification of the plants was confirmed by comparison of botanical voucher specimens with already identified specimens at GC. The identification of trees follows Hawthorne and Jongkind (2006), and other plants were identified using the Flora of Tropical West Africa (Hutchinson and Dalziel, 1954-1972).

Data analyses

Species diversity was evaluated using both Shannon-Wiener index and Simpson index (Magguran, 2004). The Shannon-Wiener index is an information statistic index that assumes all species are represented in a sample and that they are randomly sampled while Simpson index is a dominance index because it gives more weight to common or dominant species. Shannon-wiener index (H') was calculated using the formula:

$$H' = \sum_{i}^{s} pi \ln pi$$

and Simpson index (D) was estimated using the formula:

$$D = \frac{1}{\sum_{i=1}^{s} pi^2}$$

where s is the total number of species and p is the relative abundance of the i species.

Tree species frequency, density and dominance were calculated using standard formulae (Magguran 2004). Basal area (BA) of trees was calculated as equal to 0.00007854 x D^2 (D = DBH in cm).

Finally, Importance Value Index (IVI) for species of trees was estimated as IVI = Relative frequency + Relative density + Relative dominance (Curtis and McIntosh, 1950 as cited in Asase et al., 2012). The relationship between forest composition and elevation was determined through regression analysis. Statistical analyses were achieved using R statistical software.

Results

In total, 128 taxa of vascular plants were recorded in the present study (Appendix 1). Of the 128 taxa, 105 plants were identified to species level, 10 plants were identified to only genus level and 4 plants were identified at only family level whereas 9 plants were unidentified. Most (42%) of the plants were trees followed by shrubs (23.4%) and then herbaceous species (16.4 %). The number of species of vascular plants ranged between 11 and 59 per plot (Table 1). The 119 plants identified to the family level belong to 46 families, and the family Fabaceae had the largest number of 16 species. Other species rich families were Apocynanceae (9 species), Rubiaceae (7 species), Euphorbiaceae (6 species), and Sterculiaceae (6 species). Two of the species of pants identified, namely, *Bulbophyllum phaeopogon* and *Aerangis biloba* were members of the Orchidaceae. Table 2 is about distribution of plant diversity according to families and growth forms.

A total of 165 individual trees with dbh ≥ 10 cm belonging to 21 species were enumerated (Table 3). Mean tree species richness ranged

TABLE 1

Geographic location of plots studied in Apra Hills Sacred Grove in Ghana with information on elevation, plant species richness, tree density, tree diversity and tree basal area

Plot Code	Geographic location	Elevation (m)	Number of plant species	Tree density/ ha	Number of tree species	Shannon diversity index	Simpson diversity index	Tree basal area (m^2/ ha)
P1	05.53202N 0.050760W	81	47	240	6	1.24	3	67.57
P2	05.53414 N 0.50574 W	67	59	288	5	1.65	3.76	46.92
P3	05.53867N 0.50567W	51	46	176	8	1.84	4.35	33.00
P4	05.54188N 0.50384W	79	27	80	2	1.95	4.74	3.58
P5	05.54188N 0.50384W	79	37	432	6	2.01	4.95	60.22
P6	05.541589N 0.50192 W	80	25	320	7	2.07	5.17	42.73
P7	05.54714 N 0.50080 W	93	26	432	9	2.12	5.33	48.68
P8	05.54642N 0.54643 W	80	24	400	10	2.14	5.44	68.35
P9	05.54570N 0.500084W	125	11	272	5	2.16	5.49	40.45

TABLE 2

Summary of plant diversity in Apra Hills Sacred Grove in southern Ghana according to families and growth forms

Family	Growth forms						Total
	Climber	Epiphyte	Herb	Liana	Shrub	Tree	
Acanthaceae			3		1		4
Adiantaceae					1		1
Amaranthaceae			1		1		2
Anacardiaceae					1		1
Annonaceae				1	1	1	3
Apocynaceae	2			2	3	2	9
Ascelpidaceae	1			1			2
Asteraceae			1				1
Bombacaceae						1	1
Capparaceae					1		1
Caricaceae						1	1
Celastraceae				1	1	1	3
Combretaceae				1			1
Commelinaceae			1				1
Convolvulaceae				1			1
Cucurbitaceae			1				1
Dracaenaceae			1			2	3
Ebenaceae						2	2
Erythroxylaceae						1	1
Euphorbiaceae			1		3	2	6
Fabaceae	1				3	12	16
Flagellariaceae				1			1
Poaceae			4				4
Loganiaceae				1			1
Malpighiaceae						1	1
Marantaceae			1			1	2
Meliaceae					1	1	2

