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OVERSEAS DEVELOPMENT ADMINISTRATION

FORESTRY DEPARTMENT REPUBLIC OF GHANA

TROPICAL FORESTRY PAPERS 29

Ecological Profiles of Ghanaian Forest Trees

by

W.D. Hawthorne



OXFORD FORESTRY INSTITUTE
DEPARTMENT OF PLANT SCIENCES
UNIVERSITY OF OXFORD
1995

FRP
FORESTRY RESEARCH PROGRAMME

Cover Illustration

Khaya grandifoliola (mahogany tree of dry forest/savanna fringe)
(Photo © William Hawthorne)

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Summary

Textual summaries are presented of the ecology of most forest trees which in Ghana attain 5 cm dbh. For rarer and smaller trees, the text is reduced to little more than name and brief ecological group, but for others information is presented under various headings relating to tree distribution and regeneration ecology, taxonomy, and miscellaneous other notes.

1260 charts are included, summarising aspects of the ecology in Ghana of 210 of the most important species (including some few-species groups). A series of five charts summarises abundance across Ghana's forest zone, stratified into 21 broad landscape and forest type categories. A sixth chart summarises for each of the 210 important species trends of crown exposure. The crown exposure charts are potentially of value as objective indices of the extent to which each species is a 'light-demander', or 'shade-bearer', and how this changes with tree size.

The potential use, origin and explanation of these summaries is explained first in an introductory section.

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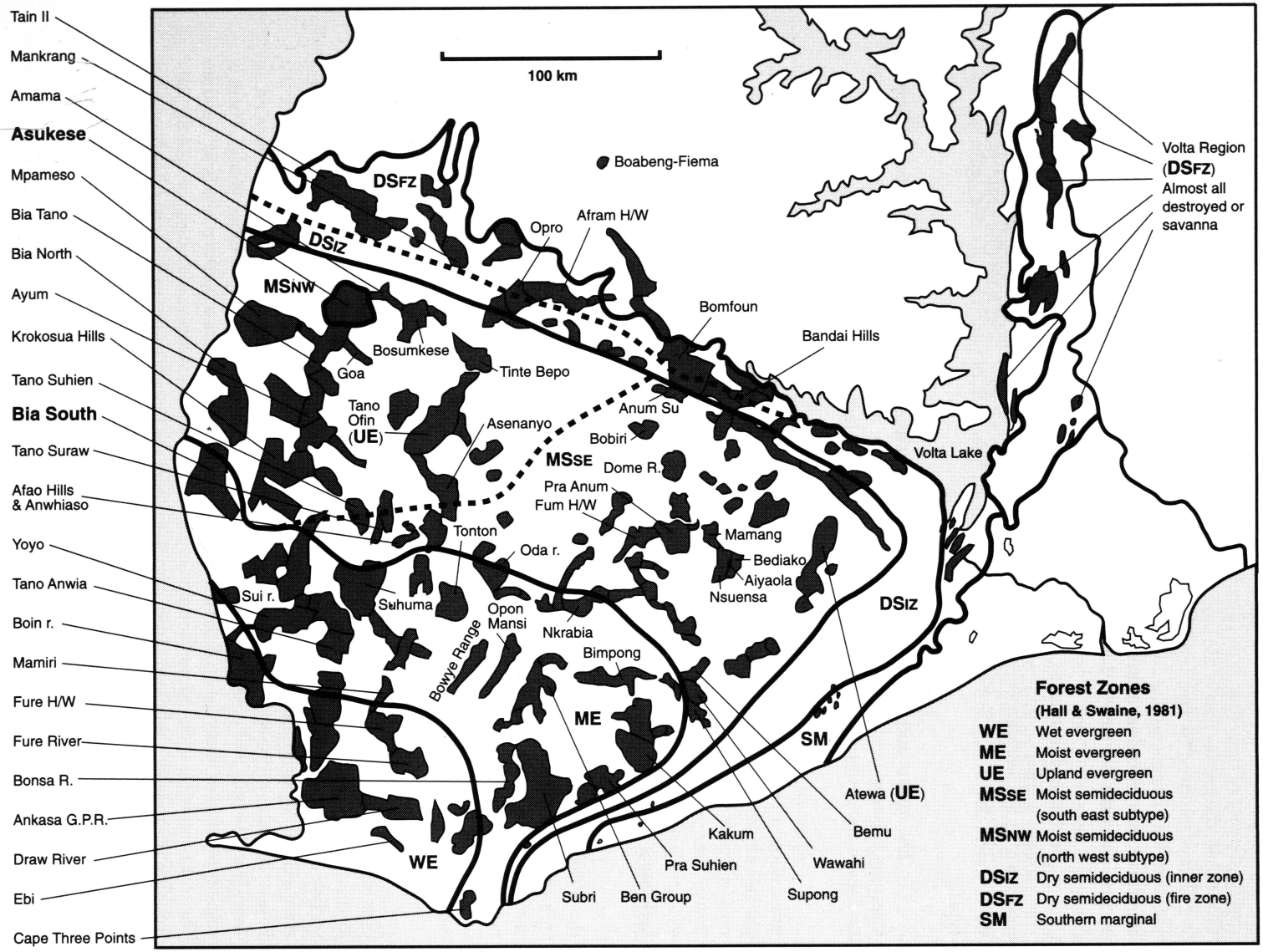


Figure 1 Forest Reserves in Ghana with selected abbreviated names including those mentioned in the text

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Thanks to Denis Filer for help with Brahms (database) and with the manuscript; Mike Swaine for comments on earlier drafts, and to Andrew Dunsdon, Dennis Alder and Doug Sheil for advice on statistics; to the library and other staff of the Oxford Forestry Institute, for being so cooperative; to Diane Pike who helped scan the literature and with typing and Oenone Dodwell for help with proof reading and correcting; to Richard Wise who helped with the publication and prepared the cover; and Colin Hughes for comments on the manuscript. Special thanks to my wife, Sonja.

Abbreviations

dbh (gbh)	Diameter (girth) at breast height, usually 1.3 m above ground
ha	Hectare
BRAHMS	Botanical Research and Herbarium Management System
F.D.	Forestry Department of Ghana
F.R.	Forest Reserve
FIMP	Forest Inventory and Management Project of the Ghana Forestry Department Planning Branch, supported by ODA.
FROGGIE	Forest Reserves of Ghana: Graphical Information Exhibitor
FTEA	Flora of Tropical East Africa
FWTA	Flora of West Tropical Africa
G.P.R.	Game Production Reserve
N.P.L.D.	Non Pioneer Light Demander
ODA	Overseas Development Administration
OFI	Oxford Forestry Institute
PSP	Permanent Sample Plot
TSP	Temporary Sample Plot, referring specifically to the samples of the Ghanaian national forest inventory (1986-1994) discussed in the text.

Hall and Swaine (1981) Forest types (see map):

DS	Dry Semideciduous forest
DSFZ, DSIZ	"" "" Fire zone, Inner zone (DS subtypes)
MS	Moist Semideciduous forest
MSSE, MSNW	"" "" South east and North west subtypes
ME	Moist Evergreen forest
SM	Southern Marginal forest
SO	South East outlier forest
UE	Upland Evergreen forest
WE	Wet Evergreen forest

SM & SO forests are types of dry, sometimes evergreen forests found on and near the coastal plains, and on hills around the Dahomey gap (see map; SO forests are unmapped, but scattered to the south and east of the SM forests).

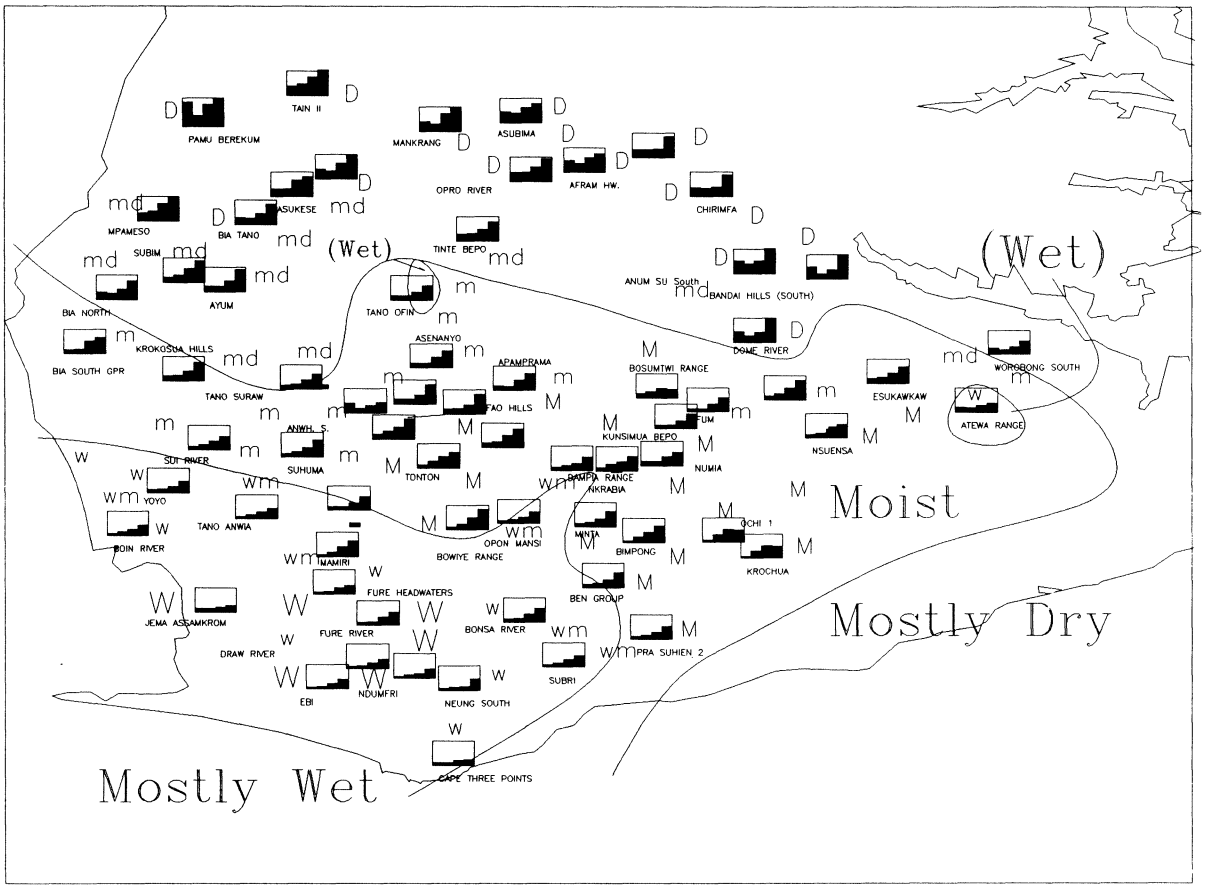


Figure 2. Map showing inventoried reserves (except where too many overlap on the illustration), with an indication of the plot composition as:

W: All plots Wet (/evergreen type) of forest
w: Wet - Moist, most plots Wet
wm: Wet - Moist, most plots Moist

M: All plots Moist type of forest
m: Moist - Dry, most plots Moist
md: Moist - Dry, most plots Dry

D: All plots Dry type of forest

Curved lines have been sketched to surround areas predominantly of Wet, Moist or Dry forest. Compare with Figure 1.

The bar charts show the proportion of trees which were pioneers. The four bars in each chart represent trees of size class: 5 -< 30 cm dbh; 30-< 60 cm dbh; 60-<90 cm dbh; 90 + cm dbh

Introduction

This paper presents data drawn from a national forest tree inventory of Ghana, from an ecological and silvicultural perspective. A precursor of the current work has gestated for several years as *Forest regeneration in Ghana: an interim report*, but completed parts of the planned final report have been published separately (Hawthorne, 1993, 1994). The original introductory chapter has now also been updated and superseded by Hawthorne (in press, due 1995), in which I discuss 'guilds', 'stars' (see below) and some general issues of forest management. The species-centric overview, which formed the greater part of the interim report, is hereby revised.

I concentrate here, therefore, on summaries, tailored to the space and budget available, of bibliographic and observational data for important Ghanaian forest trees. For the sake of completeness, and as a summary of some terminology, the aims, origin of the data, and some ecological background information will be summarised very briefly, although these issues have been discussed in more detail elsewhere.

Aim

The aim of this paper is to **summarise important aspects of the ecology of Ghana's forest trees 'in a nutshell'**, drawing on the results of Ghana's national forest inventory. This should be useful to researchers and forest managers especially, but not only, in West Africa. Potential applications are:

Potential Application 1: Choosing a shortlist of tree species for cultivation particularly in a research and trial context (e.g. agroforestry; enrichment planting in degraded forest; community development schemes; industrial plantation trials).

It seems, not least from the literature, that Ghana's forest tree flora holds much untapped potential, at least in a non-timber context and relative to other parts of the tropics. West African *Erythrina*, *Rhodognaphalon*, *Bombax*, and (nitrogen-fixing) legumes, for instance, appear much less frequently in the world literature on tree-use than their cousins elsewhere, yet there is no reason to believe this is because they are intrinsically less useful. The demand for potentially useful trees such as these is apparently lower in West Africa than, for instance, India, but is likely to increase as pressure on forest-zone land increases.

Similarly, plantations in Ghana are often of well-known, safe-bet, exotic species like *Teak* and *Gmelina*. From a medium term, commercial, private investor point of view this is understandable, but much more financial and intellectual investment in the development of the use of Ghana's own, forest genetic resources seems appropriate on a broader canvas. The need for indigenous-species solutions is particularly acute where plantation is to be intimate with degraded, natural forest, for instance on old log loading bays and as fire-breaks (see Hawthorne, 1993, 1994; Hawthorne & Abu Juam, 1995). In these contexts managers (ideally) aspire to support more normal, if not exactly natural, ecological processes of forest recovery.

The main concerns with the use of exotic species within indigenous ecosystems are ecological and conservational. *Rhododendron* in UK, *Leucaena leucocephala* in parts of Africa, and *Azadirachta indica*, rampant on Ghana's coastal plains are three of the very many, well-known

examples of initially desirable, exotic trees which have become ecological problems (see Hughes and Styles (1989) for a survey of the subject with reference to legumes). In Africa, at least, most cases of exotic plants 'turning weed' have been in situations where the natural vegetation is seriously disturbed - precisely those areas of vegetation which are a priority for forest managers to consider planting. *Chromolaena (Eupatorium) odorata* (Assam weed, 'Acheampong' etc.), a weed which chokes large areas of disturbed forest in Ghana and dominates the seed bank in some areas (Epp, 1987), has shown how rapidly (30 years) an exotic can spread and dominate disturbed forest in Ghana (Hall *et al.*, 1972).

Broussonetia papyrifera, the paper mulberry tree from South-East Asia, is a prime example of the pitfalls of using promising alien trees. It was introduced into research plots and is now starting to dominate patches of secondary forest/thicket in the burnt areas in the dry semideciduous forests around Afram Headwaters F.R. The (botanical) biodiversity value of *Broussonetia* thicket is lower than other secondary, woody vegetation nearby. Farmers do not like it where it has invaded fallow thickets, as it is difficult to eradicate (J. Falconer, pers. comm.). Commercial interests also suffer in the wake of such ecological problems: *Broussonetia* thicket areas are not associated with healthy timber regeneration, and do not provide a suitable habitat for larger-leaved Marantaceae and other non-timber commodities.

Monocultures or few-species mixtures are inevitably more prone to complete failure due to disease or environmental or economic misfortune than multi-species mixtures. However, it has apparently proved difficult to make mixed, indigenous plantations work logistically and ecologically (C. Turnbull, pers. comm.). Very often, basic features of the ecology of a tree (like preferred climatic zone) have been ignored when establishing even monocultures of indigenous trees, and after even one failure in such enterprises, plantation managers understandably retreat to using standard, well understood, usually exotic species. **This paper will hopefully help support initiatives to promote planting of indigenous species, particularly in mixtures.**

Potential Applications 2: Greater ecological input at the tree community level into management of Ghana's forest resource

Sustained use and scientific forest management require that species be treated as individually as possible yet, for most species, adequate data will be lacking for some time. Single species often behave unpredictably on the scale of a coupe or other forest management unit, even if detailed data are available. The practical compromise is for the manager to attempt to manipulate and monitor species groups. The total species list can be split, in the spirit of successive approximation, into progressively narrower groups, which managers can then try to manipulate. 'Mixed Redwood' (i.e. mahogany and similar timber trees) is a familiar example of a necessary and useful species grouping in the commercial world. Regeneration guilds and Star-ratings of conservation value are examples of non-commercial groupings summarised and listed below for each species.

Species group scores can be aggregated into values for particular patches of forest, and can show how the (ecological, commercial) quality of a forest changes as a consequence of a particular management regime (Hawthorne, in press). Computer models (e.g. Ghafosim, see Alder, 1990) predicting how the forest will develop under different, perhaps novel, regimes should be aware of such groups if they are to point towards management options for sustainable forest use. Ghana's extensive network of Permanent Sample Plots will provide

vital information on increment and mortality, and ongoing research (e.g. at Ghana's Forestry Research Institute and Aberdeen university) will provide other ecological data to enable species to be grouped in useful, diagnostic ways. However, it is easy to lose sight of the 'wood for the trees', where detailed experimentation is concerned. Yes, a species grew 2.6 times as fast in 33% of the shade in Zaire in 1956, but how does that influence how the species is to be managed in the Krokosua hills F.R. today? For many species, germination, nursery or silvicultural trials have been conducted repeatedly, often with conflicting results due to subtle differences in techniques, or experimental and other circumstantial 'noise'.

If this type of detailed information is to be useful in a general context, it has to be massaged back into the general corpus of knowledge for each species, to provide imprecise, but useable models of each species' role in, for example, forest regeneration and genetic conservation. An attempt is made, in the species textual profiles below, to sketch out how much of the corpus exists, thereby highlighting how much remains to be defined. The guild and star classifications mentioned below are not seen as definitive: merely crystal seeds to stimulate discussion, argument and eventual refinement.

Potential applications 3. Miscellaneous ecological reference

By expressing ecological profiles of many species in one format, it is likely that a wide variety of users in various disciplines - from zoologists interested in food plants, to plant physiologists interested in tropical trees - will find something of interest in the current report.

What this publication is not

It is **not** the aim of this publication to inform the reader of the national volumes of trees, e.g. for commercial purposes, nor of the levels of species in specific forests, although a few comments are made about the latter. Readers interested in these aspects should apply to the Forestry Department of Ghana (and FIMP), for the most recent analyses or working plans. Similarly, detailed distribution maps have been excluded. These are available through FROGGIE (see Hawthorne and Abu Juam, 1995), which is an interactive forest plant database which can draw distribution maps. Such maps need to be updated regularly, and for general purposes there is little justification continuously republishing distribution maps extending those in Hall and Swaine (1981).

It would be wrong to suggest that in these pages is a well-rounded or complete summary of each species' ecology. Apart from the many omissions due to published facts being hidden away in more general publications, most of the results of past research exist only in unpublished sources, often forgotten in dusty vaults. Nor has the page and time budget been large enough to do full justice to the more accessible publications. Most importantly, many of the required facts are simply not known for most species. However, the current work should contribute as a conspectus.

The Brahms database

To facilitate ongoing changes to the summaries listed below, the text and other summary data for each species have been organised in a Brahms database (developed by Denis Filer at Oxford Forestry Institute; ODA sponsored, Ghana Forestry Department data), and can be updated with new data as it becomes available. Brahms is continually being developed to link to a wide variety of forest-related data, including herbarium specimens, sample plots, and forest compartment summaries, both in its own format and that of other systems. The species summaries below are, then, a snap-shot of the available facts, edited and formatted slightly before publication.

Sources of data

Species-level information has been gleaned from many sources, but citations to Taylor (1960) and Hall and Swaine (1981) are conspicuous for their abundance, and so are reduced to **[Taylor]** and **[Hall and Swaine]** in the species profiles. Most of the nomenclature used here remains as summarised by Hepper, Keay *et al.* in Flora of West Tropical Africa **[FWTA]**. Hall and Swaine made many updates to the check-list, and Hawthorne (1990) added a few more in a field guide, which is closely linked to the current paper. Some important changes in nomenclature have occurred since then, particularly in the Sapotaceae, so that, for instance, the genus name *Aningeria* should be dropped from future usage. To keep up with the permanently shifting sands of taxonomy, the opportunity has been taken to highlight the recent name changes, but to maintain compatibility most information for a species is listed under the name used in the field guide.

Most of the original work summarised here is from inventories and other research carried out in the planning branch at Kumasi, as part of various O.D.A. /Ghana Forestry department projects starting with a Forest Inventory Project in 1986. This dataset has developed in various formats over the last nine years. An earlier version of the data was used for the interim draft report, but a final version has recently been reformatted , in 'Foxpro' (.dbf) format, and tidied up by J. Wong and others at FIMP in Kumasi, and it is this version that I have used below. The botanical and other information in this dataset has to be treated with some caution as, with more than a hundred field and office workers involved in its collection and processing, errors of various kinds are not uncommon. One inexperienced tree-spotter can pollute the data for a whole forest reserve unless discovered quickly. For this reason, some species have had to be amalgamated into groups, and TSP results for many species are not specifically discussed. In terms of quality of recording of plot characteristics, it would probably be unwise to expect much more of the data than has been presented on the charts. Within these constraints, though, the Ghanaian TSP data is remarkable for the length and breadth of the ecological and other information contained within.

Regeneration studies focusing on the effects of logging have been published separately in Hawthorne (1993), and of fire in Hawthorne (1994), and are referred to often in the species profiles. An extensive botanical survey, building on that of Hall and Swaine, has also been completed as part of the same broad project (Hawthorne and Abu Juam, 1995) and some notes on the results are included for some species.

The TSP (Temporary Sample Plot) inventory

All the charts in this paper are based on the national TSP dataset (see e.g. Blackett in Wong, 1989). One hectare plots were distributed systematically through 127 forest reserves, on a 2 km grid to give a 0.25% sampling intensity for trees of 30 cm dbh or above. A TSP plot is 500 m x 20 m, divided into five 100 m x 20 m subplots (subplots 1-5), the first of which includes a regeneration subsample. In a 1/20 ha subsample (subplot A), all trees down to 5 cm dbh were recorded. In a 1/10 ha (subplot B) subsample (containing the A subplots), all trees down to 10 cm dbh were recorded.

These samples have been post-stratified for this publication on the basis of forest type and position in landscape.

Forest types in Ghana

Hall and Swaine (1976, 1981) described seven main forest types, based on species composition of 25 m x 25 m plots (and other samples) in undisturbed, non-swampy forest throughout the forest zone (see Figure 1). The gradient in species composition was found to be correlated strongly with rainfall and associated soil base desaturation. Lines between Hall and Swaine's forest types were chosen partly to maintain some degree of compatibility with earlier classifications, but the continuum of species composition across forest types was emphasised. Subsequent botanical surveys and, indeed, the inventory data itself have established that although this classification holds up remarkably well in 'normal' forest between the original sample points, there is considerable variation of forest type due to position in landscape (see Hawthorne, in press).

The purpose of post-stratifying plots for the current publication is to highlight in an efficient way the conditions under which a given species thrives, and not primarily to show how a species performs in a given area, although there is a good correlation. Although Hall and Swaine's forest gradient is an inevitable first choice for the main subdivision of the implied environmental conditions in Ghana, their seven forest types are not ideal for stratifying the TSP dataset, and have been simplified for the current paper because:

1. Their forest types differ greatly in size: some forest types would have too few samples in them.

2. The resulting charts, when combined with variation in landscape, would be too complicated.

3. Categorisation of sample plots would have to be on an indirect basis - i.e. on the basis of the position on the forest type map of the forest blocks within which the plots are located. Many forest reserves straddle forest type boundaries, or have a wide range of vegetation types, yet the pattern of variation is depicted only symbolically by the forest type lines on Hall and Swaine's map. For most forests, there was only one 25 m x 25 m plot on which to base the classification. The specific example of variation in Bia South G.P.R. is discussed by Hawthorne (1993). This forest straddles the (straight) Moist Evergreen to Moist Semideciduous dividing line, yet a blurred-mosaic of forest types is apparent when studied closely.

For these reasons, the samples have been divided for the current paper along the same spectrum as described by Hall and Swaine, but into only three forest types. The samples have been stratified at the plot level, as follows.

Designation of (Wet, Moist or Dry) forest zone for the species charts

'Empty' plots, and plots for which the data are highly suspect (probably due to data input or subsequent handling errors), have been excluded from the analyses[1]. It can be assumed that, particularly in the Dry forest zone, the quoted absolute stem density and basal area figures are maximum values for the forest reserve as a whole, but reasonable estimate for the patches of forest within the reserve boundary.

For each hectare plot, an ordination value is calculated from the tree species ordination values defined in Hall and Swaine's forest classification, with each species weighted by the number of its stems in the plot. This gives plot scores which are reasonably compatible with unweighted ordination scores for all (including non-tree) species in botanical survey samples for the same patch of forest, although the patterns of variation are not so subtle in the TSP inventory, because rare trees were often given vague (e.g. generic) names. Nevertheless, plot scores less than 21 for ordination axis 1 are observed for one hectare TSP plots in the Wet Evergreen forests, and for 25 m x 25 m or unmeasured botanical survey samples in the same forest.

The subdivision of these scores into three main forest categories has been made firstly by choosing an appropriate cut-off for the evergreen forest stratum; then by choosing a comparable cut-off for dry forests. The moist forest sample is that which is left between these extremes.

The evergreen to semideciduous forest divide, or transition, is a significant one for many reasons. Evergreen forests have generally base-poor soils (Hall and Swaine, 1981), rather low timber stocks, and are biodiversity hotspots (Hawthorne and Abu Juam, 1995). Although no continuous boundary can be defined on a scale of metres, a line can be defined separating very different forests on the scale of kilometres. The gradient is particularly steep in Cape Three Points F.R. The main features and key indicator species, like *Triplochiton* and *Celtis spp* (semideciduous) and *Cynometra* and *Heretiera* (evergreen) can be found abundantly in one end of transitional forests like Subri and Yoyo F.R.s, and yet are almost absent on the other side, perhaps ten kilometres away. The floristic differences are very likely to be strongly influenced by rainfall and soil, probably enhanced by geological factors in some areas. Disturbance and successional change (e.g. Eggeling, 1947) may be an important determinant of this evergreen - semideciduous, divide on some scales, as discussed by Hawthorne (in press), but it is highly likely that the main trends are controlled in Ghana by extant features of the soil and/or climate (Hall and Swaine, 1981). The work conducted by Swaine, Veenendaal *et al.* is starting to throw more light on this issue (see *Mansonia* and *Heritiera*, below), but it is too early to draw firm conclusions.

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[1] Although potentially important to a calculation of absolute stem density in a given forest reserve, it is not the case that all 'empty', potential plot locations on the (2 km x 2 km) sampling grid for a forest reserve would have been registered as such (they may have been simply missed out and undocumented entirely). There was some pre-stratification of the vegetation and removal of highly degraded forest areas from the inventory target for some forest reserves.

Sample from the Wet forest zone

The Wet (/evergreen) forest stratum (or zone as it turns out on the map) recognised here covers Hall and Swaine's **Wet [2]Evergreen** (WE) type, and extends a short distance into their **Moist Evergreen** (ME) type. It includes also the wetter extreme of their **Upland Evergreen** (UE) type, which occurs as enclaves within drier, lower altitude forests. The annual rainfall associated with samples in this zone is generally >1750 mm. The soils are generally base-poor (below 40% saturation of Cation Exchange Capacity) (Hall and Swaine).

Wet forests have not suffered significantly from fire, in recent decades at least, and are also not as rich in important commercial species as drier forests. They are a priority for protection from disturbance, because of their biodiversity richness (Hawthorne & Abu Juam, 1995). Due to the large area of swamps and reduced timber stocks, this is not as great a sacrifice for Ghana's loggers as one might imagine.

The Dry forest Zone Sample

The Dry forest zone has been chosen to cover the driest extreme of forest in the TSP sample. '**Dry**' forest includes all Hall and Swaine's **Dry Semideciduous** (DS) forests, including small areas of rocky forest in this zone whose ordination scores indicate **Southern Marginal** (SM) or **South East outlier** (SO) forest, although no TSP inventory was made in the small area of forest mapped by Hall and Swaine in their SM and SO types. The Dry forest stratum includes also drier types of Moist Semideciduous (MS) forest, principally from Hall and Swaine's MS north west subtype (MSNW). The annual rainfall in the region occupied by the Dry forest sample is generally 1000-1500 mm. The soil in general is base-rich (> 40%, and often > 80% saturation of Cation Exchange Capacity (Hall and Swaine)).

Dry forests have suffered serious disturbance due to fire damage in recent years, and have also been heavily logged. Logging ought to be greatly reduced in these forests, due to past overlogging and the constant fire threat.

The Moist forest Zone Sample

The third, 'Moist' forest zone in the charts includes all those forests with an ordination score between Wet and Dry forests, covering most of Hall and Swaine's ME and MS types, together with some drier plots from UE forests. The rainfall over the area occupied by the Moist forest samples is in the region 1500-1750 mm, although the soil base saturation has about the same range as the Dry forest sample.

Moist forest includes much of Ghana's current timber stock, as it is more extensive than either extreme forest type; has a higher timber tree stem density than the Wet forest; and has suffered less fire damage than Dry forests. It is in these forests that sustainable timber production has the potential to be most profitable.

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[2] Forest type terms such as 'Evergreen', 'Dry' and 'Moist' have their first letter capitalised in this paper where they specifically refer to forest types precisely defined by Hall and Swaine, or for the current work. The same terms are often used in a less formal way, and are then written with lower case first letters.

Table 1: Summary of forest reserves and forest types from national map and plot composition

Column title	Meaning
H.& S. Type	Forest type deduced from Hall and Swaine forest type map (see Figure 1). All other columns are derived from TSP 1 ha plot.
Axis 1, 6	Average ordination score (axis 1 and 6) of acceptable TSP 1 hectare plots.
Av. zone	Average forest zone of the plots, where 1= Wet forest, 2=Moist, 3=Dry forest
No. Plots	The number of TSP 1 hectare plots, for each forest zone as shown.

FOREST RESERVE	H.& S. Type	Axis 1,	6	Av.zone	No. Plots Wet	Moist	Dry
Entirely WET forest							
Boi Tano	WE	17	44	1.00	29	0	0
Ebi River Shelterb.	WE	16	43	1.00	7	0	0
Fure River	WE	18	42	1.00	49	0	0
Jema Assamkrom	WE	17	43	1.00	16	0	0
Ndumfri	WE	18	42	1.00	18	0	0
Neung North	WE	19	43	1.00	4	0	0
WET-MOIST transition, mostly WET forest							
Draw River	WE	17	43	1.05	54	3	0
Neung South	WE	17	45	1.07	27	2	0
Fure Headwaters	WE	18	43	1.10	37	4	0
Cape Three Points	WE/ME	19	42	1.15	11	2	0
Atewa Range Ext.	UE/MS	21	42	1.20	4	1	0
Bonsa River	ME/WE	21	40	1.39	23	15	0
Tano Nimiri	WE/ME	21	41	1.39	31	20	0
Yoyo River	ME/WE	23	42	1.49	29	28	0
Disue River	WE/ME	21	43	1.50	3	3	0
WET-MOIST transition, mostly MOIST forest							
Subri River	ME/ME	21	41	1.52	63	68	0
Esuboni	MSSE	24	42	1.58	5	7	0
Mamiri	ME	22	38	1.64	4	7	0
Dadiaso	WE/ME	23	40	1.66	12	23	0
Tano Anwia	ME	23	40	1.67	12	24	0
Ben West	ME	24	38	1.75	4	12	0
Pra Suhien Block II	ME	24	40	1.80	5	20	0
Boin River	WE/ME	25	40	1.84	12	63	0
Bura River	ME	24	38	1.88	3	22	0
Atewa Range	UE/MS	26	42	1.89	6	50	0
Bonsa Ben	ME	26	38	1.92	3	35	0
Dampia Range	ME/MS	27	39	1.94	1	16	0
Opon Mansi	ME	25	40	1.97	1	30	0
Entirely MOIST forest							
Afao Hills	MSSE	29	41	2.00	0	9	0
Afia Shelterbelt	MSSE	30	40	2.00	0	5	0
Aiyaola	MSSE	27	41	2.00	0	8	0
Angoben Shelterbelt	ME	26	38	2.00	0	8	0
Auro River	MSSE	33	43	2.00	0	2	0
Baku	MSSE	30	41	2.00	0	2	0
Bediako	MSSE	27	39	2.00	0	3	0
Bemu River	ME	27	41	2.00	0	7	0
Bimpong	ME	26	40	2.00	0	25	0
Birim	MSSE	29	41	2.00	0	8	0
Birim Extension	MSSE	28	41	2.00	0	3	0
Bosumtwi Range	MSSE	28	40	2.00	0	16	0
Bowiye Range	ME	28	39	2.00	0	28	0
Denyau Shelterbelt	ME	29	39	2.00	0	2	0
Esem Epam	MSSE	29	40	2.00	0	6	0
Esukawkaw	MSSE	29	40	2.00	0	29	0
Jeni River	MSNW	29	40	2.00	0	5	0
Kontintin Shelterb.	MSSE	30	39	2.00	0	3	0
Krochua	ME	24	39	2.00	0	3	0
Kunsimua Bepo	MSSE	27	39	2.00	0	3	0
Minta	ME	26	38	2.00	0	6	0
Nkonto Ben	ME	28	38	2.00	0	3	0
Nkrabia	ME	31	40	2.00	0	26	0
Nuensa	MSSE	27	40	2.00	0	14	0
Numia	MSSE	29	40	2.00	0	13	0
Nyamibe Bepo	MSSE	30	41	2.00	0	6	0
Oboyow	MSSE	30	41	2.00	0	15	0
Ochi Headwats. Bk.1	ME	30	39	2.00	0	2	0
Ochi Headwats. Bk.2	ME	26	41	2.00	0	1	0
Oda River	ME	29	39	2.00	0	40	0

Table 1: Summary of forest reserves and plot forest zones (continued)

	H.& S. Type	Ax.1	Ax.6	Av.zone	No. Plots Wet	Moist	Dry
Entirely MOIST forest (continued)							
Onuem Bepo	MSSE	31	41	2.00	0	8	0
Onuem Nyamibe Sh.	MSSE	29	40	2.00	0	5	0
Onyimsu	MSSE	29	43	2.00	0	1	0
Pra Birim N.& S.	MSSE	28	41	2.00	0	3	0
Pra Suhien Block I	ME	26	40	2.00	0	22	0
South Fomangsu	MSSE	31	42	2.00	0	3	0
Southern Scarp (Ak.)	MSSE	28	41	2.00	0	7	0
Subin Shelterbelt	ME	27	38	2.00	0	6	0
Supuma Shelterbelt	ME	29	40	2.00	0	6	0
Tonton	ME	28	39	2.00	0	35	0
Wawahi	MSSE	28	40	2.00	0	10	0
MOIST-DRY transition, mostly MOIST forest							
Bia GPR	ME/MS	28	41	2.03	0	57	2
Asenanyo River	MSNW	29	40	2.05	0	54	3
Totua Shelterbelt	ME	26	39	2.06	0	17	1
Apamprama	MSSE	30	40	2.11	0	8	1
Supong	MSSE	28	39	2.11	0	8	1
Upper Wassaw	ME	30	39	2.13	0	20	3
Ben East	ME	29	40	2.17	0	5	1
Suhuma	MSNW	29	40	2.18	0	72	16
Sui River	ME/MS	29	41	2.20	0	64	16
Fum Headwaters	MSSE	29	41	2.22	0	14	4
Tano Suhien	MSNW	30	41	2.23	0	17	5
Tano Ofin	UE/MS	30	42	2.25	4	66	29
Tano Suraw	MSSE	30	41	2.29	0	5	2
Anhwiaso East	MSSE	31	40	2.30	0	21	9
Ofin Shelterbelt	MSNW	31	42	2.31	0	9	4
Tano Suraw Extension	MS	31	41	2.37	0	12	7
Anhwiaso South	ME	31	40	2.40	0	3	2
Kajeasi	MSSE	32	42	2.43	0	4	3
Worobong South (Ak.)	MSSE	31	42	2.45	0	12	10
Tinte Bepo	MSNW	32	42	2.46	0	15	13
Mamang River	MSSE	32	42	2.50	0	6	6
Worobong South (Kw.)	MSSE	31	40	2.50	0	3	3
MOIST-DRY transition, mostly DRY forest							
Subim	MSNW	32	42	2.51	0	26	27
Bia Tributaries N.	MSNW	32	42	2.56	0	38	49
Pra Anum	MSSE	33	42	2.63	0	11	19
Mirasa Hills	MSSE	33	43	2.65	0	6	11
North Fomangsu	MSSE	32	44	2.70	0	3	7
Krokosua Hills	MSNW	33	43	2.71	0	33	82
Muro	MSNW	33	42	2.71	0	4	10
Anum Su North	MSSE	35	44	2.75	0	2	6
Bonkoni	MSNW	33	43	2.79	0	4	15
Ayum	MSNW	34	44	2.80	0	6	24
Mpameso	MSNW	33	43	2.80	0	17	67
Bobiri	MSSE	32	42	2.88	0	1	7
Asukese	MSNW	35	44	2.90	0	6	57
Bonsam Bepo	MSNW	34	44	2.91	0	3	30
Aboniyere Shelterb.	MSNW	34	43	2.92	0	1	12
Entirely DRY forest							
Afram Headwaters	DSFZ	35	42	3.00	0	0	49
Afrensu Brohuma	DSFZ	33	42	3.00	0	0	8
Amama Shelterbelt	MSNW	34	44	3.00	0	0	12
Anhwiaso North	MSSE	36	42	3.00	0	0	1
Anum Su South	MSSE	38	41	3.00	0	0	2
Aparapi Shelterbelt	MSNW	35	44	3.00	0	0	6
Asubima	DSFZ	37	41	3.00	0	0	15
Awura	DSFZ	47	31	3.00	0	0	23
Bandai Hills	DSFZ	46	39	3.00	0	0	35
Bia Shelterbelt	MSNW	35	46	3.00	0	0	5
Bia Tano	MSNW	34	44	3.00	0	0	50
Bosumkese	MSNW	37	43	3.00	0	0	33
Chirimfa	DSFZ	43	38	3.00	0	0	20
Dome River	MSSE	36	43	3.00	0	0	15
Goa Shelterbelt	MSNW	34	43	3.00	0	0	6
Kwamisa	MSNW	37	43	3.00	0	0	22
Mankrang	DSFZ	36	44	3.00	0	0	20
Opro River	DS	37	42	3.00	0	0	25
Pamu Berekum	DS	39	45	3.00	0	0	42
Prakaw	MSSE	32	42	3.00	0	0	3
Tain Tributaries II	DSFZ	41	41	3.00	0	0	126

Plots with an ordination value divergent from the norm for a particular forest are classed with the plots in the same reserve where there are indications that the divergence is due to disturbance, or where there are only one or two, slightly divergent plots. Nevertheless, as outlined above, patches of a given forest type do occur as (fuzzily-defined) enclaves in different forest types, and these samples have been classified with other forests of the same type in so far as the data allow. Hall and Swaine's UE forest, an enclave of evergreen forest on hills (500-750 m elevation) surrounded by drier forest, is an extreme example. Other patches of Moist forest surround islands of dry forest on rocky hilltops. The patchwork effect is for obvious reasons the rule within transition zones between any forest types one might care to define, so for forest reserves in transitional zones, sample plots have been classified entirely on the basis of ordination score. In most cases, ordination value alone has determined the designated forest zone, and there is a good match between these forest types and zones as depicted on a map.

The reason for the complications outlined above is that forests vary along local gradients as well as national gradients, and these two effects are not entirely separable (Lawson *et al.*, 1970; Van Rompaey, 1993; Hawthorne, in press). Disturbed moist forest often has more species in common with (or at least a more similar ordination score to) undisturbed dry forest than with undisturbed moist forest, for instance, and an appreciation of the inseparability of effects on local, national (and global) scales is crucial to an understanding of how the forests work, and should be managed. In spite of this, local variation with landscape and disturbance can, for initial analysis at least, be treated as if it were independent of forest type. The TSP samples are thereby classified also on the basis of local landscape and disturbance features, independently of their (wet to dry) forest zone. Diagonal-trending peaks in the species profile charts below indicate species which markedly shift preferred landscape position with forest zone (e.g. to lower-lying areas in drier zones); some of the more subtle of such trends may, however, be lost to the analysis if the effect applies mainly within a transition between zones, and if many other species show the same shift: in such cases, the lower-lying samples in the drier area, for example, will be classified as belonging to the wetter forest zone.

Forest zone is defined for a plot, so all subplots in a plot belong to the same forest zone. Landscape type is defined independently for each subplot, on the rather subjective basis of observations made for that subplot by the technical officers enumerating it. Although field observations were marked independently for each component, the classification here assigns each subplot to one, and only one landscape unit.

No. samples		Landscape							
Forest type	Subplots	Swamp, river	Flat, disturbed	Flat, undisturbed	Flat, up	Rocky	Slope 5-<15	Slope >=15	Grand Total
Wet	A	36	8	268	29	7	66	58	472
	B	50	10	235	58	11	64	44	472
	1-5	296	46	1158	179	73	352	256	2360
Wet Total		382	64	1661	266	91	482	358	3304
Moist	A	93	100	907	56	43	172	143	1514
	B	124	113	829	134	58	142	114	1514
	1-5	811	591	3892	355	358	925	638	7570
Moist Total		1028	804	5628	545	459	1239	895	10598
Dry	A	39	393	494	15	34	77	30	1082
	B	50	433	436	36	37	68	22	1082
	1-5	334	2205	2053	97	207	381	133	5410
Dry Total		423	3031	2983	148	278	526	185	7574
Excluded	A	3	41	84	0	4	1	17	150
	B	3	41	84	0	4	1	17	150
	1-5	17	205	411	6	24	2	85	750
Excluded Total		23	287	579	6	32	4	119	1050
Grand Total		1856	4186	10851	965	860	2251	1557	22526

	Ratio of observed / expected no. subplots							
Forest type	**Swamp, river**	**Flat, disturbed**	**Flat, undisturbed**	**Flat, up**	**Rocky**	**Slope 5-<15**	**Slope >=15**	**Grand Total**
Wet forest	**1.40**	**0.10**	**1.04**	**1.88**	**0.72**	**1.46**	**1.57**	**1.00**
Moist forest	**1.18**	**0.41**	**1.10**	**1.20**	**1.13**	**1.17**	**1.22**	**1.00**
Dry forest	**0.68**	**2.15**	**0.82**	**0.46**	**0.96**	**0.69**	**0.35**	**1.00**

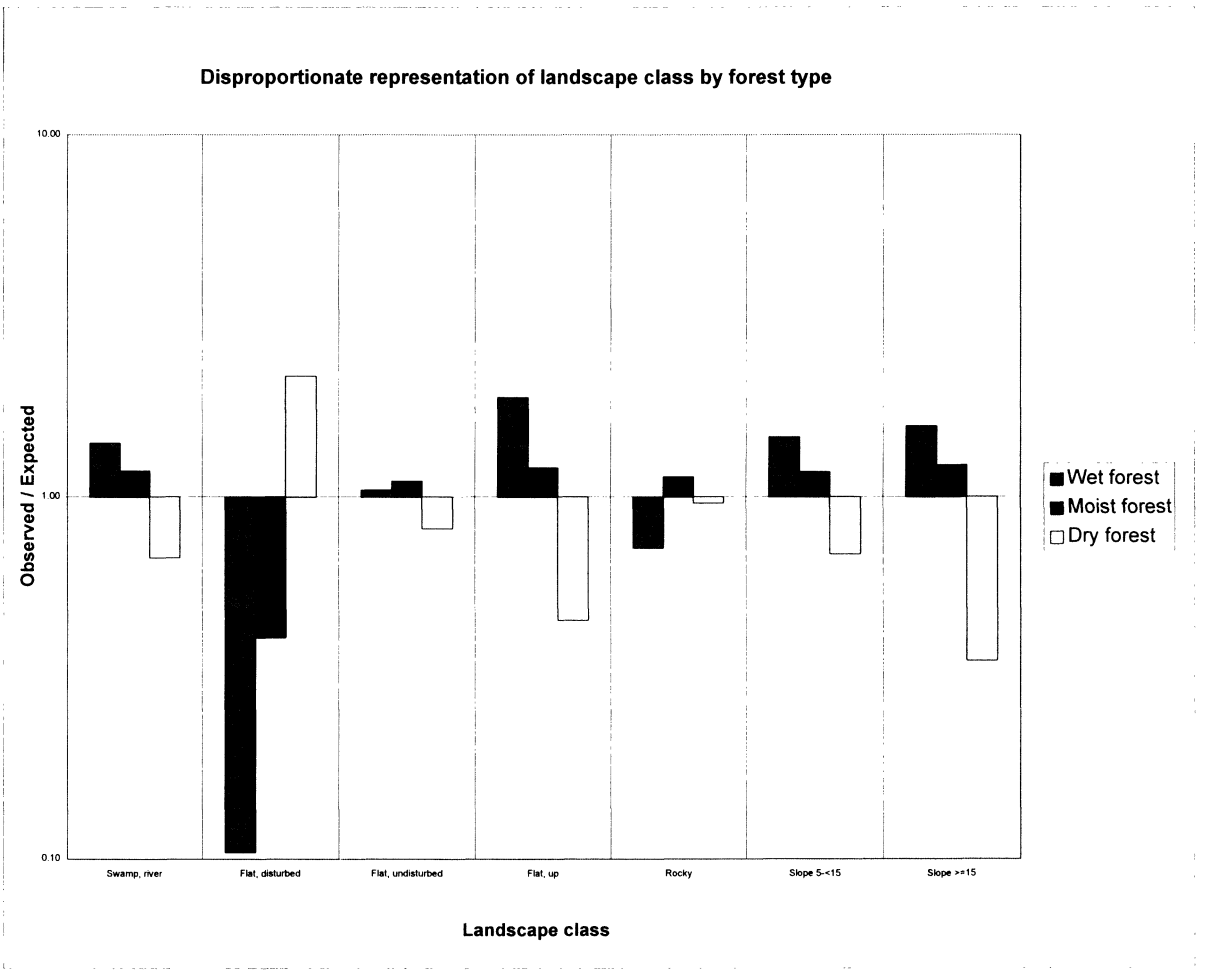


FIGURE 3. Numbers of sample units (TSP subplots) by forest zone and landscape classes

The order of priority in assignment of landscape / disturbance class for each subplot is important to the results, and can be summarised as follows.

Key to landscape categories used on contour charts, based on the subplot characteristics recorded on field sheets,

Subplot characteristic	Landscape category
Rocky	**Rocky**
Not rocky	
Swamp or watercourse	**Swamps, rivers**
No swamp or watercourse	
Slope ≥ 5°	
Slope ≥ 15°	**Slope ≥ 15°**
Not so	**Slope 5-15°**
Slope < 5°	
Position in Landscape above valley (mid slope, upper slope, ridge)	**Flat, Up**
Position in valley, lower slope, or no record	
Disturbed (logging damage, burnt, track, or 'heavily disturbed')	**Flat, disturbed**
No record of disturbance on plot sheet	**Flat, undisturbed**

So, for instance, it can be seen that the steep slope category may include both disturbed and undisturbed subplots; that rocky riverbeds are included with rocks rather than rivers; that ridge-top swamps are recorded as swamps, and so on. Rocks are given the highest priority because there are so few rocky sites, and rocky areas are in any case generally very heterogeneous. Only a minority of rocky sites are in fact riverine as well, and the rocky sample can be best visualised as an area of variable slope with many exposed rocks and boulders in the soil, and the occasional gully.

Landscape and disturbance characteristics, such as 'swamp' or 'burnt', in the A and B subplots are also applied to the larger subplot which includes them.

Figure 3, shows the extent to which various landscape features vary with forest zone, e.g. wet forest is relatively swampy and the flat land in dry forest is relatively disturbed.

Forest regeneration and crown exposure

The crown position for each tree was scored during TSP enumeration in a way similar to that advocated by Dawkins (1958) and widely followed since (see Wyatt-Smith & Vincent, 1962; Alder & Synnott, 1992). Crowns were assessed as emergent; fully exposed from above; partly exposed; fully overshadowed; or strangled (by climbers).

Not surprisingly, the proportion of trees of a given size class recorded as shaded or partially so is greater for small trees than large ones (see Figure 4a). Large trees **tend** to be more exposed than small trees, regardless of species or overall light requirements ('Cryptic pioneers' (see below) provide some interesting exceptions). The linkage between exposure and size is bound to be inexact. In a limited area, many small trees could change from shaded to exposed as a consequence of a single storm. However, if many observations are made over a large area of forest, some interesting trends emerge. With 330,000 tree records linking crown position to tree size for many species over a wide range of forest types, the TSP dataset provides meaningful trends in this respect.

In the original draft of this publication, crown exposure and derived scores were expressed as sub-bars and symbols superimposed on bar charts of size classes. This information was useful but had some problems, mostly because the stratification into forest zone, landscape type, size class and crown class was stretching the data beyond statistical usefulness for many species. Hence, a single graph for each species now shows for Ghana's forests as a whole how crown exposure varies with diameter class, and the patterns of emergence in regenerating trees are therefore generally clearer and more robust.

The varying proportion of crowns of different exposure class can be simplified as a weighted average. For the crown exposure indices presented below, emergent trees were weighted by 3; trees exposed from above by 2; trees partially exposed by 1. Other classes score 0. The weighted average is then rescaled to fit on a 0 to 100 scale (i.e. multiplied by 100/3). An exposure index of 100 for a size class of tree shows that trees of that size are all emergent. A zero value applies where all trees are completely shaded. The unscored and strangled crown scores do not influence the exposure index because their relationship with size class is vague, and they are nearly always a minority of records for a given species and size. The exposure index shows an almost linear relationship with diameter for trees 5 - 90 cm dbh. For trees above 90 cm dbh the exposure index for all species combined starts to level off.

The all-species relation between crown exposure index and size class is different in disturbed and undisturbed forest (Hawthorne, 1994). It is no surprise that, in disturbed forest, small trees are more often exposed than the same size class in less disturbed forest. More usefully, a species whose small trees are restricted to disturbed forest will have a relatively high exposure index for the small size classes compared to, for example, another species in the same samples which is not restricted to disturbed parts of the plots. Swamps, steep slopes and rocky areas have interesting exposure 'signatures', but there is no space here to explore these trends more fully.

An exposure index of this type links crown exposure and size class, forest maturity and species regeneration patterns. Similar exposure indices have been calculated for seedlings and saplings (below 5 cm dbh), in logged and unlogged forest patches in Bia South GPR (Hawthorne, 1993). These facts, and many more, informal observations have lead to the subdivision of species into guilds on the basis of apparent light requirements at different sizes.

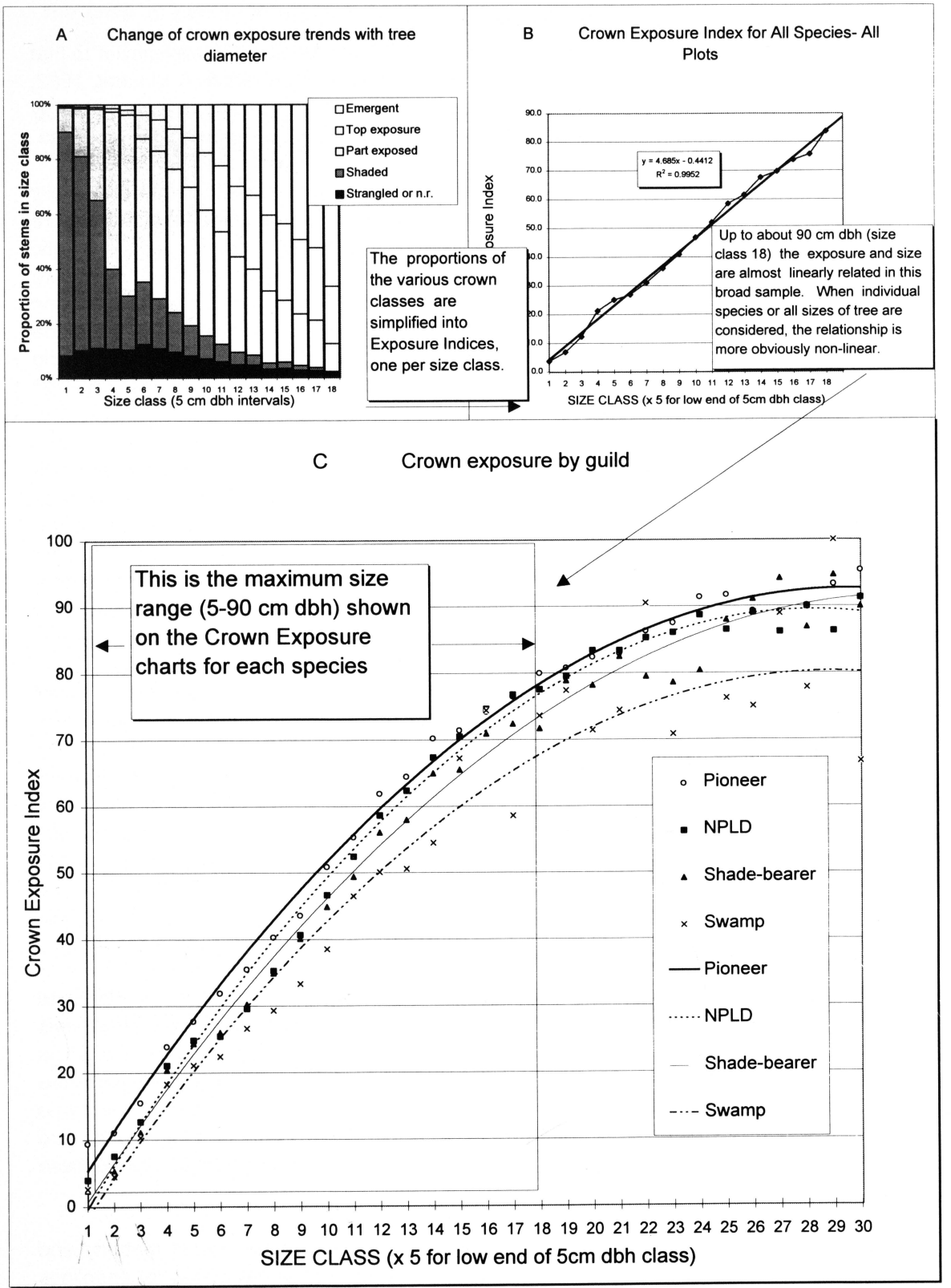


FIGURE 4. Crown exposure trends

Guilds

The Guilds defined in this paper are summarised in detail elsewhere (Hawthorne, 1993; in press):

Pioneer
Non Pioneer Light Demander
Shade-bearer (probably including some undetected 'Cryptic pioneers')
Swamp
Strangler
Savanna / non-forest

Species restricted to swampy places, savanna[3] species, and strangling figs, have many characteristics which make it convenient to consider them separately from other, 'normal' forest trees. These form three of the six guilds listed below for each forest species. The other three guilds refer to the nature of each species with respect to canopy gaps, disturbance and light.

The concepts of 'light-demander' and 'shade-bearer' are part of the traditional forester's vocabulary, and relate to aspects of a tree's physiology of central importance to how it behaves, responds to shading, and potentially to how it should be managed. The concepts of varied light-requirements have arisen on the basis of the forester's long term experience of both seedlings/nurseries, and of mature trees in the field and, although the terminology is simple, even binary, there is clearly an appreciation in the literature that the patterns of light requirement are more complex and vary, for instance, with age. Various attempts have been made to quantify this useful concept, but the more sophisticated the attempt, the smaller the number of species that have been examined, and the greater the divorce from the day to day perceptions and needs of foresters in the field. Nevertheless, such studies do tend to reveal that the practical reality, or forester's intuition, does relate in significant degree to species physiology (e.g. Riddoch *et al.*, 1991; Kyereh, 1994). Detailed studies have a role in deciding the significance and implications of field observations as well as, ultimately, a more direct role in defining species groups.

Pending the opportunity to evaluate all important tree species with a standard and useful, experimental method, direct field observation can be useful (Hawthorne, 1993). Formalised field observations can be given the rigour necessary to make the concepts scientifically acceptable. A species whose individuals are found in nature with their leaves generally exposed - i.e. with a high exposure index, as defined above - can be called a light-demander; one which is characteristic of the understorey can be called a shade-bearer. The Exposure Index can therefore help define guilds.

Trees change their light-demanding nature with age, and many suggestions have been made as to how to accommodate such variation. Swaine and Whitmore (1988) recognised the anarchy of terminology related to these issues and advocated, in effect, that '**pioneers**' be defined as those species which are light-demanders (or at least exposure-demanders) just

[3] The Savanna guild includes some species which occur quite commonly in 'transition' forest, where forest colonises savanna. Plantation and other cultivated trees which occur occasionally in forest are also in the savanna guild. *Khaya grandifoliola* and similar species which actually specialise, on a global scale, in transition forest, are treated as 'normal' forest species.

before germination. Strict adherence to germination traits as the basis for defining guilds certainly has the appeal of providing a neat theoretical dichotomy between pioneers and non-pioneers, but strongly 'pioneering' species like *Ceiba pentandra* and *Terminalia ivorensis* have recently been observed under the conditions of Kyereh *et al.*'s (1994) germination experiments to be able to germinate in the shade, even if they promptly die afterwards. The distinction between pioneers and non-pioneers has started to look less than dichotomous, given that under certain circumstances *Terminalia ivorensis* germination has the signature of a pioneer, 'switched on' by gaps.

I have adopted in the past the spirit of the Swaine and Whitmore dichotomy, whilst leaning heavily on the results of field observations of (established) seedlings and hence the proviso that pioneer seedlings need sun to establish, rather than just germinate. The definition of 'establishment' has more ambiguous limits even than germination, and Swaine and Whitmore's grail of an objective, single-character definition of important guilds begins to seem unattainable or at least impracticable for forest management purposes (Hawthorne, in press). This is not a serious problem in the world of forestry, first approximation, and a working solution, although it is an area on which philosophers and physiologists might fruitfully concentrate. Meanwhile, the guilds as defined here do have practical potential for forest management.

More of a problem with the simple segregation of pioneers and non-pioneers is that many species which are strong light-demanders from an early age are in the same group as shade-bearers. It has proved necessary to define a **Non-pioneer light demander (N.P.L.D.) guild**, which require gaps to develop beyond saplings, as contrasted with the **Shade-bearer guild** (often seen as 'understorey trees', e.g. *Greenwayodendron oliveri*). The N.P.L.D. guild was devised for species like *Pycnanthus angolensis* and *Albizia adianthifolia*, which are obvious light-demanders, and typical trees of secondary forest and fallow, yet which exist as seedlings in the deepest shade of little-disturbed forest, referred to as the 'Twilight zone' and defined more precisely in Hawthorne, 1993 (and in press). Yet, it has proved difficult to decide upon the precise lines of demarcation between these N.P.L.D.s and the obvious shade-bearers.

The exposure charts shown for individual species below provide an objective basis for a finer grouping of species into guilds on the basis of light-requirements. The similarities between small to medium-sized pioneers like *Musanga*, *Trema* and *Harungana* are highlighted, along with their common differences from larger pioneers like *Ceiba* and *Terminalia* spp. Similarities between the latter and N.P.L.Ds are also apparent. The charts show some unexpected trends. Many small pioneers like *Musanga cecropioides* have an exposure index for their larger sizes lower than expected for light demanders, yet these larger individuals are obviously not typical, shade-tolerant, understorey trees. The figures reflect the fact that trees of these species are overtopped before they die, yet persist for some time as non-emergents, exposed from above or the side, in small gaps. This effect reaches an extreme, and is possibly even genetically programmed, in '**Cryptic pioneer**' species, which are not immediately obvious as pioneers because they can persist as healthy, even fertile trees in deep shade, yet they require gaps to regenerate. Many typical 'understorey trees' may well prove to be cryptic pioneers when their germination and establishment requirements are examined experimentally.

Summary of regeneration guilds. Older plants are defined as 1-5 cm dbh. 'Twilight' zone refers to gap-free forest, as discussed by Hawthorne (1993; and in press)

	Older plants Absent or rare in Twilight zone	Older plants Frequent in Twilight zone
Youngest seedlings not found in Twilight zone, or at least very occasional there	(Manifest) PIONEERS	Cryptic pioneers
Youngest seedlings occur commonly in Twilight zone	Non Pioneer Light demanders (NPLDs)	Shade-bearers

Cryptic pioneers have been mentioned in the species summary notes only. If the pioneer status is known, they are classed as pioneers; if this is merely suspected they are classed as shade-bearers.

Rather than expecting useful and all-engrossing differences between guilds based on single characteristics, it would be more useful to forest management to integrate other characters in a more holistic appraisal of a tree's guild, directly tailored to the tasks in hand. In particular, dispersal syndromes, growth rates and mortality patterns could be included in a multivariate analysis, probably when PSP data become available. Such empirical guilds could include the crown exposure trends as one parameter, but results of direct observations on other attributes such as efficiency of recolonisation of skid trails, or 95% maximum radius of seed shadow, could also be included. The aim would be to highlight species which thrive in disturbed forest and require no special management or protection, and others which require protection (e.g. of seed trees in logged forest) in various contexts. A decline in the latter group in logged compartments would signal bad management. The advantage of the formal, holistic approach would be that little-known species could be allocated objectively to a guild on the basis of the little that is known.

The regeneration guilds as defined here do provide some 'handle' on the regeneration niche of a species, and should be useful when considered in conjunction with the exposure graphs and the levels of the trees in 'disturbed forest' shown in the charts.

Pioneer Index

The regeneration guild of species weighted (2 for pioneers, 1 for N.P.L.D., 0 for shade-bearers and swamp species), can be averaged for all species in a sample of forest then rescaled to produce a value between 0 and 200 called a Pioneer Index for that forest patch (Hawthorne, in press). The Pioneer Index (PI), for a given size class of tree or for the total species content, shows the extent to which a patch of forest is 'secondary forest', a concept which is of limited merit when defined qualitatively. The PI has potential for determining the condition of forest, as a prelude to deciding how to manage it.

Disturbance increases the PI of forest locally, but this elevated PI has the potential to become systemic in a given, broader area of forest (Hawthorne, in press). The Dry Semideciduous forests, for instance, tend to have a high PI even in areas which have not been recently disturbed, and stand to benefit more than moister forests from careful protection of individual trees of selected species, and from highly targeted enrichment planting. Patches of forest with

a very high PI tend to have a low biodiversity value, but low biodiversity values can also be found in low PI forests.

Summary: regeneration of trees in Ghana's forests

Logging is the most significant, controllable activity disturbing Ghana's forests. The greatest concerns about the effect of logging are the encouragement of fire due to breaking of the canopy, and the increased access to the heart of forests by hunters. Most timber trees are not 'shrinking violets', but regenerate reasonably well in disturbed forest, and thrive in a mosaic of small gaps. The main challenge for maintenance of Ghana's forest diversity is to keep the natural forest, rather than farms, gold mines or plantations, in forest reserves, and to do this partly requires that each species' value, whether commercial, genetic, ecological or indicator value, be fully understood.

For areas where past mismanagement has lead to an irreversible decline in forest quality, enrichment planting and similar schemes should be considered, using indigenous species. The species ecological profiles below should help with choice of species for given areas. Most successful plantation species in the tropics are strong light demanders, but interplanting of shade-bearing species is of course a familiar pursuit of agroforesters, including cocoa farmers. This paper will hopefully provide some inspiration when choosing appropriate mixtures of shade-bearers and light-demanders. One might have anticipated that *Terminalia ivorensis* monocultures would develop poorly; perhaps a sparser spacing with more shade-tolerant species like *Mammea africana* or *Chrysophyllum* spp would give a greater return from the *Terminalia*, or at least a greater return from an area of land.

Explanation of the species profiles

Some notes will now be given about the contents of the species profile pages that follow. The information is in the form of textual summaries for all species, and graphs for 210 of the most important.

Species textual summaries

Some subheadings are dropped or merged for species with minimal data.

Name This is the latin name used by Hawthorne, 1990, with recent changes noted in subsequent text.

Common Name In capitals, except for Twi syllables in lower case, as discussed and listed in Hawthorne, 1990. Timber and other trade names, if any, are included after the common name, in lower case, except the first letter.

Guild The guilds have been summarised above.

Conservation Conservation priority / action category, expressed as a **Star rating**. These have been described at length elsewhere (Hawthorne & Abu Juam, 1995; Hawthorne, in press). They are based on local and global distribution, ecological, commercial, social and taxonomic details. Table 3 provides an overview of their meaning. They have been included in the species summaries below for ready cross-reference.

Table 3: Summary of the star categories of conservation priority for species

STAR	No. Degree squares in Africa	COMMENT
BLACK	1.6 ± 0.5	Urgent attention to conservation of populations needed. Rare internationally, and at least uncommon in Ghana. Ghana must take particular care of these species.
GOLD	7.8 ± 3.8	Fairly rare internationally and/or locally. Ghana has some inescapable responsibility for maintaining these species.
BLUE	24.5 ± 12.6	Widespread internationally but rare in Ghana, or vice-versa. It may be in Ghana's interests to pay attention to protecting some of these species.
SCARLET	(inc. in Red)	Common, but under serious pressure from heavy exploitation. Exploitation needs to be curtailed if usage is to be sustainable. Protection on all scales vital.
RED	39.6 ± 16	Common, but under pressure from exploitation. Need careful control and some tree by tree and area protection.
PINK	(inc. in Red)	Common and moderately exploited. Also non-abundant species of high potential value.
GREEN	69.2 ± 49.8	No particular conservation concern
OTHERS	>100	Non forest species, or excluded from analysis for other reasons.

No. degree squares derived from subset of all species, including non-trees

Mature Tree A context-setting summary of tree form, including a page, illustration code and group reference to Hawthorne (1990) for more details.

Distribution Overview of occurrence in Ghana and in the world. Also, notes if the species is useful, and may have been planted, but these notes are highly incomplete: see Abbiw (1990) for a thorough survey of uses.

For summaries of African phytochoria and distribution categories (e.g. 'Guineo-Congolian'; 'Guinea-wide'; 'Upper Guinea') see White (1978, 1979, 1983; Hall and Swaine, 1981). **Upper Guinea endemics** occur from Ghana westwards. **Guinea-wide** species occur from west of Togo and the Dahomey gap, around the Gulf of Guinea e.g. to Nigeria or Gabon; **Guineo-Congolian** species spread across to Zaire, often from Sierra Leone to Uganda etc. **Widespread African** species extend beyond the Guineo-Congolian region and are well established e.g. in coastal East Africa, Afromontane forests and the Zambezian region.

Phenology/dispersal

Flowering and fruiting seasons are notoriously fickle, and liable to fail in some years. However, it is possible to discern general trends for most species. The 'dry season' in this context is the main dry season from November to March. The small dry season is in July and August. Comments on likely or known dispersal agent may be included.

Regeneration

Notes on germination and general picture of seedling distribution and light requirements. Germination is referred to as normal if there is no recorded dormancy or special requirements and it is epigeal, mostly as recorded by Taylor (1961). Note that results of specific regeneration surveys may be referred to under the Inventory subheading as well.

Field identity

Species with which the current species can be confused, and similar notes.

Inventory Discussion of summary chart and other FIMP data, i.e. regeneration surveys and national botanic surveys.

Tree count This refers to the number of trees recorded in the TSP dataset. Smaller trees (< 30 cm dbh) were recorded on a smaller sample area (see above), so the number of records of these small trees is recorded separately.

No. of botanical survey records

Number of samples from which the species has been recorded (by an arbitrary date in 1994) during botanical surveys (see Hawthorne & Abu Juam, 1995) for summary.

Growth A few records selected to give some indication of growth rates.

The charts

Six charts are presented for each of 210 important species of forest tree. These charts highlight ecological trends using data drawn entirely from the TSP inventory. Charts are drawn for most of those tree species for which more than thirty observation were made. The average number of observations (trees measured) per species is about 1,700, but counts for most species are well below this average.

What the charts show: Chart A is the top left chart of each page, chart F is the lower right

Chart A **Basal area per km^2** The average basal area of the current species, in various parts of the landscape. The area is for all trees recorded (i.e. trees ≥ 5 cm dbh), but smaller trees contribute relatively little to total basal area. Conditions associated with **many, large trees** of the current species are highlighted by this chart.	Chart B **Stems per km^2** The average number of stems per 100 ha, in various parts of the landscape. The figure is an estimate for all stems ≥ 5 cm dbh, and so excludes seedlings and saplings which are usually numerically the most significant component for a stem density figure. Nevertheless, conditions under which **the current species is at its most common** are highlighted.
Chart C **Relative stem density** As for Chart A, but the values for each part of the landscape have been divided by the average basal area of all trees combined, for each part of the landscape. This highlights those types of forest in which large trees are abundant, compared to other trees in those types of forest; **conditions in which the species thrives should be highlighted even if much of the sampled forest under those conditions is damaged.**	Chart D **Relative stem density** As for Chart B, but made relative to the stem density for all species in the landscape unit in question, as explained for Chart C. This graph has been made as a perspective image to allow **rapid appreciation of conditions under which a species** is important, at the cost of some clarity of detail.
Chart E **Exposure Graph** The exposure index (see above) for sizes up to 90 cm dbh are drawn alongside the all-species, all-plot exposure index. Species whose trend lines are above the all-species trend are apparently more **light-demanding** than average. Those below it are less so.	Chart F **Size class distribution** for all samples from Wet, Moist and Dry forests (all plots with no record of disturbance), and 'disturbed' plots, including burnt and recently logged plots, roads and tracks.

Charts A-D. Contour charts

Charts A-D are contour, or surface charts, and highlight the broad conditions within the Ghanaian forest landscape in which the species is most successful. For this analysis the samples have been post-stratified into 21 informal 'types' of forest, or strata as described above. Each contour chart is therefore derived from 21 data points for each species. These data points are represented as the intersections of 3 x 7 grid lines: three forest zones times seven landscape conditions. Charts A to D summarise the performance of a species in each of these forest sample strata, each in a different way. In each case, the measure of performance is derived from all trees in the samples (i.e. all stems ≥ 5 cm dbh).

In other words, the contour charts present a measure of the species performance across an idealised, abstract landscape for each of the forest zones. The values between the discrete sample strata have been interpolated from the 21 supplied data points. The position of the

landscape units along their axis was chosen initially as a range from swampy, to flat, then increasing slope. The positions of 'flat, disturbed' and 'rocky' strata were chosen by trial and error, attempting to minimise rapid changes of the species score across the graph. Unfortunately, the rocky and flat, disturbed landscape units do not fit comfortably anywhere on the chart, but their current position is probably the optimum.

Charts A and C show variation in basal area, whereas charts B and D show stem density. In charts A and B the scores are on a per area basis - for instance, how many trees were recorded per square kilometre of sampled forest. These are absolute scales. Dry forest samples, however, include more patches of forest with no trees in than Moist forest; for many purposes, a fairer picture of the compatibility between a species and landscape is obtained by expressing stem density or basal areas for the species as a proportion of the total value (e.g. total basal area) for all species of tree for the landscape in question. This proportion is expressed on a per thousand scale - i.e. percentage times ten. These relative scales are used in charts C and D.

Species with a large number of small trees feature most strongly on the stem density charts. Species with fewer, large trees have more contours on the basal area charts. Large, light-demanding species (pioneers or N.P.L.D.s) tend to have relatively low numbers of small trees, and so tend to be emphasised on the left (charts A & C). Shade-bearers and smaller trees of any guild tend to be most conspicuous on the right-hand side.

The high-scoring parts of the charts are drawn (in the manuscript, at least) in red, designating the 'hotspots' in the landscape for the current species. Some of the graphs with many contours may be hard to read, but the main trends should be clearly visible. It may be worth repeating, the aim of these graphs is not to allow the stem density and other values to be pinpointed (if you need this detail, apply directly to Ghana F.D.): the aim is to show an overview.

Chart E. Crown exposure

The derivation of these graphs has been discussed above. Each one shows the all-species, all plot trend line (in black), plus the same indices for the current species (in red). Places where the species graph is above the all-species line indicate a size where the species was more exposed than normal for trees of that size. For most species, the position of the (straight, red) trend line relative to the all-species trend line defines the species as a light-demander (red line above) or shade-bearer (red line below) in a way which accords with more subjective summaries of light requirements. The smoother the species' trend line, the more likely it is to be statistically meaningful.

Chart F. Bar charts, with error bars

Bar charts are drawn for all landscape units combined in each forest type, excluding disturbed ('burnt', 'tracks' etc.) forest plots, which are pooled into a separate bar. Note that this 'all disturbed' stratum is broader than the 'flat, disturbed' of the contour graphs, and includes disturbed, sloping land.

Dry forests are more disturbed than others, so disturbed forest figures will tend to be greater for species which are widespread throughout and restricted to the dry forests, even if they are not strongly favoured by disturbance. The opposite case (species thriving after disturbance appearing commoner in dry forests, even if they are not favoured by the soils and climate there) also applies, but it may futile to try and distinguish the prime influence for any one species (Hawthorne, in press).

For many species, the distribution of stem numbers per sample across samples is certainly not normal, and too clumped to use the statistics of the Poisson distribution. Assumption of a normal distribution often gives confidence limits which stretch below zero for a particular species and sample stratum. As some indication of variation in the data, thirteen, random 34% subsamples have been taken for each combination of species, stratum and size class (subsample fraction and sample number suggested by A. Dunsdon, pers. comm.). The standard deviation of these means is shown as the error bar on the bar charts for individual species. This is not a standard confidence interval, and should be treated as a rough indication of statistical error only. In most cases, it can be seen that this standard deviation of the mean for a forest 'zone' (e.g. Dry) is highest where the species varies most across the landscape; the zone mean should be considered along with the contour graphs.

Error bars on the exposure charts renders them porcupinesque and almost invisible. The reliability of the exposure charts can be assessed from their smoothness, or straightness; most start to oscillate and snake wildly in the higher size classes, where the observations are sparser and the statistical noise increases. This oscillation should itself be seen as a flag of no statistical confidence, even though some unusual patterns may well reflect a truth about changing crown exposure patterns. To reduce some of this statistical noise, the exposure line for many species has been terminated at the point where a single 5cm size class is empty of observations, even if trees of larger size have been recorded. Exposure graphs have in any case been drawn only for trees less than a metre in diameter (100 cm dbh). The graphs for bigger trees, even for the guilds as a whole, are increasingly erratic above this point.

Acioa barteri see *Dactyladenia barteri*
Acioa dinklagei see *Dactyladenia dinklagei*

Aeglopsis chevalieri Swingle **RUTACEAE**
Common name: KWAE-AKENKA
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 165 Group: 31A No. 59
Small, understorey spiny tree or shrub.
DISTRIBUTION
Common in Ghana, mostly in semideciduous forests (Hall and Swaine sp. 7). Upper Guinea endemic. Often near streams. Planted for shade and medicine in Ghana [Adjangba *et al.*, 1968], and for edible oil [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 107 >=30 cm: 2
No. of botanical survey records: 24

Afraegle paniculata (Schum. and Thonn.) Engl.
Common name: OBUOBI **RUTACEAE**
Guild: Savanna **Conservation:** Blue star
MATURE TREE
Field guide pp. 165 Group: 31A No. 60
Small tree, probably not a true forest species, but in thickets near the coast and planted in villages.
DISTRIBUTION
Fruits produce an edible oil [Abbiw, 1990].
PHENOLOGY/DISPERSAL
Fruits like hard-shelled orange are presumably dispersed by larger mammals.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 2
TAXONOMIC NOTE
Related to citrus fruits.

Afrolicania elaeosperma see *Licania elaeosperma*
Afrormosia elata see *Pericopsis elata*

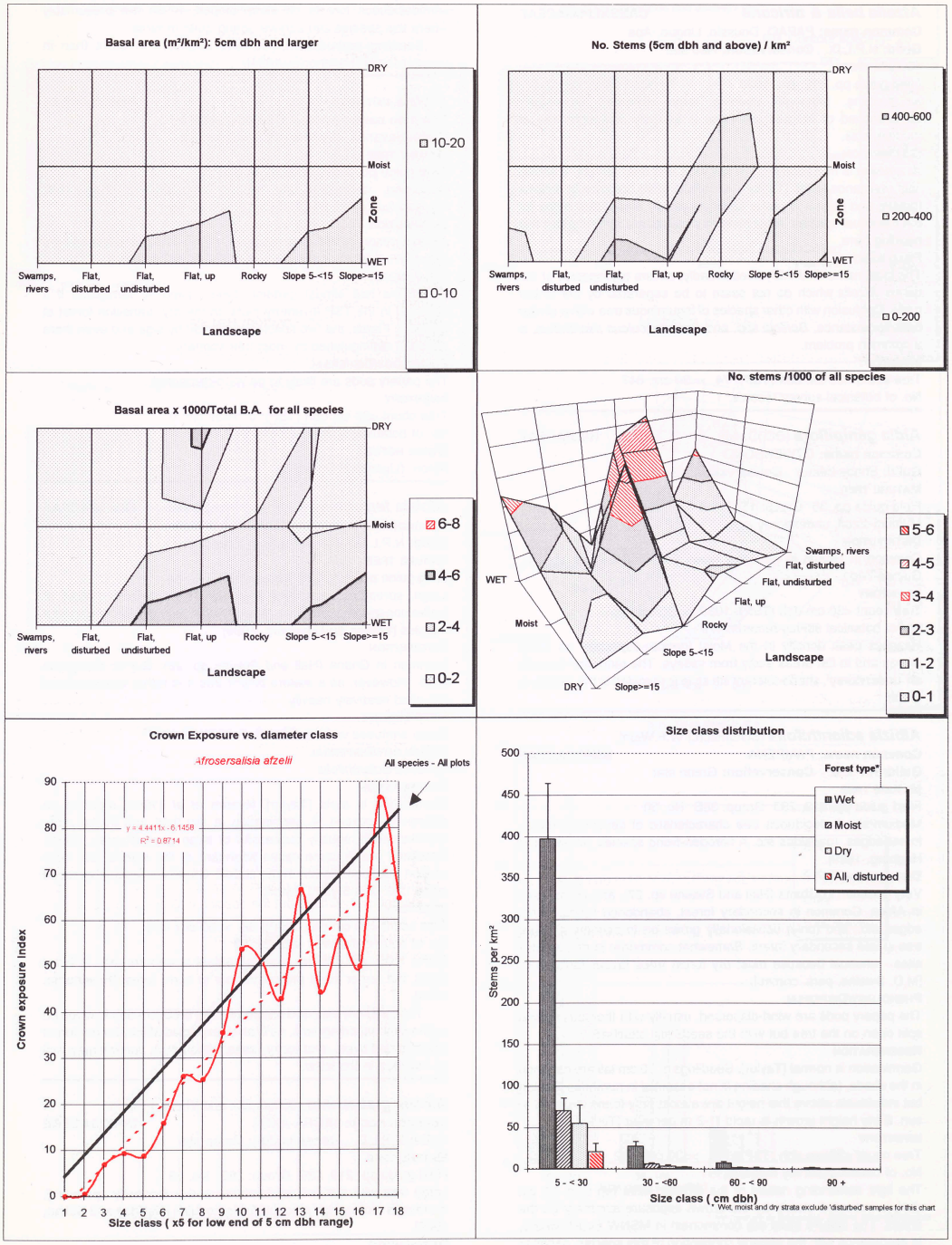
Afrosersalisia afzelii (Engl.) A.Chev. **SAPOTACEAE**
Common name: BAKUNINI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 58, 236 Group: 10A No. 61
Slightly fluted medium-sized, evergreen tree.
DISTRIBUTION
Fairly common in Ghana in evergreen forest (Hall and Swaine sp. 12). Guinea-wide.
PHENOLOGY/DISPERSAL
The red fruits are edible, with an acidic flesh, and are probably animal-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 237 >=30 cm: 328
No. of botanical survey records: 37
Reaches its peak in wet, evergreen forest away from rocks, swamps and disturbed areas. Its shade-tolerance, and lack of emergent tendencies are revealed on the crown exposure diagram.
TAXONOMIC NOTE
The genus *Afrosersalisia* has been sunk into *Synsepalum* by Pennington [1991], although the old name will be used in this report to maintain compatibility with Hawthorne [1990]. In future, the species should be referred to as *Synsepalum afzelii* (Engler) Pennington. The genus *Synsepalum* is still confined to Africa, and whilst Pennington notes great variation in the genus (Ghanaians need ponder only the great disparity between the current species and *S. aubrevillei*), he remarks that there is no reliable and stable basis for segregating the old genera.

Afrostyrax lepidophyllus Mildbr. **HUACEAE**
Common name: DUAGYENNE
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 127 Group: 21 No. 62
Medium-sized, understorey or sometimes canopy tree in Subri and Cape Three Points F.R.s (probably elsewhere) with a strong oniony smell. The slightly discolorous leaves give the drooping foliage a distinctive appearance. The position of this species and its family is discussed by Robyns [1958]. Guinea-wide, but rare.
INVENTORY
Tree count <30 cm dbh (TSP): 158 >=30 cm: 103
No. of botanical survey records: 5

Afzelia africana Sm. **CAESALPINIACEAE**
Common name: PAPAO
Guild: N.P.L.D. **Conservation:** Red star
MATURE TREE
Field guide pp. 202 Group: 37D No. 28
Spreading, heavy-boughed, deciduous tree; with ectotrophic mycorrhizae [Jenìk and Mensah, 1967].
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 13). A timber tree of dry forest, especially the savanna fringe [e.g. see Fatubarin, 1989] like *Khaya grandifoliola*, but found scattered, especially on rocky soils, in wetter forests. However, it is only slightly fire-tolerant, and is replaced where annual fires become severe [Stark, 1986].
FIELD IDENTITY
Confused with *A. bella* and other Caesalpiniaceae by tree spotters. See entry for *A. bella & africana*.
REGENERATION
Details of juvenile development are given by Francke, 1939.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 11
No. of botanical survey records: 36
OTHER NOTES
[Bentum, 1969; Cooper and Bramwell, 1953; Delwaulle, 1979; Marshall, 1945]

Afzelia bella Harms **CAESALPINIACEAE**
Common name: PAPAO-NUA
Guild: N.P.L.D. **Conservation:** Pink star
MATURE TREE
Field guide pp. 202 Group: 37D No. 29
Medium or large, deciduous tree with slightly irregular bole and small buttresses.
DISTRIBUTION
var. *gracilior*. Common in Ghana, in Moist Semideciduous and evergreen forest (Hall and Swaine sp. 14). This var. restricted to Ghana and Ivory Coast, but the species is Guineo-Congolian.
FIELD IDENTITY
Inventory data merged with *A. africana*.
PHENOLOGY/DISPERSAL
Flowers in the dry season, before losing its leaves, with pods produced towards the end of the dry season in Jan.-Mar. [Taylor].
REGENERATION
Regenerates in shade [Hall and Swaine].
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 60
The twin peaks for the combined species probably highlight the peak conditions for each: *A. africana* in flat, dry disturbed forest; and *A. bella* on slopes in wetter forest types. The crown exposure diagrams show species not markedly divergent from the average of all species.
OTHER NOTES
[Anon., 1980]

Afrosersalisia afzelii



Afzelia bella & africana CAESALPINIACEAE

Common name: PAPAO, Doussie, Lingue, Apa
Guild: N.P.L.D. **Conservation:** Red star

MATURE TREE

Field guide pp. 202 No. 1028

A. africana, although attaining large diameter, is usually low-branched or irregular. *A. bella* is typically a straight tree of medium size.

DISTRIBUTION

A. africana is most common in savanna and drier forests. It shows 'fair' resistance to fire [Taylor]. *A. bella* is more common in moister forests, and seems to prefer slightly swampy areas. See notes for the individual species. Most inventory results are stored under this heading here.

FIELD IDENTITY

The local name 'PAPAO', used broadly, covers two species of the genus *Afzelia* which do not seem to be separated by the timber trade. Confusion with other species of leguminous tree with a similar bark, for instance, *Berlinia* spp. and *Stemonocoleus micranthus*, is a common problem.

INVENTORY

Tree count <30 cm dbh (TSP): 74 >=30 cm: 647
No. of botanical survey records: 1

Aidia genipiflora (DC.)Dandy RUBIACEAE

Common name: OTWENSONO
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 35 Group: 1E No. 64

Medium-sized, understorey tree.

DISTRIBUTION

Common in Ghana in all forest types (Hall and Swaine sp. 21). Guinea-Wide.

INVENTORY

Tree count <30 cm dbh (TSP): 1039 >=30 cm: 83
No. of botanical survey records: 179

Reaches peak density in the Moist forests, especially on steep slopes and in flat areas away from valleys. The tendency towards an 'understorey', shade-tolerant life style is revealed in the exposure graph.

Albizia adianthifolia (Schumach.) W.F.Wight

Common name: PAMPENA MIMOSACEAE
Guild: N.P.L.D. **Conservation:** Green star

MATURE TREE

Field guide pp. 219, 239 Group: 38B No. 30

Medium-sized, deciduous tree characteristic of secondary forest, forest edges, roadsides etc. A nitrogen-fixing species [Wester and Hogberg, 1989].

DISTRIBUTION

Very common in Ghana (Hall and Swaine sp. 27), and widespread in Africa. Common in secondary forest, abandoned farms, forest edges etc., and (only) occasionally grows on to become a larger tree in late secondary forest. Somewhat commoner in dry, infertile sites - unusual because most dry forest trees favour fertile soils [M.D. Swaine, pers. comm.].

PHENOLOGY/DISPERSAL

The papery pods are wind-dispersed, usually with the pods having split open on the tree but with the seeds still attached.

REGENERATION

Germination is normal [Taylor]. Seedlings c. 10 cm tall are common in the shade, (although shading is not essential in nurseries [Taylor] but individuals above this height are almost only found exposed to sun. Early height growth is rapid (1-2 m per year [Taylor]).

INVENTORY

Tree count <30 cm dbh (TSP): 151 >=30 cm: 402
No. of botanical survey records: 161

The light demanding nature of the smaller sizes (up to c. 50 cm dbh) is indicated clearly by the crown exposure summary on the charts. The mature trees are commonest in MSNW forest, where, in accordance with the general conception of this species, seedling regeneration (and even trees 30-60 cm dbh) is most abundant in disturbed forest, particularly where the disturbance is logging. The summary chart reveals an unexpected degree of importance in semideciduous forests on steep slopes, which are presumably where this species can survive during quiet millenia.

Seedling regeneration was less abundant in burnt than in unburnt forest [Hawthorne, 1994].

Albizia coriaria Oliver MIMOSACEAE

Common name: AWIEMFOSAMINA-AKOA
Guild: Savanna **Conservation:** Green star

MATURE TREE

Field guide pp. 219 Group: 38B No. 65

Spreading, deciduous tree like *A. ferruginea*. Probably has nitrogen-fixing nodules [Faria *et al.*, 1989].

DISTRIBUTION

An uncommon transition forest species. In Guinea savanna and dry forest; West Africa, Cameroun, Angola [Geerling, 1982].

FIELD IDENTITY

A. coriaria has almost certainly been called *A. ferruginea* if it occurred in the TSP inventory plots. In the dry, transition forest at Boabeng Fiema, the two species grow side by side and even there were not distinguished by most tree spotters.

PHENOLOGY/DISPERSAL

The papery pods are likely to be wind-dispersed.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

OTHER NOTES

[Anon. (Uganda F.D.), 1972]

Albizia ferruginea (Guill. and Perr.) Benth. MIMOSACEAE

Common name: AWIEMFOSAMINA, Albizia
Guild: N.P.L.D. **Conservation:** Scarlet star

MATURE TREE

Field guide pp. 219, 236 Group: 38B No. 31

Large, spreading, deciduous tree, sometimes with two sizes of leaflet conspicuous in crown [Keay, 1989]. Has nitrogen-fixing root nodules [Wester and Hogberg, 1989].

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 28); Guineo-Congolian wide. However, as a mature timber tree it is rather scattered and exploited relatively heavily.

FIELD IDENTITY

Easily confused with *A. coriaria*.

PHENOLOGY/DISPERSAL

As for *A. adianthifolia*.

REGENERATION

Germination is rapid [Taylor]. Kyereh *et al.* [1993] reported no difference between % germination in the light and in the dark. Germination is equally successful in large gaps [Kyereh, 1994]. Seedlings are in some cases abundant at the start of the rainy season but soon die out in the shade. Growth is rapid in exposed areas (2-3 m in 5 yrs) [Taylor].

INVENTORY

Tree count <30 cm dbh (TSP): 68 >=30 cm: 475
No. of botanical survey records: 59

Stems 5-30 cm dbh are more abundant in unburnt than in burnt forest, but larger sizes are commoner in burnt forest [Hawthorne, 1994].

The relatively exposed nature of trees 5-60 cm dbh is revealed on the exposure diagrams, as is an unexpected affinity for dry forest swamps and rivers, and rocky areas, although *A. coriaria* may well be included in the latter.

Albizia glaberrima (Schumach. and Thonn.) Benth.

Common name: oKORA-AKOA MIMOSACEAE
Guild: N.P.L.D. **Conservation:** Green star

MATURE TREE

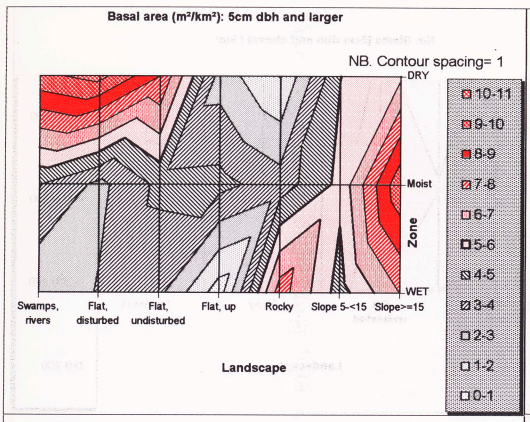
Field guide pp. 219, 239 Group: 38B No. 66

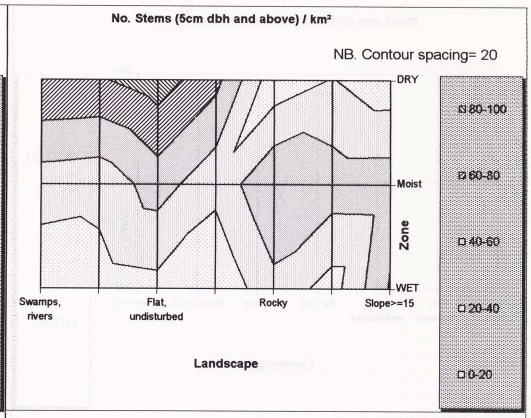
Large tree with rather irregular bole, and a modestly spreading, deciduous crown. Has nitrogen-fixing nodules [Halliday and Nakao, 1982].

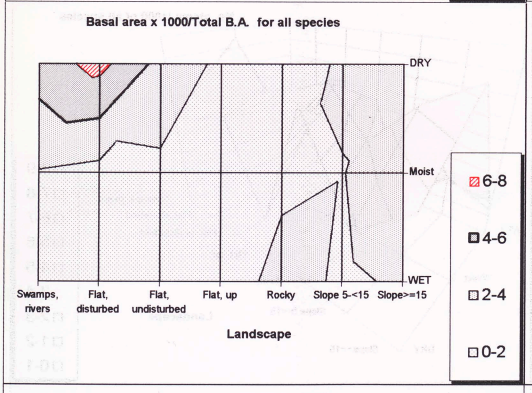
DISTRIBUTION

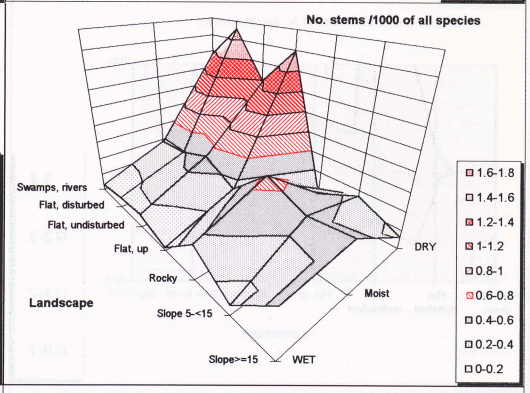
Common in Ghana, in Semideciduous forests (Hall and Swaine sp. 29). Widespread in Africa.

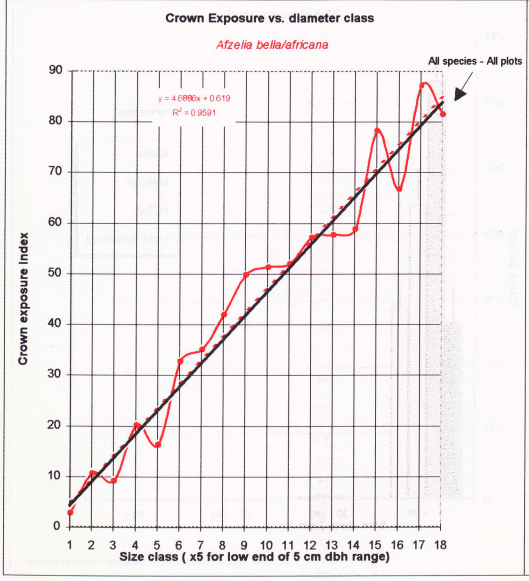
Afzelia bella & africana

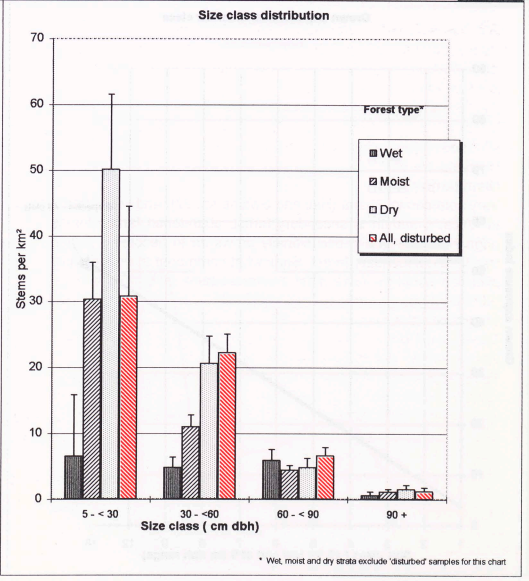




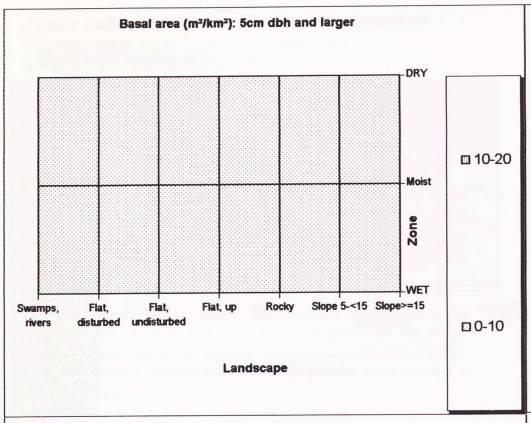


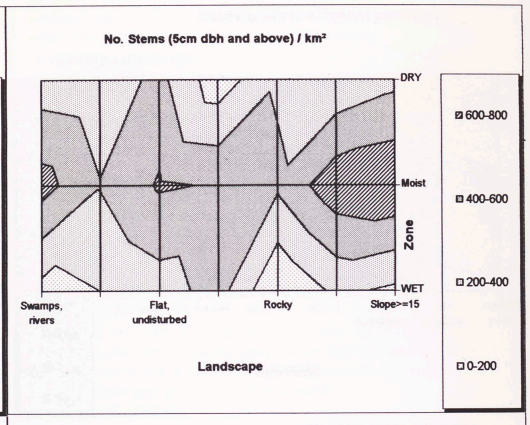


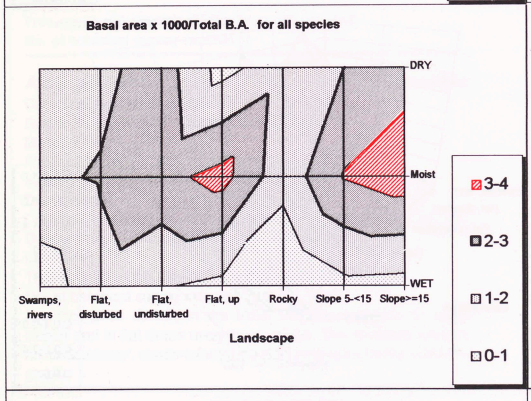


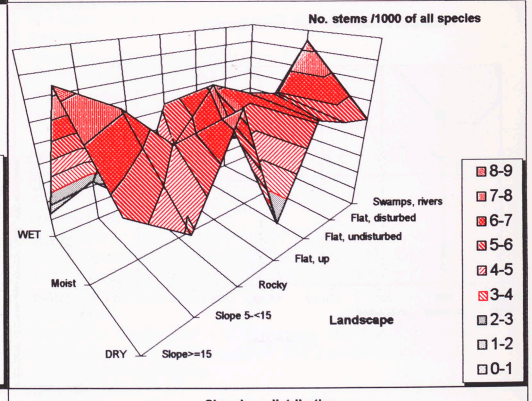


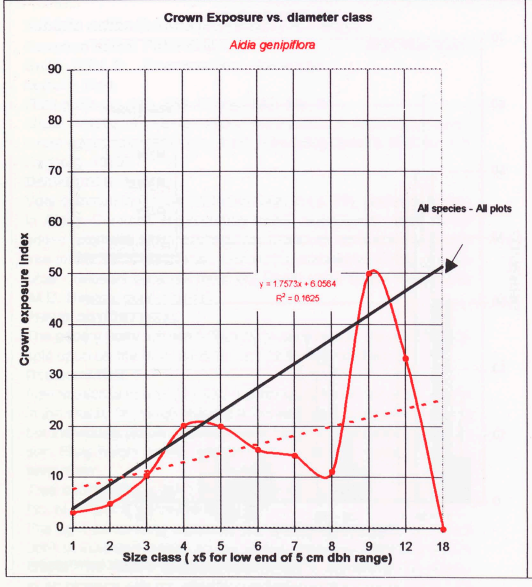
Aidia genipiflora

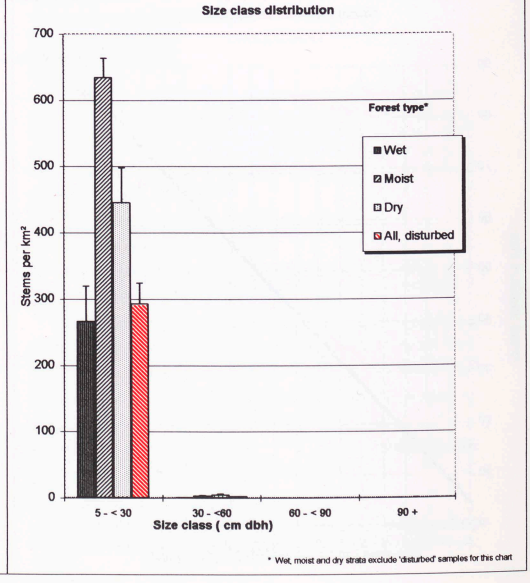




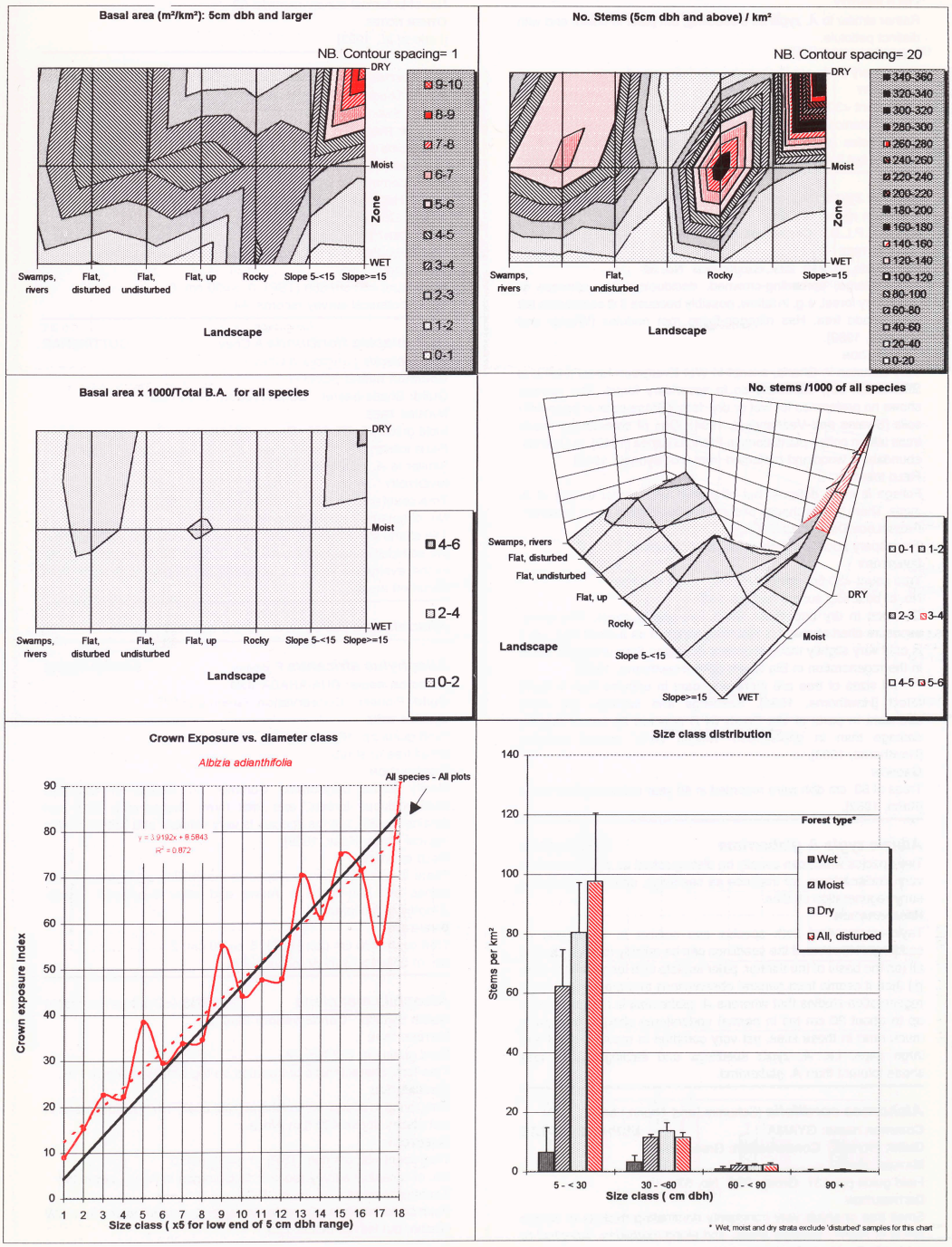








Albizia adianthifolia



FIELD IDENTITY
Rather similar to *A. zygia* as a seedling, but paler in colour and with distinct petiolule.
PHENOLOGY/DISPERSAL
The papery pods are likely to be wind-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 12 >=30 cm: 68
No. of botanical survey records: 88
The species is too rare to provide a definitive summary of its ecology, but it seems to prefer lower-lying plots in dry forest zones.

Albizia zygia (DC.) J.F.Macbr. **MIMOSACEAE**
Common name: oKORO
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 219, 239 Group: 38B No. 32
Medium-large, spreading-crowned, deciduous tree, common in secondary forest, e.g. in fallow, possibly because it is sometimes left as a shade tree. Has nitrogen-fixing root nodules [Wester and Hogberg, 1989].
DISTRIBUTION
Very common in Ghana, except in Wet Evergreen forest (Hall and Swaine sp. 30), especially so in secondary forest. The species shows no preference for wet or dry forest (base-poor or base-rich) soils [Swaine and Veenendaal, 1994]. One of commonest shade trees left on coffee plantations in French Guinea [1949]. In Uganda, abundant in woodland protected from fire [Synnott, 1985].
FIELD IDENTITY
Foliage is more delicate, but otherwise very similar to that of *A. zygia*. There is little chance of confusing the mature trees, however.
PHENOLOGY/DISPERSAL
The papery pods are likely to be wind-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 254 >=30 cm: 789
No. of botanical survey records: 210
Common in dry and moist forest swamps or rivers. The crown exposure chart shows it is relatively exposed as a small tree, yet it is only very slightly more abundant in logged than unlogged areas in the regeneration in Bia South GPR [Hawthorne, 1993].

All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].
GROWTH
Trees of 80 cm dbh were recorded in 40 year old secondary forest [Kahn, 1982].

Albizia zygia & glaberrima **MIMOSACEAE**
Two species which can usually be distinguished as adults, but their very similar foliage, for instance as seedlings, confused us during early regeneration studies.
REGENERATION
Taylor states that both species can survive in the shade as seedlings. However, if the seedlings can be reliably distinguished at all (on the basis of the thinner, paler leaflets with longer stalks in *A. g.*) then it seems from general observations and the results of the regeneration studies that whereas *A. glaberrima* is not uncommon up to about 30 cm tall in normal understorey shade, *A. zygia* is much rarer in these sites, yet very common in medium-sized and large gaps. i.e. *A. zygia* seedlings and saplings seem less shade-tolerant than *A. glaberrima*.

Alchornea cordifolia (Schumm. and Thonn.) Muell.Arg.
Common name: GYAMA **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 131 Group: 22A No. 67
DISTRIBUTION
Small tree or shrub very commonly dominating thickets in certain fallow or slightly swampy areas, and along roadsides. 'Adapted' to acid soils [Larki *et al.*, 1993].
INVENTORY
Tree count <30 cm dbh (TSP): 10 >=30 cm: 0
No. of botanical survey records: 69
OTHER NOTES
[Larki *et al.*, 1993]

Alchornea floribunda Muell. Arg. **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Green star
(nearly Swamp species)
MATURE TREE
Field guide pp. 102
DISTRIBUTION
Not uncommon in Ghana, but concentrated in Upland Evergreen forest (Hall and Swaine sp. 31), and elsewhere in swampy areas. Guineo-Congolian wide.
FIELD IDENTITY
Rarely reaches 5 cm, and unreliably named by tree spotters.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 44

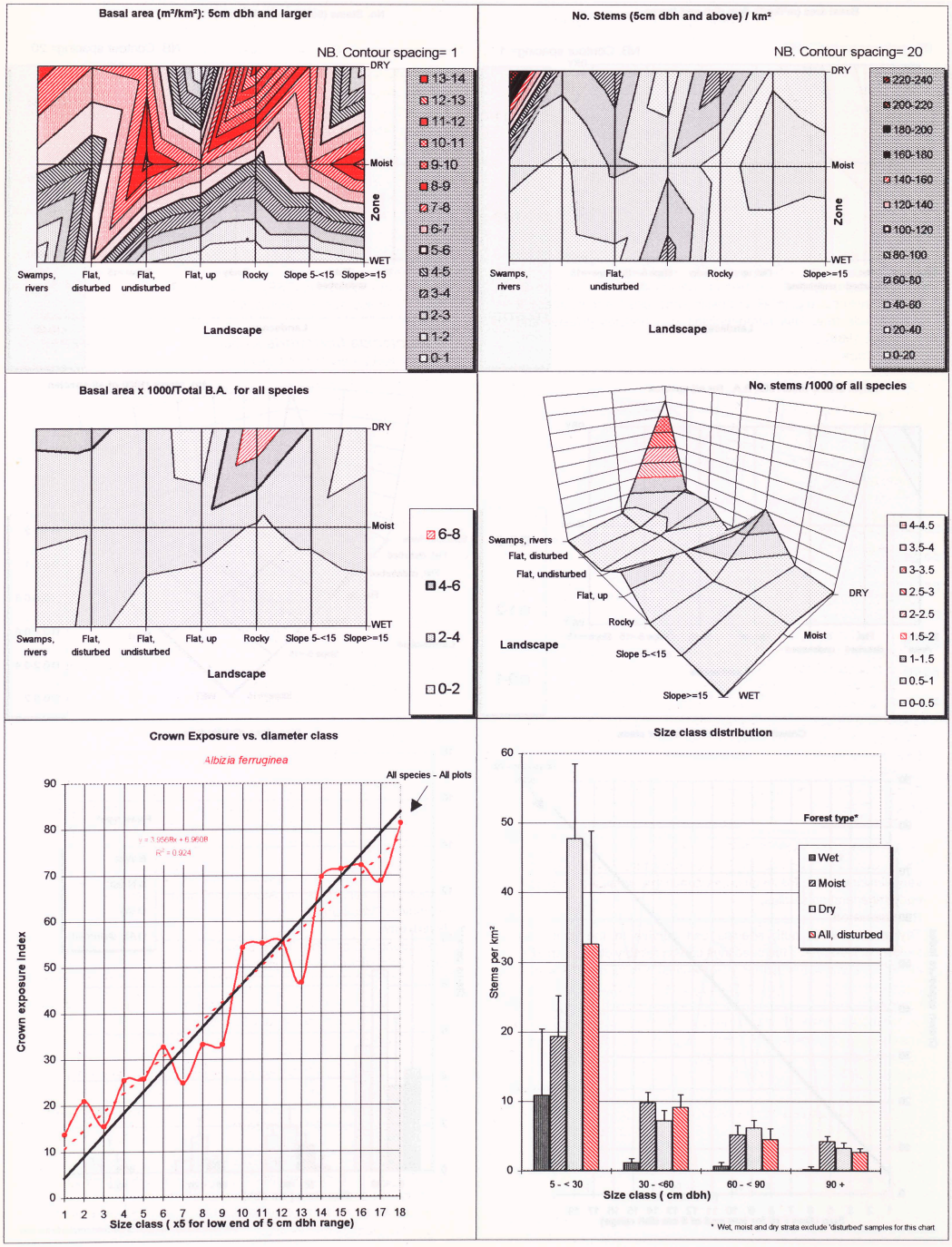
Allanblackia floribunda A.Chev. **GUTTIFERAE**
(=*Allanblackia parviflora* A.Chev.)
Common name: SONKYI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 50, 235 Group: 8B No. 33
FIELD IDENTITY
Similar to *A. parviflora*.
INVENTORY
Tree count <30 cm dbh (TSP): 666 >=30 cm: 1912
No. of botanical survey records: 75
The charts show that, although the species is scattered throughout the semideciduous forests, the tree is much more abundant home in the evergreen forests, particularly on slopes, and away from disturbed areas.

Allanblackia parviflora A.Chev. see *A. floribunda*

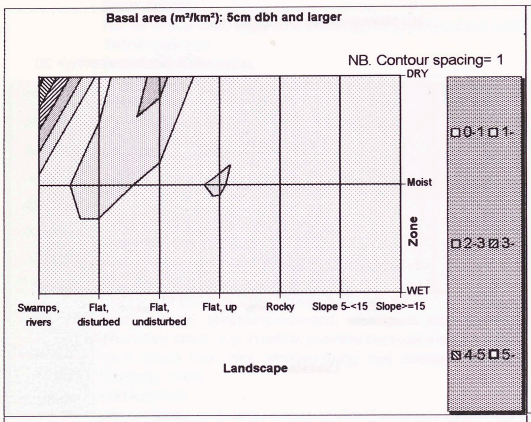
Allophylus africanus P.Beauv. **SAPINDACEAE**
Common name: DUA-AHABANUM
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 165 Group: 31 No. 70
Small tree or shrub.
DISTRIBUTION
Mostly forma *chrysothrix*. Common in Ghana in disturbed semideciduous forests, and (this form) Guinea-wide (Hall and Swaine sp. 33), but the species is very variable and widespread in tropical Africa [Keay, 1989].
FIELD IDENTITY
There is a much rarer form/species resembling a Macaranga with spines and stilt roots in Atewa and other evergreen forests: *Allophylus 'Macaranga'*.
INVENTORY
Tree count <30 cm dbh (TSP): 5 >=30 cm: 2
No. of botanical survey records: 29

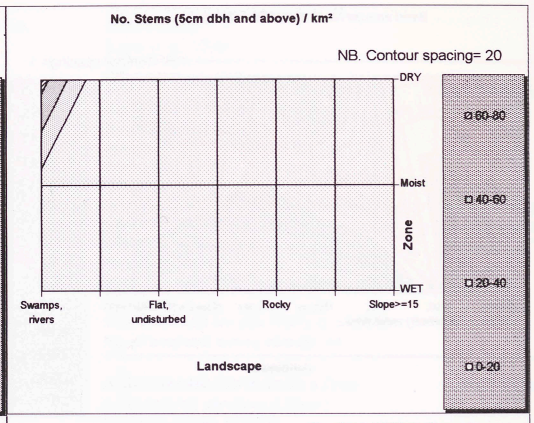
Alsophila manniana **FERNS** (=Cyathea manniana)
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 223 No. 72
Tree fern, characteristic of swamps on top of hills in Atewa F.R.
DISTRIBUTION
Only found in Atewa within Ghana [Hall *et al.*, 1973]. Widespread in wet places above 400 ft in Africa.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0 (Common in Atewa swamps.)
TAXONOMIC NOTE
Palm sized tree fern otherwise similar to *A. camerooniana* from SW Ghana, but leaves tripinnatifid.