TABLE 2 *cont.*
Summary of plant diversity in Apra Hills Sacred Grove in southern Ghana according to families and growth forms

Family	Growth forms						Total
	Climber	Epiphyte	Herb	Liana	Shrub	Tree	
Menispermaceae				1	1		2
Moraceae						3	3
Myrtaceae					1		1
Orchidaceae		2					2
Passifloraceae				1			1
Phytolaccaceae			1				1
Polygalaceae					1		1
Portulacaceae			1				1
Rubiaceae			1		3	3	7
Rutaceae						2	2
Sapindaceae					1	2	3
Sapotaceae						4	4
Solanaceae					1		1
Sterculiaceae						6	6
Tiliaceae					1		1
Ulmaceae						3	3
Verbenaceae			1		1		2
Vitaceae	2		1	1			4
Unidentified	2		2	1	2	3	10
Total	8	2	21	13	30	54	128

TABLE 3
Tree relative dominance, relative frequency, relative density, and Important Value Index (IVI) for Apra Hills Scared Grove in Ghana

Species	**Relative Dominance**	**Relative Frequency**	**Relative Density**	**IVI**
Afzelia africana	11.97	8.93	8.93	29.83
Albizia adianthifolia	0.14	1.79	1.79	3.71
Antiaris toxicaria	5.08	3.57	3.57	12.22
Carica papaya	0.39	1.79	1.79	3.97
Ceiba pentandra	14.66	10.71	10.71	36.09
Chaectame aristata	0.10	1.79	1.79	3.67
Cola millenii	17.35	12.50	12.50	42.35
Dialium guineense	1.66	5.36	5.36	12.38
Diospyros abyssinica	3.99	5.36	5.36	14.70
Dracaena aborea	0.89	10.71	10.71	22.32
Dracaena perrottettii	1.20	1.79	1.79	4.77
Elaeophobia drupifera	1.53	5.36	5.36	12.24
Ficus sp.	0.33	1.79	1.79	3.90
Hildegardia bateri	29.35	10.71	10.71	50.78
Hymenostygia afezelii	9.61	3.57	3.57	16.75
Mansonia altissima	0.07	3.57	3.57	7.22
Millettia thonningii	0.62	1.79	1.79	4.19
Monodora tenuifolia	0.31	1.79	1.79	3.88
Rothmania longiflora	0.22	1.79	1.79	3.79
Sterculia tragacantha	0.32	3.57	3.57	7.46
Triplochiton sclerexylon	0.22	1.79	1.79	3.79

2-10 per plot, Shannon diversity index was 1.91± 0.28 and Simpson diversity index was 4.69 ± 0.79. The mean density of trees was 292.33 ± 112.12 trees / ha and mean basal area was 45.72 ± 19.81 m2/ ha. The dbh-size class distribution of the trees showed an inverted J-shaped curve (Fig. 2). Frequently encountered trees included *Cola millenii*,

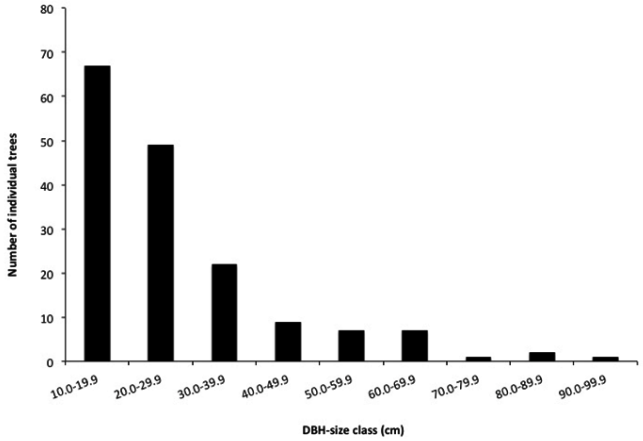

Fig. 2 Tree dbh size-class (≥10 cm) distribution in Apra Hills Sacred Grove in southern Ghana