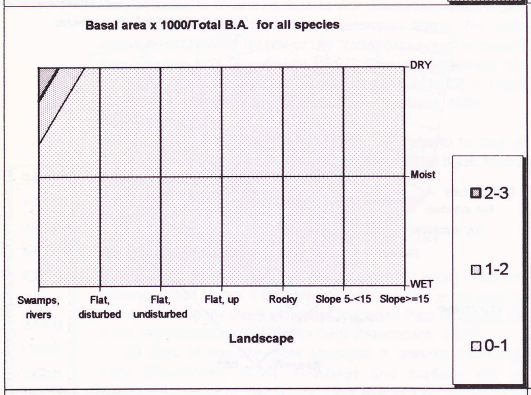
Albizia ferruginea

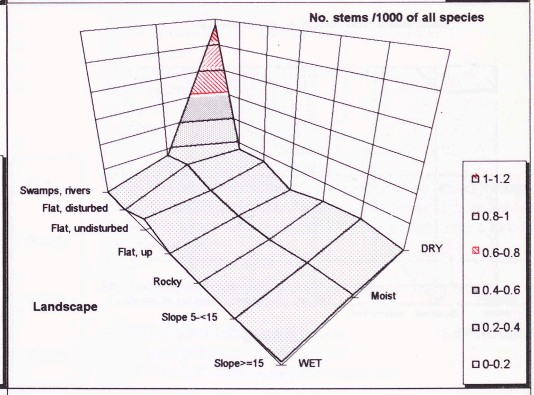


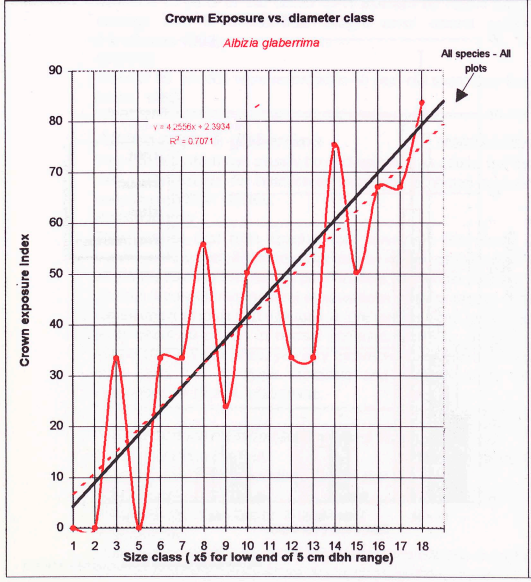
Albizia glaberrima

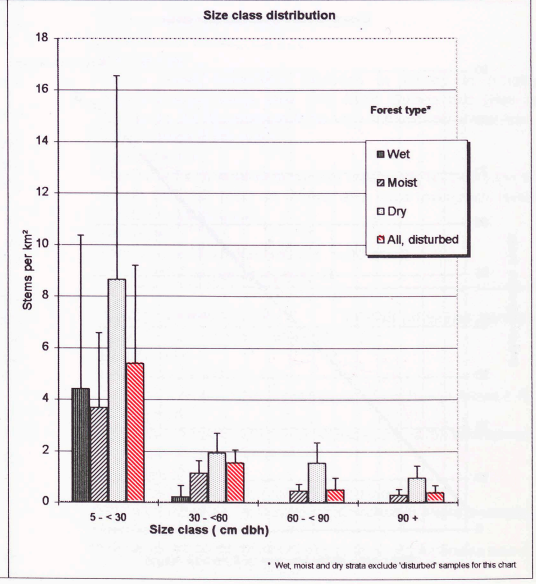




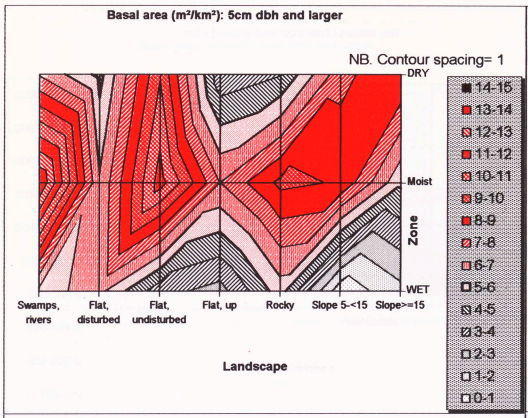


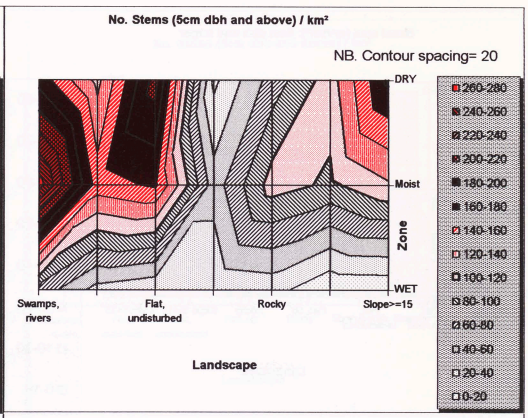


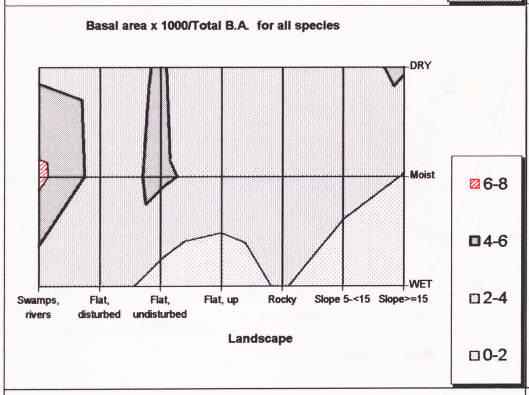


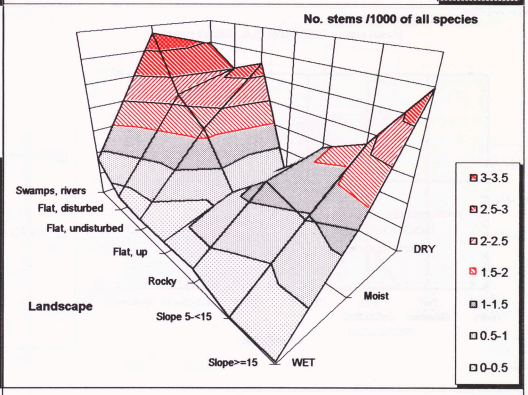


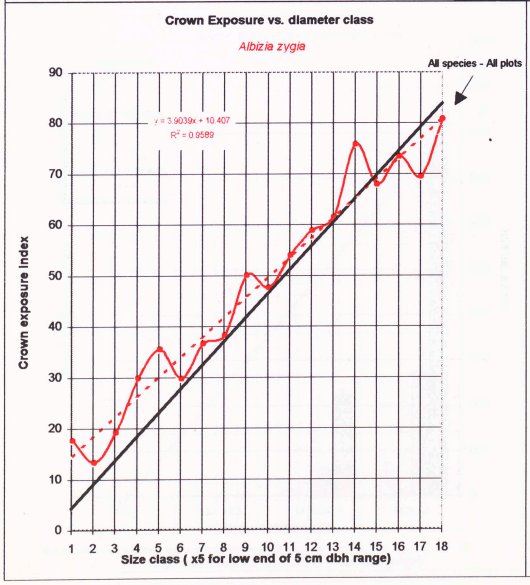
Albizia zygia

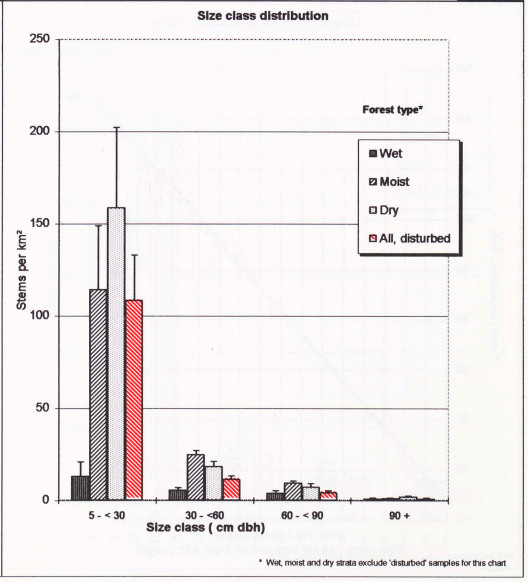




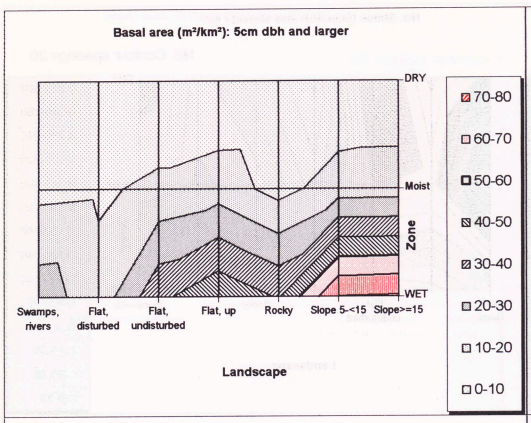


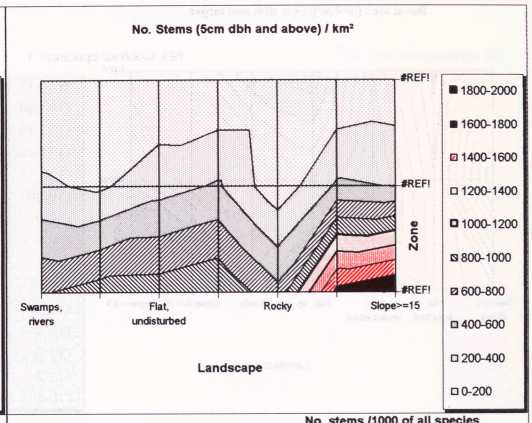


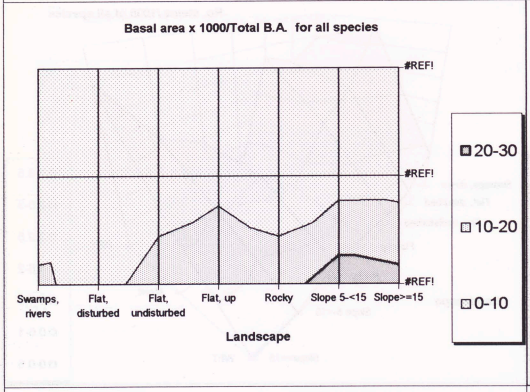


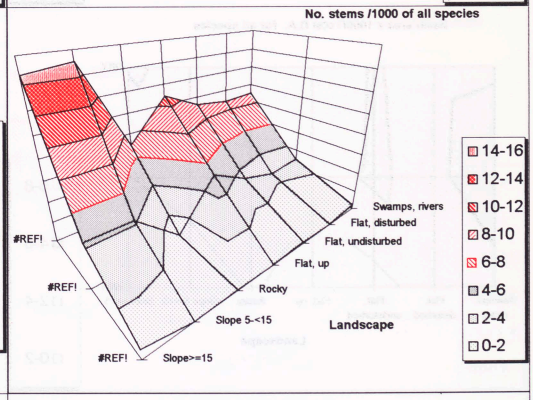


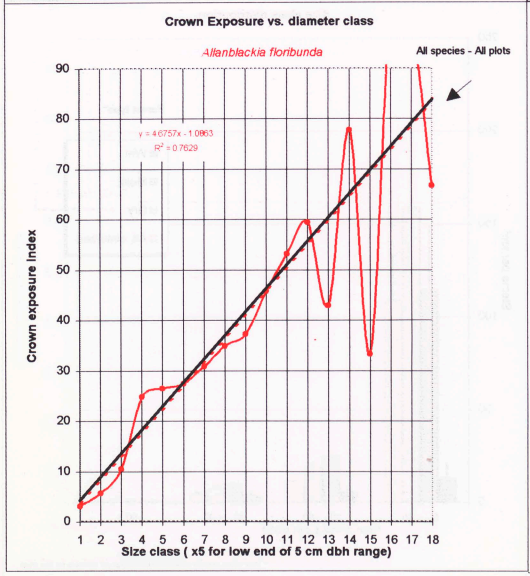
Allanblackia floribunda

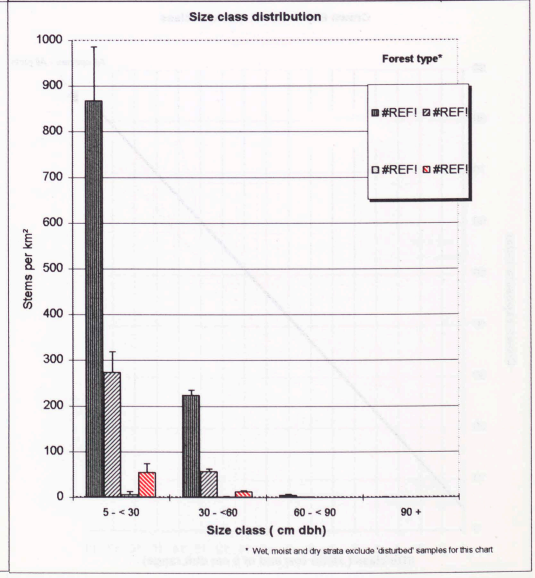




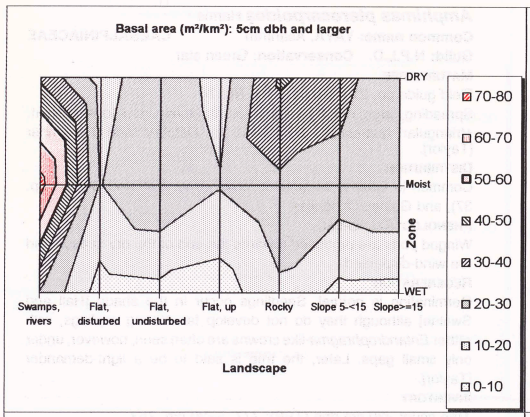


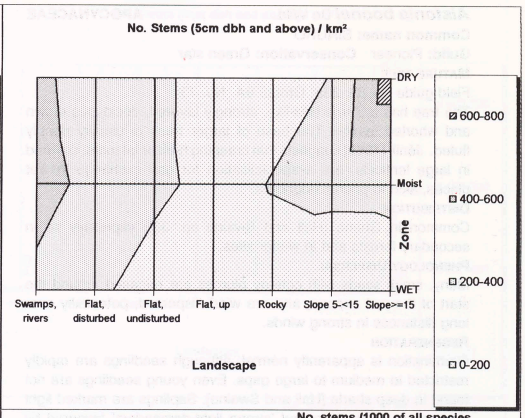


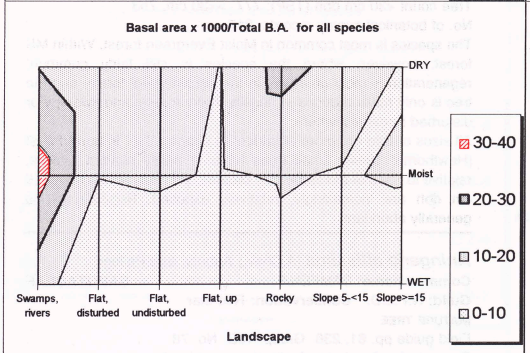


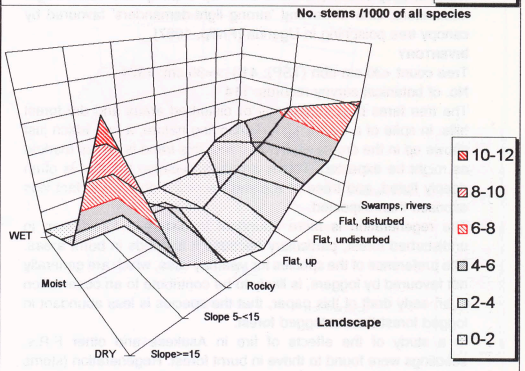


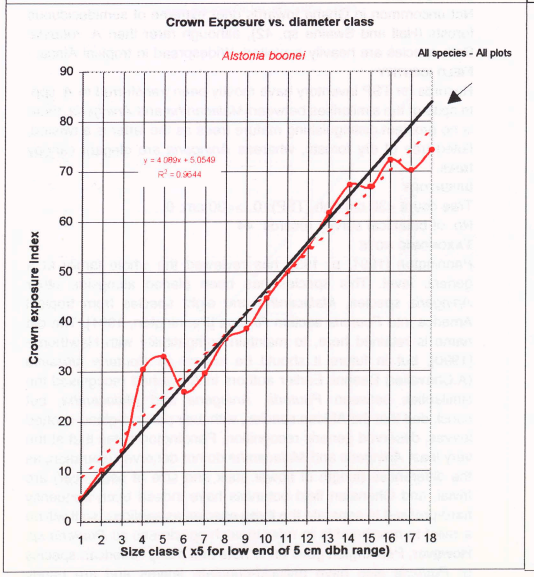
Alstonia boonei

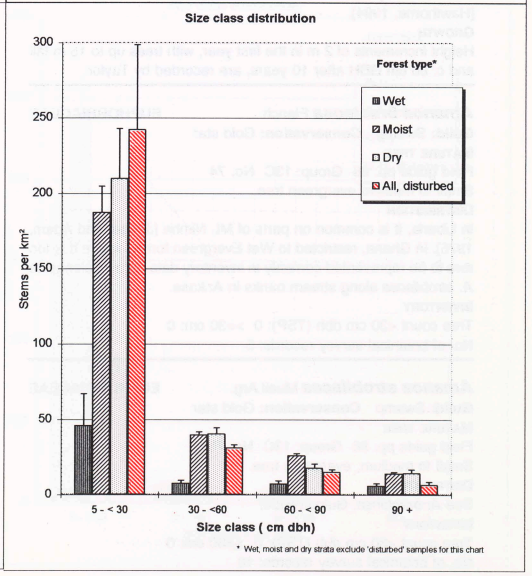












Alstonia boonei De Wild. **APOCYNACEAE**
Common name: SINURO
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 53, 235 Group: 9A No. 73
The tree has a *Terminalia*-like, strongly layered, deciduous crown and whorled leaves. The base of larger trees is usually deeply fluted. Jénik [1969] suggests that creeping horizontal roots, covered in large lenticels, are a specialisation for gas exchange in wet places, akin to pneumatophores.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 35), especially so in secondary forests and in wetter sites.
PHENOLOGY/DISPERSAL
Many, small seeds with cottony plumes are released around the start of the wet season, and are wind dispersed, potentially over long distances in strong winds.
REGENERATION
Germination is apparently normal, although seedlings are rapidly restricted to medium to large gaps. Even young seedlings are not found in deep shade [Hall and Swaine]. Saplings are marked light demanders. One of several 'strong light-demanders' favoured by canopy tree poisoning in Uganda [Philip, 1967].
INVENTORY
Tree count <30 cm dbh (TSP): 416 >=30 cm: 1924
No. of botanical survey records: 114
The tree fares best in swampy or disturbed areas and dry forest hills. In spite of a clearly light demanding nature, a fact which just shows up in the crown exposure trend, this trend is not as marked as might be expected. This is probably because the tree is often deeply fluted, and trees of a given, recorded dbh are in fact less exposed than expected.
The regeneration is more abundant in disturbed forest than in undisturbed forest, particulary because it abounds in burnt areas. The preference of the species for swampy sites, which are generally not favoured by loggers, is likely to be contribute to an observation in an early draft of this paper, that the species is less abundant in logged forest than unlogged forest.
In a study of the effects of fire in Asukese and other F.R.s, seedlings were found to thrive in burnt forest. Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest [Hawthorne, 1994].
GROWTH
Height increments of 2 m in the first year, with trees up to 15 m tall and c. 80 cm GBH after 10 years, are recorded by Taylor.

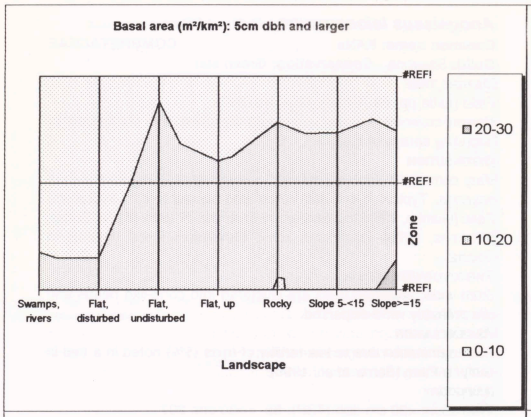
Amanoa bracteosa Planch. **EUPHORBIACEAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 86 Group: 13C No. 74
Small to medium evergreen tree.
DISTRIBUTION
In Liberia, it is common on parts of Mt. Nimba [Jaeger and Adam, 1976]. In Ghana, restricted to Wet Evergreen forest, where it is too rare to be represented correctly in inventory data. Grows alongside *A. strobilacea* along stream banks in Ankasa.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

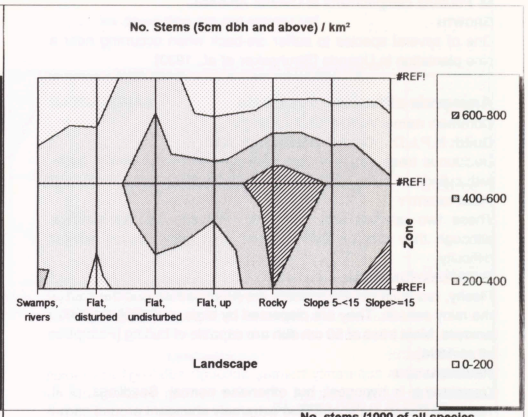
Amanoa strobilacea Muell.Arg. **EUPHORBIACEAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 86 Group: 13C No. 75
Small to medium, evergreen tree.
DISTRIBUTION
See *A. bracteosa*. Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 10

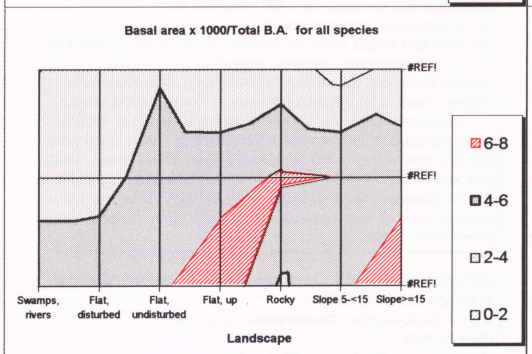
Amphimas pterocarpoides Harms
Common name: YAYA, Asanfran **CAESALPINIACEAE**
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 210 Group: 37H No. 76
Spreading, large, rough-barked tree, with dense, dark foliage. Neat, ±triangular buttresses. Deciduous in October and November [Taylor].
DISTRIBUTION
Common in Ghana, throughout forest zone (Hall and Swaine sp. 37), and Guineo-Congolian.
PHENOLOGY/DISPERSAL
Winged pods are produced towards the end of the dry season and are wind-dispersed.
REGENERATION
Germination is normal. Seedlings occur in the shade [Hall and Swaine] although they do not develop far. Young saplings, with rather *Entandrophragma*-like crowns are often seen, however, under only small gaps. Later, the tree is said to be a light-demander [Taylor].
INVENTORY
Tree count <30 cm dbh (TSP): 777 >=30 cm: 753
No. of botanical survey records: 217
The species is most common in Moist Evergreen forest. Within MS forest, however, where the species is still fairly common, regeneration is most abundant in the 'undisturbed' forest, and the tree is only really reduced in density in dry forests and swampy or disturbed forest elsewhere.
All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. Small trees have relatively shaded crowns relative to trees of the same size classes, yet trees above about 15 cm dbh are increasingly, relatively exposed. Regeneration is generally abundant.

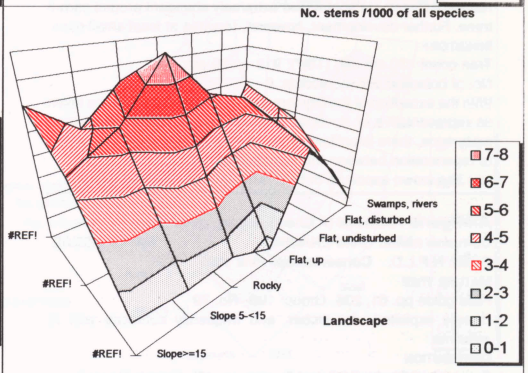
Aningeria altissima (A.Chev.) Aubrev. and Pellegr.
Common name: SAMFENA **SAPOTACEAE**
Guild: N.P.L.D. **Conservation:** Red star
MATURE TREE
Field guide pp. 61, 236 Group: 10B No. 78
See note for *A. robusta & altissima* combined.
DISTRIBUTION
Not uncommon in Ghana towards drier extreme of semideciduous forests (Hall and Swaine sp. 42), although rarer than *A. robusta*. Both species are heavily exploited. Widespread in tropical Africa.
FIELD IDENTITY
Records for TSP inventory have mostly been transferred to *A.* spp. In spite of the similarities between *Malacantha* and *Aningeria*, there is no problem distinguishing mature trees as the latter is a twisted, fluted tree of dry forests, whereas *Aningeria* are elegant canopy trees.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 44
TAXONOMIC NOTE
Pennington [1991, p. 193], has reviewed the whole family at a generic level. This species has been placed alongside other *Aningeria* species, *Malacantha* and eight species from tropical America into *Pouteria* section *Rivicoa* [Pennington, 1991]. The old name is retained here, to maintain compatibility with Hawthorne [1990], but in future it should be known as *Pouteria altissima* (A.Chevalier) Baehni. Earlier authors in Africa had recognised the similarities between *Pouteria*, *Aningeria* and *Malacantha*, but concluded that the African species, with their pellucid-gland-spotted leaves, deserved generic recognition. Pennington notes that at the very least *Aningeria* and *Malacantha* do not deserve separation, as the differences (length of flower stalk and size of seed scar) are trivial, and Ghanaian field botanists have indeed been frequently hard-pressed to separate the three species as saplings, so it will be a relief to now be able to refer to such specimens as *Pouteria sp.* However, Pennington goes on to note that many American species of *Pouteria* also have pellucid-punctate leaves and are barely distinguishable from our species. Hence, the time has come to recognise the similarities between Ghana's species and trees such

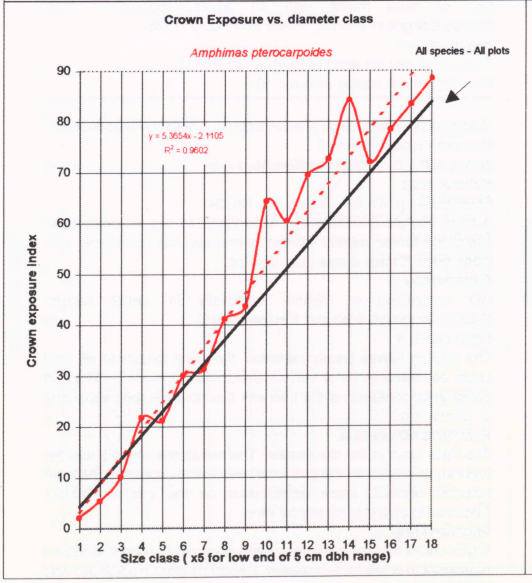
Amphimas pterocarpoides

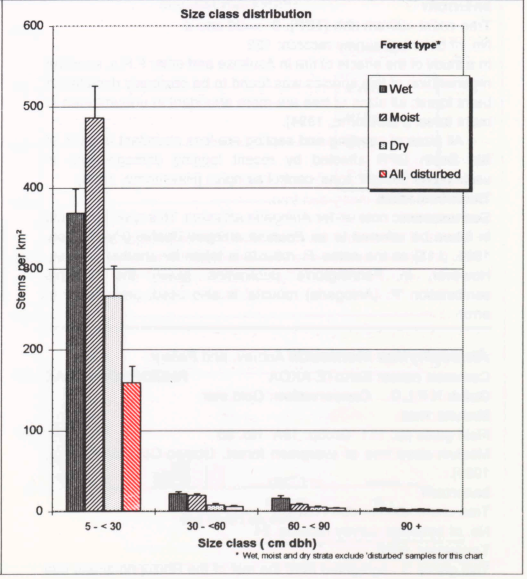












as *Pouteria campechiana* in Central America.

GROWTH

One of several species to suffer die-back when occurring near a pine plantation in Uganda [Struhsaker *et al.*, 1989].

Aningeria altissima & robusta SAPOTACEAE

Common name: ASAMFENA, Aningre

Guild: N.P.L.D. **Conservation:** Pink star

Deciduous trees, probably not distinguished by the timber trade, with cylindrical boles and neat, triangular buttresses.

FIELD IDENTITY

These two species are commonly confused by tree-spotters, although they can be distinguished from fallen leaves without difficulty.

PHENOLOGY/DISPERSAL

Fleshy, red fruits of both species are produced around the start of the rainy season. They are dispersed by birds, and probably other animals. Most trees of 50 cm dbh are capable of fruiting [Plumptree *et al.* 1994].

REGENERATION

Germination is hypogeal, but otherwise normal. Seedlings, of *A. robusta* at least, are sometimes extremely abundant around parent trees. Further development, however, requires at least small gaps.

INVENTORY

Tree count <30 cm dbh (TSP): 919 >=30 cm: 1904

No. of botanical survey records: 0

With the exception of the Dry forest sample, the charts can be taken as representative of *A. robusta*, although, apart from forest zone preference, there is unlikely to be any great differences in patterns of regeneration between the two species.

The crown exposure of regenerating trees is about average.

Aningeria robusta (A.Chev.) Aubrev. and Pellegr.

Common name: SAMFENANINI SAPOTACEAE

Guild: N.P.L.D. **Conservation:** Pink star

MATURE TREE

Field guide pp. 61, 236 Group: 10B No. 79

Heavily exploited for timber, and frequently confused with *A. altissima*.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 43); Guineo-Congolian.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 122

In a study of the effects of fire in Asukese and other F.R.s, seedling regeneration of this species was found to be obviously depleted in burnt forest; all sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

All sizes of seedling and sapling are less abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

TAXONOMIC NOTE

See taxonomic note under *Aningeria altissima*. This species should in future be referred to as *Pouteria aningeri* Baehni [Pennington, 1991, p.18] as the name *P. robusta* is taken by another species. However, in Pennington's publication (p.69) the informal combination 'P. (Aningeria) robusta' is also used, presumably in error.

Anisophyllea meniaudii Aubrev. and Pellegr.

Common name: KoKoTE-AKOA RHIZOPHORACEAE

Guild: N.P.L.D. **Conservation:** Gold star

MATURE TREE

Field guide pp. 111 Group: 18A No. 80

Medium-sized tree of evergreen forest. Guineo-Congolian [Keay, 1989].

INVENTORY

Tree count <30 cm dbh (TSP): 1 >=30 cm: 3

No. of botanical survey records: 24

TAXONOMIC NOTE

This genus is segregated from the rest of the Rhizophoraceae into the Anisophylleaceae [e.g. Keay, 1989].

Anogeissus leiocarpa (DC.) Guill. and Perr.

Common name: KANe COMBRETACEAE

Guild: Savanna **Conservation:** Green star

MATURE TREE

Field guide pp. 89 Group: 13D No. 81

Narrow-crowned tree of savanna and dry forest, with characteristic, birch-like sprays of foliage.

DISTRIBUTION

Very common in Ghana (Hall and Swaine sp. 44), especially so in savanna. Typical in wooded 'relics' and sacred forests in Burkino Faso [Guinko, 1985]; dominates lower slopes of Jebel Marra, Sudan [Wickens, 1976]. Dominates some transitional forest patches in Ghana.

PHENOLOGY/DISPERSAL

5mm wide, 2-winged fruits are clustered into cone-like heads and are probably wind-dispersed.

REGENERATION

Poor gemination due to low fertility of fruits (5%) noted in a trial in Burkina Faso [Some *et al.*, 1990].

INVENTORY

Tree count <30 cm dbh (TSP): 65 >=30 cm: 207

No. of botanical survey records: 15

The inventory results show the marked concentration in disturbed dry forest. Sporadic records elsewhere are likely to be misidentifications of *Pteleopis hylodendron* (e.g. on evergreen forest slopes). Trees show a strong tendency to have exposed crowns.

Small sizes of the tree are not especially common in 'disturbed plots'; the species dominates areas in Boabeng Fiema which have become forested since fire protection began. These areas would probably be described as 'undisturbed', yet fifteen years ago, when the *Anogeissus* arrived, would have been highly disturbed. Large sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Anonidium mannii (Oliv.) Engl. and Diels ANNONACEAE

Common name: ASUMPA

Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 78 Group: 12E No. 82

Not particularly common; dense-crowned, evergreen understorey tree of moist forest, with an edible, soursop-like fruit. Guineo-Congolian [FWTA]; Vivien and Faure [1985].

INVENTORY

Tree count <30 cm dbh (TSP): 8 >=30 cm: 45

No. of botanical survey records: 10<

Anopyxis klaineana (Pierre) Engl. RHIZOPHORACEAE

Common name: KoKoTE

Guild: N.P.L.D. **Conservation:** Red star

MATURE TREE

Field guide pp. 41, 45 Group: 3/5 No. 34

A large, straight cylindrical tree commonest in, but not confined to evergreen forest; usually without buttresses, but sometimes with steep ones. Crown dense and rounded.

DISTRIBUTION

Not uncommon in Ghana, especially in wetter forests; Guineo-Congolian (Hall and Swaine sp. 45).

FIELD IDENTITY

The sapling leaves barely resemble the adult foliage at all, and could be mistaken for a var. of *Sericanthe chevalieri*. There is potential for confusion of the tree with *Cassipourea* spp., especially *C. gummifera*.

PHENOLOGY/DISPERSAL

The fruits ripen in the dry season. The seeds are winged, and the fruit can split open on the tree to release them; unopened fruits are however normally more conspicuous on the ground [Taylor]. Dispersal is probably mostly by wind.

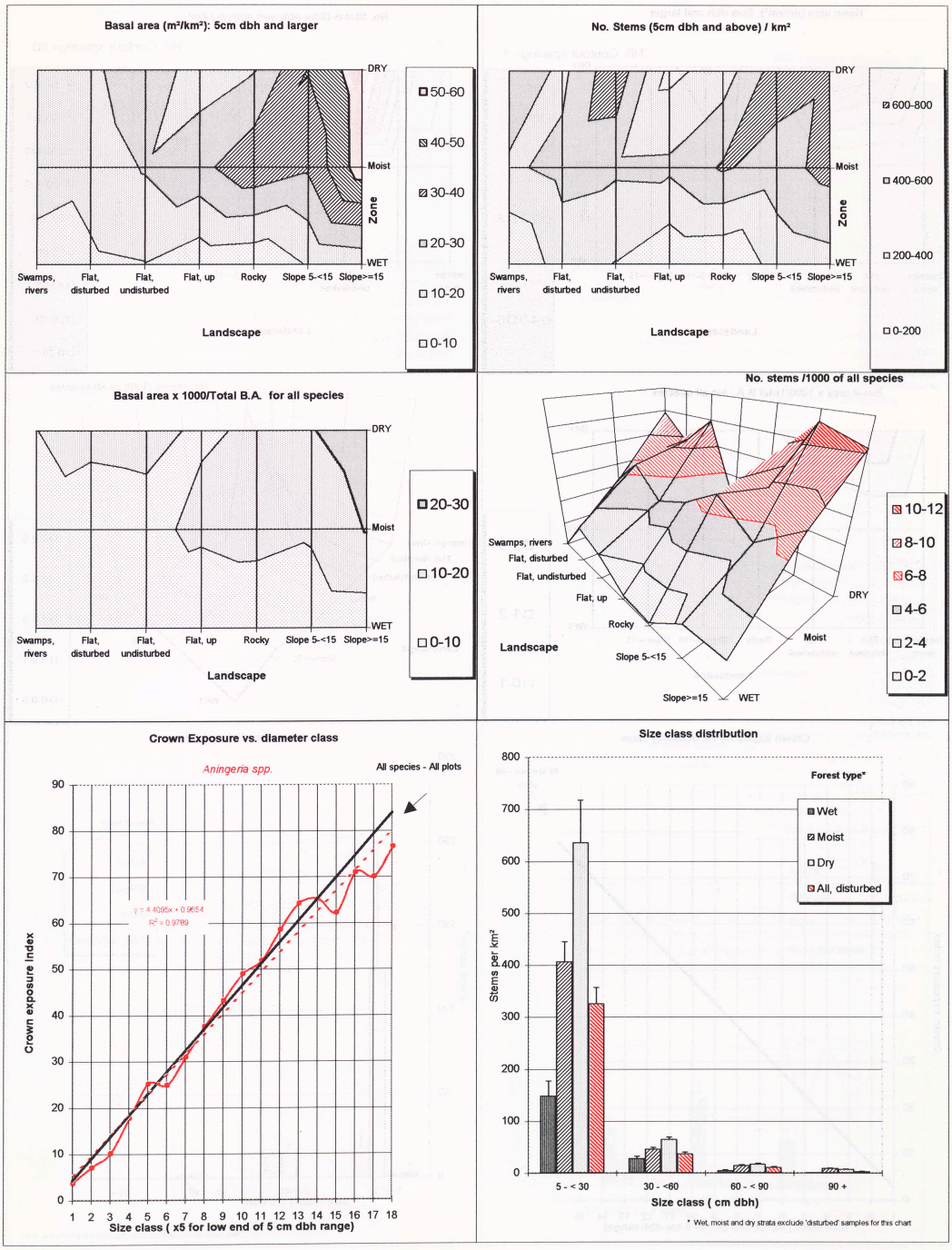
REGENERATION

Taylor states that the seeds have very poor viability and that natural regeneration is low for this reason. Seedlings that do occur are said to be in the open or only light shade [Hall and Swaine].

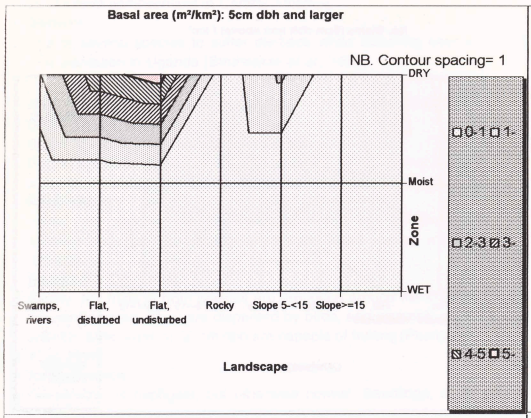
INVENTORY

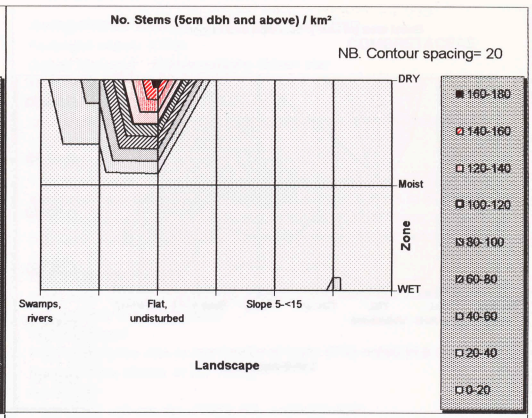
Tree count <30 cm dbh (TSP): 45 >=30 cm: 263

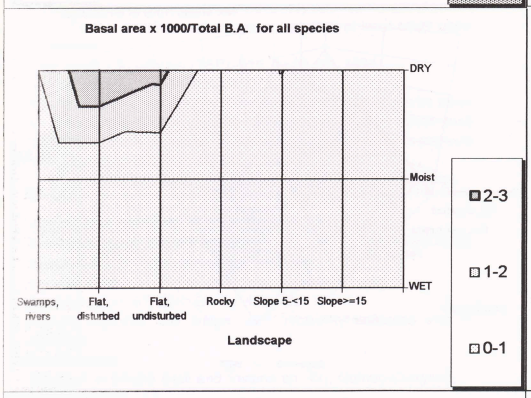
Aningeria spp.

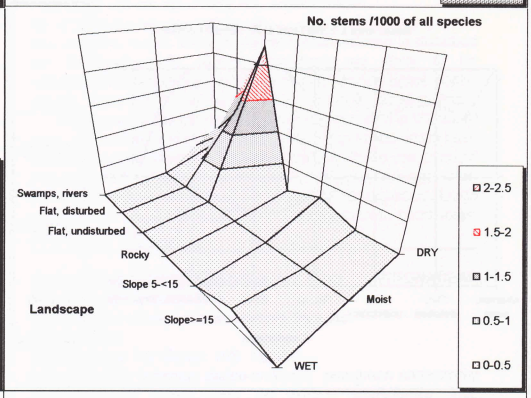


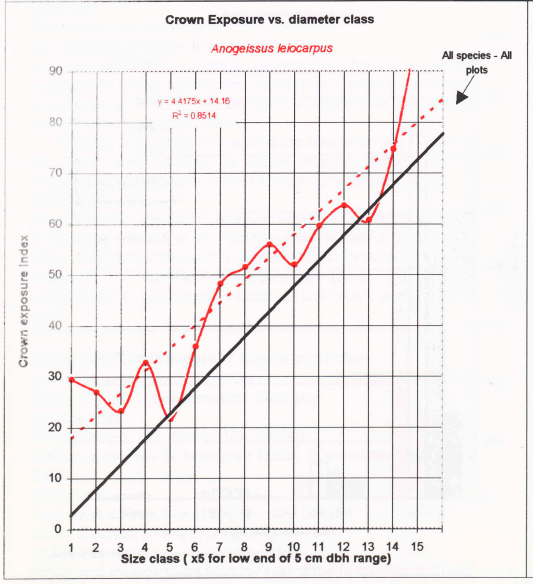
Anogeissus leiocarpus

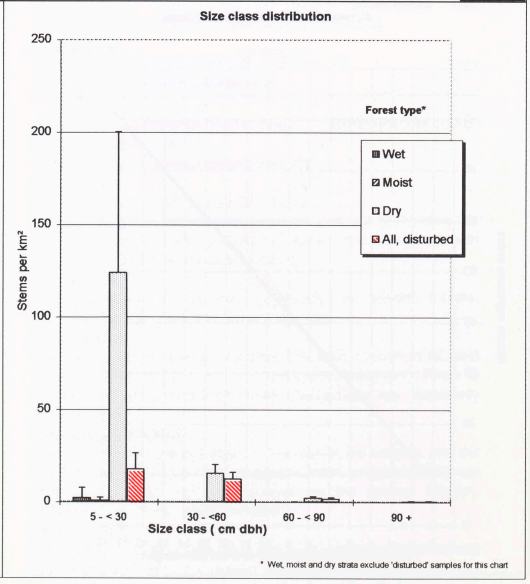




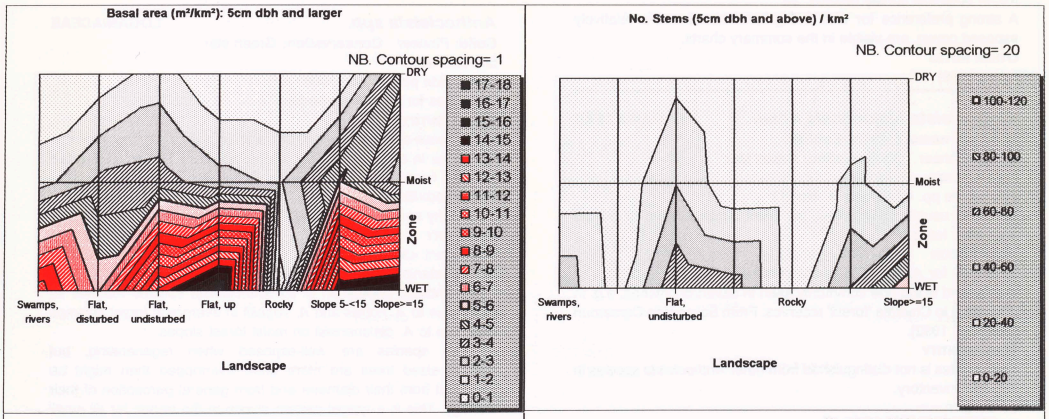


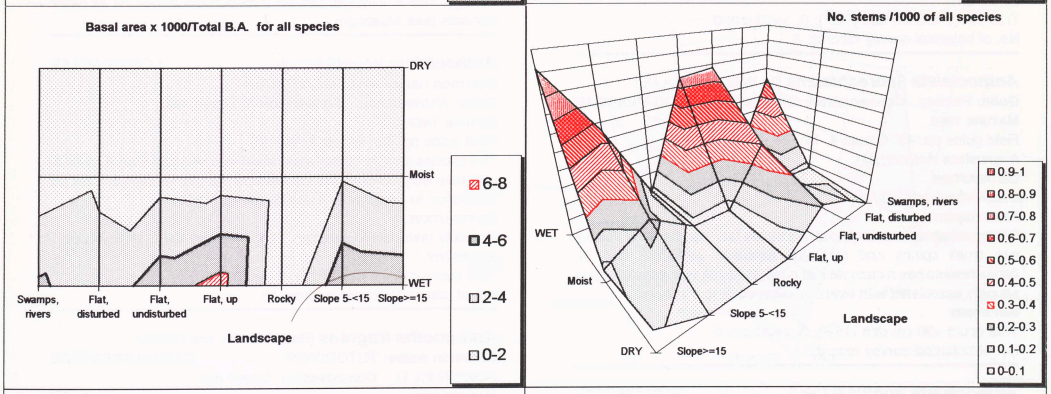


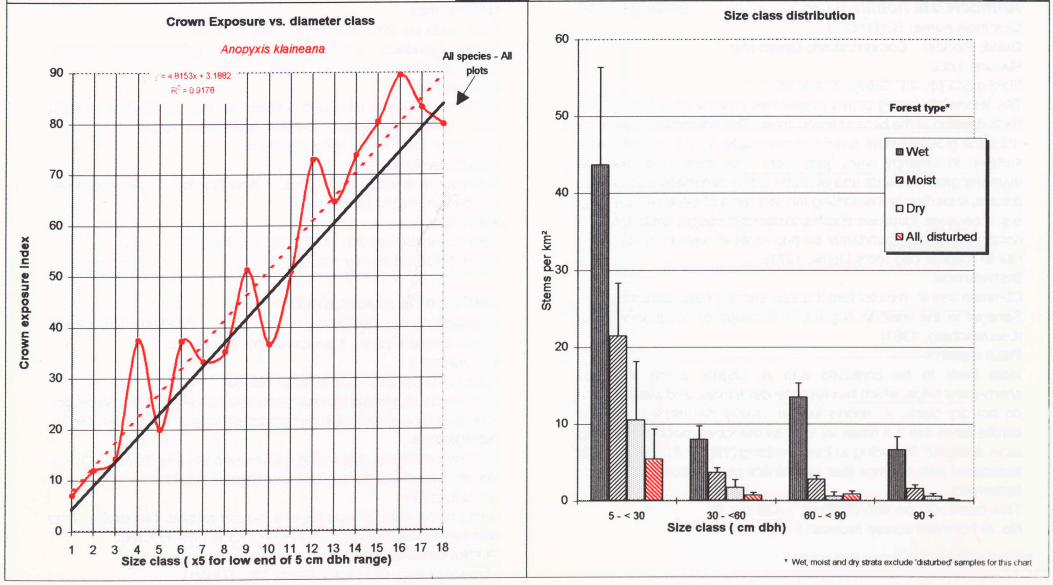




Anopyxis klaineana







No. of botanical survey records: 35
A strong preference for Wet Evergreen forests, and a relatively exposed crown, are visible in the summary charts.
OTHER NOTES
[Lohr, 1969]

Anthocleista djalonensis A.Chev. **LOGANIACEAE**
Common name: BoNToDEeBERE
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 43 Group: 4 No. 83
Branches usually have a few, but blunt, small spines, or bumps above the leaves.
DISTRIBUTION
See entry for *A.* spp. This is the commonest *Anthocleista* in drier areas, and is the one commonly seen in savanna patches, e.g. in the Awura to Chirimfa 'forest' reserves. From Senegal to Cameroun [Geerling, 1982].
FIELD IDENTITY
This species is not distinguished from other *Anthocleista* species in the TSP inventory.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 8

Anthocleista liebrechtsiana De Wild. and The.Dur.
Guild: Pioneer **Conservation:** Green star **LOGANIACEAE**
MATURE TREE
Field guide pp. 43 Group: 4 No. 84
A spineless *Anthocleista*.
DISTRIBUTION
See *Anthocleista* spp.
FIELD IDENTITY
Distinguishable from *A. djalonensis* by the fact that the latter usually has small spines and (at least minutely) auriculate leaf. *A. liebrechtsiana* has a cuneate leaf base, is absolutely spineless, and strongly associated with rivers or swamps at low altitudes.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1

Anthocleista nobilis G.Don. **LOGANIACEAE**
Common name: BoNToDEe
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 43 Group: 4 No. 86
The leaves on young plants sometimes attain 2 m in length. Stilt roots develop at the base of some trees. The adventitious stilt roots enter the ground before growing horizontally, 10-20 cm below the surface. In swampy soils, 'peg roots' less than a millimetre in diameter grow upwards and protrude a few centimetres above the ground, superficially resembling the peg roots of other swamp trees e.g. *Voacanga thouarsii, Raphia, Avicennia*; rough, white lenticels occur particularly abundantly on peg roots in wetter areas, giving rise to rougher peg roots [Jénik, 1971].
DISTRIBUTION
Common tree in moister forest areas. Guinea-wide, occurring from Senegal in the west to Nigeria, in swampy or secondary forest [Leeuwenberg, 1961].
FIELD IDENTITY
Most likely to be confused with *A. vogelii*, which also has sharp-spiny twigs, which has less slender leaves, and leaves which do not dry black. *A. nobilis* leaves usually dry black. *A. nobilis* corolla tubes are 2-3 times as long as the lobes, not 0.9-1.5 times as in *A.vogelii.* According to Leeuwenberg [1961], *A. nobilis* is not associated with swamps (but see Jénik's observations, above).
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 11

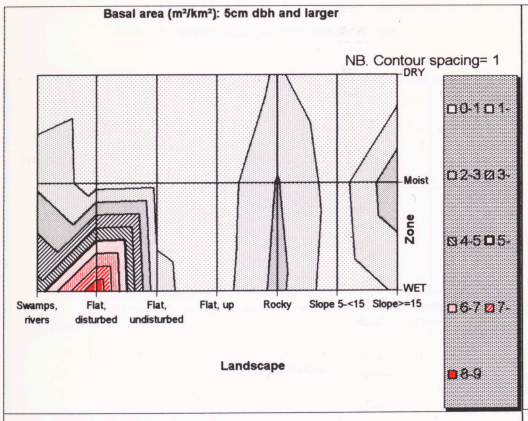
Anthocleista spp. **LOGANIACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 43 No. 1086
See notes for individual species.
FIELD IDENTITY
Anthocleista species are hard to tell apart, particularly as saplings. Seedlings in botanical survey and adults from TSP inventory are included here.
PHENOLOGY/DISPERSAL
The fleshy seeds in fleshy fruits are probably animal-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 95 >=30 cm: 65
No. of botanical survey records: 5
The combined population of all *Anthocleista* species reaches its peak (due to *A. nobilis* and *A. vogelii*) in evergreen forest swamps and (due to *A. djalonensis*) on moist forest slopes.
The species are well-exposed when regenerating, but medium-sized trees are more often overtopped than might be expected from their diameter and from general perception of their ecology. This is a typical pattern shown in the trends for all small pioneers (see *Musanga*).

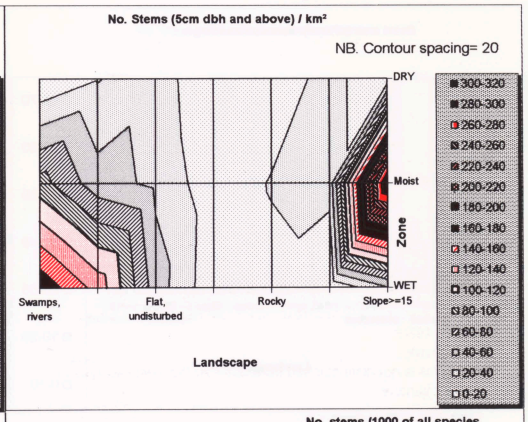
Anthocleista vogelii Planch. **LOGANIACEAE**
Common name: AWORABoNToDEe
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 43 Group: 4 No. 87
This species is more strictly associated with swamps than *A. nobilis*, yet rather surprisingly does not develop the peg roots which are an adaptation to swamps in *A. nobilis* [Jenik, 1971].
DISTRIBUTION
Probably restricted to swamps. TSP inventory data under *A.* spp.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 16

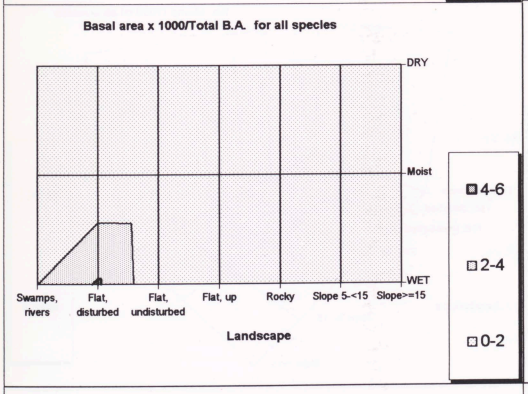
Anthonotha fragrans (Bak.f.) Excell and Hillcoat
Common name: TOTORONINI **CAESALPINIACEAE**
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 205, 236 Group: 37E No. 88
Large, cylindrical, evergreen tree with golden-brown crown. Ectomycorrhizal [Alexander, 1989].
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 46), particularly on acid soils; Guineo-Congolian. Outside evergreen forest it is most commonly seen in low-lying situations.
PHENOLOGY/DISPERSAL
Flowers are made in Dec.; pods in April [Taylor]. The seeds have no obvious means of dispersal.
INVENTORY
Tree count <30 cm dbh (TSP): 19 >=30 cm: 9
No. of botanical survey records: 70

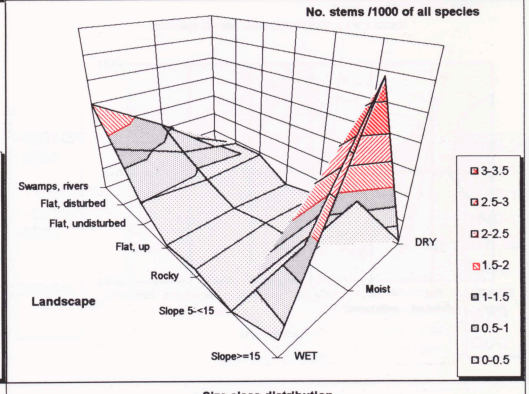
Anthonotha macrophylla P.Beauv.
Common name: TOTORO **CAESALPINIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 205 Group: 37E No. 89
Medium-sized, spreading, evergreen tree with slightly silvery foliage. The roots have ectotrophic mycorrhizae [Fassi and Fontano, 1962].
DISTRIBUTION
Common in Ghana, but fading out towards the Dry Semideciduous forest; Guineo-Congolian (Hall and Swaine sp. 47).
FIELD IDENTITY
Some of the records may be of a closely related, but smaller tree with more twisted fruits (?*A.*cf.*crassifolia* in drier forests).
PHENOLOGY/DISPERSAL
Flowers in Aug.-Oct.; fruits March-May [Taylor].
INVENTORY
Tree count <30 cm dbh (TSP): 533 >=30 cm: 271

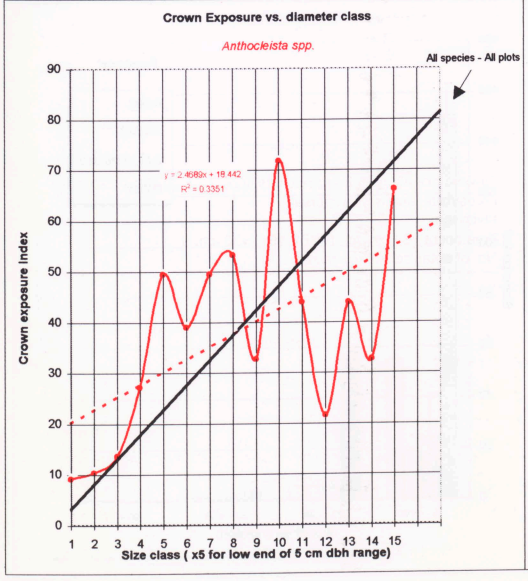
Anthocleista spp.

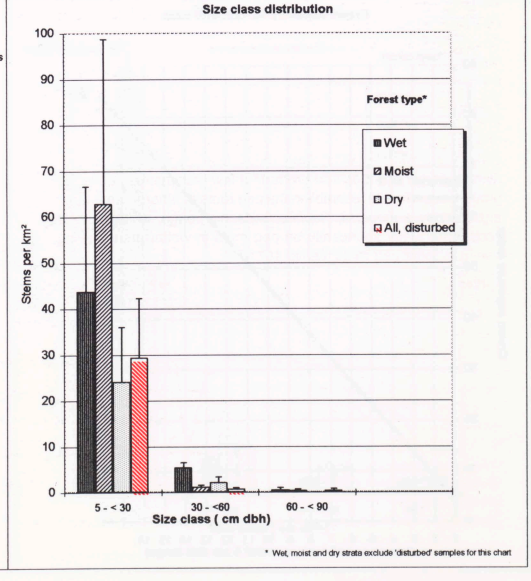




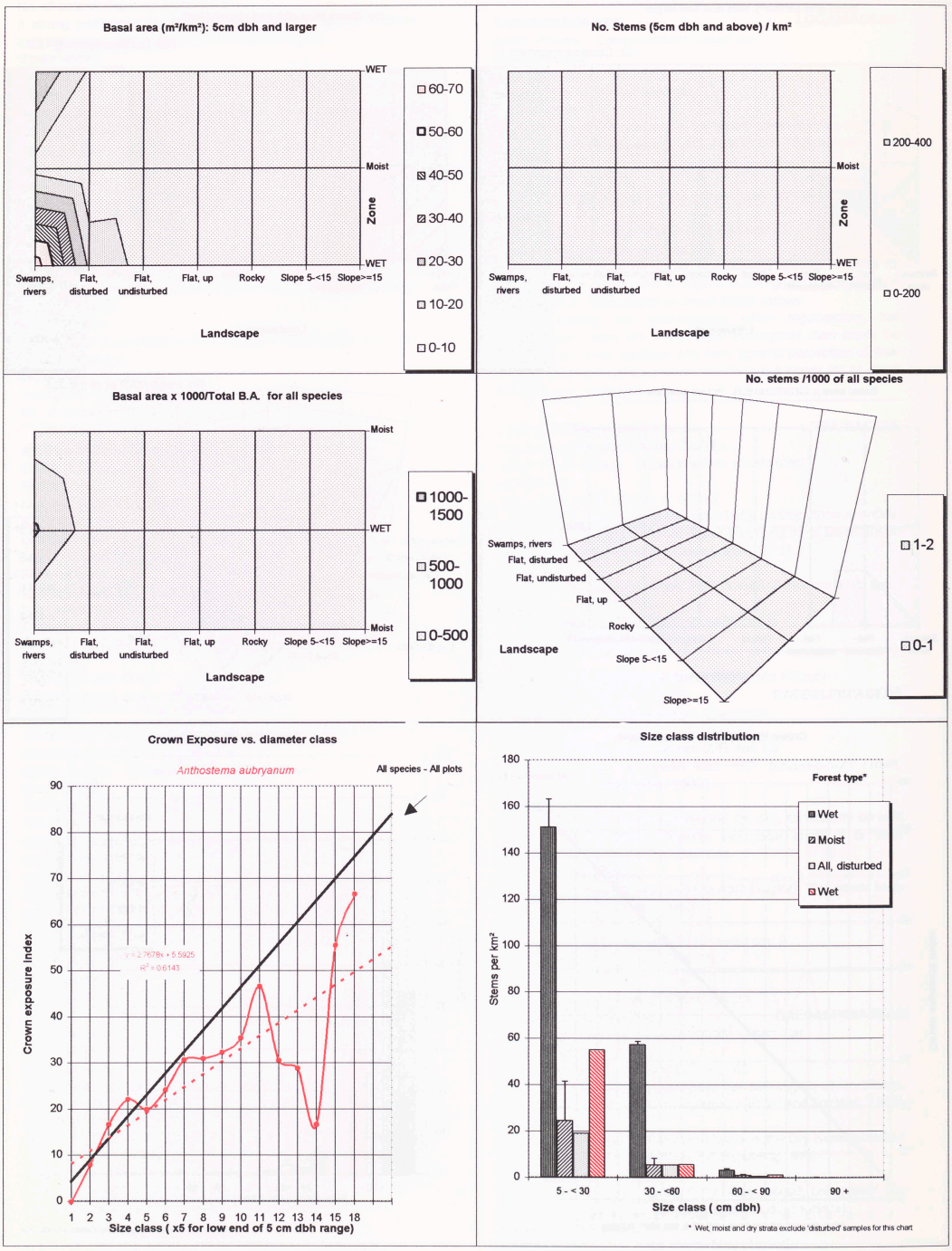




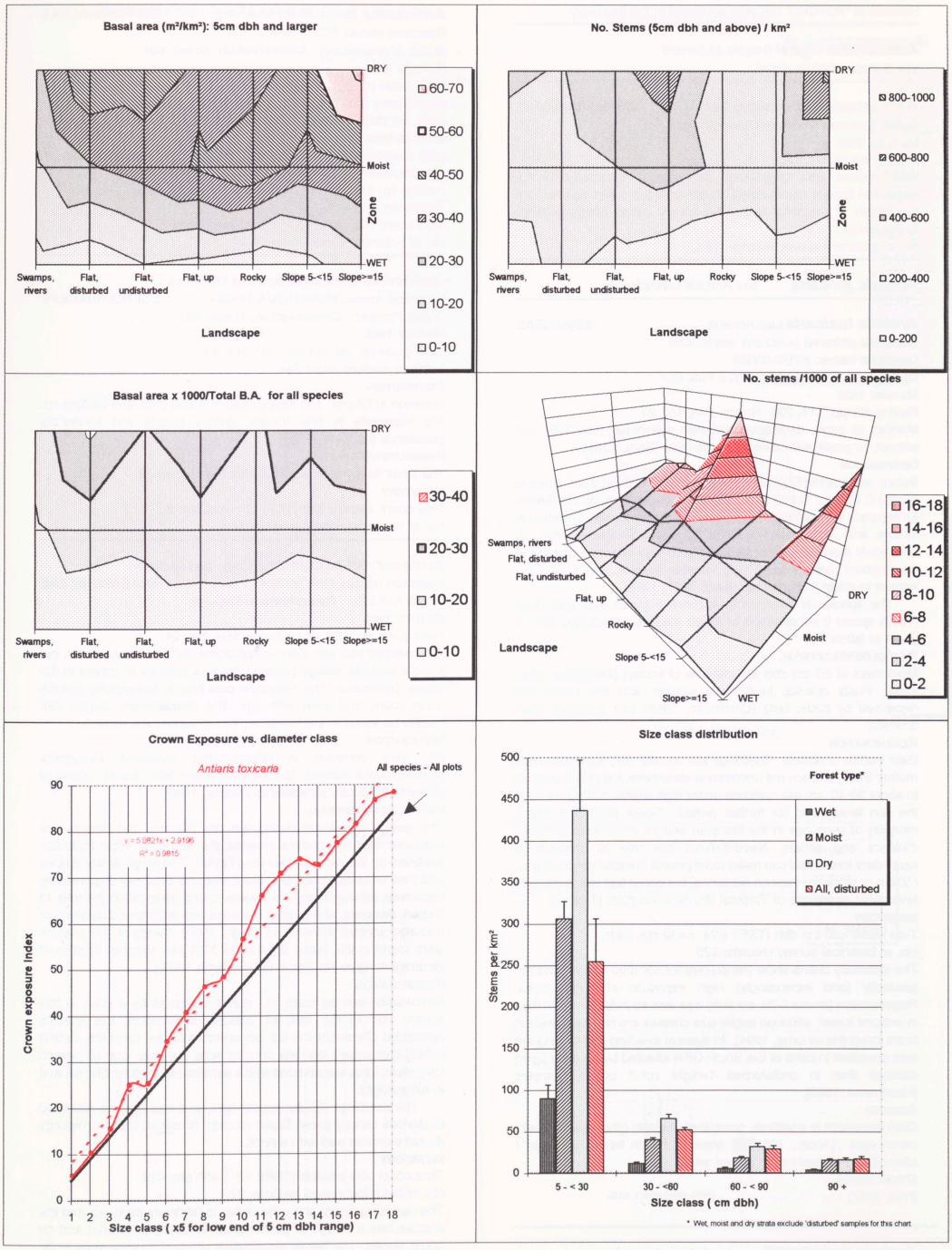




Anthostema aubryanum



Antiaris toxicaria



No. of botanical survey records: 211
Records of 'TOTORO' are very abundant in the inventory.

Anthonotha vignei (Hoyle) J.Leonard
see *Isomacrolobium vignei*

Anthostema aubryanum Baill. **EUPHORBIACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 57, 129
Medium-sized tree gregarious in swamps, especially in the evergreen forests. Leaves distinctively arranged in two parallel files the length of the long twigs. Apparently rather shade-tolerant. Guinea-wide.
No. of botanical survey records: 16

Antiaris africana see *Antiaris toxicaria*

Antiaris toxicaria Leschenault **MORACEAE**
(=*Antiaris africana*) (=*Antiaris welwitschii*)
Common name: KYEN-KYEN
Guild: N.P.L.D. **Conservation:** Pink star
MATURE TREE
Field guide pp. 117, 235 Group: 19A No. 21
Medium to large, deciduous tree with cylindrical, pale bole and without, or small buttresses. Very variable [Berg, 1978].
DISTRIBUTION
Subsp. welwitschii (Engl.) C.C.Berg var. *welwitschii* and var. *africana* (Engl.) C.C.Berg. These varieties were previously treated in Ghana as separate species (e.g. rough leaves from dry forest). Common in Ghana, and widespread in Africa (Hall and Swaine sp. 48). A commonly exploited timber tree, but both very common and not at the moment threatened. A very variable species, found from the wettest to driest forest types [Berg, 1977; 1978].

The species is common in secondary forest: Hall and Okali [1979] record it as common in forest that has developed after 8 years of fallow.
PHENOLOGY/DISPERSAL
Most trees of 50 cm dbh are capable of fruiting [Plumptree *et al.* 1994]. Fruits develop in the dry season, and are eaten and dispersed by birds, bats [Osmaston, 1965] and probably other animals.
REGENERATION
Germination is normal. Seedlings are usually very abundant near mother trees, and are not uncommon elsewhere. Height classes up to about 30-40 cm are common under high shade, but exposure to the sun is required for further growth. Taylor records a heavy mortality of seedlings in the first year and an intolerance of dense climbers and shrubs. Nevertheless, the tree is common in secondary forest, and can make rapid growth in exposed conditions. (50 cm or more per year on old farms, but about half this in the less favourable conditions of Tropical Shelterwood plots [Taylor]).
INVENTORY
Tree count <30 cm dbh (TSP): 699 >=30 cm: 2444
No. of botanical survey records: 329
The summary charts show the preference for drier forests and the generally (and increasingly) high exposure of larger trees. Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest, although larger size classes are more common in burnt forest [Hawthorne, 1994]. All sizes of seedling and sapling are less abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].
GROWTH
Girth increment is positively correlated, as with other species, with crown size [Anon., 1959]. It attained c. 1m height in Taylor's silviculture treatment plots after 4 years.
OTHER NOTES
[Neil, 1987]

Antiaris welwitschii see *Antiaris toxicaria*

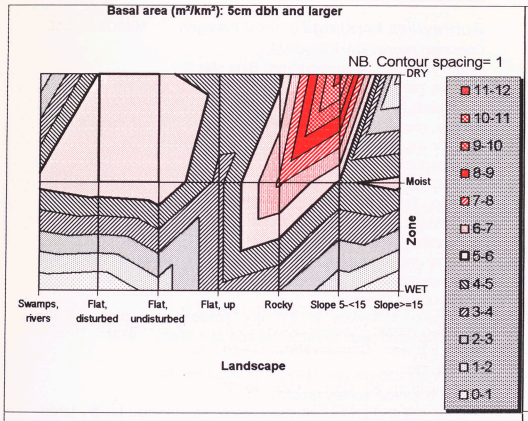
Antidesma laciniatum Muell.Arg. **EUPHORBIACEAE**
Common name: FOTO-NINI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 89 Group: 13D No. 92
Understorey tree with flaky, thin bark and pink slash. Larger trees (>20 cm dbh) are often fluted.
DISTRIBUTION
var. *membranaceum* Muell.Arg. (not to be confused with *A. membranaceum*). Common in Ghana; Guineo-Congolian (Hall and Swaine sp. 49), from riversides and forests [Leonard, 1988].
INVENTORY
Tree count <30 cm dbh (TSP): 15 >=30 cm: 2
No. of botanical survey records: 71

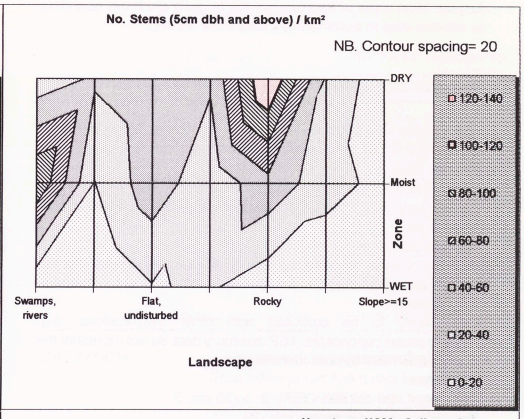
Antidesma membranaceum Muell.Arg.
Common name: NUMANUMAGYAMA **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 89 Group: 13D No. 93
Small to medium-sized tree.
DISTRIBUTION
Common in Ghana, and widespread in Africa (Hall and Swaine sp. 50); especially in drier forests, gallery forests and secondary grasslands [Leonard, 1988].
PHENOLOGY/DISPERSAL
The small fleshy fruits are probably bird-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 3
No. of botanical survey records: 14

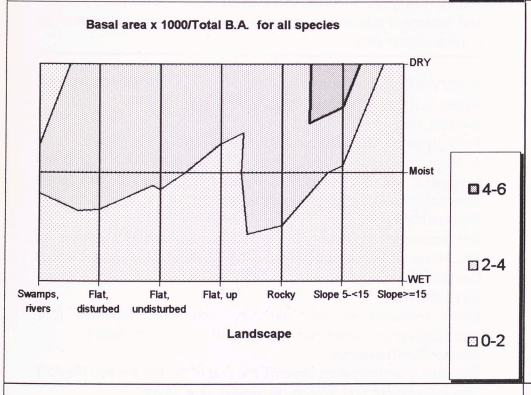
Antrocaryon micraster A.Chev. and Guillaum.
Common name: APROKUMA **ANACARDIACEAE**
Guild: N.P.L.D. **Conservation:** Red star
MATURE TREE
Field guide pp. 182, 241 Group: 35B No. 94
An emergent tree with *Entandrophragma* like leaf-arrangement, but a more lace-like foliage pattern, due to a sparsity of leaves in the crown. Deciduous. The cylindrical bole has no buttresses, smooth when young and scaly with age. The characteristic drupes can usually be found in the leaf-litter. Young leaves are reddish.
DISTRIBUTION
Not very common in Ghana, but scattered throughout semideciduous forests. Guineo-Congolian: from Sierra Leone to Uganda. Produces an edible oil [Abbiw, 1990].
PHENOLOGY/DISPERSAL
The tree is deciduous during the dry season, and flowers are produced with new leaves towards the end of it. Ripe fruits are available by the next dry season [Taylor]. The large fleshy drupes with their unusual stones are, like *Canarium*, probably dispersed by mammals, although they are usually abundant beneath the tree. In Gabon, primates, which relish the fruits, are important dispersers of a related species [Hladik and Hladik, 1967]. Seeds of *Antrocaryon* were found in 2% (rainy season) to 37% (dry season) of piles of elephant dung in Bia South GPR [Martin, 1991].
REGENERATION
Germination can be rapid, but may be delayed by a year. In this sense, and in the lack of detailed information, the species resembles *Canarium*; the subject warrants further research. Gilbert [1952] discovered that the species was the only one of several congolese trees investigated which germinated (and continued) well in full sunlight.

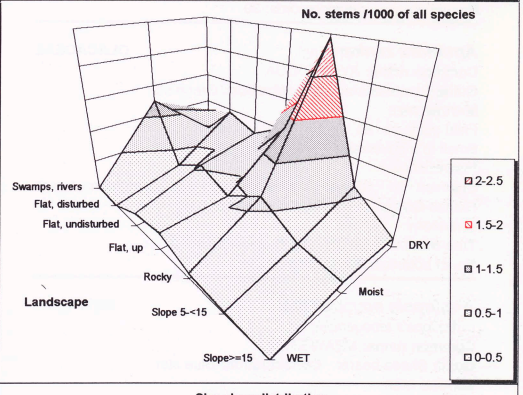
The seedlings rapidly require light, and saplings are restricted to obvious canopy gaps. Taylor records, however, that the saplings do not compete well with weeds.
INVENTORY
Tree count <30 cm dbh (TSP): 73 >=30 cm: 433
No. of botanical survey records: 22
The summary charts show the crown is relatively exposed, and the species has a trough of performance in evergreen forest and on steep slopes. The heavy disturbance of burnt forest seems to be inhibiting the regeneration, even though the largest size classes reach their peak abundance in Dry Semideciduous, fire zone

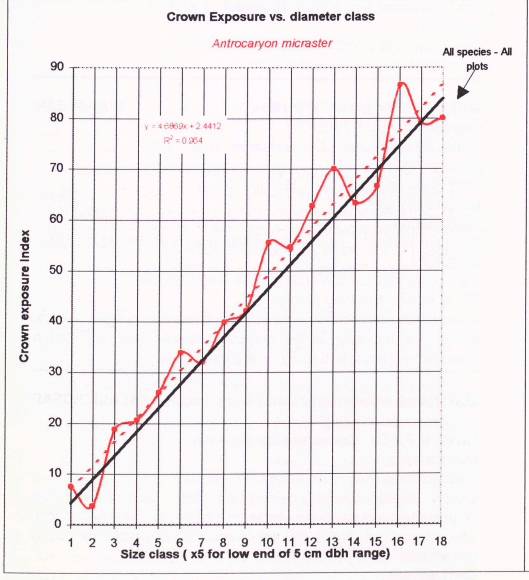
Antrocaryon micraster

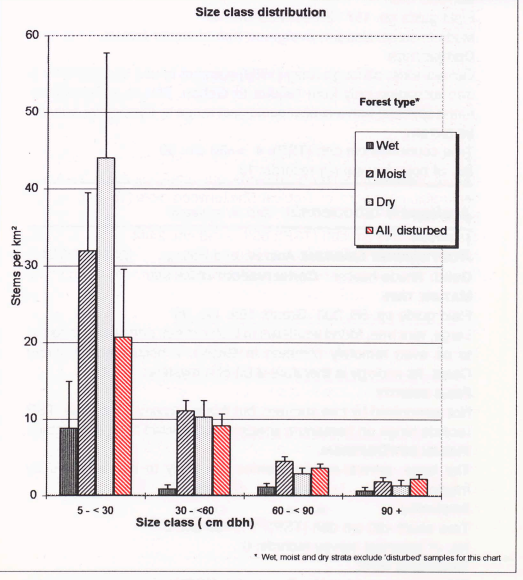












forests. Most sizes of tree (except the largest) are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Aphania senegalensis see *Lepisanthes senegalensis*

Aporrhiza urophylla Gllg. **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 187 Group: 36A No. 95
Medium sized tree, usually confused with other Sapindaceae in TSP inventories.
DISTRIBUTION
Not uncommon in Ghana, especially in evergreen forest; Guinea-wide (Hall and Swaine sp. 52).
FIELD IDENTITY
Quite likely to be confused with other Sapindaceae, e.g. *Lecaniodiscus cupanoides*. TSP inventory data do not represent the true situation due to poor identification.
INVENTORY
Tree count <30 cm dbh (TSP): 3 >=30 cm: 3
No. of botanical survey records: 30

Aptandra zenkeri Engl. **OLACACEAE**
Common name: AYEMTUDUA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 83 Group: 13A No. 96
Small to medium-sized, evergreen tree.
DISTRIBUTION
Common in Ghana, mainly outside of evergreen forest; Guineo-Congolian (Hall and Swaine sp. 53).
INVENTORY
Tree count <30 cm dbh (TSP): 3 >=30 cm: 2
No. of botanical survey records: 31

Araliopsis soyauxii Engl. **RUTACEAE**
(=*Araliopsis tabouensis*)
Common name: MEAWERE
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 157 Group: 28B No. 97
Medium-sized, slender, evergreen tree of wetter forests.
DISTRIBUTION
Guinea-wide, although Keay [1989] appears to use this name for a tree extending only from Nigeria to Gabon. This is an evergreen forest species, with a similar ecological range to *Cynometra ananta*.
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 30
No. of botanical survey records: 13

Araliopsis tabouensis see *A. soyauxii*

Aubregrinia taiensis Aubrev. and Pellegr. **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 58, 236 Group: 10A No. 98
Large, rare tree, found scattered in Moist forest, and nowhere found to be even remotely common in Ghana. It occurs also in Ivory Coast. Its ecology is therefore a bit of a mystery.
FIELD IDENTITY
Not recognised by tree spotters, but this is anyway a rare tree. TSP records hinge on herbarium specimens collected for the inventory.
PHENOLOGY/DISPERSAL
The large, several-seeded berries are likely to be dispersed by mammals.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 5
No. of botanical survey records: 0
TAXONOMIC NOTE
This genus is retained by Pennington [1991], who notes it has only one species and is related to *Breviea*.

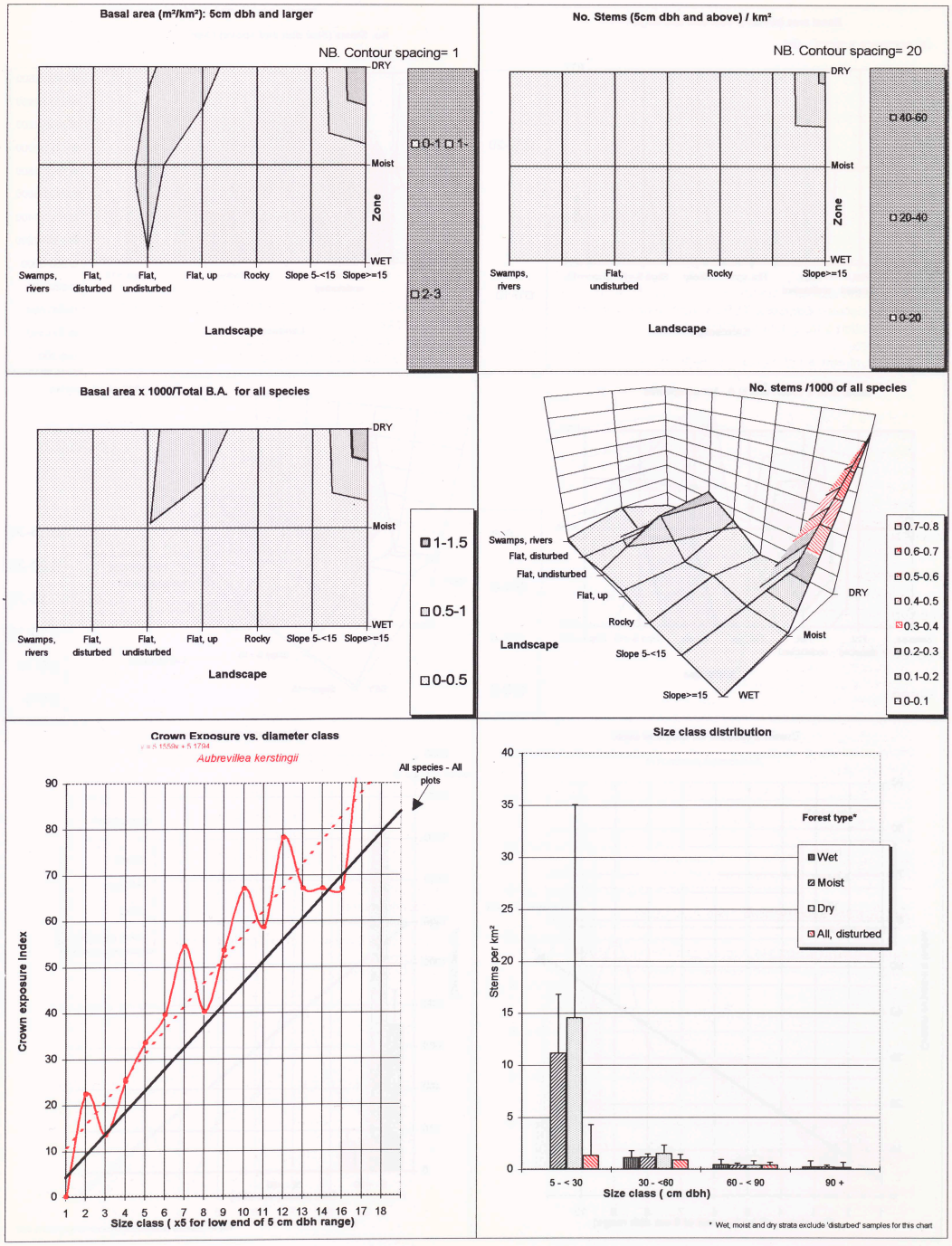
Aubrevillea kerstingii (Harms) Pellegrin **MIMOSACEAE**
Common name: DAHOMANUA
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 220 Group: 38C No. 99
A large, rough-barked tree with pinkish slash and feathery foliage. Sometimes, the crown can be seen to be tiered.
DISTRIBUTION
Characteristic of dry forest on the transition to savanna, e.g. at Boabeng-Fiema [see Fargey, 1989], along with *Khaya grandifoliola* and *Afzelia africana*. Guineo-Congolian [Lock, 1989].
FIELD IDENTITY
Possibly under-represented in TSP inventory due to confusion with other species.
PHENOLOGY/DISPERSAL
In Nigeria if flowers in the dry season, and produces the wind-dispersed pods towards the end of it [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 21 >=30 cm: 52
No. of botanical survey records: 11
The summary chart reveals the expected preference for dry forest, and emergent nature, but the tree is generally too uncommon to provide robust data.

Aubrevillea platycarpa Pellegr. **MIMOSACEAE**
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 219 Group: 38B No. 100
A large, buttressed tree similar to *Piptadeniastrum*; probably evergreen, with red-flushed new leaves. The crown is much more compact than usual for a mimosoid legume.
DISTRIBUTION
Not uncommon in Ghana; Guineo-Congolian (Hall and Swaine sp. 65). However, rather sparsely distributed, mostly in semideciduous forests.
FIELD IDENTITY
Often confused in tree inventory with other legumes (e.g. *Piptadeniastrum*, which has similar buttresses, and crown).
PHENOLOGY/DISPERSAL
Deciduous whilst fruiting towards the end of the dry season [Taylor]. The indehiscent pod is wind-dispersed as a whole.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 11

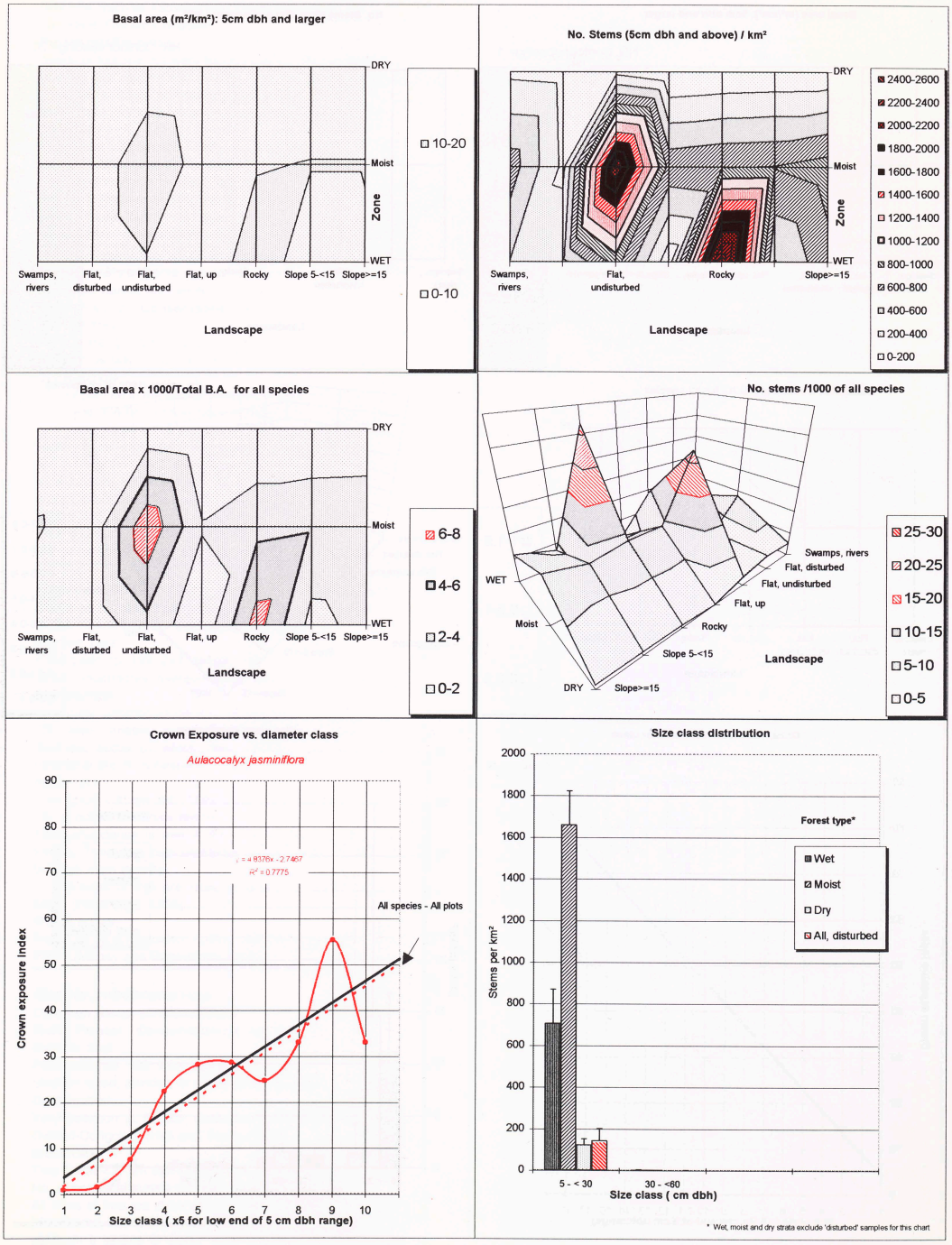
Aulacocalyx jasminiflora Hook.f. **RUBIACEAE**
Common name: NTWESON
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 35 Group: 1E No. 101
Understorey tree.
DISTRIBUTION
Common in Ghana, Guineo-Congolian (Hall and Swaine sp. 66).
INVENTORY
Tree count <30 cm dbh (TSP): 1944 >=30 cm: 37
No. of botanical survey records: 132
A small tree which is less inclined to be shaded than other trees of similar size. It clearly has two favoured types of forest: flat land in moist forest zones, and rocky, evergreen forest.

Balanites wilsoniana Dawe and Sprague **BALANITACEAE**
Common name: KROBODUA
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 165, 233 Group: 31 No. 102
Deeply fluted, probably evergreen tree, usually with the characteristic forked spines visible on the bole or epicormic shoots. The 'stones' of the 5-10 cm drupes can usually be found underneath.
DISTRIBUTION
Seedlings are often found, and germinate, in elephant dung [Lieberman *et al.*, 1987]. Probably the tree most dependent on

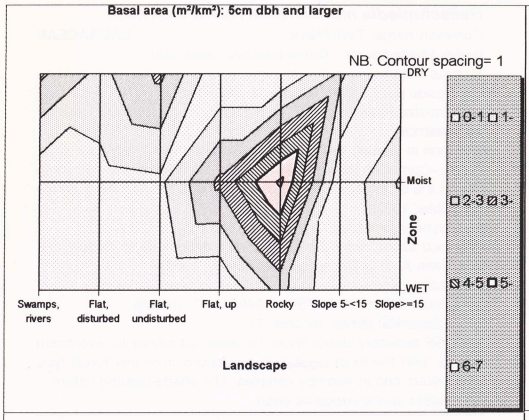
Aubrevillea kerstingii

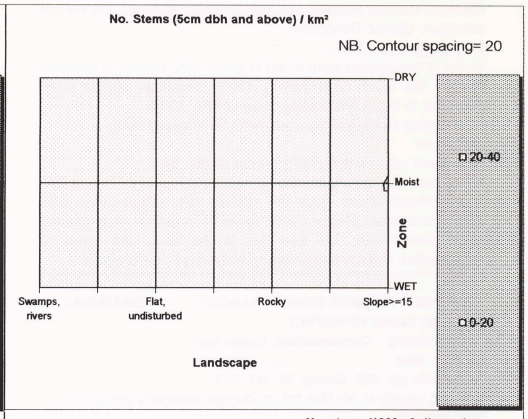


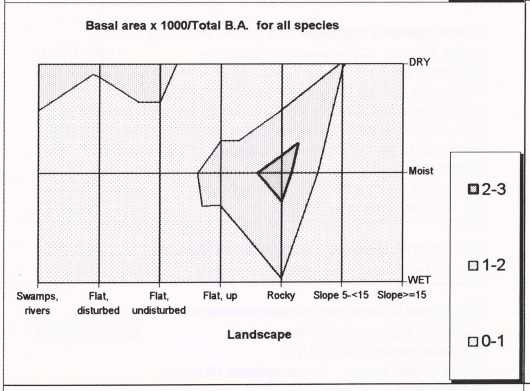
Aulacocalyx jasminiflora

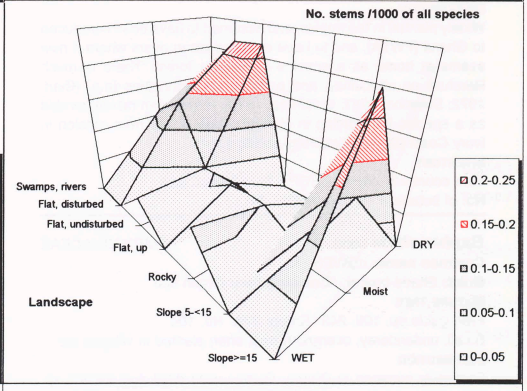


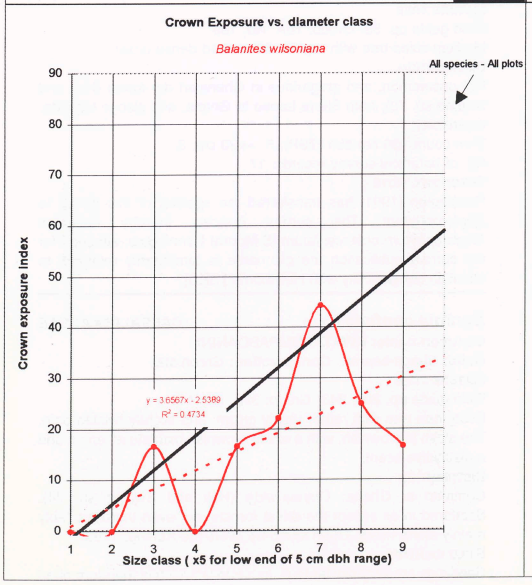
Balanites wilsoniana

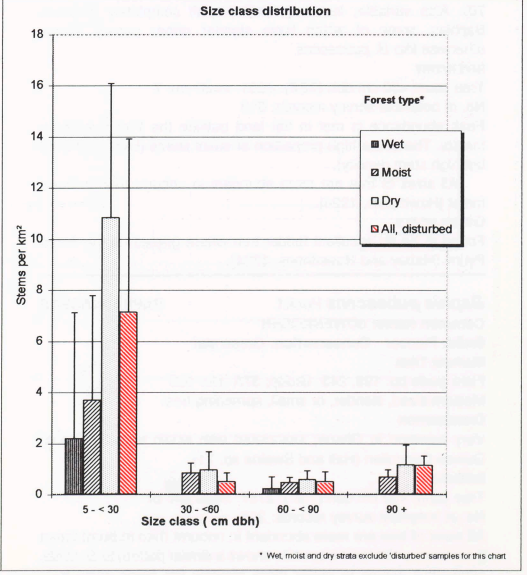












elephants in Ghana, it is most common in elephant-inhabited reserves, such as Asukese and Tain II where, however, it is still not abundant. Guineo-Congolian.

PHENOLOGY/DISPERSAL

Seeds of this species were found in about 10% of piles of elephant dung in Bia South GPR [Martin, 1991], elephants migrate great distances to areas with fruiting trees [White, 1994].

Germinating seeds are not uncommon in elephant dung.

INVENTORY

Tree count <30 cm dbh (TSP): 14 >=30 cm: 58

No. of botanical survey records: 8

The summary charts show the species has a high basal area relative to its stem density. Partly due to the problems of measuring deeply fluted trees, but also due to the rather low levels of regeneration, quite probably due to a shortage of elephants.

Bambusa vulgaris Schrad. *ex* Mendel **GRAMINEAE**

Common name: MPAMPRO

Guild: Swamp **Conservation:** Green star

MATURE TREE

Field guide pp. 223 Group: 39 No. 103

Bamboo usually c. 10-15m tall, in clumps especially along rivers.

DISTRIBUTION

Widely planted in the tropics, and assumed to have been introduced to Ghana [FWTA], and to have escaped along rivers where it now seems at home as a species of riverine forest. There is much literature on silviculture and propagation techniques [e.g. Khan, 1972; Sutiyono, 1987; Uchimura, 1978]. It has been recommended as a species for planting in cleared areas at risk from erosion in Ivory Coast [De la Mensbruge, 1958; 1961].

INVENTORY

Tree count <30 cm dbh (TSP): 1 >=30 cm: 0

No. of botanical survey records: 14

Baphia nitida Lodd. **PAPILIONACEAE**

Common name: oDWEN

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 199, 243 Group: 37A No. 104

Small, understorey, evergreen tree, often planted in villages etc.

DISTRIBUTION

Extremely common in Ghana; Guinea-wide (Hall and Swaine sp. 70). Also variable; included here are all completely glabrous Baphias, some of which have slender rather papery leaves otherwise like *B. pubescens*.

INVENTORY

Tree count <30 cm dbh (TSP): 4001 >=30 cm: 7

No. of botanical survey records: 510

Peak abundance is met in flat land outside the Wet Evergreen forests. There is a high proportion of small stems (low basal area but high stem density).

All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

OTHER NOTES

Found to be an excellent fodder tree where grazed on the Accra Plains [Mabey and Rose-Innes, 1964].

Baphia pubescens Hook.f. **PAPILIONACEAE**

Common name: oDWENKOBIRI

Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 199, 243 Group: 37A No. 105

Medium-sized, slender, or small, spreading tree.

DISTRIBUTION

Very common in Ghana; associated with acidic soils in Ghana; Guineo-Congolian (Hall and Swaine sp. 71).

INVENTORY

Tree count <30 cm dbh (TSP): 2757 >=30 cm: 67

No. of botanical survey records: 215

All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The species shows a similar pattern to *B. nitida*, although it seems to prefer more strongly flat areas away from valleys.

Beilschmiedia mannii (Meisn.) Benth. and Hook.f.

Common name: TWEANKA **LAURACEAE**

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 71, 238 Group: 12 No. 106

Medium-sized tree.

DISTRIBUTION

Common in Ghana, and strongly associated with base poor soils; Guineo-Congolian (Hall and Swaine sp. 72). Outside the evergreen forests it is mostly confined to stream banks. Exploited for an edible oil [Abbiw, 1990].

PHENOLOGY/DISPERSAL

In Banco forest, Ivory Coast, it flowers from April to August and fruits from April to December [De Koning, 1983].

INVENTORY

Tree count <30 cm dbh (TSP): 1249 >=30 cm: 336

No. of botanical survey records: 77

The TSP summary charts show the expected affinity for evergreen forests, with the most significant excursions from this forest type along rivers and in swampy samples. The shade-bearing nature is also visible on the exposure chart.

Belonophora hypoglauca (Welw. ex Hiern) A.Chev.

Guild: Pioneer **Conservation:** Blue star **RUBIACEAE**

MATURE TREE

Field guide pp. 32 Group: 1D No. 107

Small tree or shrub of dry forest, including gallery forest and rocky hills in savanna, from Guinea to Sudan and Angola [Geerling, 1982]. Too small to be represented adequately in TSP Inventory.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 7

Bequaertiodendron magalismontanum

(Sond.) Heine and J.H.Hemsley see *Englerophytum*

Bequaertiodendron oblanceolatum

(S.Moore) Heine and J.H.Hemsley **SAPOTACEAE**

Common name: NNANFURO

Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 58 Group: 10A No. 109

Medium-sized tree with regular flutes, and dense crown.

DISTRIBUTION

Not uncommon, and gregarious in Ghanaian dry forest (Hall and Swaine sp. 73); from Sierra Leone to Ghana, and also in Uganda.

INVENTORY

Tree count <30 cm dbh (TSP): 5 >=30 cm: 3

No. of botanical survey records: 17

TAXONOMIC NOTE

Pennington [1991] has transferred the species of this genus to *Englerophytum*. The current species thereby becomes *Englerophytum oblanceolatum* (S.Moore) Pennington, although for the current publication the old name is temporarily retained, to maintain compatibility with Hawthorne [1990].

Berlinia confusa Hoyle **CAESALPINIACEAE**

Common name: KWATAFOMPABOANINI

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 206, 243 Group: 37F No. 110

Evergreen tree with rather untidy crown. and slightly twisted bole. The slash is brownish, with a red to brownish exudate at length and a distinctive scent.

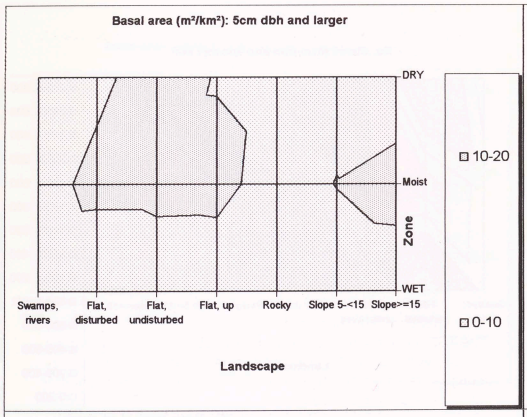
DISTRIBUTION

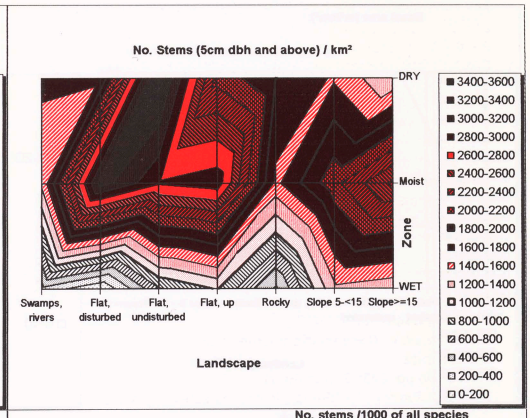
Common in Ghana; Guinea-wide (Hall and Swaine sp. 74). Scattered in all except the driest forests, but even there probably mainly along rivers. Often found by rivers [de Koning, 1983].

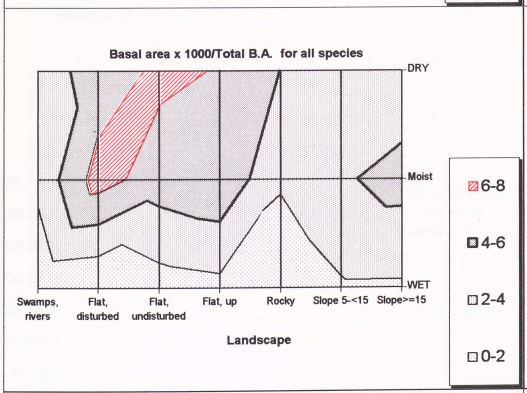
FIELD IDENTITY

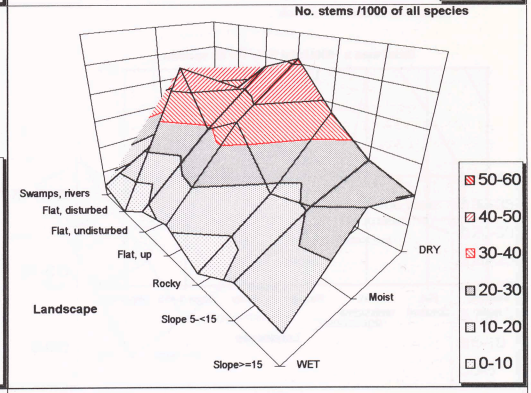
Seedlings are very similar to *B. tomentella*, which is therefore often joined in data. Inventory data joins all *Berlinia spp.*

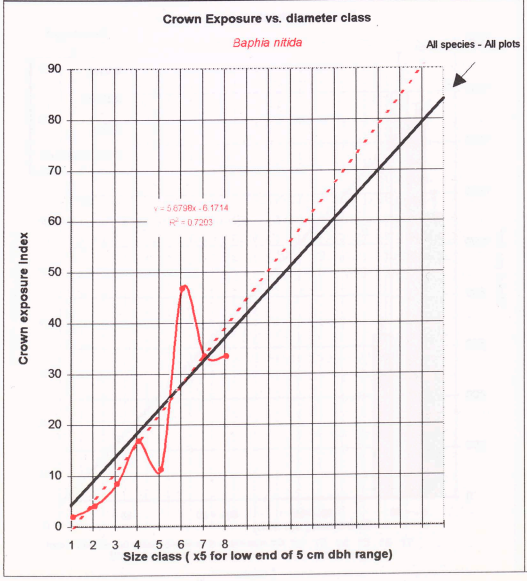
Baphia nitida

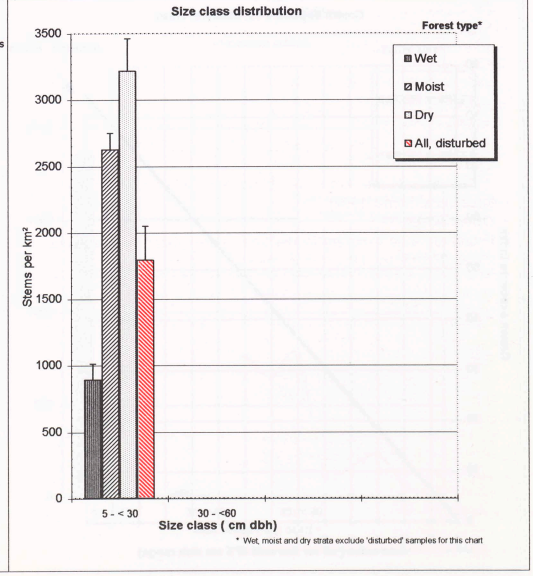




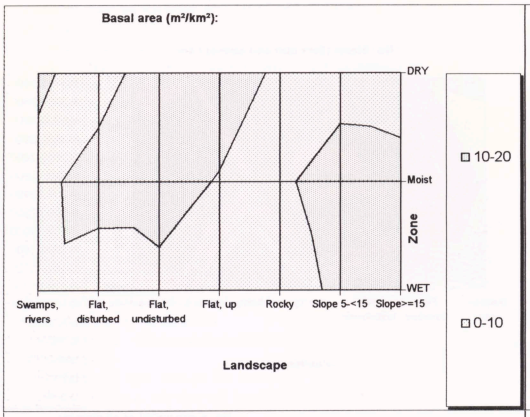


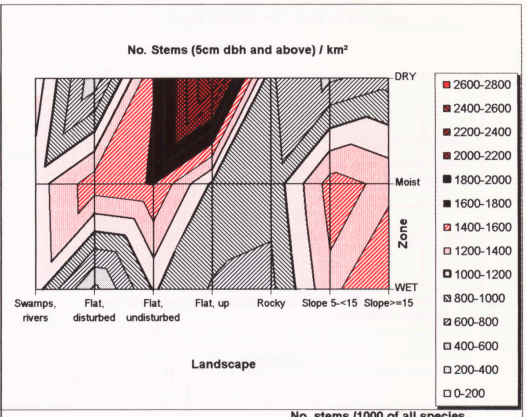


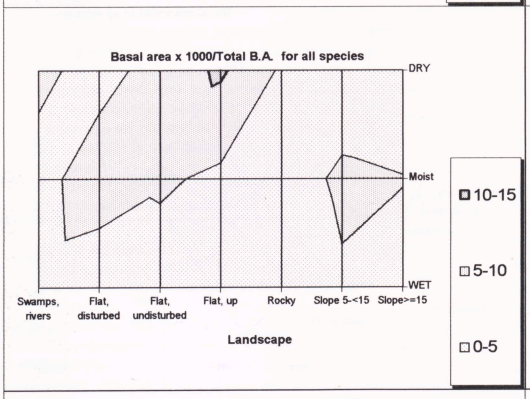


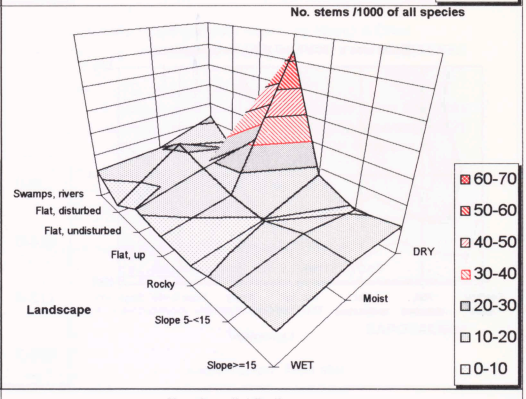


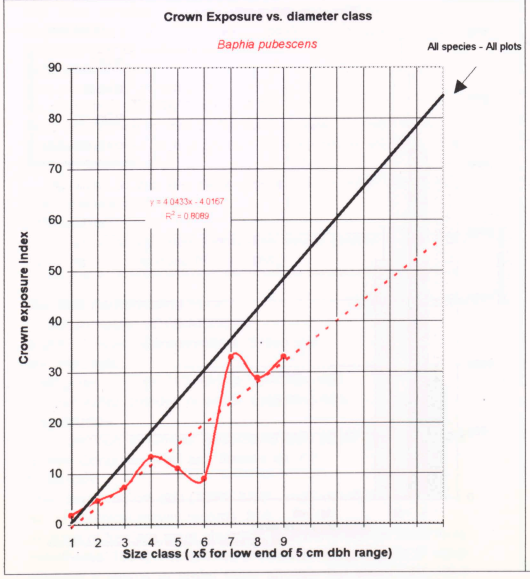
Baphia pubescens

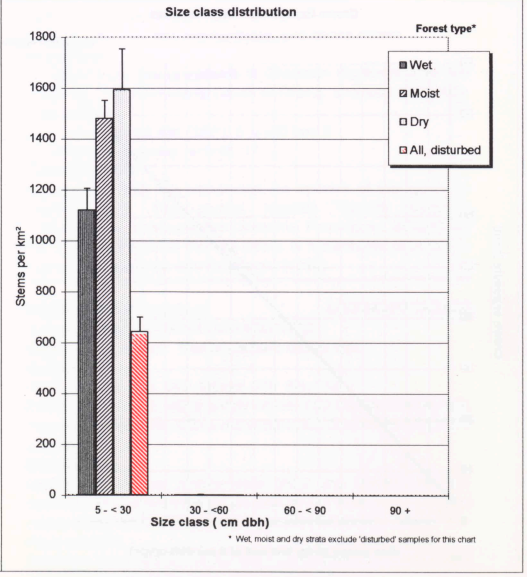




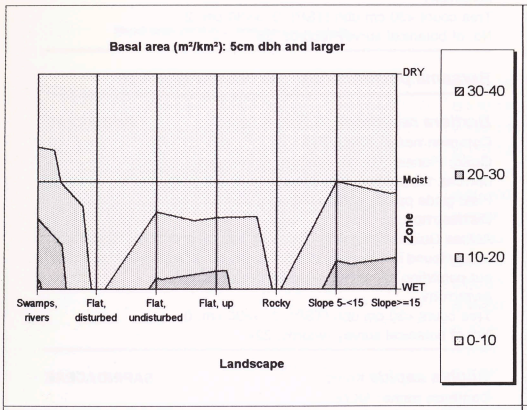


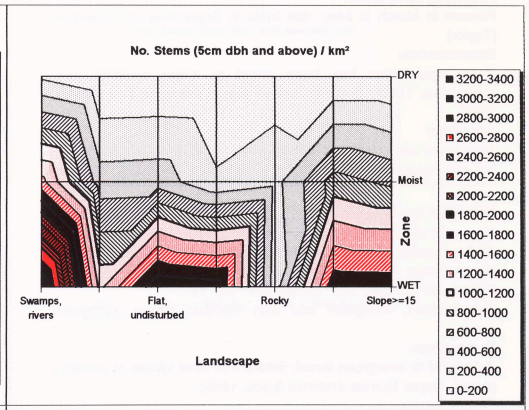


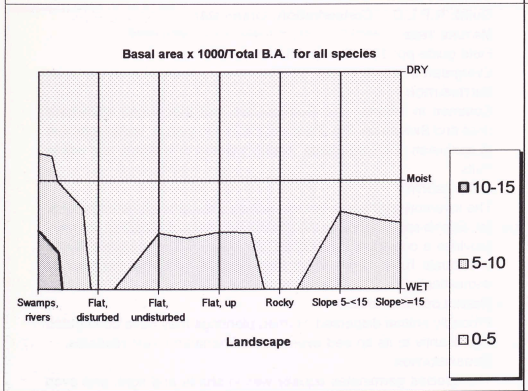


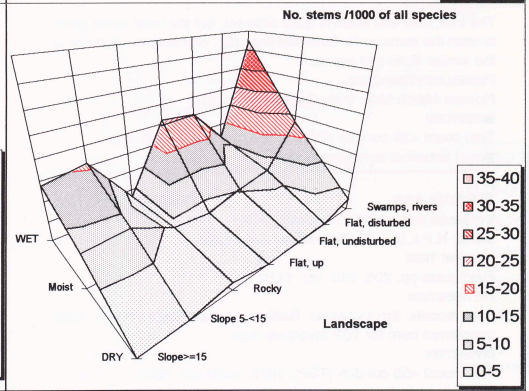


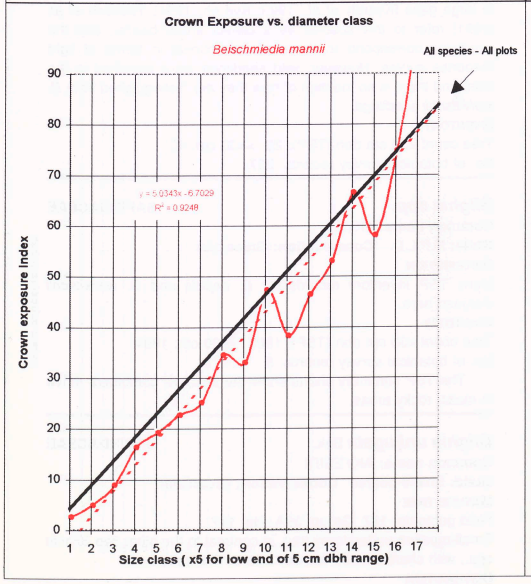
Beilschmiedia mannii

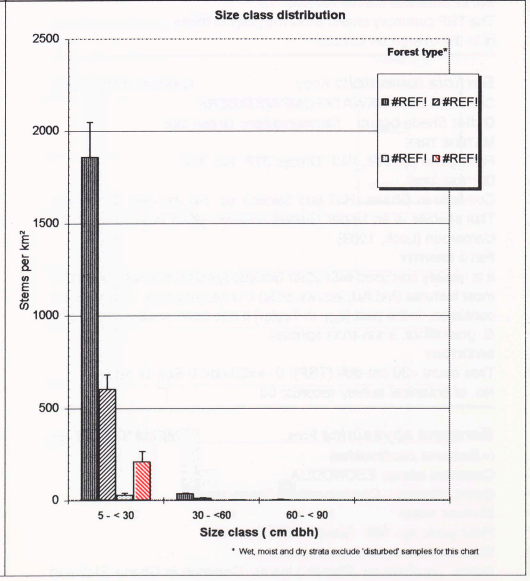












PHENOLOGY/DISPERSAL
Flowers in March to May; ripe fruits in September to December [Taylor].
REGENERATION
Poor regeneration has been noted in some contexts [e.g. Voorhoeve, 1965], possibly due to insect predation [de Koning, 1983]
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0 See *B. spp*
No. of botanical survey records: 49

Berlinia occidentalis Keay **CAESALPINIACEAE**
Common name: KWATAFOMPABOAKoKoo
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 206, 243 Group: 37F No. 111
Unbuttressed, evergreen tree with rounded, dense, evergreen crown.
DISTRIBUTION
Restricted to evergreen forest, where it is most typical of swampy places. Upper Guinea endemic [Lock, 1989].
FIELD IDENTITY
The tree, bole and slash is quite different, but the local name given is often the same as for other *Berlinia* spp., probably in reference to the similar fruits and leaves.
PHENOLOGY/DISPERSAL
Flowers March-May; fruits Oc.-Nov. [Taylor].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0 See *B. spp*
No. of botanical survey records: 11

Berlinia spp. **CAESALPINIACEAE**
Common name: KWATAFOMPABOA
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 206, 243 No. 1110
DISTRIBUTION
See records for individual Berlinias, which have mostly been transferred here for TSP inventory data.
INVENTORY
Tree count <30 cm dbh (TSP): 1872 >=30 cm: 3263
No. of botanical survey records: 13
The TSP summary charts show the peak of these species combined is in the evergreen forests.

Berlinia tomentella Keay **CAESALPINIACEAE**
Common name: KWATAFOMPABOABERE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 206, 243 Group: 37F No. 112
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 74), but see *B.confusa*. This species is an Upper Guinea endemic apart from a record for Cameroun [Lock, 1989].
FIELD IDENTITY
It is usually confused with other *Berlinia* species, between which for most features (habitat, leaves, bole) it is intermediate. To add to the confusion, in the past [e.g. in Taylor] it has been amalgamated with *B. grandiflora*, a savanna species.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0 See *B. spp.*
No. of botanical survey records: 50

Bersama abyssinica Fres. **MELIANTHACEAE**
(=*Bersama paullinioides*)
Common name: ESONODUA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 166 Group: 31B No. 113
DISTRIBUTION
Subsp. *paullinioides* (Planch.) Verdc. Common in Ghana (Hall and Swaine sp. 75), and widespread in tropical Africa, though very variable. Small tree of the forest edge or gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 2
No. of botanical survey records: 26

Bersama paullinioides see *Bersama abyssinica*

Bertiera racemosa (G.Don) K.Schum. **RUBIACEAE**
Common name: KAKADUA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 30 Group: 1C No. 114
DISTRIBUTION
Across Guineo-Congolian region to Tanzania [FWTA]. Small tree, mainly found in disturbed evergreen forest, along stream banks etc. but persisting sometimes in more closed areas.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 22<

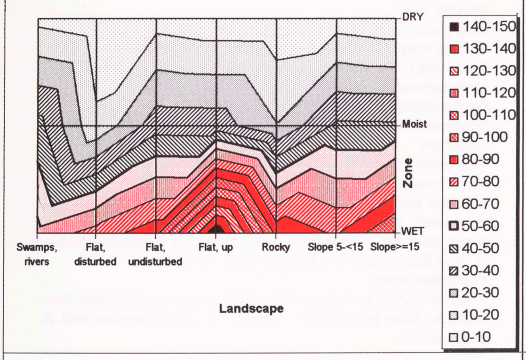
Blighia sapida Konig **SAPINDACEAE**
Common name: AKYE
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 187 Group: 36A No. 115
Evergreen tree with dense crown
DISTRIBUTION
Common in Ghana, and Guinea-wide, but introduced elsewhere (Hall and Swaine sp. 76). Records are joined with *B. welwitschii* due to confusion of young plants. Widely planted in villages; has edible fruits.
FIELD IDENTITY
The inventory and some botanic survey data amalgamates records (cf. *Blighia* spp.), although the greater hairiness of *B.sapida* normally provides a convincing distinction. *B. sapida* is Guinea-wide. Some individuals have larger fruits than normal, probably because of domestication.
PHENOLOGY/DISPERSAL
Probably animal dispersed. Human plantings may have contributed significantly to its spread even within Ghanaian forest reserves.
REGENERATION
The species germinates equally well in shade and light, and even in large gaps [Kyereh *et al.*, 1993; Kyereh, 1994]. Riddoch *et al.* [1991] refer to this species as a climax shade-bearer, and the seedlings correspond to those of *Strombosia* in terms of light response curves. However, wild seedlings were identified in the field, and there is no mention of how they are distinguished from *B. welwitschii* seedlings.
INVENTORY
Tree count <30 cm dbh (TSP): 28 >=30 cm: 40
No. of botanical survey records: 227

Blighia spp. **SAPINDACEAE**
Common name: AKYE
Guild: N.P.L.D. **Conservation:** Green star
DISTRIBUTION
Many TSP inventory records for *B. sapida* and *B. welwitschii* included here.
INVENTORY
Tree count <30 cm dbh (TSP): 1863 >=30 cm: 1994
No. of botanical survey records: 8
The TSP summary charts show the species, combined, thrive in moist, rocky areas.

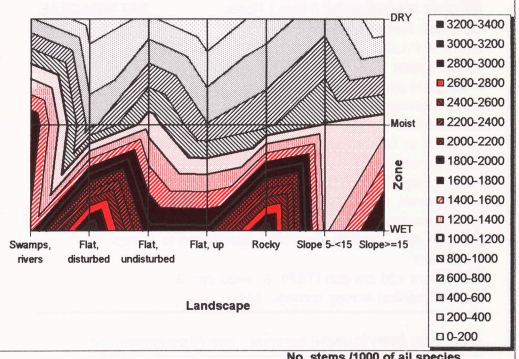
Blighia unijugata Bak. **SAPINDACEAE**
Common name: AKYEBIRI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 187 Group: 36A No. 117
Small-medium understorey tree, in contrast to the other two *Blighia* spp., with characteristic 'tuft domatia' in the leaves.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 77); widespread in tropical Africa.

Berlinia spp.

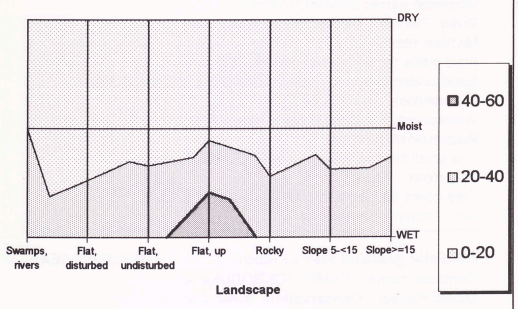
Basal area (m²/km²): 5cm dbh and larger



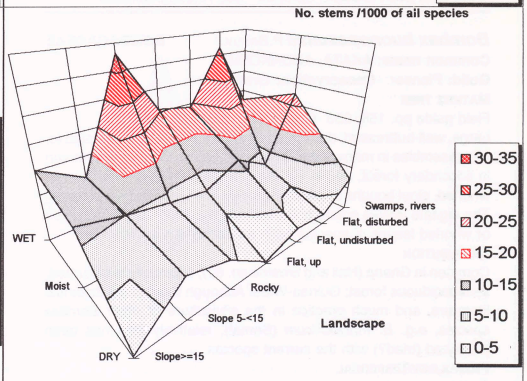
No. Stems (5cm dbh and above) / km²



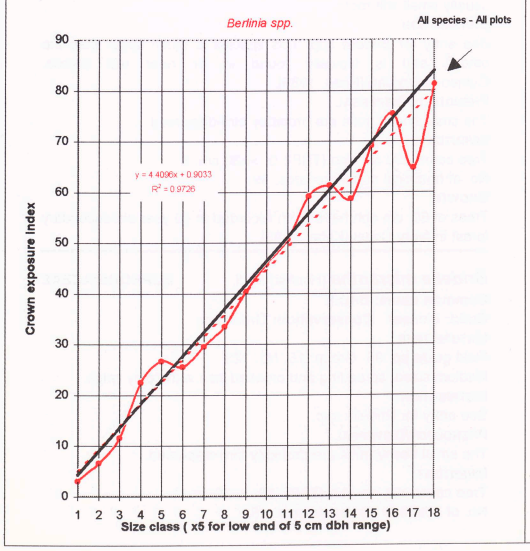
Basal area x 1000/Total B.A. for all species



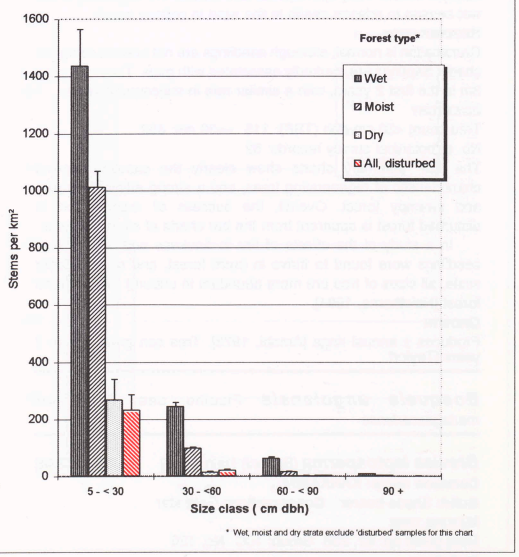
No. stems /1000 of all species



Crown Exposure vs. diameter class



Size class distribution



* Wet, moist and dry strata exclude 'disturbed' samples for this chart

INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 0
No. of botanical survey records: 166

Blighia welwitschii (Hiern.) Radlk. **SAPINDACEAE**
Common name: AKYEKOBIRI
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 187 Group: 36A No. 116
Dense-crowned, evergreen tree.
DISTRIBUTION
Common in Ghana, and Guineo-Congolian (Hall and Swaine sp. 76); see notes for *B. sapida*. This is a species commoner in moister forests than *B. sapida*, which is often seen as a regenerating, shiny-leaved, understorey tree.
FIELD IDENTITY
For TSP data, records have been transferred to *B.* spp.
INVENTORY
Tree count <30 cm dbh (TSP): 6 >=30 cm: 3
No. of botanical survey records: 144

Bombax brevicuspe Sprague see *Rhodognaphalon*

Bombax buonopozense P.Beauv. **BOMBACACEAE**
Common name: AKATA, AKONKODIE
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 158, 233 Group: 28C No. 119
Large, well-buttressed, deciduous tree. This prickly tree is related to, and resembles in many ways *Ceiba pentandra*. The tree is common in secondary forest, and is yet another such species with strongly whorled, stout boughs of which the lower ones tend to be horizontal. The digitate leaves create a similar foliage pattern to the clustered or whorled leaves of species such as *Terminalia* or *Alstonia*.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 82), especially in disturbed, semideciduous forest; Guinea-Wide. Although there is a substantial literature, and much practice in the silviculture of other *Bombax* species, e.g. *B. malabaricum* (Semal), relatively little has been published (tried?) with the current species.
PHENOLOGY/DISPERSAL
Red flowers are produced on the leafless trees during the dry season. Mature fruits open on the tree around the beginning of the wet season to release seeds to the wind in cottony kapok.
REGENERATION
Germination is normal, although seedlings are not seen in complete shade. Saplings are markedly associated with gaps. They can grow 3m in the first 2 years, with a similar rate in subsequent years.
INVENTORY
Tree count <30 cm dbh (TSP): 115 >=30 cm: 452
No. of botanical survey records: 52
The TSP summary charts show clearly the exposed crowns characteristic of regenerating trees, and a strong affinity for rocky and swampy forest. Overall, the success of regeneration in disturbed forest is apparent from the bar charts of stem numbers.

In a study of the effects of fire in Asukese and other F.R.s, seedlings were found to thrive in burnt forest, and on a broader scale, all sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].
GROWTH
Produces ± annual rings [Amobi, 1973]. Tree can grow 3 m in 2 years [Taylor].

Bosqueia angolensis Ficalho see *Trilepisium madagascariense*

Breviea leptosperma (Baehni) Heine **SAPOTACEAE**
Common name: KANKABIM
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 62, 236 Group: 10C No. 120
INVENTORY
Tree count <30 cm dbh (TSP): 14 >=30 cm: 29
No. of botanical survey records: 3

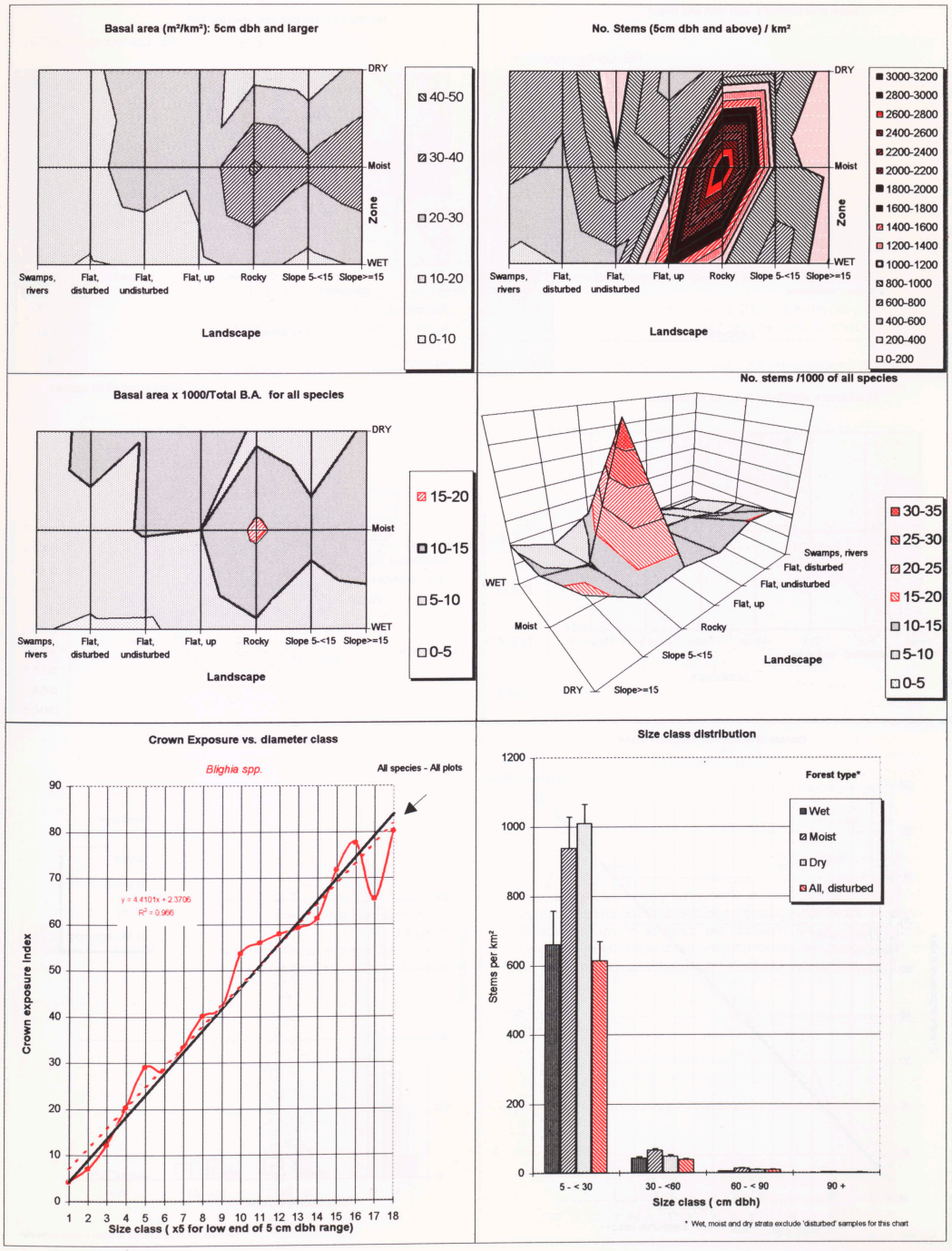
Breviea sericea Aubrev. and Pellegr. **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 62, 236 Group: 10C No. 120
Small to medium-sized tree, with golden-brown, dense crown. Older trees, which are not very common, develop deeply fluted/ high, plank-buttressed boles.
DISTRIBUTION
Scattered throughout semideciduous forests.
INVENTORY
Tree count <30 cm dbh (TSP): 14 >=30 cm: 29
No. of botanical survey records: 3
Although stem numbers are highest on moist forest slopes, as anticipated, there is an unusual, large basal area in evergreen forest, flat lands. This is quite conceivably due to misidentification of large Sapotaceae in such areas (?*C. delevoyi*).
TAXONOMIC NOTE
A genus related to *Aubregrinia* with a single species, from Ivory Coast to Zaire (*B. sericea*, having been amalgamated with *B. leptosperma*).

Bridelia atroviridis Muell.Arg. **EUPHORBIACEAE**
Common name: oPAMKOTOKRODU
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 95 Group: 15 No. 121
Small understorey, spiny tree, widespread in tropical Africa.
DISTRIBUTION
Widespread in tropical Africa [Irvine, 1961].
PHENOLOGY/DISPERSAL
The small fleshy fruits are probably bird-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 9 >=30 cm: 1
No. of botanical survey records: 11

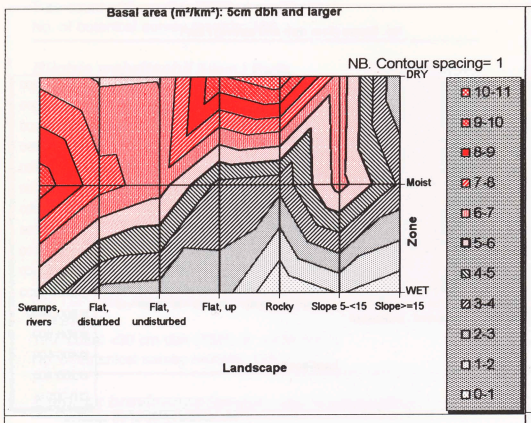
Bridelia grandis Pierr *ex* Hutch. **EUPHORBIACEAE**
Common name: oPAMKOTOKRODUKeSe
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 95, 233 Group: 15 No. 122
Large tree with distinctively scented, red slash, flaky bark, and usually small stilt roots.
DISTRIBUTION
See entry for *Bridelia* spp. This species is much larger than the others, and is typically found in or near wet places. Guineo-Congolian [Keay, 1989].
PHENOLOGY/DISPERSAL
The small fleshy fruits are probably bird-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 2
No. of botanical survey records: 49
GROWTH
Trees of 80 cm dbh have been recorded in 40 year old secondary forest in Ivory Coast [Kahn, 1982].

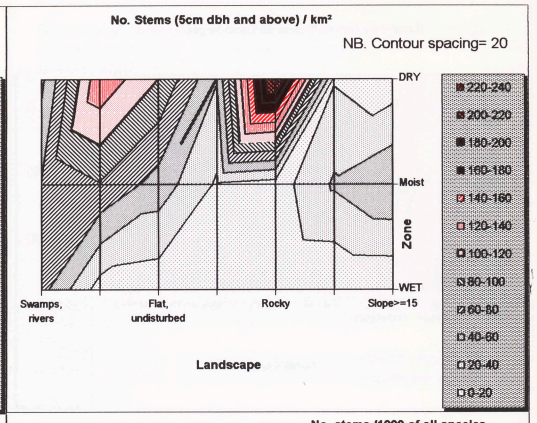
Bridelia micrantha (Hochst) Baill. **EUPHORBIACEAE**
Common name: BADIE
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 95 Group: 15 No. 123
Medium-sized, spreading and crooked tree with spiny twigs.
DISTRIBUTION
See entry for Bridelia spp.
PHENOLOGY/DISPERSAL
The small fleshy fruits are probably bird-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 36 >=30 cm: 1
No. of botanical survey records: 15

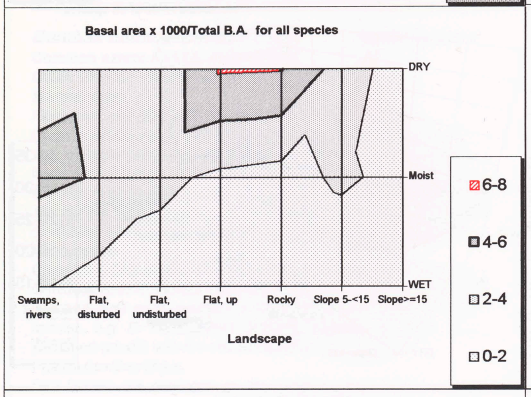
Blighia spp.

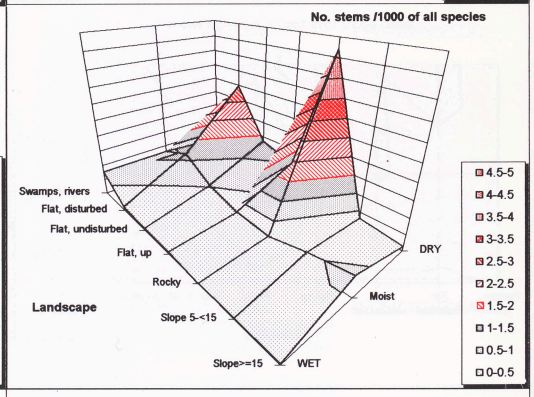

Basal area (m²/km²): 5cm dbh and larger
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
40-50
30-40
20-30
10-20
0-10
No. Stems (5cm dbh and above) / km²
3000-3200
2800-3000
2600-2800
2400-2600
2200-2400
2000-2200
1800-2000
1600-1800
1400-1600
1200-1400
1000-1200
800-1000
600-800
400-600
200-400
0-200
Basal area x 1000/Total B.A. for all species
15-20
10-15
5-10
0-5
No. stems /1000 of all species
30-35
25-30
20-25
15-20
10-15
5-10
0-5
Crown Exposure vs. diameter class
Blighia spp.
All species - All plots
y = 4.4101x + 2.3706
R² = 0.966
Crown exposure index
Size class (x5 for low end of 5 cm dbh range)
Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
90 +
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

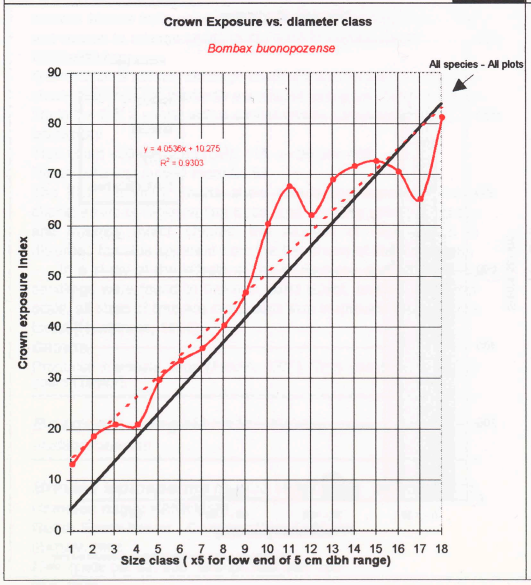
Bombax buonopozense

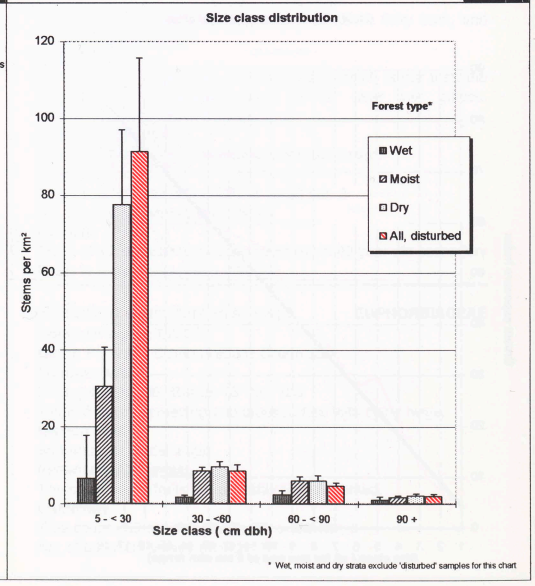




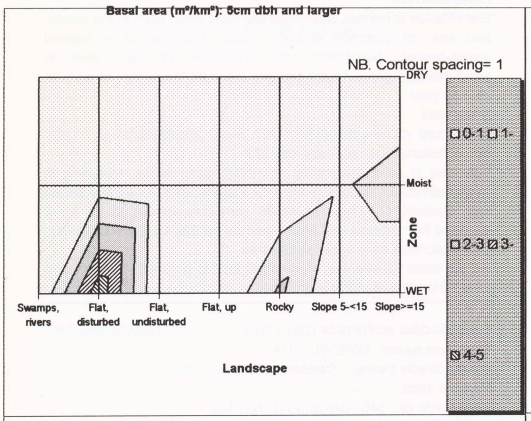


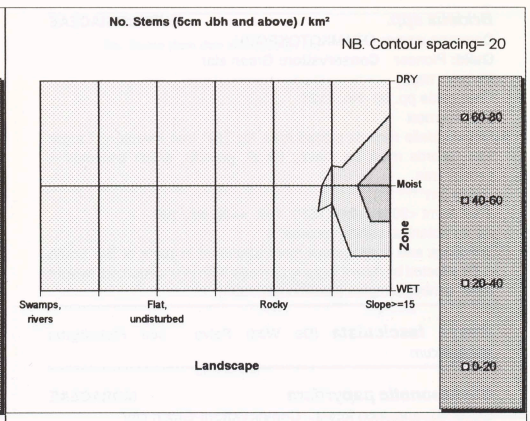


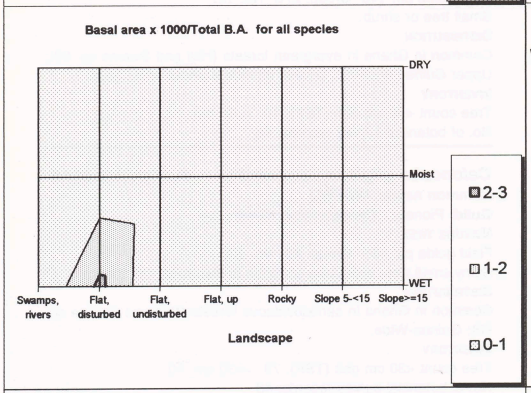


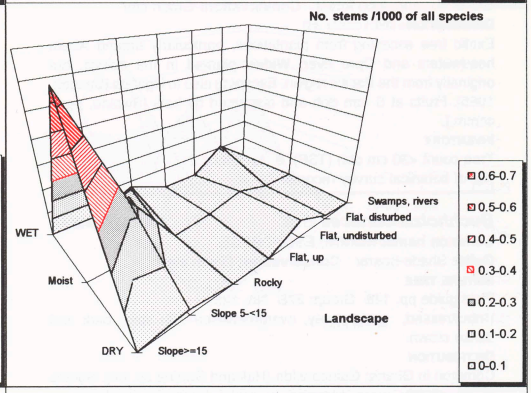


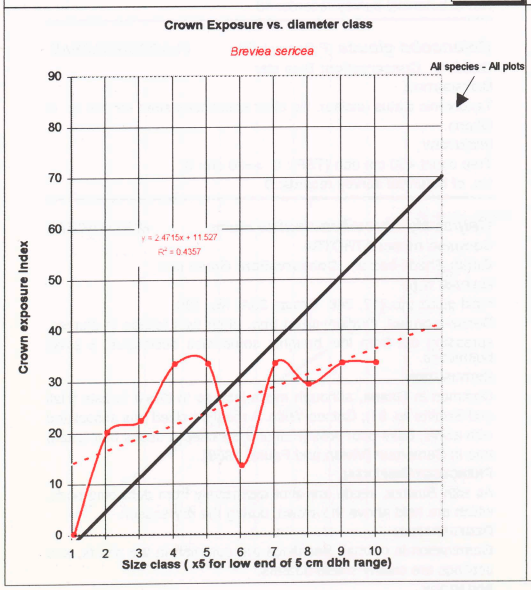
Breviea sericea

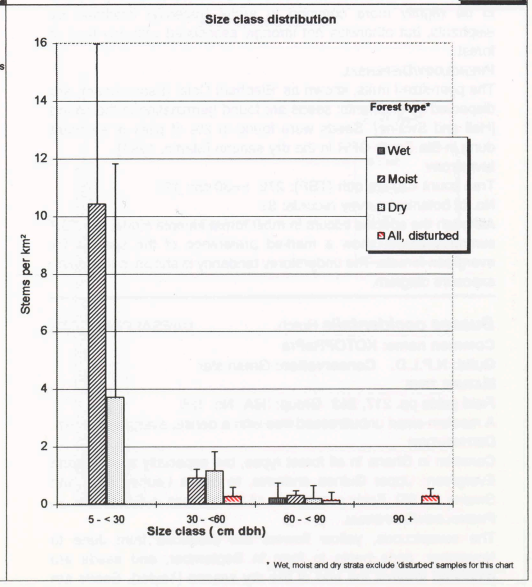












Bridelia spp. **EUPHORBIACEAE**
Common name: OPAMKOTOKRODU
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 95 No. 1121
DISTRIBUTION
Most *Bridelia* records placed here for TSP tree inventory. Larger tree records must be mainly for *B. grandis*, which becomes a canopy tree.
INVENTORY
Tree count <30 cm dbh (TSP): 143 >=30 cm: 166
No. of botanical survey records: 0
Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

Brieya fasciculata (De Wild) Paiva see *Piptostigma fasciculatum*

Broussonetia papyrifera **MORACEAE**
Guild: Savanna/non-forest **Conservation:** Green star
DISTRIBUTION
Exotic tree escaping from plantations, particularly around Afram headwaters and Opro river. Widely planted in the tropics, but originally from the Pacific region. Escaping also in Uganda [Synnott, 1985]. Fruits at 5 cm dbh and dispersed by bats [Swaine, pers. comm.].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 7

Buchholzia coriacea Engl. **CAPPARACEAE**
Common name: KONINI, ESONOBESE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 146 Group: 27B No. 125
Unbuttressed, understorey, evergreen tree with spicy bark and dense crown.
DISTRIBUTION
Common in Ghana; Guinea-wide (Hall and Swaine sp. 84). Seems to be slightly more common in areas (recently) inhabited by elephants, but otherwise not strongly associated with any type of forest.
PHENOLOGY/DISPERSAL
The pear-sized fruits, known as 'Elephant Cola' (Esono-bese), are dispersed by elephants; seeds are found germinating in their dung [Hall and Swaine]. Seeds were found in 2% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 279 >=30 cm: 121
No. of botanical survey records: 83
Although the species occurs in most forest sample strata, the TSP summary charts show a marked preference of the species for evergreen forests. The understorey tendency is shown in the crown exposure diagram.

Bussea occidentalis Hutch. **CAESALPINIACEAE**
Common name: KOTOPRePre
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 217, 243 Group: 38A No. 126
A medium-sized unbuttressed tree with a dense, evergreen crown.
DISTRIBUTION
Common in Ghana in all forest types, but especially so in Upland Evergreen; Upper Guinea endemic, to Sierra Leone (Hall and Swaine sp. 85). Fairly common in all forest types in Ghana.
PHENOLOGY/DISPERSAL
The conspicuous, yellow flowers are produced from June to November; pods begin to form in September, and seeds are produced towards the end of the dry season [Taylor]. Seeds are shot from the bursting pods throughout the drier months. The seeds are also eaten by Colobus [Hall and Swaine].
REGENERATION
Germination is normal. Seedlings are most often seen in the shade, and are not common in large gaps. The tree is a marked shade-bearer, benefitting from increases of light level in small-medium gaps. Taylor records a height increment of c.15-35 cm per year.
INVENTORY
Tree count <30 cm dbh (TSP): 397 >=30 cm: 1225
No. of botanical survey records: 123
This tree is most successful in moist, rocky areas, including in evergreen forest, but otherwise is less abundant in evergreen forest than elsewhere. Trees of 15-25 cm dbh appear to be more exposed than normal, but above and below this size, the species is best described as a lower storey tree.
All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

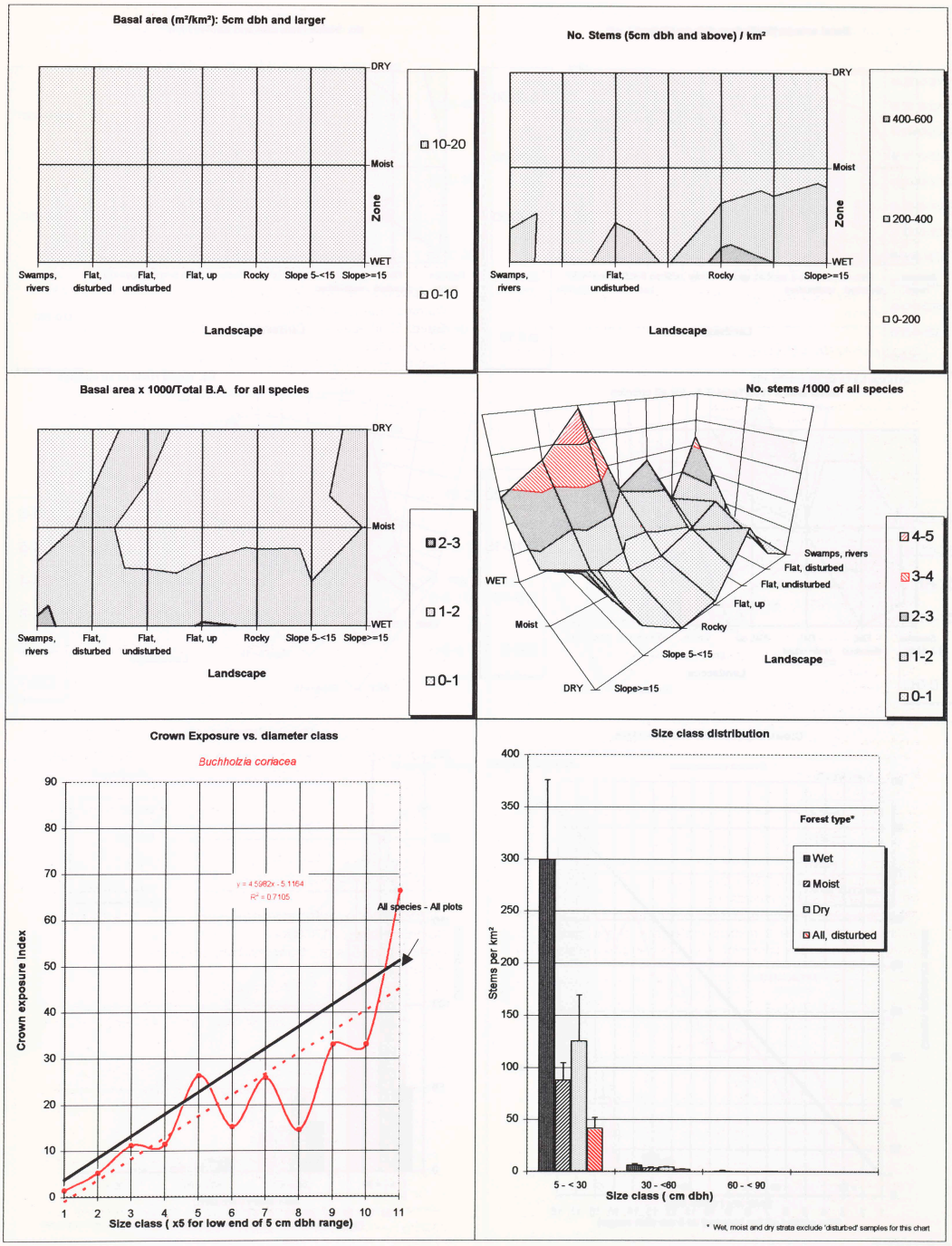
Caloncoba echinata (Oliv.) Gilg **FLACOURTIACEAE**
Common name: AWIEWU-NUA
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 146 Group: 27B No. 127
Small tree or shrub.
DISTRIBUTION
Common in Ghana in evergreen forests (Hall and Swaine sp. 89); Upper Guinea endemic. Locally abundant under small gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 10 >=30 cm: 0
No. of botanical survey records: 66

Caloncoba gilgiana (Sprague) Gilg **FLACOURTIACEAE**
Common name: AWIEWU
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 135 Group: 23 No. 128
Spiny small tree, especially common in disturbed, dry forest.
DISTRIBUTION
Common in Ghana in semideciduous forests (Hall and Swaine sp. 90); Guinea-Wide.
INVENTORY
Tree count <30 cm dbh (TSP): 79 >=30 cm: 10
No. of botanical survey records: 48

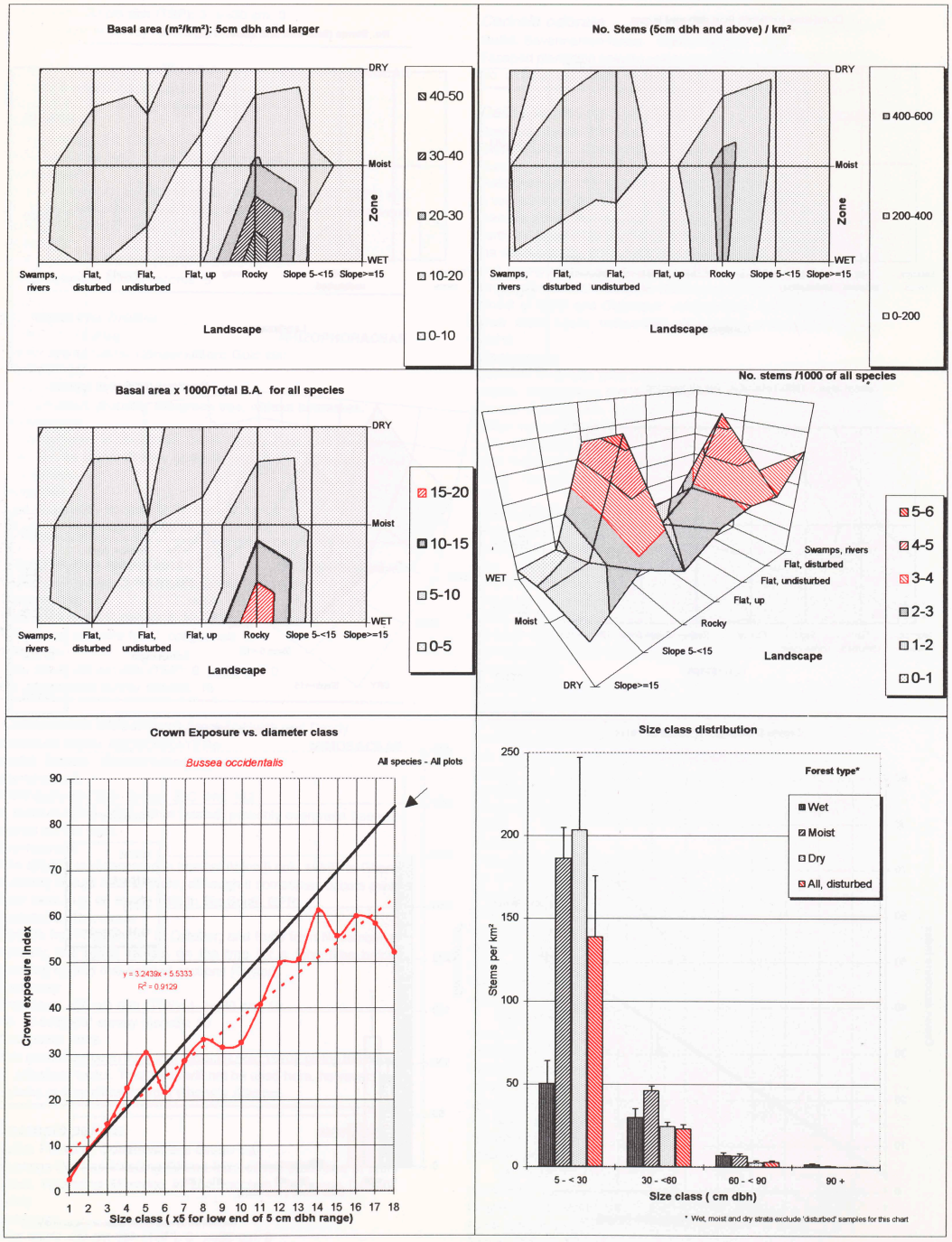
Caloncoba glauca (P.Beauv.) Gilg **FLACOURTIACEAE**
Guild: 0 **Conservation:** Blue star
DISTRIBUTION
Taxonomic status unclear. No clear specimens seen for this sp. in Ghana.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Calpocalyx brevibracteatus Harms **MIMOSACEAE**
Common name: ATROTRe
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 217, 248 Group: 38A No. 130
Dense-crowned, medium-sized tree, often with foliage in plumes, spreading out from low boughs; sometimes deciduous. ± small buttresses.
DISTRIBUTION
Common in Ghana, although much less so in driest forests (Hall and Swaine sp. 91); Guinea-Wide. A medium-sized tree associated with acidic, base-poor soils [Hall and Swaine]. A useful fruit (seed) tree in Cameroun [Vivien and Faure, 1989].
PHENOLOGY/DISPERSAL
As with *Bussea*, seeds are shot explosively from dehiscing pods, which are held above the crown, during the dry season.
REGENERATION
Germination is normal. Seedlings are common in the shade, and saplings are clearly shade-bearers.
INVENTORY
Tree count <30 cm dbh (TSP): 2215 >=30 cm: 1188
No. of botanical survey records: 173

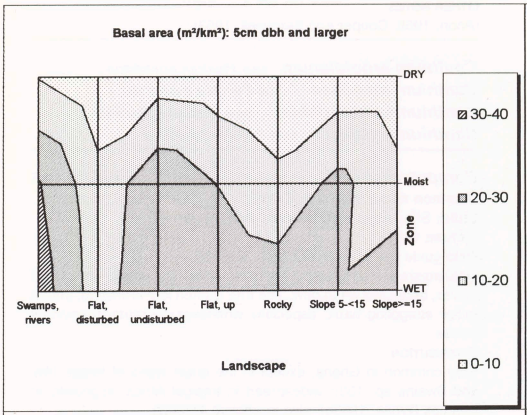
Buchholzia coriacea

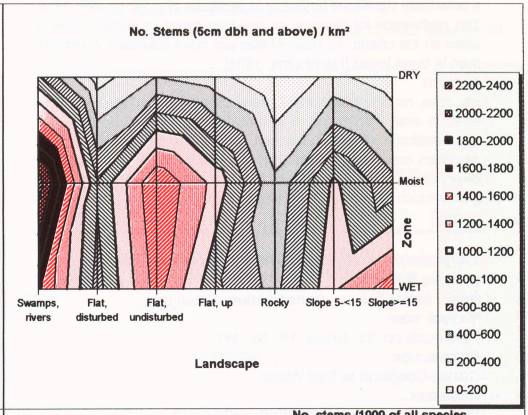


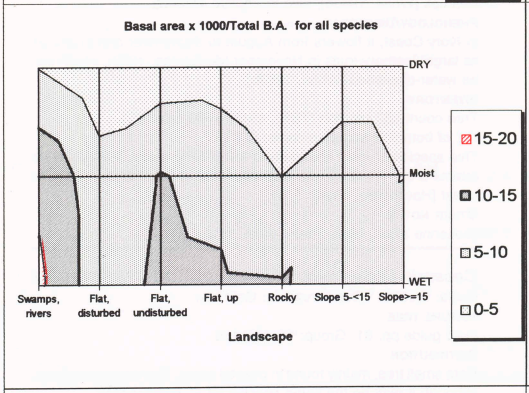
Bussea occidentalis

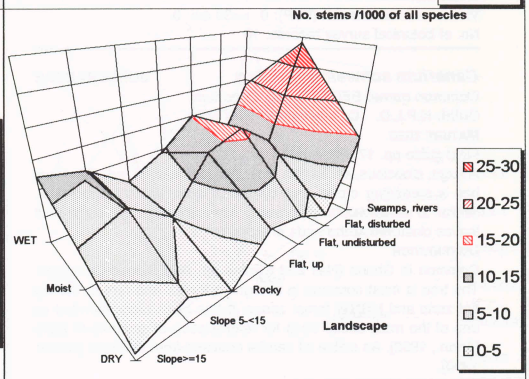


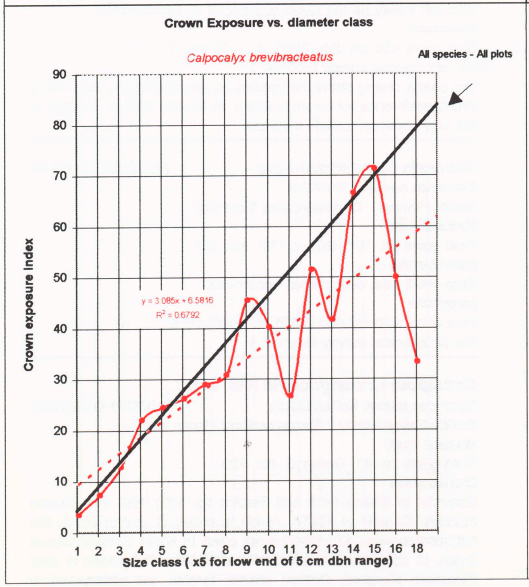
Calpocalyx brevibracteatus

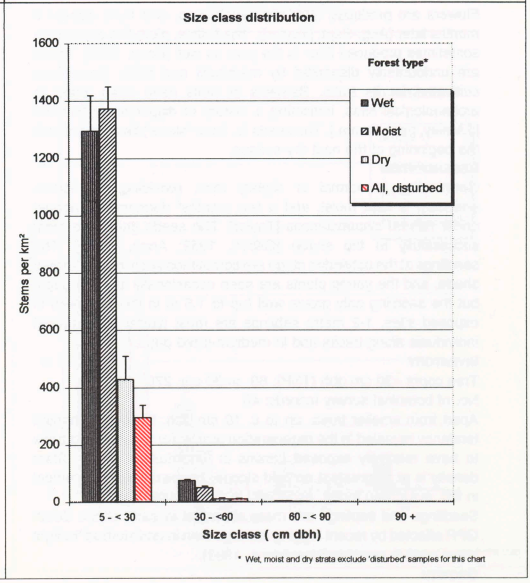












The crown exposure profile is typical for a lower storey tree, but with a potentially significant tendency to exposure of c. 20 cm dbh trees. The preference for swampy or low-lying forest in wetter zones is show on the charts. All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

GROWTH

Because, no doubt, of the soil preference, this species reaches its peak in evergreen forest. It is remarkable how in that zone, the regeneration is relatively exposed, whereas in MS forest the trees are often completely shaded, possibly because of intolerance or desiccation or reduced vigour. At Kade (Moist Semideciduous) it grows much faster than average for most species [Swaine, pers. comm.]

Calycosiphonia spathicalyx (K.Schum.) Robbrecht (=*Coffea spathicalyx*) **RUBIACEAE**

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 35 Group: 1E No. 171

DISTRIBUTION

Guineo-Congolian to East Africa.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 16

Canarium schweinfurthii Engl. **BURSERACEAE**

Common name: BEDIWONUA, Canarium

Guild: N.P.L.D. **Conservation:** Pink star

MATURE TREE

Field guide pp. 171 Group: 33 No. 35

A large, dioecious, deciduous tree. The leaf flush is red. *Canarium* has a spreading crown and cylindrical bole, without buttresses, similar to *Entandrophragma* trees, especially with the compound leaves clustered at the ends of loopy twigs.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 96); Guineo-Congolian. The tree is most common in evergreen forest, and rare in the dry fire zone and MSNW forest zones. It has been recommended as one of the most useful trees for reforestation of savanna in Zaire [Anon., 1952]. An edible oil can be obtained from the fruits [Abbiw, 1990].

PHENOLOGY/DISPERSAL

Flowers are produced after the new leaves, and fruits appear 5 months later (Aug.-Sept. [Taylor]). The Edible, plum-like drupes are sometimes produced later in the year as well [Keay, 1989]. These are undoubtedly dispersed by mammals and birds. Sometimes cultivated for its fruits. Remains of fruits have been found in archaeological sites, indicating a history of dispersal by humans [J.Maley, pers. comm.]. The seeds (c. 3 per 'stone') lie dormant until the beginning of the next dry season.

REGENERATION

Germination is normal or slightly slow, providing the fibrous endocarp is kept moist, and a few months' dormancy is normal under natural circumstances [Taylor]. The seeds germinate most successfully in the shade [Gilbert, 1952; Anon., 1958]. The seedlings at the cotyledon stage are sometimes seen in understorey shade, and the young plants are seen occasionally in small gaps, but the seedling only grows well (up to 1.5 m in the first year) in exposed sites. 1-2 metre saplings are most typical as scattered individuals along tracks and in medium-sized gaps.

INVENTORY

Tree count <30 cm dbh (TSP): 80 >=30 cm: 276

No. of botanical survey records: 46

Apart from smaller trees, up to c. 10 cm dbh, there is a marked tendency revealed in the regeneration profile, for regenerating trees to have relatively exposed crowns in 'undisturbed' forest. Stem density is at its greatest on mild slopes, but basal area is greatest in flat, evergreen forest, especially in well-drained sites.

Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

GROWTH

Trees of 6 m height were found on 4 year old logging tracks [Hawthorne, 1993]. Trees attain 55 cm dbh in 40 year old secondary forest [Kahn, 1982].

OTHER NOTES

[Anon, 1958; Cooper and Bramwell, 1953]

Canthium arnoldianum see *Psydrax arnoldiana*

Canthium manense see *Psydrax manensis*

Canthium subcordatum see *Psydrax subcordata*

Canthium vulgare see *Psydrax parviflora*

Carapa procera DC. **MELIACEAE**

Common name: KWAKUOBESE

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 177 Group: 34C No. 135

Medium-sized evergreen tree with large clustered, compound leaves, bright red when new. The tree is often low-branched, and of rather straggling habit, especially whenever it occurs in swampy places.

DISTRIBUTION

Very common in Ghana, except in the driest types of forest (Hall and Swaine sp. 103); widespread in tropical Africa, especially in swamps [White, 1983b]; also in tropical America.

PHENOLOGY/DISPERSAL

In Ivory Coast, it flowers from August to September and produces its large, leathery fruits in November [de Koning, 1983], which can be water-dispersed [White, 1983b].

INVENTORY

Tree count <30 cm dbh (TSP): 4315 >=30 cm: 1831

No. of botanical survey records: 226

This species is most abundant in lower-lying areas. Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest [Hawthorne, 1994].

OTHER NOTES

[Detienne *et al.*, 1988; Titanji *et al.*, 1990]

Casearia barteri Mast. **FLACOURTIACEAE**

Guild: Pioneer **Conservation:** Gold star

MATURE TREE

Field guide pp. 81 Group: 13 No. 136

DISTRIBUTION

Rare small tree, mainly found in coastal areas; Guinea-wide at least, although it may be the same species as *C. calodendron*

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 1

The charts clearly show the species as an understorey tree with a strong preference for swampy areas. In Moister forests, the tree is still very common outside swamps.

Casearia calodendron Gilg **FLACOURTIACEAE**

Common name: ATWIAWA

Guild: Pioneer **Conservation:** Gold star

MATURE TREE

Field guide pp. 107 Group: 17D No. 137

DISTRIBUTION

Rare small tree, of scattered occurrence.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 4

Cassipourea congoensis R.Br. *ex* DC. **RHIZOPHORACEAE**

Common name: KoKoTENUA

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 41 Group: 3 No. 139

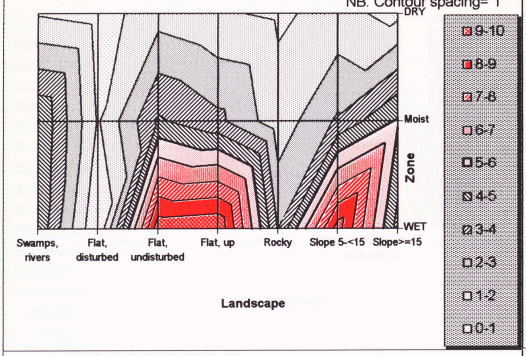
DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 105); Hall and Swaine includes *C.* sp.B of FWTA, which is called *C. lescotiana* in the botanical survey, and found most often in Moist Semideciduous forest. *C. congoensis* sensu strictu is hairier and confined to drier (Southern Marginal, Outlier) coastal forests, yet widespread in tropical Africa.

Canarium schweinfurthii

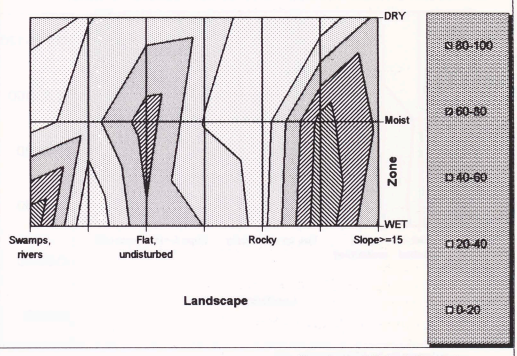
Basal area (m^2/km^2): 5cm dbh and larger

NB. Contour spacing= 1

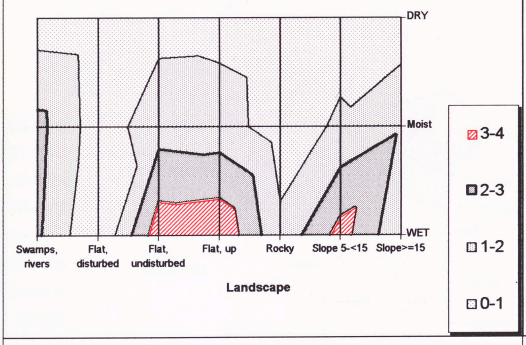


No. Stems (5cm dbh and above) / km^2

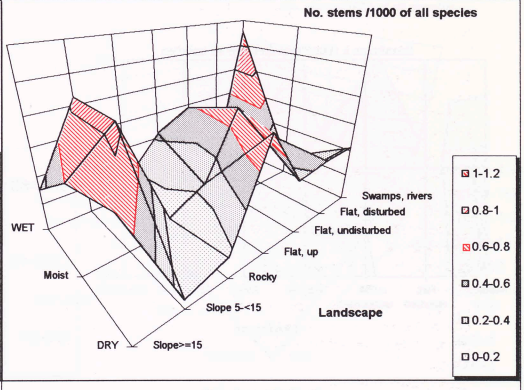
NB. Contour spacing= 20



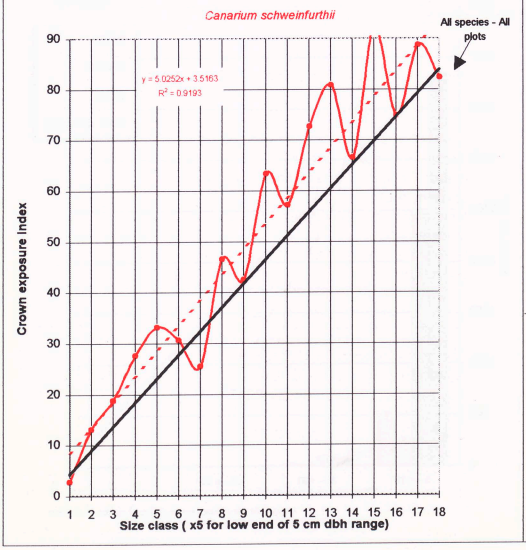
Basal area x 1000/Total B.A. for all species



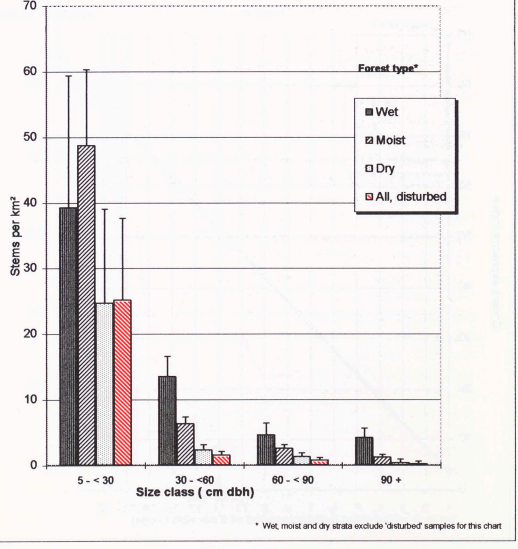
No. stems /1000 of all species



Crown Exposure vs. diameter class

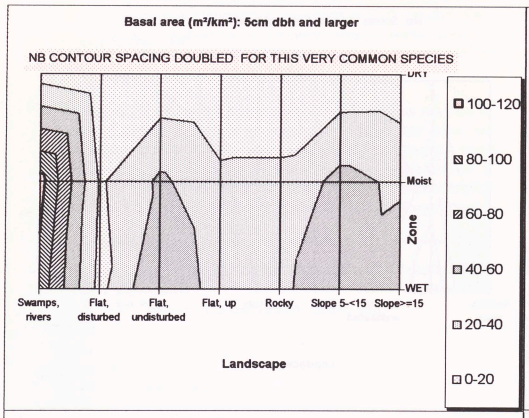


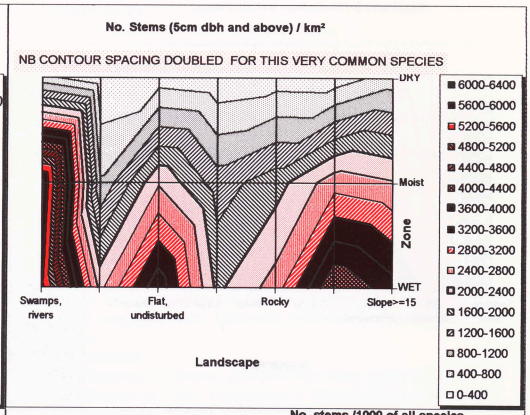
Size class distribution

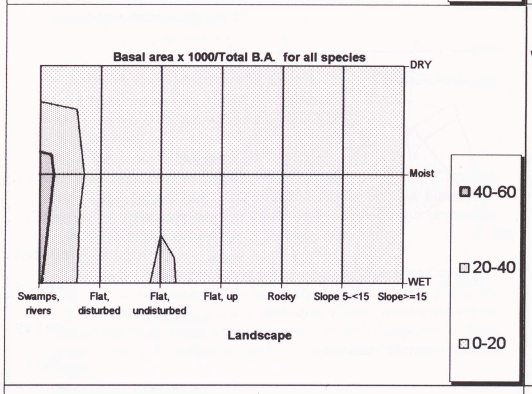


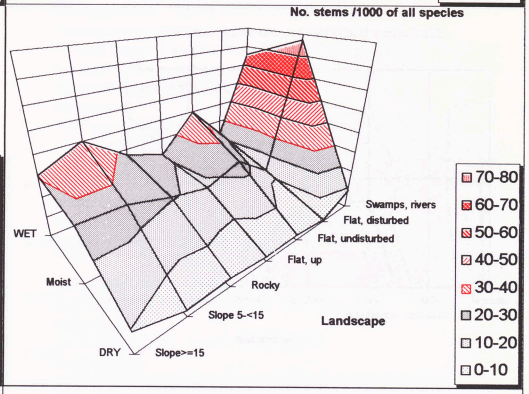
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

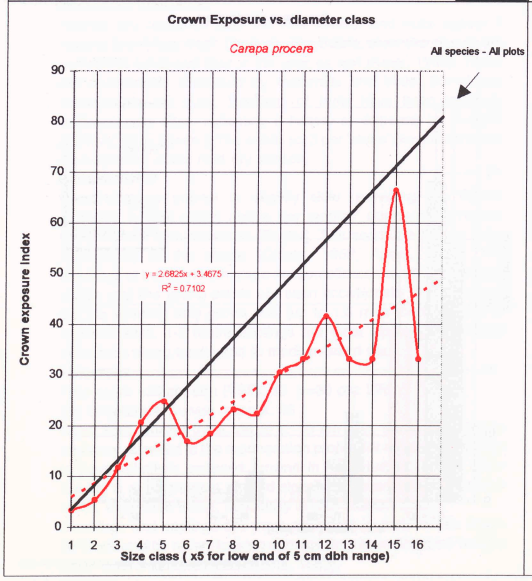
Carapa procera

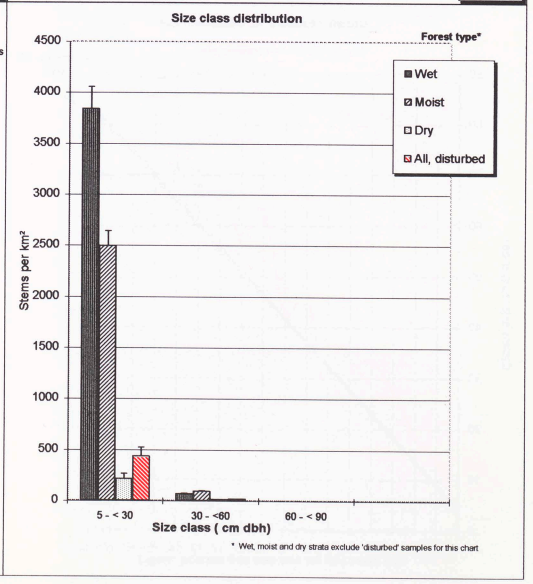




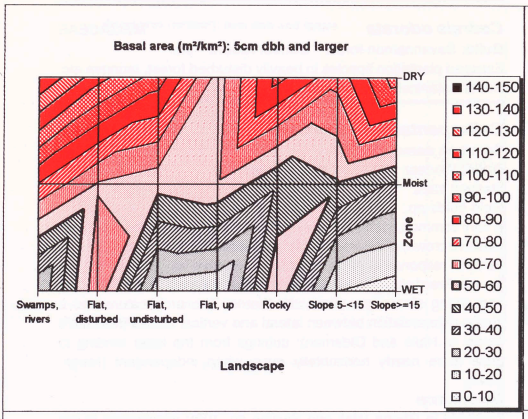


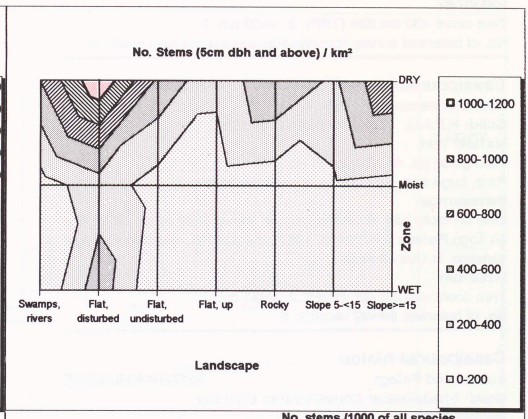


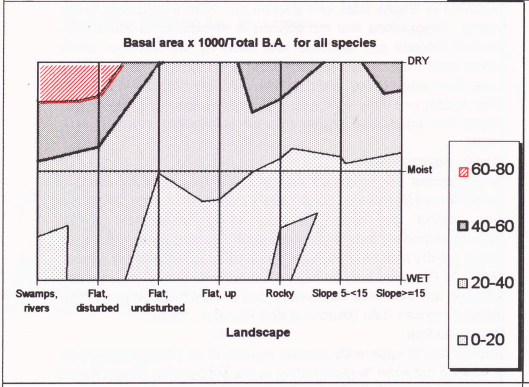


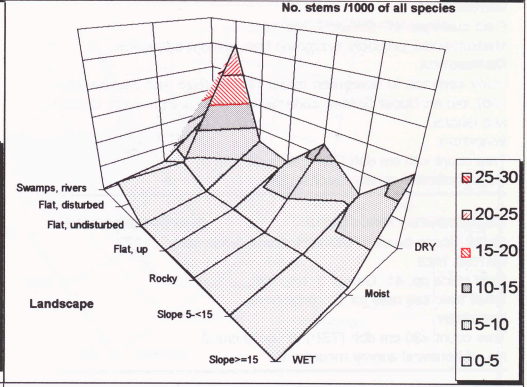


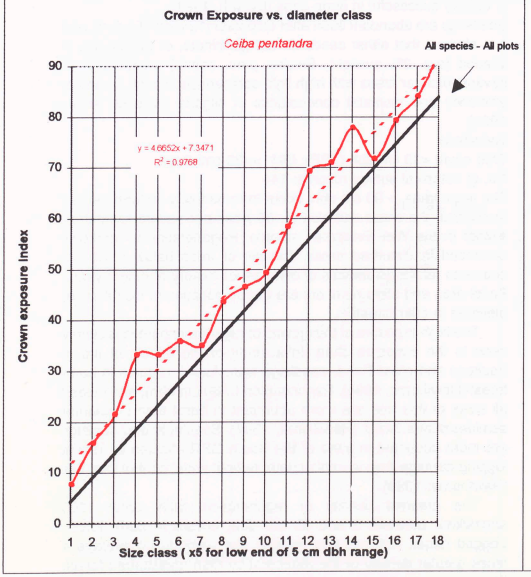
Ceiba pentandra

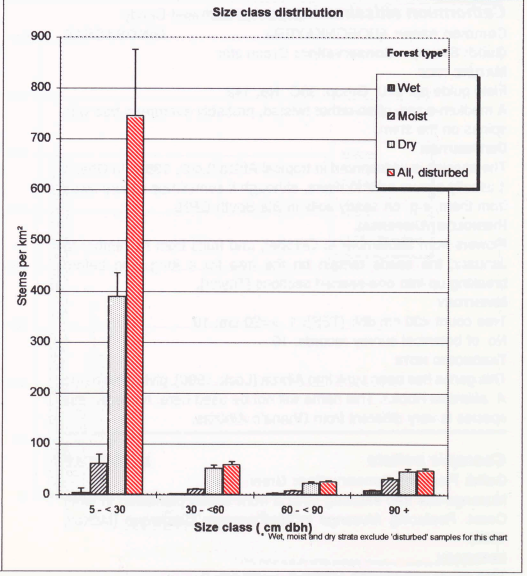












INVENTORY
Tree count <30 cm dbh (TSP): 3 >=30 cm: 0
No. of botanical survey records: 18

Cassipourea gummiflua Tul. **RHIZOPHORACEAE**
Common name: KoKoTENUA
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 41 Group: 3 No. 140
Rare, large tree, with dense, spreading crown.
DISTRIBUTION
Only on rocky hills in Ghana? e.g. in Atewa [Hall *et al.*, 1973] and on Togo Plateau F.R. [Irvine, 1961]; the species, which has several varieties, is Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 2
No. of botanical survey records: 5

Cassipourea hiotou
Aubrev. and Pellegr. **RHIZOPHORACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 41 Group: 2 No. 141
Medium-sized, probably evergreen tree, without buttresses.
DISTRIBUTION
Fairly common in evergreen forest Ghana (Hall and Swaine sp. 106), but an Upper Guinea endemic known only from Ivory Coast and Ghana.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 23

Cassipourea lescotiana **RHIZOPHORACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 41 Group: 3 No. 707
Small tree: see note for *C. congoensis*.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 16

Cathormion altissimum (Hook.f.) Hutch and Dandy
Common name: ABOBONKAYERe **MIMOSACEAE**
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 220 Group: 38C No. 142
A medium-sized, often rather twisted, probably evergreen tree with spines on the stem.
DISTRIBUTION
The species is widespread in tropical Africa [Lock, 1989]. In Ghana it usually occurs near to rivers, although it sometimes occurs away from them, e.g. on sandy soils in Bia South GPR.
PHENOLOGY/DISPERSAL
Flowers from September to October, and fruits from November to January; the seeds remain on the tree for a long time before breaking up into one-seeded sections [Taylor].
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 19
No. of botanical survey records: 10
TAXONOMIC NOTE
This genus has been sunk into Albizia [Lock, 1990], giving the name *A. altissima* Hook.f. This name will not be used here, however; this species is very different from Ghana's *Albizias*.

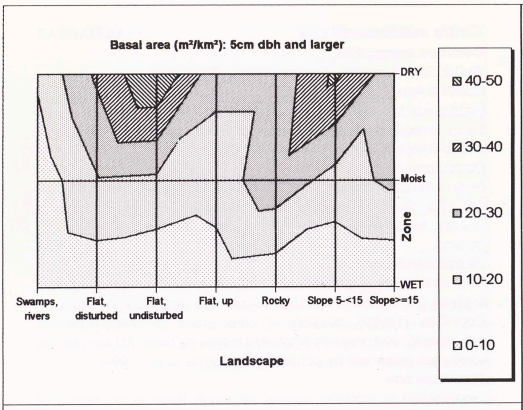
Cecropia peltata **MORACEAE**
Guild: Pioneer **Conservation:** Green star
Musanga-like tree invading Ghana from coffee plantation in Ivory Coast. Replacing *Musanga* in southwestern Cameroun [McKey, 1988].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

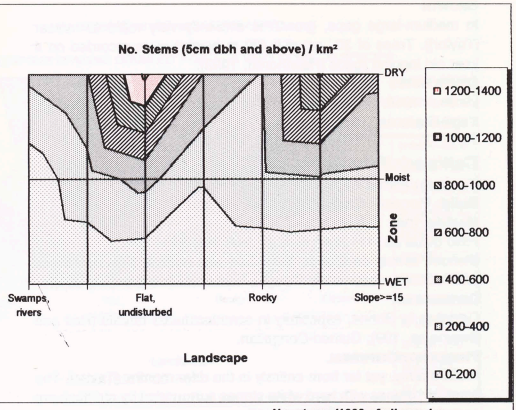
Cedrela odorata **MELIACEAE**
Guild: Savanna/non-forest **Conservation:** - star
Escaped plantation species in heavily disturbed forest, taungya etc.
No. of botanical survey records: 11

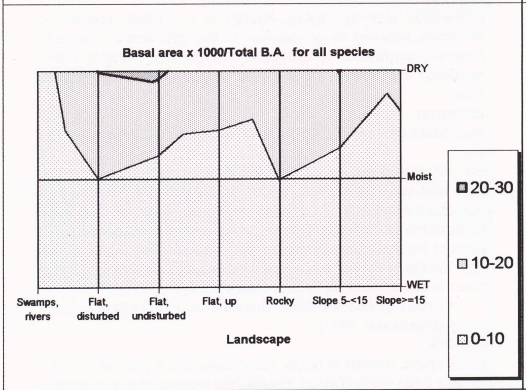
Ceiba pentandra (Linn.) Gaertn. **BOMBACACEAE**
Common name: ONYINA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 158, 233 Group: 28C No. 143
A very common, immense, grey-barked, usually deciduous tree with massive crown, and developing large buttresses. Buttresses develop partly in response to prevailing wind and crown asymmetry, e.g. on the windward size of the bole [Henwood and Baker, 1973]. The bark and young stems are often with thorns. The architecture has a strong differentiation between lateral and vertical shoots (Massart's model of Hallé and Oldeman): cuttings from the latter tending to grow more nearly horizontally even when independent [Haigh, 1941].
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 108); widespread in the tropics. Suggestions that the species is introduced to Africa from Central America are rendered less likely by the fact that *Ceiba* pollen more than 10,000 years old has been found in sediments in Lake Bosumtwi [Maley, pers. comm.]. Widely planted in Asia for food, fodder and fibre: a popular agroforestry species [Sekar *et al.*, 1990]. The adults are slightly tolerant of alkalinity [Gupta *et al.*, 1988].
PHENOLOGY/DISPERSAL
White flowers are produced mainly in the drier months and are bat-pollinated [Harris and Baker, 1959; Baker and Harris, 1959], but also visited by birds [Toledo, 1977]. Abundant seeds, wind-dispersed within tufts of white kapok, are produced towards the end of the dry season (Feb.- Apr.) [see also Kamaluddin and Banik, 1985]. In Panama, only half the adult trees flowered in one year, although few produced viable seed due to insect attack; population outcrossing was 0.69 [Murawski and Hamrick, 1992].
REGENERATION
Germination is apparently normal. Kyereh *et al.* [1993] reported no difference between % germination in the light and in the dark, and is equally successful in large gaps [Kyereh, 1994].
Seedlings are abundant soon after dispersal (12 days [Taylor]), and it is obvious that either seeds do not germinate, or rapidly die, in shaded [e.g. 2% sunlight, Swaine pers. comm] areas. One of several 'pioneer' trees with high light compensation point, quantum efficiency and stomatal conductance in Nigeria [Riddoch *et al.*, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 594 >=30 cm: 2409
No. of botanical survey records: 144
The large trees, > 90 cm dbh, occur in remarkably uniform density throughout the areas sampled (c. 35 trees per square kilometre), except in the Wet Evergreen sample. Regeneration is markedly enhanced in disturbed areas. Density of trees below c. 90 cm seems to reflect differences of disturbance history of recent years. Basal area and stem numbers are (partly because of disturbance) elevated in drier forests.

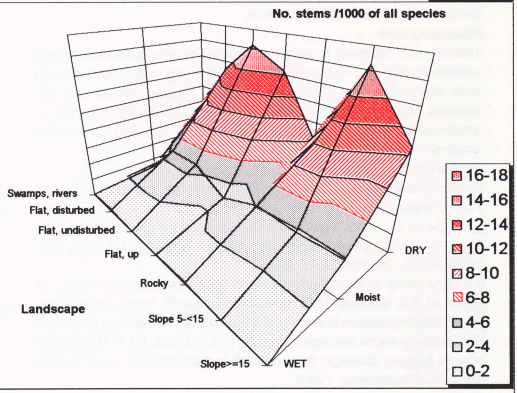
The high exposure of the crowns of regenerating trees is clearly seen in the exposure chart. In a study of the effects of fire in Asukese and other F.R.s, seedlings were found to thrive in burnt forest [Hawthorne, 1994]. Regeneration (5-30 cm dbh), and indeed all sizes of this tree are more abundant in burnt than in unburnt semideciduous forest [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

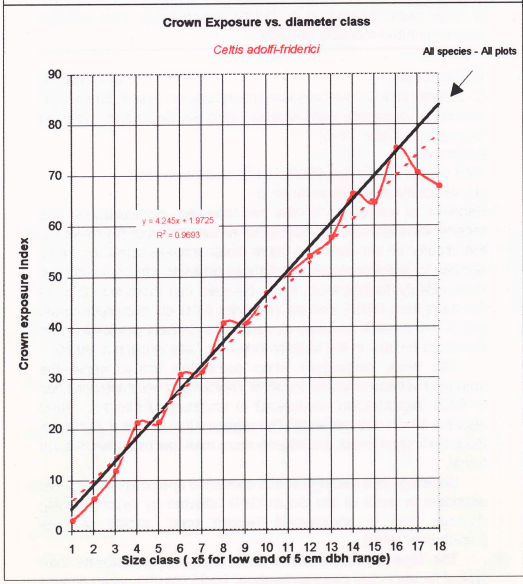
The greatest density of regeneration, with about 1000 stems/km2 between 5 and 30 cm dbh, occurs in burnt forest. Logged forest, with half this density, still supports on average 4 times greater density of the regeneration than undisturbed forest. The evergreen forest samples, being generally less disturbed, support the lowest levels of regeneration.

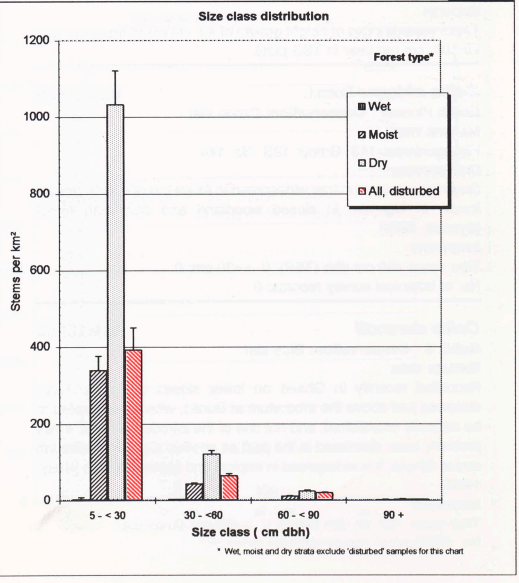

Basal area (m²/km²): 5cm dbh and larger
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
40-50
30-40
20-30
10-20
0-10


No. Stems (5cm dbh and above) / km²
DRY
Moist
WET
Zone
Swamps, rivers
Flat, undisturbed
Rocky
Slope>=15
Landscape
1200-1400
1000-1200
800-1000
600-800
400-600
200-400
0-200


Basal area x 1000/Total B.A. for all species
DRY
Moist
WET
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
20-30
10-20
0-10


No. stems /1000 of all species
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
DRY
Moist
WET
Landscape
16-18
14-16
12-14
10-12
8-10
6-8
4-6
2-4
0-2


Crown Exposure vs. diameter class
Celtis adolfi-friderici
All species - All plots
y = 4.245x + 1.9725
R² = 0.9693
Crown exposure index
Size class (x5 for low end of 5 cm dbh range)


Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
90 +
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

GROWTH
In medium-large gaps, growth is evidently very rapid (2 m/year [Taylor]). Trees of 30 cm dbh (20 m height) were recorded on 4 year old logging roads [Hawthorne, 1993].
OTHER NOTES
[Anon., 1958; Aukspurger, 1984; Haigh, 1941; Okali, 1972; Vega-Espinosa, 1981]

Celtis adolfi-friderici Engl. **ULMACEAE**
Common name: ESAKOSUA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 111, 247 Group: 18A No. 36
Slender, almost deciduous, large tree with narrow, high buttresses and rounded, dark crown. Boughs horizontal and drooping at tips.
DISTRIBUTION
Common in Ghana, especially in semideciduous forests (Hall and Swaine sp. 109); Guineo-Congolian.
PHENOLOGY/DISPERSAL
Fruits mainly, yet far from entirely in the drier months [Taylor]. The small red drupes with hard white stones surrounded by red flesh are probably dispersed mainly by birds.
REGENERATION
Germination (epigeal) is said to be rather erratic, with low viability unless soaked and exposed to sun, which improves performance only slightly [Taylor]. Although Hall and Swaine record that the species regenerates in the shade, seedlings are most typical in small-medium gap, particularly when > 50 cm tall, and seem more intolerant of shade than the other *Celtis spp.*
INVENTORY
Tree count <30 cm dbh (TSP): 1081 >=30 cm: 2169
No. of botanical survey records: 63
The charts show the tree markedly prefers drier forests, especially in drier zones. Crown exposure is about average for most size classes > 5 cm dbh.

In a study of the effects of fire in Asukese and other F.R.s, all sizes of this species, from seedlings upwards, were found to be obviously depleted in burnt forest [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].
GROWTH
Taylor records rates of height growth of 40 cm in the first year, and 20-100 cm per year in TSS plots.

Celtis africana Burm.f. **ULMACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 113 Group: 18B No. 144
DISTRIBUTION
Savanna or transition tree widespread in Africa but rare in Ghanaian forest. In Uganda, in closed woodland and colonising forest [Synnott, 1985].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Celtis durandii **ULMACEAE**
Guild: 0 **Conservation:** Blue star
MATURE TREE
Recorded recently in Ghana on lower slopes of Atewa. Later observed just above the arboretum at Bunso, where it appeared to be naturally established, and not one of the introduced trees. It has probably been dismissed in the past as another *Celtis* sp. Although rare in Ghana, it is widespread in tropical and southern Africa [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1

Celtis mildbraedii Engl. **ULMACEAE**
Common name: ESA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 113, 247 Group: 18B No. 37
Large, evergreen, steep-buttressed tree with cylindrical bole. Crown small, compact, with horizontal, thin boughs.
DISTRIBUTION
Very common in Ghana, in semideciduous forests (Hall and Swaine sp. 110); Guineo-Congolian, and occurs in East African coastal forests. Moderately resistant to drought [Swaine (*et al.*), pers. comm.].
PHENOLOGY/DISPERSAL
30% of trees of 20 cm dbh can fruit; all trees of 10 cm dbh fuit in Uganda [Plumptree *et al.*, 1994]. Fruits are produced Mar-Apr and Sept-Dec. [Taylor], possibly at other times of year. They are attractive to, and probably dispersed mainly by birds. In Uganda, the seeds are dispersed by primates [Plumptree *et al.*, 1994].
REGENERATION
Germination is probably normal (although there is no record of germination time by Taylor). Kyereh *et al.* [1993] reported no difference between % germination in the light and in the dark. However, germination is depressed in large gaps [Kyereh, 1994]. Seedlings are common, and locally very abundant near mother trees.
INVENTORY
Tree count <30 cm dbh (TSP): 7767 >=30 cm: 14742 (see also *C.* spp.)
No. of botanical survey records: 305
Note that some of the results for this species are included in a combined score with *C. zenkeri*. However, even without these records, the plummeting stem density from drier to wetter zones or parts of the landscape is very marked. Smaller sizes, up to 15 cm dbh, tend to have relatively shaded crowns, but for trees above this size the exposure index is above normal.

All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].
GROWTH
In TSS plots, records of height increments over 4 years of 1 m to 3 m have been made [Taylor]. Established saplings thrive in medium to large gaps. Swaine *et al.* [1987] record lower than average recruitment and mortality at Kade.

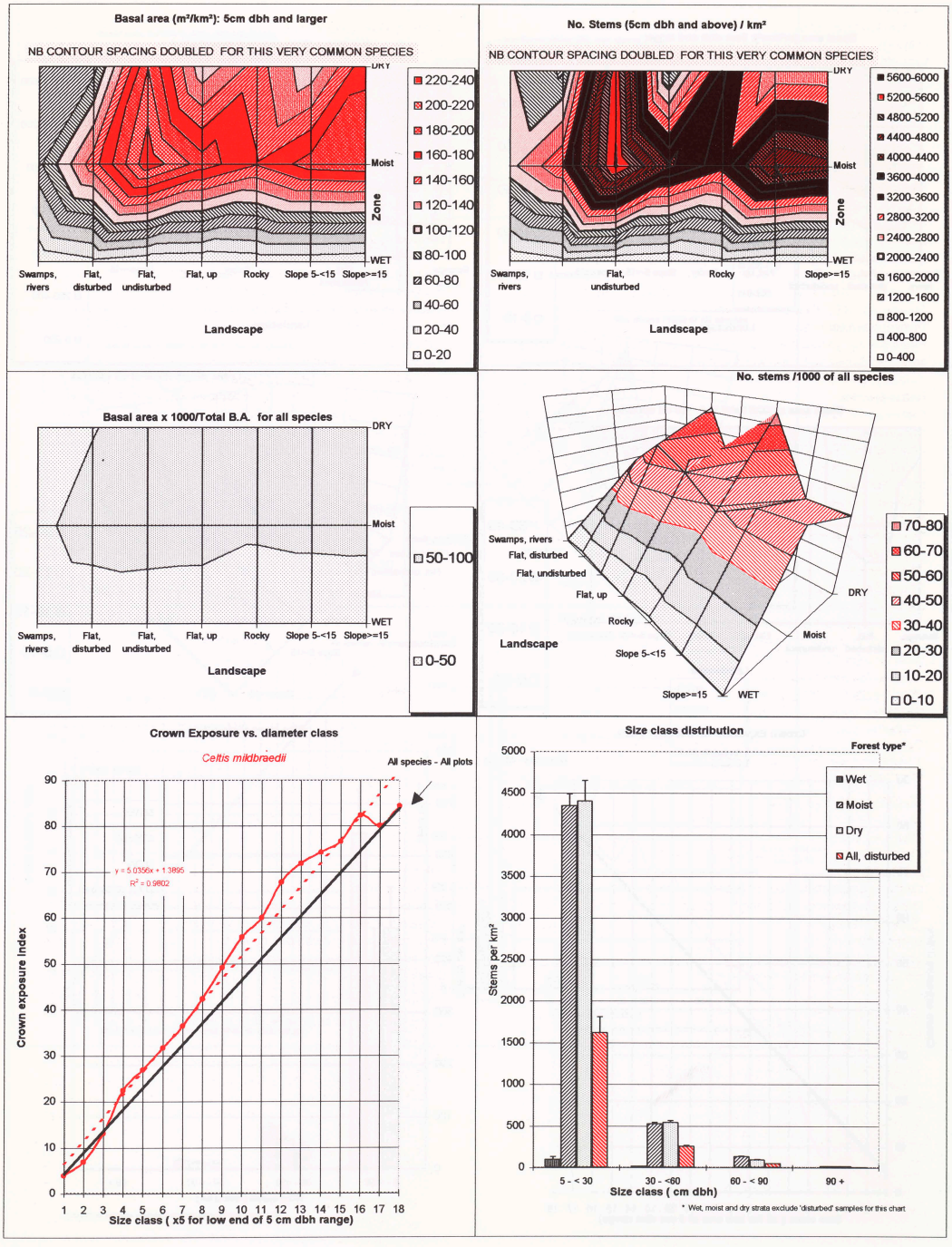
Celtis spp. **ULMACEAE**
C. zenkeri and C. mildbraedii were initially confused during TSP inventory, so records were amalgamated. All *Celtis* spp. are used for pestles [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 1076 >=30 cm: 1926
No. of botanical survey records: 0
Because of confusion of the two species, particularly in the regeneration size classes, during the earlier stages of the inventory, the results of the inventory have been amalgamated for these species for some reserves. From those reserves where the species were reliably distinguished, it can be seen that more than 80% of the trees from MSSE and the (northern parts of) evergreen forest are *C. mildbraedii*, whereas *C. zenkeri* is similarly predominant in the driest forests. In the MSNW forest the ratio is often c. 50:50.

The trees, particularly when combined, are amongst the commonest trees in MS forest, after *Triplochiton*, reaching densities of 6400 'regeneration' stems/km2 in undisturbed forest (c. 1000 stems > 30 cm dbh per km2). The regeneration is less than half as dense in logged forest, and slightly more than half as dense in burnt forest.

Seedlings and saplings of this combined species pair are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

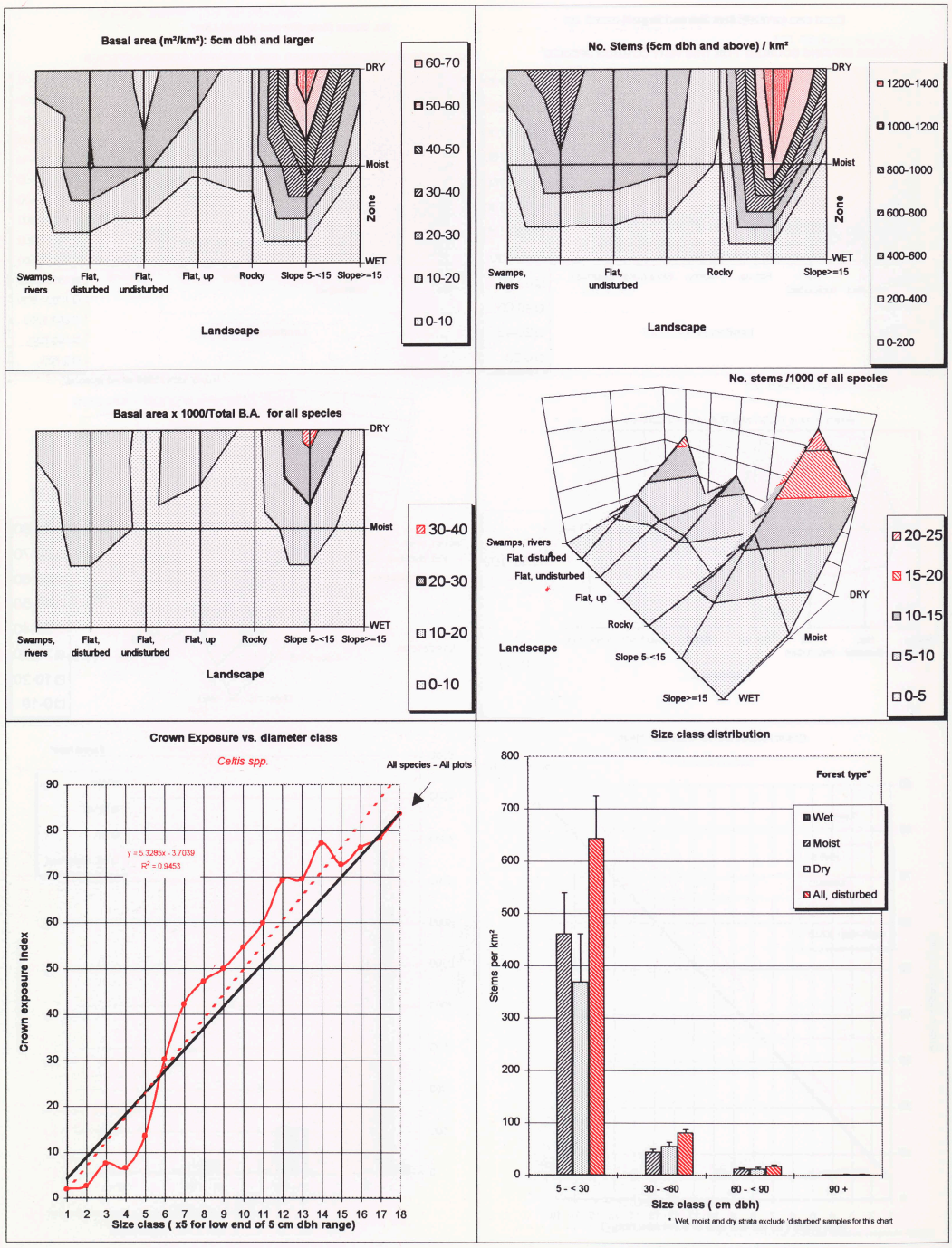
The regeneration tends to have less exposed crowns than typical for each size class up to about 20-25 cm dbh, when crowns seem to become relatively exposed.

Celtis mildbraedii

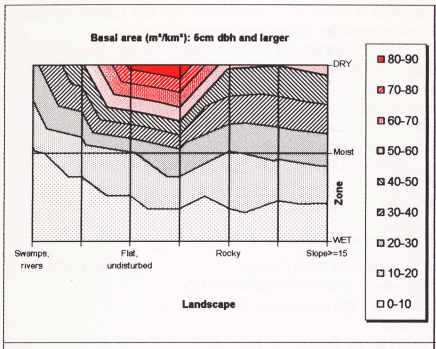


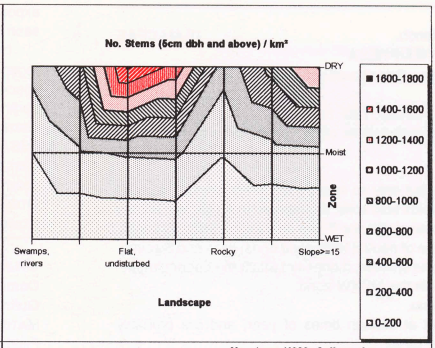
*Celtis mildbraedii & zenkeri**

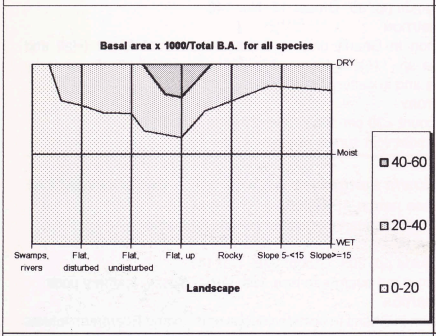
(* for forests where the species were sometimes confused)

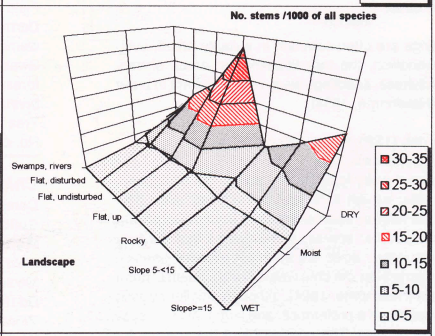


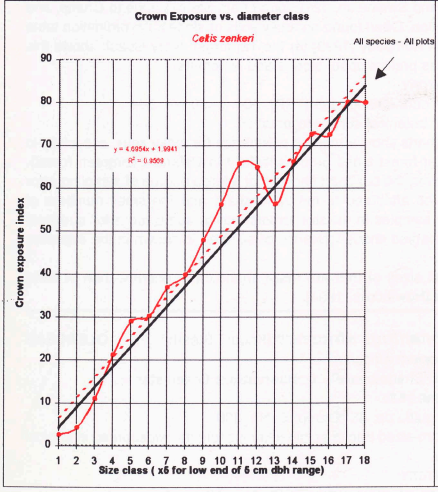
Celtis zenkeri

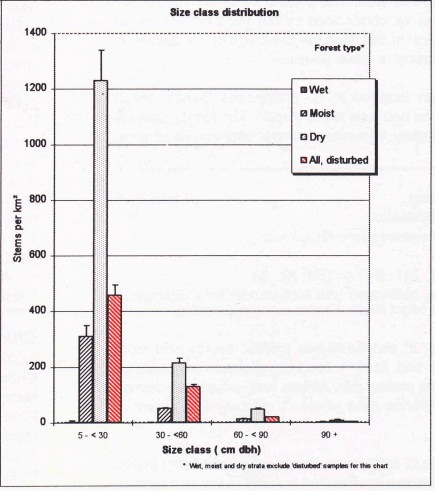












celtze

Celtis wightii Planch. **ULMACEAE**
Common name: PREMPRESA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 113 Group: 18B No. 145
Medium-sized tree characteristic of the understorey of drier forest types.
DISTRIBUTION
Common in Ghana, but only so in semideciduous forests (Hall and Swaine sp. 111); avoids acid soils; widespread in Africa; sometimes included in *C. philippensis* Blanco (Flore du Gabon). Strongly avoids acidic soils (indicative of neutral to alkaline ones) [Hall and Swaine]. Unlike the other *Celtis* species, it does not attain the upper canopy. It is most abundant in the MSNW zone.
PHENOLOGY/DISPERSAL
Fruits are produced at various times of year, and are probably dispersed mainly by birds.
REGENERATION
Seedlings and saplings are often common in suitable areas, even in the shade. Nevertheless, the tree flourishes in areas of very broken canopy. In Asukese, seedlings were very abundant in burnt regeneration plots [Hawthorne, 1994].
INVENTORY
Tree count <30 cm dbh (TSP): 976 >=30 cm: 534
No. of botanical survey records: 123
The charts clearly reveal a dry forest tree which all but disappears in moist forest sample, except in a few well-drained sites. The shade tolerance of the smaller trees is apparent from the exposure chart. Larger trees are rather sparse, and it seems that the only trees that reach these larger sizes are the most exposed ones.

Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest [Hawthorne, 1994], although smaller sizes in Asukese F.R. showed less of a preference, and larger sizes classes showed a more extreme bias. The preference of the species for burnt MS forest may be confounded by the trees preference for alkaline soils, although in that case the low levels of the species in the dry, fire zone forests is rather unusual.
TAXONOMIC NOTE
C. wightii has been included in *C. philippensis* Blanco, which spreads across Africa and Asia to the Pacific. The former name is retained here temporarily, to maintain compatibility with Hawthorne, [1990].

Celtis zenkeri Engl. **ULMACEAE**
Common name: ESAKoKo
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 113, 247 Group: 18B No. 38
Large, ± deciduous, buttressed tree with slender bole. Buttresses steep, merging into slight flutes. Crown slightly spreading.
DISTRIBUTION
Common in Ghana, in semideciduous forests; avoids acid soils, prefers pH>6 (Hall and Swaine sp. 112); Guineo-Congolian. *C. zenkeri* on the whole prefers drier forests and, indeed, is common in outliers in the savanna zone where *C. mildbraedii* is absent or rare.
FIELD IDENTITY
The tree is similar to *C. mildbraedii*. Crown colour and fallen leaves readily distinguish the two species, but in many cases tree spotters make mistakes.
PHENOLOGY/DISPERSAL
As far as is known , the same as *C. mildbraedii*. However, in Uganda most trees of 40 cm dbh can fruit [Plumptree *et al.* 1994].
REGENERATION
Apparently the same as *C. mildbraedii*, although young seedlings of the two species are very hard to differentiate. The characteristic venation and pubescence is not apparent on the youngest leaves, at least in some cases.
INVENTORY
Tree count <30 cm dbh (TSP): 1191 >=30 cm: 3483
No. of botanical survey records: 135
Note that some of the results for this species are included in a combined score with *C. mildbraedii* on a separate chart. The exposure trend is similar to *C. mildbraedii*, but this species can be seen to more markedly prefer drier forests.

In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to outperform other *Celtis* species in burnt forest, and larger size classes are commoner in burnt than in unburnt forest as well [Hawthorne, 1994].
GROWTH
TSS records suggest a similar height increment, or slightly lower than *C. mildbraedii* [Taylor]. Devineau [1991] gives some growth data.
OTHER NOTES
[Lowe, 1963]

Chaetachme aristata Planch. **ULMACEAE**
Common name: ESONO-TOKWAKOFUO
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 95 Group: 15 No. 146
DISTRIBUTION
Common in Ghana only in driest extremes of forest (Hall and Swaine sp. 116); widespread in Africa, especially in dry or rocky forests and in gallery forest.
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 0
No. of botanical survey records: 47

Chidlowia sanguinea Hoyle **CAESALPINIACEAE**
Common name: ABABIMA
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 205 Group: 37E No. 147
Medium-sized evergreen tree, with large, glossy, leathery pods.
DISTRIBUTION
Common in Ghana in semideciduous and Upland Evergreen forests (Hall and Swaine sp. 121); found from Sierra Leone to Ghana, and in Gabon. Often found on rocky soils or slopes. An ordination table in Van Rompaey [1993] for the Tai forest, Ivory Coast, shows this species prefers upper slopes and hill crests.
INVENTORY
Tree count <30 cm dbh (TSP): 264 >=30 cm: 564
No. of botanical survey records: 27
The charts show a marked preference for rocky soils, especially in moister forest types (and especially in Upland Evergreen forest). However, the bar chart shows that a large degree of sampling error must be attributed to the zone chart, and the small numbers of rocky samples in moister forests leaves some room for question. The marked shade-tolerance of all sizes in shown in the exposure chart.

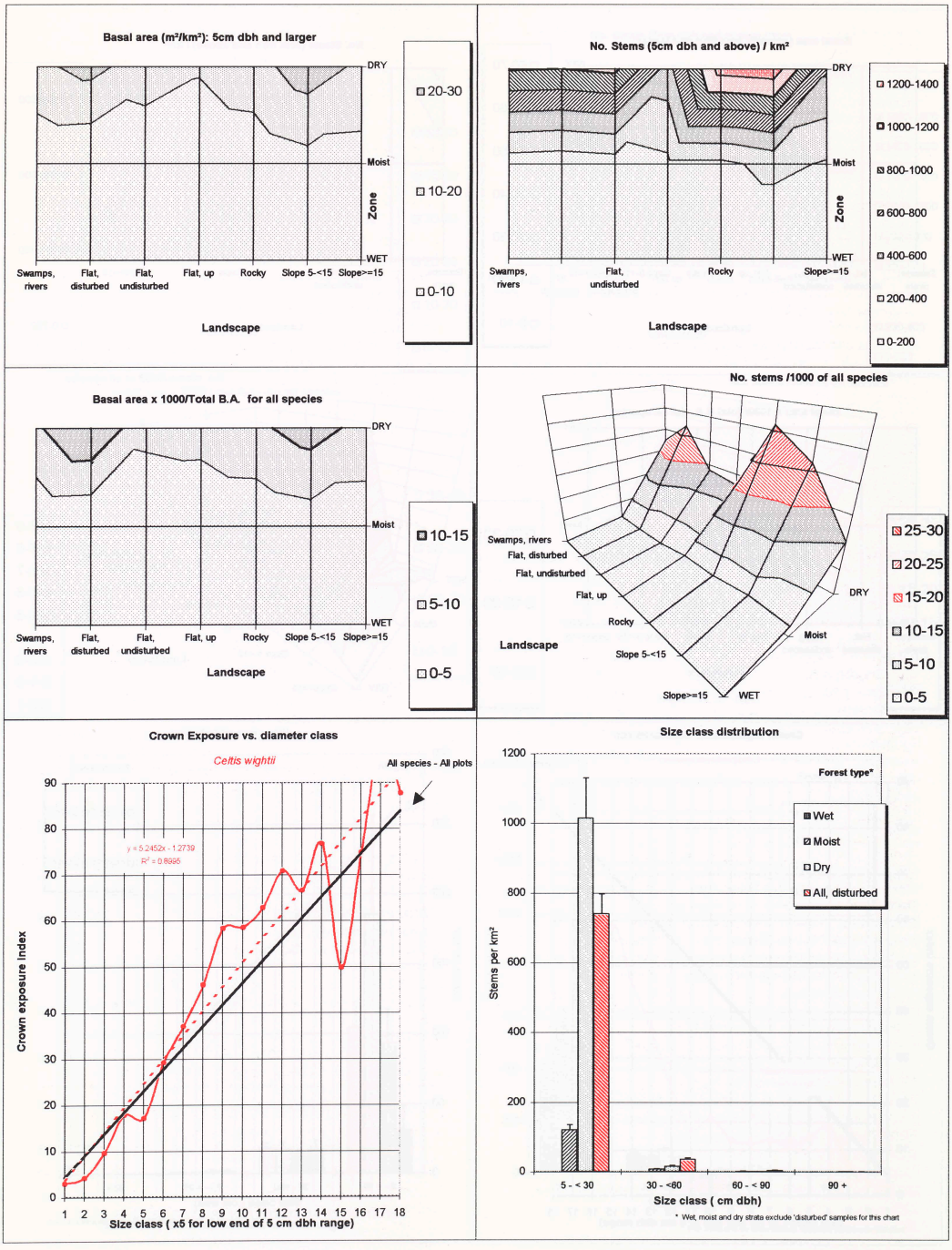
All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Chionanthus africanus (Knobl.) Stearn **OLEACEAE**
(=*Linociera africana*)
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 45 Group: 5 No. 388
Medium-sized tree of semideciduous forests, widespread in tropical Africa.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 9

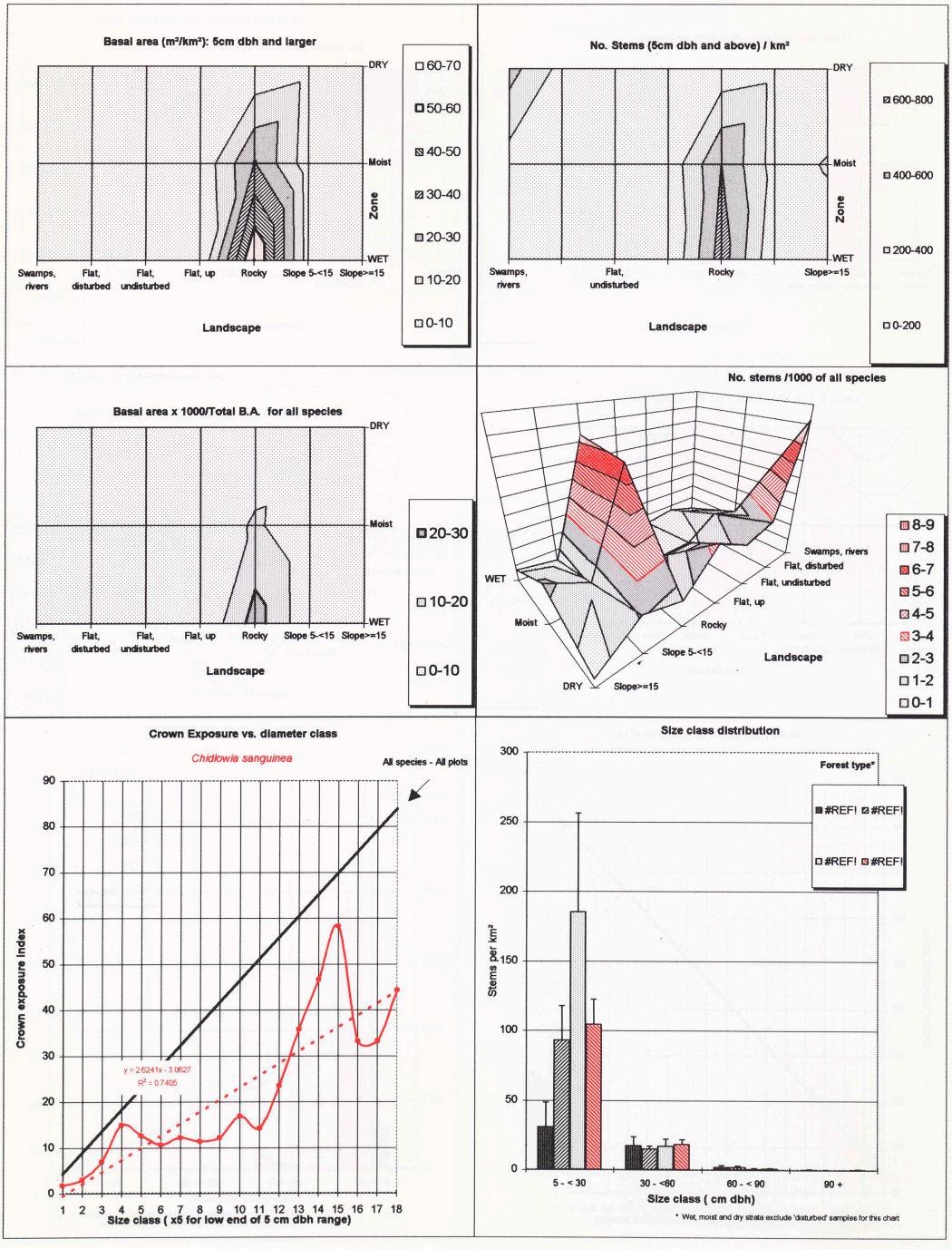
Chlorophora excelsa see *Milicia excelsa* (and *regia*)
Chlorophora regia see *Milicia regia*

Christiana africana DC. **TILIACEAE**
Common name: SESEDUA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 149 Group: 27C No. 148
Medium-sized tree similar to, but smaller than *Mansonia*, with spreading crown.

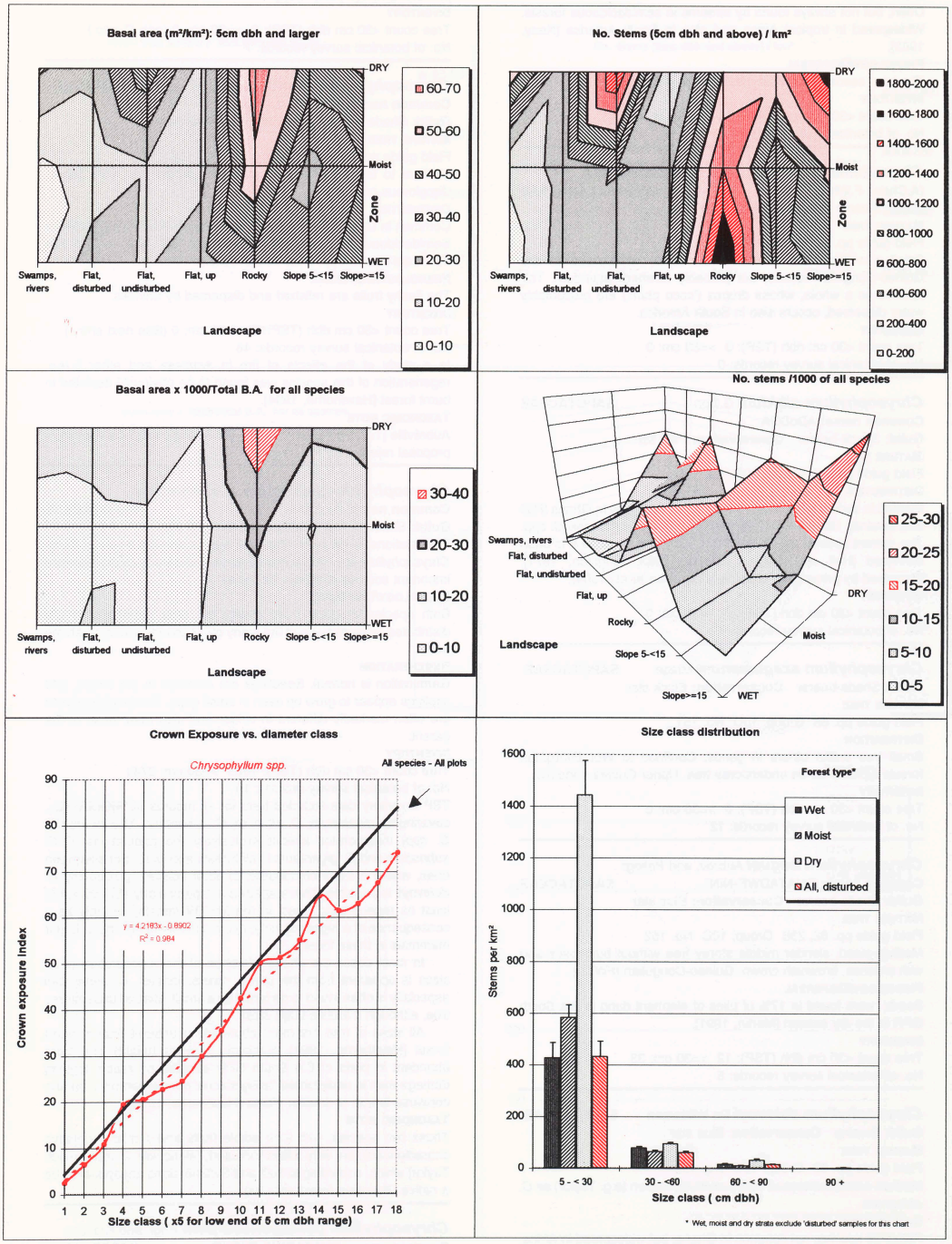
Celtis wightii



Chidlowia sanguinea



Chrysophyllum spp.



DISTRIBUTION
Often, but not always found by streams in semideciduous forests. Widespread in tropical Africa and also in South America [Keay, 1989].
PHENOLOGY/DISPERSAL
The hard seeds are possibly water-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 35 >=30 cm: 4
No. of botanical survey records: 40

Chrysobalanus icaco L. subsp. atacorensis (A.Chev.) F.White **CHRYSOBALANACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 91 Group: 14A No. 149
Small tree by rivers in the forest zone, widespread in the Guineo-Congolian forests, but probably nowhere abundant. The species as a whole, whose drupes ('coco plum') are presumably water dispersed, occurs also in South America.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Chrysophyllum albidum G.Don. **SAPOTACEAE**
Common name: ADoSOA
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 62 Group: 10C No. 150
DISTRIBUTION
Planted in sacred groves etc., and may not be native to Ghana [Hall and Swaine]. Sporadic in dry forest. For TSP records see *C.* spp. The current species has edible fruits, for which purpose it is often cultivated [Hall and Swaine; Okafor, 1983; Kingston, 1971]. Dispersed by primates in Uganda [Plumptree *et al.*, 1994].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 11

Chrysophyllum azaguieanum Miege **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 65 Group: 10D No. 151
DISTRIBUTION
Small tree unlike others in genus. Confined to Wet Evergreen forests typically as an understorey tree. Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 12

Chrysophyllum beguei Aubrev. and Pellegr
Common name: DUATADWE-NINI. **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 62, 236 Group: 10C No. 152
Medium-sized, slender middle storey tree without buttresses and with a dense, brownish crown. Guineo-Congolian [FWTA].
PHENOLOGY/DISPERSAL
Seeds were found in 17% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 12 >=30 cm: 33
No. of botanical survey records: 5

Chrysophyllum delevoyi De Wildeman **SAPOTACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 62 Group: 10C No. 153
Medium-sized, buttressed tree, previously known (e.g. Taylor) as *C. africanum.*
DISTRIBUTION
Riverside species; not common in Ghana, but widespread in Africa. Taylor recorded the species away from rivers in Bosumtwi range F.R. Fruits ('White Star Apple') are edible and can be used to produce an oil [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0 (see *C.* spp.)
No. of botanical survey records: 7

Chrysophyllum giganteum A.Chev. **SAPOTACEAE**
Common name: KUMFANA, Akasa
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 62, 236 Group: 10C No. 154
Medium to large, buttressed, evergreen forest tree with dense, discolorous crown.
DISTRIBUTION
Common in Ghana, but mostly in drier (North West) types of Moist Semideciduous forest (Hall and Swaine sp. 125); Guinea-wide. For TSP data see *C.* spp. Has edible fruits.
PHENOLOGY/DISPERSAL
The fleshy fruits are relished and dispersed by animals.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0 (See next entry.)
No. of botanical survey records: 46
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].
TAXONOMIC NOTE
Aubréville [1972] proposed placing this species in its own genus; a proposal rejected by Pennington [1991].

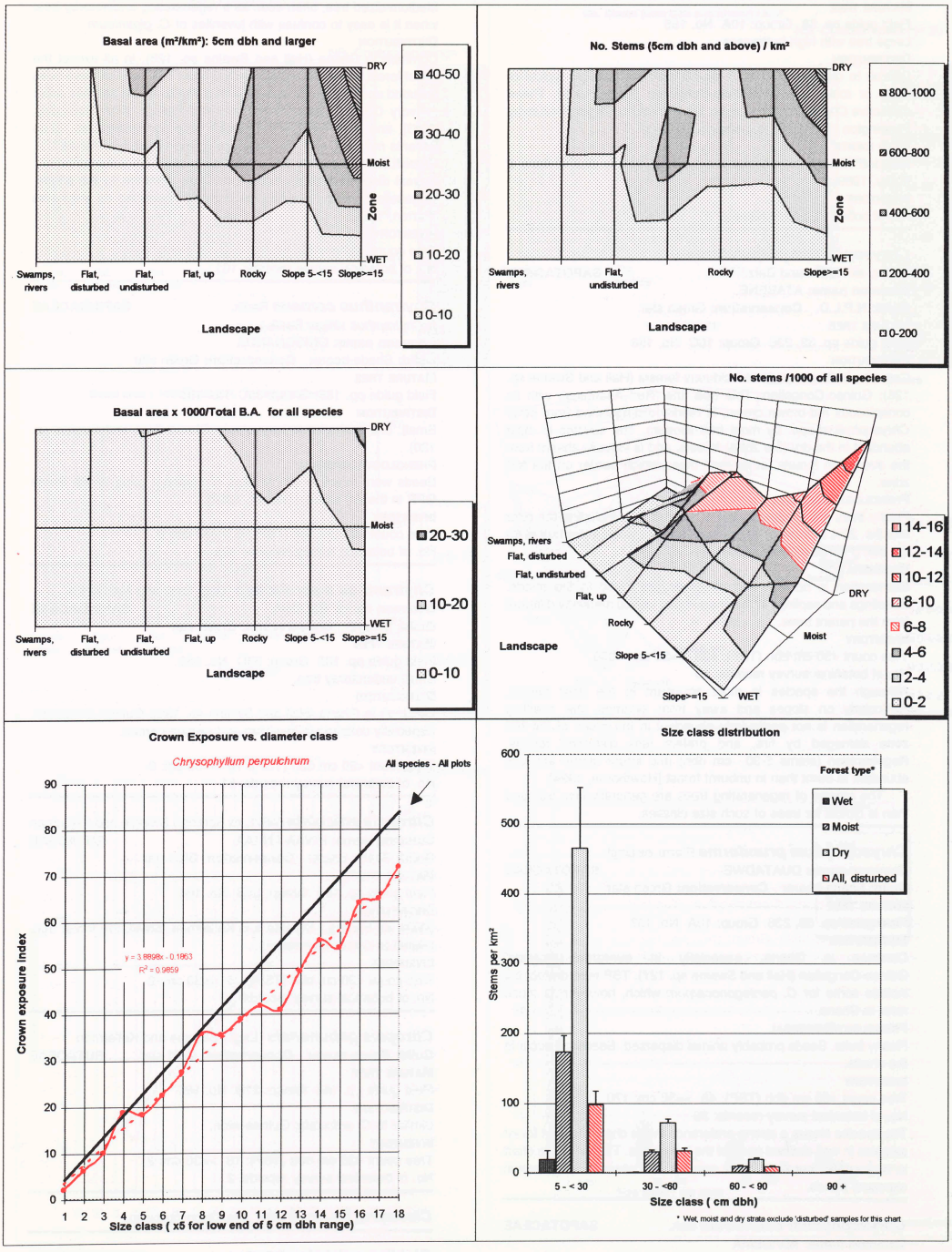
Chrysophyllum giganteum & subnudum
Common name: AKASAA **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Pink star
The relationship between dispersal agents and the levels of these *Chrysophyllum* spp. needs investigation, particularly as the trees are important sources of timber for veneer.
PHENOLOGY/DISPERSAL
Both species produce fruits during the drier months, and are distributed by monkeys and the many other animals which relish the fruits.
REGENERATION
Germination is normal. Seedlings are common in the shade, and saplings appear to grow up even in small gaps. The juvenile leaves are often markedly different in colour and size from those of the parent.
INVENTORY
Tree count <30 cm dbh (TSP): 1625 >=30 cm: 2741
No. of botanical survey records: 13
TSP Inventory data included here for all records of 'AKASA' etc., covering *C. giganteum, C. albidum, C. subnudum.* The charts (for *C. spp*) incorporates almost exclusively the populations of *C. subnudum* and *C. giganteum* in all forests except for the evergreen ones, where a small contribution of other species, particularly *C. delevoyi*, is possible. These species are particularly abundant, not least as regenerating trees, in the MSNW forests, possibly as a consequence of a higher density, at least in recent history, of larger mammals in these forests.

In most cases the shade-tolerance of the regeneration of all sizes is apparent from the profile charts. Indeed, *C. subnudum* especially is often found to be fertile as a small, shaded understorey tree, although it attains large sizes.

All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. Saplings (> 1 m height) are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples, but the converse is true of smaller plants [Hawthorne, 1993].
TAXONOMIC NOTE
These two species, with their edible fruits and similar vegetative characteristics, are very often confused, (along with *C. albidum* [cf. Taylor] which, according to Hall and Swaine, does not appear to be a native Ghanaian forest species).