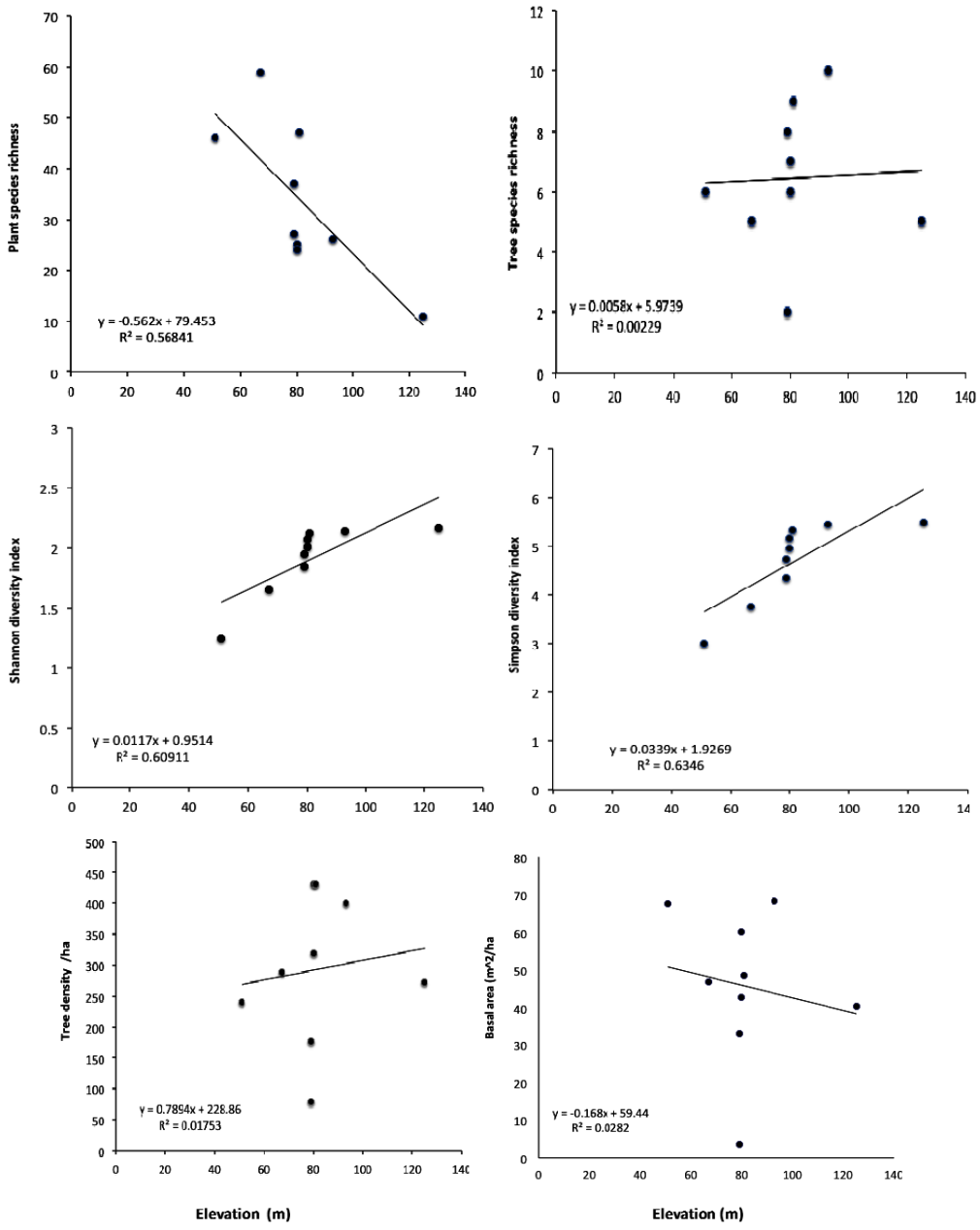

Fig. 3 Linear regression analysis of forest composition along elevation gradient

Hildegardia barteri, *Ceiba pentandra* and *Dracaena aborea*. Tree species with the largest density was *C. millenii* followed by *H. bateri*, *D. aborea* and *C. pentandra* in decreasing order of magnitude. Tree with the largest basal area (6.08 m^2/ ha) was *H. barteri* while the smallest basal area (0.02 m^2/ ha) was recorded separately for *Chaetachne aristata* and *Mansonia altissima*. The largest IVI was recorded for *H. barteri* followed by *C. milleni*, and *C. pentandra* in decreasing order of magnitude.