Chrysophyllum pentagonocarpum Engl. and Krausse
Common name: DUATADWE-FUFUO **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Blue star

Chrysophyllum perpulchrum



MATURE TREE
Field guide pp. 58 Group: 10A No. 155
Large tree with high buttresses.
DISTRIBUTION
Difficult to distinguish from *C. pruniforme*, but possibly typical of drier, or rocky forests. Guineo-Congolian [Keay, 1989]. These distinctive *Chrysophyllum* species are retained in *Chrysophyllum* by Pennington [1991], but in a section *Donella*.
FIELD IDENTITY
Included with *C. pruniforme*, and not necessarily distinct from it [Keay, 1989].
INVENTORY
No. of botanical survey records: 8

Chrysophyllum perpulchrum
Mildbr. *ex* Hutch. and Dalz. **SAPOTACEAE**
Common name: ATABENE
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 62, 236 Group: 10C No. 156
DISTRIBUTION
Common in Ghana in semideciduous forests (Hall and Swaine sp. 126); Guineo-Congolian. This tree, the 'Red Asanfena', with its conspicuous red-brown crown, is readily distinguished from other *Chrysophyllum* spp. by most tree-spotters. The species is most abundant in the dry (fire zone) forests, and is virtually absent from the evergreen forests, other than those which border on the MS zone.
PHENOLOGY/DISPERSAL
Fleshy fruits are produced over c. 1/2 the year including the drier months. 20% of trees of 20 cm dbh fruit in Uganda; most fruit at 60 cm dbh [Plumptree *et al.*, 1994].
REGENERATION
Germination is normal, and seedlings are found in the shade. Seedlings and saplings in the shade have leaves markedly different from the parent trees.
INVENTORY
Tree count <30 cm dbh (TSP): 433 >=30 cm: 1350
No. of botanical survey records: 66
Although the species is most abundant in the drier forests, particularly on slopes and away from swamps, the seedling regeneration is not particularly abundant in the areas of the MS zone damaged by fire, and prefers less disturbed forests. Regeneration (stems 5-30 cm dbh) and larger stems are less abundant in burnt than in unburnt forest [Hawthorne, 1994].

The crowns of regenerating trees are generally less exposed than is typical for trees of such size classes.

Chrysophyllum pruniforme Pierre *ex* Engl.
Common name: DUATADWE **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 58, 236 Group: 10A No. 157
DISTRIBUTION
Common in Ghana, especially in evergreen forests; Guineo-Congolian (Hall and Swaine sp. 127). TSP record probably include some for *C. pentagonocarpum* which, however, is much rarer in Ghana.
PHENOLOGY/DISPERSAL
Fleshy fruits. Seeds probably animal dispersed. Seedlings occur in the shade.
INVENTORY
Tree count <30 cm dbh (TSP): 48 >=30 cm: 170
No. of botanical survey records: 36
The species shows a strong preference in the charts for Wet forest samples in well-drained parts of the landscape. The exposure chart is very erratic, but suggests a species with about average crown exposure trends.

Chrysophyllum subnudum Bak. **SAPOTACEAE**
Common name: ADASEMA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 62, 236 Group: 10C No. 158
Medium-sized tree, often seen as a regenerating understorey tree, when it is easy to confuse with juveniles of *C. giganteum*.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 128), in all except the driest forest types; Guineo-Congolian. Most TSP records have been included under *C.* spp. Local endemics similar to this species occur in Ivory Coast *C. taiense* Aubrev. and Pellegr. [Van Rompaey, 1993], and may be little more than races or subspecies. Such variants may well exist in Ghana - e.g. one centred on Atewa?
PHENOLOGY/DISPERSAL
Animal dispersed, fleshy fruits; seedlings common in the shade. Regeneration and dispersal are possibly enhanced by elephants [Parren, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 101

Chytranthus carneus Radlk. **SAPINDACEAE**
(=*Chytranthus villiger* Radlk.)
Common name: ONIBONANUA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 188 Group: 36C No. 159
DISTRIBUTION
Small, unbranched tree common in Ghana (Hall and Swaine sp. 130).
PHENOLOGY/DISPERSAL
Seeds were found in 2% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 123

Chytranthus macrobotrys (Gilg) Exell and Mendonca
Common name: ESUINIA **SAPINDACEAE**
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 188 Group: 36C No. 163
Small understorey tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 132); Guineo-Congolian. Especially common in low-lying and swampy areas.
INVENTORY
Tree count <30 cm dbh (TSP): 18 >=30 cm: 0
No. of botanical survey records: 61

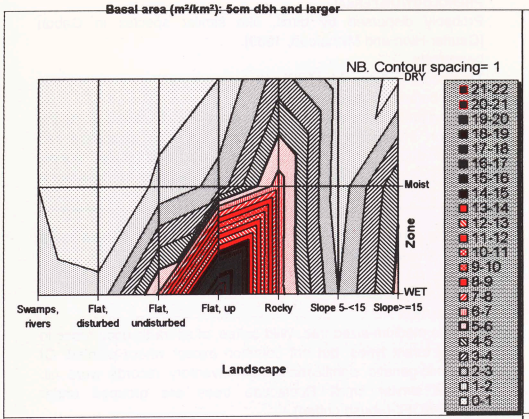
Citropsis articulata (Willd. *ex* Spreng.) Swingle and Kellerman
Common name: KWAA-ANKAA **RUTACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 166 Group: 31B No. 164
DISTRIBUTION
(Willd. ex Spreng.) Swingle and Kellerman. Small, dry forest tree, related to *Citrus*; Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 25 >=30 cm: 2
No. of botanical survey records: 19

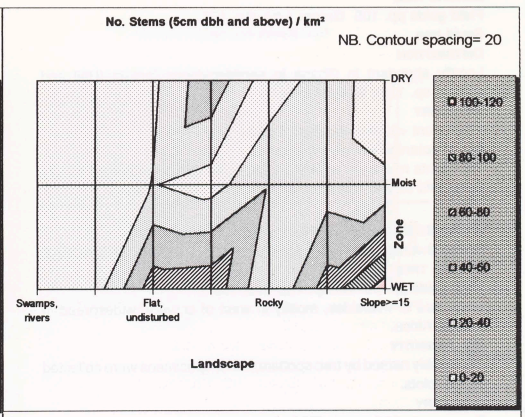
Citropsis gabunensis (Engl.) Swingle and Kellerman
Guild: Shade-bearer **Conservation:** Gold star **RUTACEAE**
MATURE TREE
Field guide pp. 166 Group: 31B No. 165
DISTRIBUTION
Similar to *C. articulata*; Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 18 >=30 cm: 2
No. of botanical survey records: 2

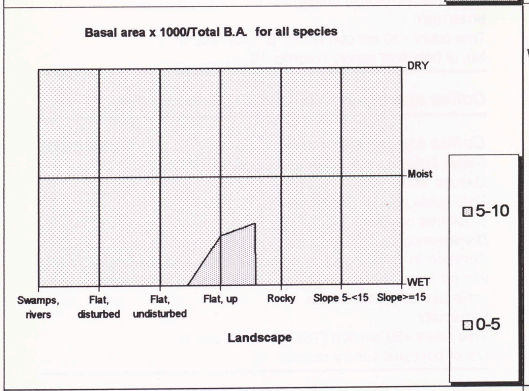
Claoxylon hexandrum see *Discoclaoxylon*

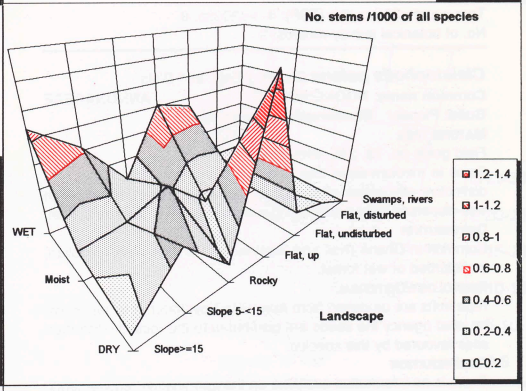
Cleidion gabonicum Baill. **EUPHORBIACEAE**
Common name: MPAWU
Guild: Shade-bearer **Conservation:** Green star

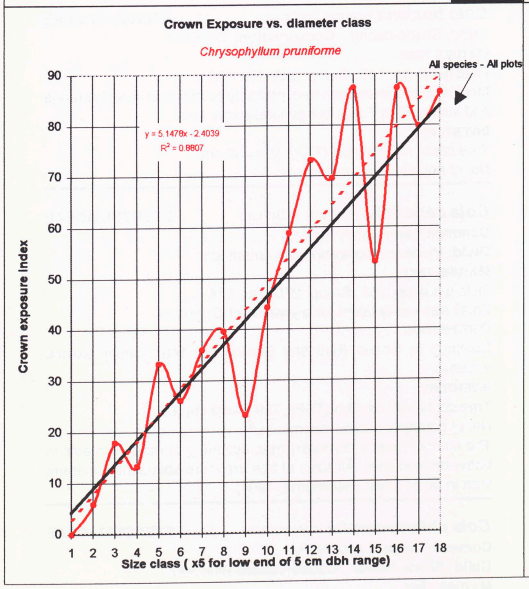
Chrysophyllum pruniforme

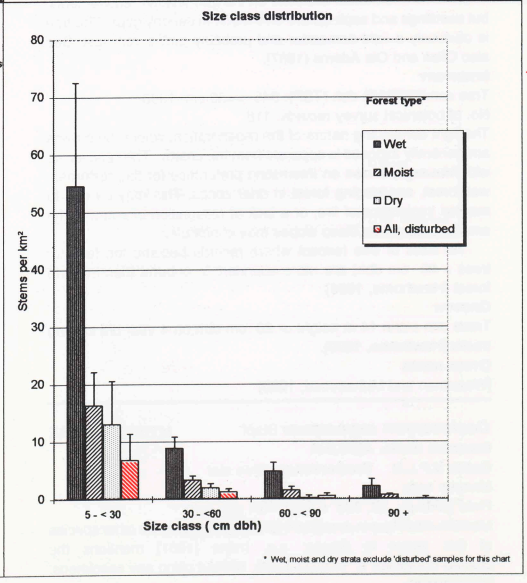












MATURE TREE
Field guide pp. 105 Group: 17C No. 167
Small tree.
DISTRIBUTION
Locally abundant in Ghana in semideciduous forests (Hall and Swaine sp. 138); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 1628 >=30 cm: 5
No. of botanical survey records: 47
The charts reveal an understorey species with a preference for dry forest and slopes and other well-drained sites elsewhere.

Cleistanthus polystachyus Hook.f. *ex* Planch.
Guild: Swamp **Conservation:** Blue star **EUPHORBIACEAE**
MATURE TREE
Field guide pp. 85 Group: 13B No. 168
Small tree of riversides, mostly in west of country; widespread in tropical Africa.
FIELD IDENTITY
Not reliably named by tree spotters; some specimens were collected in TSP plots.
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 0
No. of botanical survey records: 9

Cleistopholis patens (Benth.) Engl. and Diels
Common name: NGONENKYENE **ANNONACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 73, 242 Group: 12A No. 169
Small to medium-sized tree of secondary and swamp forest with distinctive airy crown of horizontal branches, and branchlets with well-dispersed leaves resembling compound leaves. Bole cylindrical.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 139); Guineo-Congolian, in disturbed or wet forest.
PHENOLOGY/DISPERSAL
Ripe fruits are produced from August to November. It is not known by what agency the seeds are distributed to the recently-disturbed sites favoured by this species.
REGENERATION
There is no information available on the germination requirements, but seedlings and saplings are only found in canopy gaps. The tree is obviously a light-demander and probably grows very fast. See also Okali and Ola Adams [1987].
INVENTORY
Tree count <30 cm dbh (TSP): 345 >=30 cm: 1038
No. of botanical survey records: 118
The light demanding nature of the regeneration, where the crowns are generally exposed is apparent from the charts. The species, as with *Musanga*, shows an interesting preference for flat, disturbed, wet forest, and sloping forest in drier zones. This may be due to marked intolerance of fire, or a lack of recognition of some of the smaller streams on steep slopes may contribute.

All sizes of tree (except where records become too few, for trees > 90 cm dbh) are more abundant in unburnt than in burnt forest [Hawthorne, 1994].
GROWTH
Trees can attain 14 m height or 20 cm dbh on 4 year old logging tracks [Hawthorne, 1993].
OTHER NOTES
[Waterman and Muhammed, 1985]

Coelocaryon oxycarpum Stapf **MYRISTICACEAE**
Common name: ABRUMA
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 83, 238 Group: 13A No. 170
Medium-sized tree in evergreen forests. There may be other species of this genus in Ghana: e.g. Irvine [1961] mentions the Guineo-Congolian *C. preussii* Warb. without citing any specimens.
DISTRIBUTION
Guineo-Congolian species [FWTA].
PHENOLOGY/DISPERSAL
Probably dispersed by birds, like similar species in Gabon [Gautier-Hion and Michaloud, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 49 >=30 cm: 257
No. of botanical survey records: 17
A strong preference for evergreen forest, except flat areas, is clearly seen on the charts. The species can be seen to spread into semideciduous forests mainly in swamps and steep slopes. Possibly, a lack of recognition of some of the smaller streams on steep slopes may contribute to this.

Coffea canephora **RUBIACEAE**
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 32
DISTRIBUTION
Small to medium-sized tree. Wild coffee, of sporadic occurrence in several forest types, but not common except where planted. Of economic-genetic significance. TSP inventory records were nil. Several similar small Rubiaceae trees are grouped under 'KWAE-KOFI' (=bush coffee).
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 16

Coffea spathicalyx see *Calycosiphonia spathicalyx*

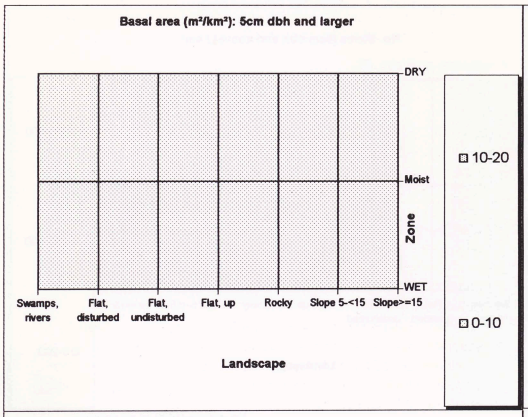
Coffea togoensis A.Chev. **RUBIACEAE**
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 35 Group: 1E No. 172
Small tree or shrub.
DISTRIBUTION
Common in Ghana only in dry forest (Hall and Swaine sp. 147), around from Tain II F.R. to the Volta region, and restricted to a small part of Upper Guinea.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 15

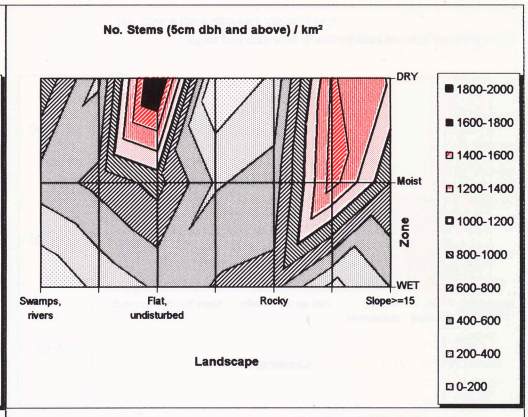
Cola boxiana Brenan and Keay **STERCULIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 145 Group: 27A No. 173
Medium-sized, evergreen tree, probably commonest in Atewa range and surrounding F.R.s, but generally very rare.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 7

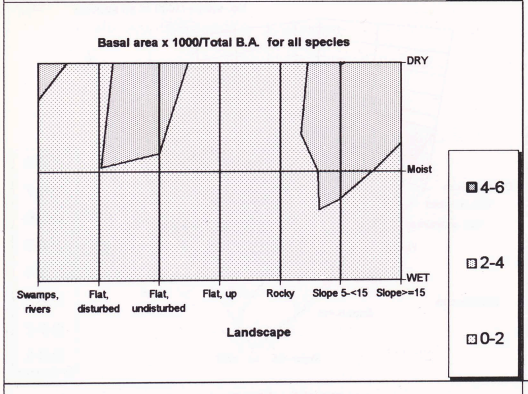
Cola caricifolia (G.Don) K.Schum **STERCULIACEAE**
Common name: ANANSEAYA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 152 Group: 27D No. 174
Small tree easily taken for a juvenile of *C. millenii.*
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 148); Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 759 >=30 cm: 66
No. of botanical survey records: 164
The charts reveal a dry forest tree, occurring in moister forests in better-drained sites. All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

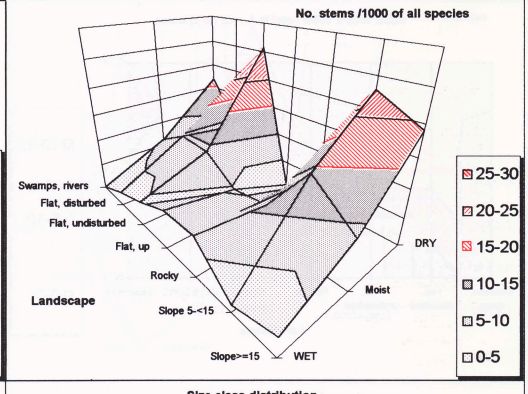
Cola chlamydantha K.Schum. **STERCULIACEAE**
Common name: TANA-NFRe
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 157 Group: 28B No. 175
Small to medium-sized, unbranched tree with large leaves.

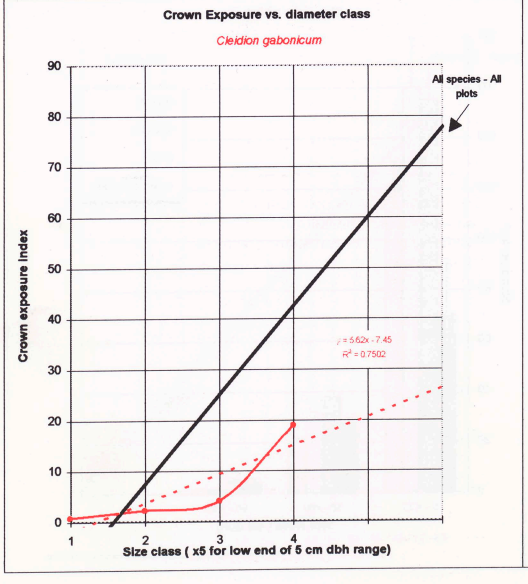
Cleidion gabonicum

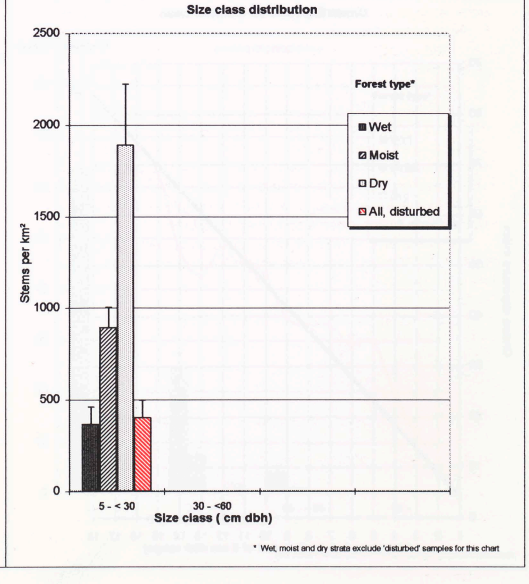




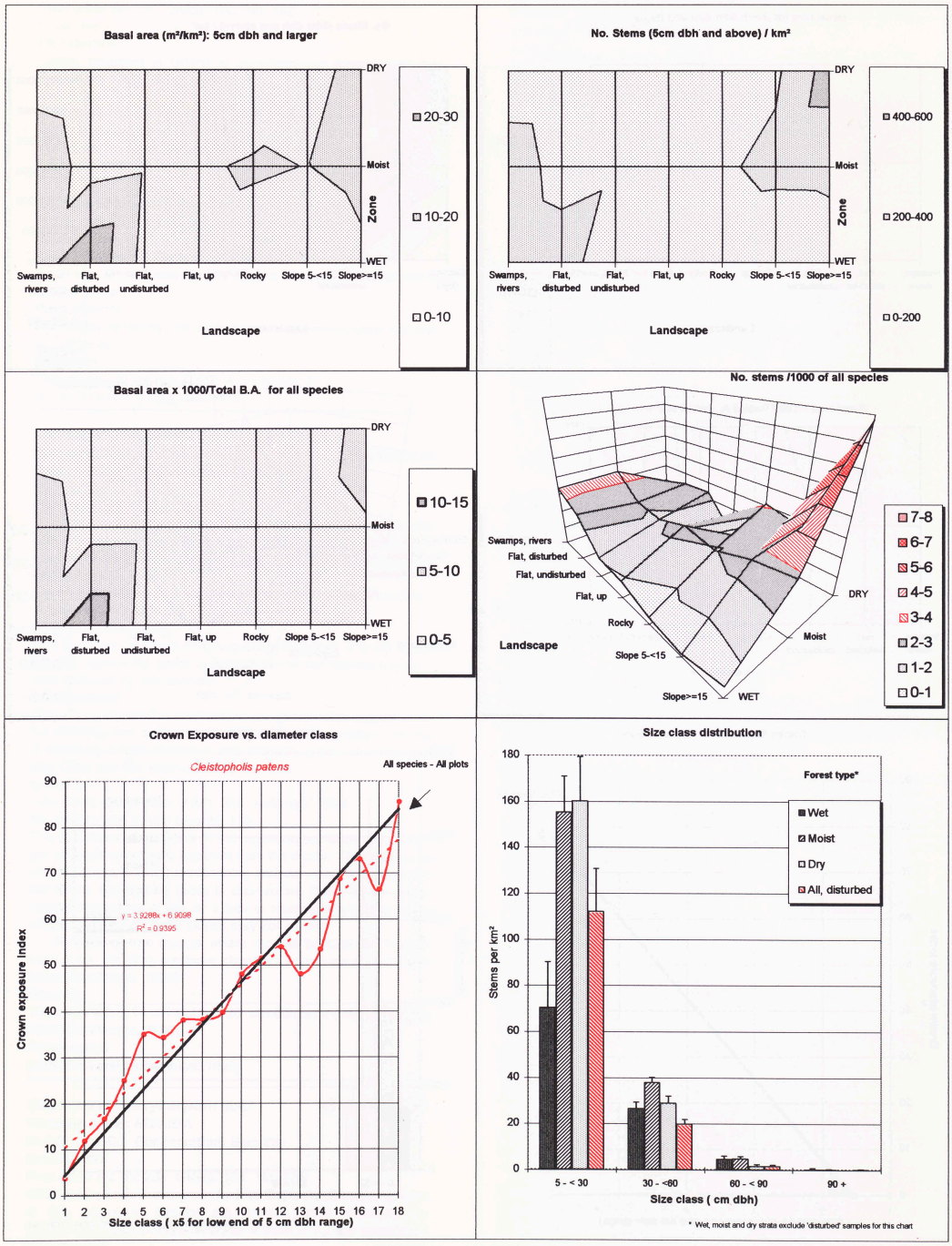




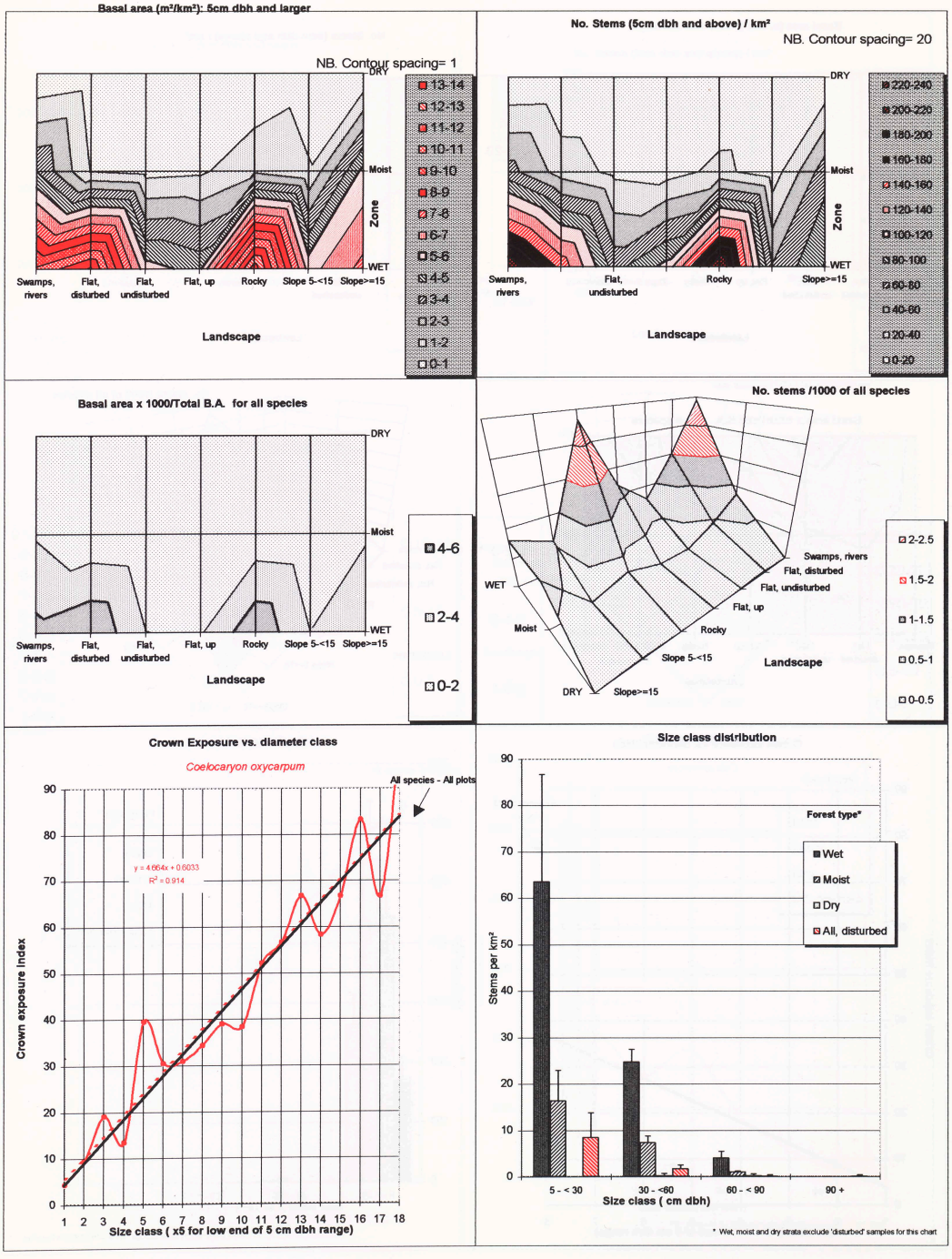




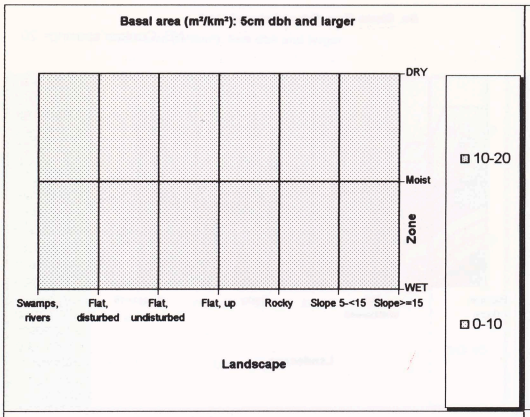
Cleistopholis patens

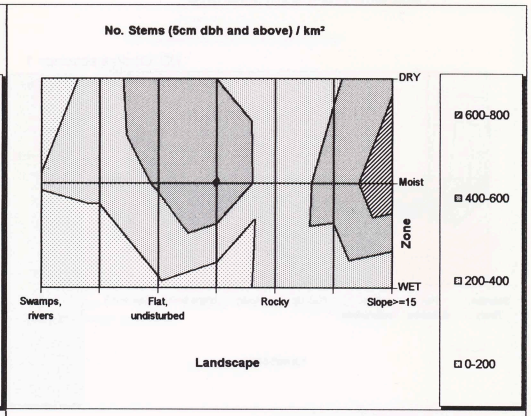


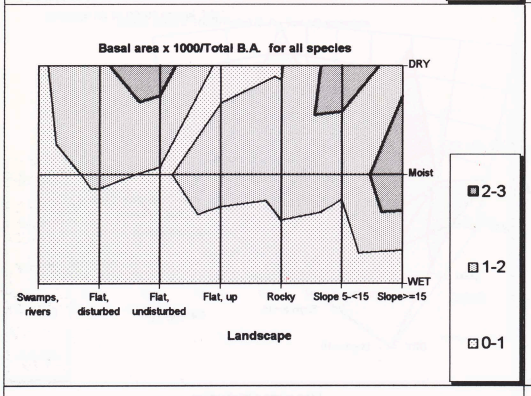
Coelocaryon oxycarpum

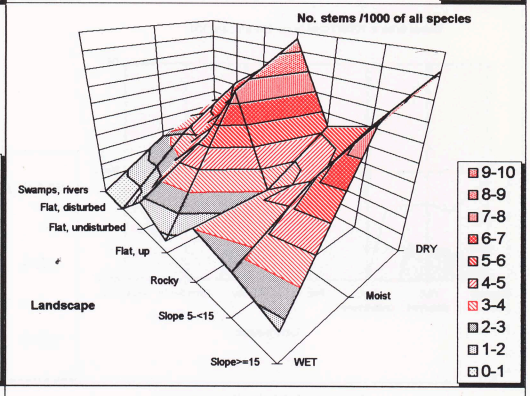


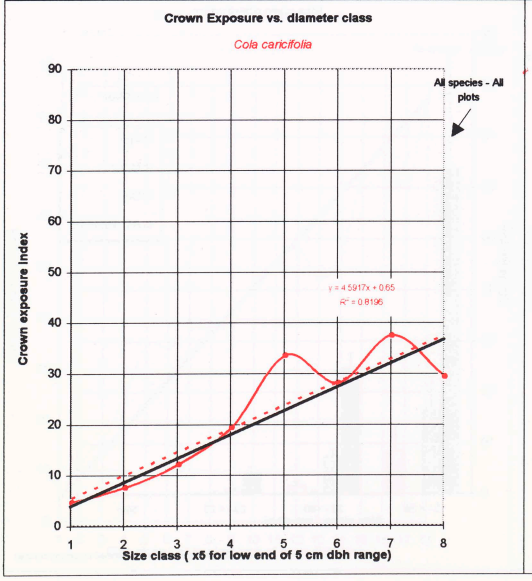
Cola caricifolia

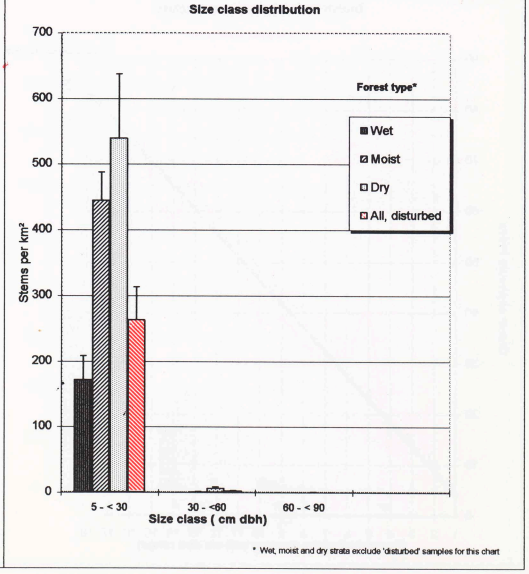




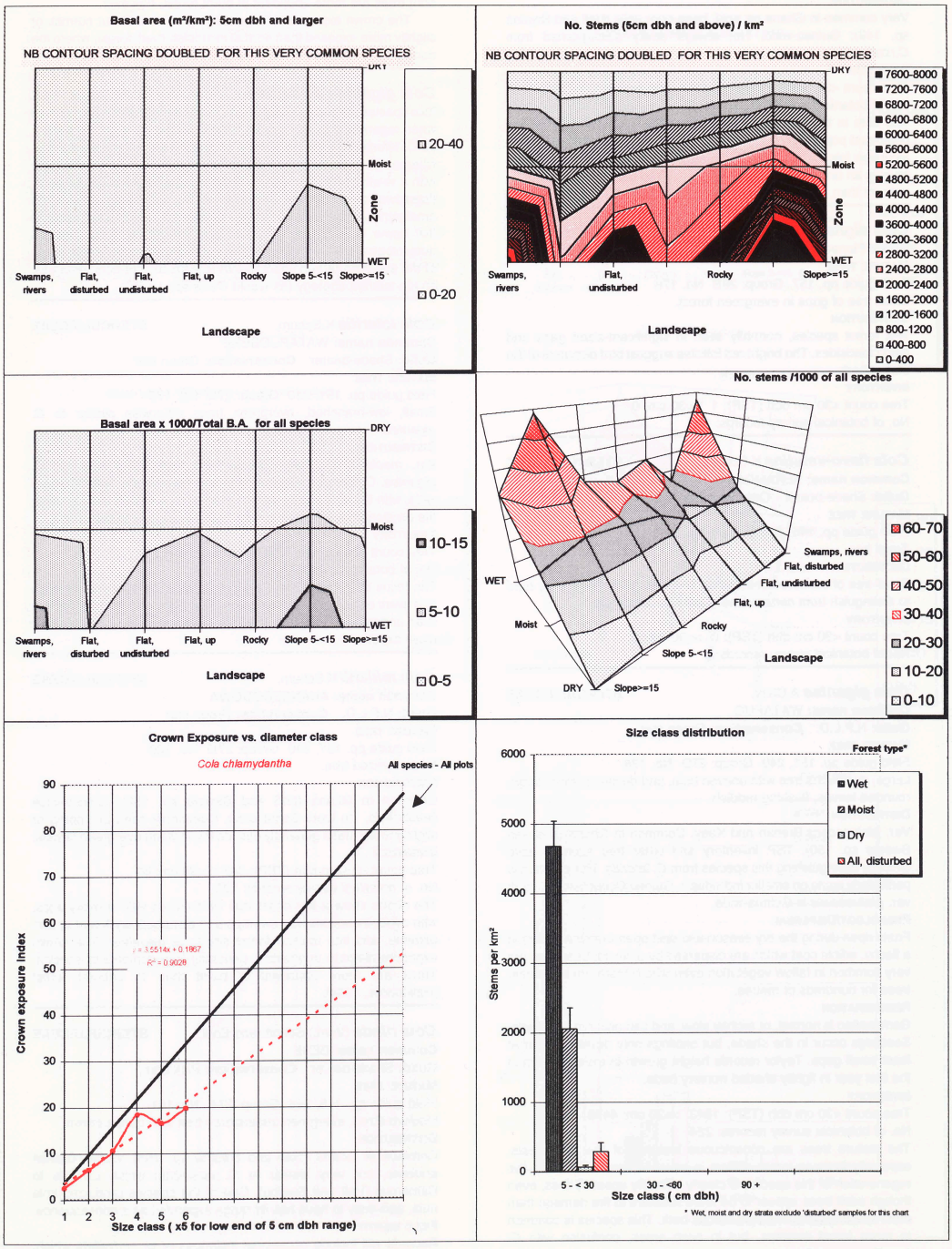








Cola chlamydantha



DISTRIBUTION
Very common in Ghana on acid, base-poor soils (Hall and Swaine sp. 149); Guinea-wide. Not always easily distinguished from *C.umbratilis.*
INVENTORY
Tree count <30 cm dbh (TSP): 3155 >=30 cm: 9
No. of botanical survey records: 118
The data in the charts will include records for *C. umbratilis.* The combined population is greatest in evergreen forest, with the main incursion into moister forests on mild slopes. The exposure chart reveals an understorey tree. All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Cola digitata Mast. **STERCULIACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 157 Group: 28B No. 176
Small tree of gaps in evergreen forest.
DISTRIBUTION
Wet forest species, normally seen in significant-sized gaps and along roadsides. The bright red follicles suggest bird dispersal of the black seeds.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 16

Cola flavo-velutina K.Schum. **STERCULIACEAE**
Common name: AFRAMDASA
Guild: Shade-bearer **Conservation:** ? star
MATURE TREE
Field guide pp. 145 Group: 27A No. 177
Small tree.
DISTRIBUTION
Small tree of scattered occurrence (? Moist, rocky hills). Very hard to distinguish from certain other *Cola/Octolobus* spp.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Cola gigantea A.Chev. **STERCULIACEAE**
Common name: WATAPUO
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 151, 240 Group: 27D No. 178
Large, deciduous tree with uneven bole, and dense crown of large, rounded leaves, flushing reddish.
DISTRIBUTION
Var. *glabrescens* Brenan and Keay. Common in Ghana (Hall and Swaine sp. 150). TSP inventory and other tree spotters have difficulty distinguishing this species from *C. lateritia.* This problem is particularly acute on smaller individuals. Guineo-Congolian, although var. *glabrescens* is Guinea-wide.
PHENOLOGY/DISPERSAL
Fruits ripen during the dry season and split open to reveal seeds in a fleshy, edible coat which are dispersed by animals. Seedlings are very common in fallow vegetation even where there are no mother trees for hundreds of metres.
REGENERATION
Germination is normal, or slightly slow, and can occur in the shade. Seedlings occur in the shade, but saplings only develop under at least small gaps. Taylor records height growth in excess of 1m in the first year in lightly shaded nursery beds.
INVENTORY
Tree count <30 cm dbh (TSP): 1843 >=30 cm: 4458
No. of botanical survey records: 224
The mature trees are conspicuous features of the dry forests, especially in those forest outliers in savanna areas. However, the regeneration of this species is clearly severely upset by fires, even though adult trees appear to be more resistant to fire damage than most species, with their thick fibrous bark. This species is common in moist forest swamps, but in such areas, confusion with *C. lateritia*, especially when young, is quite likely.

Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest [Hawthorne, 1994]. Medium-sized (30-60 cm dbh) trees are more abundant in burnt forest, however.

The crown exposure of regenerating trees is about normal, or slightly more exposed than normal in 'undisturbed' forest, where the density of small trees is the greatest.

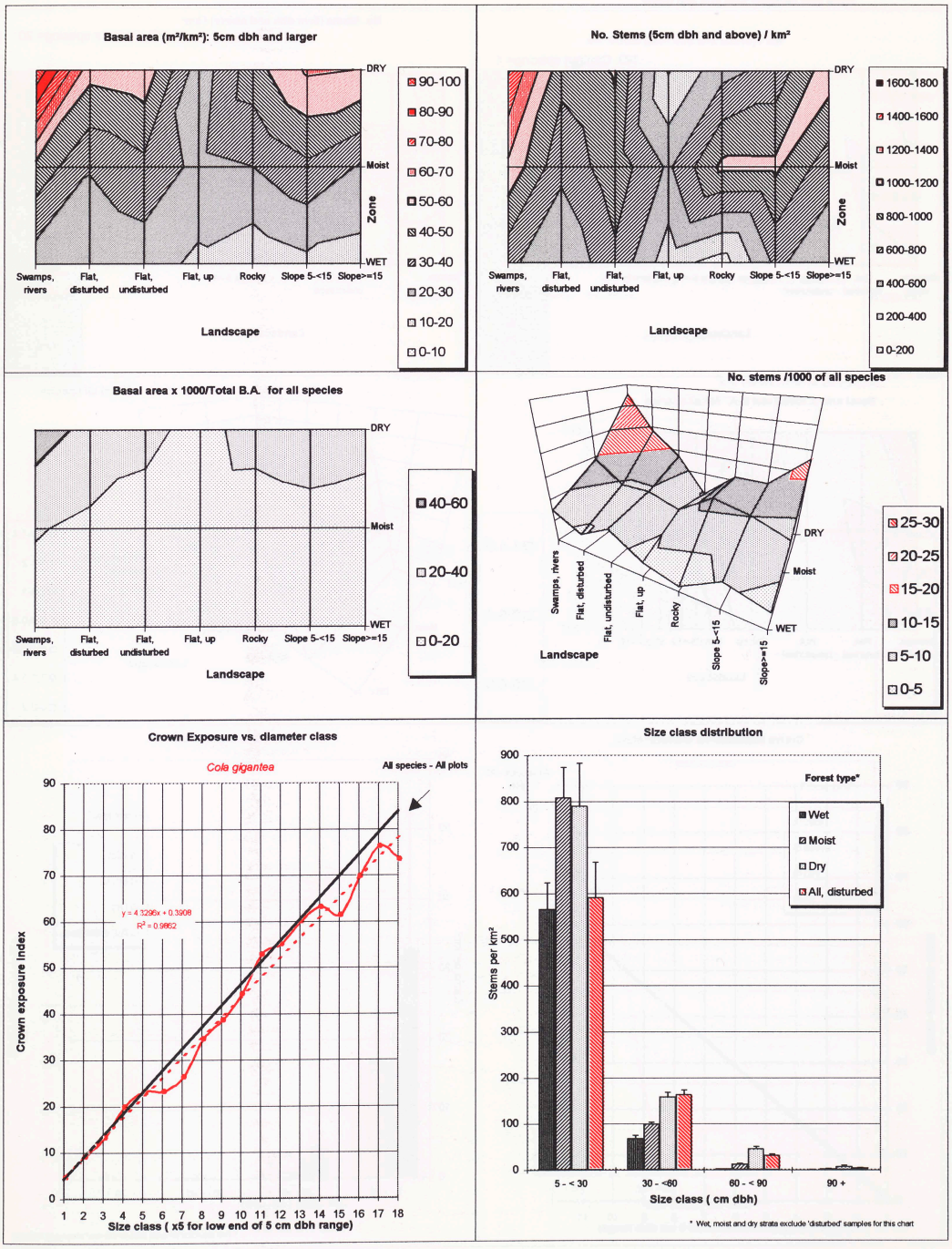
Cola gigantea & lateritia **STERCULIACEAE**
Two species with similar foliage, which are therefore easily confused when regenerating. The mature trees, however, are quite different, as *C. lateritia* is a medium-sized, spreading and often twisted tree, whereas *C. gigantea* is a straighter-stemmed, light-demanding tree with a relatively narrow crown. There has been some confusion of these two species by TSP tree spotters, but not enough to force the amalgamation of results. This pair of species, which often occur in the same forests, would make an interesting focus for an autecological study into the physiological and structural implications of the evolution of tree species with respect to light-demanding *vs.* shade-tolerant strategy (as would *Celtis* spp.).

Cola lateritia K.Schum. **STERCULIACEAE**
Common name: WATAPUOBERE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 151, 240 Group: 27D No. 179
Small, low-branched, evergreen trees otherwise similar to *C. gigantea.*
DISTRIBUTION
Var. *maclaudii* (A.Chev.) Brenan and Keay. See note for *C. gigantea.* Common in Ghana (Hall and Swaine sp. 150); Guinea-wide, with the area exclusively divided upon between two varieties; the division between their ranges being in Nigeria [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 48 >=30 cm: 73
No. of botanical survey records: 47
The focus of this species is evergreen forest slopes, and swamps and rivers elsewhere. The exposure chart highlights the fact that this is an understorey tree, in contrast to *C. gigantea* which is generally more exposed.

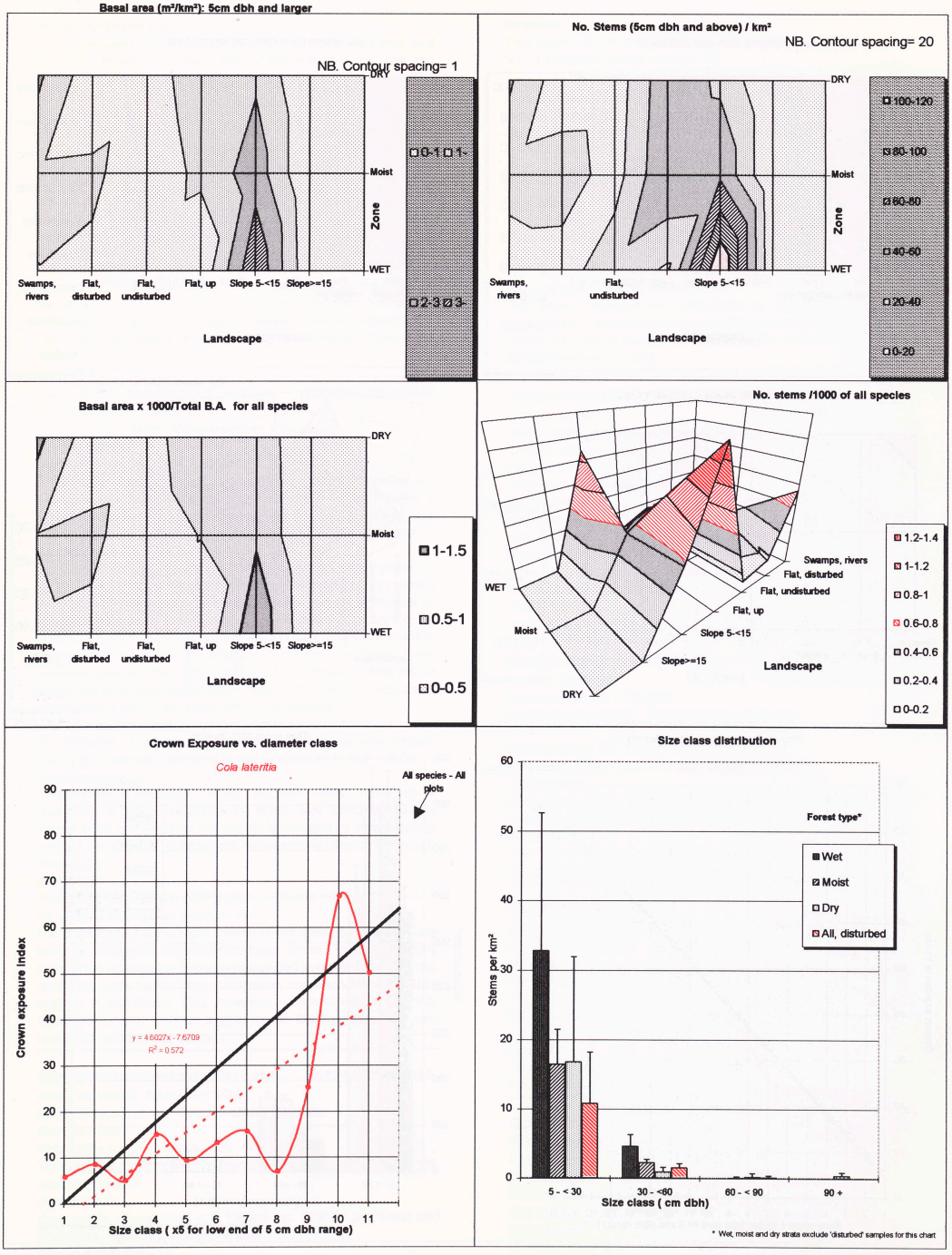
Cola millenii K.Schum. **STERCULIACEAE**
Common name: ANANSEDODOWA
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 151, 240 Group: 27D No. 180
Medium-sized tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 152); Guinea-wide (westwards, to Ivory Coast only). Commonly seen in sloping or slightly rocky areas generally outside the lowland evergreen forests.
INVENTORY
Tree count <30 cm dbh (TSP): 447 >=30 cm: 49
No. of botanical survey records: 192
The charts show a dry forest tree which fares well in rocky sites, with minor incursions into swamps and disturbed dry forest at one extreme, and into moister forest slopes at the other. The crown exposure diagram suggests a generally light-demanding species. Trees are more abundant in burnt than in unburnt forest [Hawthorne, 1994].

Cola nitida (Vent.) Schott. and Endl. **STERCULIACEAE**
Common name: BESE
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 145, 244 Group: 27A No. 181
Medium-sized, evergreen understorey tree with dense crown.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 153). Upper Guinea endemic, but very similar to *C. verticillata* which extends to Cameroun [Hall and Swaine]. One of the species producing kola nuts, and likely to have has its range expanded as a consequence.
FIELD IDENTITY
Records will include occasional instances of *C. verticillata* which, however, appears to be much rarer.

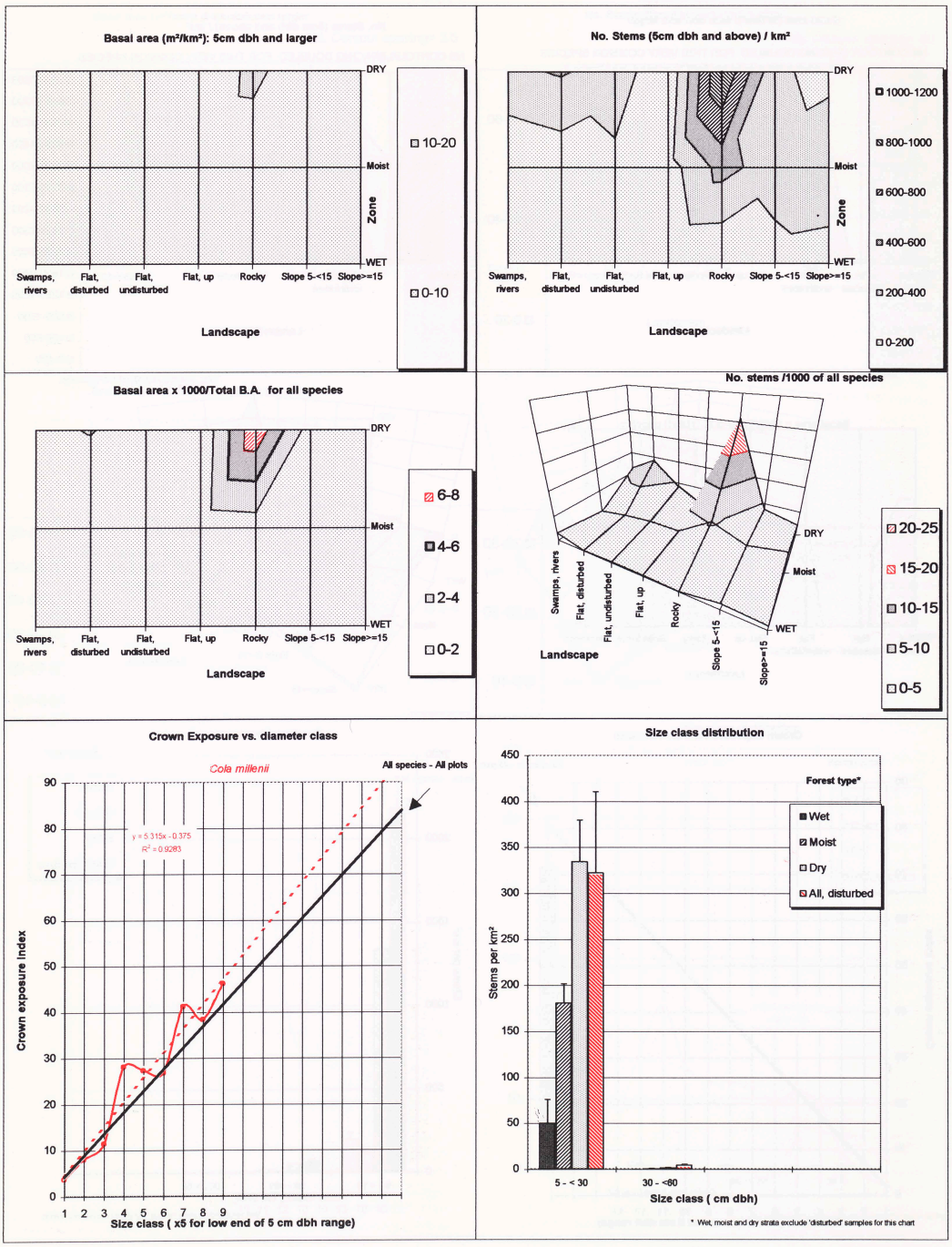
Cola gigantea



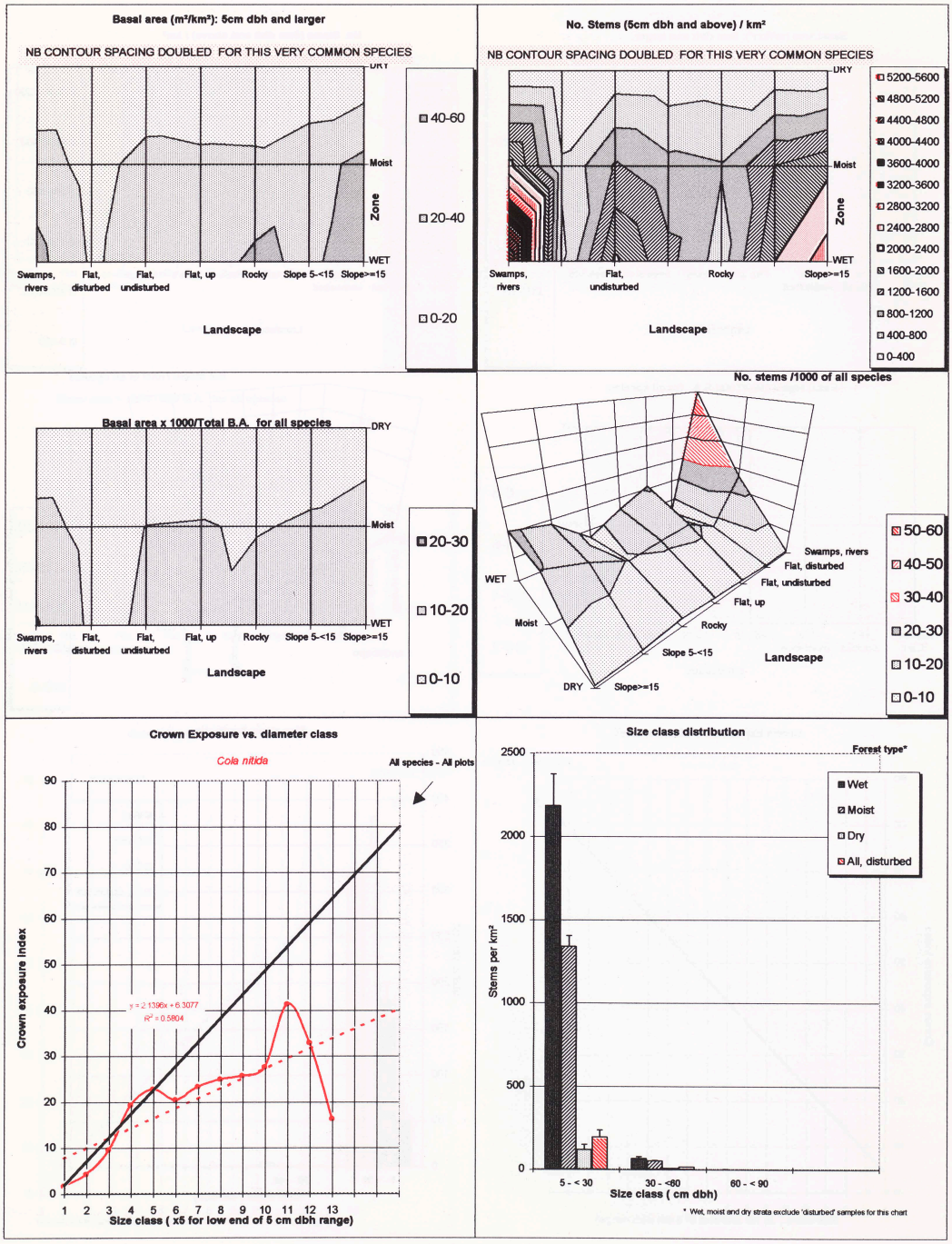
Cola lateritia



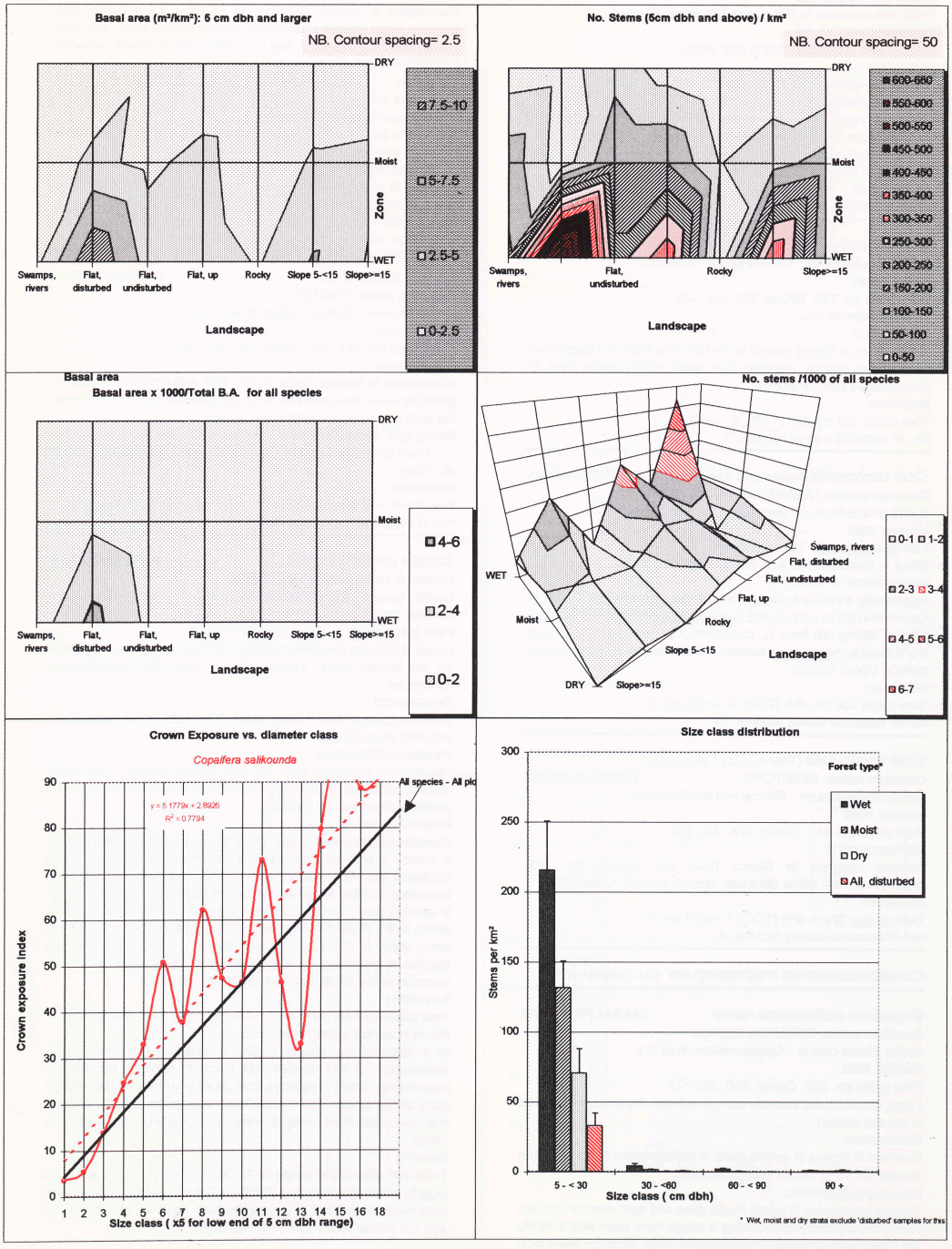
Cola millenii



Cola nitida


Basal area (m²/km²): 5cm dbh and larger
NB CONTOUR SPACING DOUBLED FOR THIS VERY COMMON SPECIES
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
40-60
20-40
0-20
No. Stems (5cm dbh and above) / km²
NB CONTOUR SPACING DOUBLED FOR THIS VERY COMMON SPECIES
5200-5600
4800-5200
4400-4800
4000-4400
3600-4000
3200-3600
2800-3200
2400-2800
2000-2400
1600-2000
1200-1600
800-1200
400-800
0-400
Basal area x 1000/Total B.A. for all species
20-30
10-20
0-10
No. stems /1000 of all species
50-60
40-50
30-40
20-30
10-20
0-10
Crown Exposure vs. diameter class
Cola nitida
All species - All plots
Crown exposure index
y = 2.1396x + 6.3077
R² = 0.5804
Size class (x5 for low end of 5 cm dbh range)
Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

Copaifera salikounda



PHENOLOGY/DISPERSAL
Fruits are produced in October to November [Taylor].
REGENERATION
Ibikunle and McKenzie, [1973] (not seen).
INVENTORY
Tree count <30 cm dbh (TSP): 2412 >=30 cm: 1187
No. of botanical survey records: 159
The charts highlight an understorey tree of moister semideciduous and evergreen forests with a distaste for rocky and disturbed forest, and a preference for swampy sites. All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].
OTHER NOTES
[Russell, 1955]

Cola reticulata A.Chev. **STERCULIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 145 Group: 27A No. 173
Small, evergreen tree.
DISTRIBUTION
Not common in Ghana except in the UE zone (Hall and Swaine sp. 154); Upper Guinea endemic. Not easily distinguished from *C. flavo-velutina* and *Octolobus*.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 7

Cola umbratilis Brenan and Keay **STERCULIACEAE**
Common name: TANANFRoBERE
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 157 Group: 28B No. 183
Small to medium-sized tree like *C. chlamydantha*.
DISTRIBUTION
Supposedly endemic to Ghana, but almost certainly in Ivory Coast. Common in Ghana only in WE forest (Hall and Swaine sp. 155), but hard to distinguish from *C. chlamydantha* if not fertile. It is even more closely related to *C. buntingii*, which occurs in more western parts of Upper Guinea.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 37

Cola verticillata (Thonn.) Stapf ex A.Chev.
Common name: BESETORO **STERCULIACEAE**
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 145 Group: 27A No. 184
DISTRIBUTION
Perhaps common in Ghana (Hall and Swaine sp. 153), Guinea-wide, but rather dubiously distinct from *C. nitida* (*cf.*).
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

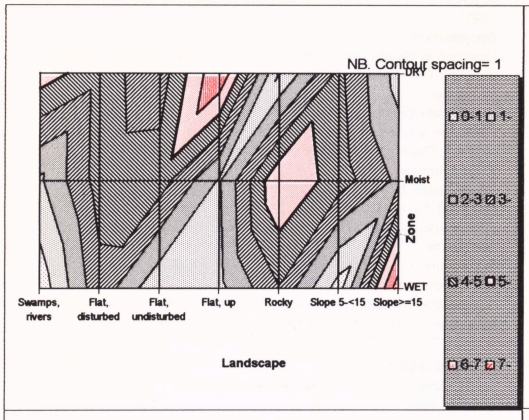
Combretodendron macrocarpum see *Petersianthus*

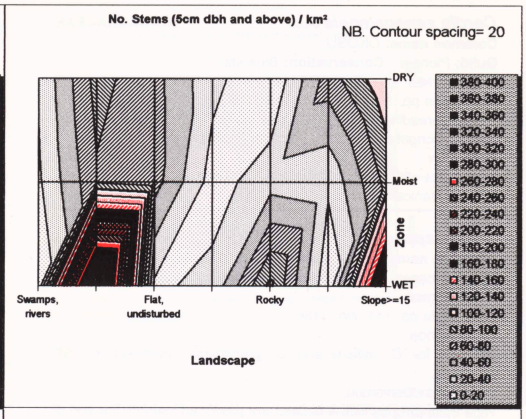
Copaifera salikounda Heckel **CAESALPINIACEAE**
Common name: ENTEDUA, Bubinga
Guild: Shade-bearer **Conservation:** Red star
MATURE TREE
Field guide pp. 202 Group: 37D No. 185
Large, unbuttressed tree with orange-red bark. New leaves flush red in the dry season.
DISTRIBUTION
Common in Ghana in certain parts of various forest types (Hall and Swaine sp. 161); Upper Guinea endemic.
PHENOLOGY/DISPERSAL
Flowers March-May [Taylor]. Fruits ripen and split open on the tree during the dry season, revealing a single hard seed with a fleshy aril. The seeds are probably dispersed by birds, although many drop straight to the ground.
REGENERATION
Germination is normal. Seedlings of all sizes are generally very common in the shaded understorey around mother trees, and even in only small gaps saplings and older trees can be found, revealing that the tree is shade-tolerant.
INVENTORY
Tree count <30 cm dbh (TSP): 231 >=30 cm: 81
No. of botanical survey records: 67
The charts clearly show the low densities of adults, but relatively very high densities of regeneration. Clearly, the mortality of trees of all size classes is very high. Those that do survive beyond c. 15 cm dbh tend to be more exposed than average for trees of their size. The species is most abundant in evergreen forest, and although stem density has various peaks throughout the landscape, the basal area (large trees) is greatest in flat, disturbed sites there.

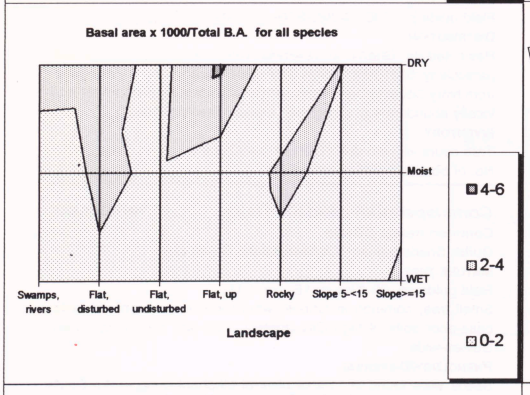
Cordia millenii Bak. **BORAGINACEAE**
Common name: TWENEBOA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 141, 240 Group: 26 No. 186
DISTRIBUTION
Widespread in tropical Africa. In the TSP inventory this species is given the same local name as *C. platythyrsa*; the latter is commoner but both have been include under *C.* spp.
Strong light-demander [Philip, 1967].
Fruits probably dispersed by primates in Uganda [Plumptree *et al.*, 1994].
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 1 (see *Cordia* spp.)
No. of botanical survey records: 8

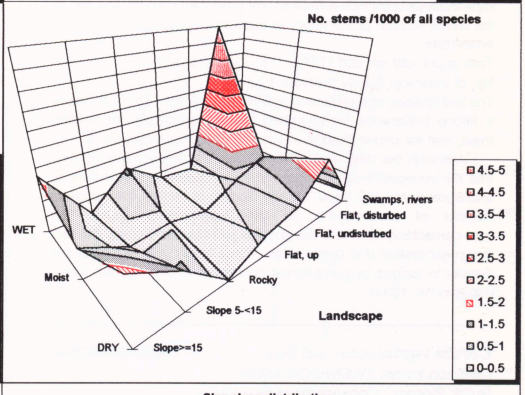
Cordia platythyrsa Bak. **BORAGINACEAE**
Common name: TWENEBOABERE
Guild: Pioneer **Conservation:** Pink star
MATURE TREE
Field guide pp. 141 Group: 26 No. 187
Large, deciduous tree of secondary forest with stout, low buttresses on the largest trees. Young trees at least are conspicuously flat-topped.
DISTRIBUTION
Common pioneer tree in some areas; Most TSP records have been included under *C.* spp.
PHENOLOGY/DISPERSAL
Flowers are produced after the new leaves [Taylor]. The fleshy drupes, produced in the rainy season (June to Aug. [Taylor]) are probably dispersed by animals.
REGENERATION
Conspicuously preferring canopy gaps as a seedling, this species is clearly a pioneer. Saplings are frequently 'in the lead' along roadsides etc. Germination is normal or slightly slow, with 77% success according to Taylor. Taylor states that natural germination is seldom seen, and indeed this seems to be the case in most areas. In Bia South G.P.R., however, the saplings are very common along many of the new logging roads. It is conceivable that the species is dispersed by elephants, or other animals which are common in Bia South but rare or absent elsewhere.
INVENTORY
Tree count <30 cm dbh (TSP): 6 >=30 cm: 7 (see *Cordia spp*)
No. of botanical survey records: 8
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to thrive in burnt forest [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR more affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].
GROWTH
Trees can attain 23 m height or 23 cm dbh within 4 years along old logging roads [Hawthorne, 1993]. In Sierra Leone, mean annual increments for the first 18 years have been reported as between 1.3 and 2.5 inches [Savill and Fox, 1967].

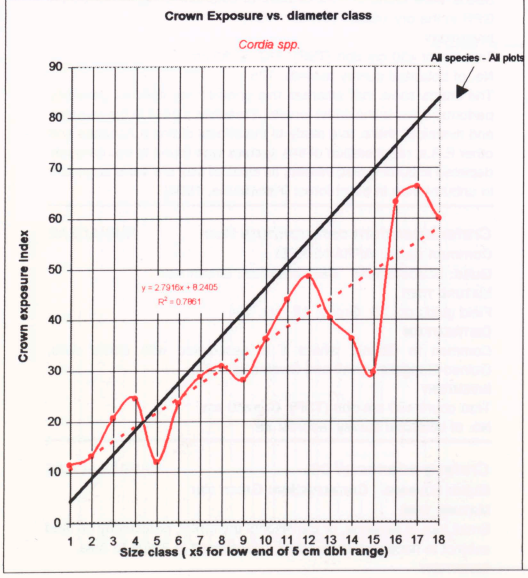
Cordia spp.

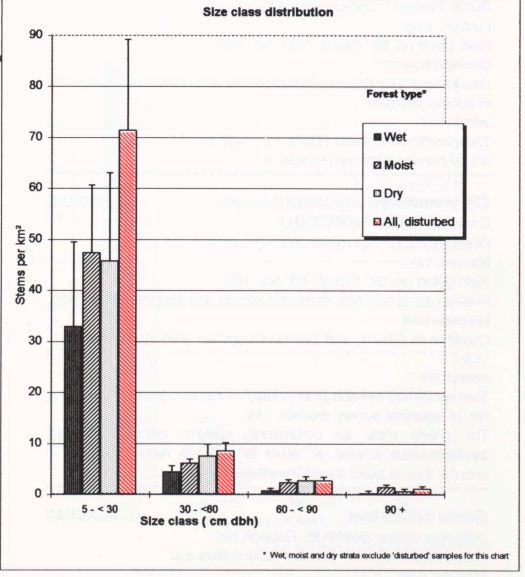

NB. Contour spacing= 1
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
0-1
1-
2-3
3-
4-5
5-
6-7
7-


No. Stems (5cm dbh and above) / km²
NB. Contour spacing= 20
DRY
Moist
WET
Zone
Swamps, rivers
Flat, undisturbed
Rocky
Slope>=15
Landscape
380-400
360-380
340-360
320-340
300-320
280-300
260-280
240-260
220-240
200-220
180-200
160-180
140-160
120-140
100-120
80-100
60-80
40-60
20-40
0-20


Basal area x 1000/Total B.A. for all species
DRY
Moist
WET
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
4-6
2-4
0-2


No. stems /1000 of all species
WET
Moist
DRY
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
4.5-5
4-4.5
3.5-4
3-3.5
2.5-3
2-2.5
1.5-2
1-1.5
0.5-1
0-0.5


Crown Exposure vs. diameter class
Cordia spp.
All species - All plots
y = 2.7916x + 8.2405
R² = 0.7861
Crown exposure index
Size class (x5 for low end of 5 cm dbh range)


Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
90 +
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

Cordia senegalensis Juss. **BORAGINACEAE**
Common name: OKOSU
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 141 Group: 26 No. 188
Small, spreading understorey tree of dry forests and savanna. Guineo-Congolian. Probably a cryptic pioneer.
INVENTORY
Tree count <30 cm dbh (TSP): 27 >=30 cm: 15
No. of botanical survey records: 7

Cordia spp. **BORAGINACEAE**
Common name: TWENEBOA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 141 No. 1186
DISTRIBUTION
Records for *C. millenii* and *C. platythyrsa* combined in TSP inventory.
PHENOLOGY/DISPERSAL
Ripe fruits (drupes with 4 nutlets) are produced towards the end of the wetter season (June-Aug.), at least in *C. platythyrsa*.
INVENTORY
Tree count <30 cm dbh (TSP): 115 >=30 cm: 307
No. of botanical survey records: 1
The two species are not distinguished in the charts. There is clearly a strong preference for disturbed forest, particularly for smaller trees, and for undisturbed, well-drained sites for larger trees.

Although the data are rather sparse, there is some indication that the youngest trees are generally very exposed, particularly in undisturbed MS-ME, and MSNW forest to which the greatest number of observations on the regeneration apply. The light-demanding nature of the species is indicated also by the fact that regeneration and larger sizes of tree occur at about twice the density in logged or burnt forest compared to undisturbed forest [Hawthorne, 1994].

Cordia vignei Hutch. and Dalz. **BORAGINACEAE**
Common name: TWENEBOA-AKOA
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 89 Group: 13D No. 189
DISTRIBUTION
Small tree of very disturbed forest, fallow and savanna. Widespread in tropical Africa.
INVENTORY
Tree count <30 cm dbh (TSP): 12 >=30 cm: 11
No. of botanical survey records: 0

Corynanthe pachyceras K.Schum. **RUBIACEAE**
Common name: PAMPENAMA
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 32 Group: 1D No. 190
Medium-sized tree with epicormic shoots and irregular, fluted bole.
DISTRIBUTION
Common in Ghana, and Guineo-Congolian (Hall and Swaine sp. 163).
INVENTORY
Tree count <30 cm dbh (TSP): 1807 >=30 cm: 3639
No. of botanical survey records: 114
The charts show an understorey species preferring (moist) semideciduous forests. All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Coula edulis Baill. **OLACACEAE**
Common name: BoDWUE, Gaboon nut
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 146, 245 Group: 27B No. 191
Medium-sized, middle-storey, evergreen tree. Some vegetative regeneration occurs, via root suckers or stem sprouts [de Klerk, 1991].
DISTRIBUTION
Common in Ghana only in Wet Evergreen forest (Hall and Swaine sp. 165); Guinea-wide. Fruits (nuts) are used to produce an edible oil [Abbiw, 1990].
PHENOLOGY/DISPERSAL
Fruits for a large portion of the year centred on the dry season [Taylor]. The fruits are probably dispersed by animals.
REGENERATION
Young trees higher than 1.5 m of this species are less strongly favoured by gaps than many other tree species, but still are disproportionately common there [de Klerk, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 155 >=30 cm: 579
No. of botanical survey records: 27
The charts highlight the preference of this species for undisturbed evergreen forest, where it is typically in the understorey.

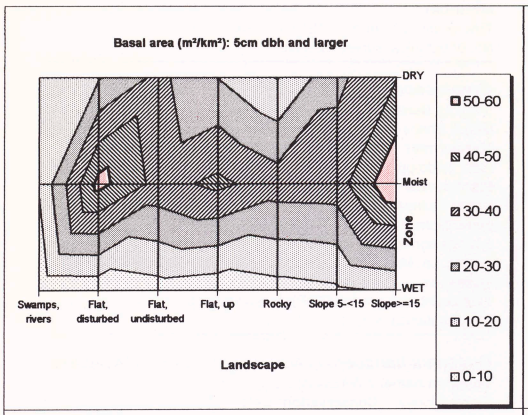
Craibia atlantica Dunn **PAPILIONACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 209 Group: 37G No. 192
DISTRIBUTION
Restricted in Ghana to reserves which were not inventoried: particularly Shai hills, but in any case uncommon. Guinea-wide: from Ivory Coast to Cameroun, with a very irregular distribution, and locally abundant e.g. along river banks [Geerling, 1982].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

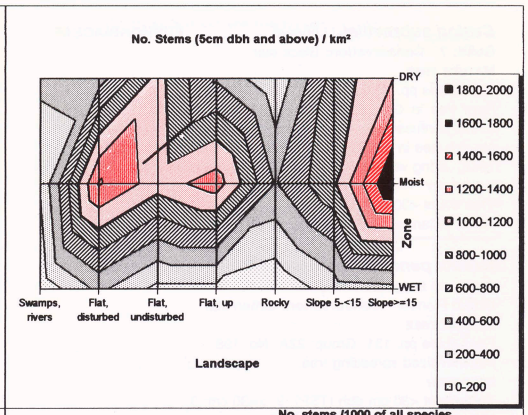
Craterispermum caudatum Hutch. **RUBIACEAE**
Common name: DUADe
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 35 Group: 1E No. 193
Small tree, common in Ghana, where it is associated with acid, base-poor soils of high clay content (Hall and Swaine sp. 166); Guinea-wide.
PHENOLOGY/DISPERSAL
Seeds were found in 11% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 332 >=30 cm: 37
No. of botanical survey records: 175
The charts show that whereas this understorey species generally performs worst in the driest forests, it reaches a peak in the swamps and riversides there. In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest; indeed, all sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

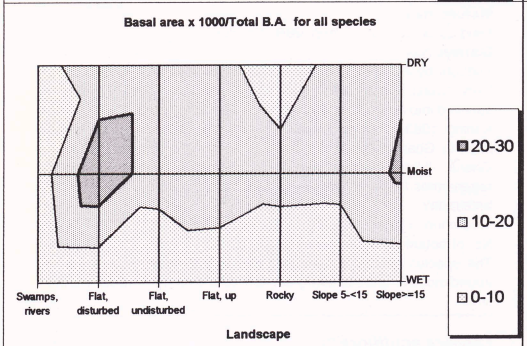
Craterispermum cerinanthum Hiern **RUBIACEAE**
Common name: AFRA-NI-AFEI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 35 Group: 1E No. 194
DISTRIBUTION
Common in Ghana, where it is associated with acidic soils; Guineo-Congolian (Hall and Swaine sp. 167).
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 28

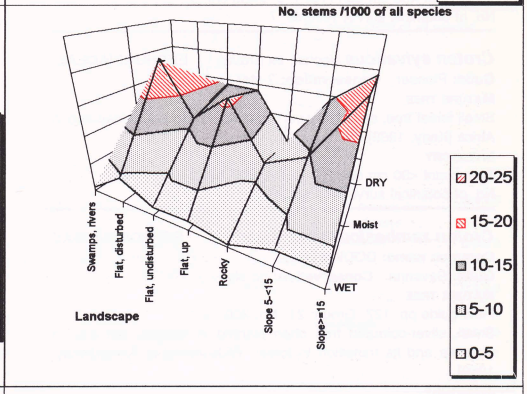
Crateva adansonii DC. **CAPPARACEAE**
Guild: Savanna **Conservation:** Green star
MATURE TREE
Small tree of savanna, or transitional dry forest, particularly on land subject to flooding [Keay, 1989]; widespread in Africa to Asia.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 2

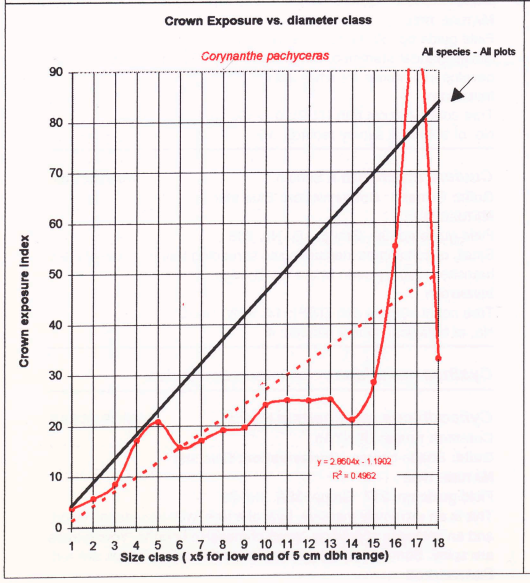
Corynanthe pachyceras

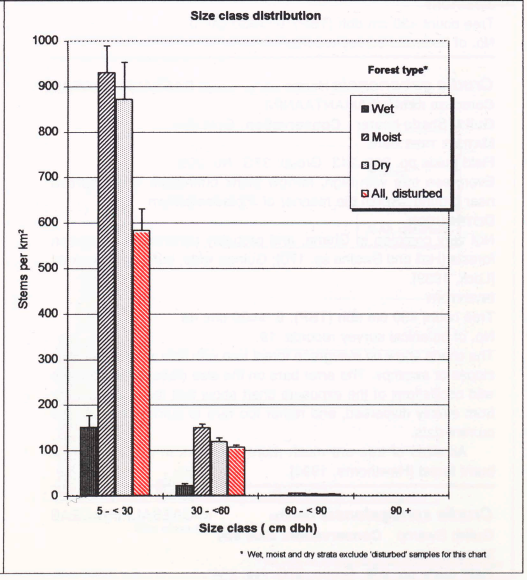












Croton aubrevillei J.Leonard **EUPHORBIACEAE**
Guild: ? **Conservation:** Black star
MATURE TREE
Field guide pp. 127 Group: 21 No. 197
Rare tree in Ghana, but probably a large pioneer of evergreen forest, confused with *S. ellipticum* ('Ketebontore'). Occurs as a 50 cm dbh tree in 40 year old secondary forest in Ivory Coast [Kahn, 1982], along with *Zanthoxylum gilletii* and *Albizia zygia.*
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

Croton penduliflorus Hutch. **EUPHORBIACEAE**
Common name: NYAMREM
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 131 Group: 22A No. 198
Medium-sized spreading tree.
INVENTORY
Tree count <30 cm dbh (TSP): 9 >=30 cm: 3
No. of botanical survey records: 7

Croton sylvaticus Hochst. *ex* Krauss **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** ? star
MATURE TREE
Small forest tree, apparently very rare in Ghana, but widespread in Africa [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Croton zambesicus Muell. Arg. **EUPHORBIACEAE**
Common name: DODWATU
Guild: Savanna **Conservation:** no star
MATURE TREE
Field guide pp. 127 Group: 21 No. 200
Small, silver-coloured tree often planted in villages, but also in savanna and its transition to forest. Widespread in Africa [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1

Crudia gabonensis Harms **CAESALPINIACEAE**
Common name: SAMANTAANINI
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 209, 243 Group: 37G No. 203
Evergreen tree with high, narrow plank buttresses which spread near ground level in the manner of *Piptadeniastrum.*
DISTRIBUTION
Not very common in Ghana, and probably confined to evergreen forests (Hall and Swaine sp. 170); Guinea-wide, but only in pockets [Lock, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 9 >=30 cm: 49
No. of botanical survey records: 19
The charts show an evergreen forest tree with little affinity for either slopes or swamps. The error bars on the size class graph, and the wild oscillations of the exposure chart show that the species is far from evenly dispersed, and rather too rare to summarise with the current data.

All sizes of tree are much more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Crudia senegalensis Benth. **CAESALPINIACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 209 Group: 37G No. 204
DISTRIBUTION
Similar to *C. gabonensis*, but a Guinea-wide riverine species with a more twisted, and low-branched habit to match.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1

Cryptosepalum tetraphyllum **CAESALPINIACEAE**
(Hook.f.) Benth.
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 201, 237 Group: 37C No. 205
DISTRIBUTION
Upper Guinea endemic [Lock, 1989]; rare in Ghana. Seems to prefer riversides. In other Upper Guinean forests, this species has a range corresponding to a dry subset of the range of *Cynometra ananta*, i.e. Moist Evergreen forests [Van Rompaey, 1993].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Cussonia bancoensis Aubrev. and Pellegr. **ARALIACEAE**
Common name: KWAEBRoFRE
Guild: Pioneer **Conservation:** Gold star
MATURE TREE
Field guide pp. 157 Group: 28B No. 206
DISTRIBUTION
Thought by Aubréville and Koning to have been planted in Banco, Ivory Coast, and not to occur there naturally, possibly having survived into forest from a long-since abandoned farm or village [de Koning, 1983]. They also noted that this species has been collected most in Ghana, where the wood is used for drums etc. Even in Ghana, however, this tree is not common, but the species regenerates freely in many areas e.g. Atewa F.R.
INVENTORY
Tree count <30 cm dbh (TSP): 36 >=30 cm: 52
No. of botanical survey records: 21
The species occurs in all forest zones, with local 'outbreaks' of abundance in disturbed evergreen forest, and rocky or mildly sloping sites.

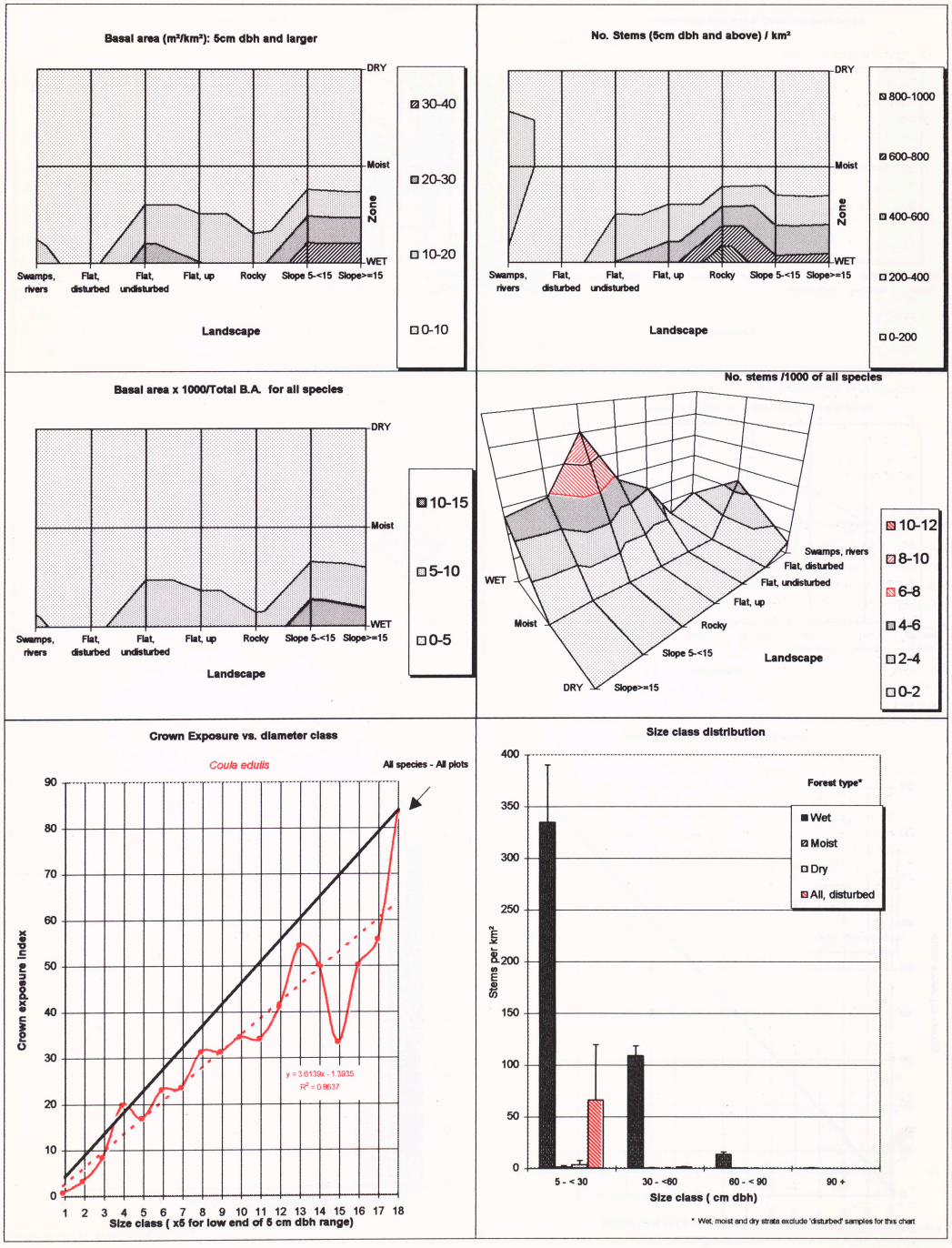
Cuviera acutiflora DC. **RUBIACEAE**
Common name: KWAKUO-ASRA
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 39 Group: 1G No. 207
Small, slender-stemmed, ant-infested tree of wetter forests. Twigs develop into homes for small ants.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 15

Cuviera macroura K.Schum. **RUBIACEAE**
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 39 Group: 1G No. 208
Small, or sometimes medium-sized spreading tree with ant-infested branches, usually seen at the forest edge.
INVENTORY
Tree count <30 cm dbh (TSP): 14 >=30 cm: 0
No. of botanical survey records: 4

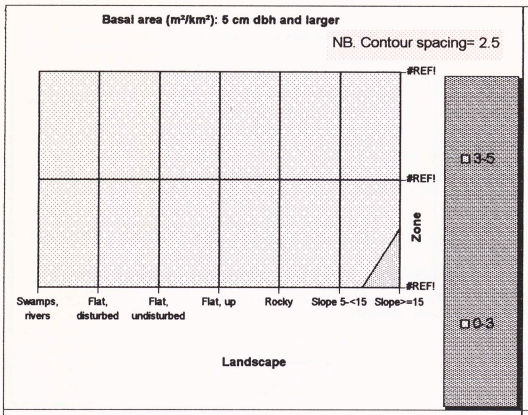
Cyathea manniana see *Alsophila manniana*

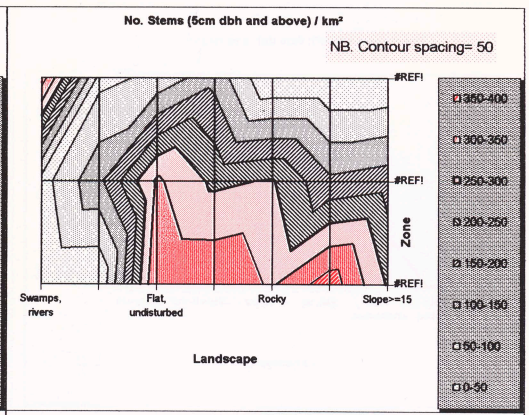
Cylicodiscus gabunensis Harms **MIMOSACEAE**
Common name: DENYAo
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 217 Group: 38A No. 39
This is an extremely massive, hulk of a tree, with very dense wood, and an immense spreading crown of massive boughs. Young trees are spiny. Some trees are deciduous, and the new leaves are red.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 177). Guinea-wide, and only species in genus [Lock, 1989].

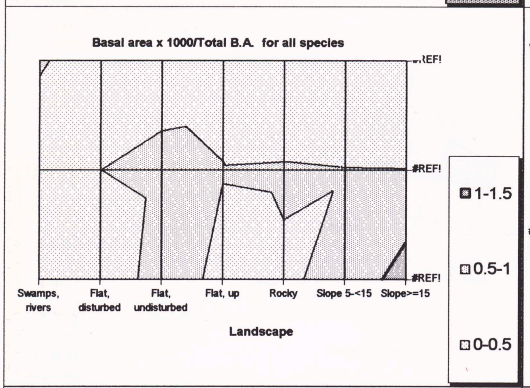
Coula edulis

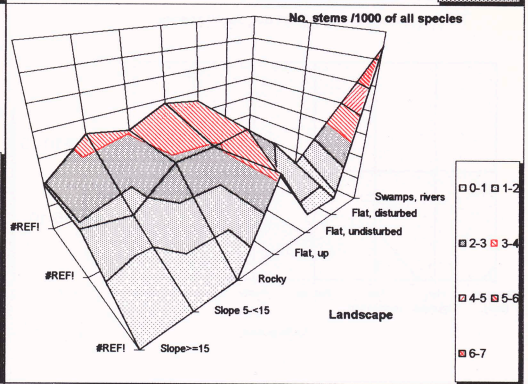


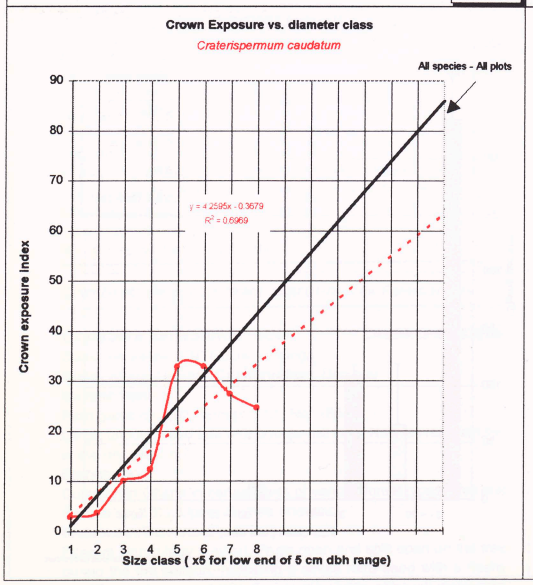
Craterispermum caudatum

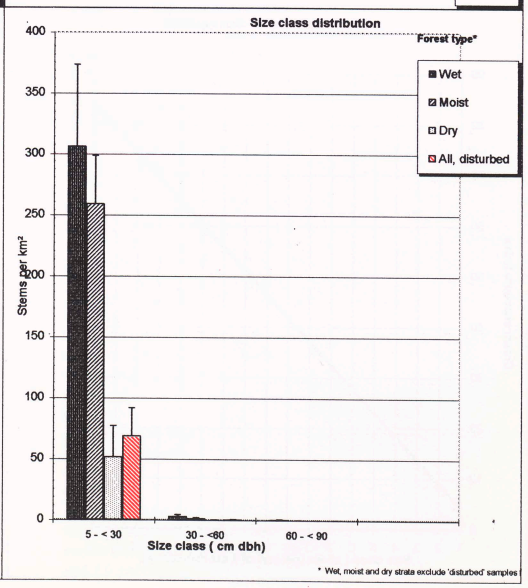




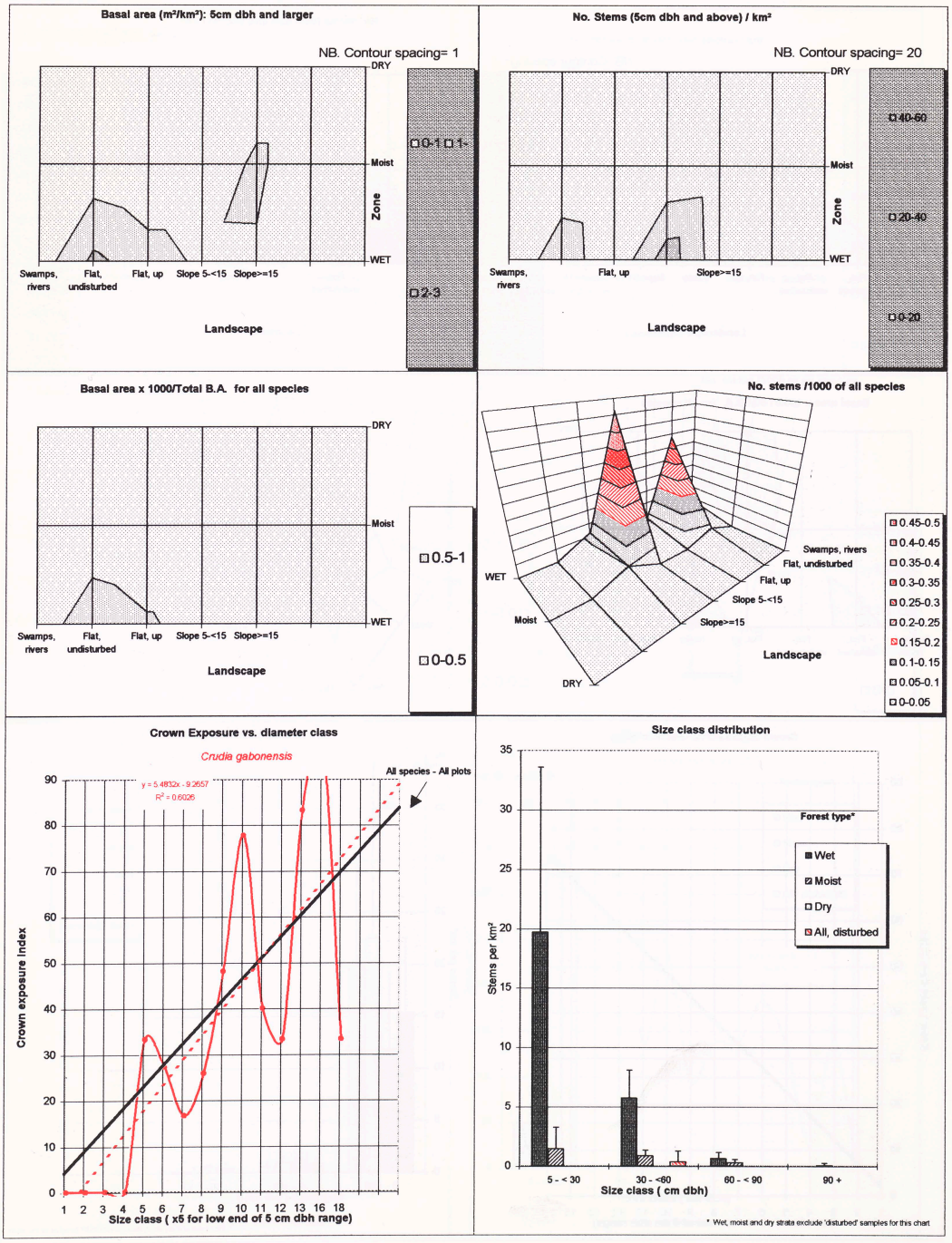




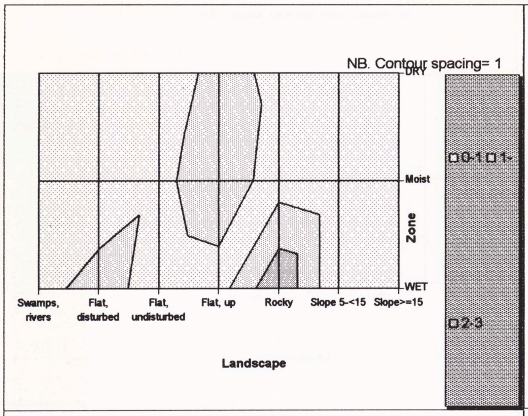


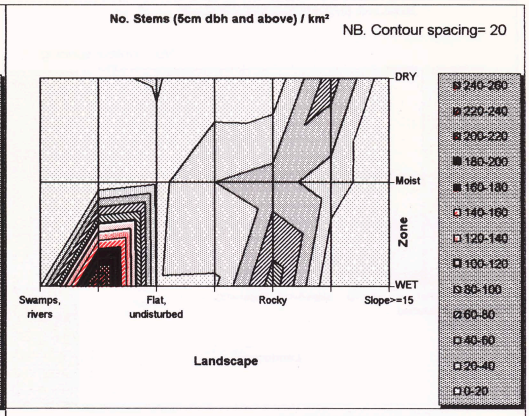


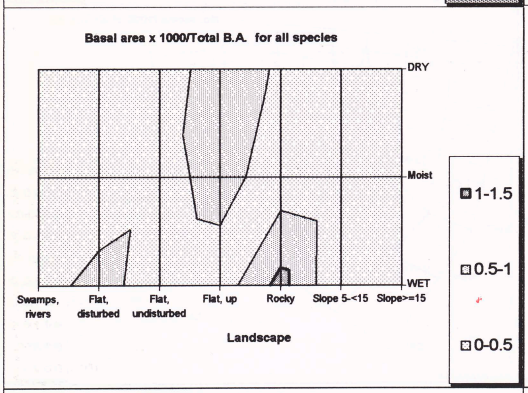
Crudia gabonensis

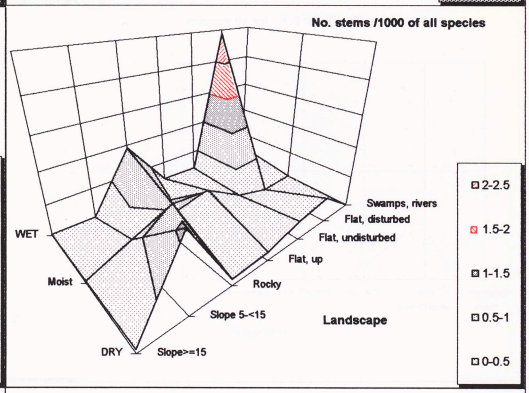


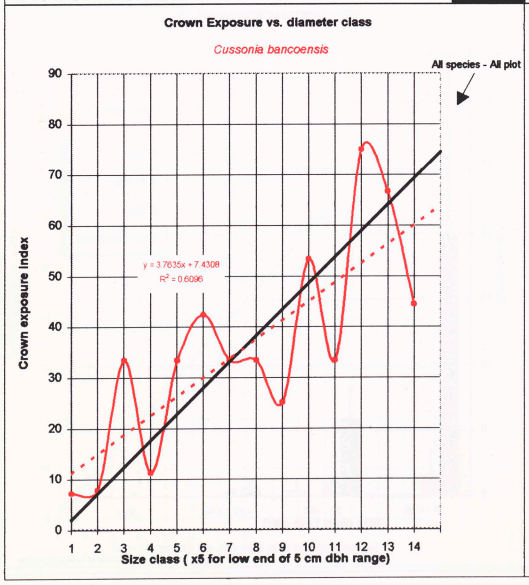
Cussonia bancoensis

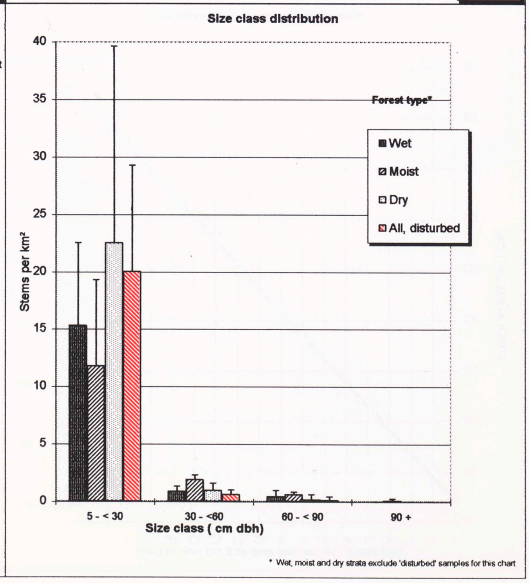




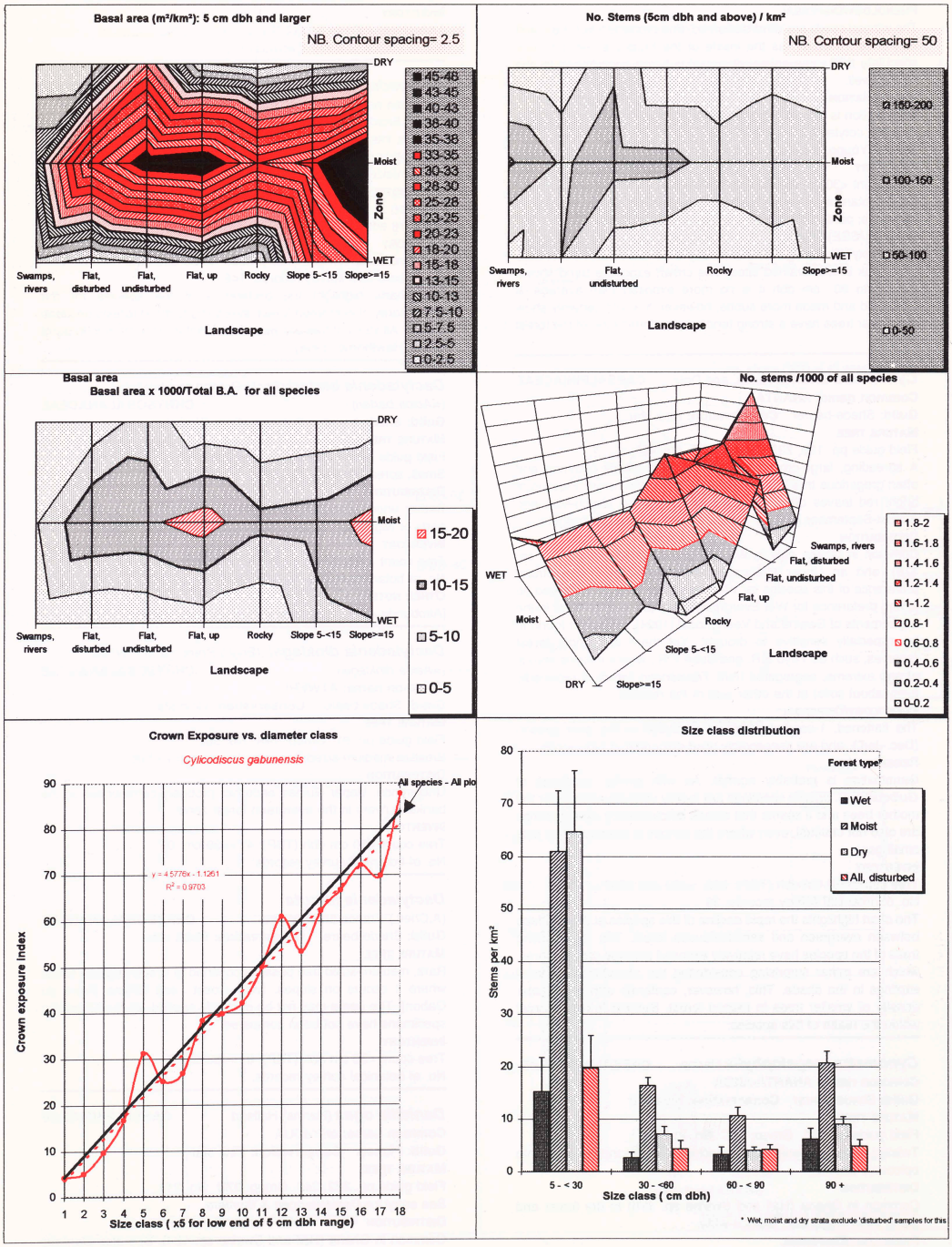








Cylicodiscus gabunensis



PHENOLOGY/DISPERSAL
The winged seeds are wind-dispersed, and produced Jan.-Feb. and May-June. However, as the inside of the fruits are red, one can speculate that some animal dispersal is being encouraged by the tree as well.
REGENERATION
Germination is normal (epigeal, without obvious dormancy) except that the cotyledons remain on the ground and the hypocotyl is twisted. Young, healthy trees are often seen in only small gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 116 >=30 cm: 893
No. of botanical survey records: 31
The trees, particularly the largest specimens, are most abundant in Moist (MSSE) forest. The regeneration is sparse, although reasonably in keeping with the density of parent trees, which reach their peak in well-drained sites. The crown exposure trend shows that up to 90 cm dbh it is no more exposed than average. If continued and made more subtle, however, it would certainly show that larger trees have a strong tendency to domination of the forest canopy.

Cynometra ananta Hutch. and Dalz. **CAESALPINIACEAE**
Common name: ANANTA
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 199, 239 Group: 37B No. 40
A spreading, large-crowned evergreen tree locally common and often gregarious tree characteristic of evergreen forest. Flushes of bright red leaves often cover the crown, during March-May and August-September [Taylor]. Bole high-buttressed, and irregular.
DISTRIBUTION
Common in Ghana only in WE (/ME) zone (Hall and Swaine sp. 178), and an Upper Guinea endemic. In spite of the strong preference of this species for Wet Evergreen forests, it showed no strong preference for Wet Evergreen forest (base-poor) soils in the experiments of Swaine and Veenendaal [1994], nor was it found to be especially sensitive to drought. Yet there are single forest reserves, such as Yoyo F.R. and Subri F.R., where it forms stands at one extreme, segregated from *Triplochiton* (which is reportedly fussy about soils) at the other side of the reserve.
PHENOLOGY/DISPERSAL
The flattened, 1-seeded pods are produced in the drier season (Dec.-Jan.), and are conceivably wind-dispersed in high winds.
REGENERATION
Germination is probably normal. As with similar seedlings of *Guibourtia*, *C. ananta* seedlings are locally very abundant near the mother trees and it seems that stands dominated by older saplings are also not unusual, even where the canopy is interrupted by only small gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 383 >=30 cm: 1567
No. of botanical survey records: 33
The chart highlights the rapid decline of this species at the interface between evergreen and semideciduous forest. The regenerating trees of the species have relatively exposed average crown scores, which are rather surprising considering the abundance of small saplings in the shade. This, however, conforms with the greater density of smaller trees in logged forest. Burning is not a threat within the realm of this species.

Cynometra megalophylla Harms **CAESALPINIACEAE**
Common name: ANANTA-AKOA
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 201 Group: 37C No. 211
Twisted, high-buttressed, low-branched, evergreen tree often with epicormic shoots.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 179) in dry forest and along rocky rivers etc.; Guinea-wide.
PHENOLOGY/DISPERSAL
Flowers in the dry season; fruits March-May [Taylor] fall unopened; they are probably adapted to dispersal by water.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 4
No. of botanical survey records: 18

Dacryodes klaineana (Pierre) H.J. Lam **BURSERACEAE**
Common name: ADWEA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 171, 242 Group: 33 No. 212
Medium-sized evergreen tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 180); Guinea-wide. The fruits are edible [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 2525 >=30 cm: 5357
No. of botanical survey records: 146
The charts highlight the preference of the species for the understorey of evergreen forest, stretching to moist forests on steep slopes. All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

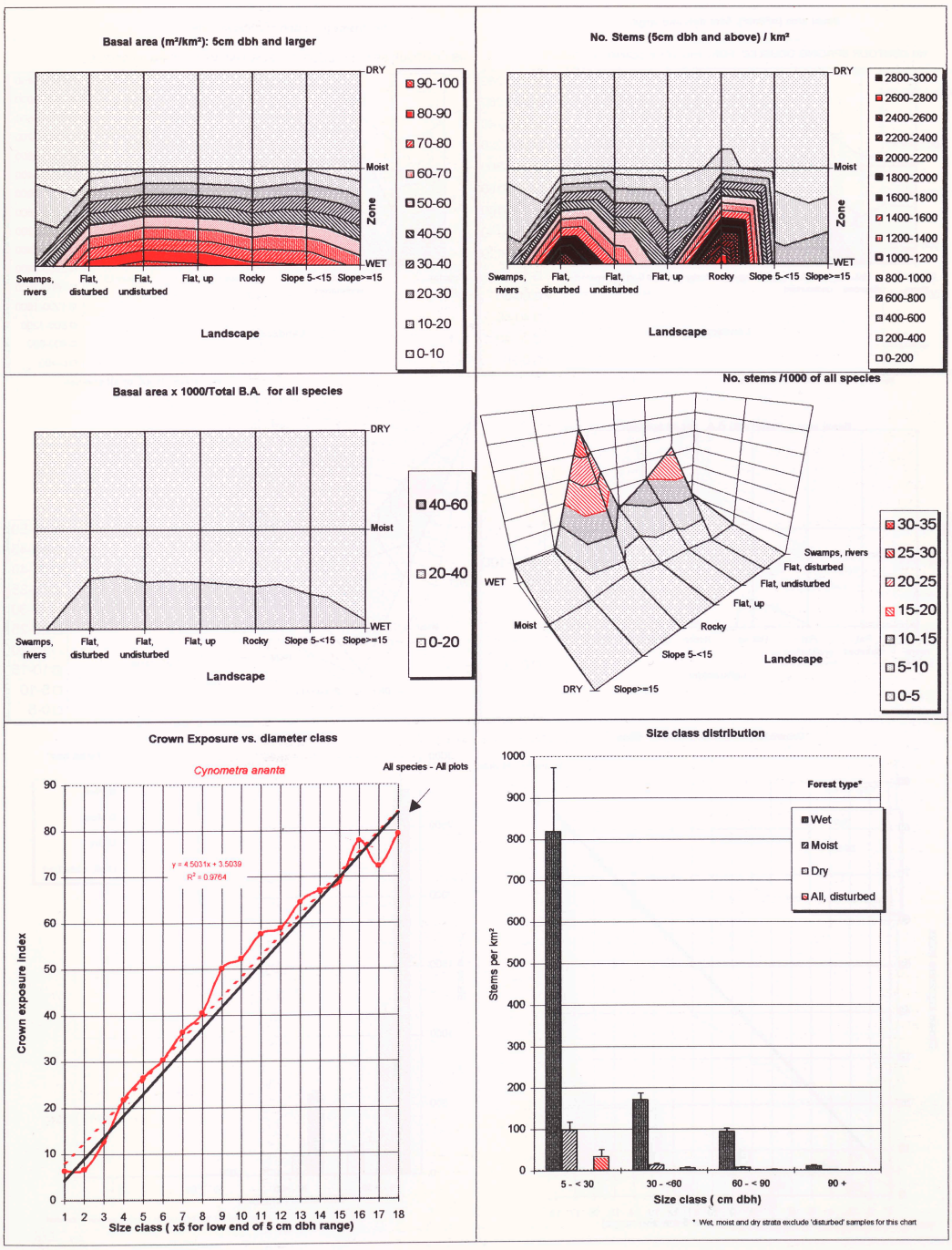
Dactyladenia barteri (Engl.) Prance and F.White
(=*Acioa barteri*) **CHRYSOBALANACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 91 Group: 14A No. 55
Small, spreading tree.
DISTRIBUTION
Rather uncommon in Ghana, but apparently much commoner in parts of Nigeria on acidic Ultisols [Ruhigwa *et al.*, 1992].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 8
OTHER NOTES
[Akobundu *et al.*, 1993; Hausu and Gichuru, 1994]

Dactyladenia dinklagei (Engl.) Prance and F.White
(=*Acioa dinklagei*) **CHRYSOBALANACEAE**
Common name: ATWERE
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 91 Group: 14A No. 56
Small to medium-sized tree with drooping branches.
DISTRIBUTION
Uncommon, Upper Guinea endemic, probably commonest on the banks of rivers in the evergreen forest zone.
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 0
No. of botanical survey records: 1

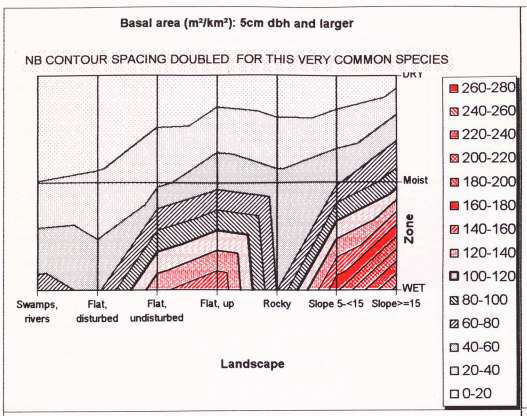
Dactyladenia hirsuta
(A.Chev.) Prance and F.White **CHRYSOBALANACEAE**
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Rare, medium-sized tree possibly confined to Wet Evergreen forest where it occurs on slopes. Ivory Coast and Ghana [Flore du Gabon]. The name may not be correctly applied, as the Ghanaian specimens have not been compared.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 7

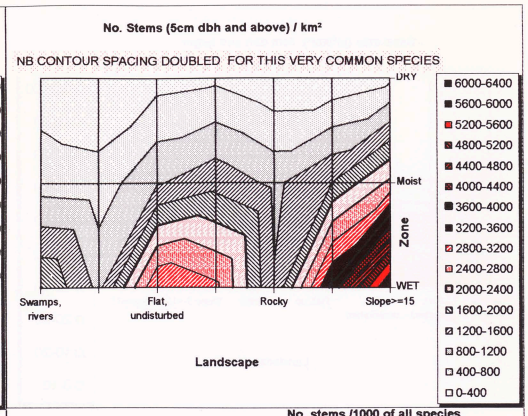
Daniellia ogea (Harms) Holland **CAESALPINIACEAE**
Common name: eHYeDUA
Guild: Pioneer **Conservation:** Pink star
MATURE TREE
Field guide pp. 202, 248 Group: 37D No. 214
See entry for *Daniellia ogea & thurifera*
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 184). See also *Daniellia* spp.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

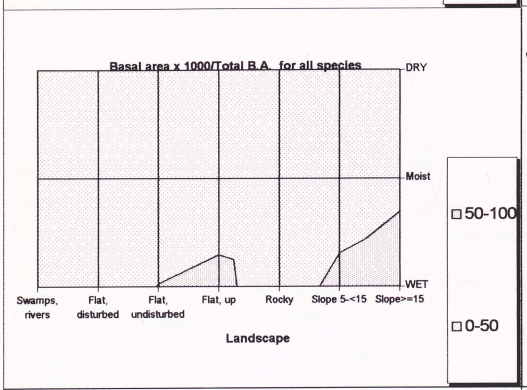
Cynometra ananta

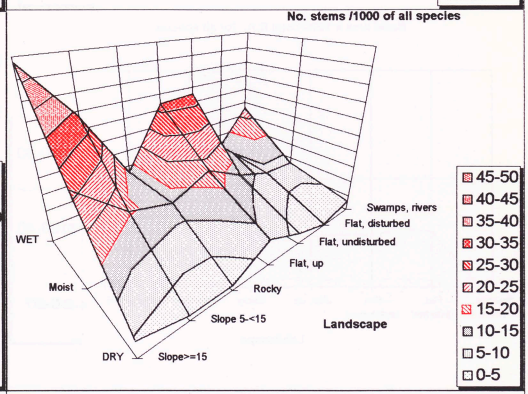


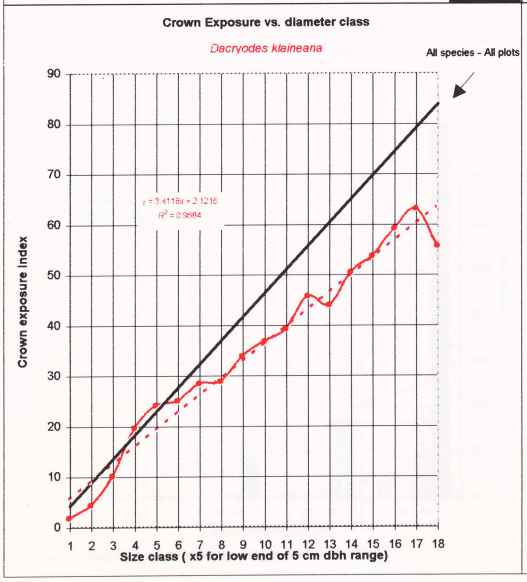
Dacryodes klaineana

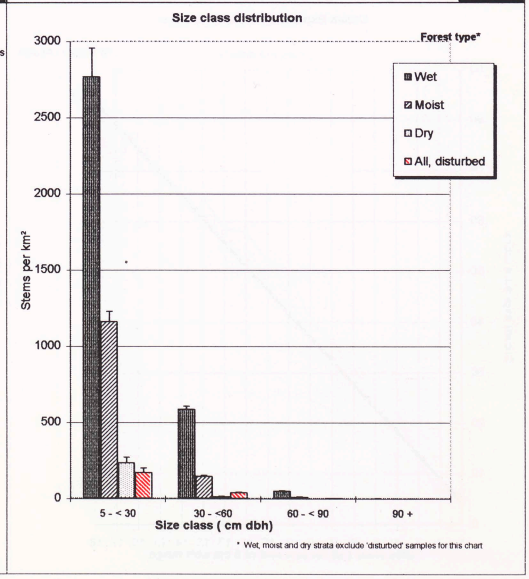




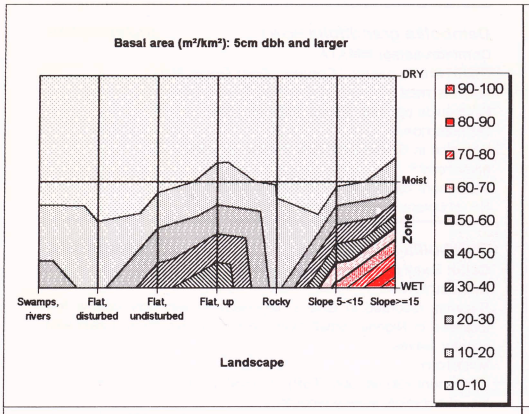


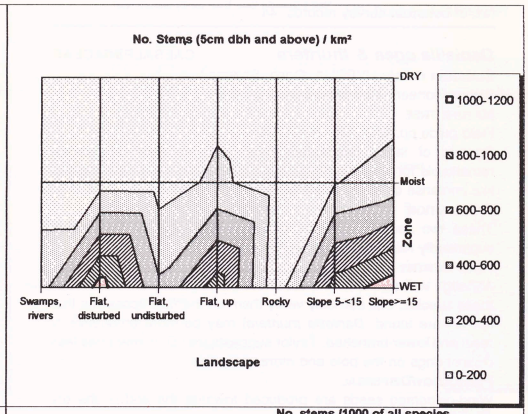


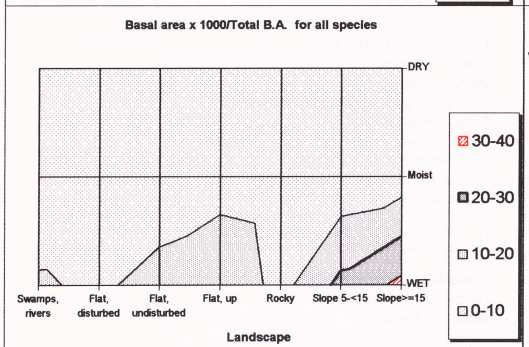


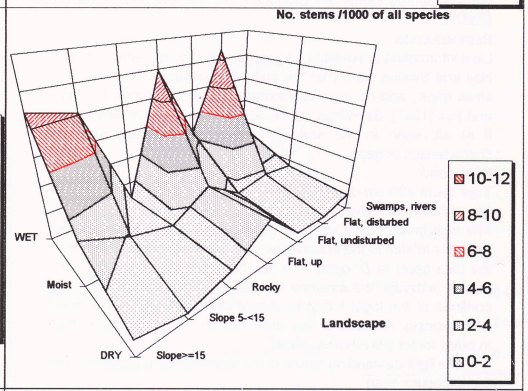


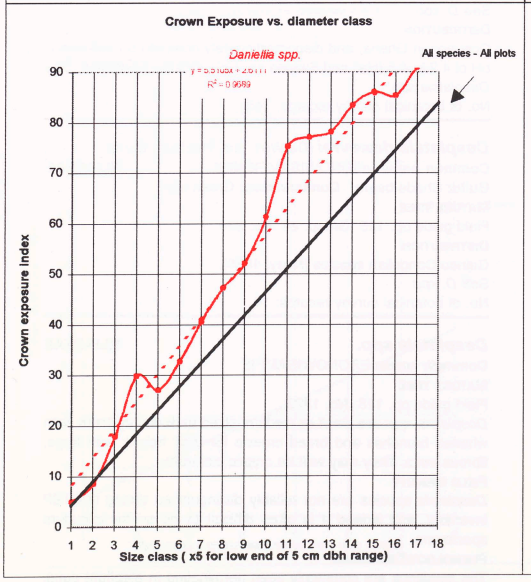
Daniellia spp.

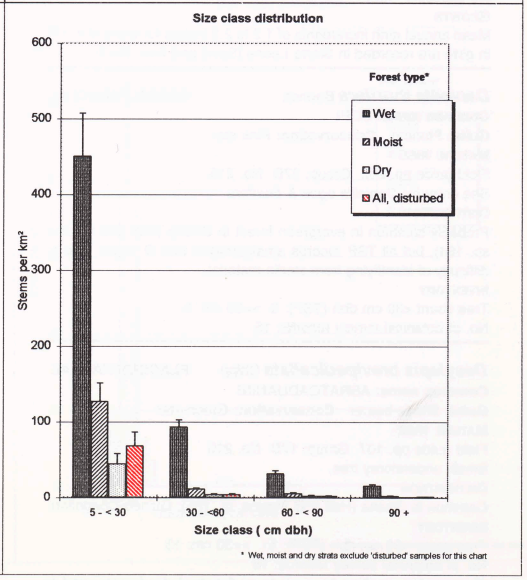












No. of botanical survey records: 44

Daniellia ogea & thurifera **CAESALPINIACEAE**
Common name: HYEDUA, Ogea, Shedua
Guild: Pioneer **Conservation:** Pink star
MATURE TREE
Field guide pp. 202, 248 No. 1214
Species of large, deciduous trees with red flush of leaves, remarkable for the often large but highly cylindrical boles, looking like immense concrete pillars sunk into the ground.
DISTRIBUTION
These two species are very similar, except that *D. thurifera* is supposedly restricted to wetter forests.
FIELD IDENTITY
Although various theories exist about the separation in the field of these species, one can only verify them on the rare occasions that flowers are found. *Daniellia thurifera*} may be more productive of resin and lower-branched. Taylor suggests that *D. hurifera* has less distinct rings on the bole and more scaly bark.
PHENOLOGY/DISPERSAL
Wind-dispersed seeds are produced towards the end of the dry season.
REGENERATION
Little information is available on germination requirements, although Hall and Swaine state that the species regenerate 'in shade and small gaps', and no unusual requirements are recorded by Savill and Fox [1967]. Seedlings above 50 cm, however, are very rarely, if at all, seen in the shade of undisturbed forest, and are characteristic of gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 346 >=30 cm: 982
No. of botanical survey records: 14
The high levels of the species, combined, in the evergreen forest probably relates to the occurrence of *D. thurifera* there. Elsewhere, the data apply to *D. ogea*. The genus is rare in the dry, fire zone forests (although the savanna species *D. oliveri* occurs within the confines of the legal forest boundary in some parts of the driest forest zones). All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

The light-demanding nature of the regeneration is apparent from the exposure chart.
GROWTH
Mean annual girth increments of 1.2 to 2.3 inches for trees of c. 1m in girth are recorded in Sierra Leone [Savill and Fox, 1967].

Daniellia thurifera Bennett **CAESALPINIACEAE**
Common name: SOPI
Guild: Pioneer **Conservation:** Pink star
MATURE TREE
Field guide pp. 202 Group: 37D No. 215
See entry for *Daniellia ogea & thurifera*
DISTRIBUTION
Probably common in evergreen forest in Ghana (Hall and Swaine sp. 184), but all TSP records amalgamated with *D. ogea* due to difficulty of identifying from sterile material.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 15

Dasylepis brevipedicellata Chipp **FLACOURTIACEAE**
Common name: ASRATOADUANINI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 107 Group: 17D No. 216
Small, understorey tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 185); Guineo-Congolian.
INVENTORY
Tree count <30 cm dbh (TSP): 51 >=30 cm: 13
No. of botanical survey records: 18
The species reaches its peak in undisturbed dry forests, and in rocky, Moist Semideciduous forests, and is generally rather shaded.

Deinbollia grandifolia Hook.f. **SAPINDACEAE**
Common name: MMATA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 188 Group: 36C No. 218
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 186).
INVENTORY
Tree count <30 cm dbh (TSP): 6 >=30 cm: 0
No. of botanical survey records: 98

Deinbollia saligna Keay **SAPINDACEAE**
Guild: Swamp **Conservation:** Black star
DISTRIBUTION
Recently recorded in Ghana, otherwise known only from a few localities in Nigeria. Small riverside tree in evergreen forest with slender leaves.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 2

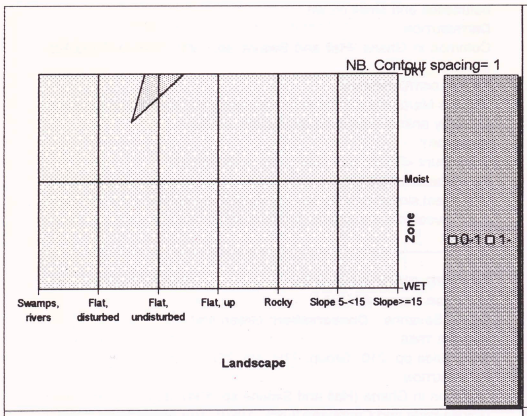
Dennettia tripetala Bak.f. **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 78 Group: 12F No. 221
Small, evergreen tree.
DISTRIBUTION
Not uncommon in certain types of dry forest Ghana (Hall and Swaine sp. 189), and Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 22

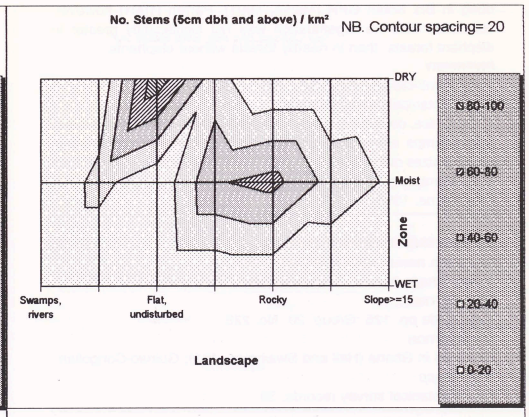
Desplatsia chrysochlamys
(Mildbr.and Burret) Mildbr.and Burr **TILIACEAE**
Guild: Shade-bearer **Conservation:** Green star
Common name: eSONOWISAMFIE
MATURE TREE
Field guide pp. 125 Group: 20 No. 223
See *D.* spp.
DISTRIBUTION
Common in Ghana, and disporportionately common on soil with a pH of 4.2 to 4.5 (Hall and Swaine sp. 190); Guineo-Congolian. See *Desplatsia* spp.
No. of botanical survey records: 145

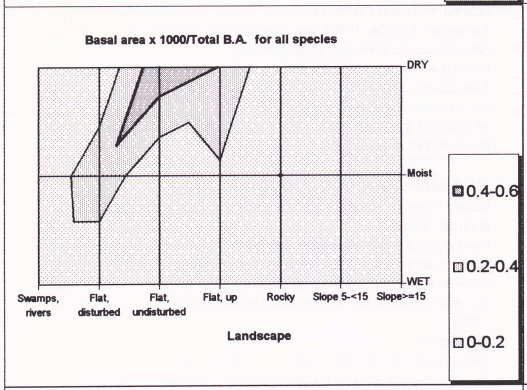
Desplatsia dewevrei (De Wild. and The.Dur.) Burret
Common name: eSONOWISAMFIENINI **TILIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 125 Group: 20 No. 224
DISTRIBUTION
Guineo-Congolian species [Keay, 1989].
See *D. spp*
No. of botanical survey records: 14

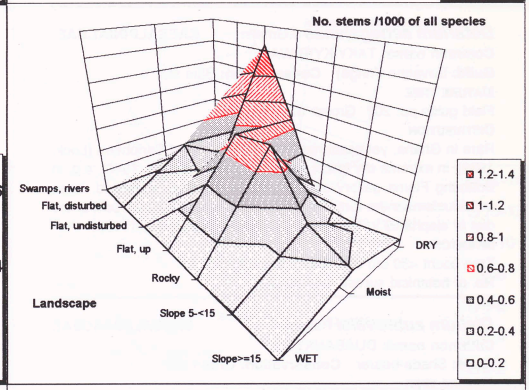
Desplatsia spp. **TILIACEAE**
Common name: ESONOWISAMFIE
MATURE TREE
Field guide pp. 125 No. 1223
Desplatsia spp. are small or medium-sized understorey trees, with whorled branches and broad crowns for their height; with large, fibrous fruits. They may well be cryptic pioneers.
FIELD IDENTITY
Desplatsia species are not reliably distinguished during the TSP inventory, and indeed it is often difficult to do so for immature specimens.
PHENOLOGY/DISPERSAL
The seedlings are commonly seen germinating in elephant dung, but elephants cannot be the only means of dispersal, as young trees are common in areas without elephants. Seeds were found in 7% (small rainy season) to 11% (dry season) of piles of elephant

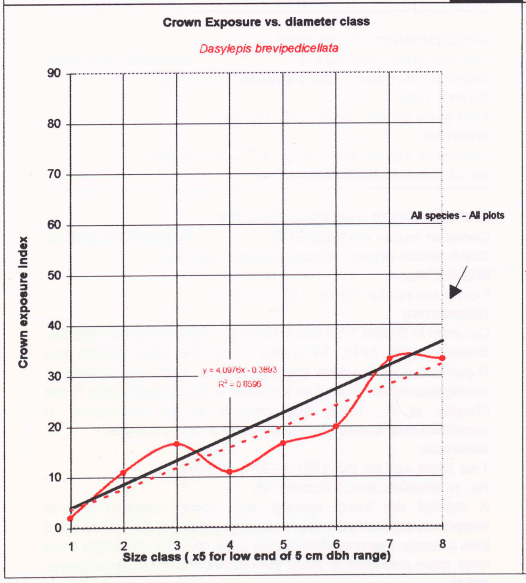
Dasylepis brevipedicellata

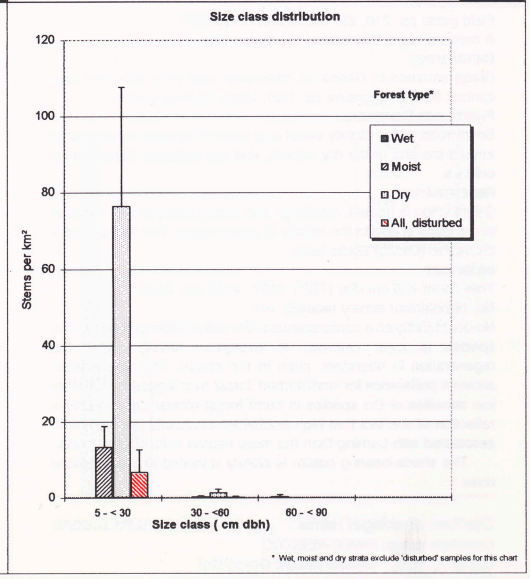












dung in Bia South GPR [Martin, 1991]. Parren [1991] however, concluded that the regeneration was not significantly greater in elephant forests than in nearby forests without elephants.

INVENTORY

Tree count <30 cm dbh (TSP): 539 >=30 cm: 155
No. of botanical survey records: 3
The species, combined, reach their peak in flatter, evergreen forest and swamps elsewhere, and are generally in the understorey. Smaller sizes of the tree (5-30 cm) are more abundant in burnt than in unburnt forest, but for larger sizes the opposite is true [Hawthorne, 1994].

Desplatsia subericarpa Bocq. **TILIACEAE**
Common name: eSONOWISAMFIEBERE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 125 Group: 20 No. 225
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 191); Guineo-Congolian. See *D. spp*
No. of botanical survey records: 39

Detarium senegalense J.Gmelin **CAESALPINIACEAE**
Common name: TAKYIKYIRIWA
Guild: Savanna (fringe) **Conservation:** Blue star
MATURE TREE
Field guide pp. 202 Group: 37D No. 226
DISTRIBUTION
Rare in Ghana, yet scattered across to Asia and Caribbean [Lock, 1989]; in extreme dry forest and savanna [Aubréville, 1948], e.g. in Boabeng Fiema gallery etc. forest it is found as scattered, large individuals near the forest edge. Fruits form a significant part of the diet of elephants in Cameroun [Tchamba and Seme, 1993].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 7

Dialium aubrevillei Pellegr. **CAESALPINIACEAE**
Common name: DUABANKYE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 210, 237 Group: 37H No. 227
A medium-large, buttressed, evergreen tree.
DISTRIBUTION
(Very) common in Ghana on base-poor acid soils with high clay content (Hall and Swaine sp. 192); Upper Guinea endemic.
PHENOLOGY/DISPERSAL
Small fruits, with a slightly sweet pulp around the seed are produced around the end of the dry season, and are probably dispersed by animals.
REGENERATION
Germination is normal. Seedlings and young saplings are common in complete shade in the vicinity of parent trees. The foliage has a distinctive (Oxalic) acidic taste.
INVENTORY
Tree count <30 cm dbh (TSP): 1377 >=30 cm: 2454
No. of botanical survey records: 141
No doubt partly as a consequence of the soil preference (above) the species is most common in evergreen forest, where the regeneration is abundant, even in the shade. The regeneration shows a preference for 'undisturbed' forest over logged forest. Very low densities of the species in burnt forest almost are certainly a reflection of the fact that high acidic/high clay soils are less often associated with burning than the more neutral soils of drier areas.

The shade-bearing nature is clearly revealed in the exposure chart.

Dialium dinklagei Harms **CAESALPINIACEAE**
Common name: DWEDWEEDWE
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 213, 237 Group: 37I No. 228
A medium to large, cylindrical, deciduous tree with narrow buttresses and small crown.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 193); Guineo-Congolian species.
PHENOLOGY/DISPERSAL
Flowers March-May; fruits in the dry season [Taylor]. The fruits are probably animal dispersed as in other *Dialium*.
INVENTORY
Tree count <30 cm dbh (TSP): 66 >=30 cm: 88
No. of botanical survey records: 124
Wet forest slopes and dry forest swamps are amongst the favoured sites revealed in the charts. Medium-sized trees at least are rather shaded.

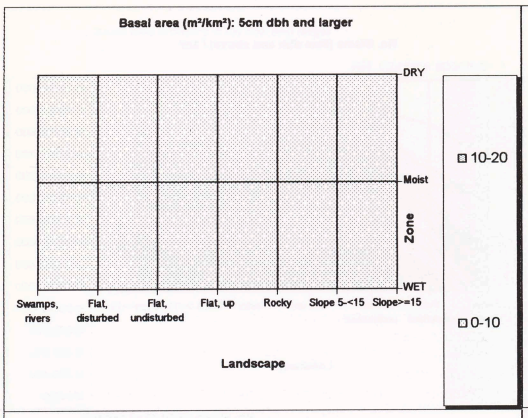
Dialium guineense Willd. **CAESALPINIACEAE**
Common name: ASENAA
Guild: Savanna **Conservation:** Green star
MATURE TREE
Field guide pp. 210 Group: 37H No. 229
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 194), esp. in drier areas. Guinea-wide and Caribbean [Lock, 1989]. The edible fruits ('Velvet Tamarind', [Abbiw, 1990]) are often on sale in markets. The leaves have an acidic taste like *D. aubrevillei*.
INVENTORY
Tree count <30 cm dbh (TSP): 36 >=30 cm: 8
No. of botanical survey records: 75
All sizes of tree are much more abundant in burnt than in unburnt forest [Hawthorne, 1994].

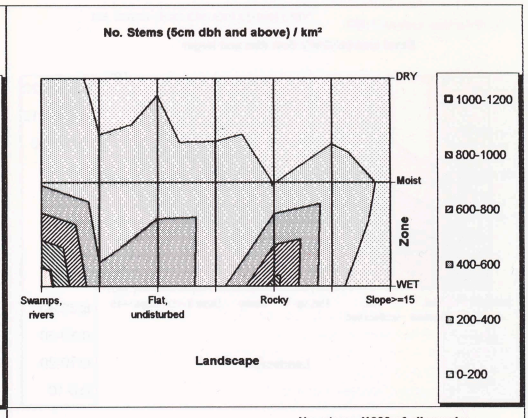
Dichaetanthera africana (Hook.f.) Jac.Fel.
Guild: Pioneer **Conservation:** Gold star **MELASTOMATACEAE**
MATURE TREE
Field guide pp. 47 Group: 6 No. 230
Medium-sized tree with almost horizontal branches and well-dispersed, but not very dense crown. Regenerates in open areas, e.g. along track sides, in evergreen forest; Guinea-Congolian [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1

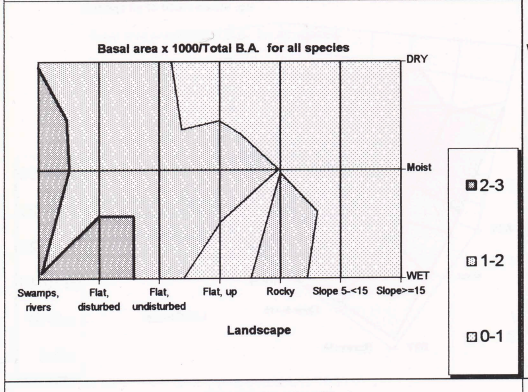
Dichapetalum guineense (DC.) Keay
See note under next species. **DICHAPETALACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 89 Group: 13D No. 232
INVENTORY
Tree count <30 cm dbh (TSP): 197 >=30 cm: 506
No. of botanical survey records: 45

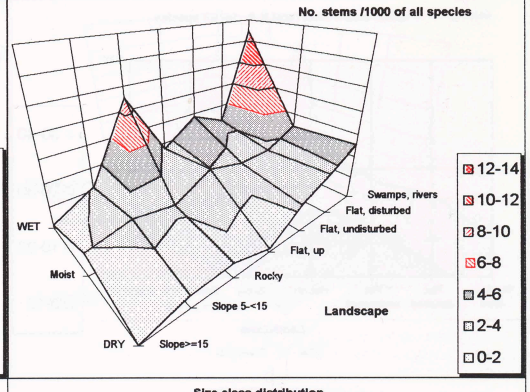
Dichapetalum madagascariense
Common name: eSONOWEDIE **DICHAPETALACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 89 Group: 13D No. 232
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 199). Extremely variable. Breteler [1973, 1978, 1979] has joined the West African tree *D.guineense* with various trees and lianes in the widespread *D. madagascariense*. Occurs as a pioneer in South East Outlier forest [Swaine *et al.*, 1990], but common as an understorey in semideciduous forests. Very likely to be a cryptic pioneer.
INVENTORY
Tree count <30 cm dbh (TSP): 197 >=30 cm: 506
No. of botanical survey records: 45
A marked dry forest species, with some inventory records elsewhere, especially on slopes. Crowns are generally more shaded than average. Regeneration (stems 5-30 cm dbh) and larger trees were more abundant in burnt than in unburnt forest [Hawthorne, 1994].
OTHER NOTES
[Okali, 1979]

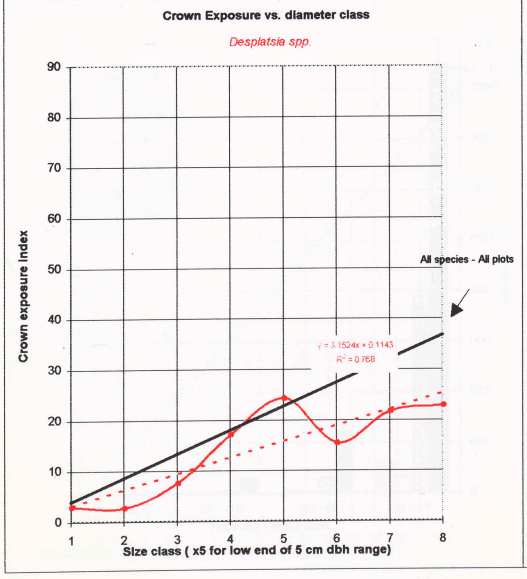
Desplatsia spp.

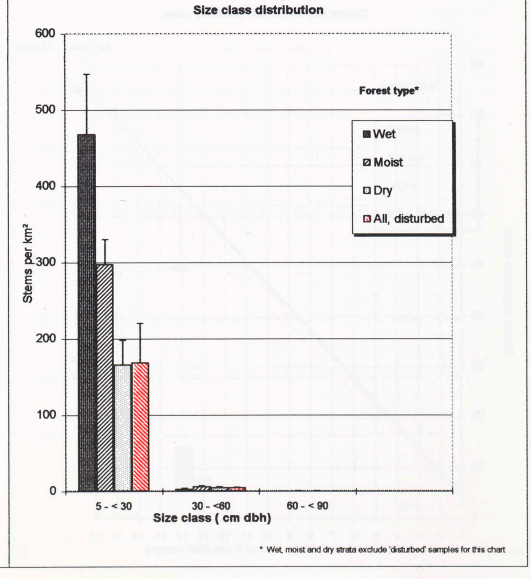




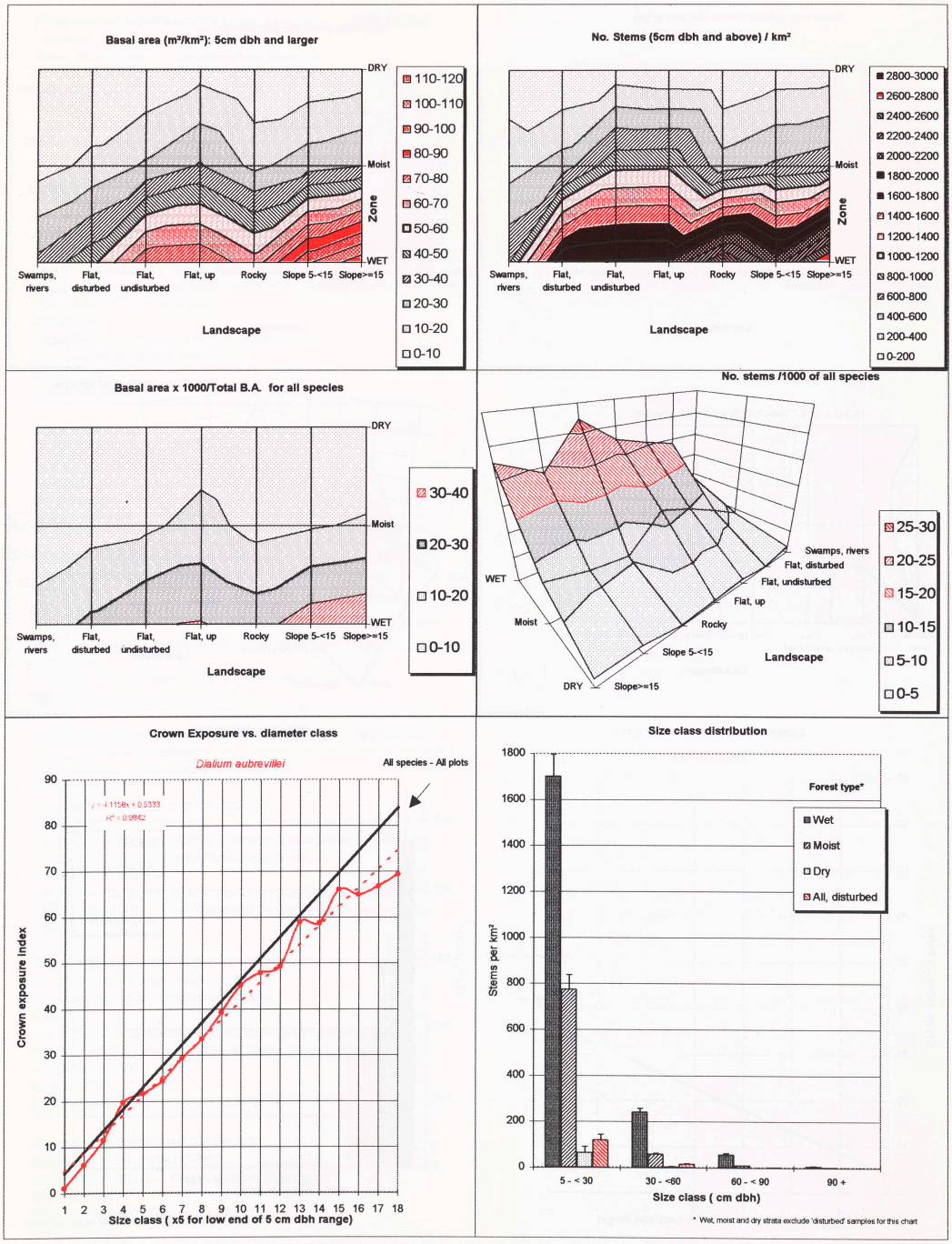




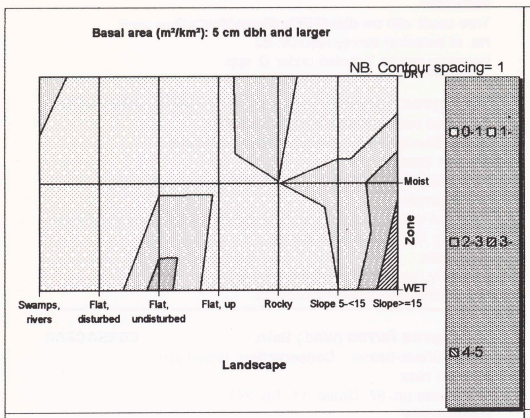


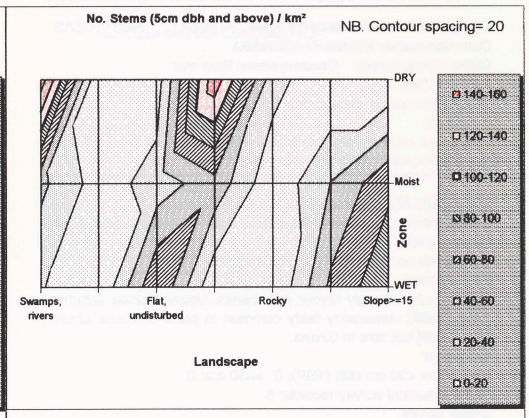


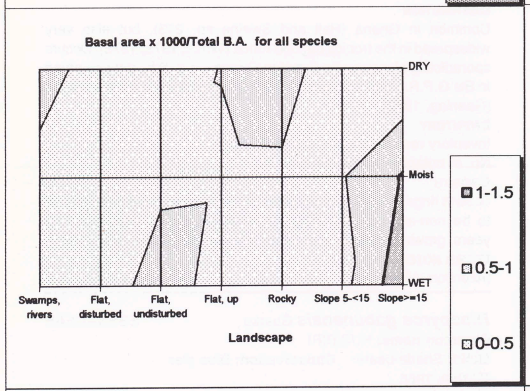
Dialium aubrevillei

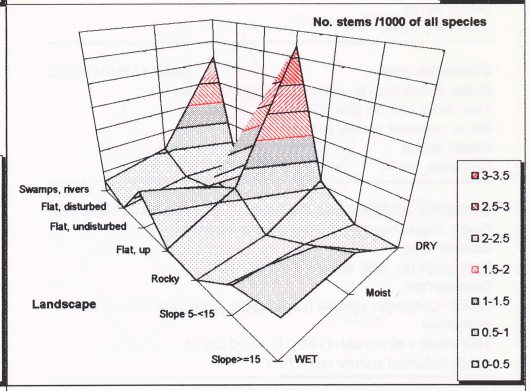


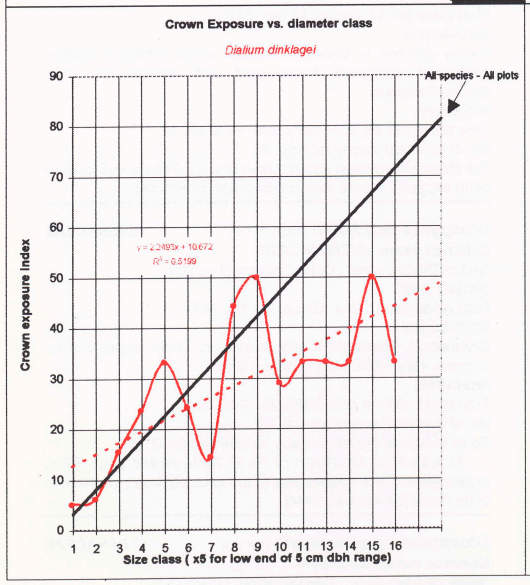
Dialium dinklagei

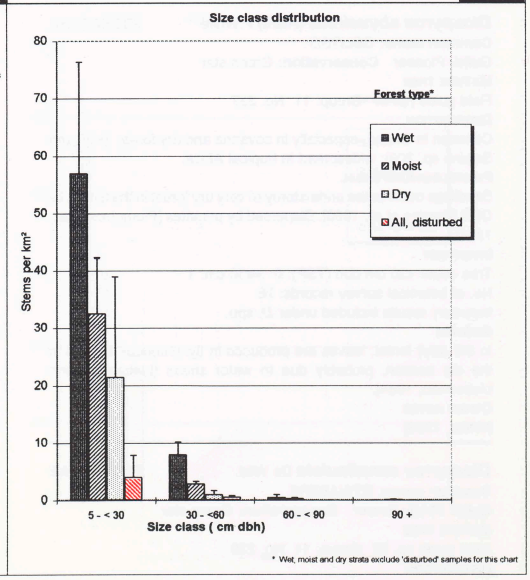












Dictyandra arborescens Welw. *ex* Hook.f. **RUBIACEAE**
Common name: KWAKUO-ASENABA
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 39 Group: 1G No. 233
INVENTORY
Tree count <30 cm dbh (TSP): 26 >=30 cm: 1
No. of botanical survey records: 30

Didelotia idae Oldeman, de Wit and J.Leonard
Guild: Swamp **Conservation:** Gold star **CAESALPINIACEAE**
MATURE TREE
Field guide pp. 199 Group: 37A No. 235
DISTRIBUTION
Seems to be strongly favour river banks. Upper Guinea endemic [Lock, 1989]. Apparently fairly common in parts of Sierra Leone [Fox, 1968] but rare in Ghana.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 6
OTHER NOTES
[Oldeman, 1964]

Didelotia spp. **CAESALPINIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 2
OTHER NOTES
[Oldeman, 1964]

Didelotia unifoliolata J.Leonard **CAESALPINIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 199 Group: 37A No. 236
DISTRIBUTION
Guineo-Congolian species [Lock, 1989; Vivien and Faure, 1985].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 9

Diospyros abyssinica (Hiern) F.White **EBENACEAE**
Common name: GBLITSO
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 67 Group: 11 No. 237
DISTRIBUTION
Common in Ghana, especially in savanna and dry forest (Hall and Swaine sp. 209); widespread in tropical Africa.
PHENOLOGY/DISPERSAL
Seedlings occur in the understorey of very dry forest in the Shai hills GPR [Swaine *et al.*, 1990]. Dispersed by primates [Plumptree *et al.*, 1994].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 76
Inventory results included under *D.* spp.
GROWTH
In SO (dry) forest, leaves are produced in synchronous flushes in the dry season, probably due to water stress [Lieberman and Lieberman, 1984].
OTHER NOTES
[White, 1956]

Diospyros canaliculata De Wild. **EBENACEAE**
Common name: OTWABERE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 67 Group: 11 No. 239
DISTRIBUTION
Common in Ghana, except in extreme forest types (Hall and Swaine sp. 210); Guineo-Congolian. Has edible fruits [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 49 >=30 cm: 2
No. of botanical survey records: 83
Inventory results included under *D.* spp.

Diospyros cooperi (Hutch.and Dalz.) F.White **EBENACEAE**
Common name: FRENCH ATWEABERE
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 67 Group: 11 No. 240
DISTRIBUTION
Common in Ghana only in and around Bia G.P.R.(Hall and Swaine sp. 212); Upper Guinea endemic.
INVENTORY
Inventory results included under *D. spp.*
No. of botanical survey records: 12

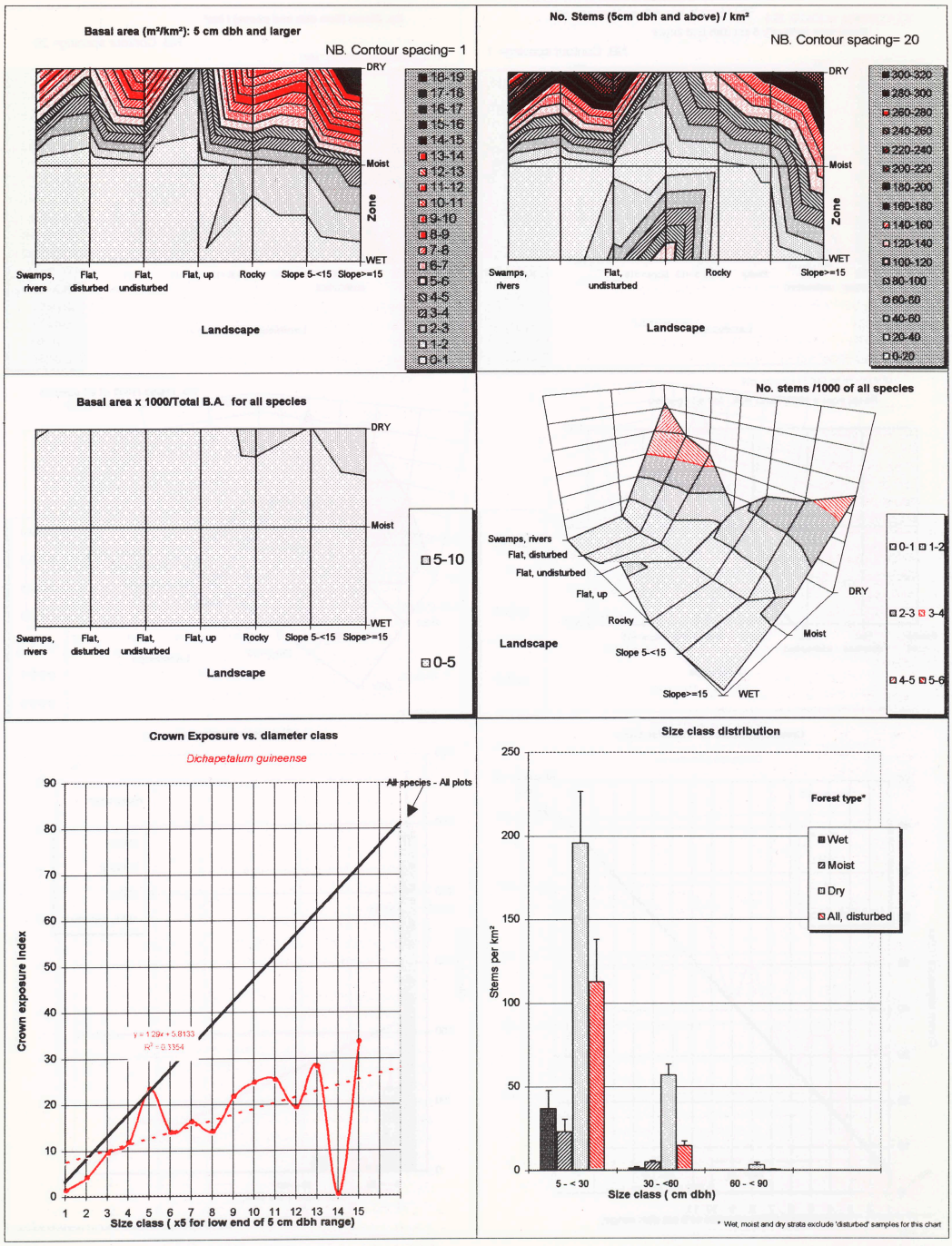
Diospyros ferrea (Willd.) Bakh. **EBENACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 67 Group: 11 No. 241
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 213), but also very widespread in the tropics beyond Africa (White, 1978; 1979]. Occurs sporadically along in rain forest in Ghana - e.g. it is fairly common in Bia G.P.R. - and also along rivers and in rocky places in savanna [Geerling, 1982].
INVENTORY
Inventory results included under *D. spp.*
No. of botanical survey records: 40
GROWTH
Growth rings in mangrove varieties of this species have been shown to be non-annual, producing, on average, seven rings per four years, growing faster in years after heavier rain [Duke *et al.*, 1981].
OTHER NOTES
[Atkinson, 1970]

Diospyros gabunensis Guerke **EBENACEAE**
Common name: KUSIBIRI
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 67 Group: 11 No. 242
DISTRIBUTION
Locally common in Ghana in certain areas, mainly in eastern portion of evergreen forest (Hall and Swaine sp. 214); Guineo-Congolian.
INVENTORY
Tree count <30 cm dbh (TSP): 138 >=30 cm: 56
No. of botanical survey records: 87
The charts clearly show an evergreen species. The crown exposure trend suggests a more exposed tree than anticipated.

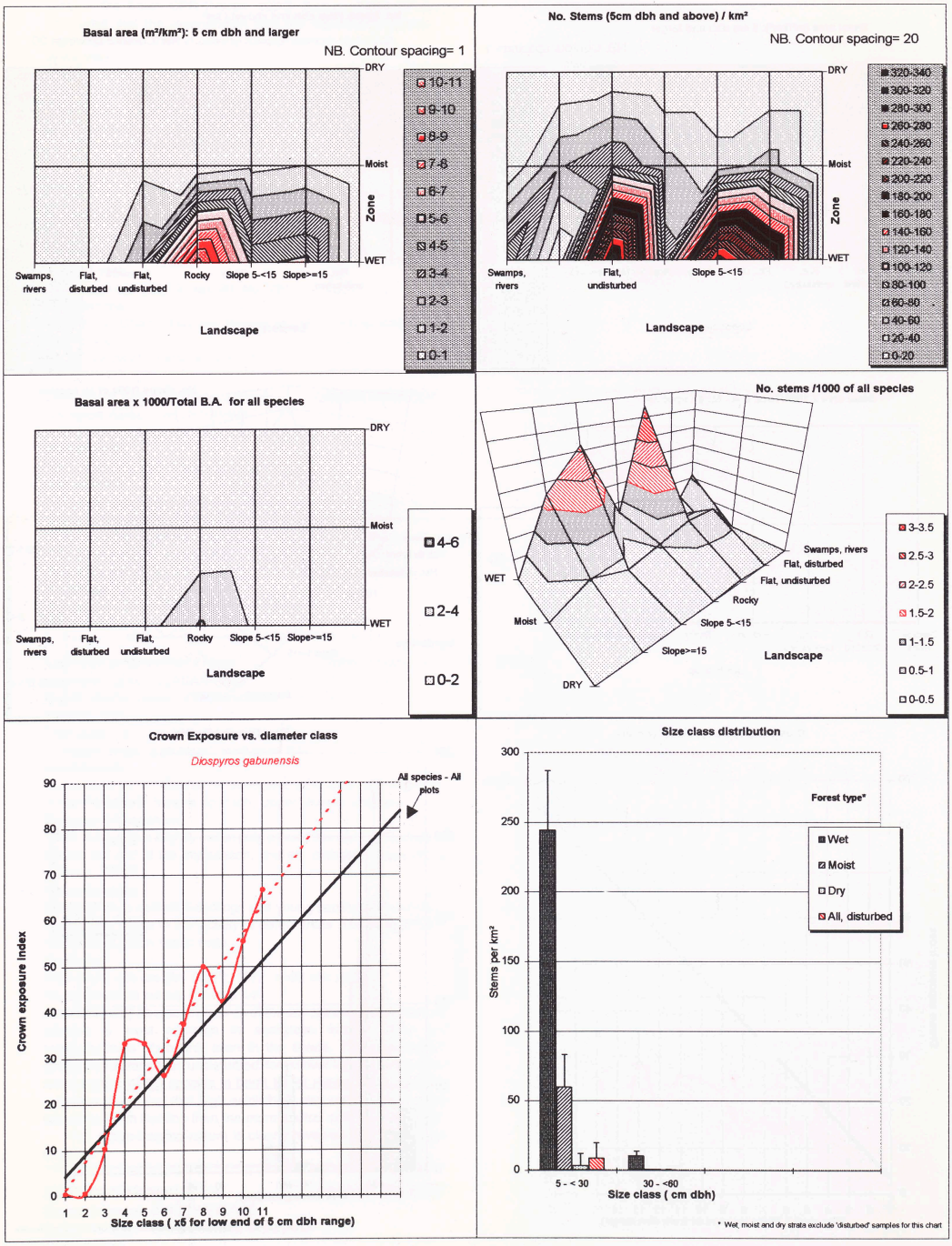
Diospyros heudelotii Hiern **EBENACEAE**
Common name: oMENEWABERE
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 67, 244 Group: 11 No. 243
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 215); Upper Guinea endemic. Has edible fruits [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 20 >=30 cm: 3
No. of botanical survey records: 77
Some inventory results probably included under *D. spp.*
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].

Diospyros kamerunensis Guerke **EBENACEAE**
Common name: oMENEWA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 67, 244 Group: 11 No. 244

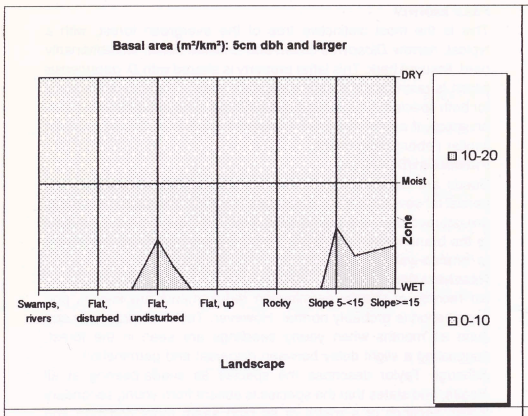
Dichapetalum guineense

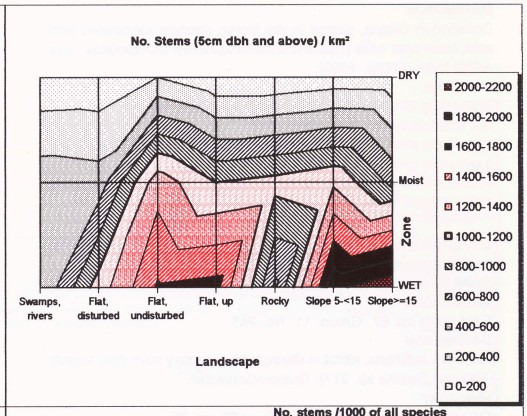


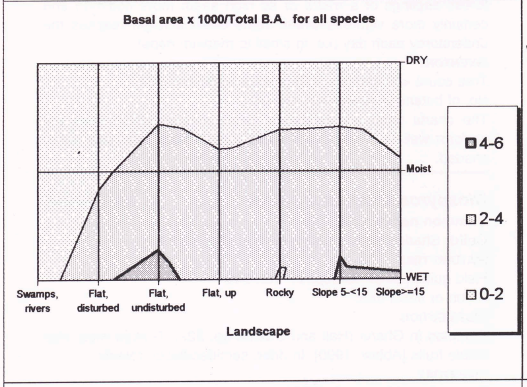
Diospyros gabunensis

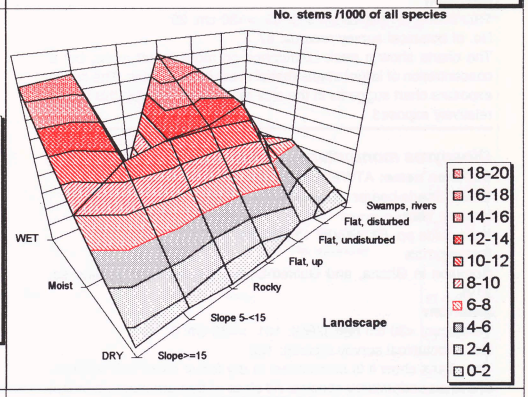


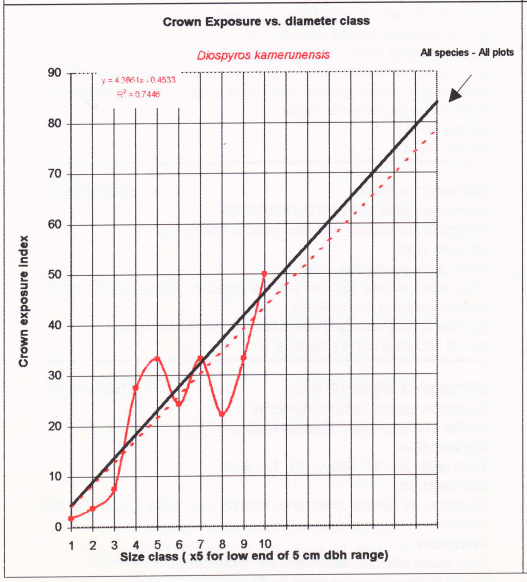
Diospyros kamerunensis

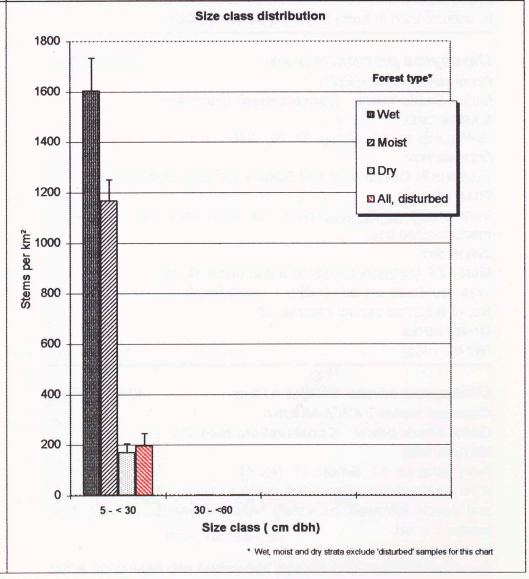












DISTRIBUTION
Common in Ghana, except in dry forest; strongly associated with acid, base-poor soils (Hall and Swaine sp. 216); Guinea-wide. Has edible fruits [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 1643 >=30 cm: 32
No. of botanical survey records: 167
The charts show a dramatic decline from moister to dry forest, and a generally understorey species. All sizes of tree are more abundant in unburnt than in burnt forest except larger trees, which occur more often in burnt forest [Hawthorne, 1994].

Diospyros mannii Hiern **EBENACEAE**
Common name: ATWEAFUFU
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 67 Group: 11 No. 245
DISTRIBUTION
Common in Ghana, albeit in discrete blocks away from drier forests (Hall and Swaine sp. 217); Guineo-Congolian.
INVENTORY
Tree count <30 cm dbh (TSP): 59 >=30 cm: 29
No. of botanical survey records: 67
The charts show a peak abundance on moist forest rocks, but a concentration of larger stems (basal area) in rocky sites. The crown exposure chart suggests in the size range 5-30 cm dbh this tree is relatively exposed.

Diospyros monbuttensis Guerke **EBENACEAE**
Common name: ATWERE-NANTIN
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 67 Group: 11 No. 247
DISTRIBUTION
Common in Ghana, and Guineo-Congolian (Hall and Swaine sp. 219).
INVENTORY
Tree count <30 cm dbh (TSP): 161 >=30 cm: 0
No. of botanical survey records: 132
The charts show it is commonest in dry forest rocks and swamps, and in an understorey species. All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Diospyros piscatoria Guerke **EBENACEAE**
Common name: BENKYI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 67 Group: 11 No. 248
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 220); Guinea-wide.
FIELD IDENTITY
Very similar to *D. soubreana*, but drip-tipped and becomes a medium-sized tree.
INVENTORY
Most TSP Inventory results included under *D. spp.*
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 48
OTHER NOTES
[White, 1956]

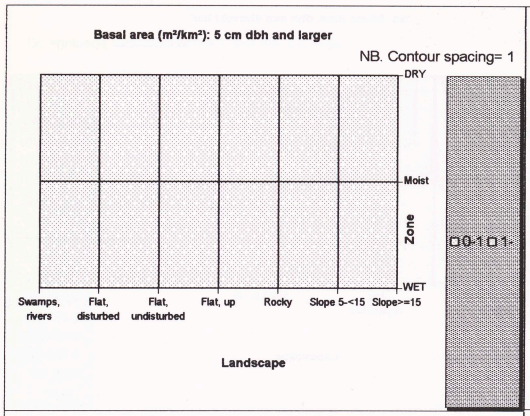
Diospyros sanza-minika A.Chev. **EBENACEAE**
Common name: SANZA-MULIKA
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 67 Group: 11 No. 41
A very distinctive medium-sized, evergreen tree, with cylindrical bole and deeply furrowed, extremely hard and very black bark. New leaves are red.
DISTRIBUTION
Common in Ghana, and strongly associated with base-poor, acidic soils (Hall and Swaine sp. 221); Guinea-wide. According to Taylor, it requires a well-drained soil, and strongly avoids swamps etc.
FIELD IDENTITY
This is the most distinctive tree of the evergreen forest, with a typical, narrow *Diospyros* crown and unusual black, extraordinarily hard, fissured bark. This latter property is shared with *D. gabunensis* which is restricted to wetter evergreen forest. There is a tendency for both species to be called Kusibiri.There is no published research on which, if any of the other *Diospyros* species in Ghana produce similar ('ebony-like') wood.
PHENOLOGY/DISPERSAL
Seeds are produced from near the end of the wet season but persist for several months (Sept-Jan. [Taylor]). The dispersal agents are not recorded, and not obvious. The fruits, being produced close to the branches without stalks would seem to be most convenient to 'branch-walking' animals.
REGENERATION
No records of special germination requirements are known, and germination is probably normal. However, Taylor records May and June as months when young seedlings are seen in the forest, suggesting a slight delay between dispersal and germination.
Although Taylor describes the species as shade-bearing at all stages, and states that the species is absent from young secondary forest, saplings of a metre or so high seem more common and certainly more vigorous where some direct sunlight reaches the understorey each day (i.e. in small to medium gaps).
INVENTORY
Tree count <30 cm dbh (TSP): 1853 >=30 cm: 827
No. of botanical survey records: 88
The charts show an evergreen forest species which does not perform well in swampy and rocky forest. Most sizes are rather shaded.

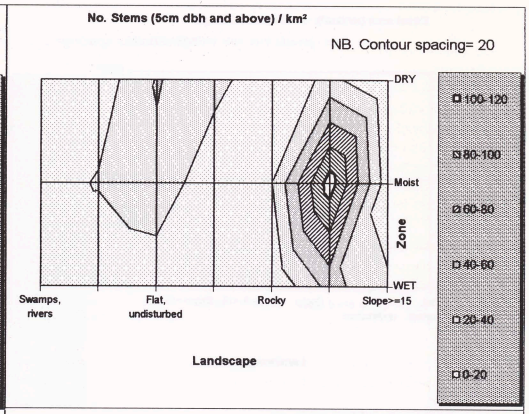
Diospyros soubreana F.White **EBENACEAE**
Common name: oTWETO
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 67 Group: 11 No. 249
Shrub or small tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 222); Guinea-wide. Has edible fruits [Abbiw, 1990]. In drier, semideciduous forests.
INVENTORY
Tree count <30 cm dbh (TSP): 11 >=30 cm: 0
No. of botanical survey records: 114
Most inventory results included under *D.* spp.
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994]
OTHER NOTES
[White, 1956]

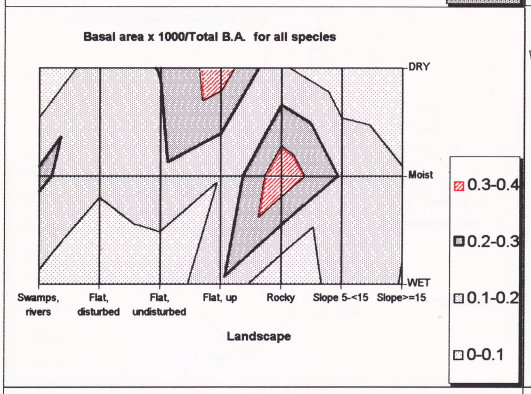
Diospyros spp. **EBENACEAE**
Common name: OTWETO-OMENEWA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 67 No. 1237
This entry mainly for the several species, including *Diospyros canaliculata* and *D. viridicans.*
Several *Diospyros* spp. have edible fruits [Abbiw, 1990].
No. of botanical survey records: 5

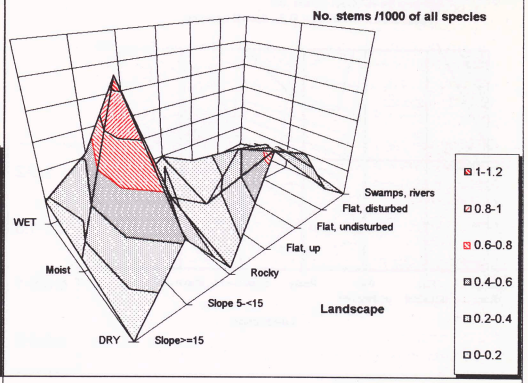
Diospyros vignei F.White **EBENACEAE**
Common name: OMENEWABERE
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 67 Group: 11 No. 243
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 223); Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 20 >=30 cm: 3
No. of botanical survey records: 77
Most inventory results included under *D. spp.* Very similar to *D. heudelotii.*

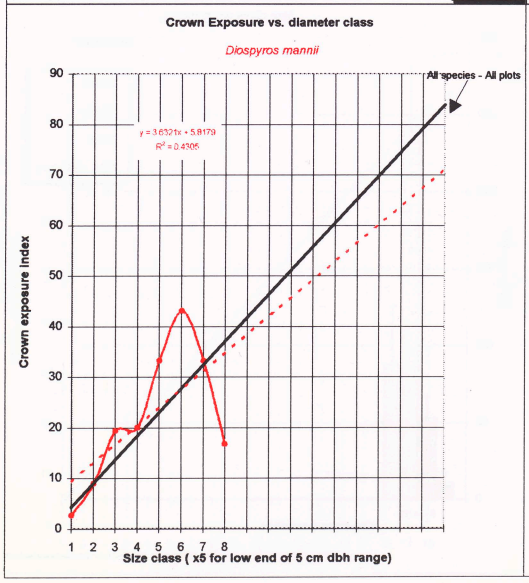
Diospyros mannii

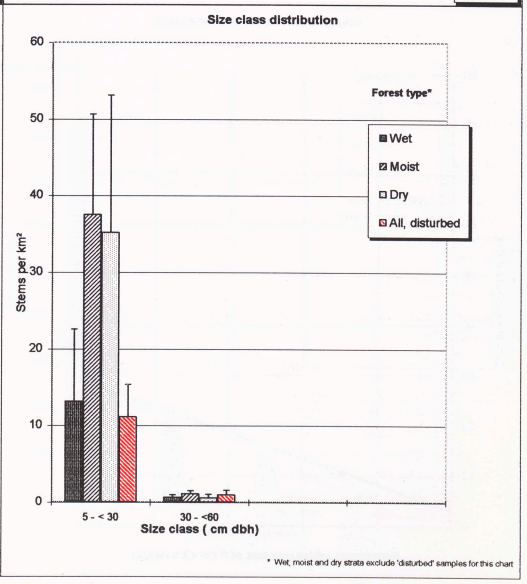




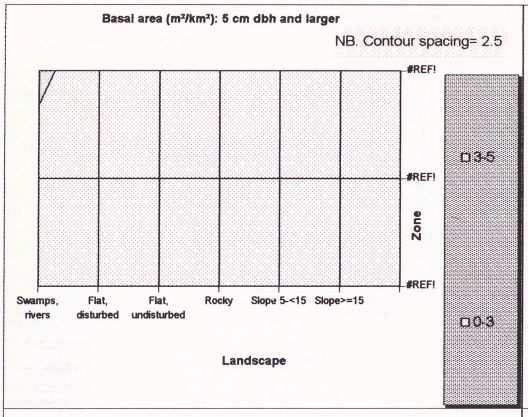


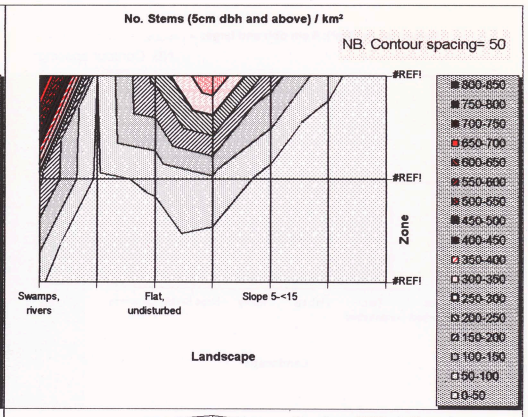


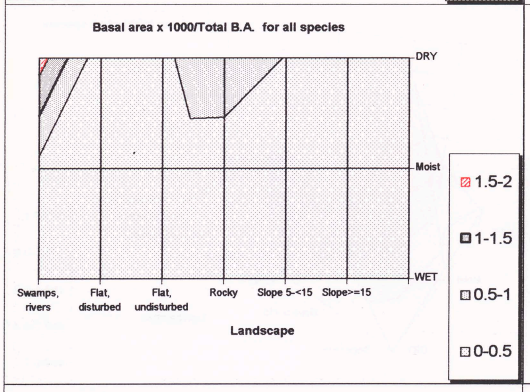


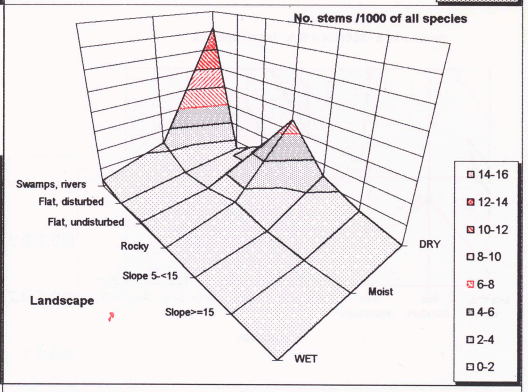


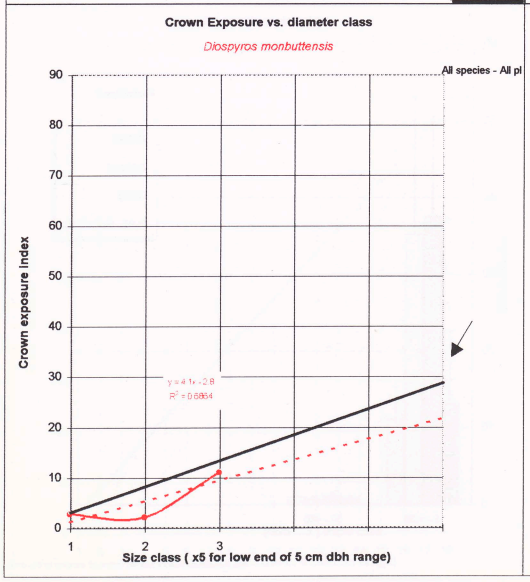
Diospyros monbuttensis

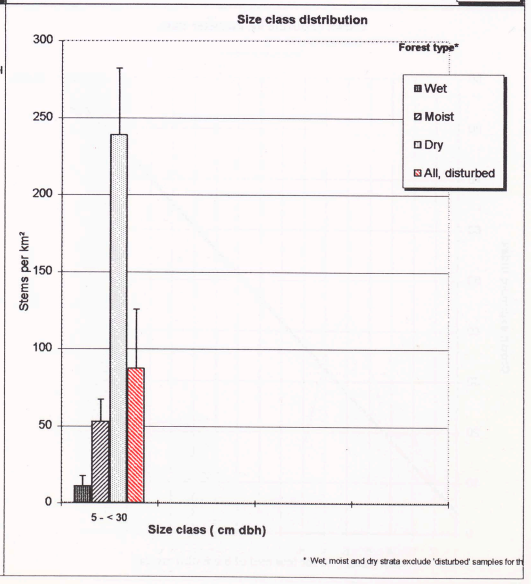




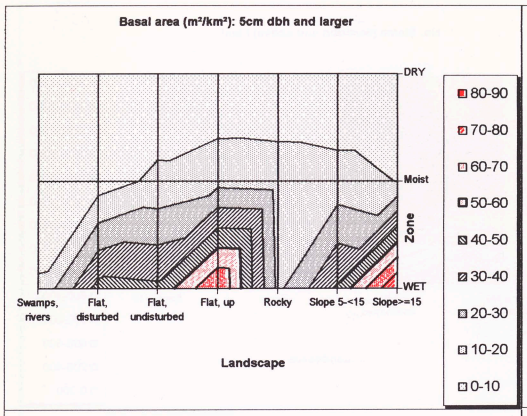


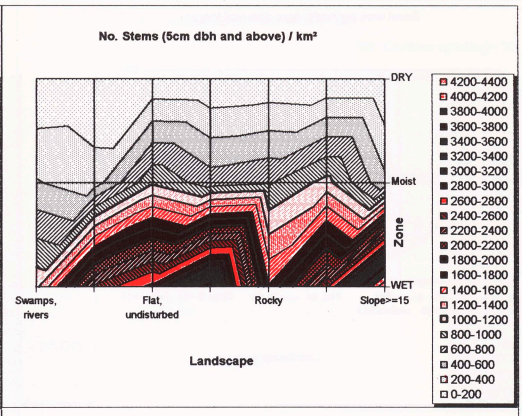


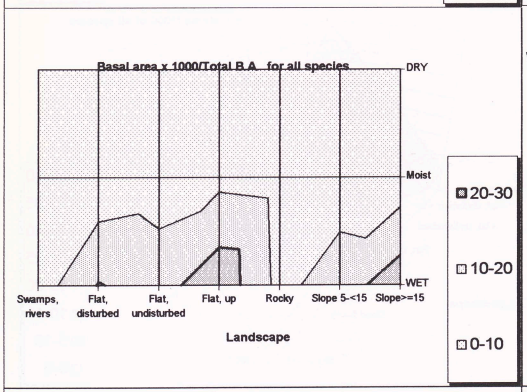


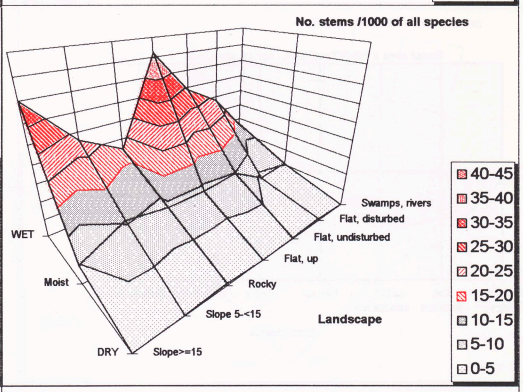


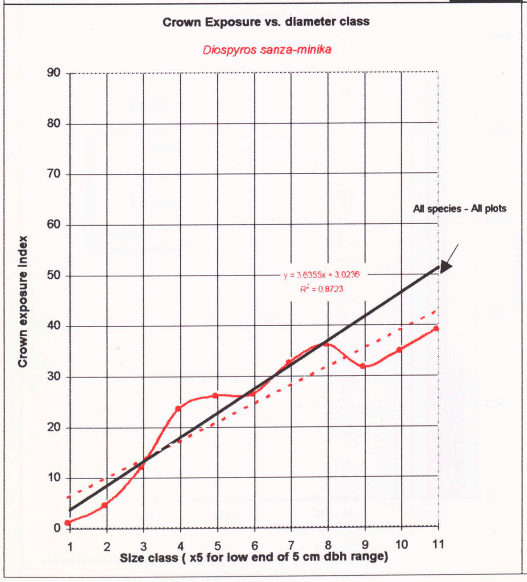
Diospyros sanza-minika

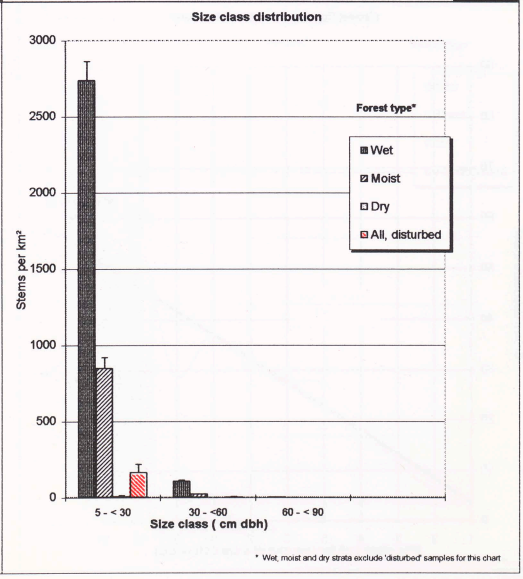




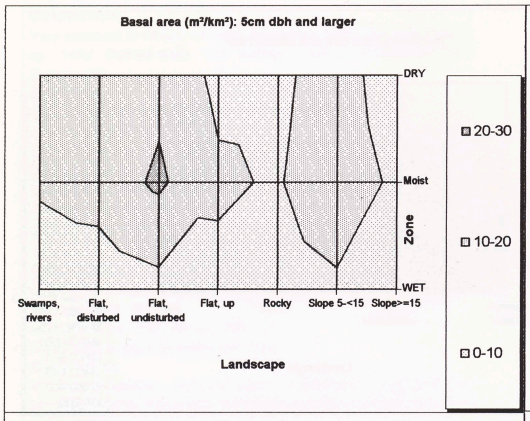


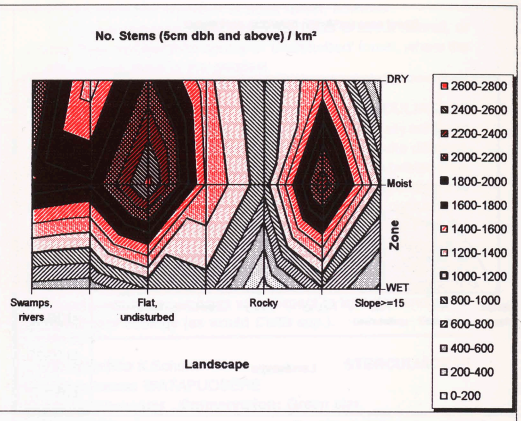


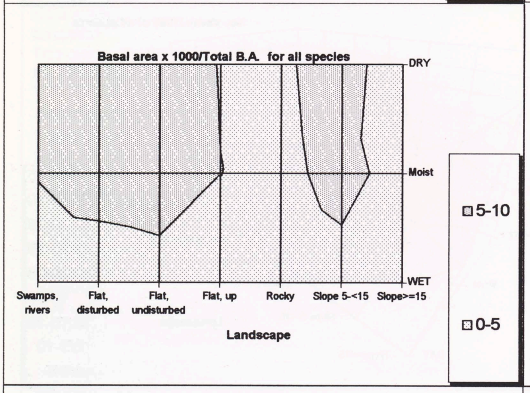


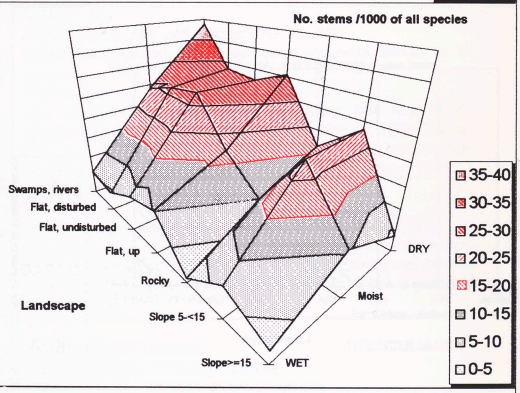


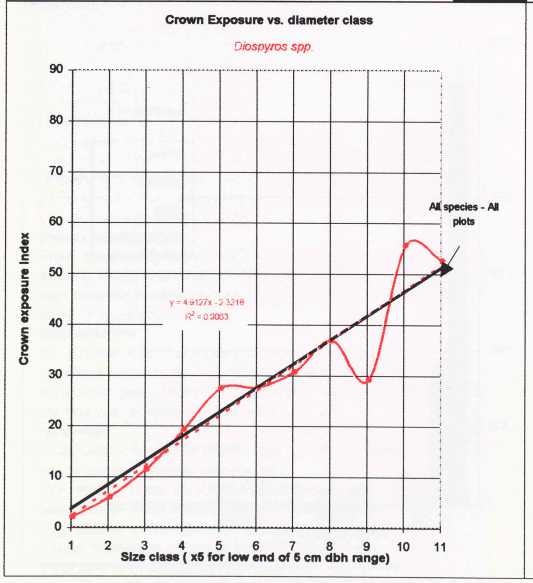
Diospyros spp.

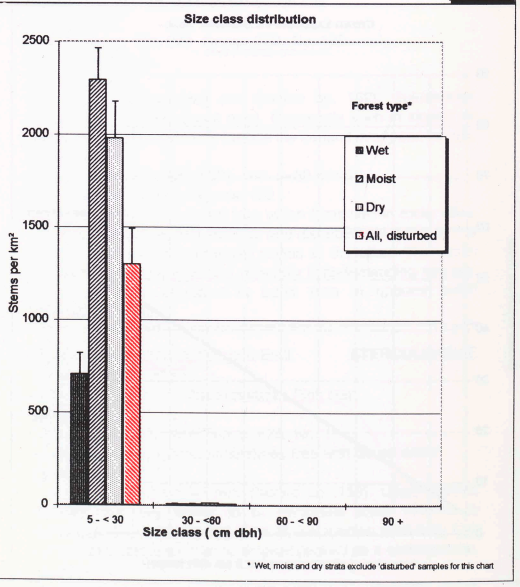




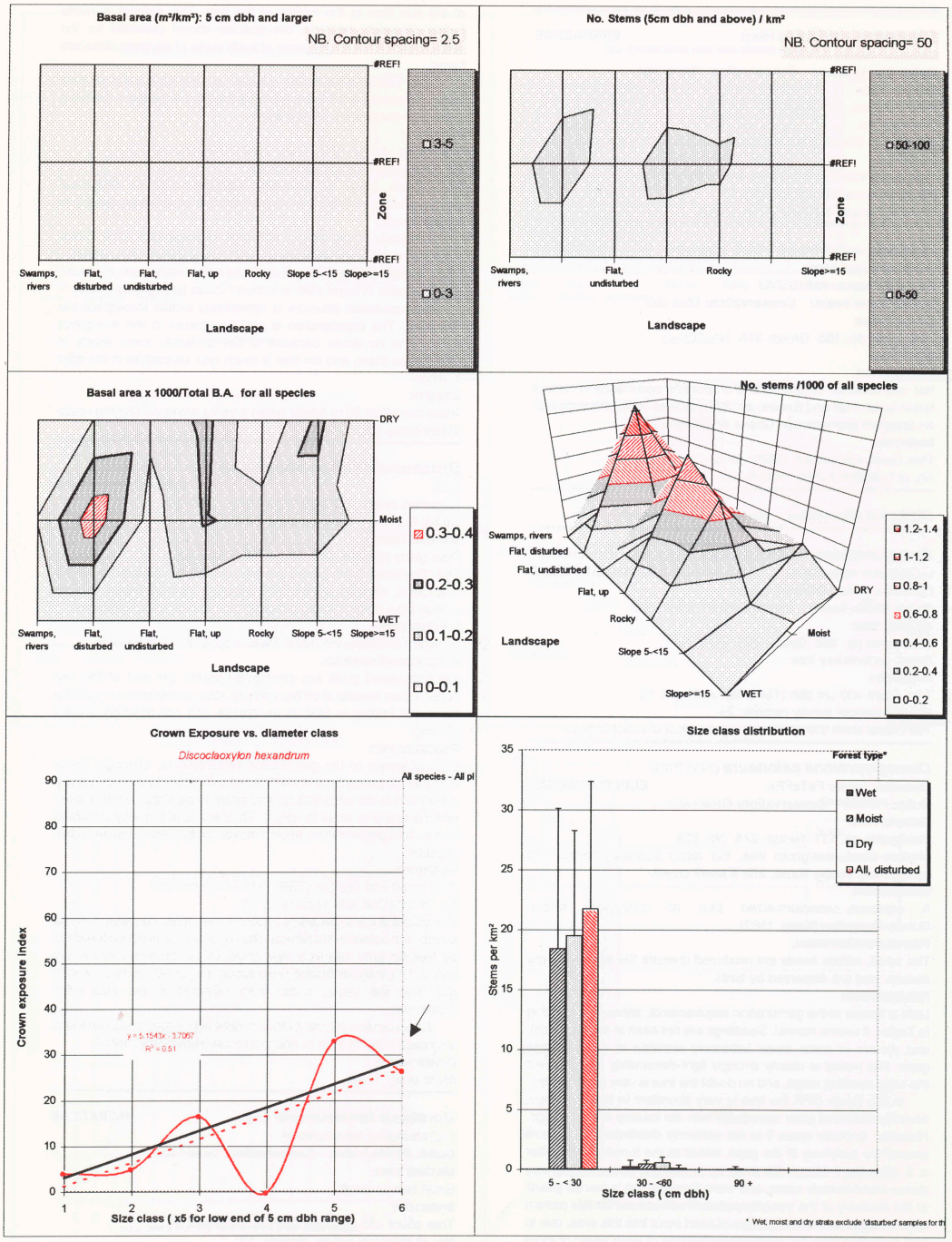








Discoclaoxylon hexandrum



Diospyros viridicans Hiern **EBENACEAE**
Common name: ATWEA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 68 Group: 11 No. 250
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 224); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 43 >=30 cm: 19
No. of botanical survey records: 67
Inventory results included under *D. spp.*

Diphasia angolensis (Hiern) Verdoorn **RUTACEAE**
(=*Diphasia klaineana*)
Common name: AMUDURO
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 165 Group: 31A No. 251
Small tree.
DISTRIBUTION
Not very common in Ghana, and of sporadic occurrence in various forest types (Hall and Swaine sp. 225); Guinea wide, although with an apparent gap between Ghana and Angola.
INVENTORY
Tree count <30 cm dbh (TSP): 19 >=30 cm: 9
No. of botanical survey records: 23

Diphasia klaineana see *Diphasia angolensis*

Discoclaoxylon hexandrum (Mull. Arg.) Pax and K.Hoffm.
(=*Claoxylon hexandrum*) **EUPHORBIACEAE**
Common name: DUBRAFONINI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 132 Group: 22B No. 252
Small, understorey tree.
INVENTORY
Tree count <30 cm dbh (TSP): 35 >=30 cm: 12
No. of botanical survey records: 24
The charts show the species is most typical of moist forests.

Discoglypremna caloneura (Pax) Prain
Common name: FeTeFRe **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 131 Group: 22A No. 253
Medium-sized, evergreen tree, but rarely becoming large, and occasionally deeply fluted; with a small crown.
DISTRIBUTION
A common, medium-sized tree of secondary forest. Guineo-Congolian [Keay, 1989].
PHENOLOGY/DISPERSAL
The small, arillate seeds are produced towards the end of the dry season, and are dispersed by birds.
REGENERATION
Little is known of the germination requirements, although according to Taylor, it seems normal. Seedlings are not seen in mature forest, and yet are in some areas extremely common in medium-large gaps. The treelet is clearly strongly light-demanding from at least the early seedling stage, and no doubt the tree is very fast growing.

In Bia South GPR the tree is very abundant in the very large, severely-disturbed gaps associated with old loading areas for logs. However, in these areas it is not uniformly distributed, but occurs around the periphery of the gaps, closer to the forest proper. After c. 5 years the 5-15 cm dbh trees up to 10m tall occurred in a very dense stand in such areas, and were therefore the 'advance guard' of the recovery of the tree population. Two reasons for this pattern can be suggested:- the high rate of seed input into this area, due to bird droppings from the overhanging boughs of large trees; or more suitable conditions for growth, either due to less soil erosion closer to the edge of the gap (where piles of humus and broken wood inevitably accumulate), or less exposure to the desiccating effects of the sun than in the middle of the gap. This subject warrants further research, because the species shows potential for the encouragement of the recovery of such areas of severely disturbed forest.

Ross [1954] records this species as one of several pioneer trees dominating at 15 years the vegetation of large gaps following a wave of dominance by *Musanga*.
INVENTORY
Tree count <30 cm dbh (TSP): 1264 >=30 cm: 553
No. of botanical survey records: 89
The charts show a generally exposed tree of disturbed, semideciduous forests. The regeneration is at its peak density in logged forest.

In a study of the effects of fire in Asukese and other F.R.s, seedlings were found to thrive in burnt forest [Hawthorne, 1994]. Regeneration (stems 5-30 cm dbh) and larger trees were, however, less abundant in burnt than in unburnt forest [Hawthorne, 1994].

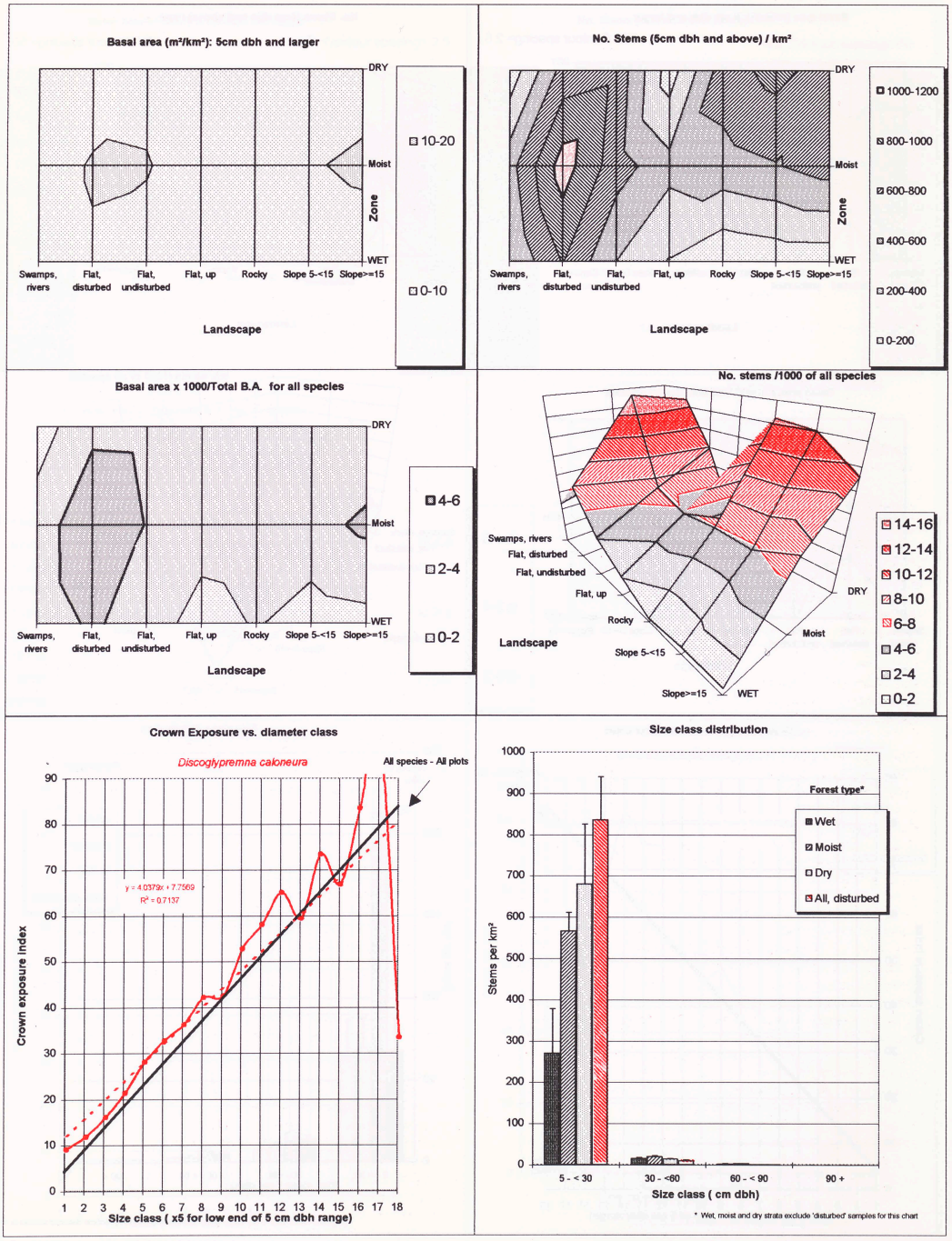
The population structure is remarkably similar throughout the MS zone. The regeneration is slightly sparser in the evergreen forest zone no doubt because of the generally lower levels of disturbance there, and the tree is much less successful in the drier forests.
GROWTH
Trees can attain 20 m height within 4 years along old logging roads [Hawthorne, 1993].

Distemonanthus benthamianus
Baill. **CAESALPINIACEAE**
Common name: BONSAMDUA, Ayan, Movingui
Guild: N.P.L.D. **Conservation:** Pink star
MATURE TREE
Field guide pp. 209, 247 Group: 37G No. 42
The 'Devil-tree' with distinctive reddish bark. Medium to large, buttressed, deciduous tree, with regular, domed crown of very slightly blue-green foliage, although the flush is copper-coloured.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 226); Guinea-wide.
PHENOLOGY/DISPERSAL
Wind-dispersed pods are produced towards the end of the wet season over several months, and are seen sometimes on leafless trees, yet fruiting is said to be sparse and not regularly annual [Taylor].
REGENERATION
Little is known of the germination requirements, although Taylor notes a high percentage of viable seeds. Seedlings and saplings are often seen in the understorey, and seem to be shade tolerant even when a metre or more in height. They are found in very disturbed forest, but regeneration seems never to be abundant in either situation.
INVENTORY
Tree count <30 cm dbh (TSP): 326 >=30 cm: 611
No. of botanical survey records: 78
The charts show a generally exposed tree, most common in moist forests, but common elsewhere. The regeneration is not encouraged by logging (and relatively few areas in the favoured zones are burnt). The irregular fruiting recorded by Taylor seems to be 'ironed out' over the years, rather than reflected in the size class distribution.

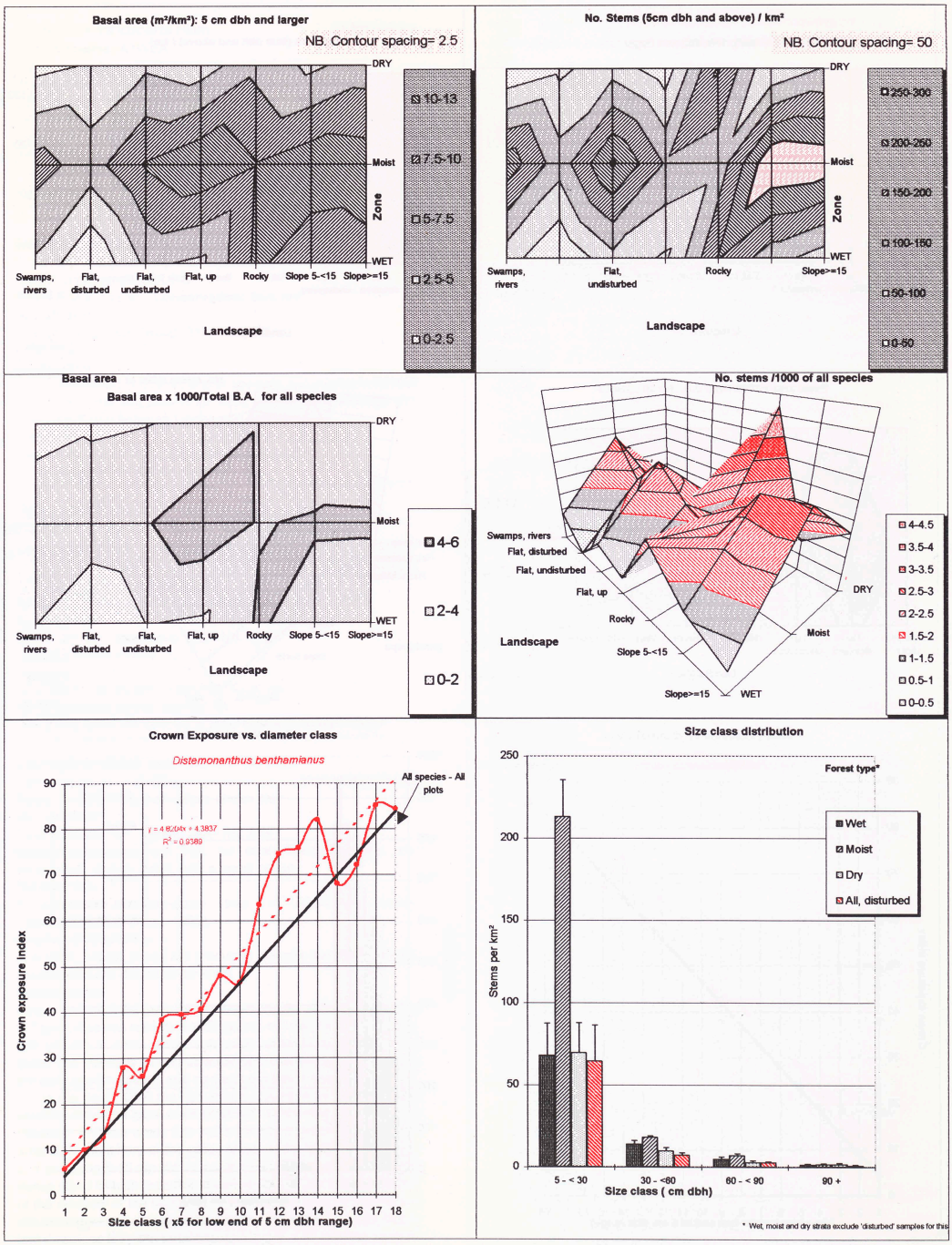
Regeneration (stems 5-30 cm dbh) and larger trees were less abundant in burnt than in unburnt forest [Hawthorne, 1994].
OTHER NOTES
[Berti *et al.*, 1982]

Dorstenia kameruniana Engl. **MORACEAE**
(=*Craterogyne kameruniana*)
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Small tree or shrub
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 13

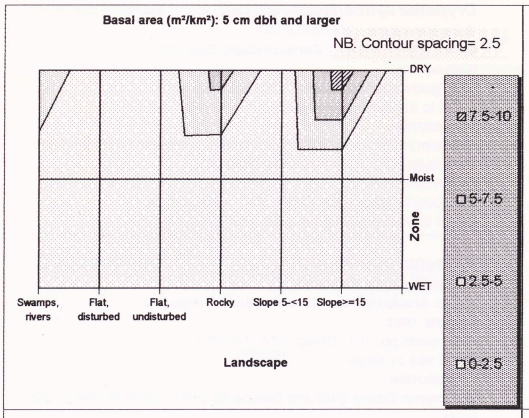
Discoglypremna caloneura

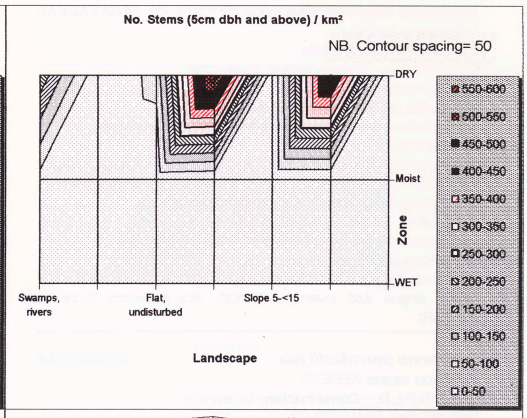


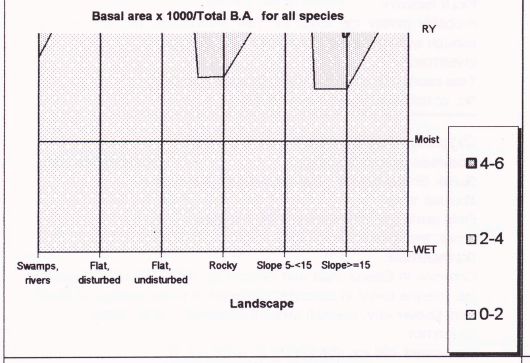
Distemonanthus benthamianus

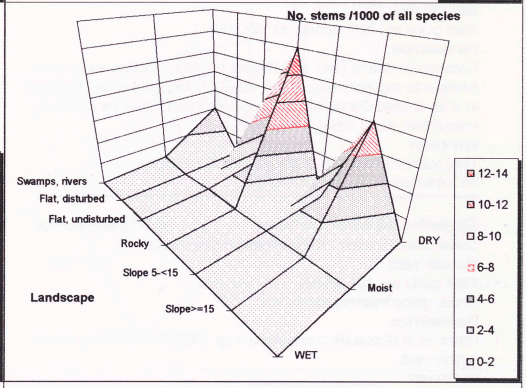


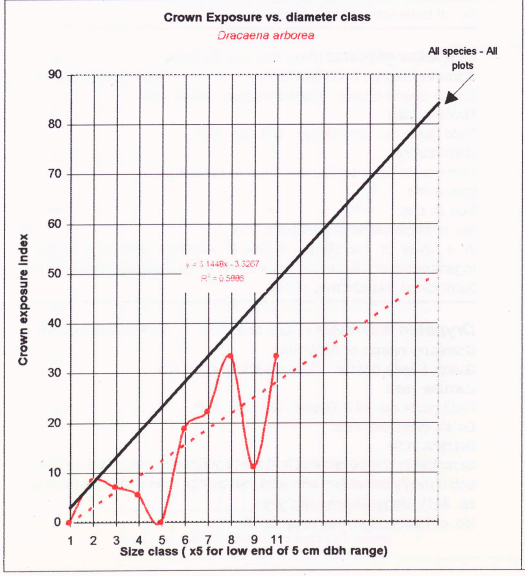
Dracaena arborea

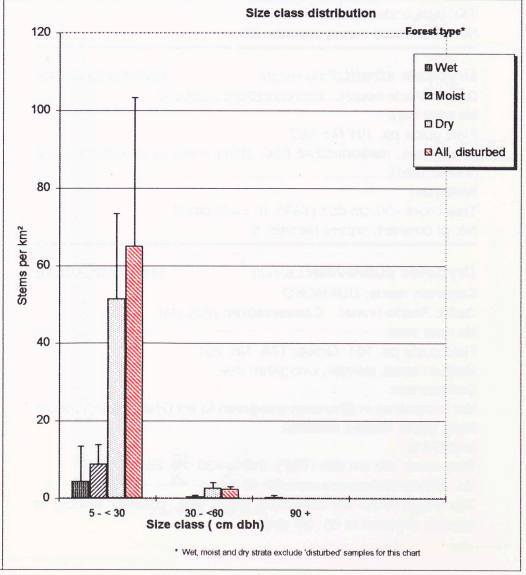












Dracaena arborea (Willd.) Link **AGAVACEAE**
(=*Dracaena smithii*)
Common name: NToNMe
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 223 Group: 39 No. 257
Medium-sized tree, often by rivers or in disturbed areas.
DISTRIBUTION
Common in Ghana in dry forests, and often planted as a boundary tree (Hall and Swaine sp. 227), partly as a consequence of resprouting ability [Sabiti *et al.*, 1992]; Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 63 >=30 cm: 40
No. of botanical survey records: 48
The charts show this is a lower storey tree of disturbed forest rocky areas, slopes and swamps. Overall, the preferred forest in disturbed.

Dracaena perrottetii Bak. **AGAVACEAE**
Common name: KESENE
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 223 Group: 39 No. 258
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 231); Guinea-wide, from Senegal to Nigeria [Keay, 1989], although Akpagana [1992] refers to it as Guineo-Congolian. This species should now be called *D. mannii* Bak. [Bos, 1984].
INVENTORY
Tree count <30 cm dbh (TSP): 88 >=30 cm: 70
No. of botanical survey records: 56

Drypetes aframensis Hutch. **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 101 Group: 17A No. 259
Small, gregarious, dioecious tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 235); Guinea-wide, but no further east.
INVENTORY
TSP data under *D.* spp.
No. of botanical survey records: 32

Drypetes afzelii (Pax) Hutch **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 101 No. 260
Uncommon, medium-sized tree; along rivers in evergreen forest [Irvine, 1961].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Drypetes aubrevillei Leandri **EUPHORBIACEAE**
Common name: DUAMOKO
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 101 Group: 17A No. 261
Medium-sized, slender, evergreen tree.
DISTRIBUTION
Not uncommon in Ghanaian evergreen forest (Hall and Swaine sp. 236); Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 243 >=30 cm: 285
No. of botanical survey records: 46
The charts show an evergreen forest tree, possibly tending to become exposed at 60 cm dbh.

Drypetes aylmeri Hutch. and Dalz. **EUPHORBIACEAE**
Common name: oPAHAFUFUO
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 101 Group: 17A No. 262
Small to medium-sized tree.
DISTRIBUTION
Common in Ghana but mainly confined to evergreen forest (Hall and Swaine sp. 237); Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 252 >=30 cm: 22
No. of botanical survey records: 113

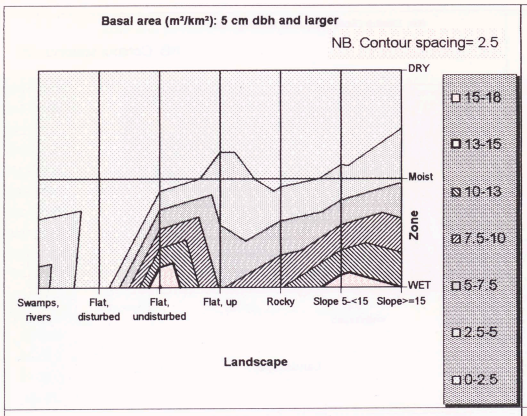
Drypetes chevalieri Beille **EUPHORBIACEAE**
Common name: KATRIKA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 101 Group: 17A No. 263
Small tree or shrub.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 238), mainly in drier forest types.
FIELD IDENTITY
Probably mostly too small for TSP inventories, but where large enough almost certainly confused with *D. gilgiana*.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 61

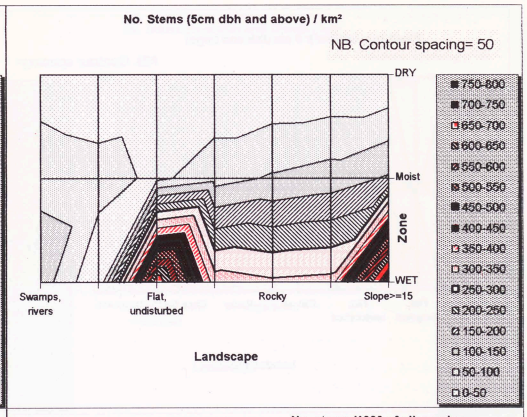
Drypetes floribunda (Muell. Arg.) Hutch
Common name: BEDIBeSA **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 101 Group: 17A No. 264
Small, evergreen tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 239); Guineo-Congolian, inc. riverine forest in savanna. Common in some patches of South East Outlier (dry, coastal) forest [Lieberman, 1979; 1982].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 45

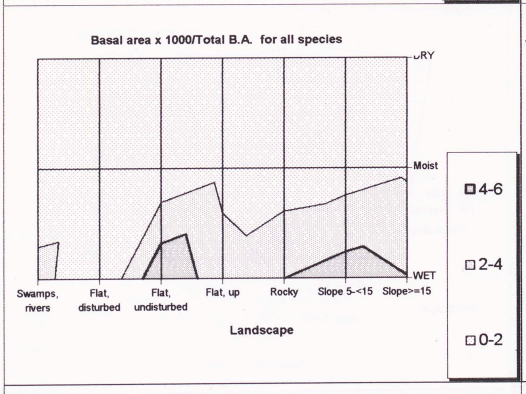
Drypetes gilgiana (Pax) Pax and K.Hoffm.
Common name: KATRIKANINI **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 101 Group: 17A No. 265
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 240).
INVENTORY
See *D.* spp.
No. of botanical survey records: 216
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].

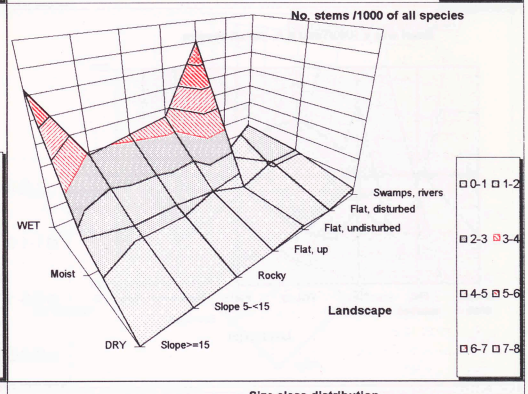
Drypetes ivorensis Hutch. and Dalz. **EUPHORBIACEAE**
Common name: oPAHA-NINI
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 101 Group: 17A No. 266
Small, dioecious tree.
DISTRIBUTION
Common in Ghana, although almost confined to evergreen forests, and strongly correlated with acid, base-poor soils (Hall and Swaine sp. 241); Upper-Guinea endemic.
No. of botanical survey records: 95

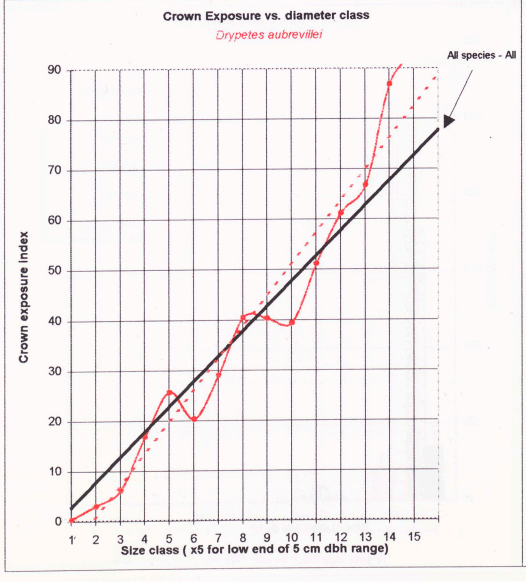
Drypetes aubrevillei

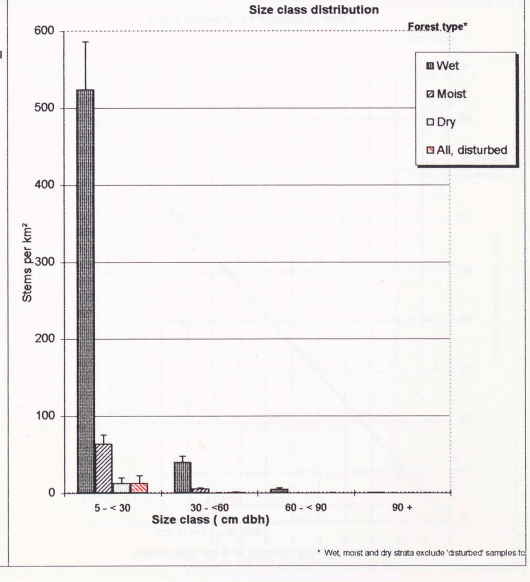








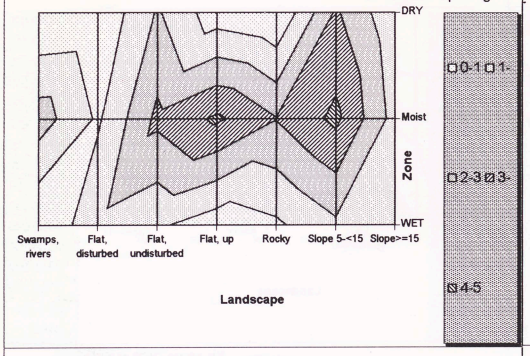




Drypetes pellegrinii

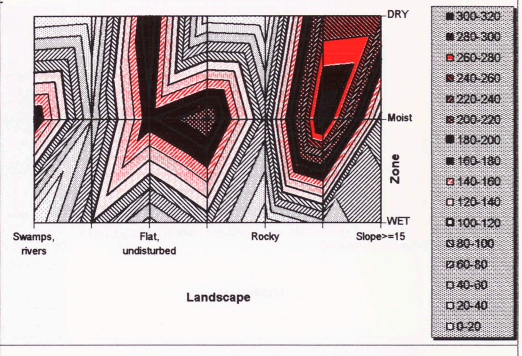
Basal area (m^2/km^2): 5 cm dbh and larger

NB. Contour spacing= 1

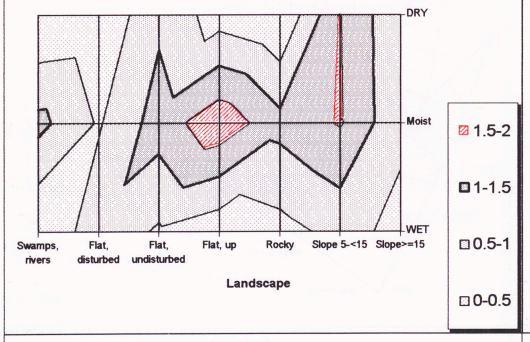


No. Stems (5cm dbh and above) / km^2

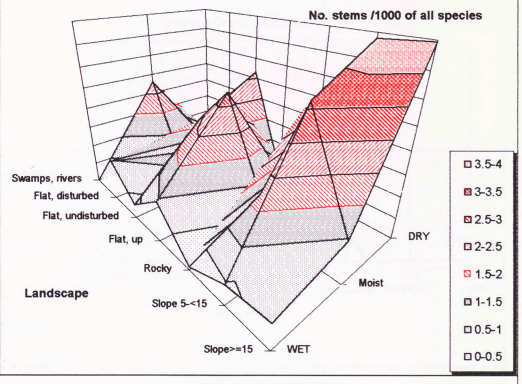
NB. Contour spacing= 20



Basal area x 1000/Total B.A. for all species

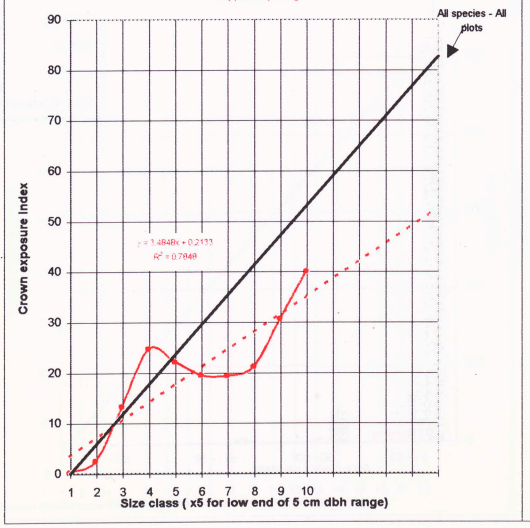


No. stems /1000 of all species

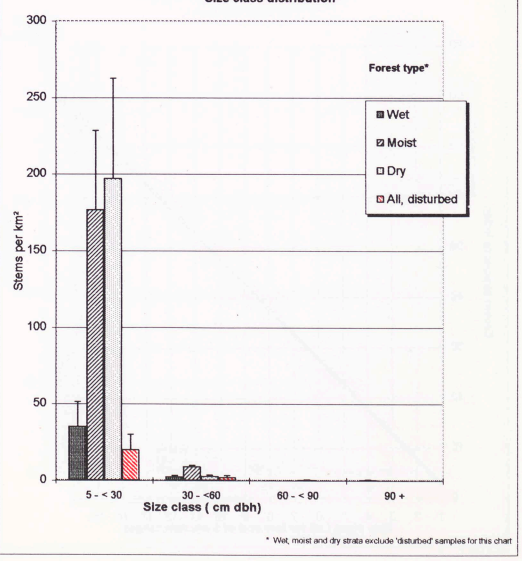


Crown Exposure vs. diameter class

Drypetes pellegrinii

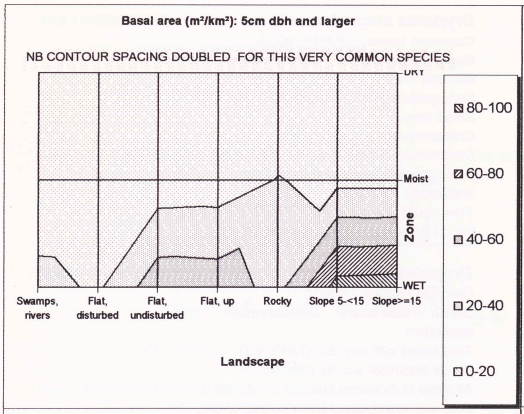


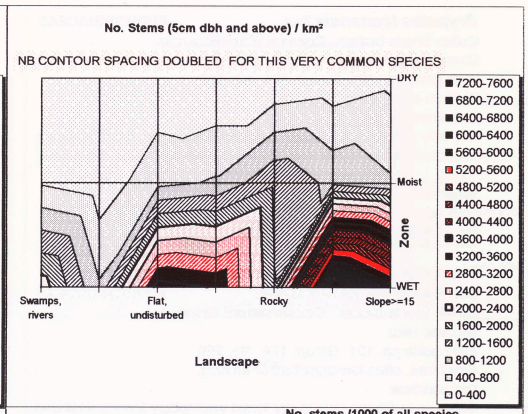
Size class distribution

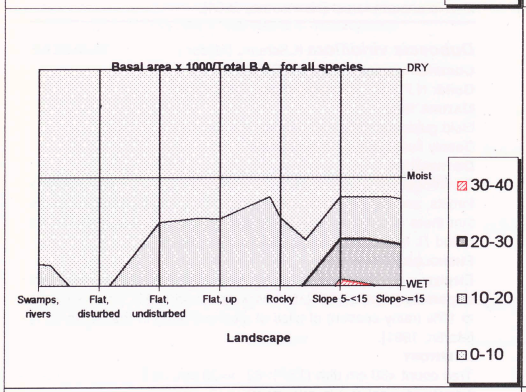


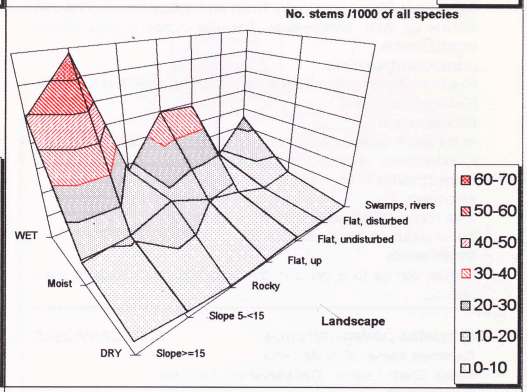
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

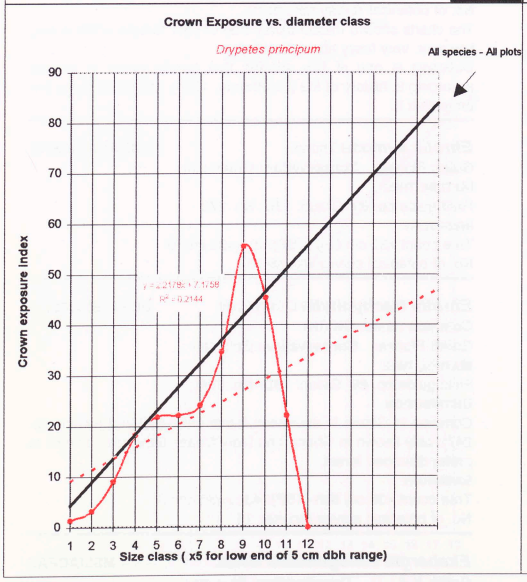
Drypetes principum

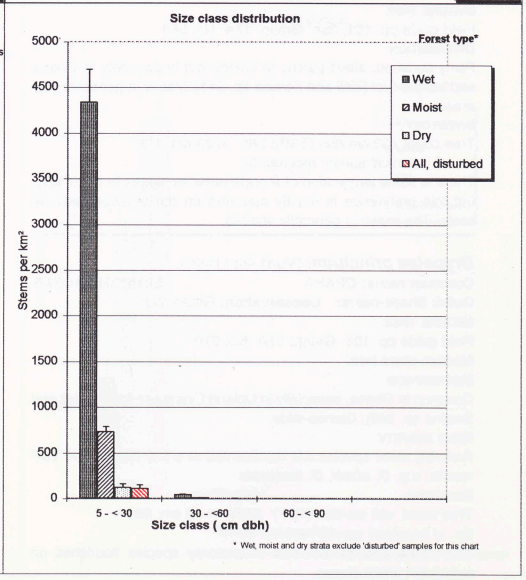












Drypetes leonensis Pax **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 101 Group: 17A No. 267
Medium-sized, evergreen tree.
DISTRIBUTION
Not very common in Ghana (Hall and Swaine sp. 242); nowhere abundant. Guinea-Wide. Occurs on mountains in Togo [Akpagana, 1992].
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 2
No. of botanical survey records: 21

Drypetes parvifolia Mull.Arg. Pax. and K.Hoffm.
Common name: KATRIKABERE **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 101 Group: 17A No. 268
Small tree, often low-branched or arching.
DISTRIBUTION
Common in Ghana only in dry forest and gallery forests (Hall and Swaine sp. 243). Guinea-wide, and also occurs in East African coastal forests.
PHENOLOGY/DISPERSAL
Seeds were seen germinating in Baboon dung in the Shai Hills GPR [Swaine *et al.*, 1990].
REGENERATION
In the South East Outlier forest type at Shai hills G.P.R., this is a shade-tolerant, understorey tree with abundant seedlings in the shade [Swaine *et al.*, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 7 >=30 cm: 0
No. of botanical survey records: 32
OTHER NOTES
Leaves last up to 5 years in the Shai hills [M.D. Swaine, pers. comm.].