The linear relationships between the forest composition and elevation are shown in Fig. 3. Overall plant species richness decreased significantly with increasing elevation ($p < 0.05$) whereas tree species diversity (both Shannon and Simpson diversity indexes) increased with increasing elevation ($p > 0.05$ in each case). However, the relationships between elevation and tree species richness ($p = 0.90$), tree density ($p > 0.05$) and basal area ($p > 0.05$) were insignificant.

Discussion

This study is the first report about plant diversity in the Apra Hills Sacred Grove in the Southern Marginal Forest of Ghana. The study has confirmed the existence of species such as *Drypetes parvifolia*, *H. barteri*, *Lecaniodiscus cupaniodes*, *Nesogordonia papaverifera* and *Teclea verdoorniana* that are typically found in the Southern Marginal Forest of Ghana (Hall and Swaine, 1981). Although plant diversity in Southern Marginal Forest of Ghana is comparatively low (Hawthorne and Abu-Juam, 1995, Boshier et al., 2011) they often contain species of conservation importance. In the present study, four of the species of plants identified in the grove have been listed in the IUCN Red List of Threatened Species (www.ucnredlist.org) as either vulnerable species (*Afzelia africana*, *Albizia ferruginea*, *Nesogordonia papaverifera*) or endangered species (*Hunteria ghanensis*). These species should be given special protection in the grove. Our results show that abundance of trees in the grove is low compared to other forest types in Ghana (Gatti et al., 2017). The tree community structure in the grove as revealed from dbh size-class distribution of the trees suggests an uneven-aged forest vegetation (Hitimana et al., 2004), which is indicative of a good regeneration and recruitment of tree species (Hundera et al., 2007). The tree community structure was obviously influenced by a few dominant tree species with high IVI. These trees are among the plants that are better adapted to the environmental and anthropogenic factors in the grove. It is important that trees such as *Triplochiton sclerexylon* and *Sterculia tragacantha* that are rare in the grove should be given high conservation priority. Other plants to be considered are those identified with ethnobotanical uses in the grove (Adeniyi, 2015).

The relationship between the forest vegetation and elevation was very interesting. Overall plant species richness decreased along an elevation gradient similar to that of some previous studies (Yang et al., 2014, Zhang et al., 2016). In contrast, tree diversity increased with elevation similar to the results of Baruch (1984). The effects of elevation on plant diversity are dependent on plant life form (Cirimwami et al., 2019) and this might account for the different patterns observed. Furthermore, the effects of elevation on tree diversity do not follow rigid patterns as uni-modal hump-shaped (Ren et al., 2012), monotonic decrease (Trigas et al., 2013) as well as monotonic increase (Baruch, 1984) have been reported. Plant diversity along elevation gradient could be influenced by many factors such as climate, spatial heterogeneity, biotic processes, and evolutionary history (McCain and Grytnes, 2010). We observed that soil might be a major limiting factor to plant diversity along the elevation gradient as we encountered huge boulders at higher elevations. Anthropogenic factors could also contribute to the patterns of the plant diversity and tree community structure in the grove (Gebrehiwot et al., 2019). Common anthropogenic activities observed include timber harvesting, firewood collections, and

harvesting of plants for medicinal uses (see Adeniyi et al., 2018).

The findings of this study show that Apra Hills Sacred Groves is a refuge for plants of conservation importance and the forest has a good regeneration and / recruitment potential for trees. It is therefore vital to support sustainable management and conservation of the plant diversity in the grove. Our results also show that elevation has a significant influence on the distribution of plant diversity in the grove. As plant species richness and distribution along an elevation gradient may be influenced by factors such as management intensity, edaphic factors and anthropogenic disturbance, future studies on the interactions among these factors are needed.

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Conflict of interest

The authors have no conflict of interest to declare.

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APPENDIX 1

Checklist of species of plants identified in Apra Hills Sacred Grove in Ghana

Species	**Family**	**Growth from**
Abrus precatorius L.	Fabaceae	Climber
Acacia kamerunensis Gand.	Fabaceae	Tree
Acacia pennata (L.) Willd.	Fabaceae	Tree
Achyranthes bidentata Blume	Amaranthaceae	Shrub
Acridocarpus longifolius (D.Don) Hook.f.	Malpighiaceae	Tree
Adenia lobata Engl.	Passifloraceae	Liana
Aerangis biloba Schltr.	Orchidaceae	Epiphyte
Afzelia africana Sm.	Fabaceae	Tree
Alafia sp.	Apocynaceae	Liana
Albizia adianthifolia W.F. Wight	Fabaceae	Tree
Albizia ferruginea (Guill. & Perr.) Benth.	Fabaceae	Tree
Albizia zygia J.F.Macbr.	Fabaceae	Tree
Alchornea cordifolia (Schumach.) Müll.Arg.	Euphorbiaceae	Tree
Aningeria altissima(A.Chev.) Aubrév. & Pellegr.	Sapotaceae	Tree
Antiaris toxicaria (Pers.) Lesch.	Moraceae	Tree
Artabotrys insignis Engl. & Diels	Annonaceae	Liana
Asystacia sp.	Acanthaceae	Herb
Baissea multiflora A.DC.	Apocynaceae	Shrub
Baissea zygodioides (K. Schum.) Stapf	Apocynaceae	Liana
Baphia nitida Lodd.	Fabaceae	Shrub
Blighia sapida K.D.Koenig	Sapindaceae	Tree
Bulbophyllum phaeopogon Schltr.	Orchidaceae	Epiphyte
Callichilia subsessilis Stapf.	Apocynaceae	Shrub
Calycobolus sp.	Convolvulaceae	Liana
Calyptrochilum emarginatum Schltr.	Orchidaceae	Shrub
Canthium sarcocarpum Merr.	Rubiaceae	Herb
Canthium cornelia Cham. & Schltdl.	Rubiaceae	Shrub
Capparis sp.	Rutaceae	Tree
Carica papaya L.	Caricaceae	Tree
Carpolobia lutea G. Don	Polygalaceae	Shrub
Cassia tuhavalyana	Fabaceae	Tree
Ceiba pentandra(L.) Gaertn.	Bombacaceae	Tree
Celtis mildbraedii Engl.	Ulmaceae	Tree
Celtis wightii Planch.	Ulmaceae	Tree
Chaetacme aristata Planch.	Ulmaceae	Tree
Chassalia kolly(Schumach.) Hepper	Rubiaceae	Shrub
Chromolaena odorata (L.) R.M.King & H.Rob	Asteraceae	Herb
Cissus arguta Hoof.K	Vitaceae	Climber
Cissus diffusiflora (Baker) Planch.	Vitaceae	Climber
Cissus quadrangularis L.	Vitaceae	Herb
Cissus sp.	Vitaceae	Liana
Clerodendrum capitatum Hook.	Verbanaceae	Shrub
Cola millenii K.Schum.	Sterculiaceae	Tree

APPENDIX 1 *cont.*
Checklist of species of plants identified in Apra Hills Sacred Grove in Ghana

Species	Family	Growth from
Combretum racemosum P. Beauv.	Combretaceae	Liana
Cyathula prostrata (L.) Blume	Amaranthaceae	Herb
Cystostemma umbellatum E. Fourn	Ascelpidaceae	Climber
Deinbollia pinnata Schumach. & Thonn.	Sapindaceae	Tree
Dialium guineense Willd.	Fabaceae	Tree
Dichapetalum sp.	Menispermaceae	Liana
Digitaria insularis (L.) Mez ex Ekman	Gramineae	Herb
Diospyros abyssinica (Hiern) F.White	Ebenaceae	Tree
Diospyros kamerunensis Gürke	Ebenaceae	Tree
Dracaena arborea Hort.Angl. ex Link	Dracaenaceae	Tree
Dracaena surculosa Lindl.	Dracaenaceae	Tree
Drypetes parvifolia Pax & K.Hoffm.	Euphorbiaceae	Shrub
Elaephorbia drupifera (Thonn.) Stapf	Euphorbiaceae	Tree
Elytaria marginata Vahl	Acanthaceae	Herb
Erythrococca anomala Prain.	Euphorbiaceae	Shrub
Erythroxylum emarginatum Thonn.	Erythroxylaceae	Tree
Eugenia coronata. Schumach. & Thonn.	Myrtaceae	Shrub
Ficus exasperata Vahl	Moraceae	Tree
Ficus sagitilfolia Mildbr. & Burret	Moraceae	Tree
Flagellaria guineensis Schumach	Flagellariaceae	Liana
Floscopa sp.	Commelinaceae	Herb
Gardenia nitida Hook.	Rubiaceae	Tree
Graptophyllum pictum Griff.	Acanthaceae	Shrub
Grewia megalocarpa P.Beauv.	Tiliaceae	Shrub
Griffonia simiplicifolia(Vahl ex DC.) Baill.	Fabaceae	Shrub
Hildegardia barteri (Mast.) Kosterm.	Sterculiaceae	Tree
Hilleria latifolia H.Walter	Phytolaccaceae	Herb
Hunteria ghanensis J.B.Hall & Leeuwenberg	Apocynaceae	Tree
Hymenostygia afezelii (Oliv.) Harms	Fabaceae	Tree
Hypselodelphys violacea (Ridl.) Milne-Redh.	Marantaceae	Tree
Landolphia macratha (K. Schum) Pichon	Apocynaceae	Climber
Lantana camara L.	Verbenaceae	Herb
Lecaniodiscus cupaniodes Planch. Ex Benth.	Sapindaceae	Shrub
Mallotus opposifolius (Geisel.) Müll. Arg.	Euphorbiaceae	Shrub
Manilkara obovata (Sabine & G.Don) J.H.Hemsl.	Sapotaceae	Tree
Mansonia altissima A.Chev.	Sterculiaceae	Tree
Marantochloa leucantha (K.Schum.) Milne-Redh.	Marantaceae	Herb
Millettia chrysophylla Dunn	Fabaceae	Tree
Millettia thonningi (Schumach. & Thonn.) Baker	Fabaceae	Tree
Millettia zechiana Harms	Fabaceae	Tree
Momordica charantia L.	Cucurbitaceae	Herb
Monodora tenuifolia Benth.	Annonaceae	Tree
Nauclea pobeguinii (Pobég.) E.M.A.Petit	Rubiaceae	Tree