Drypetes pellegrinii Leandri **EUPHORBIACEAE**
Common name: oPAHAKoKoo
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 101, 234 Group: 17A No. 269
DISTRIBUTION
Fairly common, albeit patchy in Ghana but known only in Ghana and Ivory Coast [Hall and Swaine sp. 244]. Mainly in generally hilly areas.
INVENTORY
Tree count <30 cm dbh (TSP): 281 >=30 cm: 159
No. of botanical survey records: 34
There is some suggestion of a preference for slopes in the charts, but this preference is mostly apparent on the broader, national scale. The crown is generally shaded.

Drypetes principum (Muell.Arg.) Hutch.
Common name: OPAHA **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 101 Group: 17A No. 270
Medium-sized tree.
DISTRIBUTION
Common in Ghana, especially in Upland Evergreen forest (Hall and Swaine sp. 245); Guinea-wide.
FIELD IDENTITY
Probably other species are represented at a low level in the TSP results, e.g. *D. afzelii, D. leonensis.*
INVENTORY
Tree count <30 cm dbh (TSP): 2341 >=30 cm: 381
No. of botanical survey records: 50
The charts confirm that this understorey species flourishes on evergreen forest slopes.

Drypetes singroboensis Ake Assi **EUPHORBIACEAE**
Common name: OPAHA-AKOA
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 101 Group: 17A No. 271
Small tree.
DISTRIBUTION
Common in Ghana in some dry forests only (Hall and Swaine sp. 246); only in Ghana and Ivory Coast [FWTA].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 12

Drypetes spp. **EUPHORBIACEAE**
Common name: OPAHA
Guild: Shade-bearer **Conservation:** ? star
INVENTORY
Tree count <30 cm dbh (TSP): 630 >=30 cm: 131
No. of botanical survey records: 0
All sizes of *Drypetes* species combined are more abundant in burnt than in unburnt forest [Hawthorne, 1994].

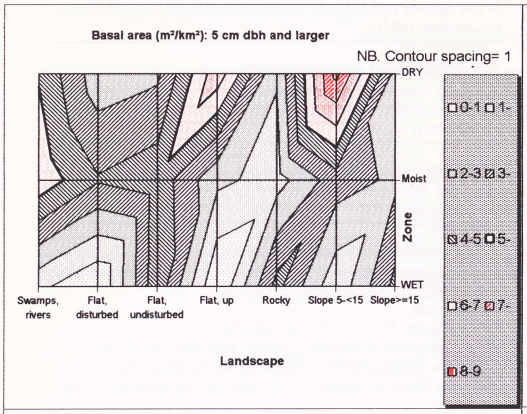
Duboscia viridiflora K.Schum. (Mildbr.) **TILIACEAE**
Common name: AKOKORAGYEHINI
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 125, 243 Group: 20 No. 272
Deeply fluted tree of drier forests.
DISTRIBUTION
Commonest in Ghana in Moist Semideciduous north-west subtype forests, and possibly favoured by elephants. Keay [1989] suggests that there is only one species in this genus, and that it should be called *D. macrocarpa* Bocq. Guineo-Congolian.
PHENOLOGY/DISPERSAL
Elephants are attracted to fruiting trees, and probably are important dispersers [Martin, 1991]. Seeds were found in 2% (rainy season) to 10% (rainy season) of piles of elephant dung in Bia South GPR [Martin, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 62 >=30 cm: 343
No. of botanical survey records: 0
The charts show a middle storey tree of drier forests which is not, however, very fussy about forest type.
Duboscia is one of few species that barely varies in density according to history of fire [Hawthorne, 1994]. Maybe its flutes are protecting it.

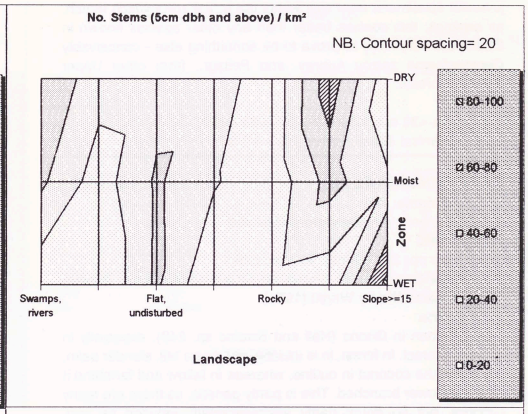
Ehretia cymosa Thonn. **BORAGINACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 89 Group: 13D No. 273
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

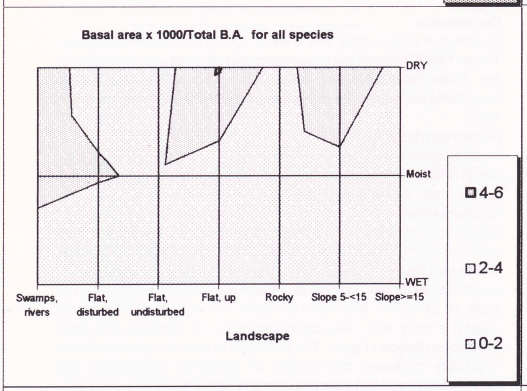
Ehretia trachyphylla C.H. Wright **BORAGINACEAE**
Common name: OKYINI
Guild: Pioneer **Conservation:** Gold star
MATURE TREE
Field guide pp. 89 Group: 13D No. 274
DISTRIBUTION
Common in Ghana in evergreen forest only (Hall and Swaine sp. 247); only known in Ghana and Ivory Coast, although it seems to prefer disturbed forest.
INVENTORY
Tree count <30 cm dbh (TSP): 43 >=30 cm: 34
No. of botanical survey records: 15

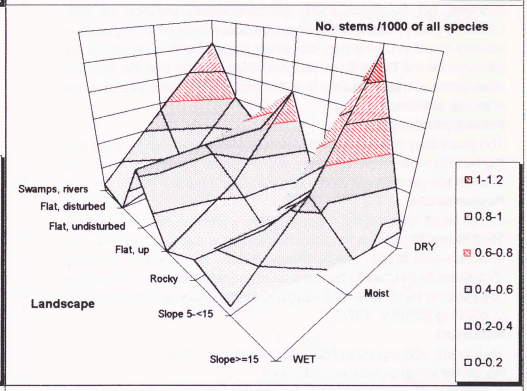
Ekebergia senegalensis A.Juss. **MELIACEAE**
Guild: N.P.L.D. **Conservation:** Blue star
In savanna or dry forest, locally common, from Senegal to Zaire and Angola on well-drained soils [Geerling, 1982]. Records of (sterile,

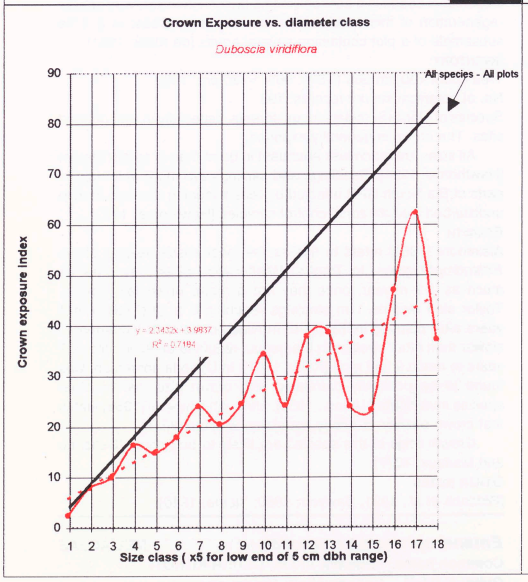
Duboscia viridiflora

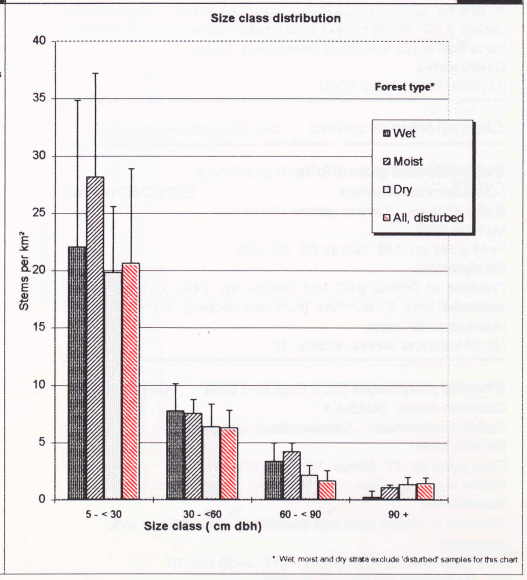












juvenile) specimens from well within the forest zone which match, as saplings, this species better than any other species known in Ghana are very likely to prove to be something else - conceivably *Gymnostemon zaizou* Aubrev. and Pellegr., from other Upper Guinean forests.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Elaeis guineensis Jacq. **PALMAE**

Common name: Abe
Guild: Pioneer **Conservation:** Pink star

MATURE TREE

Field guide pp. 225 Group: 40 No. 276
The oil palm tree, common throughout Ghana's forest zone. Rooting systems discussed by Wright [1951].

DISTRIBUTION

Very common in Ghana (Hall and Swaine sp. 248), especially in disturbed forest. In forest, in is usually found as a tall, slender palm, not unlike the coconut in outline, whereas in fallow and farmland it is usually lower branched. This is partly genetic, as there are many cultivars, but no doubt partly environmentally induced as well. Letouzey [1978] refers to the common occurrence of this species in primary forest in Cameroun, but whilst observing that seedlings are common on the forest floor, Hall and Swaine note that the greatest abundance of mature palms is in the most disturbed areas of forest near the savanna boundary.

PHENOLOGY/DISPERSAL

The phenology is discussed by Anon. [1955]. Ajayi [1977] notes that the fruits are an important part of the diet of the African giant rat *Cricetomys gamnianus*; some dispersal is therefore likely.

REGENERATION

Germination is seasonal, occurring only after the start of the rain; 70-90% viability is lost in seeds buried in the soil in two years, due to insect and fungal attack [Rees, 1963]. The seed is probably stimulated to germinate by fire and other disturbances and various complicated treatments are required to stimulate germination prior to planting [Cobley, 1976].

INVENTORY

Tree count <30 cm dbh (TSP): 60 >=30 cm: 1416
No. of botanical survey records: 279
A species of dry, disturbed or swampy forests. 'Regeneration' (stems 5-30 cm dbh) and larger palms were more abundant in burnt than in unburnt forest [Hawthorne, 1994].

OTHER NOTES

[Hussey, 1955; Rees, 1963]

Elaeophorbia drupifera see *Elaeophorbia grandifolia*

Elaeophorbia grandifolia (Haw.) Croizat
(=*Elaeophorbia drupifera*) **EUPHORBIACEAE**

Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 128 Group: 22 No. 278

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 249), and not clearly separable from *E. drupifera* [Hall and Swaine]. From the Accra plains to moist forest.
No. of botanical survey records: 48

Enantia polycarpa (DC.) Engl. and Diels **ANNONACEAE**

Common name: DUASIKA
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 77 Group: 12D No. 279
Middle storey, medium-sized tree, with golden yellow slash.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 250); Guinea-wide.

INVENTORY

Tree count <30 cm dbh (TSP): 1017 >=30 cm: 70
No. of botanical survey records: 210
The charts show a species avoiding drier forests. In a study of the effects of fire in Asukese and other F.R.s, seedlings and larger trees of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].

Englerophytum magalistmontanum
(Aubr.and Pelleg.) Aubr.and Pelleg. **SAPOTACEAE**
See *Bequaertiodendron magalismontanum* (Sond.) Heine and J.H.Hemsley)

Englerophytum oblanceolatum
(S.Moore) Pennington **SAPOTACEAE**
See *Bequaertodendron oblanceolatum*

Entandrophragma angolense (Welw.) DC.

Common name: EDINAM, Gedunohor **MELIACEAE**
Guild: N.P.L.D. **Conservation:** Red star

MATURE TREE

Field guide pp. 174, 241 Group: 34B No. 3
Large, deciduous [Sept.-Nov., Taylor] tree with rather 'fat', high buttresses. Compound leaves clustered, but not as strongly as in *E. utile*. The crown is usually not as large as the huge bole might suggest.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 251); Guineo-Congolian. Timber tree. Common, particularly in better-drained sites, throughout the Moist Semideciduous forest zone, but found elsewhere. Successful plantations have been made in the Ivory Coast [de Klerk, 1991].

PHENOLOGY/DISPERSAL

Flowers with the new leaves in December [Taylor]. Fruits split on the tree to release the winged, wind-dispersed seeds throughout the wet season from July to September.

REGENERATION

Germination is normal. Seedlings require shade for the first few years. In plantations the seedlings grow c. 1m per year in the first two years [Taylor]. Subsequently, they require greater exposure to sun for at least part of the day. Saplings are commonly seen in gaps of all sizes, their narrow crown on little-branched stems usually, if all is well, held above any mass of climbers and other competition typical of gaps. The presence of parent trees in the area noticeably increases the number of seedlings, suggesting that dispersal of seeds is a serious limiting factor. However, very sparse regeneration of this species was found in Ivory Coast in a 3 ha subsample of a plot containing several adults [de Klerk, 1991].

INVENTORY

Tree count <30 cm dbh (TSP): 968 >=30 cm: 1909
No. of botanical survey records: 192
Species of Moist (Semideciduous) forests, especially in well-drained sites. The crown is generally exposed.

All sizes are much less abundant in burnt than in unburnt forest [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

GROWTH

Alexandre [1982] refers to this as the most shade-bearing of the *Entandrophragmas*. In Tropical Shelterwood plots they grow as much as 1-2 m/year, once they are a metre or so tall [Taylor]. Taylor also records 1 m striplings reaching 6 m (12" GBH) in 4 years after planting in Taungya. In Nigeria, the girth increment is slower than other species in the genus, requiring an estimated 137 years to reach 9 feet girth [Keay, 1961]. In Uganda, increment was found to be positively correlated with crown size, as for other species investigated [Anon., 1959], although Dawkins [1956] states that crown position is poorly correlated with increment.

Growth rings in this species are likely to be annual [Detienne and Mariaux, 1977].

OTHER NOTES

[Riddoch *et al.*, 1991; Sawyerr, 1960; Tiama, 1948]

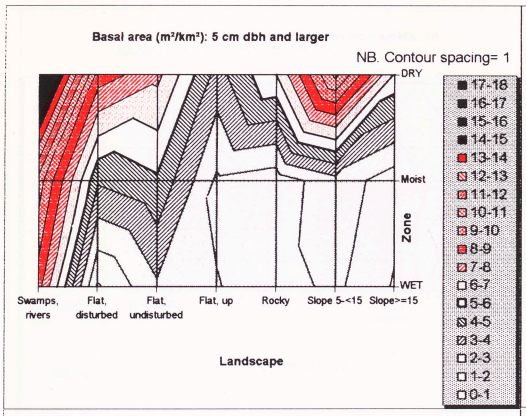
Entandrophragma candollei Harms **MELIACEAE**

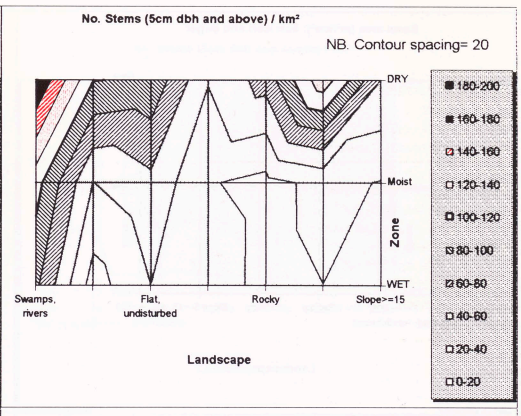
Common name: PENKWA-AKOA, CEDAR KOKOTI
Guild: N.P.L.D. **Conservation:** Scarlet star

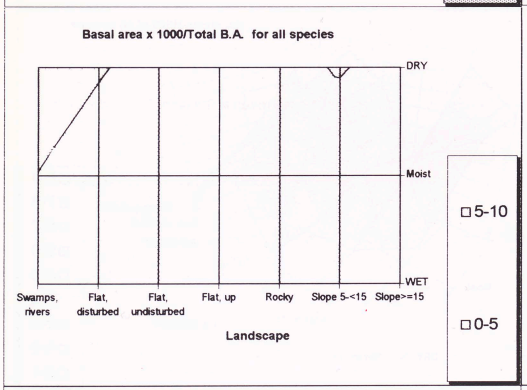
MATURE TREE

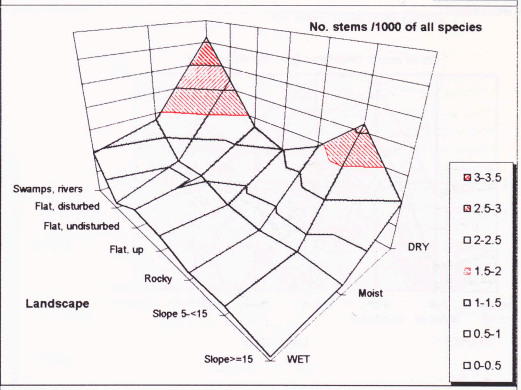
Field guide pp. 174, 241 Group: 34B No. 16

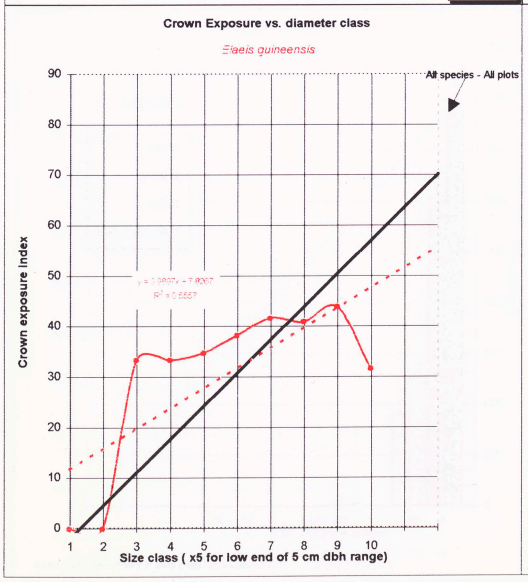
Elaeis guineensis

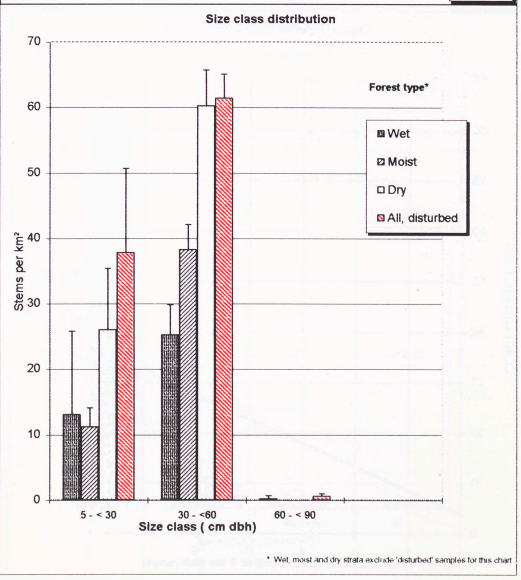




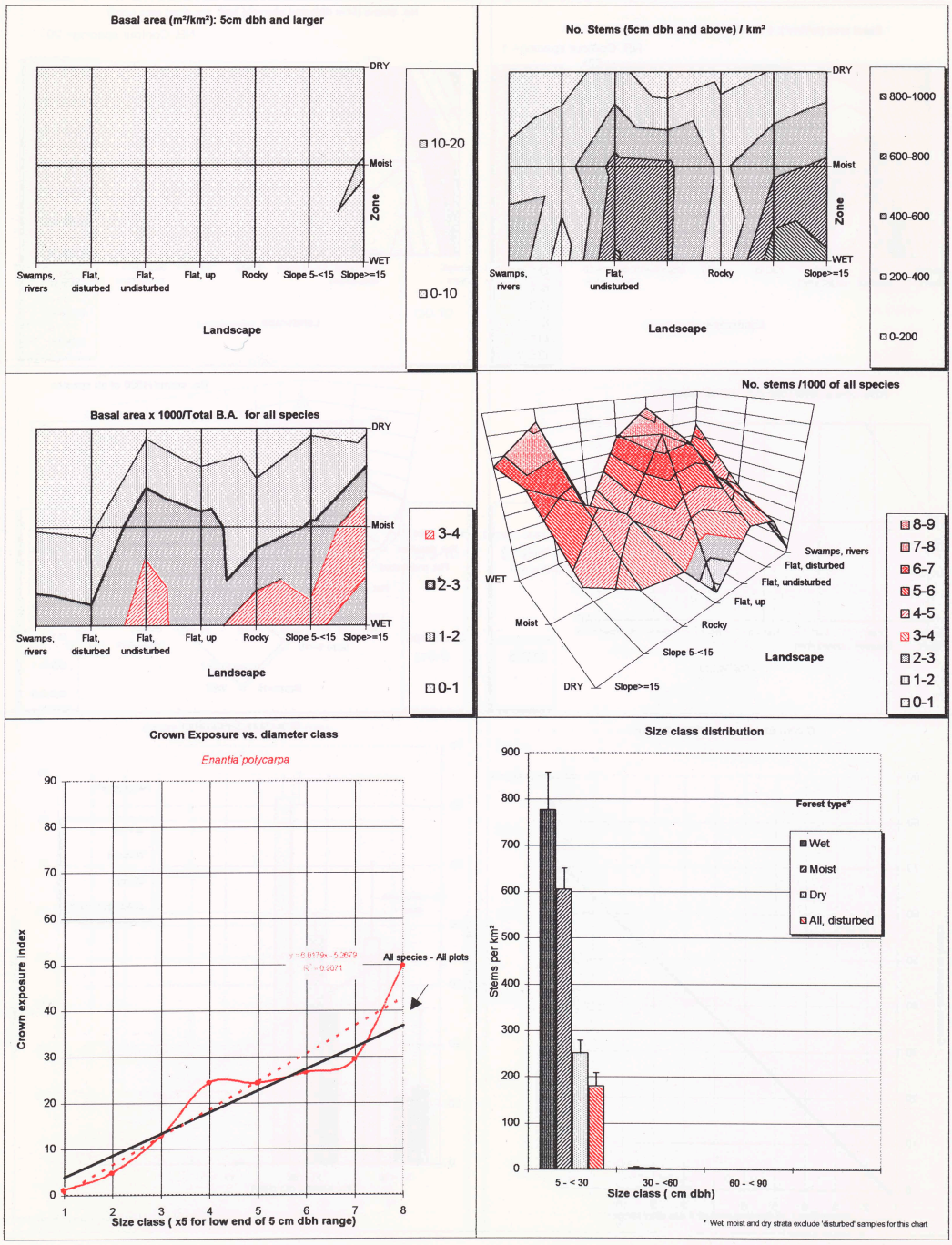




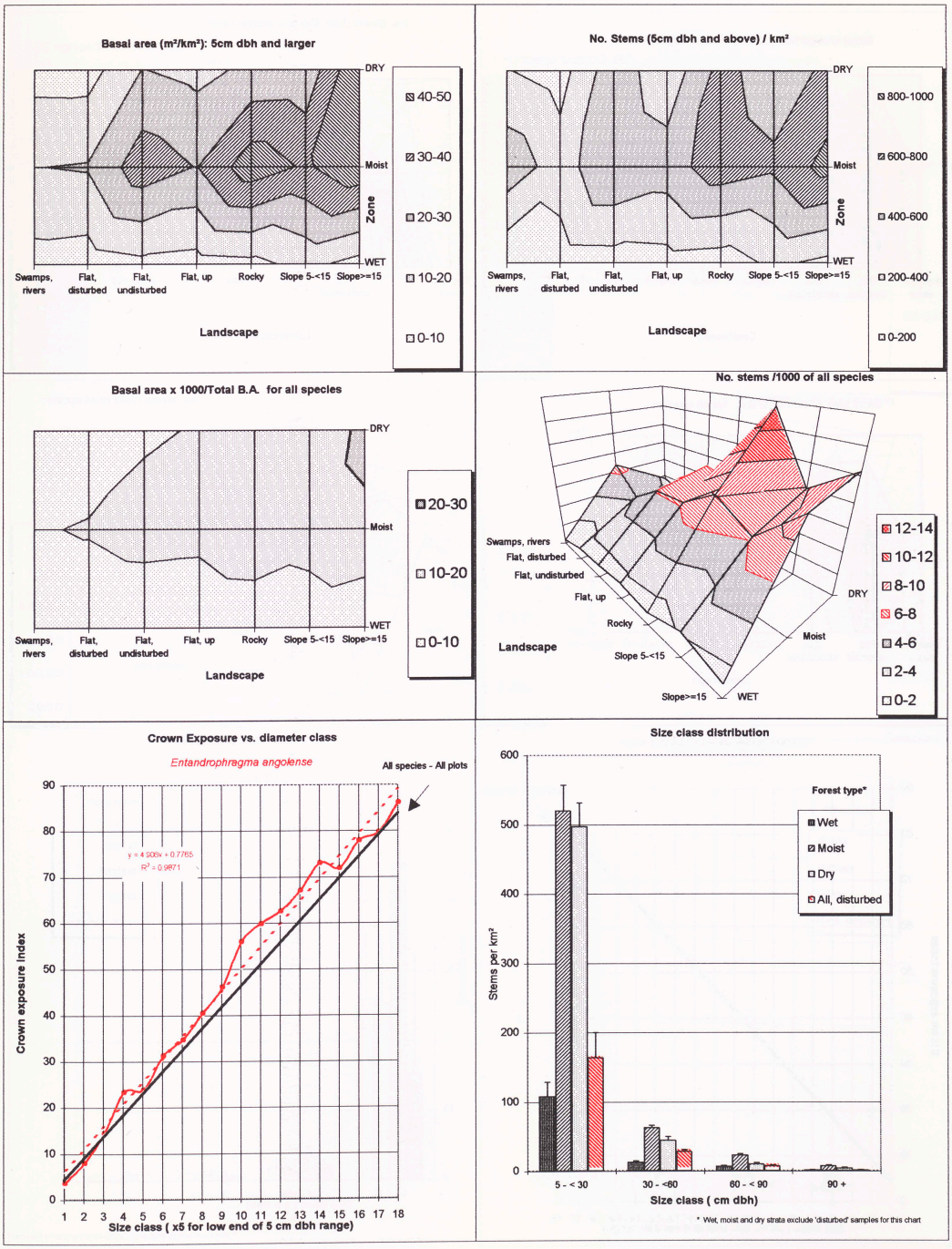




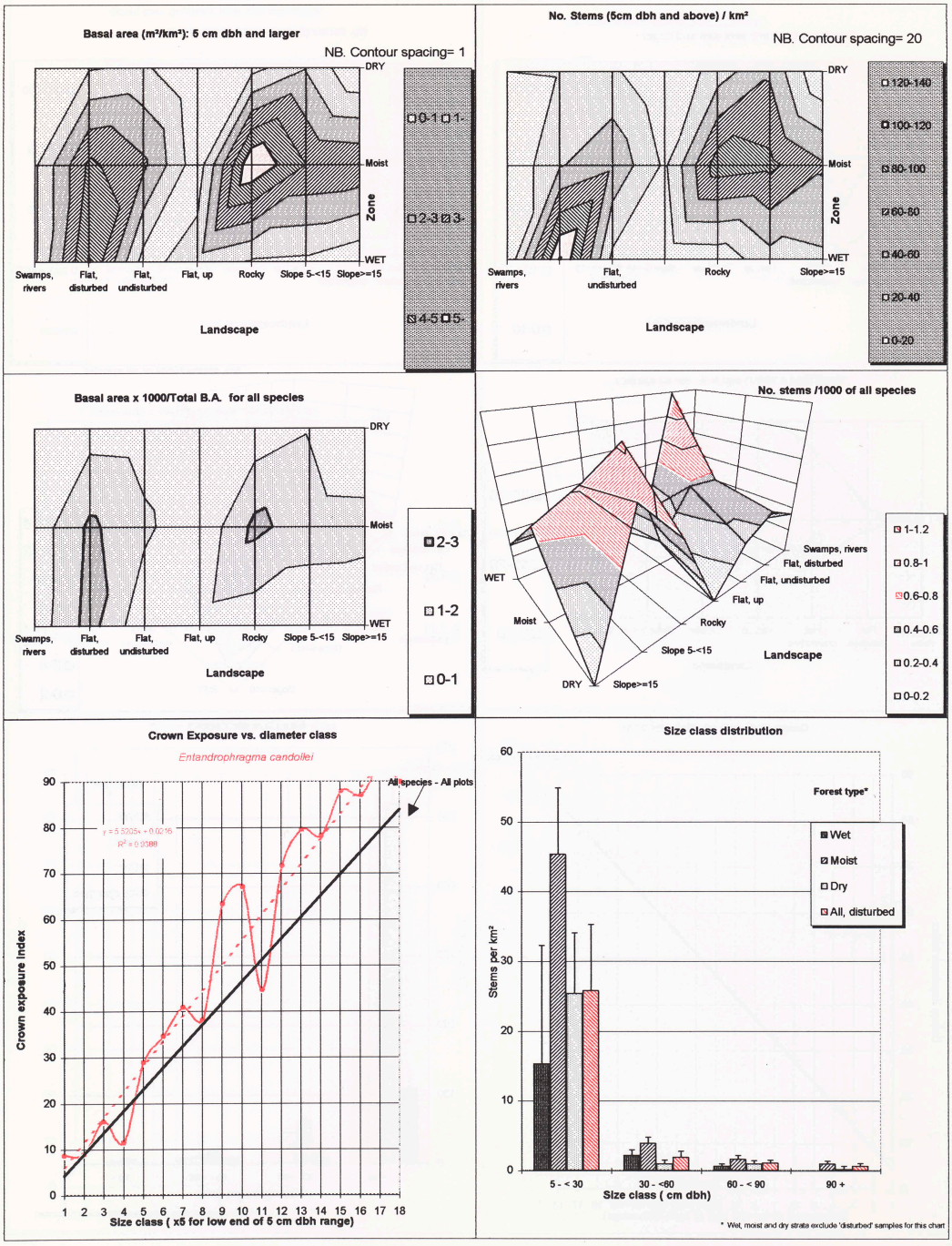
Enantia polycarpa



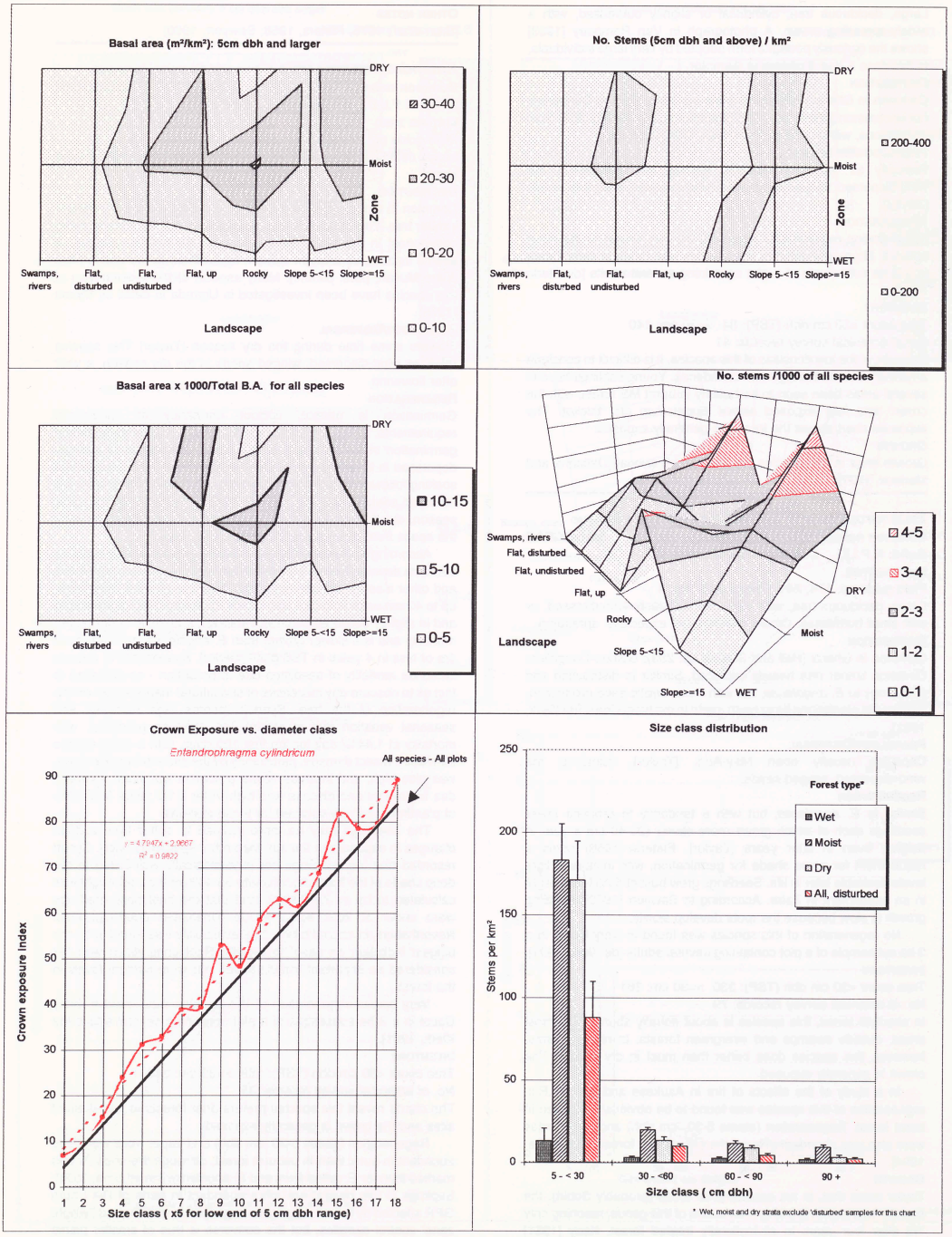
Entandrophragma angolense



Entandrophragma candollei



Entandrophragma cylindricum



Large, deciduous tree, cylindrical or slightly buttressed, with a widely-spreading crown. A photograph in Van Rompaey [1993] shows the curiously podagric form adopted by very large individuals, in this case a tree 6 metres in diameter.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 252); Guineo-Congolian; not uncommon timber tree. This is similar to, but slightly rarer than its relations, with scattered individuals in most areas.

PHENOLOGY/DISPERSAL

Basically as the other species, except that release of the wind-dispersed, winged seeds is in the dry season, and more erratic [Taylor].

REGENERATION

Regeneration requirements appear to be very similar to the other species. No regeneration of this species was found in Ivory Coast in a 3 ha subsample of a plot containing several adults [de Klerk, 1991].

INVENTORY

Tree count <30 cm dbh (TSP): 84 >=30 cm: 140

No. of botanical survey records: 41

Because of the low densities of this species, it is difficult to conclude anything about its ecology with confidence. Young saplings have in several areas been seen to be healthy in burnt MS forest, with the crown held fully exposed above *Eupatorium* etc. thicket. The exposure chart shows the trees are generally exposed.

GROWTH

Growth rings in this species are likely to be annual [Detienne and Mariaux, 1977].

Entandrophragma cylindricum (Sprague) Sprague

Common name: PENKWA, Sapele **MELIACEAE**

Guild: N.P.L.D. **Conservation:** Scarlet star

MATURE TREE

Field guide pp. 174, 241 Group: 34B No. 4

Large, deciduous tree, with very scented slash. Unbuttressed, or with small buttresses. Crown rounded, not especially spreading.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 253); Guineo-Congolian. Common timber tree heavily exploited. Similar in distribution and phenology to *E. angolense*, but with more erratic seed production. Successful plantations have been made in the Ivory Coast [de Klerk, 1991].

PHENOLOGY/DISPERSAL

Capsules usually open May-Aug. [Taylor], releasing the wind-dispersed, winged seeds.

REGENERATION

Similar to *E. angolense*, but with a tendency to produce fewer seedlings each of which grows more slowly (20-40 cm a year in height), even in later years [Taylor]. Pieters (1958) notes a requirement for some shade for germination, with increased light levels desirable later in life. Seedlings grew best at 50% full sunlight in an experiment in Zaire. According to Sawyerr [1960], seedling growth is slow because the roots develop slowly.

No regeneration of this species was found in Ivory Coast in a 3 ha subsample of a plot containing several adults [de Klerk, 1991].

INVENTORY

Tree count <30 cm dbh (TSP): 330 >=30 cm: 861

No. of botanical survey records: 79

In absolute terms, this species is about equally abundant in most areas, outside swamps and evergreen forests. In relative terms, however, this species does better than most in dry forests. The crown is generally exposed.

In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest. Regeneration (stems 5-30 cm dbh) and larger trees were also less abundant in burnt than in unburnt forest [Hawthorne, 1994].

GROWTH

Taylor notes that, in his experimental areas (probably Bobiri), the species was slower growing than others of this genus, reaching only 1m after four years in silviculturally treated forest. Keay [1961] predicted 87 years to reach 8 ft girth.

Growth rings in this species are likely to be annual [Detienne and Mariaux, 1977].

OTHER NOTES

[Brun *et al.*, 1976; Pieters, 1958; Sawyerr, 1960]

Entandrophragma utile (Dawe and Sprague) Sprague

Common name: EFOoBRODEDWO, Sipo, Utile **MELIACEAE**

Guild: N.P.L.D. **Conservation:** Scarlet star

MATURE TREE

Field guide pp. 174, 241 Group: 34B No. 5

Large, deciduous tree with very clustered leaves at the tips of stout twigs.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 254); Guineo-Congolian. Timber tree. This species is less widespread than the others, being commonest in the Moist Semideciduous, North-West subtype. It seems to be more drought-tolerant than others in the genus [Abu Juam Musah, pers. comm.]. Many aspects of the regeneration of this species have been investigated in Uganda in detail by Synott (1975).

PHENOLOGY/DISPERSAL

Flowers some time during the dry season [Taylor] This species releases wind-dispersed, winged seeds in the dry season, a year after flowering.

REGENERATION

Germination is normal, without dormancy or specialised requirements. Kyereh *et al.* [1993] report little difference between germination in the light and in the dark. Germination is strongly depressed in large gaps [Kyereh, 1994]. Synnott [1975] found that soaking followed by a dry period did not allow germination, whereas repeated soaking, signalling more reliably the onset of the rainy season, did. Also seed viability was found to be adequate to carry the seeds from dispersal to the onset of the rains.

According to Sawyerr [1960], seedling growth is slow because the roots develop slowly; and seedlings become infested with mites and other insects in nurseries unless they are shaded. Seedlings, up to 40 cm or so in height, are locally abundant, both in the shade and in slightly disturbed patches. However, it tends to suffer higher mortality and is a slower grower than *E. angolense*, growing about 1m or less in 4 years in TSS plots [Taylor]. Synnott [1975] records immense mortality of seedlings due to predation - so immense in fact as to obscure any influences of silvicultural management on the regeneration of the tree. Synnott records high mortality, and seasonal variation due to rodent and antelope predation, with mortality at 1.44%/ day for the first 100 days, with a slight decline thereafter. Insect damage, particularly by the shoot-borer *Hypsipyla*, was also high, and in areas where predation was least, mortality due to drought and disease was high. After 2 1/2 years only 1.3% of planting seedlings survived for these reasons.

The seedlings may be more inclined to suffer from sudden changes in exposure to the sun than other species [Taylor]. Synott recorded that the seedlings are physiologically well-suited to the deep shade of the forest floor (where 35-40% of the useful light was calculated to be as sunflecks), and that the healthiest seedlings were under at least some shade. Unshaded seedlings died. Nevertheless, in natural forest, light availability was found to be the biggest limitation on seedling growth. Root competition was not considered an important limiting factor, nor were nutrient levels in the forest.

Very sparse regeneration of this species was found in Ivory Coast in a 3 ha subsample of a plot containing several adults [de Klerk, 1991].

INVENTORY

Tree count <30 cm dbh (TSP): 159 >=30 cm: 342

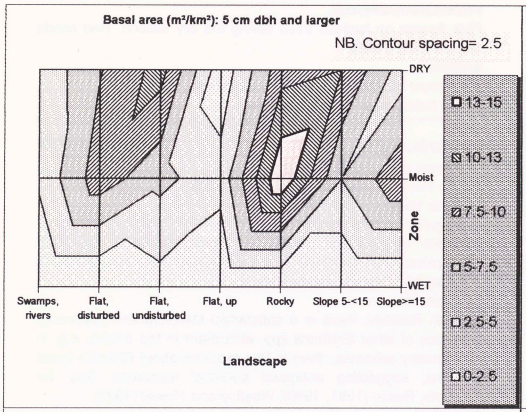
No. of botanical survey records: 35

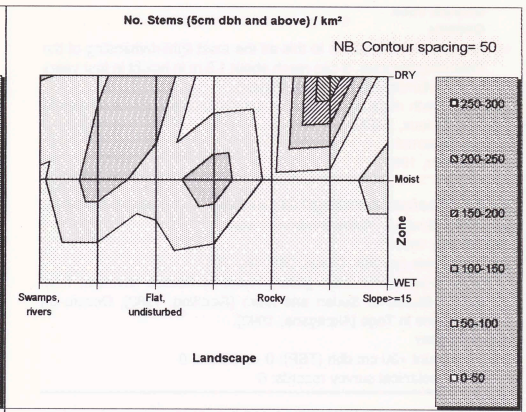
The charts reveal this species prefers drier forests in well-drained sites and the crown is generally exposed.

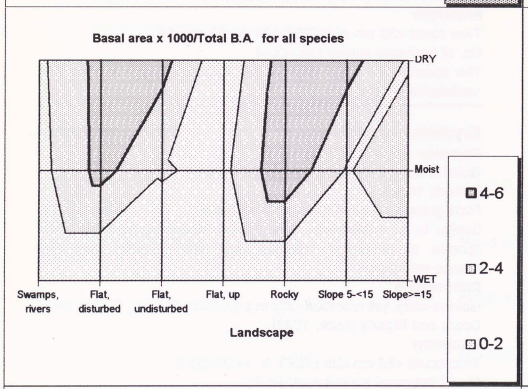
Regeneration (stems 5-30 cm dbh) and larger trees were less abundant in burnt than in unburnt forest, although the effect is less marked than for *E. cylindricum* and *E. angolense* [Hawthorne, 1994]. Saplings (>1 m height) are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples, but the converse is true of smaller plants [Hawthorne, 1993].

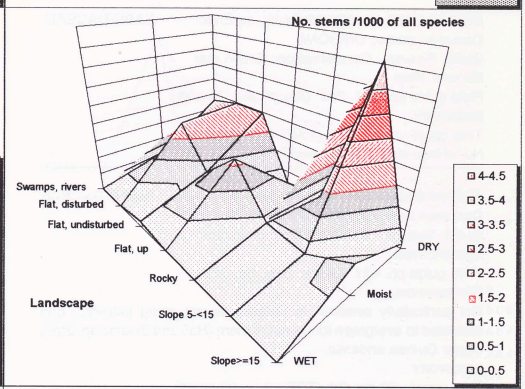
The young size classes, except perhaps 5-20 cm dbh, are relatively exposed, reflecting the shade-intolerance of all but the

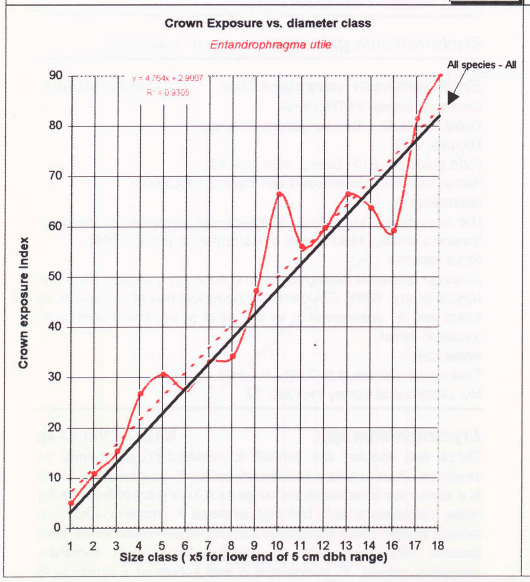
Entandrophragma utile

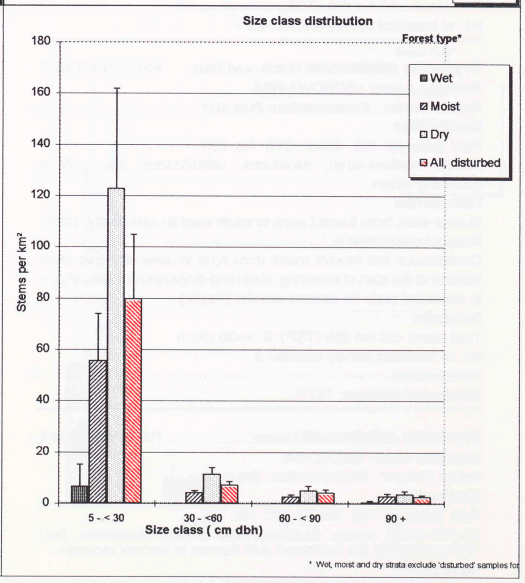












smallest trees.

GROWTH

Alexandre [1982] refers to this as the most light-demanding of the *Entandrophragmas*. It can reach about 1.5 m in height in four years in silviculturally treated forest [Taylor].

Growth rings in this species are likely to be annual [Detienne and Mariaux, 1977].

OTHER NOTES

[Sawyerr, 1960]

Eriocoelum kerstingii Gilg *ex* Engl. **SAPINDACEAE**

Guild: Swamp **Conservation:** ? star

MATURE TREE

Field guide pp. 188 Group: 36B No. 280

Medium-sized tree from gallery forest in Guinea savanna, from Guinea-Bissau to Sudan and Zaire [Geerling, 1982]. Occurs on mountains in Togo [Akpagana, 1992].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 0

Eriocoelum pungens Radlk. ex Engl. **SAPINDACEAE**

Common name: ONIBONA

Guild: Swamp **Conservation:** Green star

MATURE TREE

Field guide pp. 187, 234 Group: 36A No. 281

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 32

Eriocoelum racemosum Bak. **SAPINDACEAE**

Common name: ONIBONAKoKoo

Guild: Swamp **Conservation:** Blue star

MATURE TREE

Field guide pp. 187 Group: 36A No. 282

DISTRIBUTION

Not particularly common in Ghana, except along swamps, and restricted to evergreen forest out of them (Hall and Swaine sp. 256); Upper Guinea endemic.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 23

Erythrina addisoniae Hutch. and Dalz. **PAPILIONACEAE**

Common name: oSOROWA-NINI

Guild: Pioneer **Conservation:** Blue star

MATURE TREE

Field guide pp. 166 Group: 31C No. 283

Prickly, medium-sized, deciduous, unbuttressed tree with a spreading crown.

DISTRIBUTION

Guinea-wide, from Sierra Leone to south west Nigeria [Keay, 1989].

PHENOLOGY/DISPERSAL

Conspicuous red flowers made from April to June, the tree often leafless at the start of flowering. Red (bird-dispersed?) seeds visible in dehiscent pods for several months [Taylor].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 3

OTHER NOTES

[Kudler and Quaynor, 1971]

Erythrina mildbraedii Harms **PAPILIONACEAE**

Common name: OSOROWA

Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 166 Group: 31C No. 284

Medium-sized, prickly, deciduous tree ± small buttresses. Best distinguished by the numerous pink flowers in slender racemes.

DISTRIBUTION

Guineo-Congolian, from Guinea to Zaire and Uganda [Keay, 1989]; esp. in disturbed forest.

PHENOLOGY/DISPERSAL

Pink flowers on leafless trees during the dry season. Red seeds dispersed by ?birds.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 14

Erythrina spp. **PAPILIONACEAE**

Common name: OSOROWA

Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 166 No. 1284

Erythrina species are usually not distinguished in the TSP inventories. Most *Erythrina* spp. investigated have nitrogen-fixing nodules [Halliday and Nakao, 1982].

DISTRIBUTION

As with *Bombax*, there is a substantial literature and apparently wide use of other *Erythrina* spp. elsewhere in the tropics, e.g. in agroforestry schemes, there is little reported about Ghana's forest *Eythrina*, suggesting untapped potential resources. See, for example, Russo [1981, 1990]; Westley and Powell [1993].

INVENTORY

Tree count <30 cm dbh (TSP): 94 >=30 cm: 110

No. of botanical survey records: 4

The species combined show a preference for swampy and flat, 'undisturbed' forest.

Erythrina vogelii Hook.f. **PAPILIONACEAE**

Common name: oSORE

Guild: Pioneer **Conservation:** Blue star

MATURE TREE

Field guide pp. 166 Group: 31C No. 285

Similar to *E. mildbraedii* - see *E. spp.* According to Taylor, this species is deciduous between July and January, and has orange-red flowers.

DISTRIBUTION

Guinea-wide, yet recorded only in equatorial Guinea, Ghana, Ivory Coast and Nigeria [Lock, 1989].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 21

Erythrophleum guineense see *E. suaveolens*

Erythrophleum ivorense A.Chev. **CAESALPINIACEAE**

Common name: PoTRoDOM

Guild: N.P.L.D. **Conservation:** Pink star

MATURE TREE

Field guide pp. 217 Group: 38A No. 43

Rather twisted, unbuttressed and low-branched tree.

DISTRIBUTION

Not uncommon in Ghana, although not common in Hall and Swaine's survey. Most typical of Guinea-wide [Lock, 1989].

FIELD IDENTITY

Although difficult to distinguish during surveys, it seems that, as in Nigeria [Keay, 1989], *E. ivorense* is the typical tree of wet and moist forest and *E. suaveolens* is most typical of dry forest rivers and transition forest.

INVENTORY

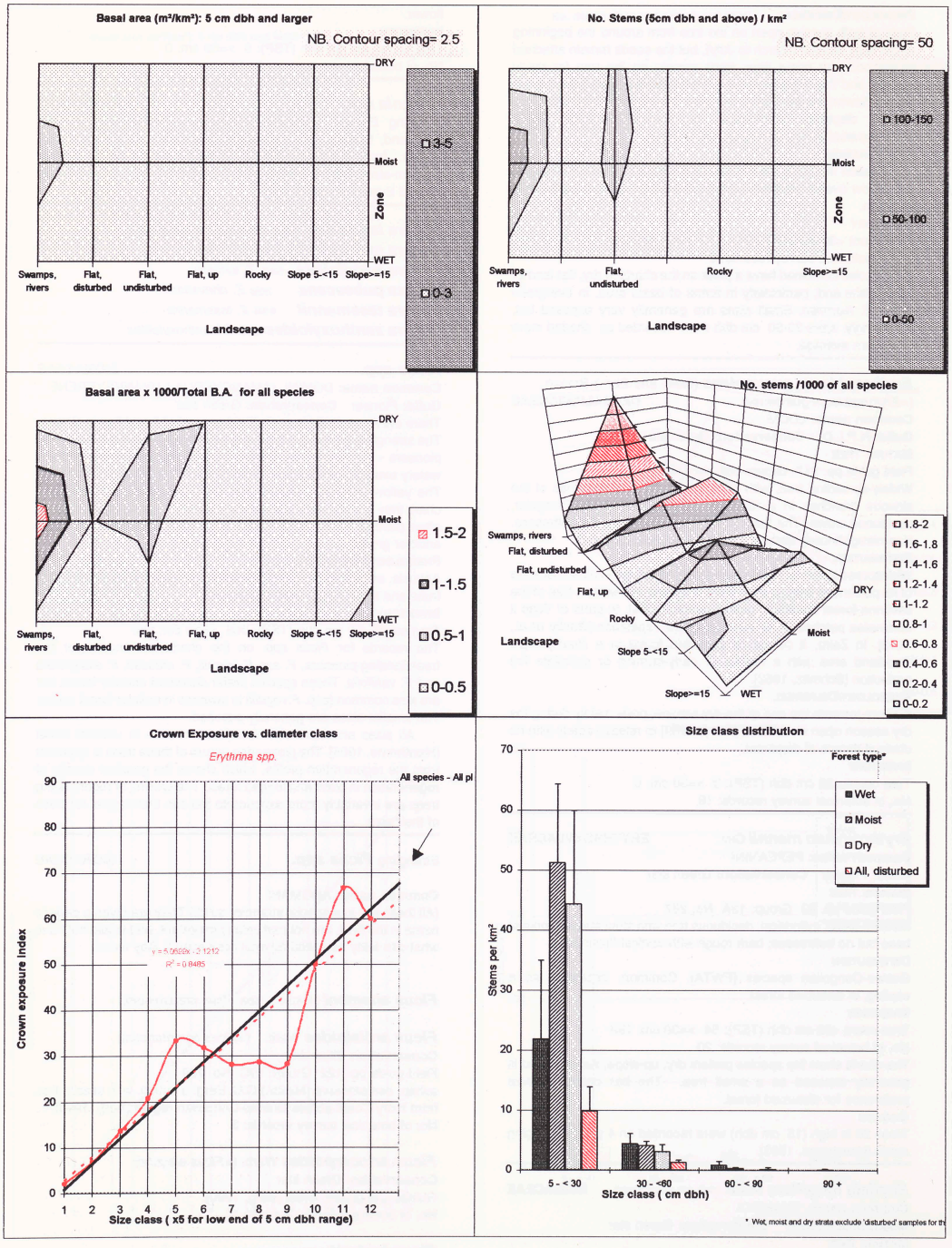
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 19

Erythrophleum spp. **CAESALPNIACEAE**

These two species are difficult to distinguish, particularly as seedlings. *E. suaveolens* (previously called *E. guineense*) is found in a similar dry forest-savanna range as *Khaya grandifoliola* [Taylor notes resistance to early burning], whereas *E. ivorense* is found in moister forests, and is particularly common in evergreen forest. Both become large, rough-barked emergent trees with immense, spreading crowns. *E. suaveolens* is well known as a producer of poison bark, used as fish poison or in trials of ordeal, but *E. ivorense* bark is said to be less poisonous [Taylor].

Erythrina spp.



PHENOLOGY/DISPERSAL
Pods of both species open on the tree from around the beginning of the rainy season (March to July), but the seeds remain attached to the pods for some time. Pods remain on the tree for many months, and Taylor notes (for *E. i.*) that trees with pods still attached do not flower, suggesting a two year flowering-fruiting cycle. No special dispersal mechanism is known, although some wind-dispersal during strong storms is likely.
REGENERATION
Germination in *E.s.* is rather slow and irregular (27 days average, with a low overall viability [Taylor]). Seedlings are not particularly common.
INVENTORY
Tree count <30 cm dbh (TSP): 110 >=30 cm: 309
No. of botanical survey records: 0
The species combined have a peak on the charts in dry, flat land *E. suaveolens* and, particularly in terms of basal area, in evergreen forest *E. ivorense*. Small sizes are generally very exposed but, surprisingly, sizes 30-90 cm dbh were recorded as shaded more often than average.

Erythrophleum suaveolens (Guill. and Perr.) Brenan (=*Erythrophleum guineense*) **CAESALPINIACEAE**
Common name: oDOM
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 217 Group: 38A No. 44
Widely-spreading tree, with foliage pendulous at the ends of the sinuous branches in a rounded or spherical, slightly irregular, deciduous crown. The flush of new leaves is red. No buttresses. Has nitrogen-fixing nodules [Halliday and Nakao, 1982].
DISTRIBUTION
Widespread in Africa; also in Asia [Lock, 1989], well-known because of its poisonous bark used in trials of ordeal. A common tree of the savanna-forest transition, and of riverine forest. In parts of Togo it dominates patches of 25 year old fallow vegetation [Guelly *et al.*, 1993]. In Zaire, it comes to dominate forest in a *Brachystegia* woodland area with a regime of early-burning or complete fire protection [Schmitz, 1952].
PHENOLOGY/DISPERSAL
Flowers towards the end of the dry season; pods mainly during the dry season open on the tree [Keay, 1989] to release seeds with no obvious means of dispersal.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 18

Erythroxylum mannii Oliv. **ERYTHROXYLACEAE**
Common name: PEPEANINI
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 83 Group: 13A No. 287
Medium-sized, cylindrical, deciduous tree with stout surface roots at base but no buttresses; bark rough with vertical fissures.
DISTRIBUTION
Guineo-Congolian species [FWTA]. Common, especially as a sapling, in disturbed forest.
INVENTORY
Tree count <30 cm dbh (TSP): 54 >=30 cm: 190
No. of botanical survey records: 20
The charts show the species prefers dry, up-slope, flat sites and is generally exposed as a small tree. The bar charts show a preference for disturbed forest.
GROWTH
Trees 20 m high (15 cm dbh) were recorded on 4 year old logging roads [Hawthorne, 1993].

Euclinia longiflora Salisb. **RUBIACEAE**
Common name: GYANEYA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 36 Group: 1F No. 289
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 259). ? May need gaps to flower.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 64

Eugenia spp. **MYRTACEAE**
Including *Eugenia coronata* Schum. and Thonn. from coastal grassland, thickets and rocky hills; *E. kalbreyeri* Engl. and Von Brehm., from secondary forest; *E. leonensis* on rocky hills. A medium-sized tree related to *E. calophylloides* DC. occurs e.g. in Upland Evergreen forest.

Fagara leprieurii see *Zanthoxylum leprieurii*
Fagara macrophylla see *Z. gilletii*
Fagara parvifoliola see *Z. lemairei*
Fagara pubescens see *Z. chevalieri*
Fagara tessmannii see *Z. tessmannii*
Fagara zanthoxyloides see *Z. xanthoxyloides*

Ficus spp. **MORACEAE**
Common name: DOMINI, (AMANGYEDUA,) NYANKEYERENE
Guild: Pioneer **Conservation:** Green star
There are three obvious, main 'field-groups' of forest figs in Ghana. The stranglers (Amangyedua), and two groups of smooth-stemmed pioneers - the laticiferous Domini (e.g. *F. sur, F.vogelii*); and the watery exudat, sandpapery 'Nyakyerene' *F. exasperata, variifolia.* The yellow-stemmed, second and third group are included on a chart; they are common in secondary forest. *F. ovata* etc. and other often planted, savanna, or forest edge hemi-stranglers represent another group.
PHENOLOGY/DISPERSAL
Animals, especially bats and primates, are well-known to enjoy the fruits and to be active seed dispersers.
INVENTORY
Tree count <30 cm dbh (TSP): 303 >=30 cm: 250
The records for *Ficus spp.* on the charts are mostly for the free-standing pioneers, *F. sur, F. vogelii, F. mucuso, F. exasperata* and *F. variifolia.* These species prefer disturbed and dry forest, but are also common (esp. *F.vogelii*) in swamps in moister forest zones. The smaller sizes are generally exposed.

All sizes are more abundant in burnt than in unburnt forest [Hawthorne, 1994]. The pioneering nature of these trees is apparent from the regeneration profile, which shows the greatest density of regeneration in burnt and logged forest. The crowns of regenerating trees are invariably more exposed to the sun than typical for trees of their size.

Strangling ***Ficus spp.*** **MORACEAE**

Common name: ANOMANI
(All these are in a special strangler guild.) They are given a generic name in the field; are not particularly important, and would not have what can fairly be called a basal area even if they were.

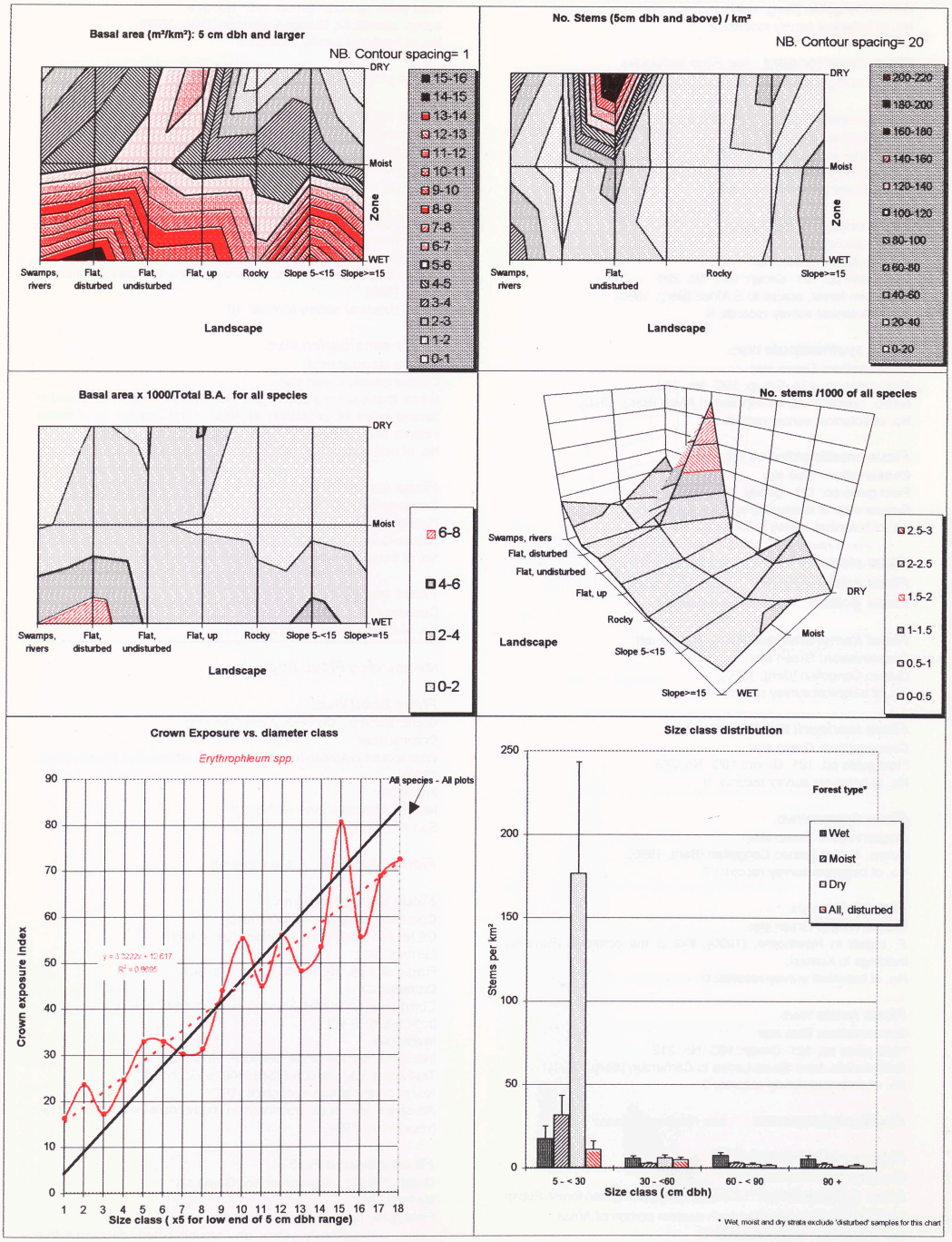
Ficus anomani Hutch. see *Ficus craterostoma*

Ficus ardisioides Warb. (=*Ficus camptoneura*)
Conservation: Blue star
Field guide pp. 122 Group: 19C No. 299
subsp. *camptoneura* (Mildbr.) C.C. Berg: a subsp. with sessile figs, from Ivory Coast across Guineo-Congolian region [Berg, 1990].
No. of botanical survey records: 3

Ficus artocarpoides Warb. (=*Ficus elegans*)
Conservation: Green star
Guineo-Congolian; forest [Berg, 1990].
No. of botanical survey records: 1

Ficus barteri Sprague
Conservation: Blue star
Field guide pp. 122 Group: 19C No. 297

Erythrophleum spp.



Guineo-Congolian [Berg, 1990].
No. of botanical survey records: 4

Ficus camptoneura see *Ficus ardisioides*
Ficus congensis see *Ficus trichopoda*

Ficus conraui Warb. (=*Ficus praticola*)
Conservation: Blue star
Field guide pp. 122 Group: 19C
Guineo-Congolian [Berg, 1990].
No. of botanical survey records: 7

Ficus craterostoma Mildbr. and Burrett.
(=*Ficus anomani* Hutch.)
Conservation: Green star
Field guide pp. 121 Group: 19C No. 296
Evergreen forest, across to S.Africa [Berg, 1990].
No. of botanical survey records: 6

Ficus cyathistipula Warb.
Conservation: Green star
Field guide pp. 122 Group: 19C No. 303
subsp. *cyathistipula*; widespread in Africa [Berg, 1990].
No. of botanical survey records: 6

Ficus elasticoides De Wild.
Conservation: Blue star
Field guide pp. 121 Group: 19C No. 304
Guinea-wide at least, also in Zaire [Berg, 1990].
No. of botanical survey records: 3

Ficus elegans see *Ficus artocarpoides*
Ficus eriobotryoides see *Ficus saussureana*
Ficus goliath see *Ficus recurvata*

Ficus kamerunensis Mildbr. and Burrett
Conservation: Green star
Guineo-Congolian [Berg, 1990].
No. of botanical survey records: 10

Ficus leprieurii Miq.
Conservation: Green star
Field guide pp. 121 Group: 19C No. 309
No. of botanical survey records: 3

Ficus lingua Warb.
Conservation: Green star
Subsp. *lingua*; Guineo-Congolian [Berg, 1990].
No. of botanical survey records: 1

Ficus lutea Vahl.
Conservation: Green star
F. vogelii in Hawthorne, [1990]; this is the common *Ficus* on buildings in Kumasi.
No. of botanical survey records: 0

Ficus lyrata Warb.
Conservation: Blue star
Field guide pp. 121 Group: 19C No. 312
Guinea-wide, from Sierra Leone to Cameroun [Berg, 1990].
No. of botanical survey records: 3

Ficus macrosperma see *Ficus sansibarica*

Ficus natalensis Hochst.
Conservation: Green star
Subsp. ***leprieurii*** (Miq.) C.C.Berg: Guineo-Congolian forest. Subsp ***natalensis*** occupies the south eastern portion of Africa.
No. of botanical survey records: 0

Ficus ottoniifolia (Miq.) Miq.
Conservation: Green star
Field guide pp. 122 Group: 19C No. 316
subsp. *ottoniifolia*: Guineo-Congolian [Berg, 1990].
No. of botanical survey records: 5

Ficus praticola see *Ficus conraui*

Ficus recurvata De Wild (=*Ficus goliath*)
Conservation: Green star
Field guide pp. 121 Group: 19C No. 321
Guineo-Congolian [Berg, 1990]
No. of botanical survey records: 11

Ficus sagittifolia Warb. *ex* Mildbr. and Burret
Conservation: Green star
Field guide pp. 121 Group: 19C No. 322
Common in Ghana (Hall and Swaine sp. 265). Guinea to Cameroun [Berg, 1990].
No. of botanical survey records: 19

Ficus sansibarica Warb.
(=*Ficus macrosperma*)
Conservation: Green star
subsp. *macrosperma* (Mildbr. and Burrett) C.C.Berg. Widespread in several types of vegetation in Africa - the species as a whole extends even further south, into woodland [Berg, 1990].
No. of botanical survey records: 1

Ficus tesselata Warb.
Conservation: Gold star
Field guide pp. 122 Group: 19C No. 323
Guineo-Congolian [Berg, 1990].
No. of botanical survey records: 1

Ficus vogelii (Miq.) Miq. see *F. lutea*
Conservation: Green star
No. of botanical survey records: 10

Non-strangling ***Ficus spp.***

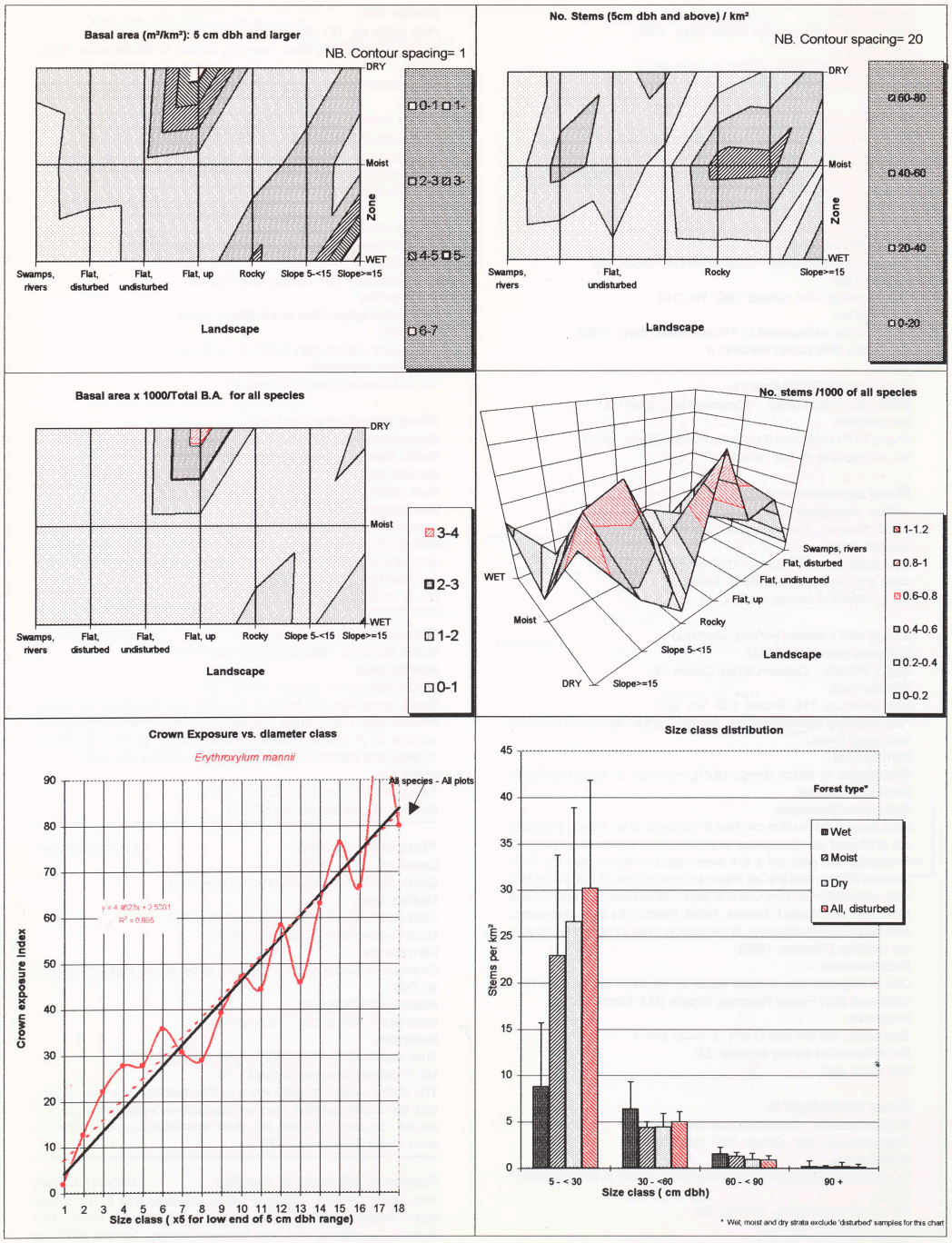
Ficus bubu Warb.
Guild: Swamp **Conservation:** Blue star
DISTRIBUTION
Widespread in African forest; similar to *F.umbellata* & *F.polita* [Berg, 1990].
INVENTORY
No. of botanical survey records: 3
See *Ficus spp.*

Ficus capensis see *Ficus sur*

Ficus exasperata Vahl
Common name: NYANKYEReNE
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 155 Group: 28A No. 307
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 264); across Africa and to India [Berg, 1990].
INVENTORY
Inc. some records of the similar *F. variifolia*
Tree count <30 cm dbh (TSP): 409 >=30 cm: 170
No. of botanical survey records: 75
All sizes are more abundant in burnt than in unburnt forest [Hawthorne, 1994].

Ficus mucuso Ficalho
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 118 Group: 19B No. 314
Large, conspicuously yellow and smooth-boled, deciduous tree. Always free-standing (not strangling), and usually in very obviously secondary forest, farmland etc.

Erythroxylum mannii



DISTRIBUTION
Widespread in African rain forest [Berg, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 34

Ficus ovata Vahl
Guild: Savanna/planted **Conservation:** Green star
Field guide pp. 121 Group: 19C No. 317
Savanna and disturbed dry forest across to Mozambique and Ethiopia [Berg, 1990].
No. of botanical survey records: 8

Ficus polita Vahl
Guild: Savanna/planted **Conservation:** Green star
MATURE TREE
Field guide pp. 121 Group: 19C No. 318
DISTRIBUTION
subsp. *polita*; widespread in African forest [Berg, 1990].
No. of botanical survey records: 8

Ficus populifolia Vahl
Guild: Savanna/planted **Conservation:** Green star
DISTRIBUTION
Ghana to Ethiopia and Tanzania, Yemen [Berg, 1990].
No. of botanical survey records: 3

Ficus saussureana DC.
(=*Ficus eriobotryoides*)
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 121 Group: 19C No. 306
West and Central Africa [Berg, 1990].
No. of botanical survey records: 12

Ficus sur Forsssk. (=*Ficus capensis*)
Common name: NWADUA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 118 Group: 19B No. 300
Free-standing (non-strangling), smooth-barked fig tree common in secondary forest.
DISTRIBUTION
Widespread in Africa [Berg, 1977]; common in disturbed forest areas and savanna.
PHENOLOGY/DISPERSAL
Most trees of 60 cm dbh can fruit [Plumptree *et al.*,1994]. The fruits are produced on specialised branches from the trunk or boughs, throughout the year, on a 6-7 week rotation. When ripe, the fruits become redder, and are an important component of the diet of fruit bats, especially - in Ivory Coast at least - *Micropteropus pusillus* and *Epomops buettikoferi* [Thomas, 1988]. Feeding by such dispersers, and therefore fruit dispersal, is reduced in trees inhabited by weaver ant colonies [Thomas, 1988].
REGENERATION
One of only two tree species found in the seed bank of soil from Olokemeji (dry) Forest Reserve, Nigeria [Ola Adams, 1977].
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 3
No. of botanical survey records: 32
See *Ficus spp.*

Ficus thonningii Bl.
Guild: Savanna **Conservation:** Green star
Field guide pp. 122 Group: 19C No. 324
DISTRIBUTION
Very widespread in African savanna [Berg, 1990]; in some transition forest.
No. of botanical survey records: 12

Ficus trichopoda Baker
(=*Ficus congensis*)
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 121 Group: 19C No. 301
Savanna woodland, often swampy, across to Madagascar [Berg, 1990].
No. of botanical survey records: 0

Ficus umbellata Vahl
Guild: Savanna/Strangler **Conservation:** Green star
Field guide pp. 121 Group: 19C No. 325
Guinea-wide in woodland and forest [Berg, 1990].
No. of botanical survey records: 2

Ficus variifolia Warb.
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 155 Group: 28A No. 326
DISTRIBUTION
Guineo-Congolian drier forest [Berg, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 5 >=30 cm: 0
See *Ficus exasperata*
No. of botanical survey records: 21

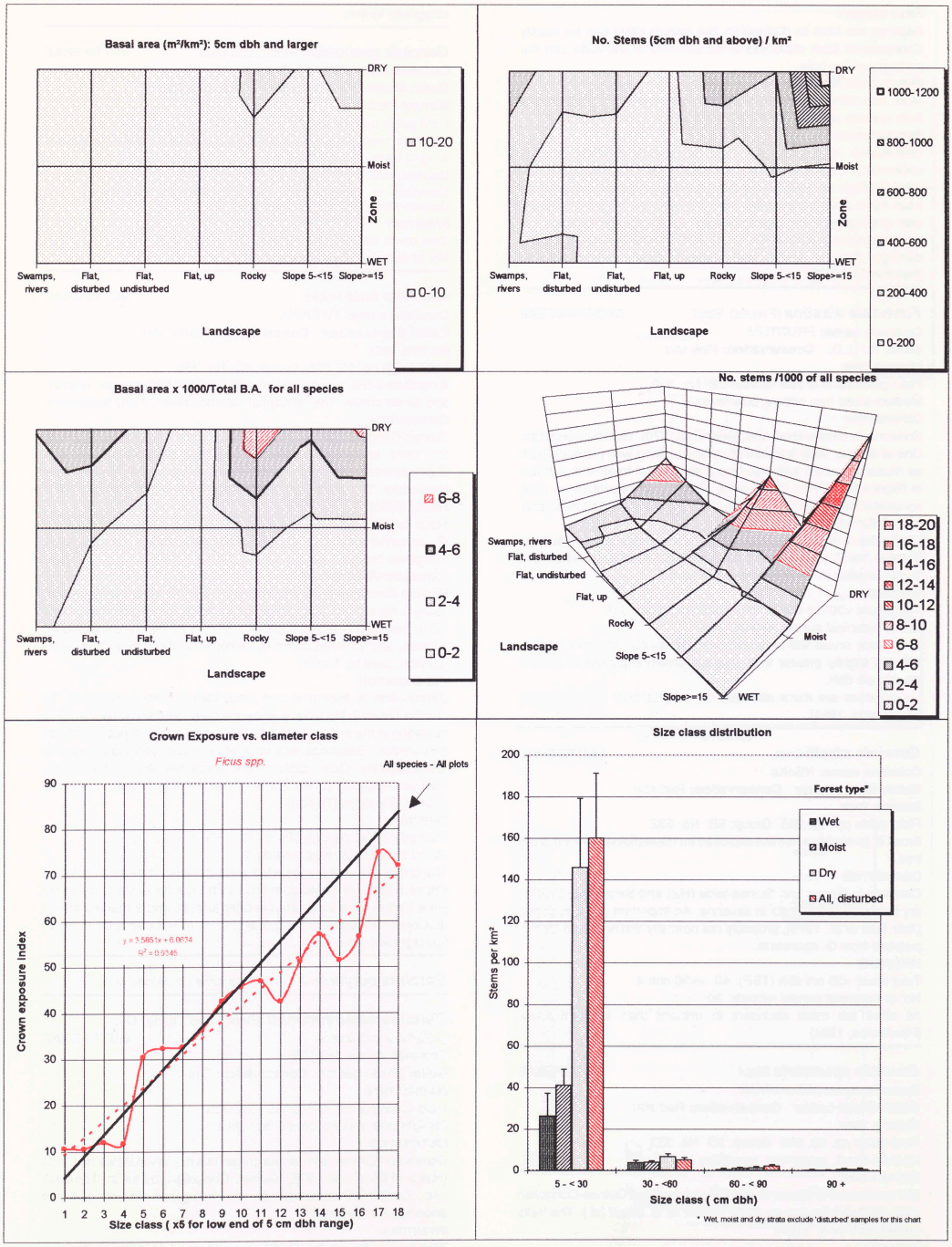
Ficus vogeliana (Miq.) Miq.
Common name: OPANTO
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 118 Group: 19B No. 327
DISTRIBUTION
Widespread in tropical Africa [Berg]. In Ghana this is most common on river floodplains and in other wet, disturbed areas. The fruits are generally found on inflorescences which run below the considerable leaf litter typical of such sites.
No. of botanical survey records: 17

Flacourtia flavescens Willd. **FLACOURTIACEAE**
Guild: Savanna **Conservation:** Green star
MATURE TREE
Field guide pp. 95 Group: 15 No. 328
Small, spiny tree or shrub of savanna and disturbed dry forest, thickets etc. Friis (1992) includes this and other West African species in *F. indica* (Burm.f.) Merrill, which is then extremely variable and stretches across Africa and beyond into Asia.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 11

Funtumia africana **APOCYNACEAE**
Common name: OKAE
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 54, 235 Group: 9B No. 329
Medium-sized tree without buttresses.
DISTRIBUTION
Common in Ghana; widespread in tropical Africa (Hall and Swaine sp. 269).
PHENOLOGY/DISPERSAL
Wind-blown with aid of cottony plume.
INVENTORY
Tree count <30 cm dbh (TSP): 1466 >=30 cm: 1258
No. of botanical survey records: 145
The charts reveal the preference of this species for wetter forests, and the slightly greater than average crown exposure of trees 5 cm-30 cm dbh. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Funtumia africana & elastica **APOCYNACEAE**
Two similar species. Although Taylor suggests that *F. africana* is found 'almost exclusively in the Rain Forest (evergreen forest). This is not supported by Hall and Swaine's survey, nor the inventory results, although it does become more common in such areas. *F. elastica* reaches its peak of abundance in the MSNW zone.

Ficus spp.


Basal area (m²/km²): 5cm dbh and larger
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
10-20
0-10
No. Stems (5cm dbh and above) / km²
1000-1200
800-1000
600-800
400-600
200-400
0-200
Basal area x 1000/Total B.A. for all species
6-8
4-6
2-4
0-2
No. stems /1000 of all species
18-20
16-18
14-16
12-14
10-12
8-10
6-8
4-6
2-4
0-2
Crown Exposure vs. diameter class
Ficus spp.
All species - All plots
Crown exposure Index
Size class (x5 for low end of 5 cm dbh range)
Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
90 +
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

FIELD IDENTITY
Saplings are hard to distinguish, but mature trees can be readily distinguished from stickiness or rubberiness of the latex and the paleness of the bole.
PHENOLOGY/DISPERSAL
More than 80% of trees >20 cm dbh can fruit [Plumptree, 1994]. Both species produce wind-dispersed seeds in the dry season.
REGENERATION
Germination is normal. Seedlings are found in lightly shaded understorey (unlike *Alstonia*), but rapidly die out with insufficient light. Saplings are marked light demanders, although more mature trees have small crowns and are often situated in later life under only small gaps in the higher canopy. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

Funtumia elastica (Preuss) Stapf **APOCYNACEAE**
Common name: FRUNTUM
Guild: N.P.L.D. **Conservation:** Pink star
MATURE TREE
Field guide pp. 54, 235 Group: 9B No. 330
Medium-sized tree without buttresses.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 270). Guineo-Congolian. One of several early succession species, along with pioneers such as *Musanga*, which benefitted from silvicultural treatment of forest in Nigeria [Okali and Ola Adams, 1987]. Also described as early successional in Uganda [Synnott, 1985], invading closed woodland.
REGENERATION
Germinates in shade, but requires gaps to develop further [Hall and Swaine, 1981]. Kyereh *et al.* [1993] reported no difference between % germination in the light and in the dark.
INVENTORY
Tree count <30 cm dbh (TSP): 1025 >=30 cm: 581
No. of botanical survey records: 104
The charts reveal the preference of this species for drier forests, and the slightly greater than average crown exposure of trees 5 cm-25 cm dbh.
All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Garcinia afzelii Engl. **GUTTIFERAE**
Common name: NSoKo
Guild: Shade-bearer **Conservation:** Red star
MATURE TREE
Field guide pp. 50, 235 Group: 8B No. 332
Small or (probably when not exploited for chewsticks) medium-sized tree.
DISTRIBUTION
Common in Ghana and Guinea-wide (Hall and Swaine sp. 272), in dry forests, with outposts in savanna. An important chew stick tree [Adu-Tutu *et al.*, 1979], probably not normally distinguished for this purpose from G. epunctata.
INVENTORY
Tree count <30 cm dbh (TSP): 40 >=30 cm: 4
No. of botanical survey records: 20
All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Garcinia epunctata Stapf **GUTTIFERAE**
Common name: NSoKoNUA
Guild: Shade-bearer **Conservation:** Red star
MATURE TREE
Field guide pp. 50, 235 Group: 8B No. 333
Medium-sized, evergreen, spreading tree.
DISTRIBUTION
Not uncommon in Ghana in evergreen forest and Guineo-Congolian wide (Hall and Swaine sp. 273). Similar to *G. afzelii* (cf.). The fruits are edible [Irvine, 1961].
INVENTORY
Tree count <30 cm dbh (TSP): 85 >=30 cm: 0
No. of botanical survey records: 36
The charts show this species prefers better-drained sites in the evergreen forests.

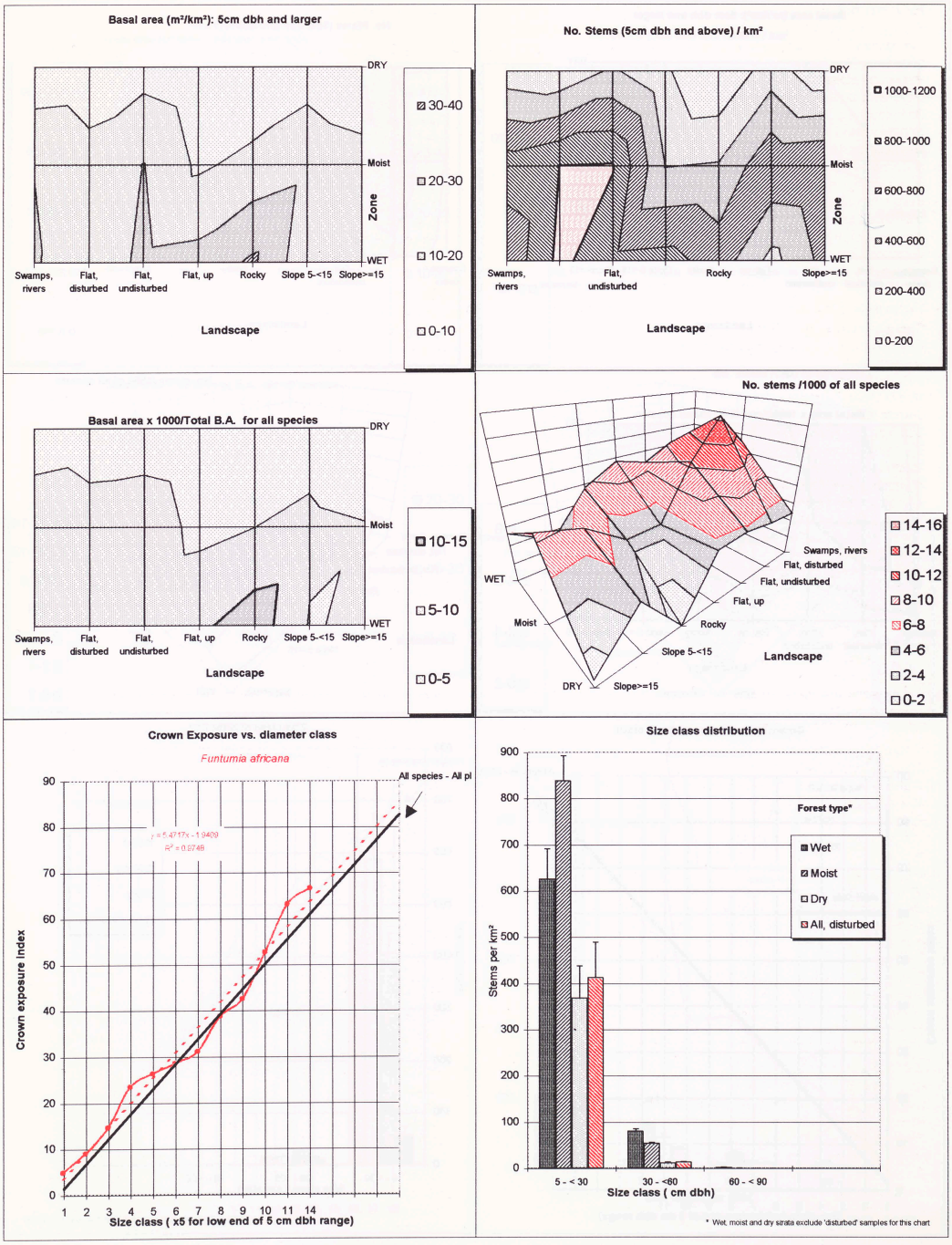
Garcinia gnetoides Hutch. and Dalz. **GUTTIFERAE**
Common name: TWEAPIAKOA
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 50 Group: 8C No. 334
Small to medium-sized, understorey tree, with characteristically winged twigs.
DISTRIBUTION
Common in Ghana only in WE zone (± elsewhere), and Guinea-wide (Hall and Swaine sp. 274).
INVENTORY
Tree count <30 cm dbh (TSP): 238 >=30 cm: 6
No. of botanical survey records: 45

Garcinia kola Heckel **GUTTIFERAE**
Common name: TWEAPIA
Guild: Shade-bearer **Conservation:** Scarlet star
MATURE TREE
Field guide pp. 50, 235 Group: 8C No. 335
A medium-sized, evergreen tree with a tall but fairly narrow, regular, and dense crown. The cylindrical bole has small, if any buttresses.
DISTRIBUTION
Guineo-Congolian [Keay, 1989] but not common in Ghana. Probably the most important chewstick tree, but possibly mixed with *G.smeathmannii* for this purpose? Not as abundant as the other chewsticks. The seeds are also eaten like kola nuts [Irvine, 1961; Abbiw, 1990].
FIELD IDENTITY
G. smeathmannii and *G. gnetoides* are similar species from evergreen forest.
PHENOLOGY/DISPERSAL
Profuse flowering in the dry season [Taylor] Large, orange-sized, fleshy fruits are produced around the end of the wetter season and fall to the ground where apparently [Taylor] they are dispersed by animals, and (at least eaten by) elephants who travel far to eat it [Lawton, cited by Taylor].
REGENERATION
Germination is hypogeal and slow, taking from 6 weeks to 18 months [Taylor]. No work is known on any dormancy mechanisms operating in the seed, nor on whether ingestion by elephants affects germination. Seedlings are very uncommon, although probably shade-bearers. Older saplings are shade-bearers, and evidently very slow-growing (c. 50 cm height in 7 years and c. 1 m in 10 years of Taungya [Taylor]).
INVENTORY
Tree count <30 cm dbh (TSP): 13 >=30 cm: 20
No. of botanical survey records: 23
The charts suggest an elevated stem density on evergreen forest slopes (?possibly some confusion with juvenile *G.smeathmannii*); yet a high relative basal area in drier forests; and a marked shade -tolerance. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

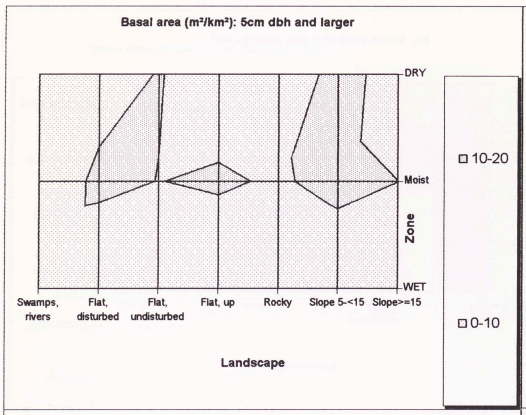
Garcinia polyantha see *Garcinia smeathmannii*

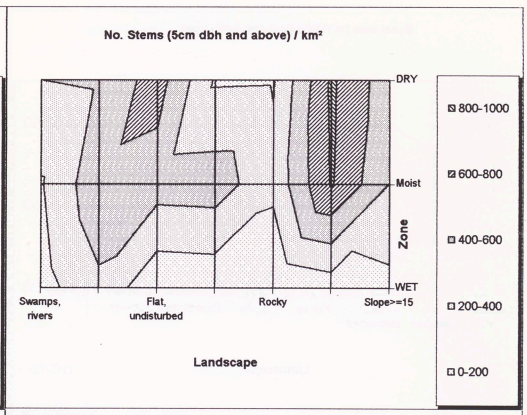
Garcinia smeathmannii (Planch and Triana) Oliv.
(=*Garcinia polyantha*) **GUTTIFERAE**
Common name: BOHWE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 50 Group: 8C No. 336
Straight bole with horizontal branches.
DISTRIBUTION
Common in Ghana, sometimes gregarious in seasonal swamp forest (Hall and Swaine sp. 275); Guineo-Congolian, as far as Tanzania and Zambia. Commonest in the evergreen forest, but not uncommon in drier areas.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1 (see next entry)
No. of botanical survey records: 44

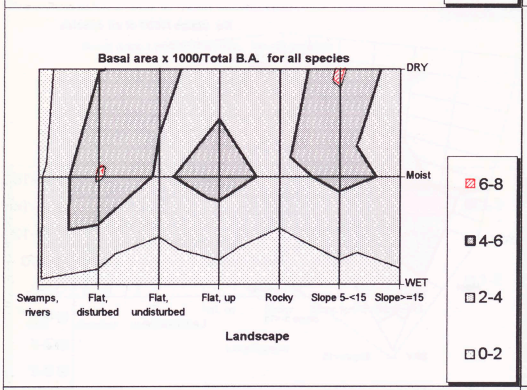
Funtumia africana

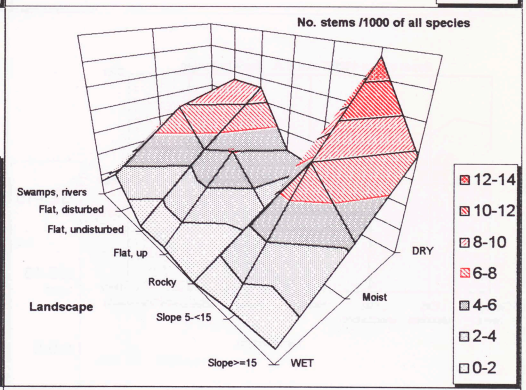


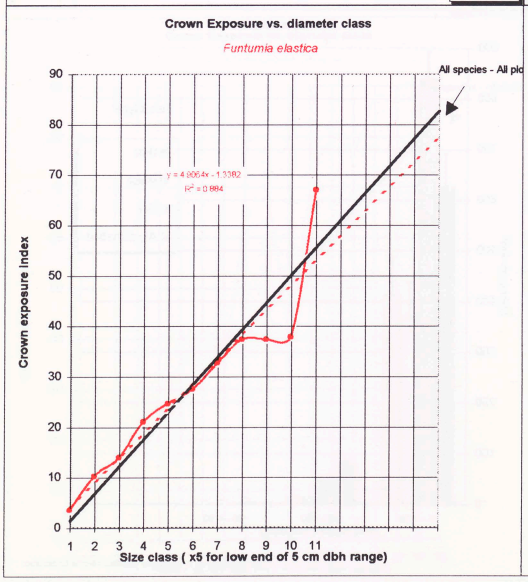
Funtumia elastica

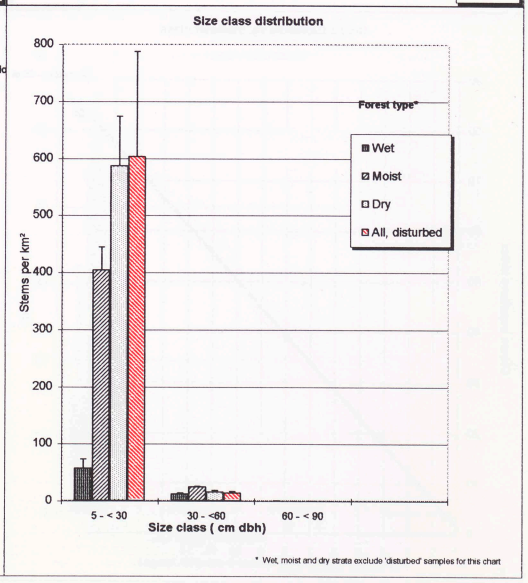




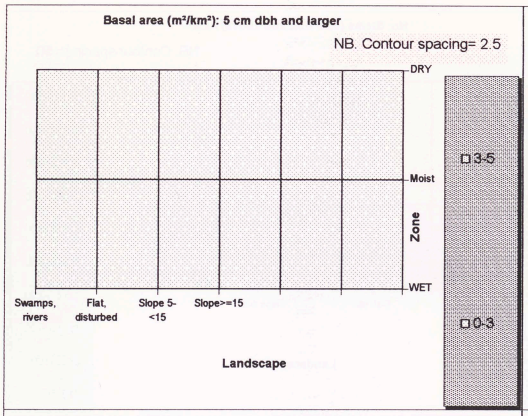


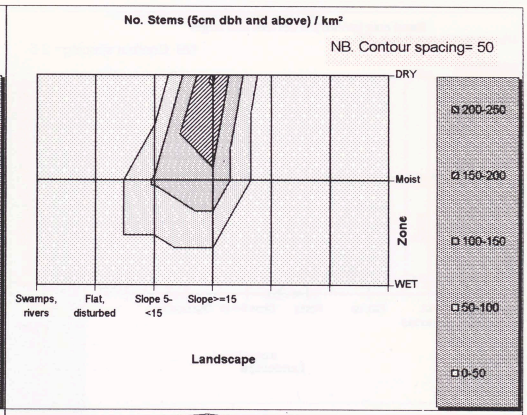


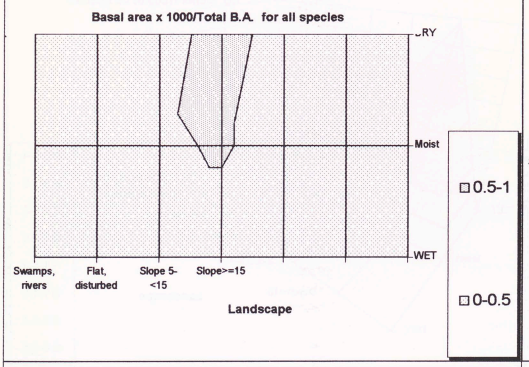


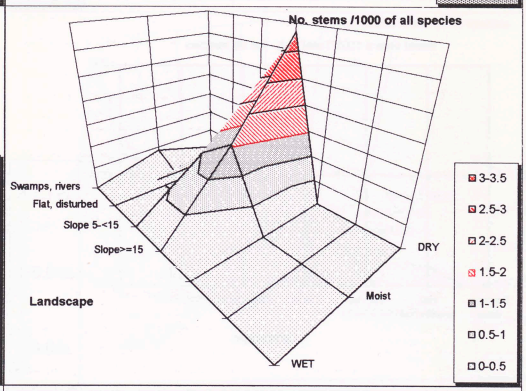


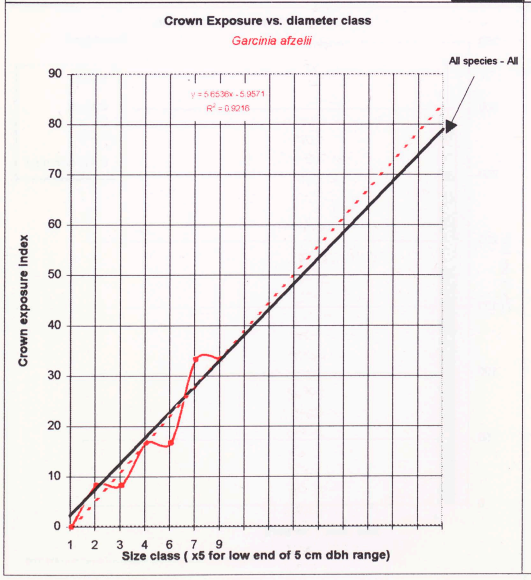
Garcinia afzelii

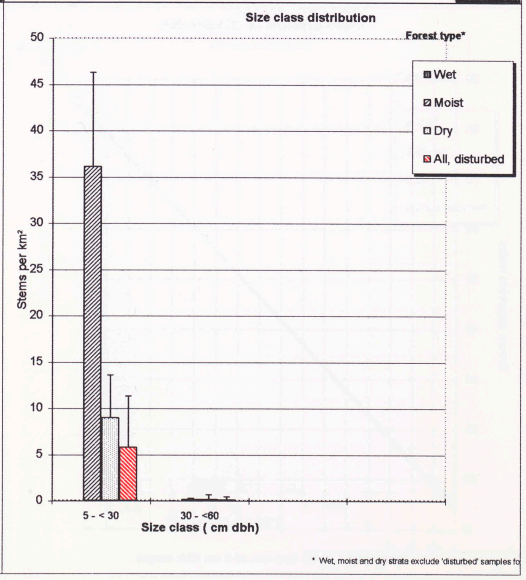




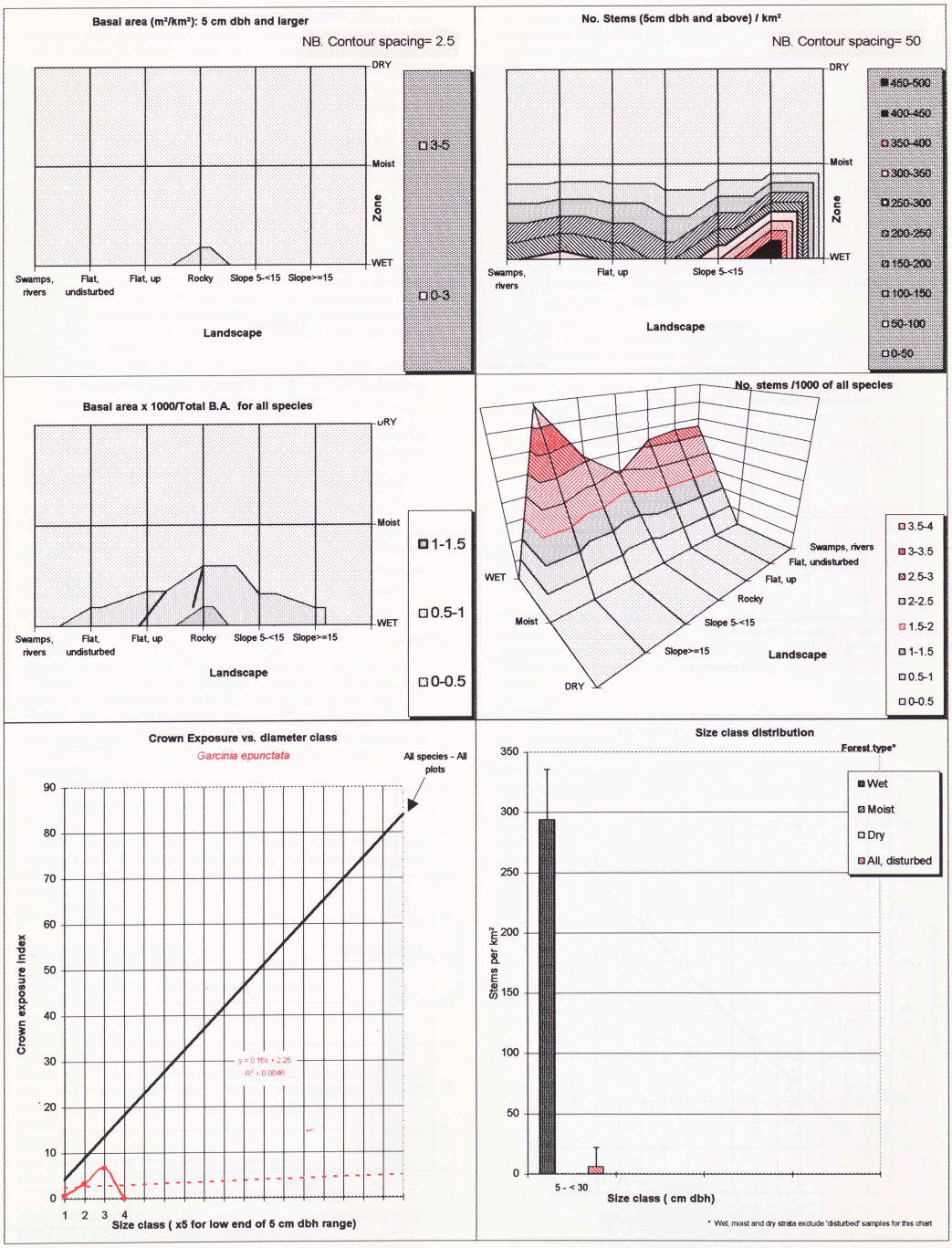




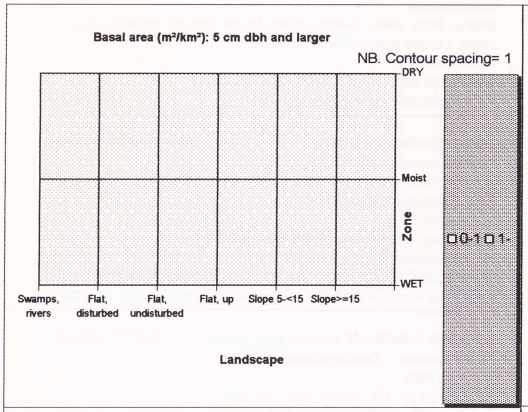


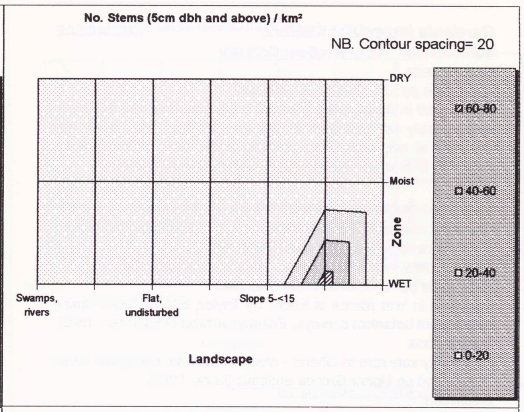


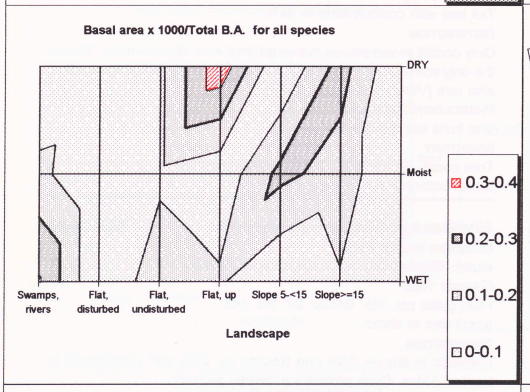
Garcinia epunctata

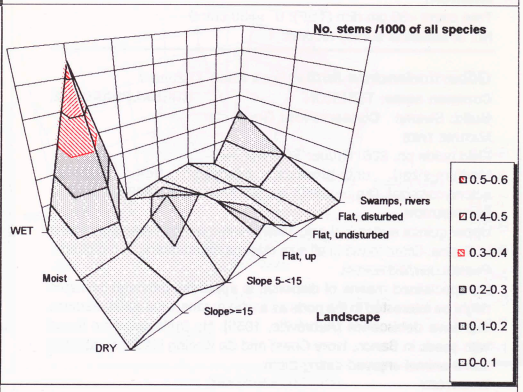


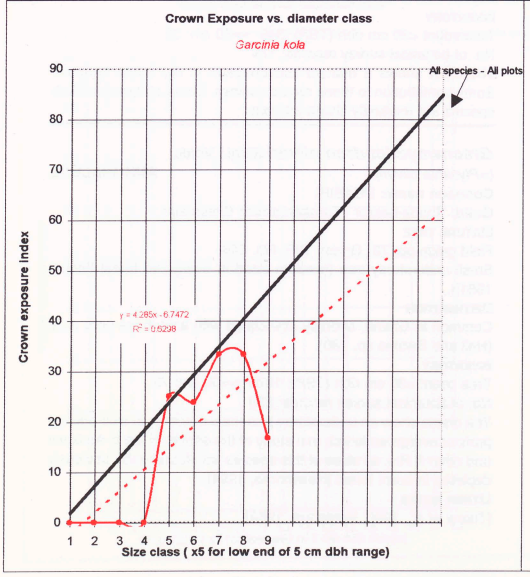
Garcinia kola

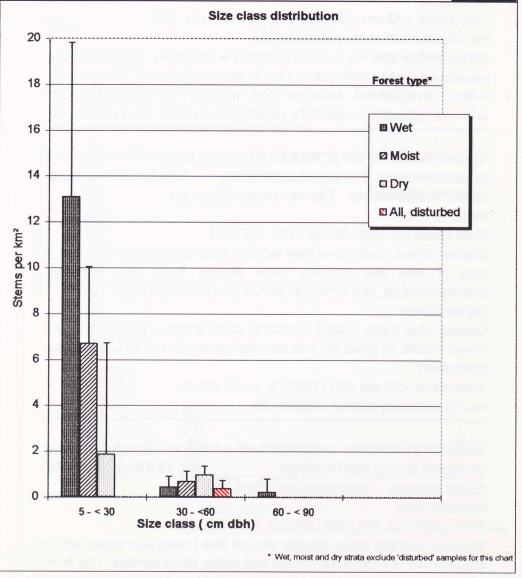












Gardenia imperialis K.Schum. **RUBIACEAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 30 Group: 1C No. 337
Widespread in Africa along rivers [FWTA], but very rare in Ghana and probably not abundant in any one country. The leaves are clustered at twig-ends. Has pockets at the base of the leaves, visited by ants which live in hollow stems [Schnell, 1966].

Gilbertiodendron bilineatum (Hutch. and Dalz.) J.Leonard
Common name: TETEKON-NUA **CAESALPINIACEAE**
Guild: Swamp **Conservation:** Black star
MATURE TREE
Field guide pp. 206 Group: 37F No. 340
Recorded in 'wet places at Enchi' by Taylor, but not found during subsequent botanical surveys. Ectomycorrhizal (Alexander, 1989).
DISTRIBUTION
Apparently very rare in Ghana - along occasional evergreen forest rivers - and an Upper Guinea endemic [Lock, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1

Gilbertiodendron limba (Scott Elliot) J.Leonard
Common name: TETEKON **CAESALPINIACEAE**
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 206 Group: 37F No. 341
Medium-sized, unbuttressed, evergreen tree. Probably ectomycorrhizal, like others in genus (Alexander, 1989).
DISTRIBUTION
Upper guinea endemic [Lock, 1989]; fairly common in swamp forest in Ghana. Often found in all size classes regenerating in the shade.
PHENOLOGY/DISPERSAL
No specialised means of dispersal is apparent, although primates might be interested in the pods as a whole; otherwise short-distance explosive dehiscence [Aubréville, 1959]. No fruits could be found with seeds in Banco, Ivory Coast and de Koning [1983] suggested some animal enjoyed eating them.
INVENTORY
Tree count <30 cm dbh (TSP): 412 >=30 cm: 767
No. of botanical survey records: 25
Although this species is seen to thrive in swamps, there are many records on slopes and upland sites in evergreen forest. These could reflect unregistered swamps and rivulets; misidentification of *G.preussii* (likely); or sporadic occurrence in such sites (unlikely).

Gilbertiodendron preussii (Harms) J.Leonard.
Common name: TETEKON-GYAMERA **CAESALPINIACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 206 Group: 37F No. 342
Medium-sized, evergreen tree without buttresses, and with rough bark a little like *Lophira*. New leaves flush red. Probably ectomycorrhizal, like others in genus [Alexander, 1989].
DISTRIBUTION
Guinea-wide [Lock, 1989]. Found in some areas, e.g. hills of Cape Three Points, in great abundance, but generally rather uncommon.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 25

Gilbertiodendron splendidum (Hutch. and Diels) J.Leonard
Common name: AGYAMERA **CAESALPINIACEAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 206, 240 Group: 37F No. 343
Small or medium sized swamp tree of Wet Evergreen forest with a deep crown of pendulous leaves and rather large leaflets. The flush of new leaves is red. Probably ectomycorrhizal, like others in genus [Alexander, 1989].
DISTRIBUTION
Ghana, Ivory coast, Sierra Leone (Upper Guinea endemic) [Lock, 1989]. Locally gregarious in swamps.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 13

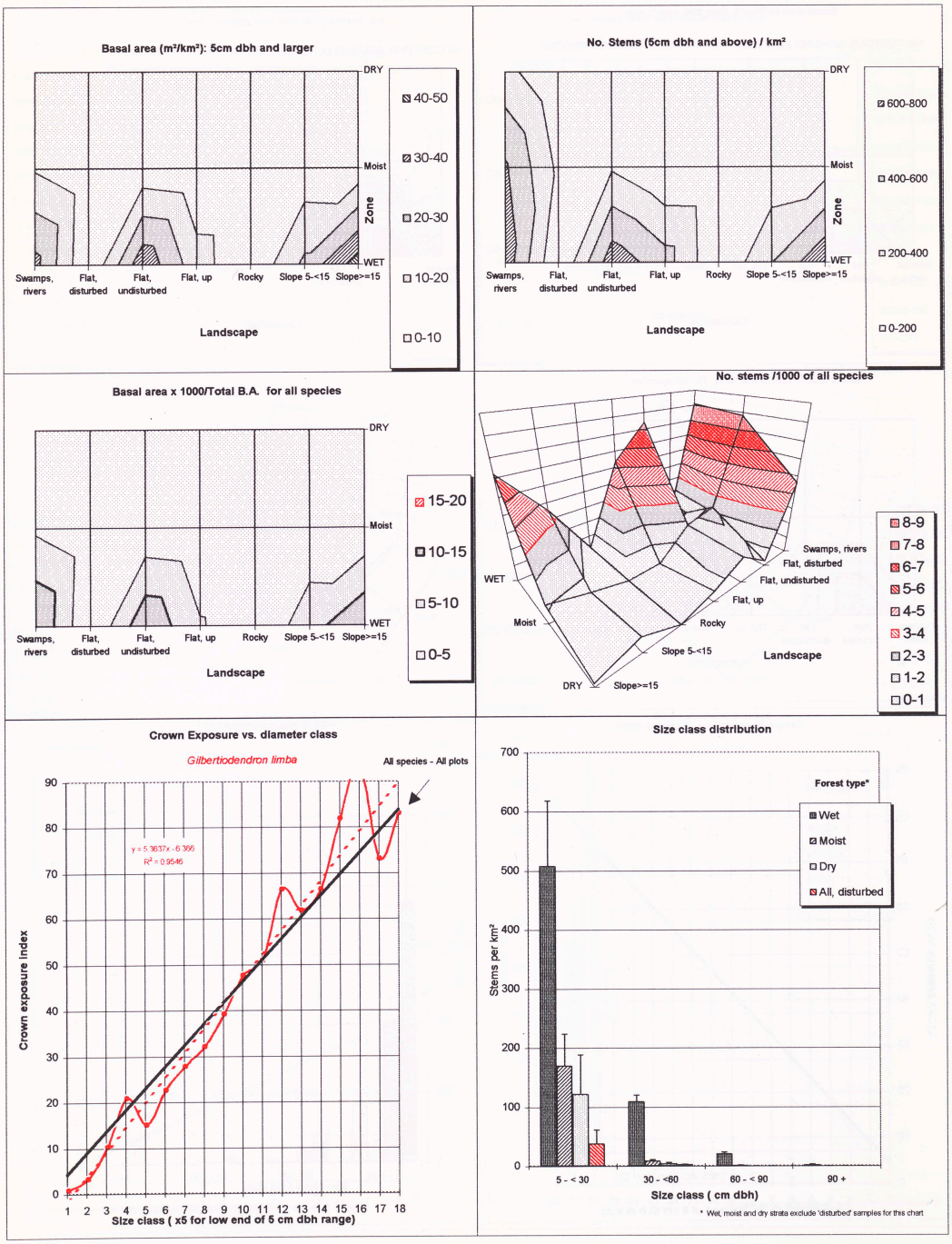
Gilbertiodendron spp. **CAESALPINIACEAE**
Common name: TETEKON
MATURE TREE
Field guide pp. 206 No. 1341
INVENTORY
Tree count <30 cm dbh (TSP): 396 >=30 cm: 511
No. of botanical survey records: 0
Records for 'Tetekon' etc. are generally unreliable, especially in evergreen forest, due to the existence of several, similar legumes.