APPENDIX 1 *cont.*
Checklist of species of plants identified in Apra Hills Sacred Grove in Ghana

Species	Family	Growth from
Nesogordonia papaverifera(A.Chev.) Capuron ex N.Hallé	Sterculiaceae	Tree
Olyra latifolia L.	Gramineae	Herb
Oplismenus hirtellus (L.) P.Beauv.	Gramineae	Herb
Panicum maximum Jacq.	Gramineae	Herb
Parquetina nigrescens (Afzel.) Bullock	Ascelpidaceae	Liana
Pellaea doniana (J.Sm.) Hook.	Adiantaceae	Shrub
Pouteria alnifolia (Baker) Roberty	Sapotaceae	Tree
Ritchiea reflexa (Thonn.) Gild & Benedict	Capparaceae	Shrub
Rothmannia longiflora Salisb.	Rubiaceae	Shrub
Rothmannia urcelliformis Bullock. ex Robyns	Rubiaceae	Tree
Salacia sp.	Celastraceae	Shrub
Salacighia letestuana (Pellegr.) Blakelock	Celastraceae	Liana
Sanseviera liberica Ger. & Labr.	Dracaenaceae	Herb
Solanum enriathum D. Don	Solanaceae	Shrub
Sorindeia jugladifolia (A.Rich.) Planch. ex Oliv.	Anacardiaceae	Shrub
Sterculia tragacantha Lindl.	Sterculiaceae	Tree
Strophantus gratus (Hook.) Franch.	Apocynaceae	Shrub
Strychnos icaja Baill.	Loganiaceae	Liana
Synsepalum sp.	Sapotaceae	Tree
Talinum triangulare (Jacq.) Willd.	Portulacaceae	Herb
Teclea verdoorniana Exell & Mendonça	Rutaceae	Tree
Tiliacora dielsiana Hutch. & Dalziel	Menispermaceae	Shrub
Tragia sp.	Euphorbiaceae	Herb
Trichilia prieureana A. Juss.	Meliaceae	Tree
Triplochiton scleroxylon K.Schum.	Sterculiaceaae	Tree
Turraea heterophylla Sm.	Meliaceae	Shrub
Uvaria globusa Hook.f.	Annonaceae	Shrub
Vigna radiata (L.) R.Wilczek	Fabaceae	Shrub
Undetermined	Acanthaceae	Herb
Undetermined	Apocynaceae	Tree
Undetermined	Apocynaceae	Climber
Undetermined	Celastraceae	Tree
Undetermined	Unidentified	Tree
Undetermined	Unidentified	Tree
Undetermined	Unidentified	Shrub
Undetermined	Unidentified	Herb
Undetermined	Unidentified	Shrub
Undetermined	Unidentified	Liana
Undetermined	Unidentified	Climber
Undetermined	Unidentified	Herb
Undetermined	Unidentified	Climber
Undetermined	Unidentified	Tree