Gluema ivorensis Aubrev. and Pellegr. **SAPOTACEAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 65 Group: 10D No. 344
Tall tree with copious latex in bark.
DISTRIBUTION
Only occurs in wet places in evergreen forest. Guinea-wide. This is the only species in the genus [Pennington, 1991]. In Cameroun it is also rare [Vivien and Faure, 1985].
PHENOLOGY/DISPERSAL
The fruits are dehiscent.
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 15
No. of botanical survey records: 13

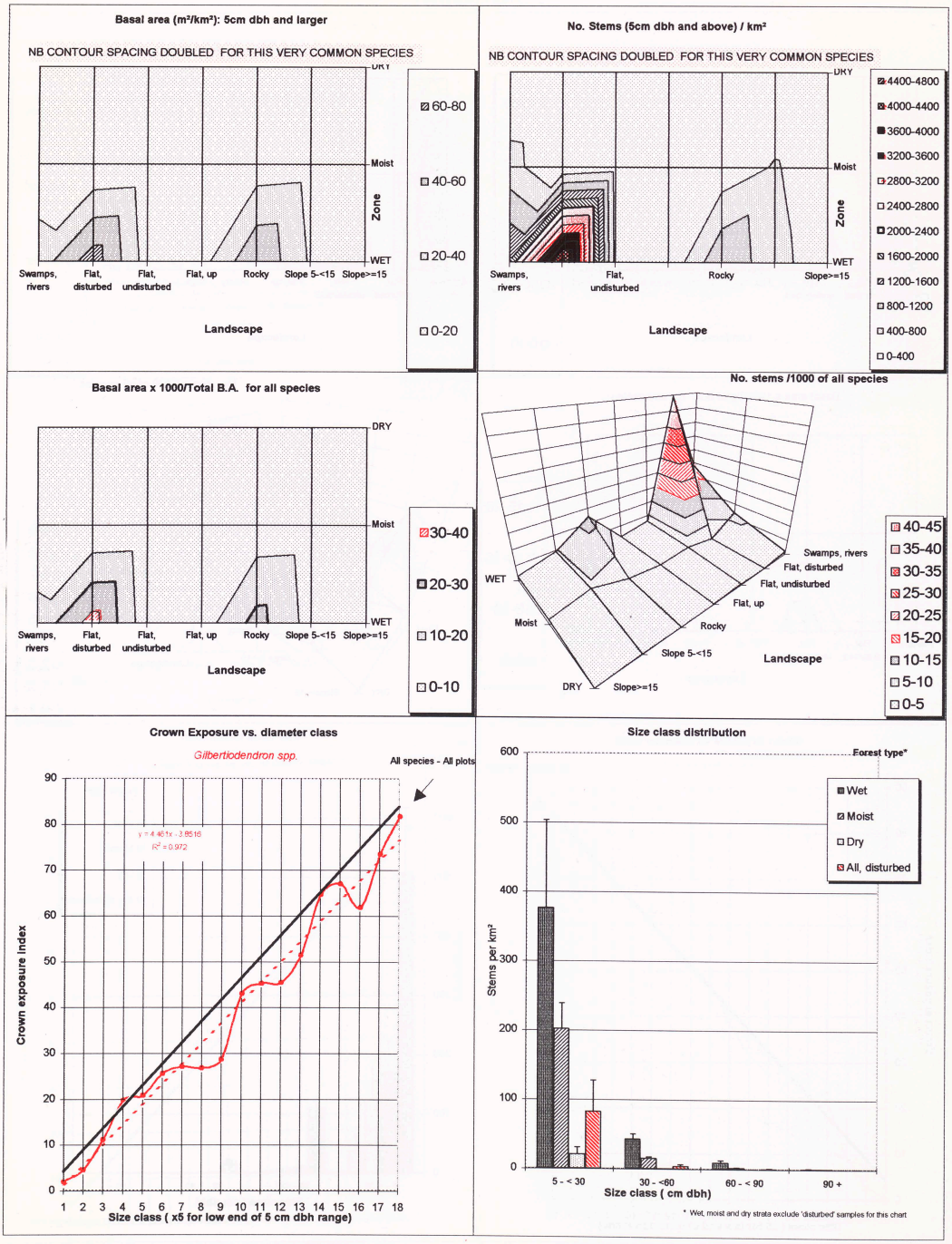
Glyphaea brevis (Spreng.) Monachino **TILIACEAE**
Common name: FoTo
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 125 Group: 20 No. 345
Small tree or shrub.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 279) and widespread in tropical Africa. Quite probably a 'cryptic pioneer'.
INVENTORY
Tree count <30 cm dbh (TSP): 345 >=30 cm: 33
No. of botanical survey records: 174
The chart shows a marked concentration in dry forest swamps. Some contribution to these records comes from *Leptonychia*. Both species are markedly shade-tolerant.

Greenwayodendron oliveri (Engl.) Verdc.
(=*Plyalthia oliveri*) **ANNONACEAE**
Common name: DUABIRI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 78 Group: 12F No. 346
Small understorey tree (medium-sized in evergreen forest [Irvine, 1961]).
DISTRIBUTION
Common in Ghana, strongly associated with acid, base-poor soils (Hall and Swaine sp. 280).
INVENTORY
Tree count <30 cm dbh (TSP): 1689 >=30 cm: 73
No. of botanical survey records: 239
The charts show an understorey tree most common in well-drained parts of evergreen forest. In a study of the effects of fire in Asukese and other F.R.s, all sizes of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].
OTHER NOTES
[Titanji *et al.*, 1990; Verdcourt, 1969]

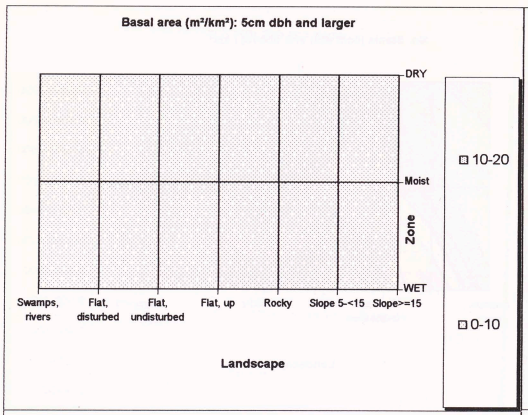
Gilbertiodendron limba

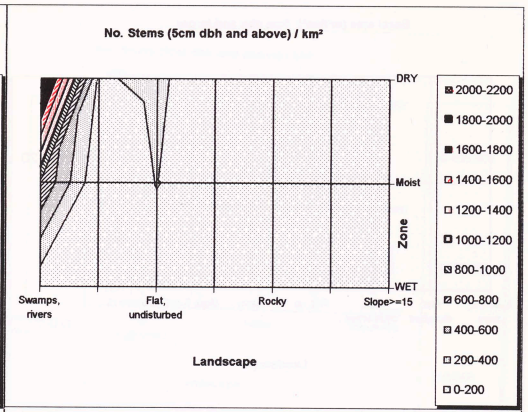


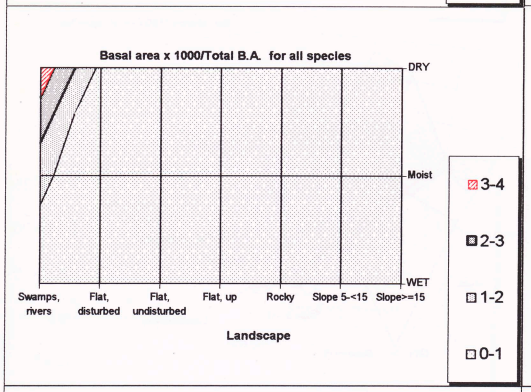
Gilbertiodendron spp.

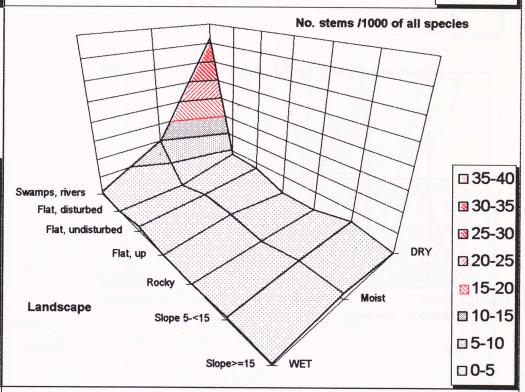


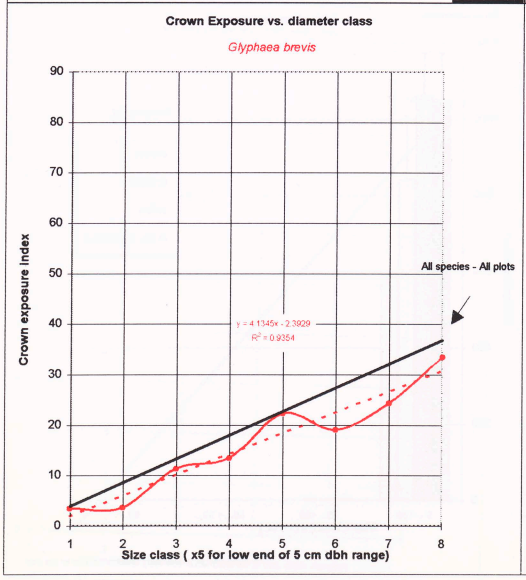
Glyphaea brevis

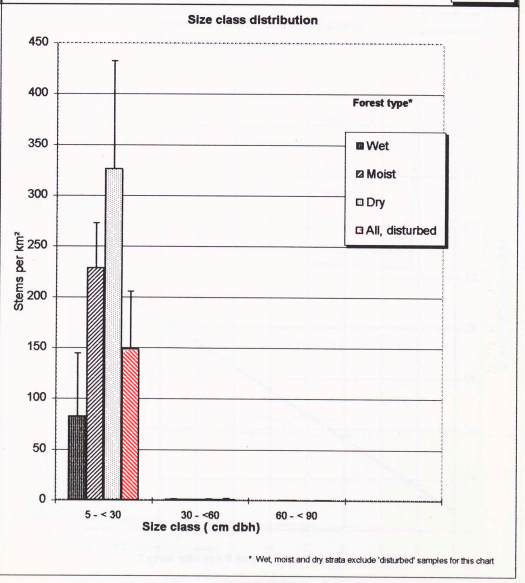




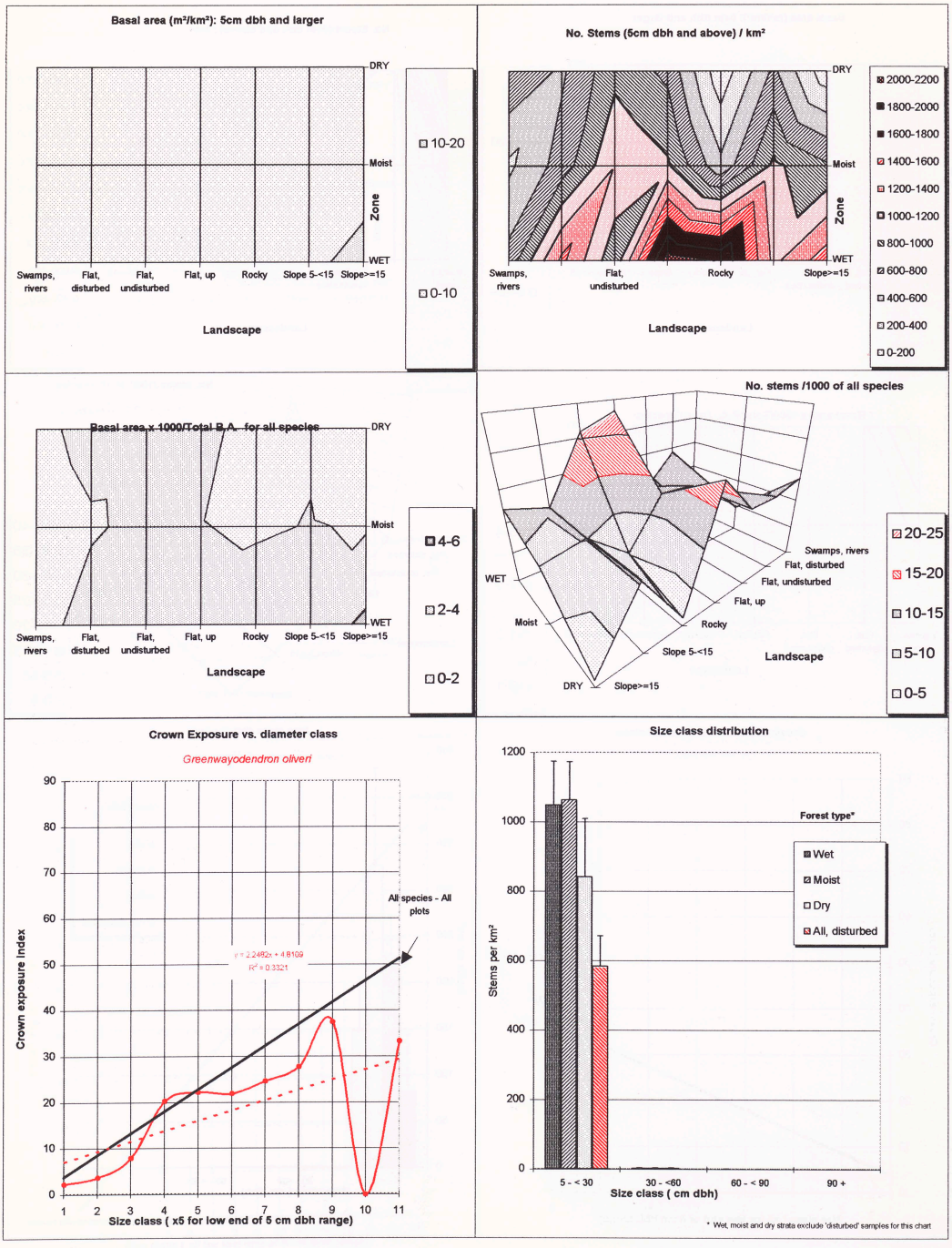




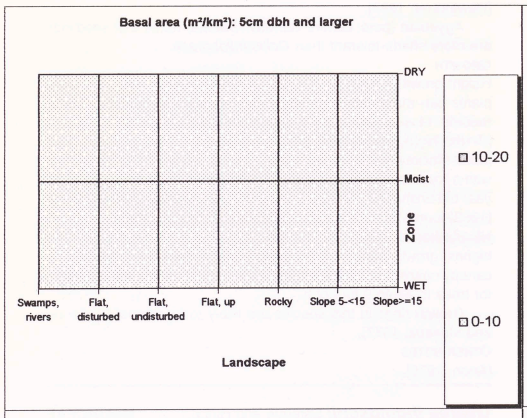


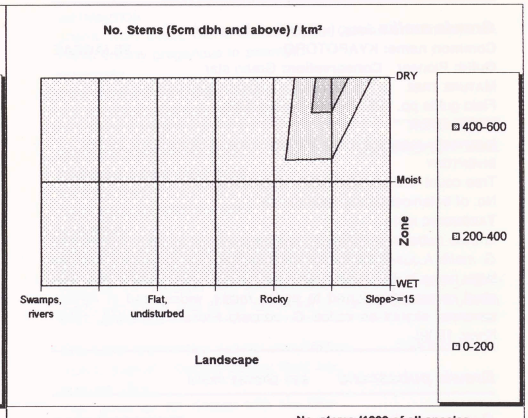


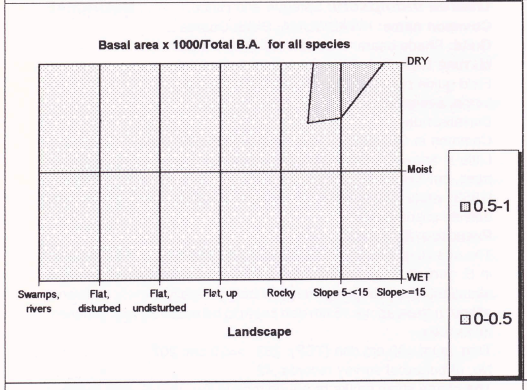
Greenwayodendron oliveri

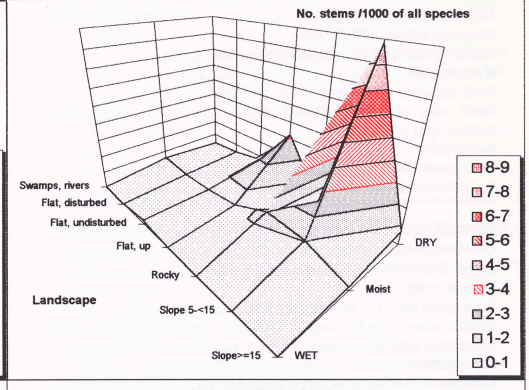


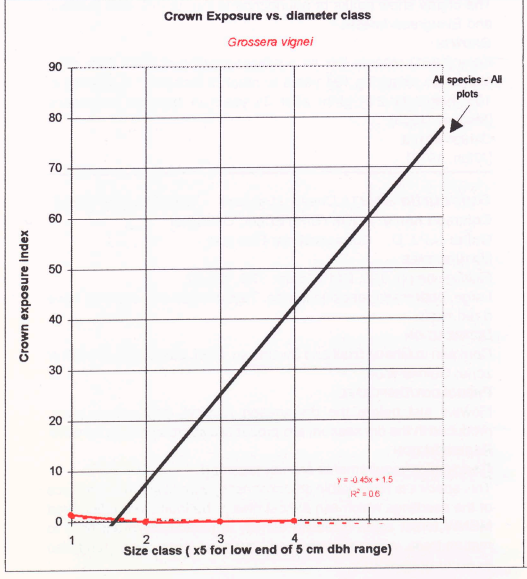
Grossera vignei

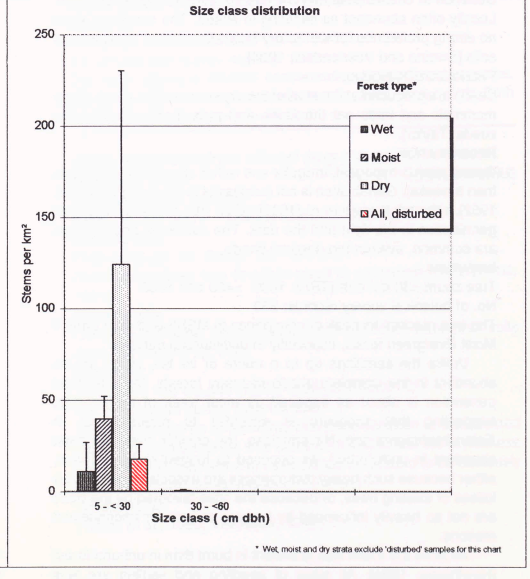












Grewia mollis Juss. (=*Grewia pubescens*)
Common name: KYAPOTORO **TILIACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 125 Group: 20 No. 347
DISTRIBUTION
Incorrectly recorded under the old name in Hawthorne, [1990].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 13
TAXONOMIC NOTE
Grewia pubescens P.Beauv. has been shown to be a synonym of *G. mollis* A.Juss.; the former name is therefore redundant, and the latter name is the correct name for the dry forest *Grewia* tree. The plant commonly referred to as *G. mollis*, widespread in African savanna, should be called *G. venusta* Fresen. [Geerling, 1982; Keay, 1989].

Grewia pubescens see *Grewia mollis*

Grossera vignei Hoyle **EUPHORBIACEAE**
Common name: MPEDURO
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 132 Group: 22B No. 348
Small tree of semideciduous forest usually on rocky hills. Guinea-wide [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 78 >=30 cm: 2
No. of botanical survey records: 9

Guarea cedrata (A.Chev.) Pellegrin **MELIACEAE**
Common name: KWABOHORO, Scented Guarea, Bos
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 177, 242 Group: 34C No. 17
Medium-sized, rarely large, evergreen tree sometimes with buttresses, with dark, compact crown. Leaf flush reddish.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 286); Guineo-Congolian. Locally often abundant as seedling in shade. The seedlings show no strong preference for wet or dry forest (base-poor or base-rich) soils [Swaine and Veenendaal, 1994].
PHENOLOGY/DISPERSAL
Seeds are produced at the start of the dry season (Oct.-Dec). Many mammals and birds eat the fruits, and presumably disperse the seeds [Taylor].
REGENERATION
Germination is hypogeal, irregular and rather slow (averaging more than 5 weeks). Germination is not successful in full sunlight [Gilbert, 1952], although Kyereh *et al.* [1993] report little difference between germination in the light and the dark. The seedlings and saplings are common, even in the deepest shade.
INVENTORY
Tree count <30 cm dbh (TSP): 1086 >=30 cm: 1033
No. of botanical survey records: 259
The tree reaches its peak of abundance in MSSE and drier parts if Moist Evergreen forest, especially in undisturbed patches.

Unlike the seedlings up to a metre or so tall, which are so abundant in the complete shade of many forests, the advanced generation is about as exposed as most trees of similar size, suggesting that exposure is essential to ongrowth as in *Entandrophragma spp.* Nevertheless, the smaller sizes are most abundant in undisturbed, as opposed to logged or burnt forest, either because such heavy disturbances are associated with heavy losses of existing trees, or because the sites favoured by the trees are not so heavily influenced by loggers or fires for unconnected reasons.

All sizes are much less abundant in burnt than in unburnt forest [Hawthorne, 1994]. All sizes of seedling and sapling are less abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

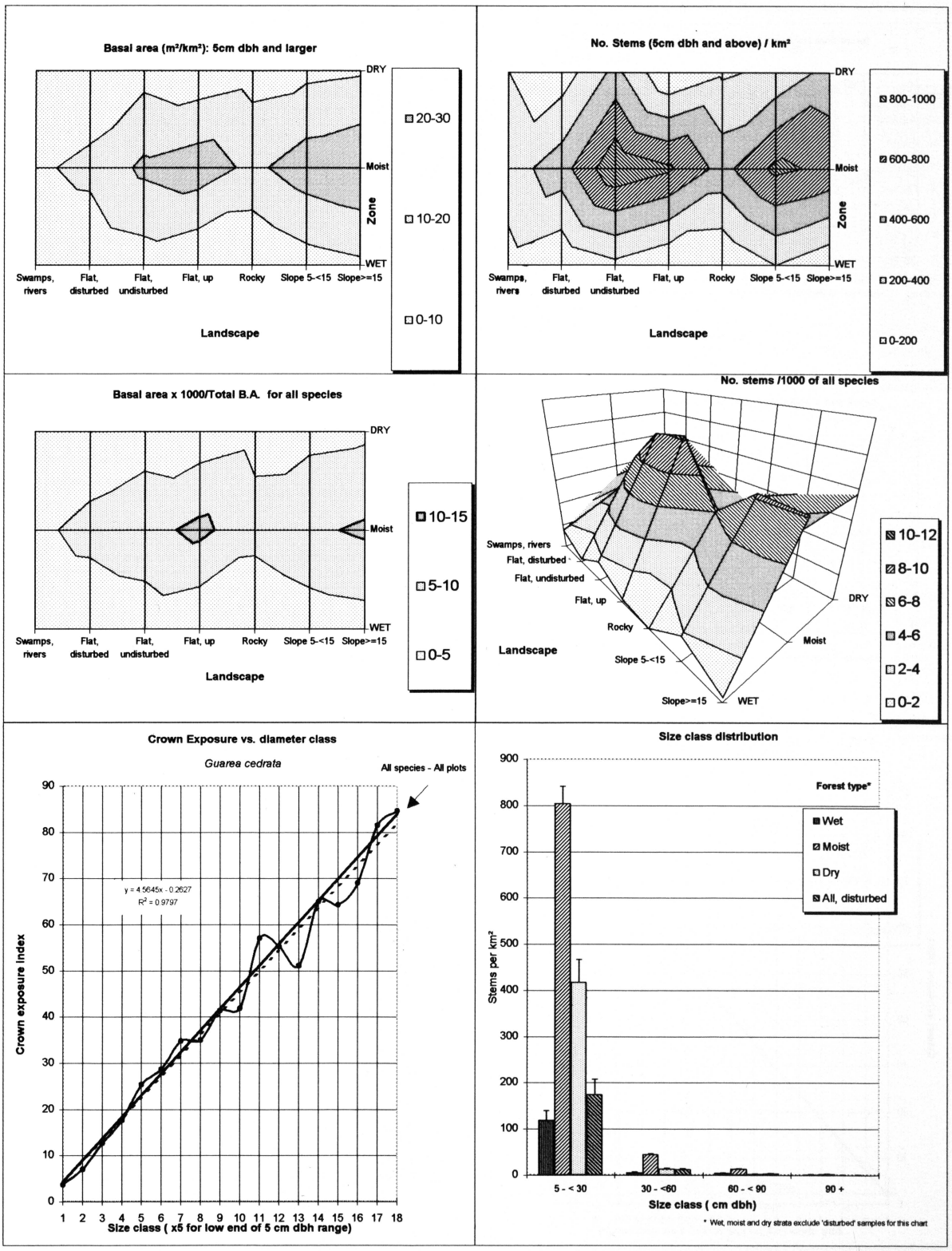
Agyeman (pers. comm. via M.D. Swaine) notes that seedlings are more shade-tolerant than *Celtis mildbraedii.*
GROWTH
Height growth is slow at first (25-30 cm after year one), but older plants can make faster growth when exposed to sunlight. Taylor records 14 year old trees in plantations with girths of 25-60 cm (7-15m high), and annual height increments of up to 1m in TSS plots. Mackay [1953] records that even the older trees grow best with a top shade, with 20 year old trees being of a same size to 12 year old unshaded trees (1-3 feet girth in 22 years recorded). Bada [1989] found that the mean annual basal area increment varied in Nigeria from 0.6 to 12.14 cm^2 per 30 x 30m PSP per annum. The highest growth rates only occurred in plots which were treated by canopy opening or similar effects. Keay [1961] estimated 168 years for trees to attain 9 foot gbh.

Growth rings in this species are likely to be annual [Detienne and Mariaux, 1977].
OTHER NOTES
[Anon, 1978]

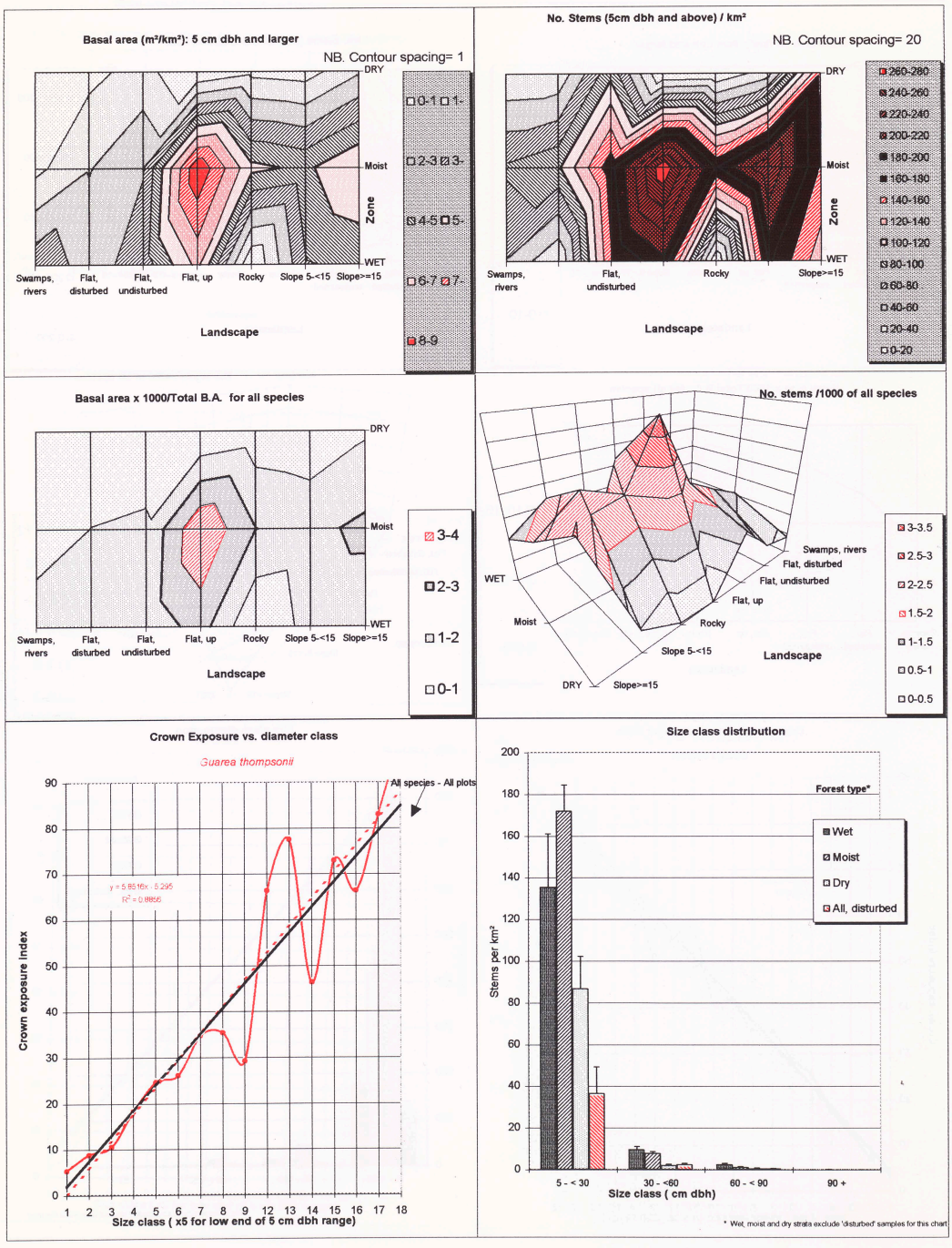
Guarea thompsonii Sprague and Hutch. **MELIACEAE**
Common name: KWADWUMA, Black Guarea
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 178, 236 Group: 34D No. 18
Large, evergreen, buttressed tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 287); Guineo-Congolian. Little is known in detail about this tree compared to other timber trees, but it is not as commercially important as *G. cedrata.* Mackay [1953] wrote 'the slowest of (several species) tried, it is a very definite shade-bearer'.
PHENOLOGY/DISPERSAL
The seedlings are not as conspicuously abundant in the shade as in *G. cedrata.* In evergreen forest, where the parent trees are most abundant, the young regeneration has generally exposed crowns, although trees above 15 cm dbh seem to be relatively less exposed.
INVENTORY
Tree count <30 cm dbh (TSP): 283 >=30 cm: 207
No. of botanical survey records: 42
The charts show peaks of abundance in flat, up-hill sites in Moist and Evergreen forests.
GROWTH
Keay [1961] records this as a slower-growing species than other Meliaceae, requiring 194 years to reach 9 foot gbh. It attained c. 10m height (1'-2'6" girth) after 25 years in Nigerian plantations [Mackay, 1953].
OTHER NOTES
[Anon, 1978]

Guibourtia ehie (A.Chev.) J.Leonard **CAESALPINIACEAE**
Common name: ANOKYE-HYEDUA, Ovengkol
Guild: N.P.L.D. **Conservation:** Red star
MATURE TREE
Field guide pp. 199, 244 Group: 37B No. 22
Large, buttressed, deciduous tree. Taylor notes that saplings have a red flush.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 288), particularly in MSNW zone; Guinea-wide.
PHENOLOGY/DISPERSAL
Flowers just before the dry season [Taylor], and papery pods, produced in the dry season, are probably dispersed mostly by wind.
REGENERATION
Germination requirements are not recorded.
This species is remarkable amongst canopy trees in the abundance of the seedlings which can almost always be found in the favoured MSNW forest zone. Seedling density is particularly great near to mature trees, where saplings and advanced regeneration tend also to occur gregariously.
INVENTORY
Tree count <30 cm dbh (TSP): 293 >=30 cm: 632
No. of botanical survey records: 89

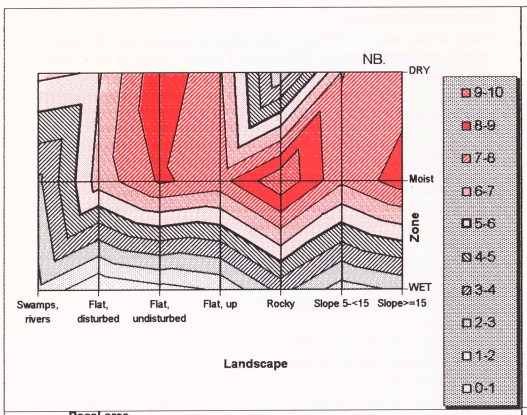
Guarea cedrata

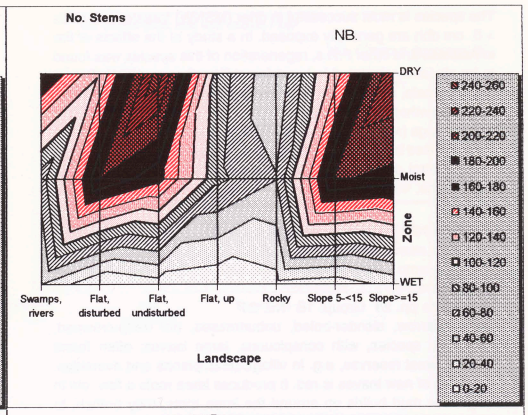


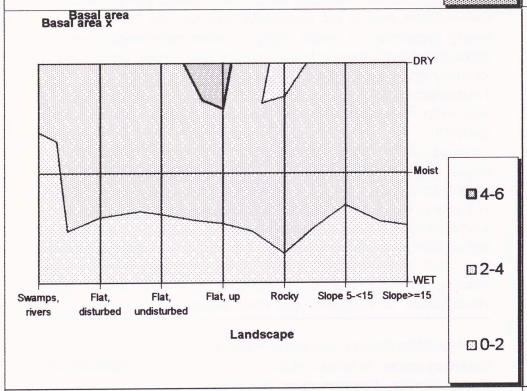
Guarea thompsonii

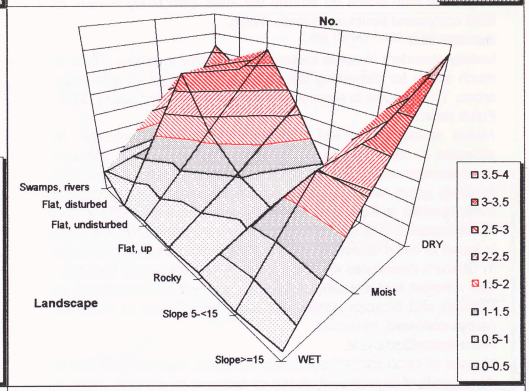


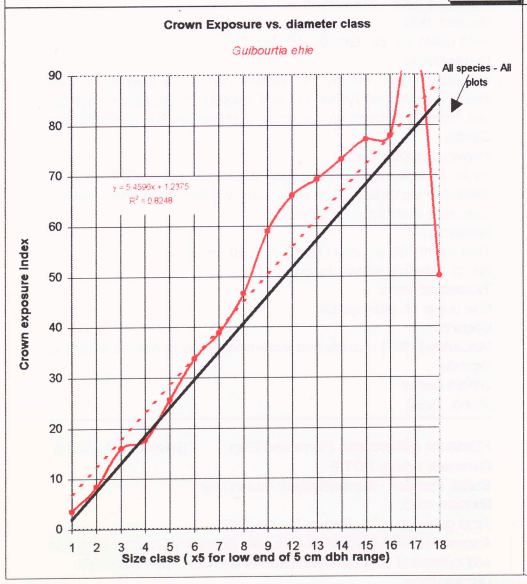
Guibourtia ehie

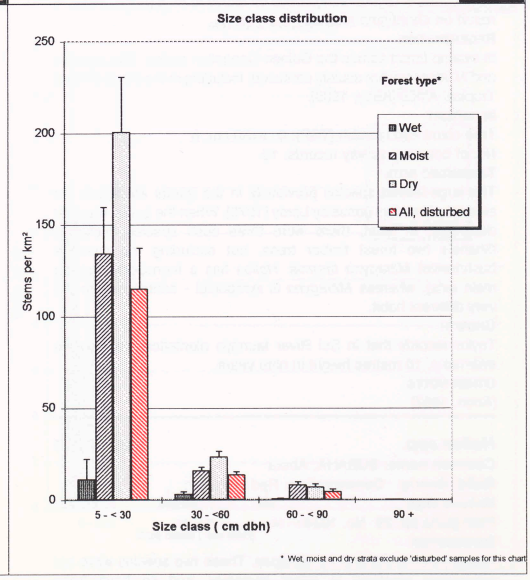












The species is most successful in drier (MSNW) forests, and sizes > 5 cm dbh are generally exposed. In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994]. On a broader scale, all sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Saplings (> 1m height) are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples, but the converse is true of smaller plants [Hawthorne, 1993].

Hallea ledermannii (=*Mitragyna ciliata*) **RUBIACEAE**

Common name: SUBAHA

Guild: Swamp **Conservation:** Red star

MATURE TREE

Field guide pp. 29 Group: 1B No. 24

Rather narrow, slender-boled, unbuttressed, but deep-crowned, evergreen species, with conspicuous, large leaves; often found outside forest reserves, e.g. in village swamplands and riversides. The flush of new leaves is red. It produces knee roots a few cm in height. As mud builds up around the knee roots, they branch, to form compound structures [Jénik, 1969].

DISTRIBUTION

Locally abundant in some swamps, but absent in others. There is much scope for dispersing this species to swamps in unforested areas. This species is surveyed in general terms by Osain [1973].

FIELD IDENTITY

Hallea species were not distinguished in the inventories. *H. stipulosa* is distinguished by its slightly hairier leaves, although flowers are needed for a reliable determination. Distribution area will probably prove to be the most practicable means of segregating these species. In Nigeria [Keay, 1989], and probably in Ghana, the current species is restricted to 'coastal' areas, whereas *H. stipulosa* is found in forest outliers in the savanna zone. Virtually all records in Ghana's inventories are likely to be of *H.ledermannii*, therefore. The different leaf anatomy of the two species is summarised by Shellard and Shadan [1963], although they appear to have the names confused.

PHENOLOGY/DISPERSAL

Masses of small winged seeds are released, and can give rise to dense beds of regenerating seeds on exposed mud [Anon, 1958, in report on *Oxystigma mannii*].

REGENERATION

In swamp forest across the Guineo-Congolian region. This species and *H. stipulosa* are usually confused, including in the Flora of West Tropical Africa [Keay, 1989].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 15

TAXONOMIC NOTE

The large-leaved species previously in the genus *Mitragyna* are separated into this genus by Leroy [1975]. When the genus was first described, at least, there were three such species, including Ghana's two forest timber trees, but excluding the savanna bush/treelet *Mitragyna inermis*. *Hallea* has a monopodial (single main axis), whereas *Mitragyna* is sympodial - contributing to the very different habit.

GROWTH

Taylor records that in Sui River taungya plantation, the species attained c. 10 metres height in nine years.

OTHER NOTES

[Anon, 1952]

Hallea spp. **RUBIACEAE**

Common name: SUBAHA, Abura

Guild: Swamp **Conservation:** Red star

MATURE TREE

Field guide pp. 29 No. 1024

DISTRIBUTION

Hallea ledermannii and *H. stipulosa*. These two species were not adequately identified in either inventory, and so have been amalgamated. *H.ledermannii* is more typical of wet forests, *H.stipulosa* in dry ones.

PHENOLOGY/DISPERSAL

Many small, wind-dispersed seeds are produced (in *H.l* at least) during the wetter months (June-July) [Taylor]. Keay *et al.* [1960] states that the tree fruits twice a year in Nigeria.

REGENERATION

The regeneration of both species has been summarised by Lowe [1984]; the ecology and silviculture of the species, but especially *H. ledermannii* in Nigeria has been summarised by Osain [1973], and for *H. stipulosa* in Uganda by McCarthy [1961]. Most of the following information is derived from literature on *H. ledermannii*.

Osain states that the seeds will only germinate in full sunlight, and that the seeds remain dormant (with 8 months viability according to Keay [1960]) in shade. The species is known to regenerate profusely when the canopy shading swamp soils is removed [Macgregor, 1932; Lowe, 1964]. In suitably wet and sunny conditions the seeds germinate in c. 2 weeks.

INVENTORY

Tree count <30 cm dbh (TSP): 76 >=30 cm: 382

No. of botanical survey records: 0

Although the genus appears to be most common in the evergreen forest zone, probably because there is more swampy land there, the species even here is not particularly common. As the species is locally gregarious, it would repay a more autecological study, although relatively more is known already about these species than for many more important timber species.

TAXONOMIC NOTE

See under *H. ledermannii*.

GROWTH

Trees can attain about 10m in 9 years in taungya [Taylor], with an annual height increment of c. 60 cm in young trees. Growth rates summarised by Osain [1973] indicate that *H.l.* can attain 10m height in 6 years, with a mean annual girth increment of 1.3 inches. The species is obviously a strong light demander; McCarthy [1961] notes that seedlings will grow horizontally if in that way they receive most light, and states that the species suffers naturally from a high seedling mortality due to competition from other plants, e.g. Marantaceae, for light, and from insect attacks.

Hallea stipulosa (=*Mitragyna stipulosa*)

Common name: SUBAHA-AKOA **RUBIACEAE**

Guild: Swamp **Conservation:** Red star

MATURE TREE

Field guide pp. 29 Group: 1B No. 25

DISTRIBUTION

See also other entries for *Hallea spp.*. The species occurs throughout tropical Africa, but well outside the Guineo-Congolian rain forest heartland, in countries such as Sudan, Senegal and Zambia.

PHENOLOGY/DISPERSAL

As for *H. ledermannii*. A summary of the silviculture of the current species in Uganda is given by McCarthy [1961], who notes that the species is a strong light-demander.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 11

TAXONOMIC NOTE

See under *H. ledermannii*.

GROWTH

McCarthy [1961] records that increment is low in natural stands in Uganda.

OTHER NOTES

[Anon, 1956]

Hannoa klaineana Pierre and Engl. **SIMAROUBACEAE**

Common name: FOTIE

Guild: Pioneer **Conservation:** Green star

MATURE TREE

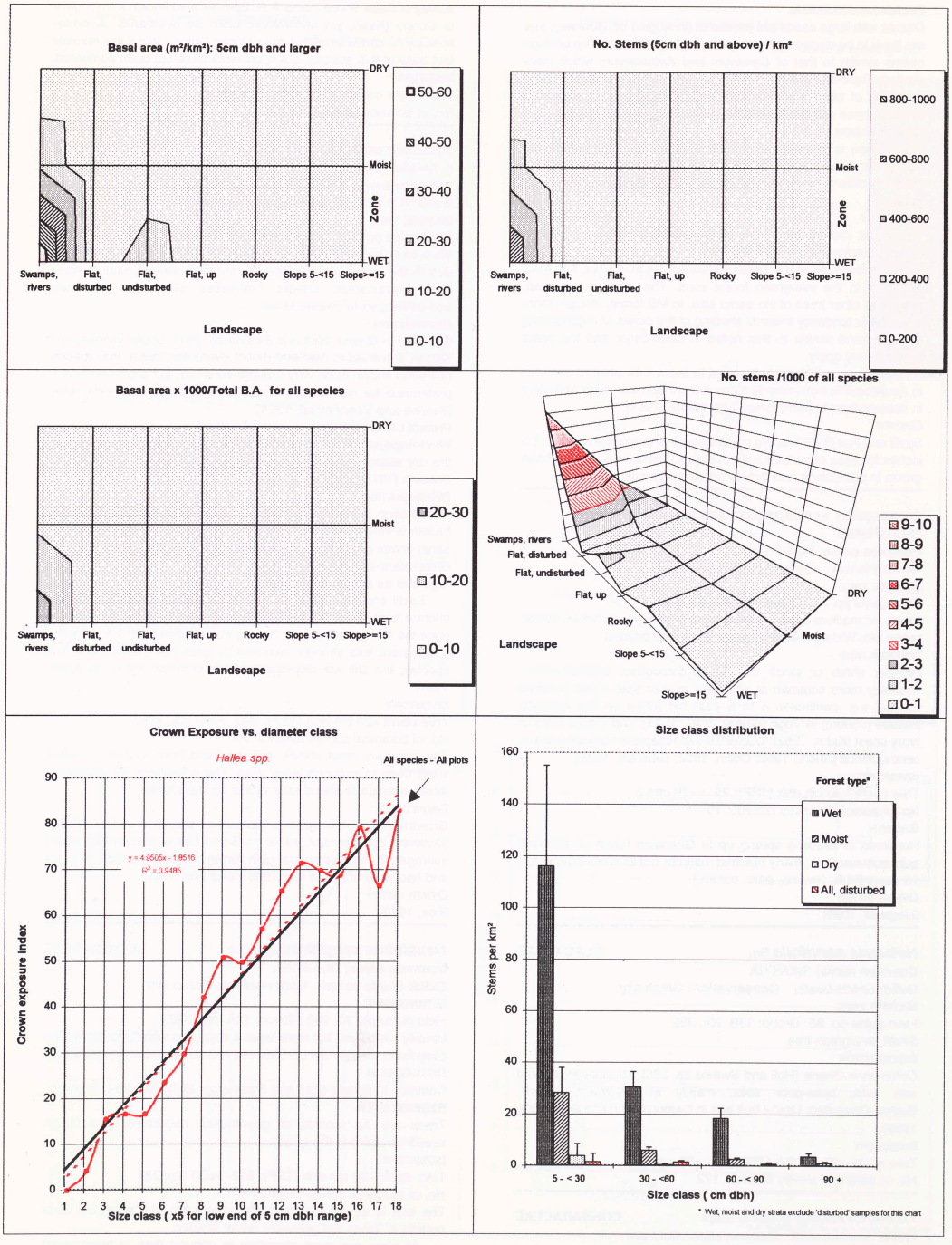
Field guide pp. 171 Group: 32 No. 349

A common, briefly deciduous tree, with *Entandrophragma*-like crown and cylindrical bole. The bark, seeds and other parts are bitter.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 289) indicative of acid soils [Hall and Swaine]. Mature trees are commonest in secondary forest.

Hallea spp.


Basal area (m²/km²): 5cm dbh and larger
DRY
Moist
WET
Zone
50-60
40-50
30-40
20-30
10-20
0-10
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
No. Stems (5cm dbh and above) / km²
800-1000
600-800
400-600
200-400
0-200
Basal area x 1000/Total B.A. for all species
No. stems /1000 of all species
9-10
8-9
7-8
6-7
5-6
4-5
3-4
2-3
1-2
0-1
Crown Exposure vs. diameter class
Hallea spp
All species - All plots
y = 4.9505x - 1.8516
R² = 0.9485
Crown exposure index
Size class (x5 for low end of 5 cm dbh range)
Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
90 +
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

PHENOLOGY/DISPERSAL
Drupes with large seeds are produced (in August nr. Dunkwa), and are likely to be dispersed by animals [Taylor]. The seedling ecology seems similar to that of *Canarium* and *Antrocaryon*, which have similarly light-demanding seedlings. We need, however, some indication of what, if any factors stimulate germination, to decide whether these species should be defined as pioneer species.
REGENERATION
Germination is normal, with very limited viability [Savill and Fox, 1967]. Seedlings occur in the shade. Saplings, with leaflets markedly different from the parents (e.g. acuminate) are found only in gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 2032 >=30 cm: 1791
No. of botanical survey records: 190
No doubt because of the trees' preference for acid soils, it is most abundant in the evergreen forest zone. The crown is exposed, relative to other trees of the same size. In MS forest, though, there is a greater tendency towards shading of the crown of regenerating trees; a trend similar to that noted in *Calpocalyx*, and the same reasons may apply.

Seedlings were more abundant in burnt than unburnt samples in Asukese FR; however, all sizes > 5 cm dbh are more abundant in unburnt than in burnt forest [Hawthorne, 1994].
GROWTH
Savill and Fox [1967] record mean annual girth increments of c. 1.5 inches for trees of various ages in Sierra Leone, where it has been grown in plantations and thrives on barren sands.

Harungana madagascariensis Lam. *ex* Poir.
GUTTIFERAE
Common name: KOSOWA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 49 Group: 8A No. 350
Small or medium-sized, spreading tree of very disturbed forest, fallow etc. Widespread in tropical Africa and beyond.
DISTRIBUTION
Pioneer shrub or small tree found throughout tropical Africa. Probably more common at altitudes greater than a few hundred metres, e.g. dominates 4 to 6 year old fallow on the Akposso plateau [>500m] in Togo [Guelly *et al.*, 1993]; and similar sites in Ivory coast [Kahn, 1982]. Useful for site recapture from savanna in central Africa [Anon., 1952; Collin, 1952; Germain, 1945].
INVENTORY
Tree count <30 cm dbh (TSP): 25 >=30 cm: 3
No. of botanical survey records: 15
GROWTH
Hundreds of seedling sprung up in Ghanaian forest on exposed soils in Atewa F.R.; many reached maturity but all were dead within 15 years [M.D. Swaine, pers. comm.].
OTHER NOTES
[Liegeois, 1958]

Heisteria parvifolia Sm. **OLACACEAE**
Common name: SIKAKYIA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 85 Group: 13B No. 352
Small, evergreen tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 290); strongly associated with acid, base-poor soils, mainly in evergreen forests; Guineo-Congolian; Useful fruit tree in Cameroun [Vivien and Faure, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 172

Hemandradenia mannii Stapf **CONNARACEAE**
Guild: Shade-bearer **Conservation:** Gold star
Small tree with hard red slash, hairy twigs and petiole, very rare in Ghana, but Guineo-Congolian [Breteler, 1989]. Leaves slightly like *Baphia pubescens*; found in Ghana for first time during botanic survey of Cape Three Points F.R. Species also known from Nigeria to Congo (Kew), yet uncommon; often on riverbanks. A similar species *H. chevalieri* Stapf from Upper Guinea lacks the revolute leaf base of this species, but specimens have not been compared.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

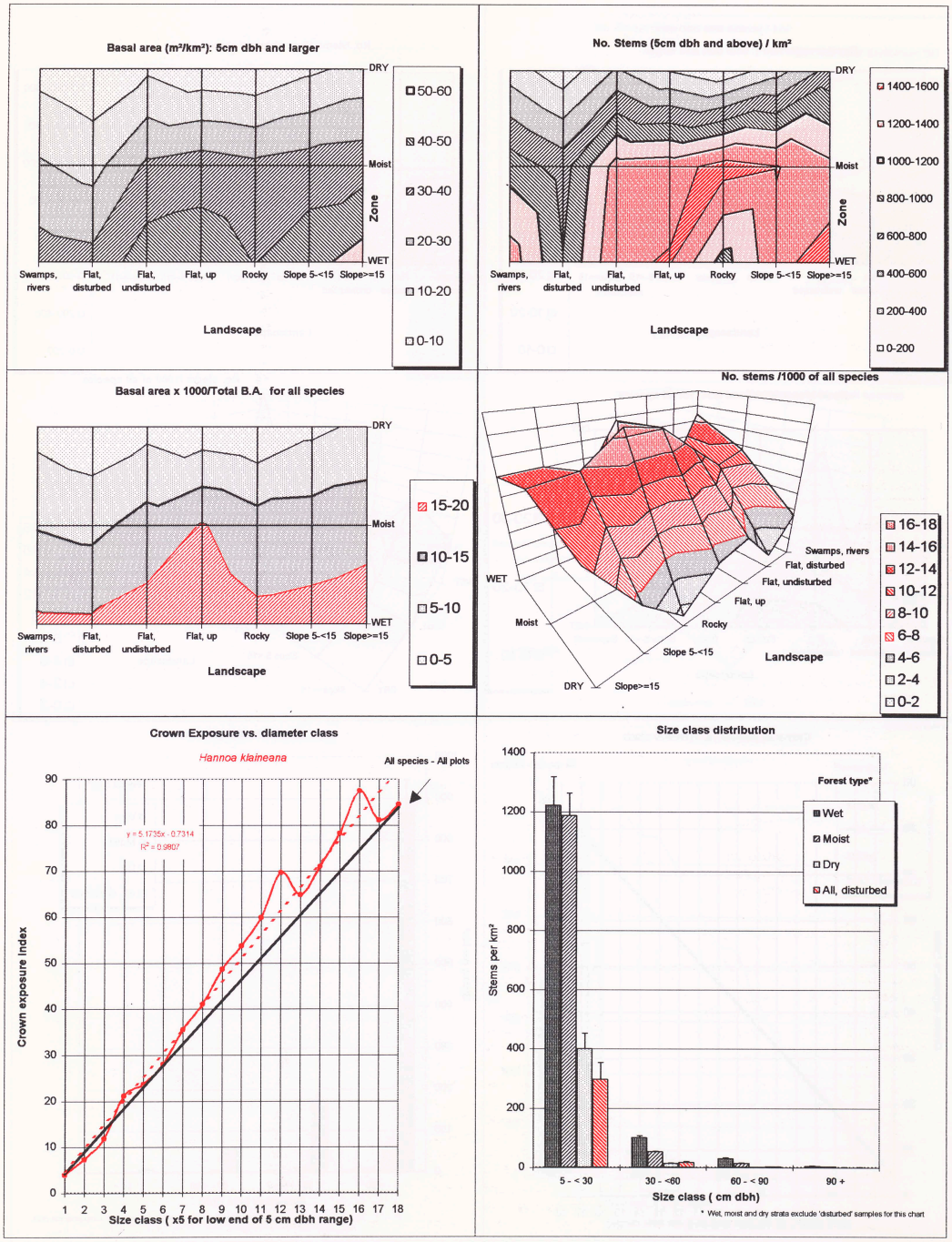
Heritiera utilis (Sprague) Sprague **STERCULIACEAE**
(=*Tarrietia utilis*)
Common name: NYANKOM, Niangom, Ogoue
Guild: N.P.L.D. **Conservation:** Red star
MATURE TREE
Field guide pp. 157, 234 Group: 28B No. 15
Medium to large tree with a golden-brownish sheen to the crown due to the scales and stellate hairs on the leaves. Mature trees have characteristic stilt-like buttresses which are especially well-developed in swamp forest.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 291); Upper Guinea, and Gabon. Confined to (wet and moist) evergreen forest, this species has been shown to be very drought-sensitive, but shows no strong preference for wet or dry forest (base-poor or base-rich) soils [Swaine and Veenendaal, 1994].
PHENOLOGY/DISPERSAL
Wind-dispersed fruits (samaras) are produced towards the end of the dry season, although according to Savill and Fox [1967] and Britwum [1976] seeding is erratic.
REGENERATION
Germination is normal, or rather rapid. Taylor records that early growth is very erratic, and that there is no obvious requirement for either shade or sun in nurseries, although growth is rapid in suitable circumstances (2 m after 4 yrs in TSS plots), and the tree is best regarded as a 'light demander'.

Savill and Fox [1967] record that seedlings and saplings can tolerate high shade for years and still begin to grow immediately once the canopy is opened. Young trees higher than 1.5 m of this species are less strongly favoured by gaps than many other tree species, but still are disproportionately common there [de Klerk, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 380 >=30 cm: 1282
No. of botanical survey records: 39
The exposure chart shows well the trend from relatively shaded small trees to exposed large ones. The preference for evergreen forest swamps is also clearly visible on the charts.
GROWTH
Growth rings of this species have been analysed in Ivory Coast [Detienne and Mariaux, 1975]. In Sierra Leone trees in plantation averaged 2.1 inches annual girth increment over the first 15 years and had reached 20 m high [Savill and Fox, 1967].
OTHER NOTES
[Fox, 1970]

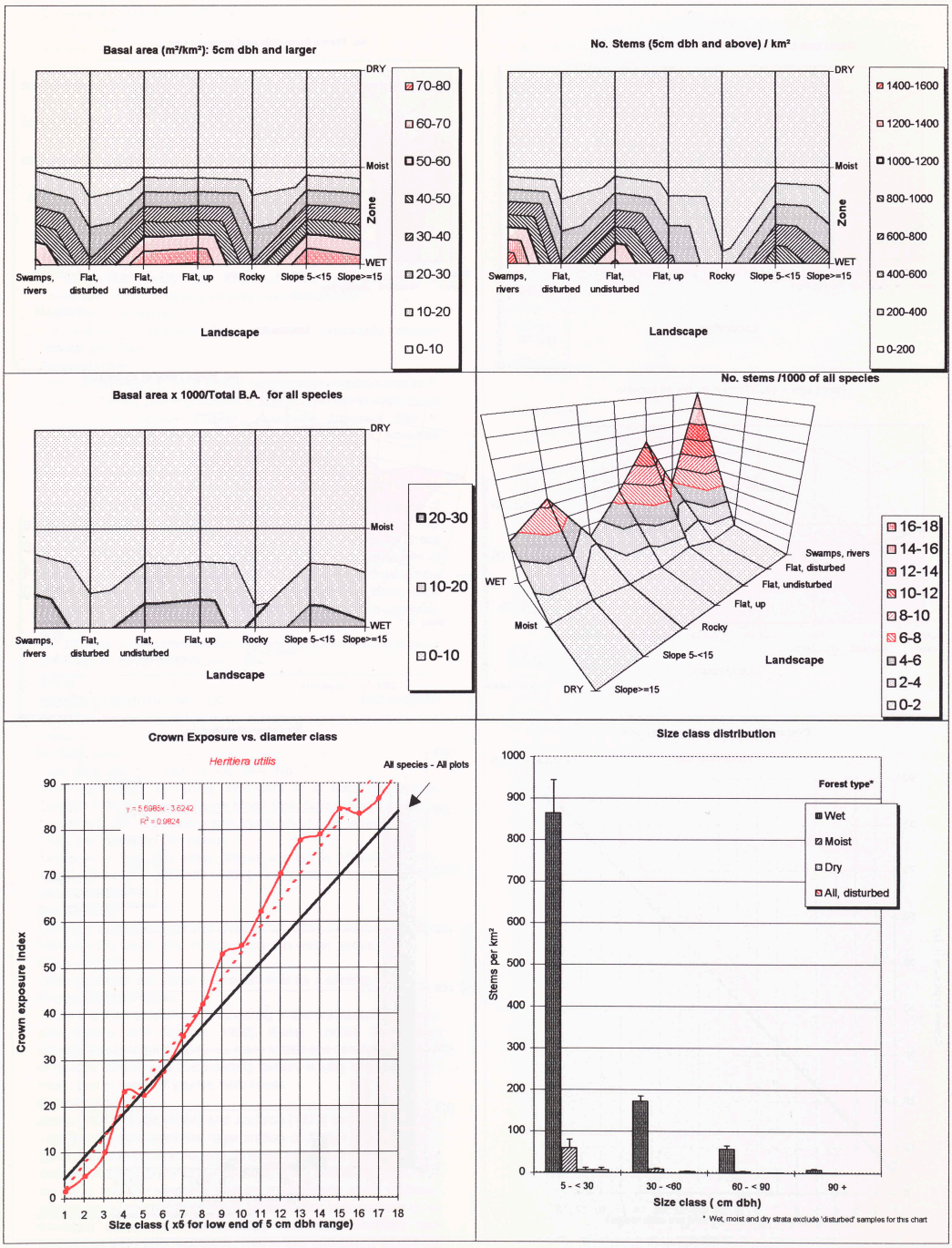
Hexalobus crispiflorus A.Rich. **ANNONACEAE**
Common name: DUABAHA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 73, 242 Group: 12A No. 353
Usually a medium, but sometimes a large tree with deep flutes. The deep flutes may render the diameter measurements of limited value.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 292); Guineo-Congolian.
REGENERATION
There are no records of germination requirements, although seedlings occur in the shade.
INVENTORY
Tree count <30 cm dbh (TSP): 597 >=30 cm: 733
No. of botanical survey records: 67
The tree is equally common throughout the MS zone, but rarer outside it. Trees are generally rather shaded.

All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The crown of 5-10 cm dbh trees is usually shaded, although there is some tendency for larger trees to have

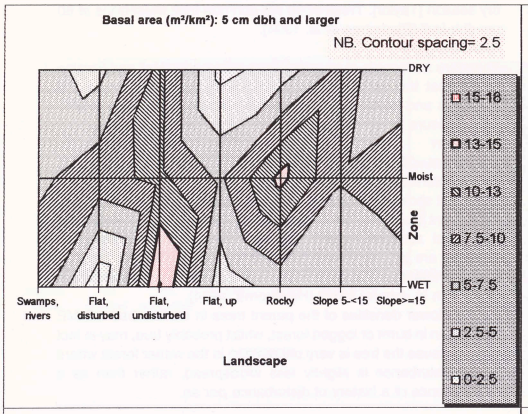
Hannoa klaineana

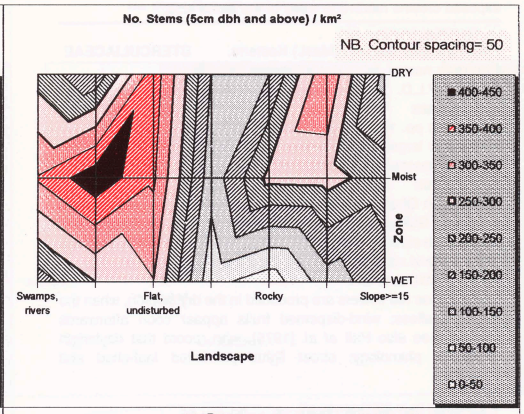


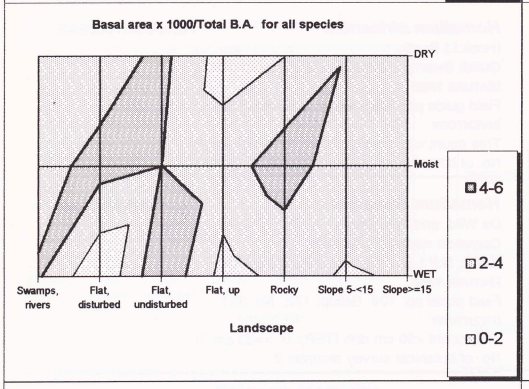
Heritiera utilis

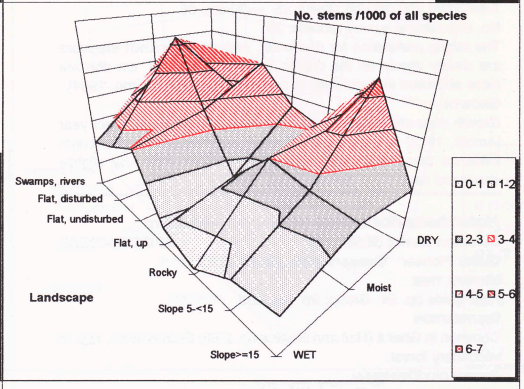


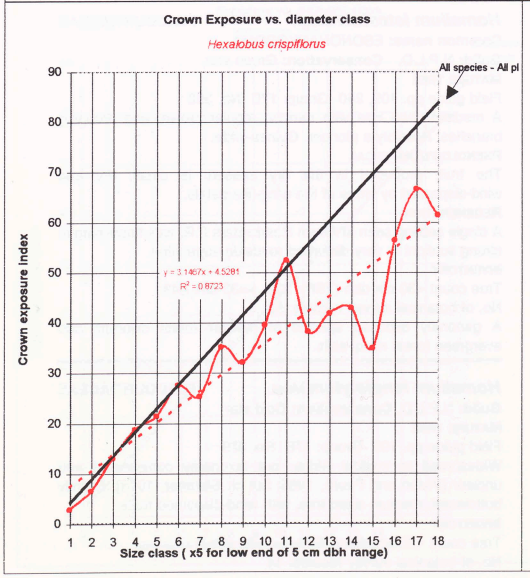
Hexalobus crispiflorus

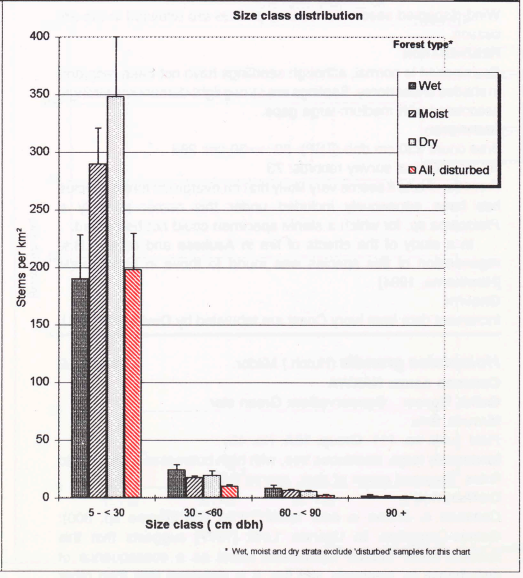












exposed crowns relative to trees of the same size.

Hildegardia barteri (Mast.) Kosterm. **STERCULIACEAE**
Common name: AKYEReKYEWeWA
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 151 Group: 27D No. 354
Medium to large deciduous tree with smooth, greenish bark and steep buttresses, characteristic of some dry rocky hills.
DISTRIBUTION
Common in Ghana only on some dry rocky hills (Hall and Swaine sp. 293); Guinea-wide as far as Nigeria. The distribution and ecology are summarised by Enti [1968], who points out its potential value for land reclamation on dry, rocky sites.
PHENOLOGY/DISPERSAL
Conspicuous red flowers are produced in the dry season, when the tree is leafless; wind-dispersed fruits appear soon afterwards [Taylor]. See also Hall *et al.* [1975], who record that daylength influences phenology; street lights prevented leaf-shed and flowering.
INVENTORY
Tree count <30 cm dbh (TSP): 35 >=30 cm: 66
No. of botanical survey records: 26
The strong preference for dry forest, and marked crown exposure are clearly shown on the charts. Sizes of tree > 30 cm dbh are more abundant in burnt than in unburnt forest [Hawthorne, 1994].
GROWTH
Growth rings are periodic, with one ring produced, usually, per year [Amobi, 1973] in Nigeria. Small seasonal changes in day length influence these rhythms, with bud-formation induced by slightly shortened days (11.5 hours) [Njoku, 1964].

Holarrhena floribunda (G.Don) Dur. and Schinz.
Common name: SESE **APOCYNACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 54 Group: 9B No. 355
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 299); Guinea-wide, esp. in secondary forest.
PHENOLOGY/DISPERSAL
Wind-dispersed seeds with cottony plumes are released in the dry season.
REGENERATION
Germination is normal, although seedlings have not been recorded in shaded understorey. Saplings are strong light-demanders strongly associated with medium-large gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 80 >=30 cm: 284
No. of botanical survey records: 73
From the charts it seems very likely that an evergreen forest species has been erroneously included under this name: possibly a *Pleiocarpa* sp, for which a sterile specimen could not be named.

In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to thrive in burnt forest [Hawthorne, 1994]
GROWTH
Increment data from Ivory Coast are tabulated by Devineau [1991].

Holoptelea grandis (Hutch.) Mildbr. **ULMACEAE**
Common name: NAKWA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 111 Group: 18A No. 45
Moderately large, deciduous tree, with high buttresses merging into flutes. Rounded crown of dark, sparse foliage.
DISTRIBUTION
Common in Ghana in drier forests (Hall and Swaine sp. 300); Guineo-Congolian. In Uganda, Lock [1977] suggests that this species would replace *Cynometra* forest as a consequence of disturbance by elephants and fire. It is disturbed less than other trees by elephants.
PHENOLOGY/DISPERSAL
Wind-dispersed fruit (samaras) are produced towards the end of the dry season [Taylor]. Trees of 18 cm dbh can fruit; most trees of 60 cm dbh fruit [Plumptree *et al.* 1994].
REGENERATION
There are no records of germination requirements. Hall and Swaine record that the species can regenerate in moderate shade, but seedlings and saplings are strongly associated with canopy gaps and exposure to direct sunlight.
INVENTORY
Tree count <30 cm dbh (TSP): 130 >=30 cm: 427
No. of botanical survey records: 48
The chart shows a dry forest tree with a generally exposed crown.

Parent trees are most abundant in dry forest and, within the MS forest zone, in logged and otherwise disturbed forest, but densities are too low for the data to show any significant trends in the regeneration. All sizes > 30 cm dbh are more abundant in burnt than in unburnt forest [Hawthorne, 1994].

The lower densities of the parent trees in undisturbed MS-ME forest than in burnt or logged forest, whilst probably true, may in fact arise because the tree is very uncommon in the wetter forest where heavy disturbance is slightly less widespread, rather than as a consequence of a history of disturbance *per se*.

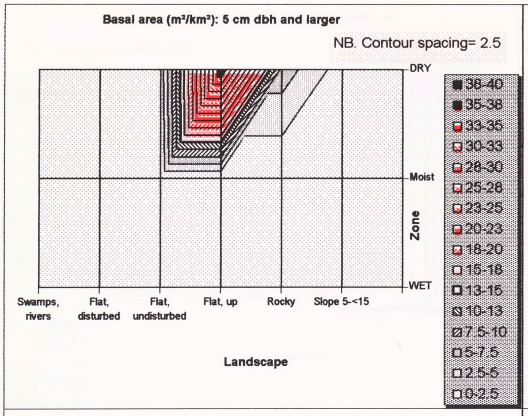
Homalium africanum **FLACOURTIACEAE**
(Hook.f.) Benth.
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 109 Group: 17E No. 356
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 20

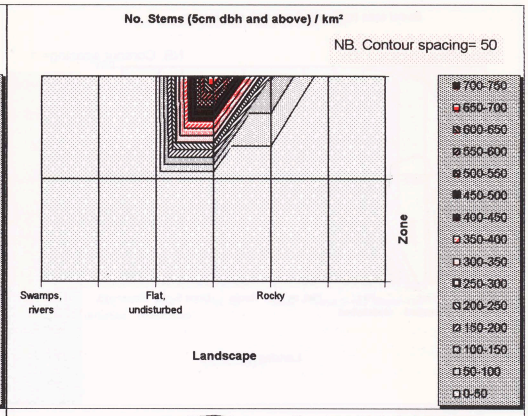
Homalium dewevrei **FLACOURTIACEAE**
De Wild. and The. Dur.
Common name: oWEBIRIBI
Guild: N.P.L.D. **Conservation:** Gold star
MATURE TREE
Field guide pp. 109 Group: 17E No. 357
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 8

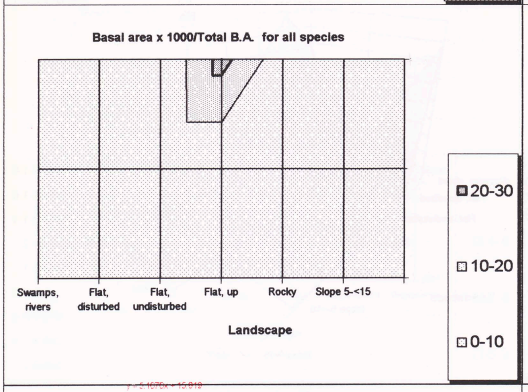
Homalium letestui Pellegr. **FLACOURTIACEAE**
Common name: ESONONANKOROMA
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 109, 240 Group: 17E No. 358
A medium-sized tree with narrow, regular crown, and drooping branches. Possibly a pioneer. Guinea-wide.
PHENOLOGY/DISPERSAL
The fruit, produced in the dry season, is small, dry and wind-dispersed by virtue of the wing-like petals.
REGENERATION
A single sapling seen in Afram Headwaters F.R. was flourishing in strong sunlight in very disturbed roadside vegetation.
INVENTORY
Tree count <30 cm dbh (TSP): 238 >=30 cm: 643
No. of botanical survey records: 53
A generally exposed species of moister forest swamps and evergreen forest rocky soils.

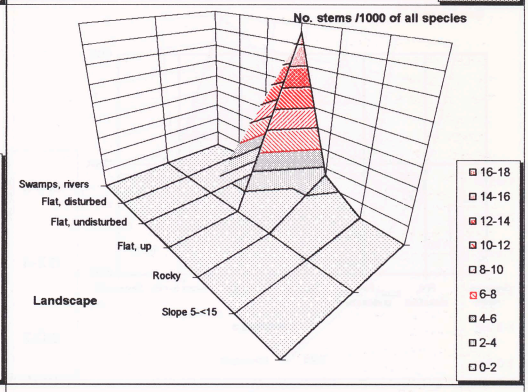
Homalium longistylum Mast. **FLACOURTIACEAE**
Guild: N.P.L.D. **Conservation:** Gold star
MATURE TREE
Field guide pp. 109 Group: 17E No. 359
Widespread in tropical Africa, but taxonomy complicated and unclear [Vivien and Faure, 1985; but cf. Sleumer, 1973]. Slightly buttressed, medium-sized tree, with wind-dispersed fruits.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 14

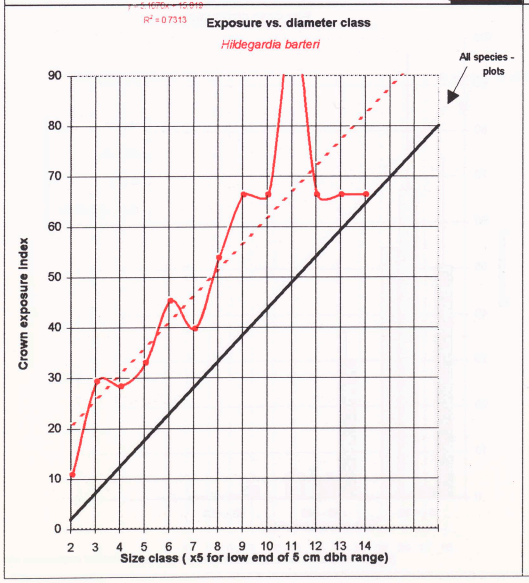
Hildegardia barteri

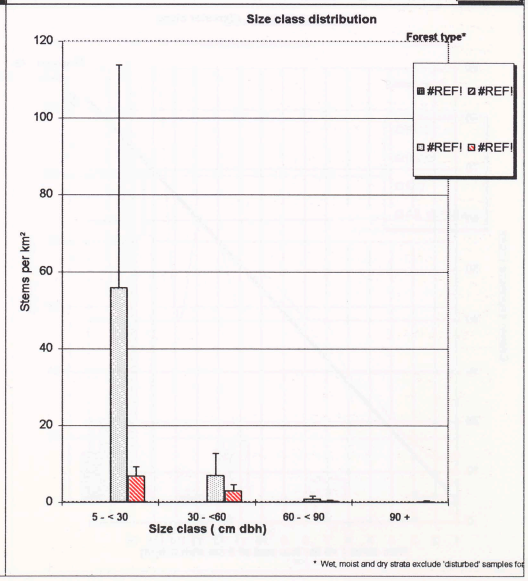




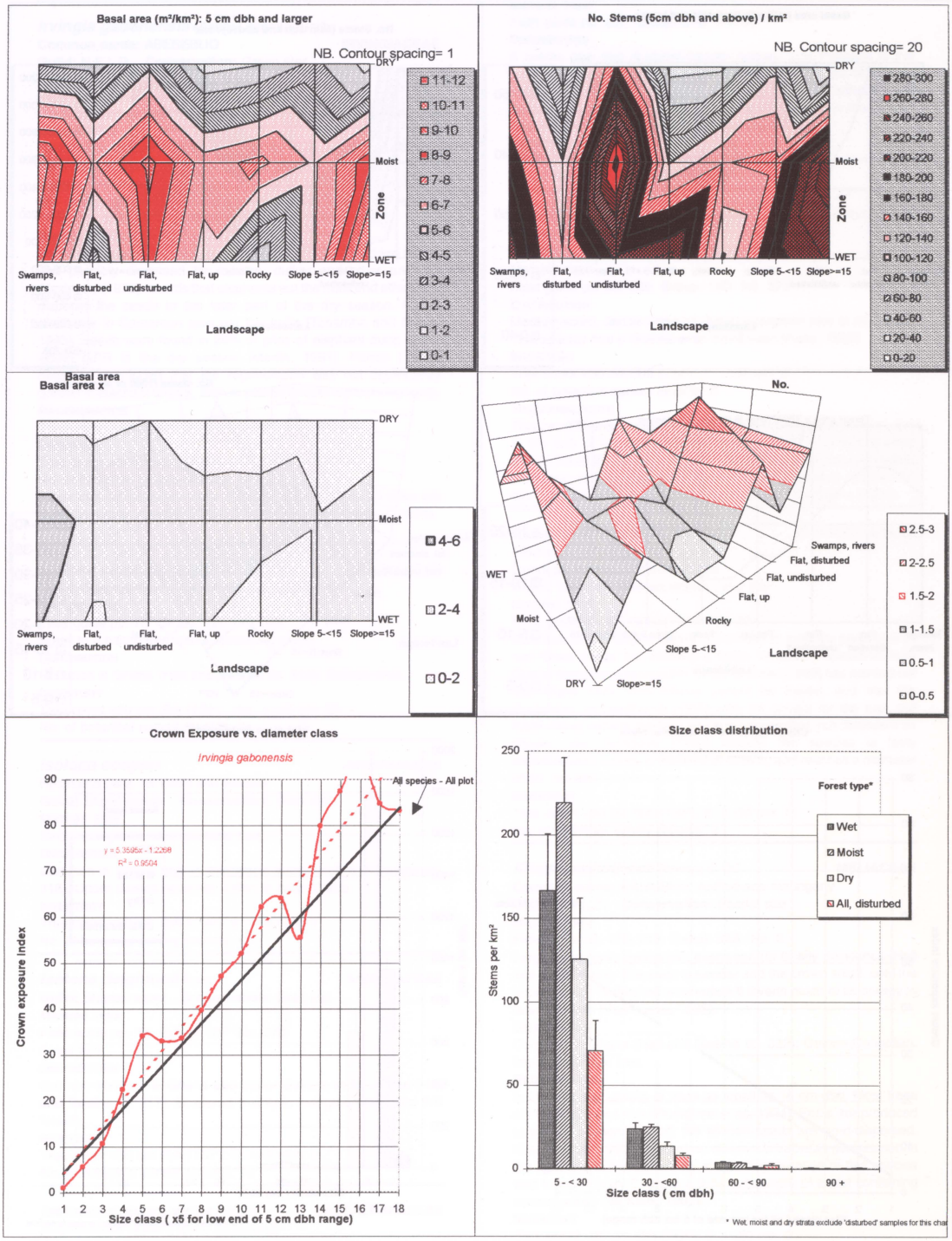




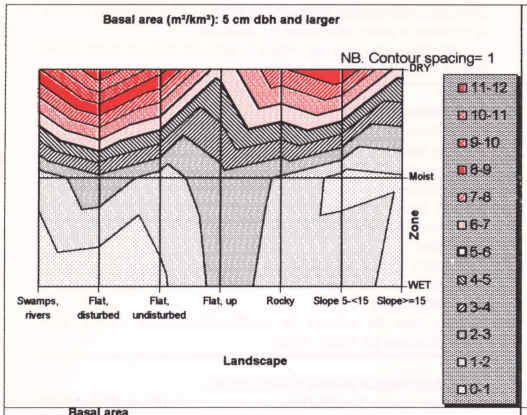


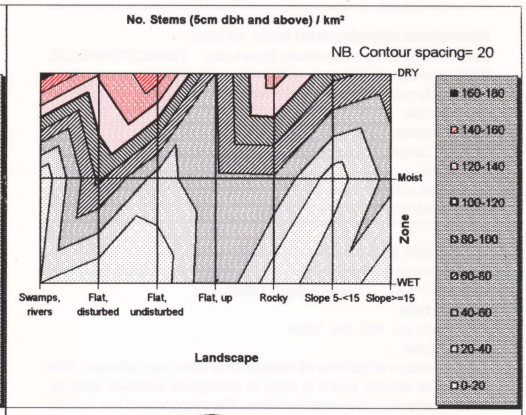


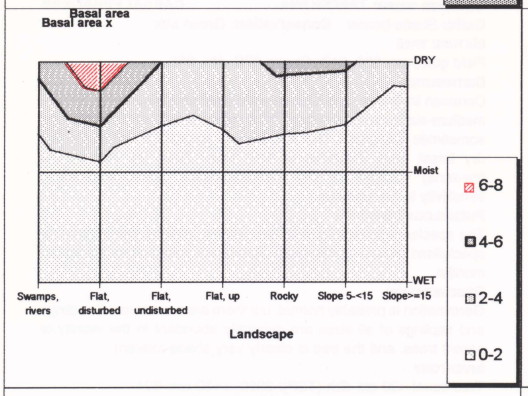
Irvingia gabonensis

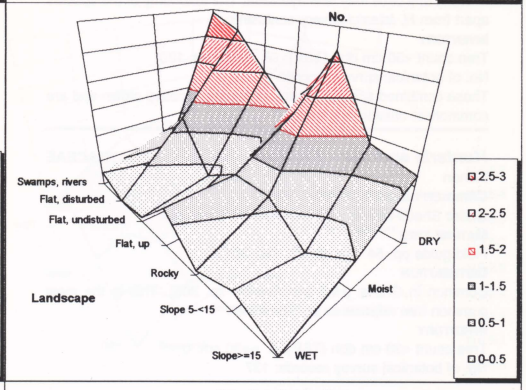


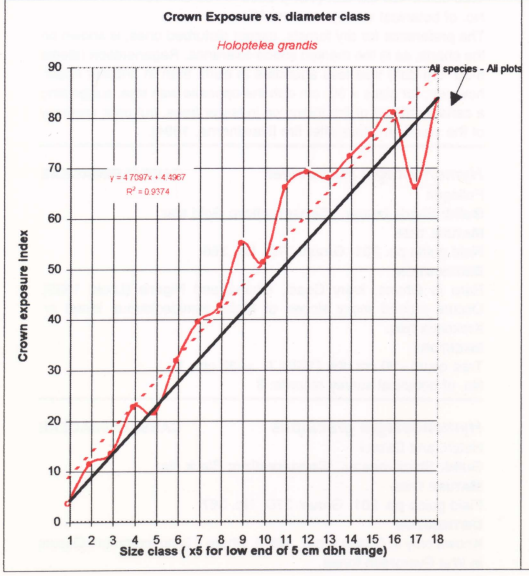
Holoptelea grandis

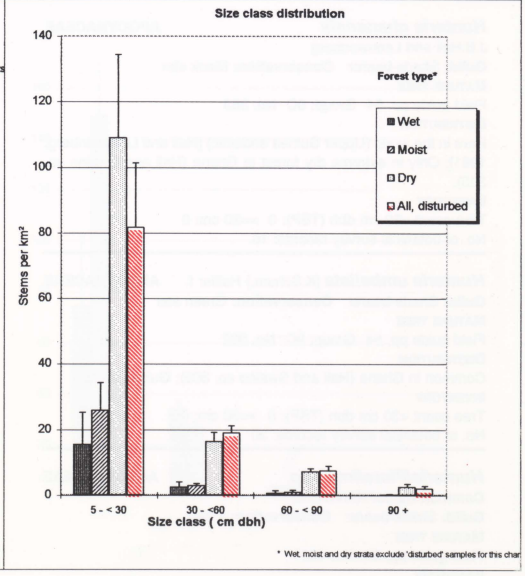












Homalium stipulaceum Welw. *ex* Mast.
Guild: N.P.L.D. **Conservation:** Green star **FLACOURTIACEAE**
MATURE TREE
Field guide pp. 109 Group: 17E No. 360
DISTRIBUTION
Fairly common in Ghana (Hall and Swaine sp. 301); Guineo-Congolian. See entry for *Homalium stipulaceum & dewevrei.*
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 42

Homalium stipulaceum & dewevrei
Common name: OWEBIRIBI **FLACOURTIACEAE**
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 109 No. 1359
DISTRIBUTION
Sapling foliage of species of *Homalium* is often very different from the mature leaves, and it is hard to distinguish between species, which in any case may well hybridise. The taxonomy of the species apart from *H. letestui* is very confusing.
INVENTORY
Tree count <30 cm dbh (TSP): 98 >=30 cm: 120
No. of botanical survey records: 6
These combined species have a generally exposed crown and are commonest outside dry forests.

Hunteria eburnea **APOCYNACEAE**
Pichon
Common name: KANWENE-AKOA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 54 Group: 9C No. 361
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 305). This is the most common tree referred to as 'Kanwene'.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 137

Hunteria ghanensis **APOCYNACEAE**
J.B.Hall and Leeuwenberg
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 54 Group: 9C No. 363
DISTRIBUTION
Rare in the world (Upper Guinea endemic) [Hall and Leeuwenberg, 1981]; Only in extreme dry forest in Ghana (Hall and Swaine sp. 305).
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 16

Hunteria umbellata (K.Schum.) Hallier f. **APOCYNACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 54 Group: 9C No. 362
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 305); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 30

Hunteria/Picralima spp. **APOCYNACEAE**
Common name: KANWENE
Guild: Shade-bearer **Conservation:** ? star
MATURE TREE
Field guide pp. 54 No. 1361
INVENTORY
Tree count <30 cm dbh (TSP): 1385 >=30 cm: 53
No. of botanical survey records: 1
Species of these genera have had to be amalgamated due to difficulty of segregating 'Kanwene' in the field. The combined density is greatest in evergreen forest (*H. eburnea*).
All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

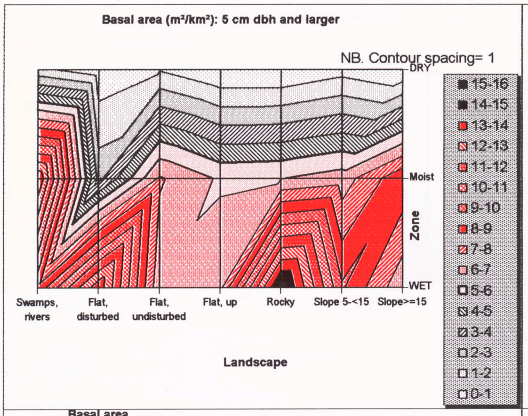
Hymenocardia lyrata Tul. **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** Gold star
MATURE TREE
Field guide pp. 127 Group: 21 No. 364
Medium-sized tree of dry forest close to savanna, on sandy soil; or fringing forest. Upper Guinea endemic. Rare within forests, but might be more common in pockets of more closed Guinea savanna.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 2
TAXONOMIC NOTE
Should now be placed in Hymenocardiaceae, rather than Euphorbiaceae [cf. Keay, 1989].

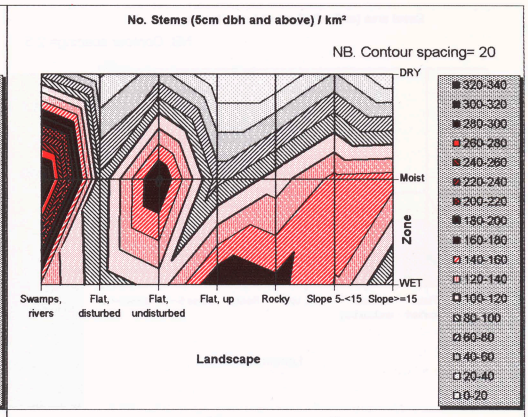
Hymenostegia afzelii (Oliver) Harms
Common name: TAKOROWA **CAESALPINIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 201, 243 Group: 37C No. 365
DISTRIBUTION
Common in Ghana, and Guinea-wide (Hall and Swaine sp. 308). A medium-sized tree common in a wide range of forests, and sometimes gregarious. Hall and Swaine record it is one of the few dry forest trees indicative of their Inner Zone (as opposed to fire-zone) subtype of Dry Semideciduous forest, suggesting sensitivity to fire damage.
PHENOLOGY/DISPERSAL
The species regenerates in its own shade, and the seeds have no specialised means of dispersal. Seeds are released in the wetter months.
REGENERATION
Germination is probably normal, but there are no records. Seedlings and saplings of all sizes are generally abundant in the vicinity of parent trees, and the tree is clearly very shade-tolerant.
INVENTORY
Tree count <30 cm dbh (TSP): 2050 >=30 cm: 604
No. of botanical survey records: 174
The preference for dry forests, except disturbed ones, is shown on the charts, as is the marked shade-tolerance. Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest; however, for sizes > 30 cm dbh the opposite was true, suggesting a certain amount of fire tolerance in larger trees, but poor recovery of the stand structure after fire [Hawthorne, 1994].

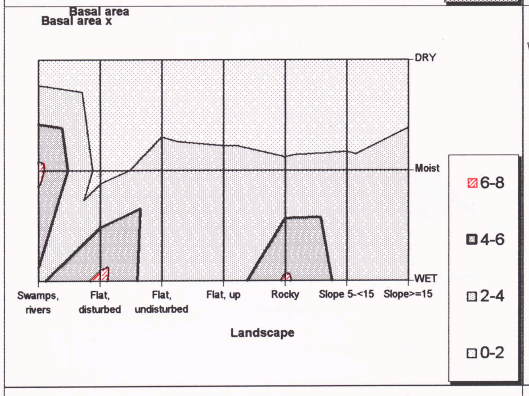
Hymenostegia aubrevillei **CAESALPINIACEAE**
Pellegrin
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 201 Group: 37C No. 366
DISTRIBUTION
Rare in Ghana; Ivory Coast, Ghana and Nigeria [Lock, 1989]. Occurs around rocky slopes of Moist semideciduous forest nr. Krokosua hills.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 10
No. of botanical survey records: 3

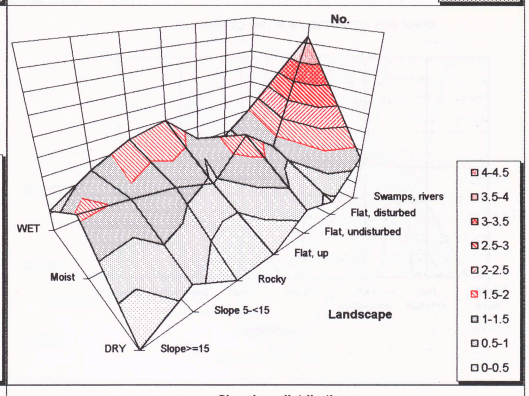
Hymenostegia gracilipes **CAESALPINIACEAE**
Hutch. and Dalziel
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 201 Group: 37C No. 367
DISTRIBUTION
Known only in Ghana [Lock, 1989], where it is not common. Occurs in Wet Evergreen forest.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 4

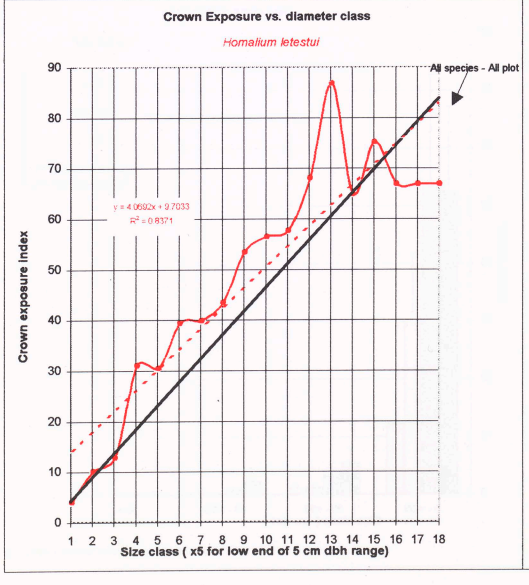
Homalium letestui

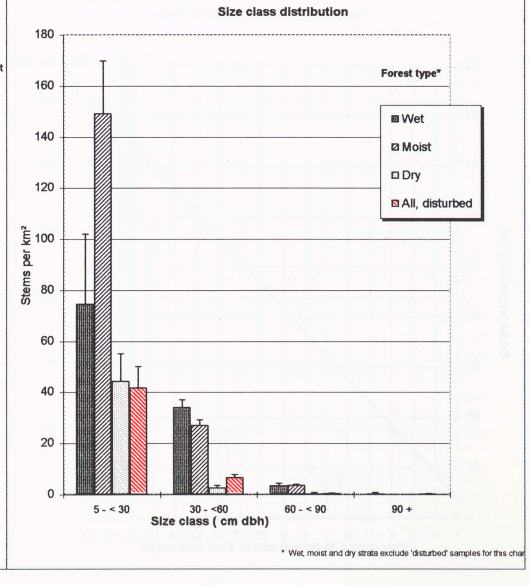




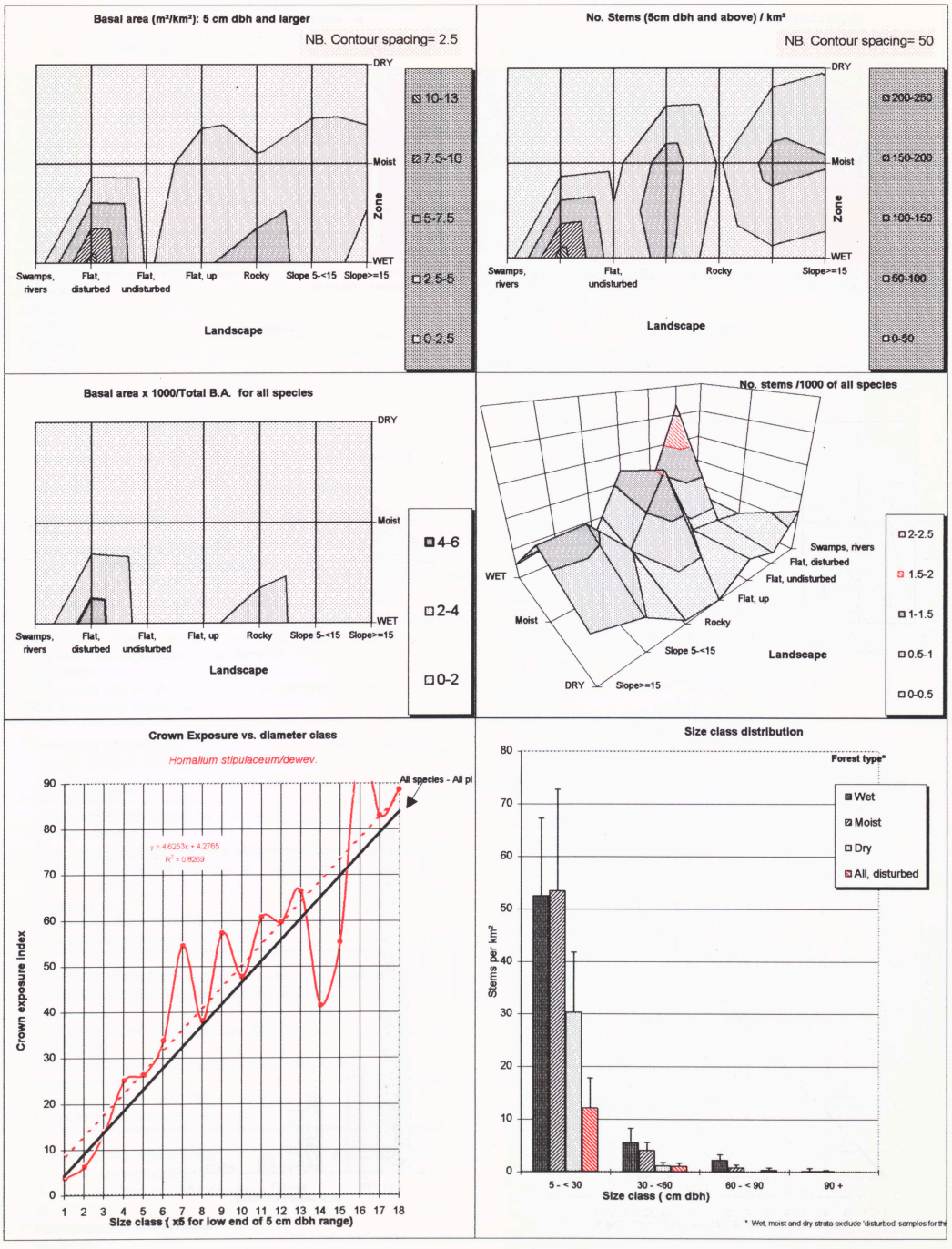




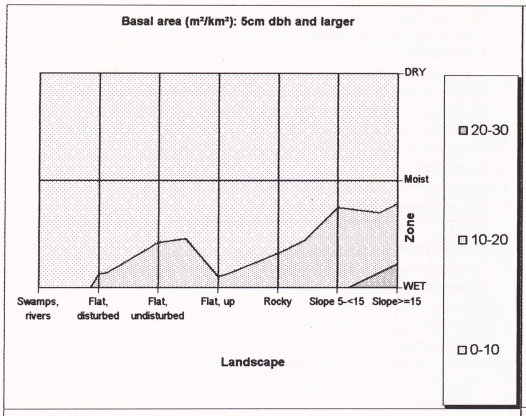


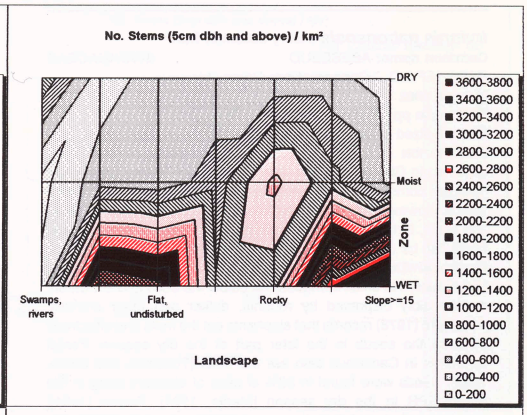


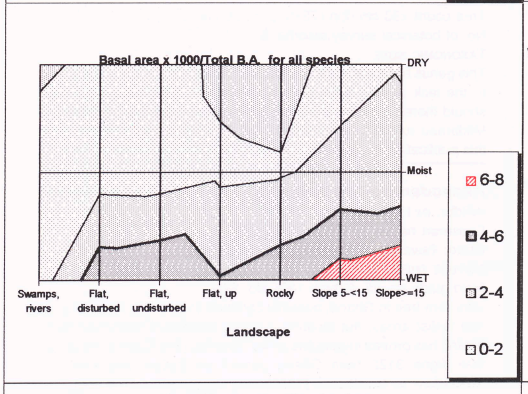
Homalium stipulaceum & dewevrei

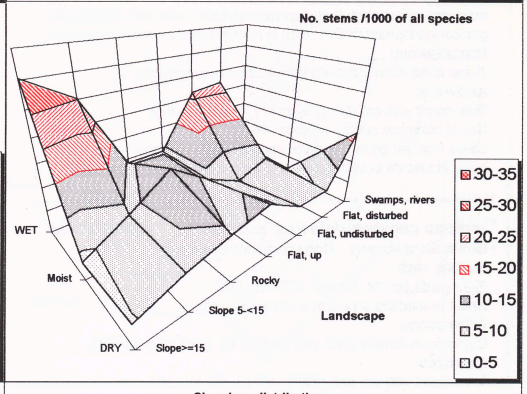


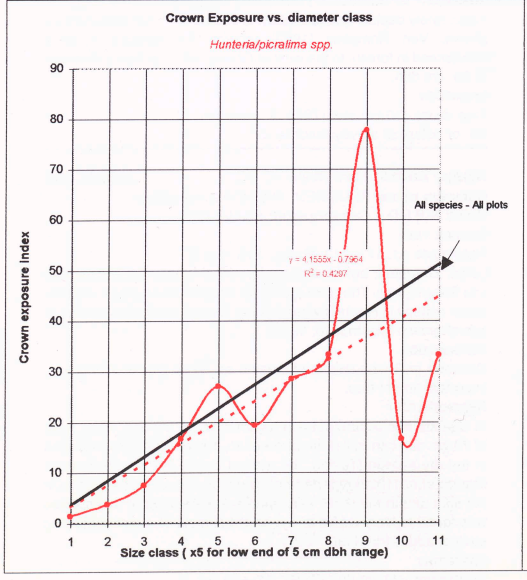
Hunteria/picralima spp.

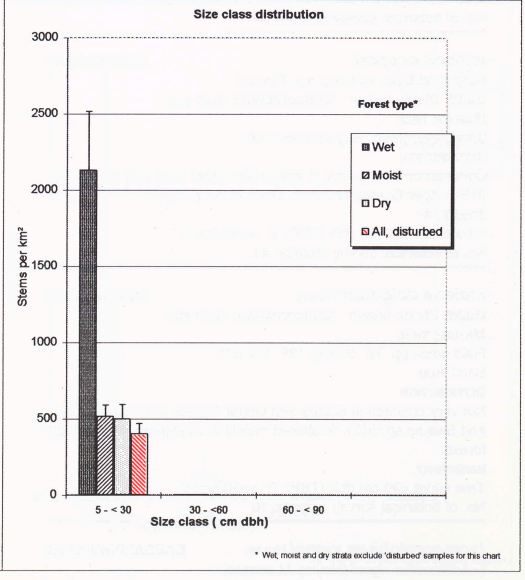












Irvingia gabonensis (Aubry-Lecomte) Baill.
Common name: ABESEBUO **IRVINGIACEAE**
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 86 Group: 13C No. 368
Medium-sized or large tree with dense, dark spherical crown.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 314). Mature (emergent) trees are commoner in low-lying areas [Lawson et al, 1970]. There seems, however, to be a great amount of infra-specific variation, and small, fertile trees can be found on higher land in dry forests. Fruits can be used to produce an edible oil [Abbiw, 1990].
PHENOLOGY/DISPERSAL
Large fruits, like small mangoes, fall below the trees and are eaten, and possibly dispersed by rodents, duiker and other animals. Alexandre (1978) records that elephants eat the fruits and effectively disperse the seeds in the later part of the dry season. Forest elephants in Cameroun also eat the fruits [Tchamba and Sema, 1993]. Seeds were found in 26% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991]. Parren [1991], however, concluded that the regeneration was not significantly greater in elephant forests than in nearby forests without elephants.
REGENERATION
There is no information on germination requirements.
INVENTORY
Tree count <30 cm dbh (TSP): 411 >=30 cm: 672
No. of botanical survey records: 44
Large tree are generally more exposed than average. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Isolona campanulata Engl. and Diels **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 78 Group: 12F No. 369
Small to medium tree with a spreading crown.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 315); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 169 >=30 cm: 39
No. of botanical survey records: 34

Isolona cooperi **ANNONACEAE**
Hutch.and Dalz. *ex* Coop.and Record
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Small, evergreen, very aromatic tree.
DISTRIBUTION
Common in Ghana only in evergreen forest (Hall and Swaine sp. 316); Upper Guinea endemic. Often in deep shade.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 41

Isolona deightonii Keay **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 78 Group: 12F No. 370
Small tree.
DISTRIBUTION
Not very common in Ghana and Upper Guinea endemic tree (Hall and Swaine sp. 317). Scattered mainly in evergreen (ME and WE forest).
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 16

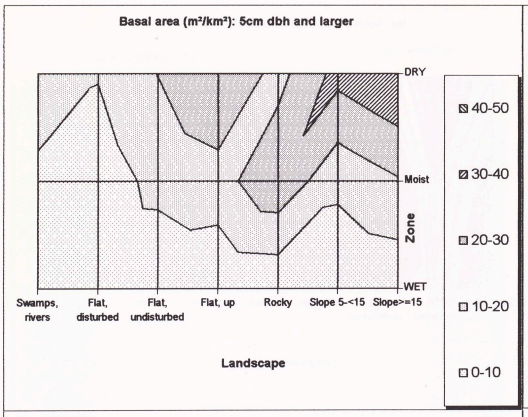
Isomacrolobium vignei Hoyle **CAESALPINIACEAE**
(=*Anthonotha vignei* (Hoyle) J.Leonard)
Common name: TUTUABO
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 205 Group: 37E No. 90
DISTRIBUTION
It seems now that *A.vignei* (Hoyle) Aubrev. and Pellegrin is the correct name. Verbal notification of the reinstatement of the old name has not yet been confirmed in the literature, although this species is rather different from the other Ghanaian *Anthonotha's*. Occurs near rivers in (lowland) evergreen forest.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 6

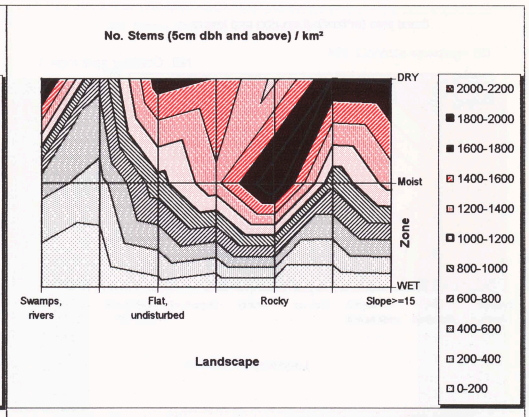
Ituridendron bequaertii De Wild. **SAPOTACEAE**
Common name: AKASOA-NINI
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 65, 236 Group: 10D No. 372
DISTRIBUTION
Medium-sized, dense-crowned, fluted evergreen tree in dry forest. This species has a Guinea-wide distribution [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 6
No. of botanical survey records: 8
TAXONOMIC NOTE
This genus has been sunk by Pennington into *Omphalocarpum*, due to the lack of any distinguishing characters. The current species should therefore be referred to as *Omphalocarpum pachysteloides* Mildbraed *ex* Hutchinson and Dalziel. The old name is retained for this publication to maintain compatibility with Hawthorne [1990].

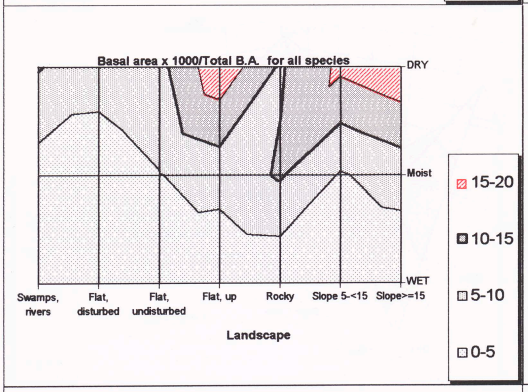
Keayodendron bridelioides **EUPHORBIACEAE**
(Mildbr. *ex* Hut. and Dalz.) Leandri
Common name: AKOKoSRADEe
Guild: ?swamp **Conservation**: Gold star
MATURE TREE
Field guide pp. 85 Group: 13B No. 374
Very rare tree in Ghana, possibly confined to swampy parts of drier rain forest areas; but locating a fertile herbarium specimen from Ghana has proved impossible so far. Breteler [1993] has pointed out that Vigne 3122 from Ghana cannot be traced, and that the illustration in Hawthorne [1990] may be correct for the leaf, but inaccurately depicts the fruit, which is indehiscent, not dehiscent as shown. Van Rompaey [1993] records the species is fairly widespread in forests to the west of Ghana, and reaches a diameter of 80 cm dbh.
INVENTORY
Tree count <30 cm dbh (TSP): 8 >=30 cm: 11
No. of botanical survey records: 2

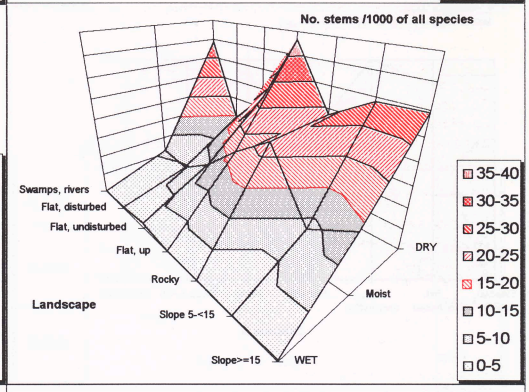
Khaya anthotheca (Welw.) C.DC. **MELIACEAE**
Common name: KRUMBEN, Anthotheca mahogany
Guild: N.P.L.D. **Conservation:** Scarlet star
MATURE TREE
Field guide pp. 173, 242 Group: 34A No. 6
Large, emergent, buttressed, evergreen (or briefly deciduous [Hall and Swaine] tree. The stem is slender and the crown small, until the upper canopy is reached whereupon it diverts much of its energy to lateral growth [Voorhoeve, 1965].
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 322); Guineo-Congolian. important timber tree.
REGENERATION
In Uganda fruit occurs of trees as small as 18 cm dbh. Most trees of 70 cm dbh can fruit [Plumptree *et al.*, 1994]. Fruits are produced in the dry season [Taylor]; the winged seeds are wind-dispersed. Kyereh *et al.* [1993] reported no difference between germination in the light and in the dark. Very sparse regeneration of this species was found in Ivory Coast in a 3 ha subsample of a plot containing several adults [de Klerk, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 25
GROWTH
Any growth rings in trees of this species are not likely to be annual

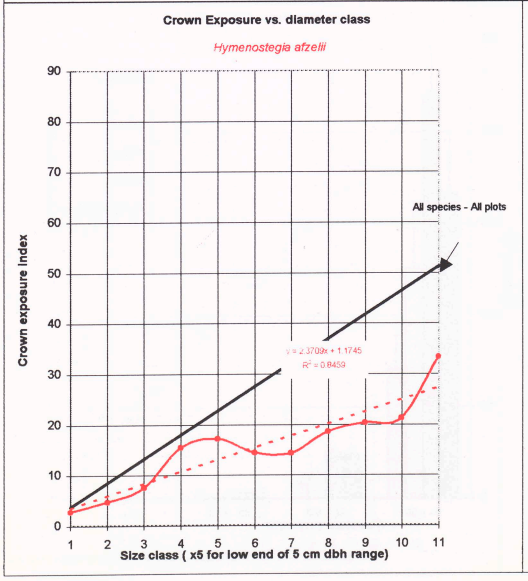
Hymenostegia afzelii

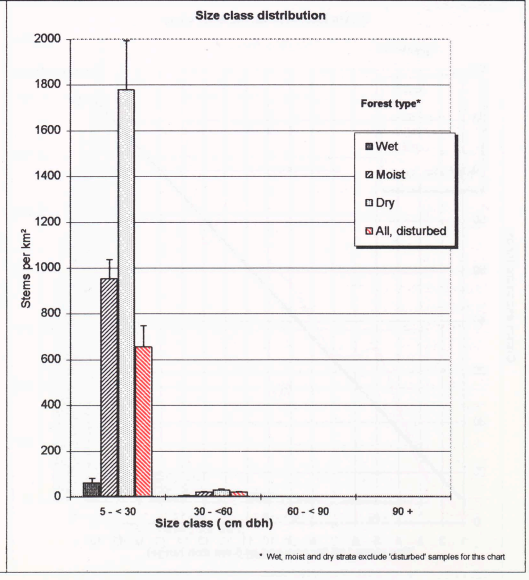




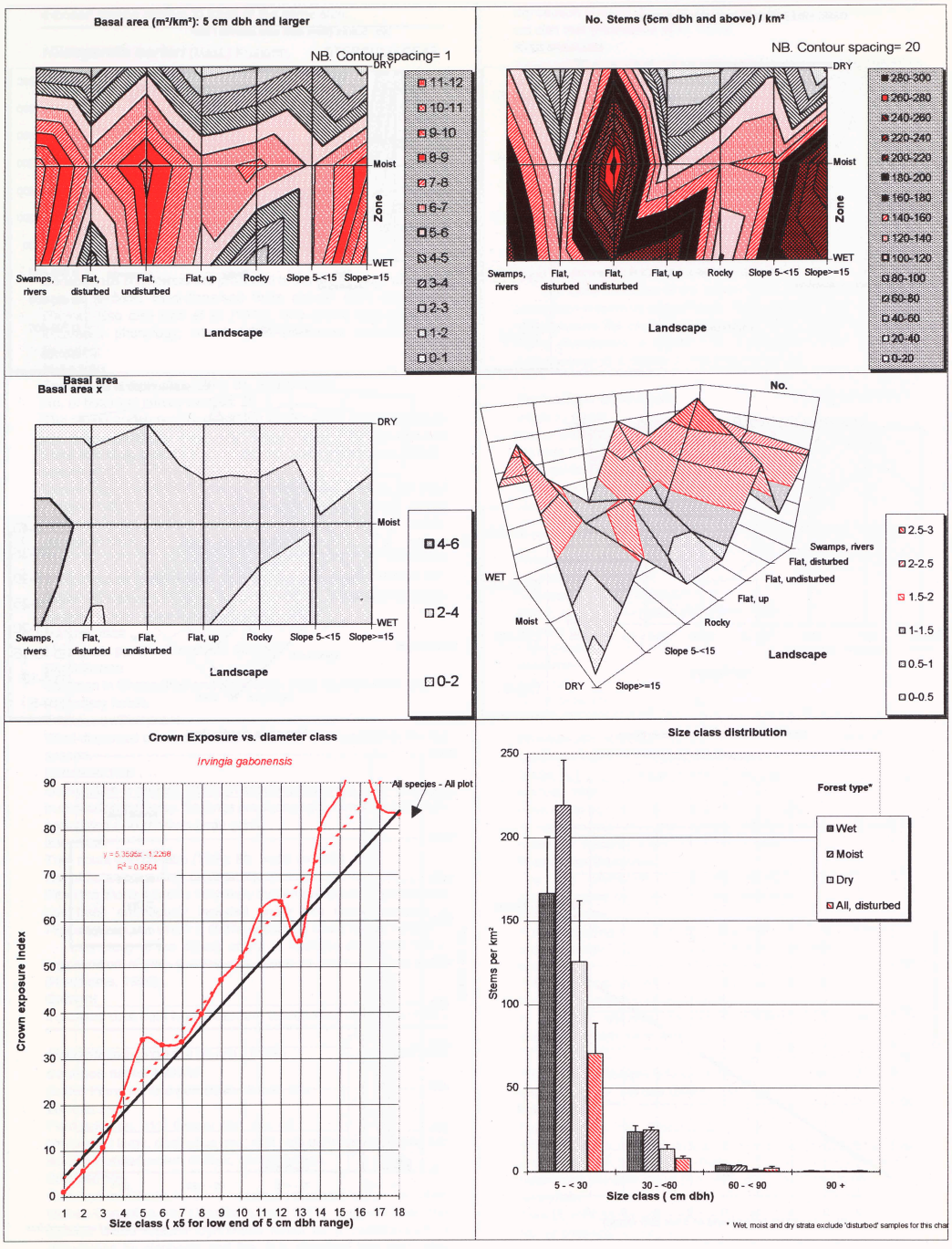




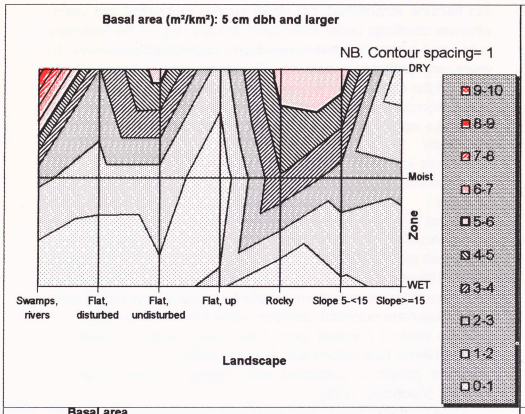


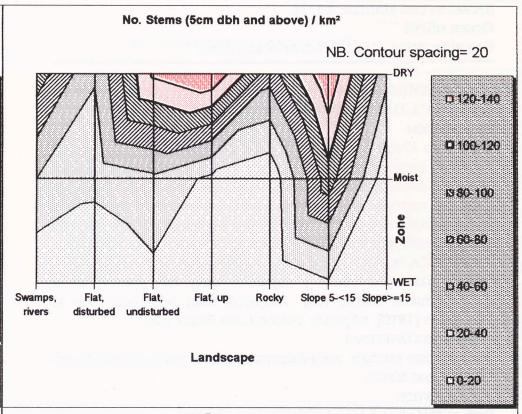


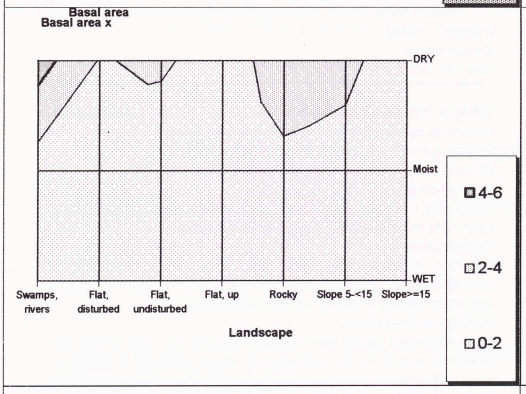
Irvingia gabonensis

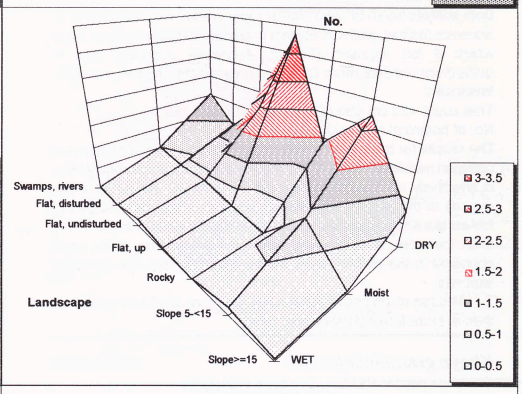


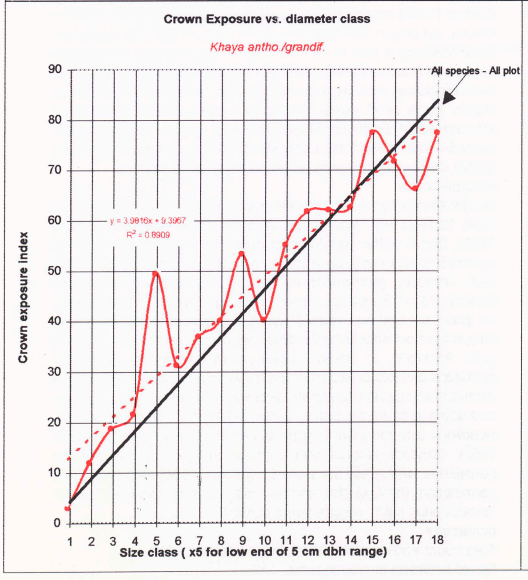
Khaya anthotheca & grandifoliola

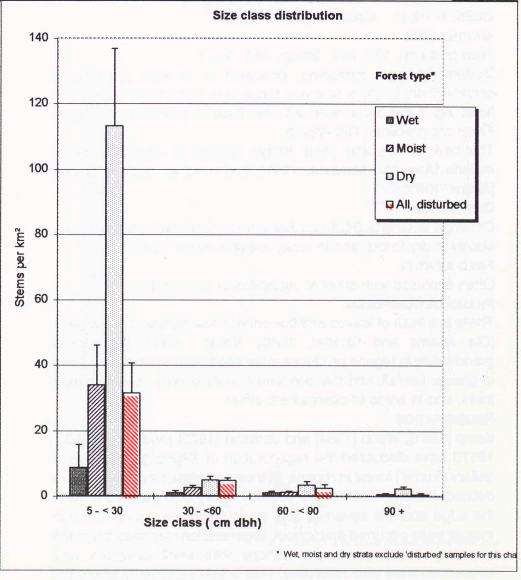












[Detienne and Mariaux, 1977].

OTHER NOTES

See also: Anon. [1951]; Widarti *et al.* [1986].

Khaya anthotheca/grandifoliola MELIACEAE

Guild: N.P.L.D. **Conservation:** Scarlet star

DISTRIBUTION

These two *Khaya* species have been amalgamated, due to some confusion between them, particularly in the smaller size classes. They can even hybridise on occasions [Synnott, 1985]. The adult trees can normally be segregated with confidence on the basis of preferred habitat.*K.g.* is common in Dry Semideciduous forest, and in forest outliers in the savanna zone, but is much rarer elsewhere, whereas *K.a.* is most typical of the MSNW zone. *K.g.* has a darker, rougher bark. However, *K.g.* occurs in rocky, hilly parts of Moist Semideciduous forests (e.g. Krokosua hills) and, according to Thompson [1910], originally around Lake Bosumptwi.

PHENOLOGY/DISPERSAL

Both species produce wind-dispersed seeds, particularly between October and March.

REGENERATION

Both species seem to have similar regeneration requirements to *K. ivorensis* (below), and *K.g.* at least is also susceptible to shoot borer attack if too exposed [Taylor]. Aubréville suggests that *K. anthotheca* requires more light, and grows faster than *K. ivorensis*.

INVENTORY

Tree count <30 cm dbh (TSP): 99 >=30 cm: 188

No. of botanical survey records: 0

The results for these two species have been combined because of common misidentification of the regeneration stages. However, *K.g.* is effectively confined to the dry fire zone forest, except for a few records in the MSNW set where it occurs on the rocky slopes of forests like Krokoshua hills. *Khaya anthotheca*, which dominates the chart therefore, is surprisingly rare for a timber tree, being most abundant in the MSNW zone. Medium size classes are generally exposed.

All sizes of the combined species are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Khaya grandifoliola C.DC. MELIACEAE

Common name: KRUBA, Dry zone mahogany

Guild: N.P.L.D. **Conservation:** Red star

MATURE TREE

Field guide pp. 173, 242 Group: 34A No. 7

Moderately large, spreading, emergent or at least (gregarious) canopy of dry forest or savanna fringe tree. Sometimes deciduous, flowering in the dry season with the flush of new leaves [Taylor]. Fruits are produced Oct.-March.

The bark of this and other *Khaya* species is effective against malaria [Awe and Makinde, 1991], and used as such in Ghana [Abbiw, 1990].

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 323); Guineo-Congolian. Mainly in dry forest, and in rocky forest in wetter zones.

FIELD IDENTITY

Often confused with other *K. grandifoliola* as a sapling.

PHENOLOGY/DISPERSAL

There is a flush of leaves and flowering in the dry season in Nigeria [Ola Adams and Charter, 1980]. Kemp notes that *Khaya grandifoliola* in Nigeria produces more seeds and seedlings in years of greater rainfall, and that seedling density is very close to parent trees, and in areas of sparse herb cover.

REGENERATION

Kemp [1961], Webb [1964] and Jackson [1973] (and Anon. [1953, 1957]) have discussed the regeneration of *Khaya grandifoliola* in gallery ('kurmi') forest in Nigeria. In these patches, three zones were defined: internal, close to the streams; a dry boundary zone, near the edge and the savanna; and an intermediate zone. Although mature trees occurred throughout, regeneration was greatest in the boundary zone, where the canopy was least complete (soil differences were also recorded). This is true particularly where the edge is free from fire damage. Regeneration is limited on the other hand by excessive shade. Experiments carried out with permanent sample plots in kurmi forest showed how in closed forest, seedlings can become established, but rarely survive more than two years, whereas seedlings under more open canopy (e.g. in the boundary zone, and where the forest has been treated) often survive 10 years, and probably to maturity. The conclusion of these studies was that the species is a 'pioneer' in the transition from savanna to forest, according with Jones' [1963] observation that larger trees tend to be nearer the centre of the forest patches.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 21

GROWTH

Increment in Nigeria is correlated with tree size, but not obviously with environmental variables [Kemp and Lowe, 1973]. Kemp [1961] noted that the growth rate of *Khaya grandifoliola* was low (6-7ft girth in 100 years), dependent on annual rainfall and on competition even from the surrounding smaller plants. In plantations higher rates of increment are recorded. Jackson notes that seedlings take c. 15 years to attain 2.7 inches girth. Trees grow fastest in months of highest rainfall [Ola Adams and Charter, 1980].

Plant growth is correlated with degree of endomycorrhizal infection [Redhead, 1975].

Growth rings occur, but could not be correlated with age [Hummel, 1946].

OTHER NOTES

See also Anon [1962]; Osmaston [1958].

Khaya ivorensis A.Chev. MELIACEAE

Common name: DUBINI, Afric.mahogany, Acajou

Guild: N.P.L.D. **Conservation:** Scarlet star

MATURE TREE

Field guide pp. 173, 242 Group: 34A No. 8

Very large tree, high-buttressed, with dark-green, rounded crown, often with the pendulous, spherical fruits visible.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 324); Guinea-wide. Important timber tree, but often confused with other mahoganies by exploiters and as a young tree by tree spotters.

PHENOLOGY/DISPERSAL

Wind-dispersed seeds are produced around the start of the wet season or end of the dry season (Feb.-May.), although in Nigeria at least fruits may be produced at other times of year [Sanders,1953]. Gyimah [1986] records flowering and fruiting throughout the year in Ghana, but only in the Moist Evergreen zone; in the Wet Evergreen zone flowering is said to be from July to January, and fruiting from January to March. Gyimah gives the flowering season for the Moist Semideciduous zone as June-September; fruiting from October to March. Trees of 30 years can produce good crops of seeds and, although some seed is produced annually, good seed crops occur every 3-4 years [Sanders]. Lancaster (1954) recorded a very patchy spatial distribution of seeds, even during a good year.

REGENERATION

Germination is hypogeal, but otherwise normal, with limited viability (from 100% at first, down to 5% success after 3 months [Sanders, 1953]. Seeds suffer heavily from predation. Kyereh *et al.* [1993] reported no difference between germination in the light and in the dark. However, germination is strongly depressed in large gaps [Kyereh, 1994]. Seedlings require to be lightly shaded in nurseries, for about the first two years [Taylor]. If exposed to too much sun they suffer from attacks by the *Hypsipyla* moth larvae, and from leaf galls. However, in natural forest, even though the seedlings germinate and can survive below a dense layer (e.g. a year beneath *Aframomum* stands [Sanders]), seedling survival is encouraged by increasing light levels above those below the complete canopy. Seedlings are common in gaps below climber tangles [Sanders, 1953]. Sanders records that saplings suffer from damage by porcupines, which eat the bark. Lancaster [1954] also noted that germination (best in the shade) and seedling growth (best in 'considerable light') requirements conflict.

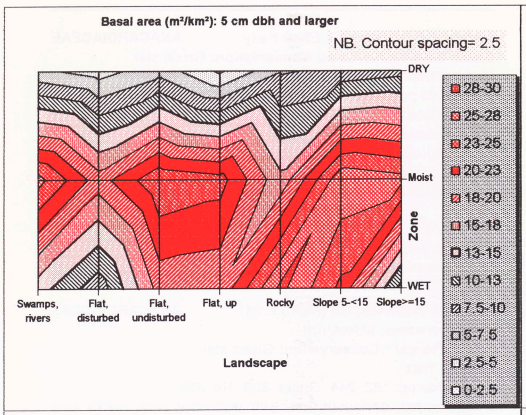
INVENTORY

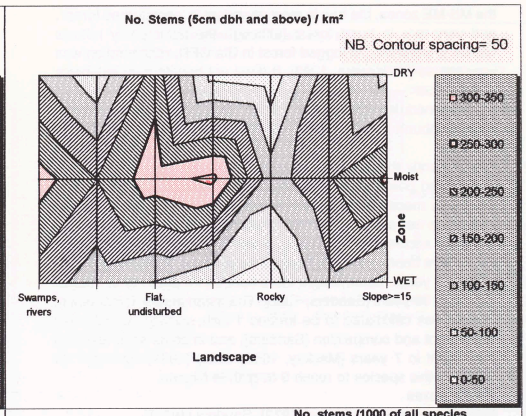
Tree count <30 cm dbh (TSP): 344 >=30 cm: 1098

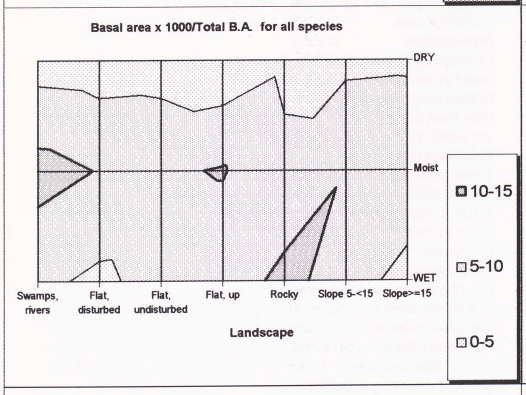
No. of botanical survey records: 125

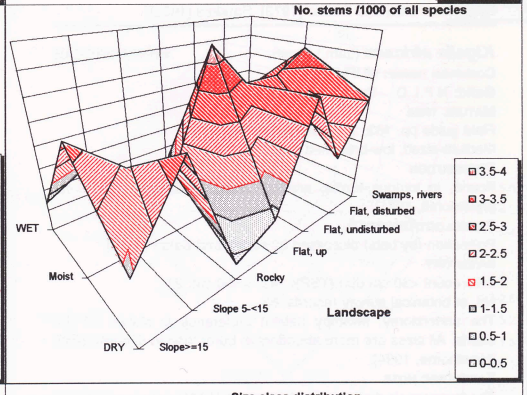
This species is most abundant, and regenerates most abundantly therefore, in the evergreen forest zone. The smaller trees are generally more exposed than is typical for trees of their size. Within

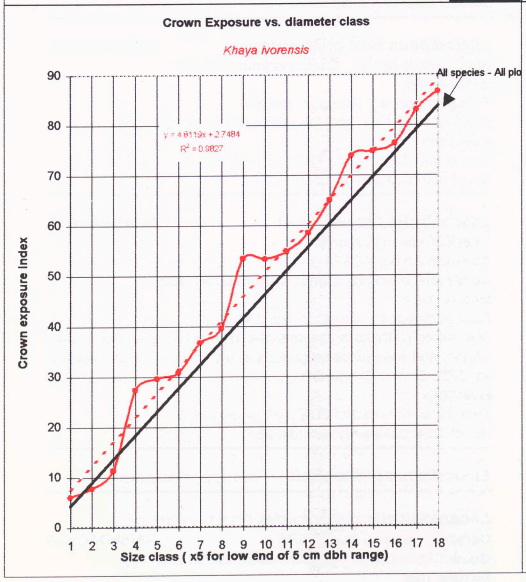
Khaya ivorensis

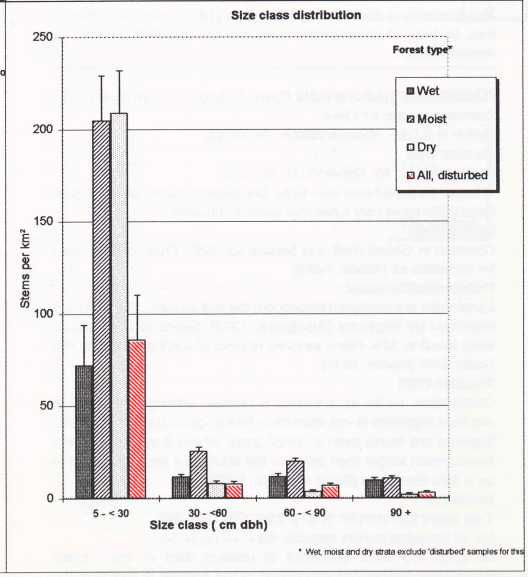












the MS-ME zones, the tree is most abundant in 'undisturbed forest', and very rare in burnt forest (although the latter partly reflects habitat preference). In logged forest in Bia GPR, regeneration was very sparse [Hawthorne, 1993]. It does not benefit from extensive disturbance.

Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest [Hawthorne, 1994].

GROWTH

Subsequently the species is a light demander but with a narrow crown, and possibly other attributes that seem to suit it more to small and medium-sized gaps than to larger-grained disturbance. The tree is well suited to Tropical Shelterwood System management (or, more accurately, vice-versa), where c. 1 height increment in 4 years have been recorded [Taylor]. increasing to almost 3 per year after c. 7 years. Later, height increment slows again to c. 1m per year over 30 years [Sanders, 1953]. The mean annual increment in Nigeria was calculated to be around 1 inch, varying considerably with height and competition [Sanders], and in some sites reaching 10 height in 7 years [Mackay, 1953]. Keay [1961] estimated 88 years for this species to reach 9 ft. girth in Nigeria.

OTHER NOTES

Other refs: Okali and Dodoo [1973]; Sanders [1953].

Kigelia africana (Lam.) Benth. **BIGNONIACEAE**

Common name: NUFUTEN

Guild: N.P.L.D. **Conservation:** Green star

MATURE TREE

Field guide pp. 163, 245 Group: 30 No. 375

Medium-sized, low-branched tree.

DISTRIBUTION

Found, in various forms, across Africa in savanna and forest [Innamorati, 1971].

PHENOLOGY/DISPERSAL

Pollination (by bats) discussed by Harris and Baker [1958].

INVENTORY

Tree count <30 cm dbh (TSP): 142 >=30 cm: 21

No. of botanical survey records: 63

The understorey, swampy habitat preference is shown on the charts. All sizes are more abundant in burnt than in unburnt forest [Hawthorne, 1994].

TAXONOMIC NOTE

The taxonomy is discussed by Innamorati [1971], who recommends that, in spite of considerable variation, the genus is treated as monospecific.

Klainedoxa gabonensis Pierre *ex* Engl. **IRVINGIACEAE**

Common name: KROMA

Guild: N.P.L.D. **Conservation:** Green star

MATURE TREE

Field guide pp. 86 Group: 13C No. 376

A large, emergent tree with wide, but domed, dense crown. Large trees often have very extensive plank buttresses.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 325). Fruits can be used for an edible oil [Abbiw, 1990].

PHENOLOGY/DISPERSAL

Large fruits are produced throughout the wet season. The fruits are dispersed by elephants [Alexandre, 1978]. Seeds of this species were found in 32% (rainy season) of piles of elephant dung in Bia South GPR [Martin, 1991].

REGENERATION

Germination, as far as is known, is normal, although the effect of elephant ingestion is not recorded. Seedlings occur in the shade. Saplings are found even in small gaps, where they usually have leaves much longer than those of the adult. The species is said to be a light demander [Savill and Fox, 1967].

INVENTORY

Tree count <30 cm dbh (TSP): 226 >=30 cm: 865

No. of botanical survey records: 43

All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The distribution of the species is similar to the related species *Irvingia*. Younger trees are also rather shaded.

Lannea nigritana (Sc.Elliot) Keay **ANACARDIACEAE**

Guild: Savanna/non-forest **Conservation:** Green star

MATURE TREE

Field guide pp. 182

DISTRIBUTION

(var. *nigritana*. Common in Ghana in extreme dry forests (Hall and Swaine sp. 335), from Senegal to Benin, Guinea-wide (Keay, 1989). Var. *pubescens* Keay (Ivory coast to Nigeria) is a related woodland/rocky area (not forest) species, with evenly-spaced leaves.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 37

Lannea welwitschii (Hiern) Engl. **ANACARDIACEAE**

Common name: KUMANINI

Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 182, 244 Group: 35B No. 378

Medium-sized, deciduous tree with distinctive pock marks over cylindrical bole.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 336). A sun-loving tree found in wet places, but not restricted to them.

PHENOLOGY/DISPERSAL

Ripe fruits are produced towards the end of the rainy season. They are small, fleshy drupes and probably dispersed by birds.

REGENERATION

There are no details on germination requirements, although Hall and Swaine claim that the tree regenerates in the shade. If so, seedlings suffer a high mortality in the shade, and saplings are generally found in medium-large gaps.

INVENTORY

Tree count <30 cm dbh (TSP): 358 >=30 cm: 1113

No. of botanical survey records: 113

The charts show the species to be generally exposed, and to prefer dry forest swamps. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The generally exposed regeneration shows little preference either for different forest zones, or for different disturbance histories.

Lasiodiscus fasciculiflorus Engl. **RHAMNACEAE**

Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 41 Group: 2 No. 379

Shrub or small tree, often on riverbanks or rocky slopes.

INVENTORY

Tree count <30 cm dbh (TSP): 4 >=30 cm: 0

No. of botanical survey records: 10

Lasiodiscus mannii Hook.f. **RHAMNACEAE**

(=Lasiodiscus mildbraedii)

Common name: ADAFA

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 41 Group: 2 No. 380

The variety in Ghana is var. *chevalieri* (Hutch.) N.Hallé. Common in Ghana, and sometimes gregarious in dry forest (Hall and Swaine sp. 338); Guineo-Congolian.

INVENTORY

Tree count <30 cm dbh (TSP): 35 >=30 cm: 3

No. of botanical survey records: 26

Lasiodiscus mildbraedii see *Lasiodiscus mannii*

Lecaniodiscus cupanioides Planch. *ex* Benth.

Common name: DWINDWERA **SAPINDACEAE**

Guild: Shade-bearer **Conservation:** Green star

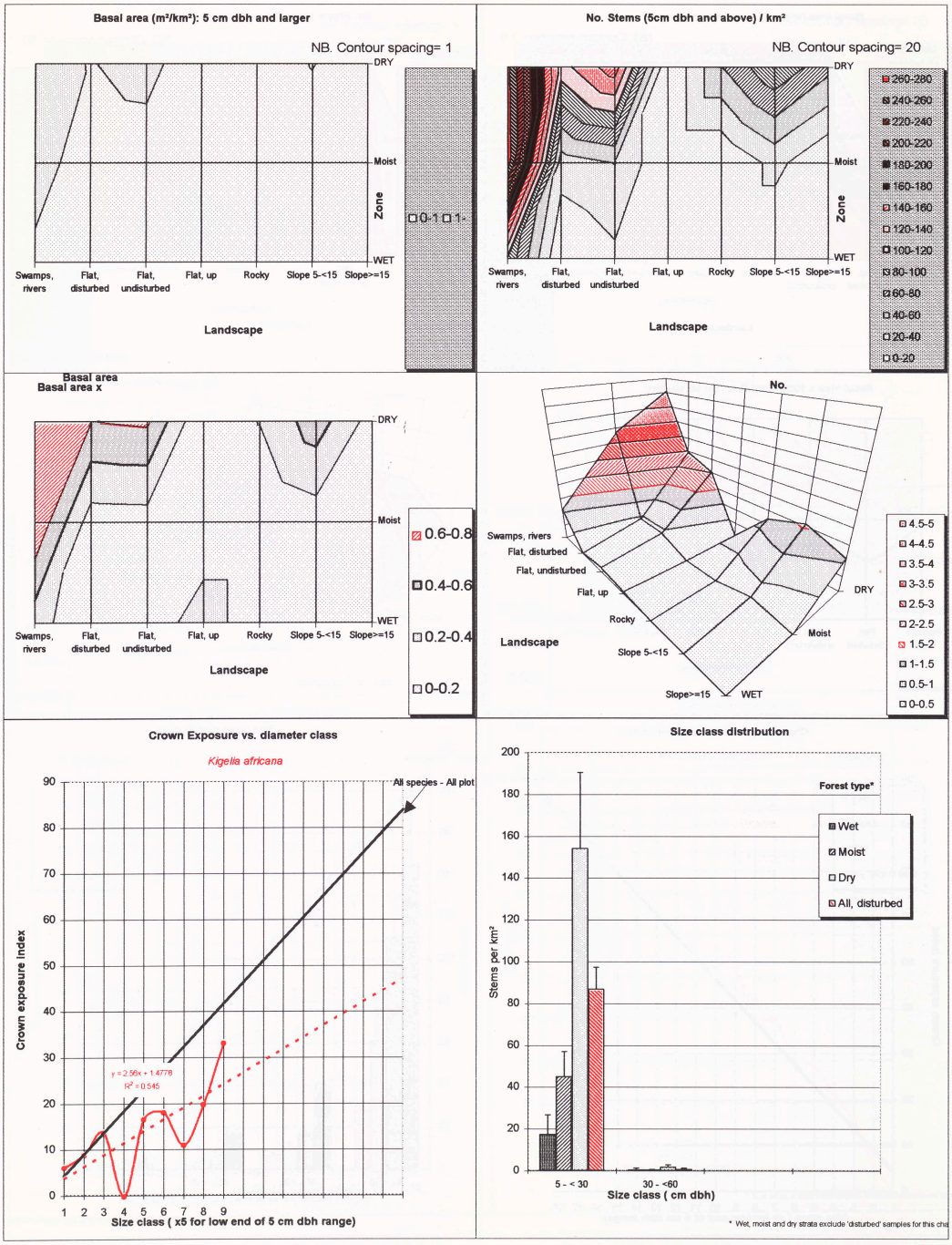
MATURE TREE

Field guide pp. 187 Group: 36A No. 381

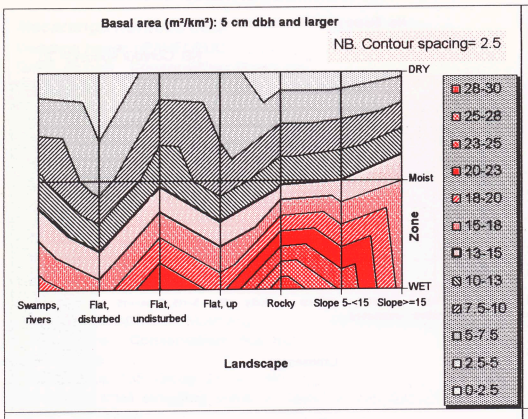
DISTRIBUTION

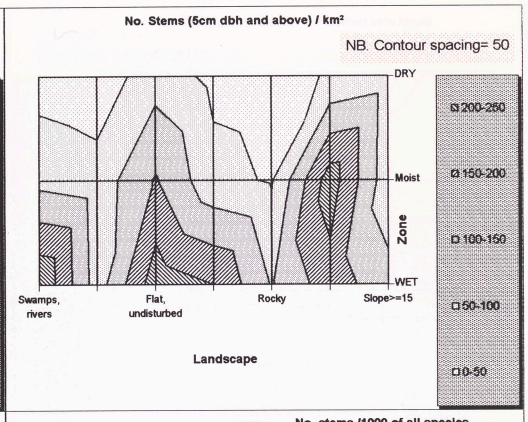
Common in Ghana (Hall and Swaine sp. 339); associated with

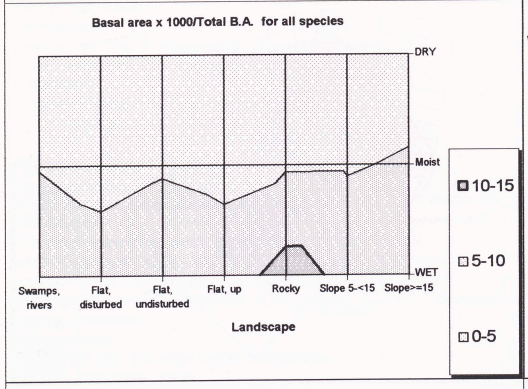
Kigelia africana

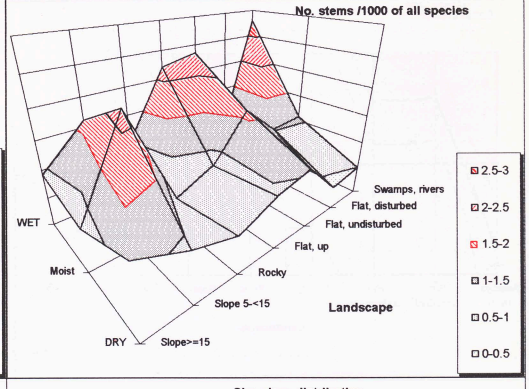


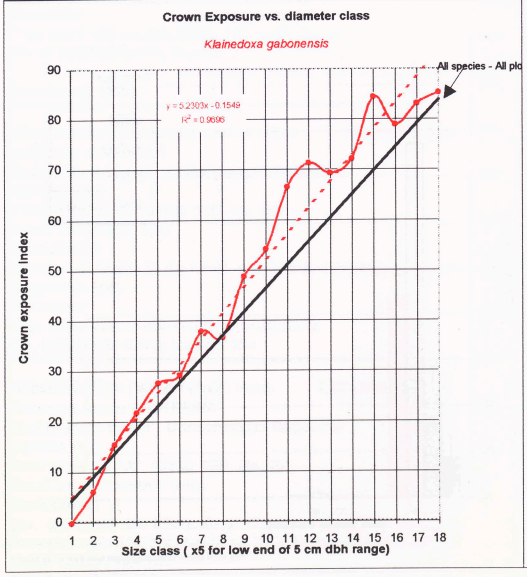
Klainedoxa gabonensis

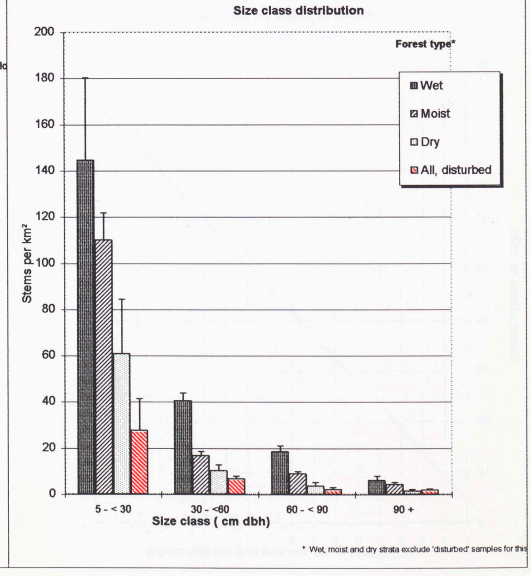




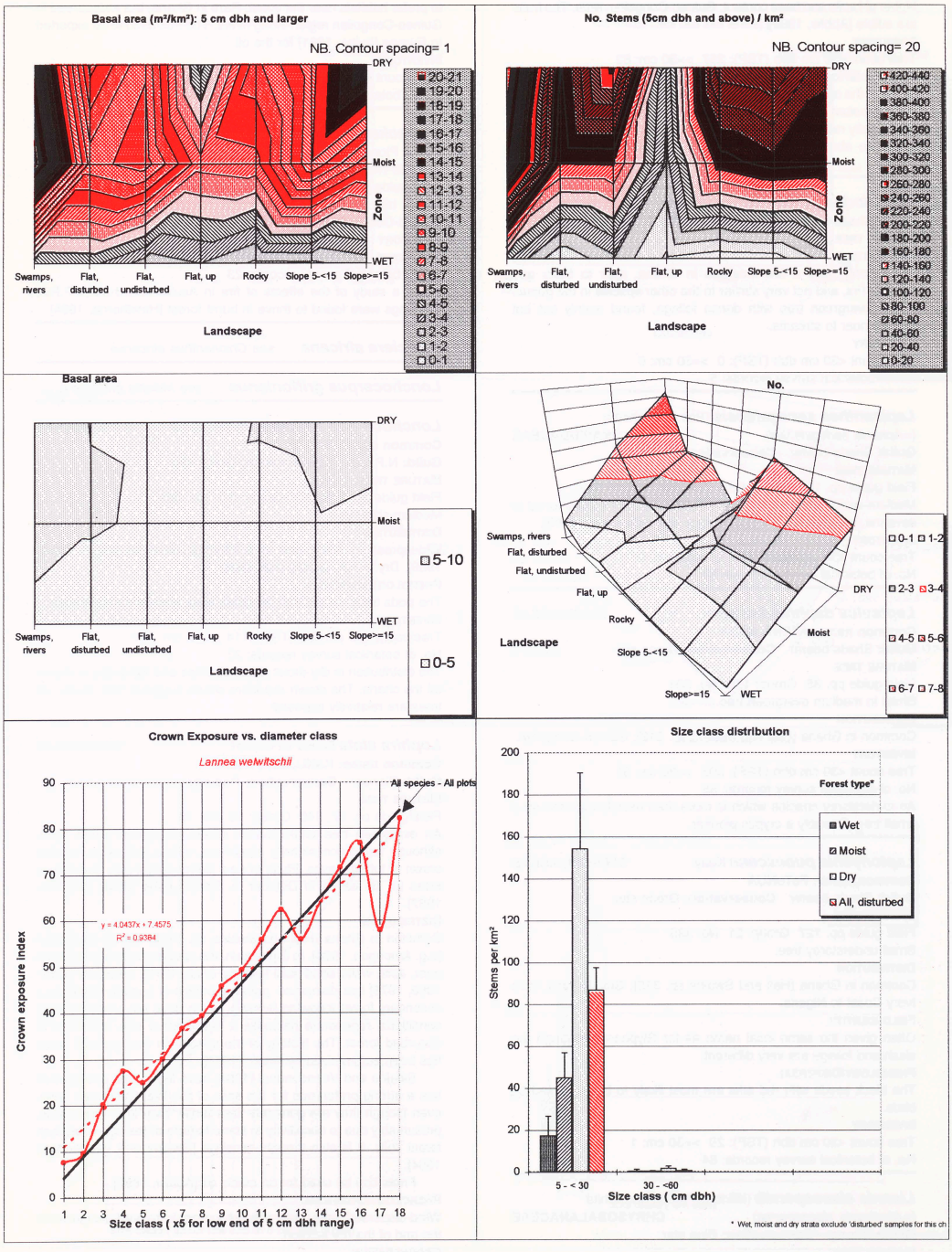








Lannea welwitschii



higher pH soils and base content; Guineo-Congolian wide. The fruits are edible [Abbiw, 1990].

INVENTORY

Tree count <30 cm dbh (TSP): 257 >=30 cm: 82
No. of botanical survey records: 241
Some of the charted records in swampy areas could be of *Aporrhiza* or *Eriocoelum* spp. The species otherwise peaks in dry forest and is generally rather shaded. It may well be a cryptic pioneer. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Lecaniodiscus punctatus J.B.Hall **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Black star

MATURE TREE

DISTRIBUTION

Known only from a few localities in Ghana, near to Baku and Supong Frs, and not very similar to the other species in the genus. Small, evergreen tree with dense foliage, found mainly but not entirely near to streams.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Lepisanthes senegalensis (Poir.) Lennhouts
(=*Aphania senegalensis*) **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 187 Group: 36A No. 383
Medium-sized, evergreen tree in forest, especially gallery forest in savanna, widespread in tropical Africa and Asia [Keay, 1989].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 34

Leptaulus daphnoides Benth. **ICACINACEAE**
Common name: AFENA-AKOA
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 85 Group: 13B No. 384
Small to medium evergreen tree.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 342); Guineo-Congolian.

INVENTORY

Tree count <30 cm dbh (TSP): 503 >=30 cm: 61
No. of botanical survey records: 55
An understorey species which is more than usually exposed as a small tree. Possibly a cryptic pioneer.

Leptonychia pubescens Keay **STERCULIACEAE**
Common name: FoToNUA
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 127 Group: 21 No. 385
Small understorey tree.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 345); Guinea-wide, from Ivory Coast to Nigeria.

FIELD IDENTITY

Often given the same local name as for Glyphaea, although the slash and foliage are very different.

PHENOLOGY/DISPERSAL

The black seeds with red arils are most likely to be dispersed by birds.

INVENTORY

Tree count <30 cm dbh (TSP): 29 >=30 cm: 1
No. of botanical survey records: 84

Licania elaeosperma (Mildbr.) Prance and White
(=*Afrolicania elaeosperma*) **CHRYSOBALANACEAE**
Guild: Swamp **Conservation:** Blue star

MATURE TREE

Field guide pp. 91 Group: 14A No. 386
Medium-sized swamp forest tree of the Wet Evergreen zone; seems to prefer habitats near the coast. Rare in Ghana, but widespread in Guineo-Congolian region along rivers. The fruit used to be exported to Europe [Irvine, 1961] for the oil.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

Lindackeria dentata (Oliv.) Gilg **FLACOURTIACEAE**
Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 131 Group: 22A No. 387
Small tree or shrub with spiny twigs, in disturbed forest; Guineo-Congolian [Irvine, 1961].

INVENTORY

Tree count <30 cm dbh (TSP): 26 >=30 cm: 0
No. of botanical survey records: 23

In a study of the effects of fire in Asukese and other F.R.s, seedlings were found to thrive in burnt forest [Hawthorne, 1994]

Linociera africana see *Chionanthus africanus*

Lonchocarpus griffonianus see *Millettia griffoniana*

Lonchocarpus sericeus (Poiret) Kunth **PAPILIONACEAE**
Common name: SANTE
Guild: N.P.L.D. **Conservation:** Green star

MATURE TREE

Field guide pp. 213, 237 Group: 37I No. 391
Medium-sized tree.

DISTRIBUTION

Widespread in Africa and in S.America; used for poison [Lock, 1989]. Dry forest, usually near water.

PHENOLOGY/DISPERSAL

The pods hang on the tree for some time, and do not split open.

INVENTORY

Tree count <30 cm dbh (TSP): 114 >=30 cm: 227
No. of botanical survey records: 23
The distribution in dry-moist forest swamps and flat areas is shown on the charts. The crown exposure charts suggests that 15-30 cm trees are relatively exposed.

Lophira alata Banks *ex* Gaertn. **OCHNACEAE**
Common name: KAKU, Ekki, Azobe
Guild: Pioneer **Conservation:** Red star

MATURE TREE

Field guide pp. 97, 240 Group: 16 No. 19
An evergreen tree characteristic of the evergreen forest zone, although found occasionally elsewhere, with a distinctive, modest crown of tufted leaves. Flush of new leaves bright red. Sometimes loses all its leaves in October in Sierra Leone [Savill and Fox, 1967].

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 349); Guineo-Congolian [e.g. Amougou, 1990]. In Cameroun, the species occurs partially on poor, acid, white sand soils [McKey *et al.*, 1978]. Letouzey [1957, 1960, 1978] has discussed possible origins of Lophira forest, as a secondary forest following farming, which does not, under present conditions, regenerate naturally. It is a pioneer tree, indicative of disturbed forest. The biology of the species in very general terms has been summarised by Anon. [1954].

Swaine and Veendendaal [1994] have found that this species has a strong preference for the soils of the Wet Evergreen zone, even though they are generally 'less fertile' than drier-forest soils, presumably due to sensitivity to some feature of the non-evergreen forest soils. It is also drought-sensitive [Swaine and Veenendaal, 1994].

Fruits can be used for an edible oil [Abbiw, 1990].

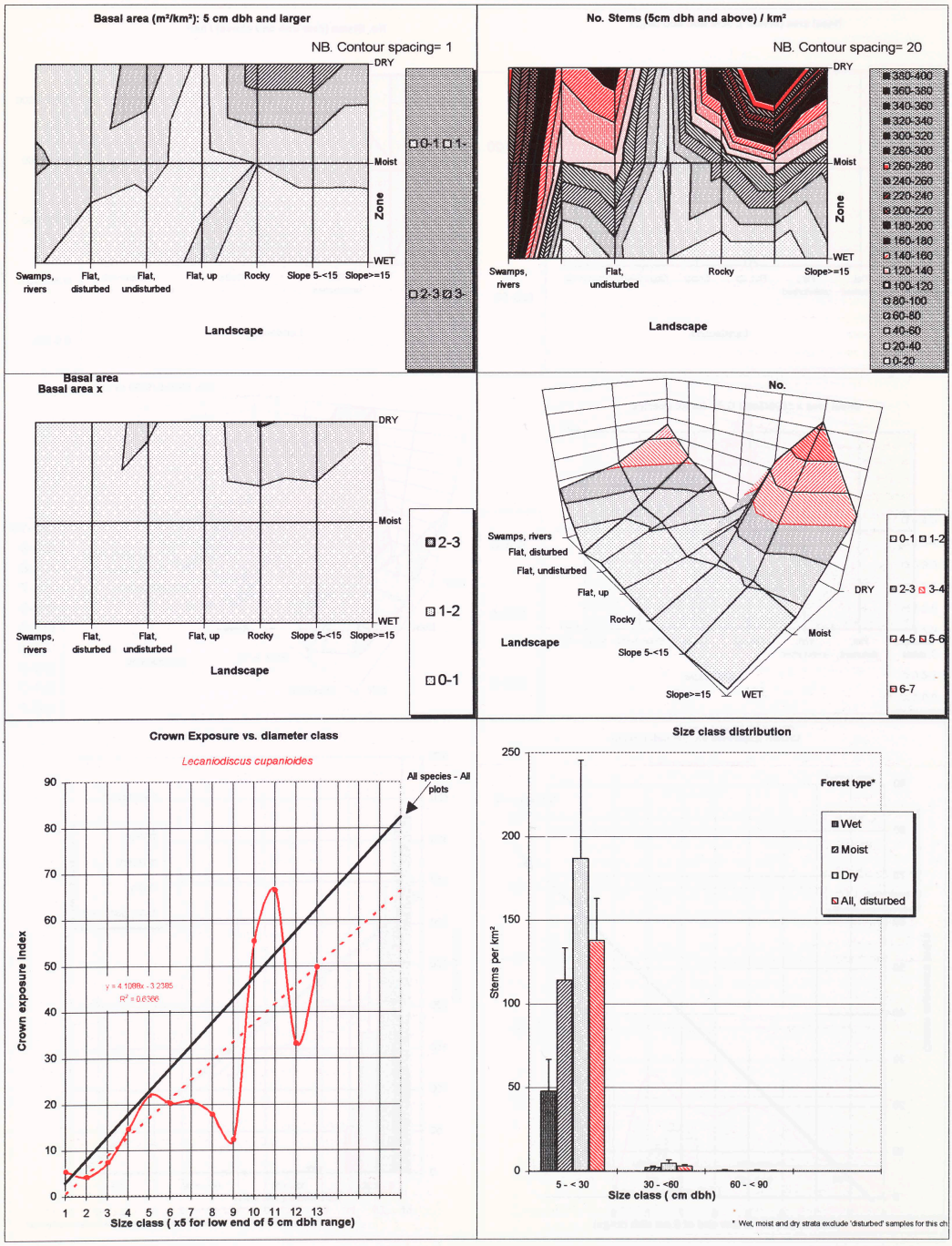
PHENOLOGY/DISPERSAL

Wind-dispersed fruits (nuts with calyx wings) are produced towards the end of the dry season.

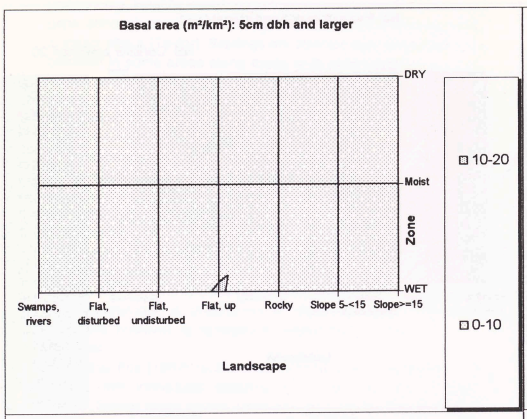
REGENERATION

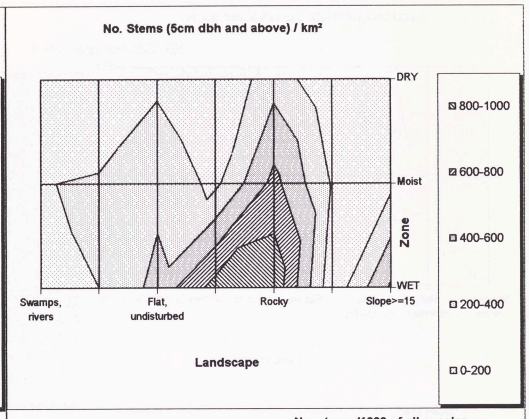
Germination is hypogeal, but with no recorded dormancy and limited viability. Seeds, however, do not germinate in the shaded

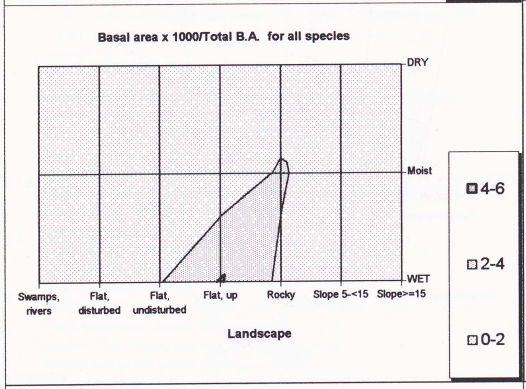
Lecaniodiscus cupanioides

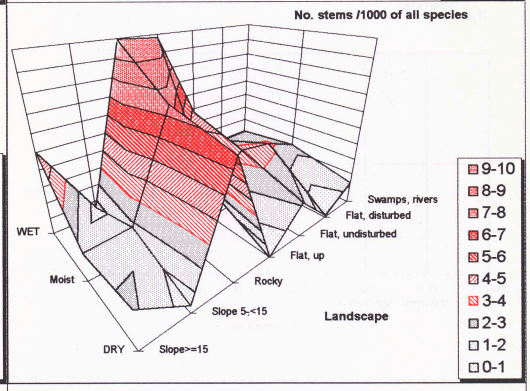


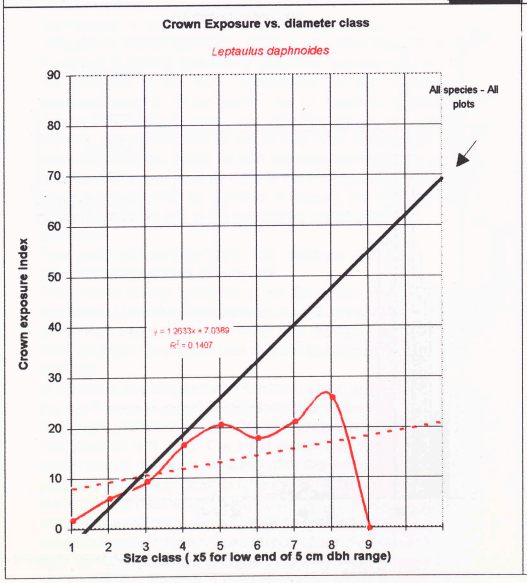
Leptaulus daphnoides

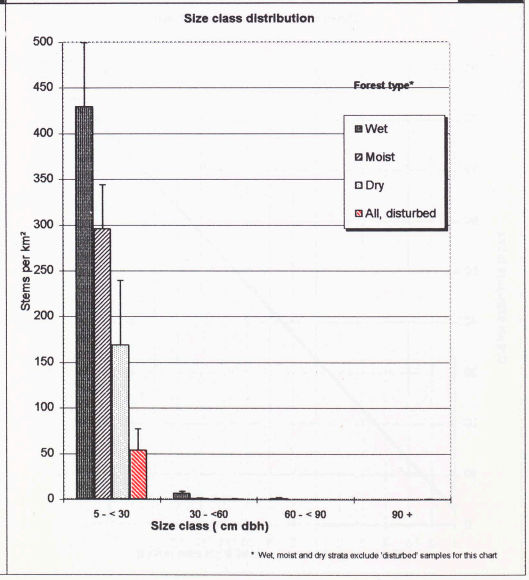




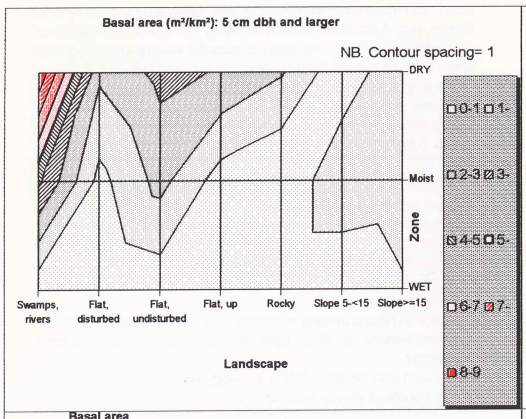


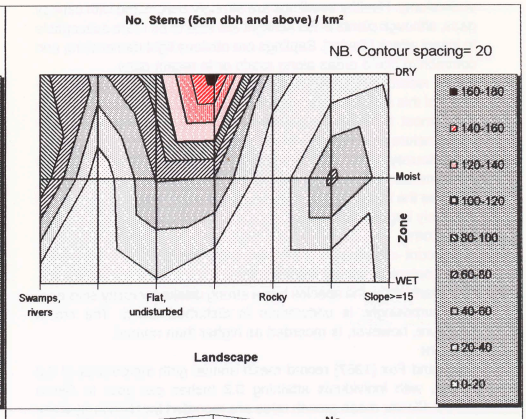


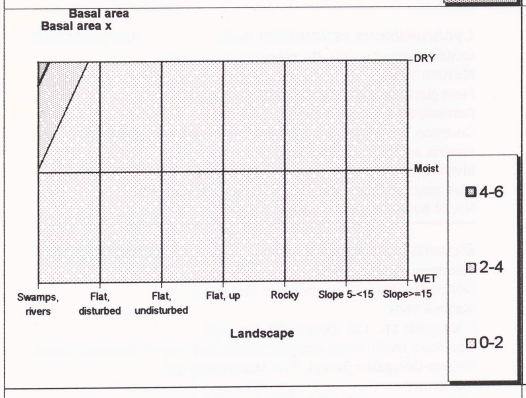


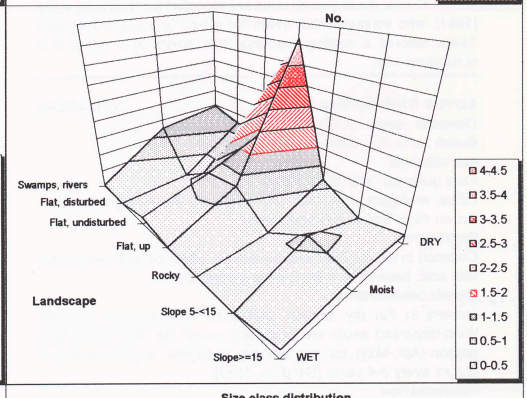


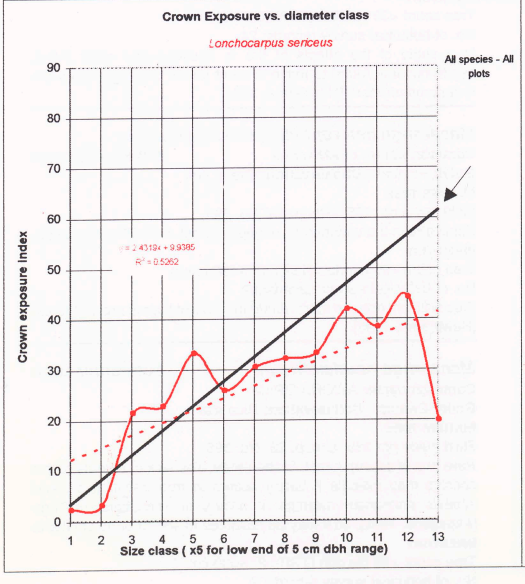
Lonchocarpus sericeus

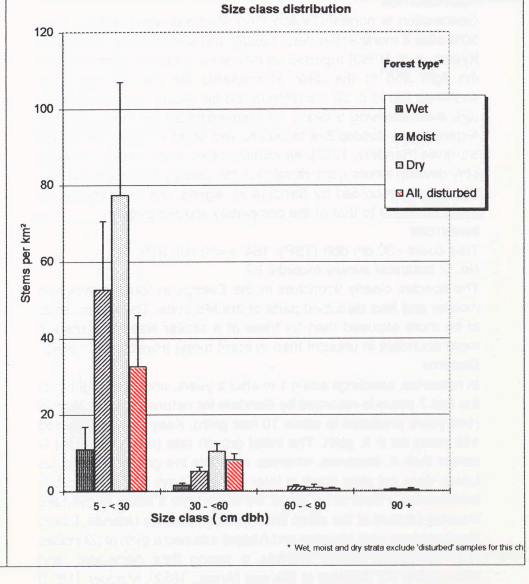












understorey. Healthy seedlings are strongly associated with canopy gaps, although plants in full sunlight are said to be more susceptible to insect attack [Taylor]. Saplings are obvious light demanders, and common in some areas along roads or in recent gaps.
Taylor records the development in a large gap in Subri F.R. of a stand of this species mixed with Musanga. After 7 years the Lophira was almost 10 m tall, and healthy even though overtopped by the (over)mature Musanga (at 15-20 m tall).

Letouzey [1960] suggested that forest dominated by this species in Cameroun followed human disturbance of the original forest, because the tree is light demanding and the forests were composed of mainly larger size classes.

INVENTORY
Tree count <30 cm dbh (TSP): 44 >=30 cm: 305
No. of botanical survey records: 33
The charts show the species has a strong dislike for rocky soils and, very surprisingly, is uncommon in disturbed forest. The crown exposure, however, is recorded as higher than normal.

GROWTH
Savill and Fox [1967] record mean annual girth increments of 0.8 inches, with individuals attaining 3.3 inches per year in Sierra Leone. Slower mean growth rates are recorded for Nigeria by Keay [1961], who estimates 220 years for a tree to reach 9 feet gbh. Taylor records a sapling reaching 3 m height in 4 years in a silvicultural trial.

Lovoa trichilioides Harms — MELIACEAE

Common name: DUBINIBIRI, African walnut
Guild: N.P.L.D. **Conservation:** Red star

MATURE TREE
Field guide pp. 173 Group: 34A No. 12
Large, emergent, evergreen tree with thick ascending buttresses. Crown thick, dense and dark green.

DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 350); strongly associated with acid, base-poor soils; Guineo-Congolian.

PHENOLOGY/DISPERSAL
Flowers in the dry season, and fruits in March-April [Taylor]. Wind-dispersed seeds are produced around the start of the rainy season (Apr.-May), but not annually. In Nigeria, a good seed year occurs every 3-4 years [Sanders, 1953].

REGENERATION
Germination is normal [Taylor]. The seed has short viability (only 30% after 2 months [Sanders, 1953]), and suffers heavy predation. Kyereh *et al.* [1993] reported no difference between germination in the light and in the dark. Remarkable for the abundance of seedlings (up to c. 20 cm high) in the full shade for several years (5% even surviving 5 years, and remaining 20 cm tall in a plot in Nigeria); less susceptible to borers and other insects than Khaya ivorensis [Sanders, 1953]. As with the other such species, saplings only develop where gaps develop in the canopy (although in a less shaded plot recorded by Sanders in Nigeria, the mortality over 5 years is similar to that of the completely shaded plots).

INVENTORY
Tree count <30 cm dbh (TSP): 164 >=30 cm: 315
No. of botanical survey records: 89
The species clearly flourishes in the Evergreen forest zones and moister and less disturbed parts of the MS zone. The crown tends to be more exposed than for trees of a similar size. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

GROWTH
In nurseries, seedlings attain 1 m after 2 years, and 9 m height over the first 7 years is recorded by Sanders for natural forest in Nigeria (140 years predicted to attain 10 feet girth). Keay [1961] predicted 106 years for 9 ft. girth. The initial growth rate (up to 8 ft girth) is slower than K. ivorensis, whereas after this the growth is rapid, as Lovoa does not slow down in later life like Khaya [Sanders, 1953]. Increment still rises at 32 years, by which time it starts to overtake Nauclea planted at the same time [Horne, 1962]. In Uganda, Lovoa (in plantations with *Nauclea* and *Khaya*) attained a girth of 33 inches after 25 years, having become a strong light demander, and overtopping the *Nauclea* at this age [Anon., 1952). Mackay [1953] records trees of 30 m height (c. 1 m girth) after 2] years.

Akachuku [1984] deduced growth rate from ring width in the wood and found no influence of site (swamp *vs.* non-swamp) factors, nor of crown diameter, but found that age alone 'explained' most of the variation. Particularly successful when planted in groups under thinned natural forest [Anon. (group planting), 1959].

Any growth rings in this species are not likely to be annual [Detienne and Mariaux, 1977].

OTHER NOTES
[Anon. (Uganda F.D.), 1972]

Lychnodiscus dananensis — SAPINDACEAE

Aubrev. and Pellegr.
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE
Field guide pp. 188 Group: 36B No. 392
Medium-sized tree.

DISTRIBUTION
Common in Ghana in certain patches of Moist Semideciduous forest (Hall and Swaine sp. 351); Upper Guinea endemic, to Sierra Leone.

INVENTORY
Tree count <30 cm dbh (TSP): 3 >=30 cm: 0
No. of botanical survey records: 15

Lychnodiscus reticulatus Radlk. — SAPINDACEAE

Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE
Field guide pp. 188 Group: 36B No. 393

DISTRIBUTION
Common in Ghana, scattered in various forest types (Hall and Swaine sp. 352); Guinea-wide.

INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 0
No. of botanical survey records: 31

Macaranga barteri Muell.Arg. — EUPHORBIACEAE

Common name: oPAM
Guild: Pioneer **Conservation:** Green star

MATURE TREE
Field guide pp. 135 Group: 23 No. 394
Common, small, weak wooded, stilt-rooted tree of disturbed forest. Guineo-Congolian [Keay]. See *Macaranga spp.*

INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 24
In a study of the effects of fire in Asukese and other F.R.s, seedlings were found to thrive in burnt forest, but larger trees are less common there [Hawthorne, 1994]

Macaranga heterophylla (Muell.Arg.) Muell.Arg.

Common name: oPAMKoKoo — EUPHORBIACEAE
Guild: Pioneer **Conservation:** Green star

MATURE TREE
Field guide pp. 135 Group: 23 No. 395
Small tree in the understorey of gappy forest. See *Macaranga* spp.

INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 62
Tree 5-30 cm dbh are more abundant in burnt than in unburnt forest [Hawthorne, 1994].

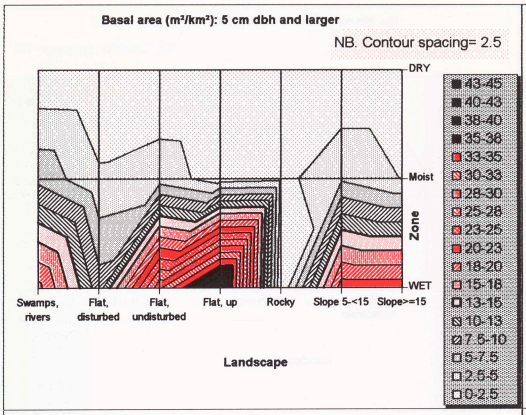
Macaranga heudelotii Baill. — EUPHORBIACEAE

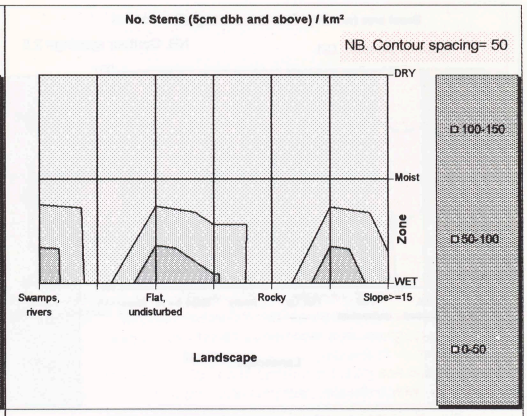
Common name: AWORA-OPAM
Guild: Swamp **Conservation:** Blue star

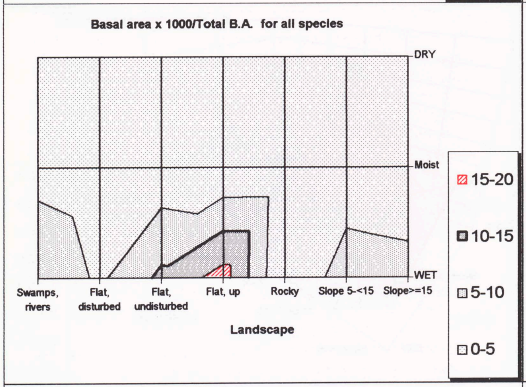
MATURE TREE
Field guide pp. 135 Group: 23 No. 396
Rare tree of swamp forest; Guinea-wide. The lack of records of this species may indicate it barely occurs in true forest at all, and inhabits permanent swamps. It occurs on mountains in Togo [Akpagana, 1992], so it may be restricted to similar parts of Ghana

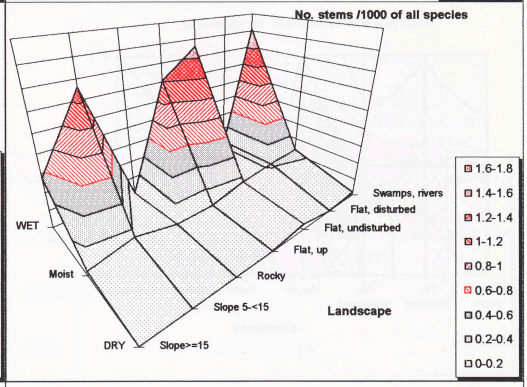
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 0
No. of botanical survey records: 9

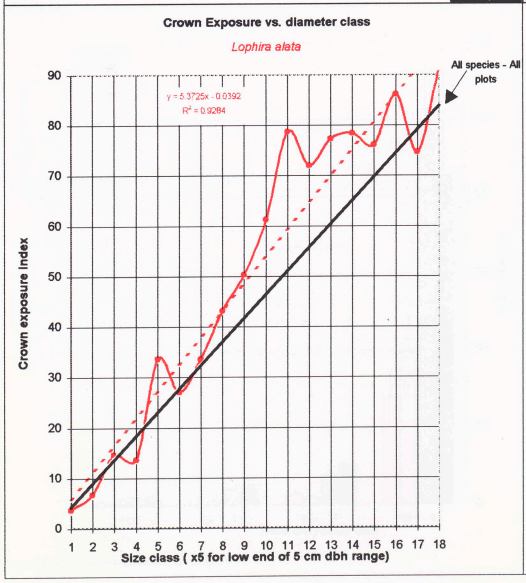
Lophira alata

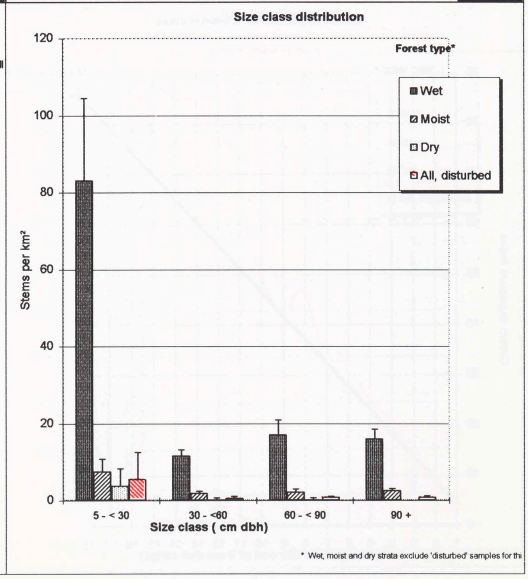




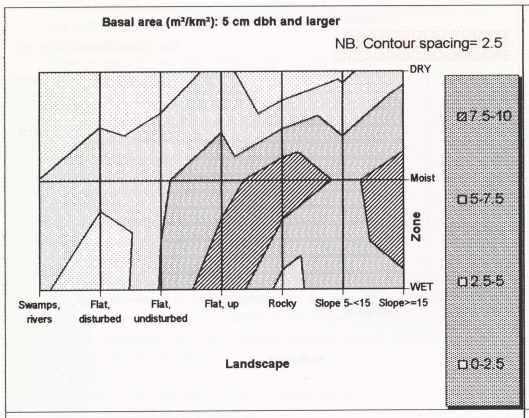


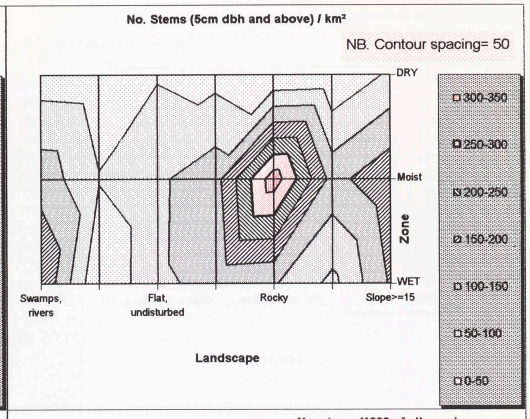


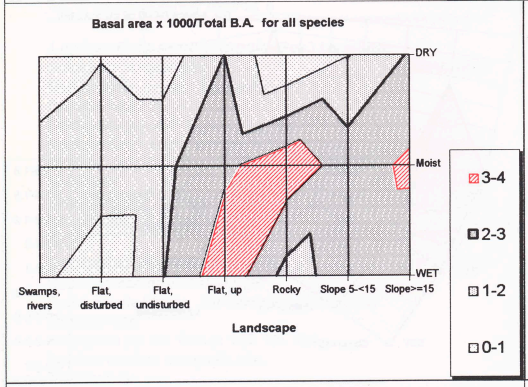


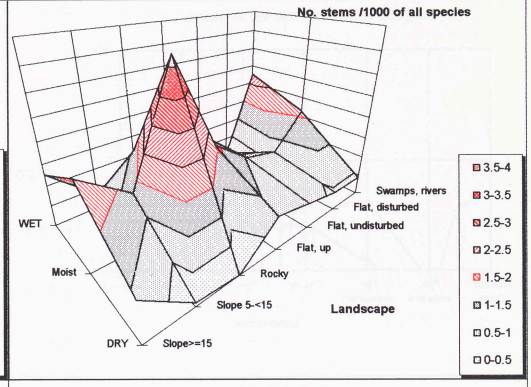


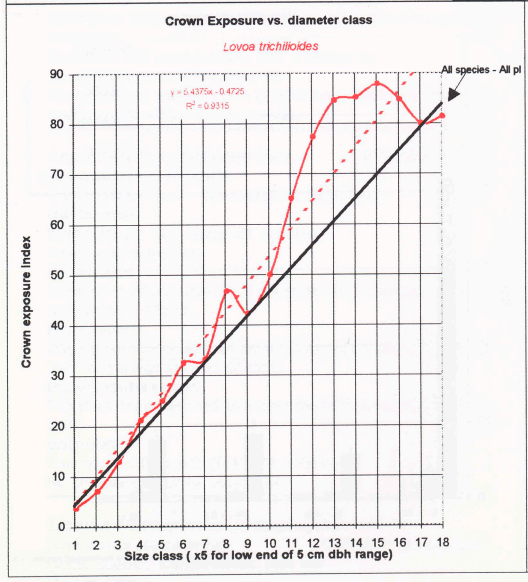
Lovoa trichilioides

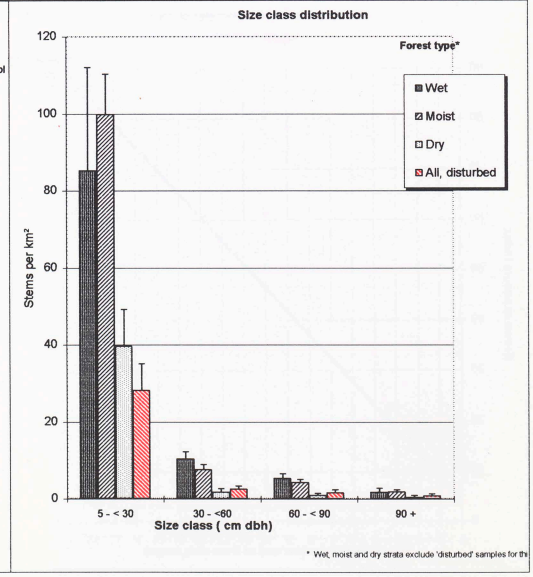




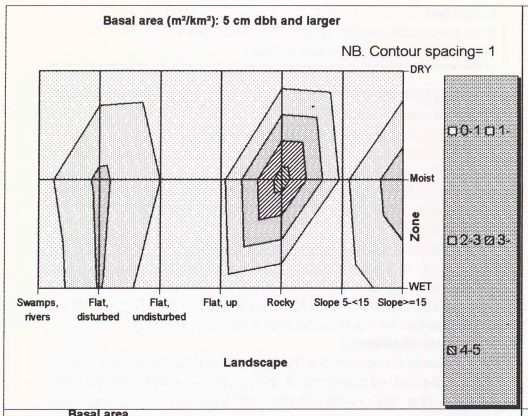


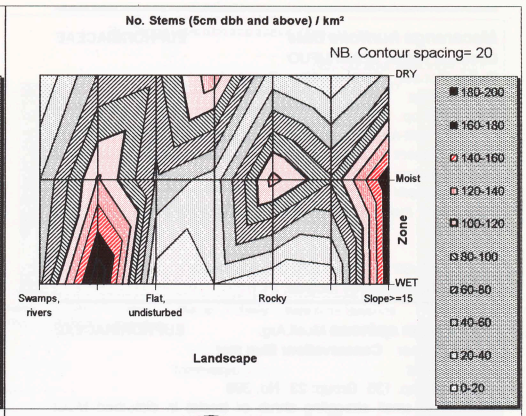


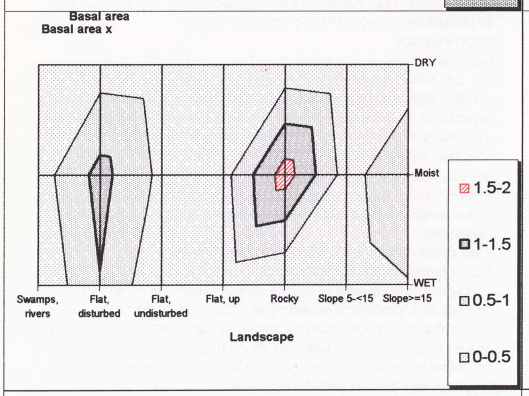


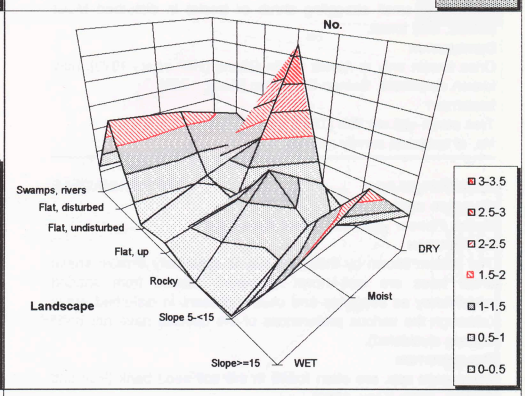


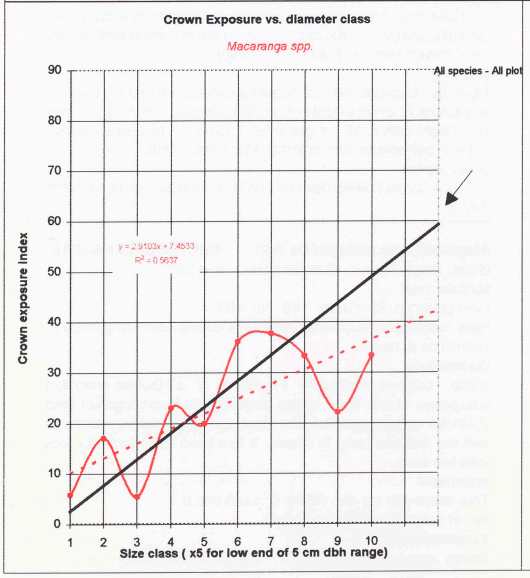
Macaranga spp.

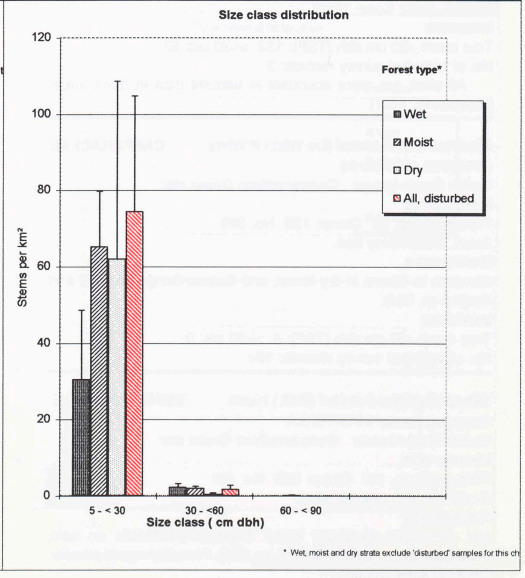












Macaranga hurifolia Beille **EUPHORBIACEAE**
Common name: oPAMFUFUO
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 135 Group: 23 No. 397
Common, stilt-rooted small tree of disturbed areas. Guinea-wide. Typical pioneer of large gaps in Ivory Coast [Kahn, 1982]. See *Macaranga* spp.
REGENERATION
Keay [1960] recorded *M. hurifolia* germinating in boxes of exposed forest soil.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 21

Macaranga spinosa Muell.Arg. **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 135 Group: 23 No. 398
Uncommon small straggling shrub or treelet in disturbed Moist (MSSE, ME) forest.
DISTRIBUTION
Once known only in Atewa within Ghana [Hall *et al.*, 1973]; now known elsewhere. Guineo-Congolian [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 9

Macaranga spp. **EUPHORBIACEAE**
Common name: OPAM
Guild: Pioneer **Conservation:** Green star
DISTRIBUTION
The pattern shown by these species is essentially similar. These small trees are well-known 'pioneers', absent from shaded understorey as seedlings and usually present in disturbed areas (although the various preferences of the species have not been entirely elucidated).
REGENERATION
Macaranga spp. are often found in the soil seed bank [Hall and Swaine, 1980; Keay, 1960].
INVENTORY
Tree count <30 cm dbh (TSP): 133 >=30 cm: 53
No. of botanical survey records: 3
All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Maerua duchesnei (De Wild.) F.White **CAPPARACEAE**
(=*Ritchiea duschesnei*)
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 85 Group: 13B No. 399
Small, understorey tree.
DISTRIBUTION
Common in Ghana in dry forest, and Guineo-Congolian (Hall and Swaine sp. 354).
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 0
No. of botanical survey records: 18<

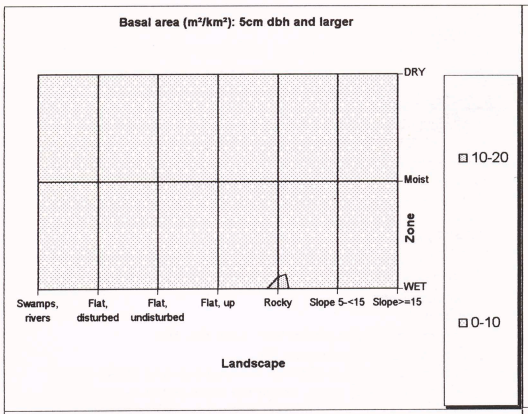
Maesobotrya barteri (Baill.) Hutch. **EUPHORBIACEAE**
Common name: APOTREWA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 132 Group: 22B No. 401
Small tree with uneven stem.
DISTRIBUTION
var. sparsiflora (Sc.Elliot) Keay. Common in Ghana on acid, base-poor soils (Hall and Swaine sp. 355). Probable cryptic pioneer. Upper Guinea endemic.
PHENOLOGY/DISPERSAL
The red fruits are pleasantly sharp and refreshing; the seeds are probably dispersed by mammals and birds.
INVENTORY
Tree count <30 cm dbh (TSP): 747 >=30 cm: 4
No. of botanical survey records: 150

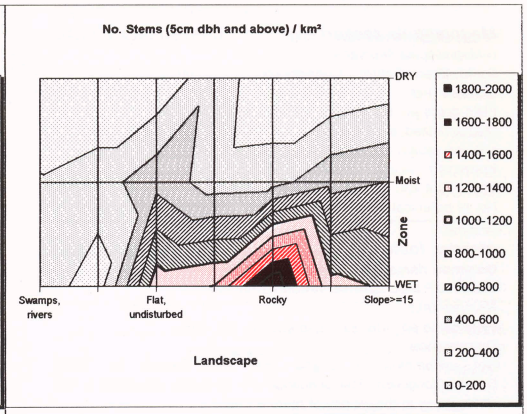
Maesopsis eminii Engl. **RHAMNACEAE**
Common name: oNWAMDUA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 41 Group: 2 No. 402
Small to medium-sized tree with rather conical, regular, airy, crown of horizontal or slightly drooping or upturned branches.
DISTRIBUTION
The species occurs across tropical Africa (with a different subspecies in East Africa]. In parts of Tanzania, where it was introduced as a plantation tree in 1913, the species is invading natural forest [Hamilton and Bensted-Smith [1989]; Binggeli, 1990].
Fruits can be used for an edible oil [Abbiw, 1990].
PHENOLOGY/DISPERSAL
Most trees of 40 cm dbh can fruit in Uganda [Plumptree *et al.* 1994]. The medium-sized drupes are dispersed by birds and probably other animals (the TWI name means 'hornbill tree'). In Uganda it is dispersed by primates [Plumptree *et al.* 1994].
REGENERATION
Germination was said to be normal [Taylor] but seedlings very soon die out in the shade. Sporadic and prolonged seed germination which is improved by scarification [Mugasha and Msanga, 1987]. An experiment in Rwanda revealed that *M. eminii* exhibits distinct rhythmicity of germination and growth, in phase with the lunar cycles [Zurcher, 1992]. Healthy seedlings, saplings and mature trees are obvious demanders of high light levels, and are only found in medium-large gaps. Eggeling [1947] recorded this as a characteristic pioneer of certain Ugandan forests.
INVENTORY
Tree count <30 cm dbh (TSP): 62 >=30 cm: 37
No. of botanical survey records: 26
The species is nowhere in Ghana very abundant, yet it shows in its regeneration profile the expected abundance in burnt forest. In the light of the species' general sparseness, its apparent absence in the logged forest sample is probably insignificant (two records of 5-10 cm trees there would have given estimates of greater density in logged forest than recorded elsewhere).
Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].
GROWTH
Taylor has recorded the fast height increments - with trees capable of reaching 70 cm in height in 6 months; 7m height in 2.5 years and 10m height with c. 35 cm gbh after 3 years. In Tanzania it grows faster in plantations than in forest [Mugasha, 1980].
OTHER NOTES
See also Borota [1969]; Dawkins [1963]; Mugasha [1981]; Kingston [1974].

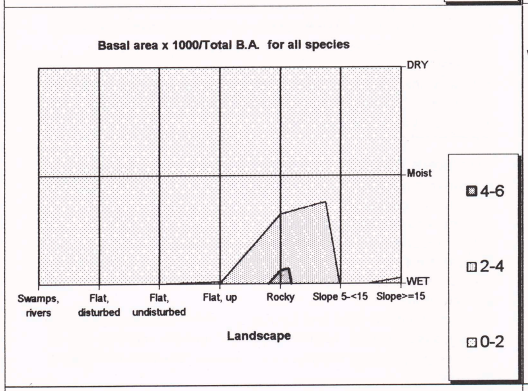
Magnistipula butayei De Wild. **CHRYSOBALANACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 92 Group: 14B No. 403
Rare, medium-sized understorey tree in Ghana. Becoming fluted or buttressed at base.
DISTRIBUTION
subsp. *sargosii* (Pellegrin) F. White is a Guineo-congolian subspecies of this more widely dispersed Guineo-congolian (and E.African coastal) species. The broad global distribution contrasts with the extreme rarity in Ghana: it has been seen probably less than ten times.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3
TAXONOMIC NOTE
Subsp. *sargosii* De Wild.

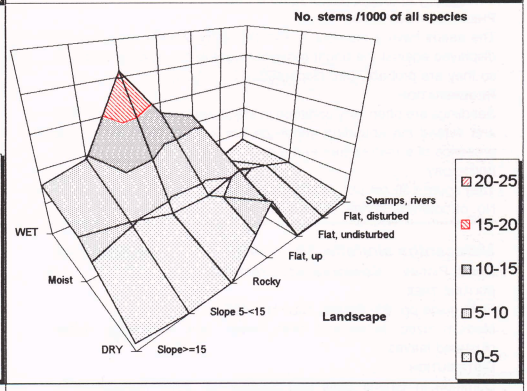
Magnistipula fleuryana see *Magnistipula zenkeri*

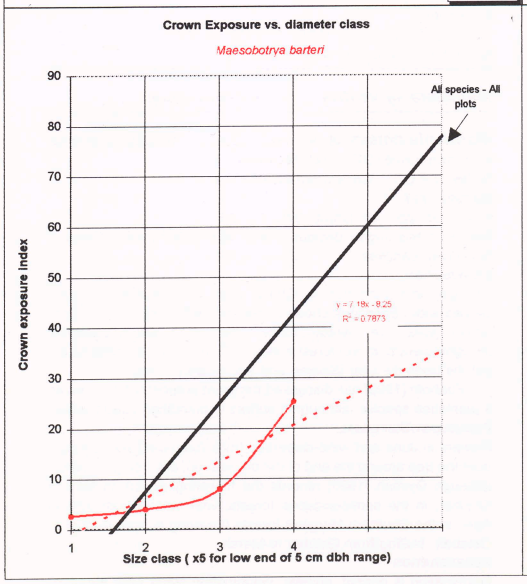
Maesobotrya barteri

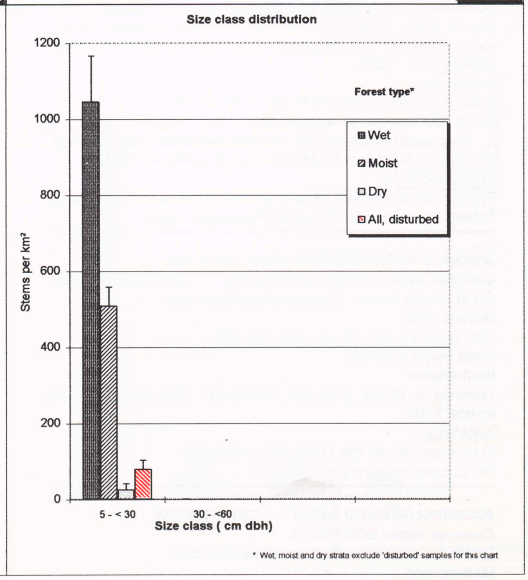












Magnistipula zenkeri Engl. **CHRYSOBALANACEAE**
(=*Magnistipula fleuryana*)
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 92 Group: 14B No. 404
Medium-sized, evergreen tree. Very rare in Ghana, but Guinea-wide species usually found in swampy places.
INVENTORY
Tree count <30 cm dbh (TSP): 5 >=30 cm: 1
No. of botanical survey records: 4

Majidea fosteri (Sprague) Radlk. **SAPINDACEAE**
Common name: ANKYEWA
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 188, 242 Group: 36B No. 405
DISTRIBUTION
Not uncommon in Ghana (Hall and Swaine sp. 356); Guineo-Congolian. The seedlings are generally abundant in the understorey in the vicinity of mature trees.
PHENOLOGY/DISPERSAL
The seeds have a blue-black, slightly fleshy, arillate coat and are displayed against the bright red inner walls of the opened capsule, so they are probably bird dispersed.
REGENERATION
Seedlings are often very common in the shade around parent trees, and indeed the abundant seedlings are a good indication of the presence of a mature tree in the area.
INVENTORY
Tree count <30 cm dbh (TSP): 34 >=30 cm: 54
No. of botanical survey records: 37

Malacantha alnifolia (Bak.) Pierre **SAPOTACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 61 Group: 10B No. 406
Medium sized, fluted and often twisted tree with large, rather clustered leaves.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 357); widespread in tropical Africa. Common in disturbed dry forest, in gallery forest, rocky places etc., including South East Outlier, extreme dry forest [Swaine *et al.*, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 99 >=30 cm: 68
No. of botanical survey records: 59
Regeneration (stems 5-30 cm dbh) and larger trees are more abundant in burnt than in unburnt forest [Hawthorne, 1994].
TAXONOMIC NOTE
This species should now be referred to as *Pouteria alnifolia* (Baker) Roberty. See notes for *Aningeria* [Pennington, 1991].

Mallotus oppositifolius (Geisel.) Muell.Arg.
Common name: ANYANYANFOROWA **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 131 Group: 22A No. 407
Small treelet or shrub.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 358); widespread in tropical Africa.
INVENTORY
Tree count <30 cm dbh (TSP): 22 >=30 cm: 0
No. of botanical survey records: 162

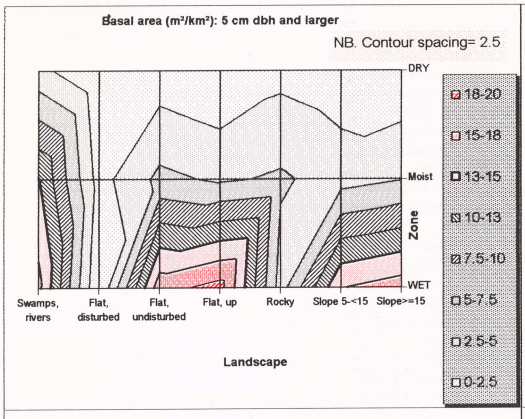
Mammea africana Sabine **GUTTIFERAE**
Common name: BOMPAGYA
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 50, 235 Group: 8B No. 46
This is a medium-sized, sometimes tall tree with a very regular, cylindrical bole and dense evergreen crown of short, regular, horizontal branches. The flush of new leaves is red.
DISTRIBUTION
Common in Ghana and strongly associated with base-poor soils (Hall and Swaine sp. 359); Guineo-Congolian. Fruits ('African Mammy Apple') can be used for an edible oil [Abbiw, 1990].
PHENOLOGY/DISPERSAL
Large, fleshy fruits with as few large seeds in a sweet pulp are produced usually towards the end of the dry season (Feb-Mar). Dispersed by elephants [Hall and Swaine], and other animals relish the seeds e.g. porcupines, antelopes [Guinier, 1943]. Parren [1991], however, concluded that the regeneration was not significantly greater in elephant forests than in nearby forests without elephants.
REGENERATION
Germination often takes many months, and is always slower than normal. The saplings are markedly shade-tolerant, and grow c. 30 cm per year [Taylor].
INVENTORY
Tree count <30 cm dbh (TSP): 278 >=30 cm: 451
No. of botanical survey records: 88
The species is most common in evergreen and MSSE forest, especially in low-lying areas, where the regeneration is plentiful. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. Trees up to 15 cm dbh tend to be relatively shaded, whereas larger trees are found with increasingly exposed crowns.
GROWTH
In Nigeria the species is said to be slow-growing at first (c. 60 cm height after 2 years), but trees attained c. 1m girth (almost 15m high) in 24 years [Mackay, 1953].

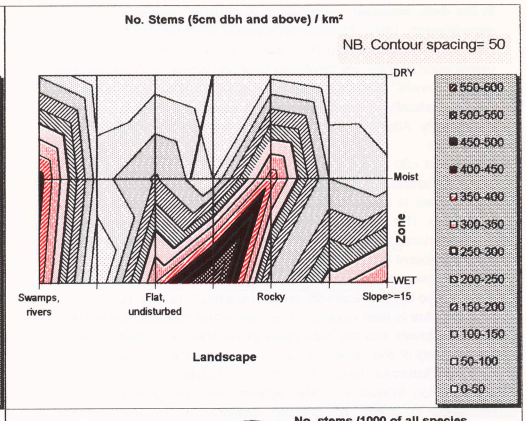
Manilkara obovata (Sabine and G.Don) J.H.Hemsley
(=*Manilkara multinervis* (Baker) Dubard) **SAPOTACEAE**
(=*Manilkara sylvestris*)
Common name: BEREKANKUM
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 58 Group: 10A No. 409
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 361). However, this name encompasses a wide range of trees and genetic material and in future may yield many subspecies or varieties [See Hall and Swaine for summary].
INVENTORY
Tree count <30 cm dbh (TSP): 8 >=30 cm: 21
No. of botanical survey records: 52

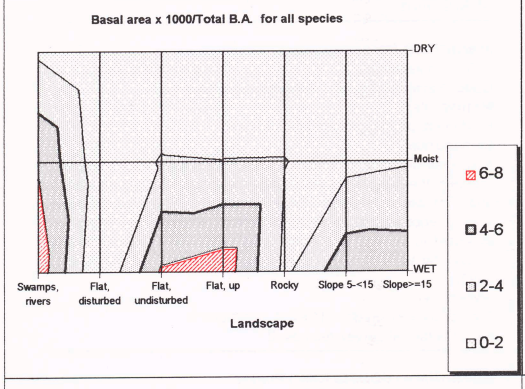
Manilkara sylvestris see *Manilkara obovata*

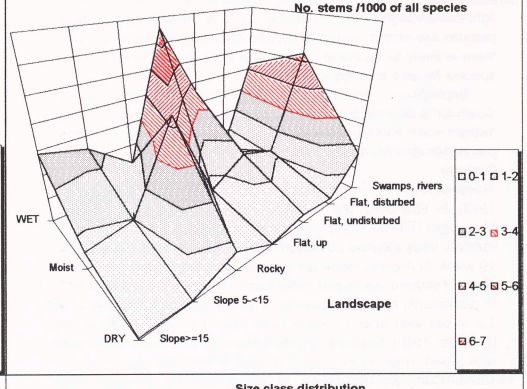
Mansonia altissima (A.Chev.) A.Chev. **STERCULIACEAE**
Common name: OPRONO, Mansonia
Guild: N.P.L.D. **Conservation:** Pink star
MATURE TREE
Field guide pp. 149 Group: 27C No. 23
Medium-sized, highly deciduous tree with small crown of almost horizontal branches.
DISTRIBUTION
var. *altissima*. Common in Ghana (Hall and Swaine sp. 364); Guinea-wide. Seedlings shows a preference for drier forest (more fertile) soils over wetter forest ones, and are moderately drought-tolerant. In wet forest zones plantations can be established but the trees die later [Swaine and Veenendaal, 1994].
Foahom [1990] has discussed the great potential of this tree as a plantation species, although it suffers in plantation due to pests.
PHENOLOGY/DISPERSAL
Flowers in June and wind-dispersed fruits (samaras) are released from the tree around the end of the dry season, according to Taylor, although Gyimah [1986] records the flowering period as May to October, in the semideciduous forests, with fruiting from July to April; in the Southern Marginal forests flowering is from August to October, fruiting from October to March.
REGENERATION
Germination is normal, epigeal. Germination starts after about 10 days, and lasts a week, but dormancy of several months can be induced with slight loss of viability [Foahom, 1990]. Kyereh *et al.* [1993] reported no difference between germination in the light and

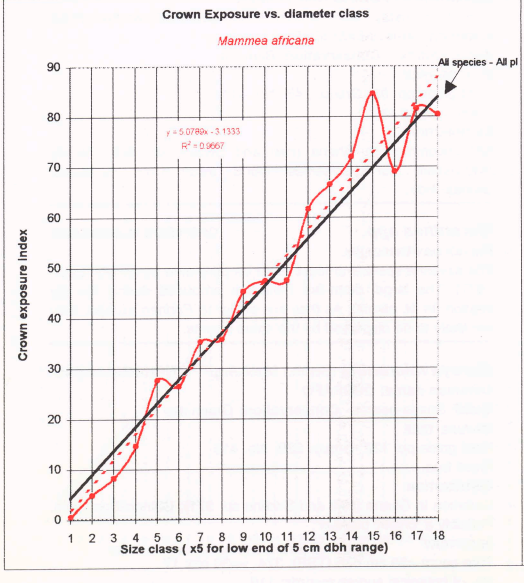
Mammea africana

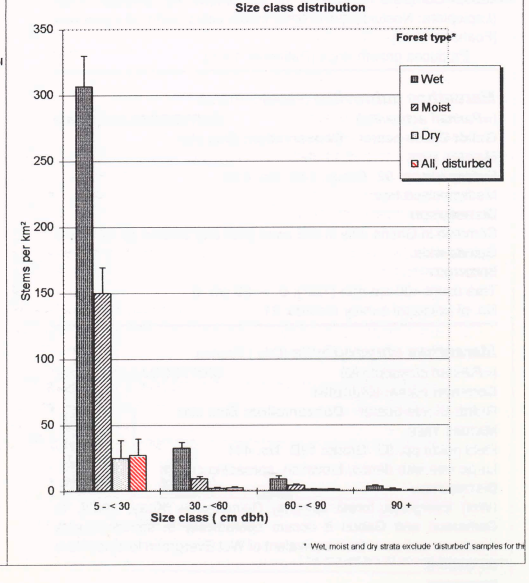












in the dark. However, germination is strongly depressed in large gaps [Kyereh, 1994]. The seedlings prefer shade for the first 2 years [Taylor]. Macgregor [1934, 1934b] found that shade delays germination slightly, yet increases seedling growth and encourages healthy leaves. In exposed areas, he noted, the plant holds the leaves vertically whereas in shaded areas the leaves are held horizontally. After 2 years the tree is a strong light demander.

INVENTORY

Tree count <30 cm dbh (TSP): 300 >=30 cm: 1340
No. of botanical survey records: 110
The species is much more abundant in MSNW zone forests than elsewhere. The tree is invariably more exposed than average.

Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest [Hawthorne, 1994]. The adult trees, up to 60 cm dbh, are more common in logged or burnt forest than in undisturbed forest (trees >60 cm dbh are much rarer in burnt forest, probably due to past logging). This may either be a consequence of the recruitment into this size class of regenerating trees following the opening of the upper canopy by disturbance, or may reflect a bias of disturbed forest in terms of habitat differences. The regeneration follows a similar pattern, with the greatest density occurring in areas of greater disturbance. In view of the light-demanding nature of the species, it is most likely that these patterns are mostly related to canopy disturbance effects, although there is likely to be some contribution from the preference of the species for less swampy ground.

Saplings (> 1 m height) are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples, but the converse is true of smaller plants [Hawthorne, 1993].

GROWTH

Trees attained 6 m in 4 years in old logged areas [Hawthorne, 1993]. In TSS plots, the saplings reach 1-2 m height in 4 years. Macgregor [1934b] records seedlings reaching 4-5 m in 3 years. In Kumasi, trees attained 20-50 cm GBH, c. 8-15 m height [Taylor], in 10 years. In Nigeria, mean annual girth increments over the first 21 years of around. 44 inches have been recorded [Dommen, 1957]. In plantations, height increments of 2 m a year after two years, or 1.3 m per year after 10 years have been recorded in Cameroun [Foahom, 1990]. Seasonal growth follows rainfall, and is associated with growth rings which could be used to estimate age [Foahom, 1990]. Complete defoliation of plantations by *Godasa sidae* (Lepioptera: Noctuidae] and other insect pests could be a problem [Foahom, 1990].

Produces growth rings [Detienne, 1975].

Maranthes aubrevillei (Pellegr.) Prance
(=*Parinari aubrevillei*) **CHRYSOBALANACEAE**
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 92 Group: 14B No. 410
Medium-sized tree.

DISTRIBUTION

Common in Ghana only in WE zone (Hall and Swaine sp. 366) and Guinea-wide.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 21

Maranthes chrysophylla (Oliv.) Prance
(=*Parinari chrysophylla*) **CHRYSOBALANACEAE**
Common name: KAJABIRI
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 92 Group: 14B No. 411
Large tree with dense, brownish, spreading crown.

DISTRIBUTION

(Wet) Evergreen forest species. Guinea-wide [Keay, 1989]. In Cameroun and Gabon it occurs sporadically in semideciduous forests as well as in their equivalent of Wet Evergreen forests [Flore du Gabon].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 17

Maranthes glabra (Oliv.) Prance **CHRYSOBALANACEAE**
(=*Parinari glabra*)
Common name: AFAMNINI
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 91 Group: 14A No. 412
Large, spreading tree.

DISTRIBUTION

Common in Ghana, and strongly associated with acidic, base-poor soils throughout all forest types; Guineo-Congolian (Hall and Swaine sp. 367).

PHENOLOGY/DISPERSAL

Regeneration and dispersal are possibly enhanced by elephants [Parren, 1991]. This effect might be expected to apply to other Chrysobalanaceae (*Parinari, Maranthes, Magnistipula, Licania, Dactyladenia*, which have similar fruits.

INVENTORY

Tree count <30 cm dbh (TSP): 26 >=30 cm: 68
No. of botanical survey records: 41
The species flourishes in evergreen forest slopes, and is generally rather shaded.

Maranthes kerstingii (Engl.) Prance
(=*Parinari kerstingii*) **CHRYSOBALANACEAE**
Guild: Savanna (fringe) **Conservation:** Blue star

MATURE TREE

Field guide pp. 91 Group: 14A No. 413

DISTRIBUTION

A species of savanna and particularly transition forests, where it occurs in the company of *Aubrevillea kerstingii, Khaya grandifoliola* and *Eriocoelum kerstingii* [Flore du Gabon]. This association is seldom encountered in Ghana's forest reserves, but might be expected to be well developed in uninventoried savanna/ forests around the Volta lake. It occurs on mountains in Togo [Akpagana, 1992].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 2

Maranthes robusta (Oliv.) Prance
(*Parinari robusta*) **CHRYSOBALANACEAE**
Common name: AFAMBERE
Guild: Swamp **Conservation:** Blue star

MATURE TREE

Field guide pp. 92 Group: 14B No. 414
Medium-sized tree.

DISTRIBUTION

Not uncommon in Ghana (Hall and Swaine sp. 368). Mostly river-based, but sometimes found away from riversides. Guinea-wide.

Maranthes spp. **CHRYSOBALANACEAE**

PHENOLOGY/DISPERSAL

The savanna species at least might be pollinated by genets [Lack, 1977]. The large, plum-like fruits are produced during the dry season (in *M. glabra*). As they are similar to *Parinari excelsa*, they are likely to be dispersed by the same agents.

Mareya micrantha (Benth.) Muell.Arg. **EUPHORBIACEAE**
Common name: DUBRAFO
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 132 Group: 22B No. 415
Small tree.

DISTRIBUTION

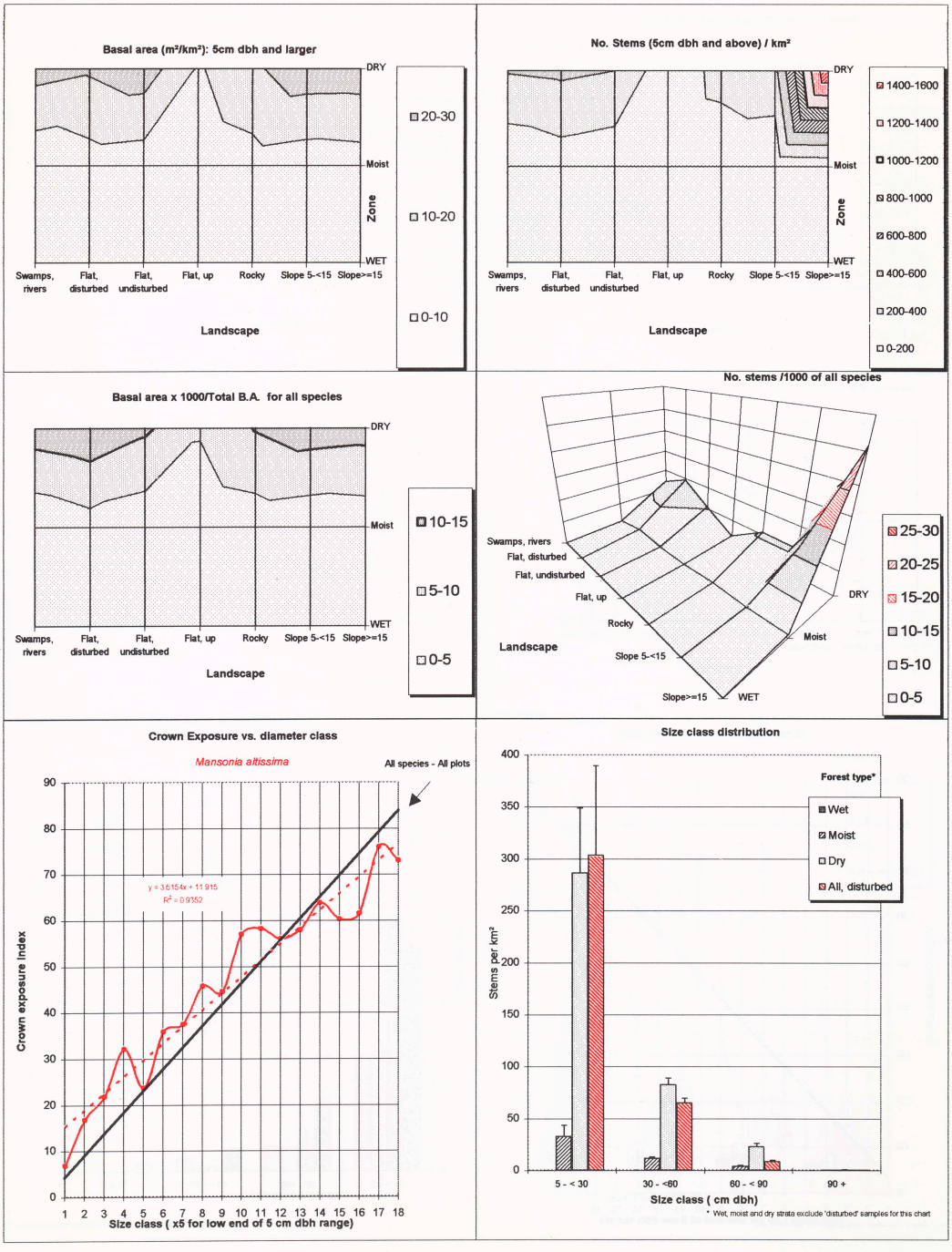
Common in Ghana (Hall and Swaine sp. 371); Guineo-Congolian. Possibly a 'cryptic pioneer'.

INVENTORY

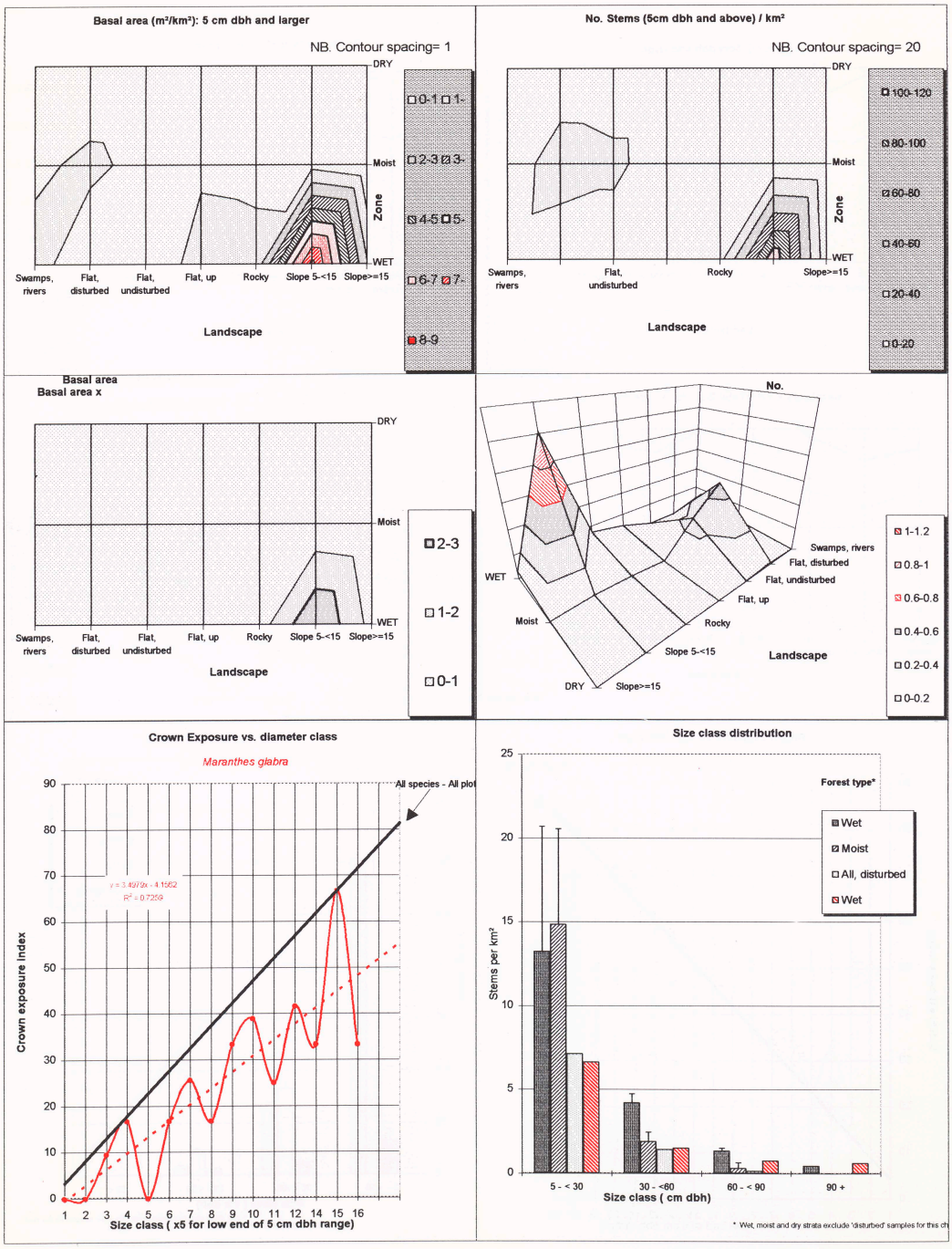
Tree count <30 cm dbh (TSP): 374 >=30 cm: 17
No. of botanical survey records: 116

The charts show the species thrives in dry forest swamps and flat, evergreen forest.

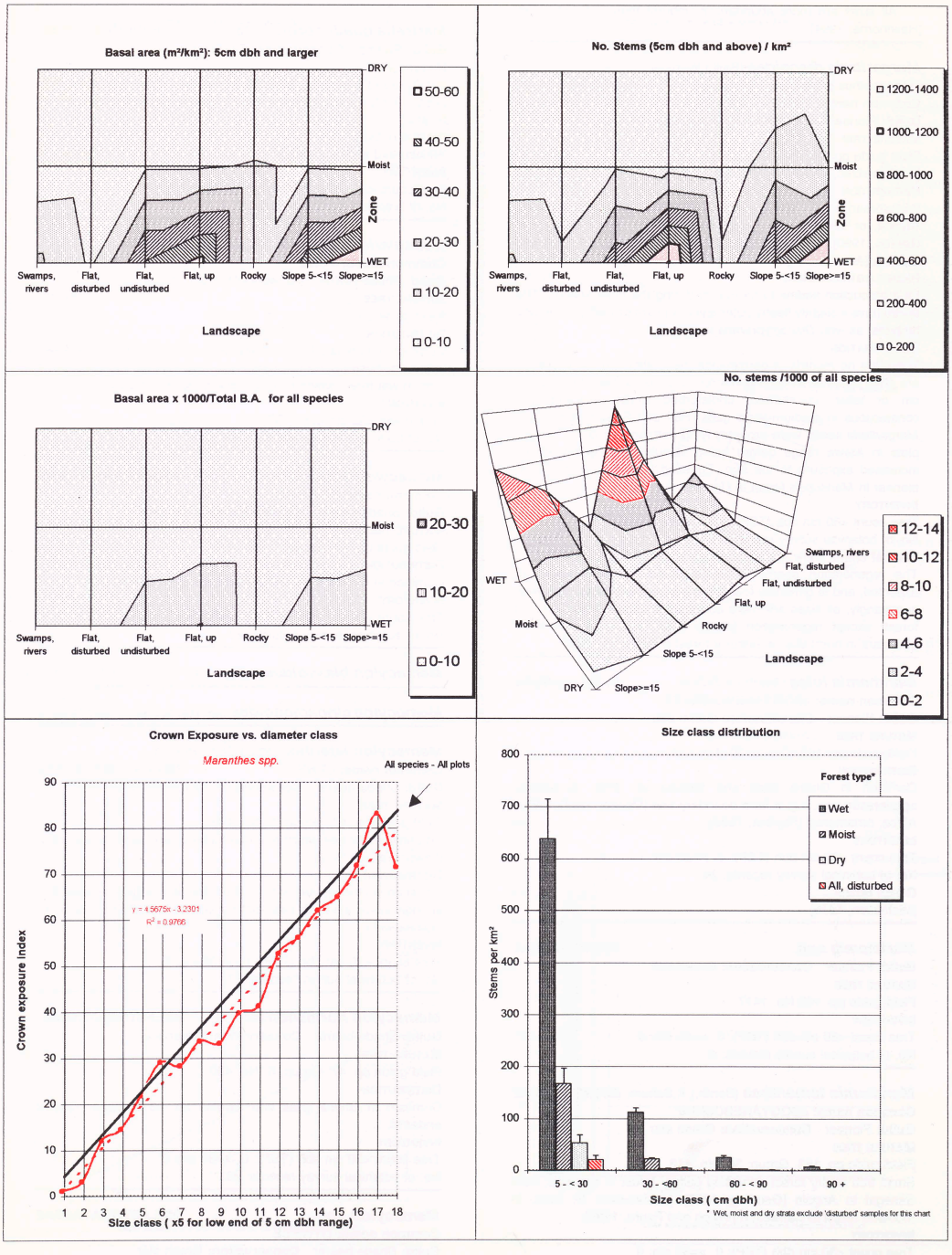
Mansonia altissima



Maranthes glabra



Maranthes spp.



All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Margaritaria discoidea (Baill.) Webster
(=*Phyllanthus discoideus*) **EUPHORBIACEAE**
Common name: PEPEA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 85, 244 Group: 13B No. 416
Medium-sized, deciduous tree with drooping branches.
DISTRIBUTION
Widespread in tropical Africa, especially in secondary forest, thicket clumps, or savanna areas [e.g. Guelly *et al.*, 1993; Lovett and Geraeu, 1990]. Used as a second line of defense in fire-breaks in Uganda [Anon., 1947].
PHENOLOGY/DISPERSAL
Fruit production seems to be mainly during the rainy season. The seeds have a slightly fleshy outer layer, and are probably dispersed by birds, as with *Discoglypremna*.
REGENERATION
There are no records of germination trials, although the seedlings are often common in disturbed forest and not, at least when c. 20 cm or taller, in shaded, undisturbed forest. Saplings are conspicuous in medium-large gaps. Hall and Swaine report that *Margaritaria* seeds were probably lying dormant in the soil of their plots in Atewa range before being stimulated to germinate by increased exposure to the sun. Eggeling [1947] records it as a pioneer in *Maesopsis* forest in Uganda.
INVENTORY
Tree count <30 cm dbh (TSP): 180 >=30 cm: 191
No. of botanical survey records: 38
The bar charts show the species thrives in disturbed forest.
The regeneration seems to be favoured by disturbance, as expected, and is generally found in more exposed sites. However, surprisingly, all sizes are more abundant in unburnt than in burnt forest, except regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest [Hawthorne, 1994].

Markhamia lutea (Benth.) K.Schum. **BIGNONIACEAE**
Common name: oBOGYANEBOoBEREE
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 163 Group: 30 No. 417
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 372). A popular agroforestry tree, e.g. a farm boundary tree [Otieno, 1992] in East Africa; ornamental [Pawlick, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 1
No. of botanical survey records: 24
OTHER NOTES
[Michelson, 1959]

Markhamia spp. **BIGNONIACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 163 No. 1417
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

Markhamia tomentosa (Benth.) K.Schum. **BIGNONIACEAE**
Common name: oBOGYANEBOoNINI
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 163 Group: 30 No. 418
Small tree of dry forest, including gallery forest in savanna, from Senegal to Angola [Geerling, 1982]. Hairier than *M. lutea*. In montane forest in Cameroun [Vivien and Faure, 1985].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 9

Martretia quadricornis Beille **EUPHORBIACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Small tree of rivers and swamps in the Wet Evergreen zone, not uncommonly outside forest reserves. Guineo-Congolian, but rare in Ghana.
DISTRIBUTION
Widespread in swamp forest around Zaire basin; rare in Ghana.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

Massularia acuminata (G.Don.) Bullock *ex* Hoyle
Common name: POBE **RUBIACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 36 Group: 1F No. 420
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 373), strongly associated with acid, base-poor soils; there is a very distinct, narrow leaved form in wet forest which might be worth recognising taxonomically.
INVENTORY
Tree count <30 cm dbh (TSP): 11 >=30 cm: 0
No. of botanical survey records: 191

Memecylon afzelii G.Don. **MELASTOMATACEAE**
Common name: oTWE-ANI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 47 Group: 6 No. 422
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 374); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 28

Memecylon blakeoides G.Don. see *Spathandra blakeoides*

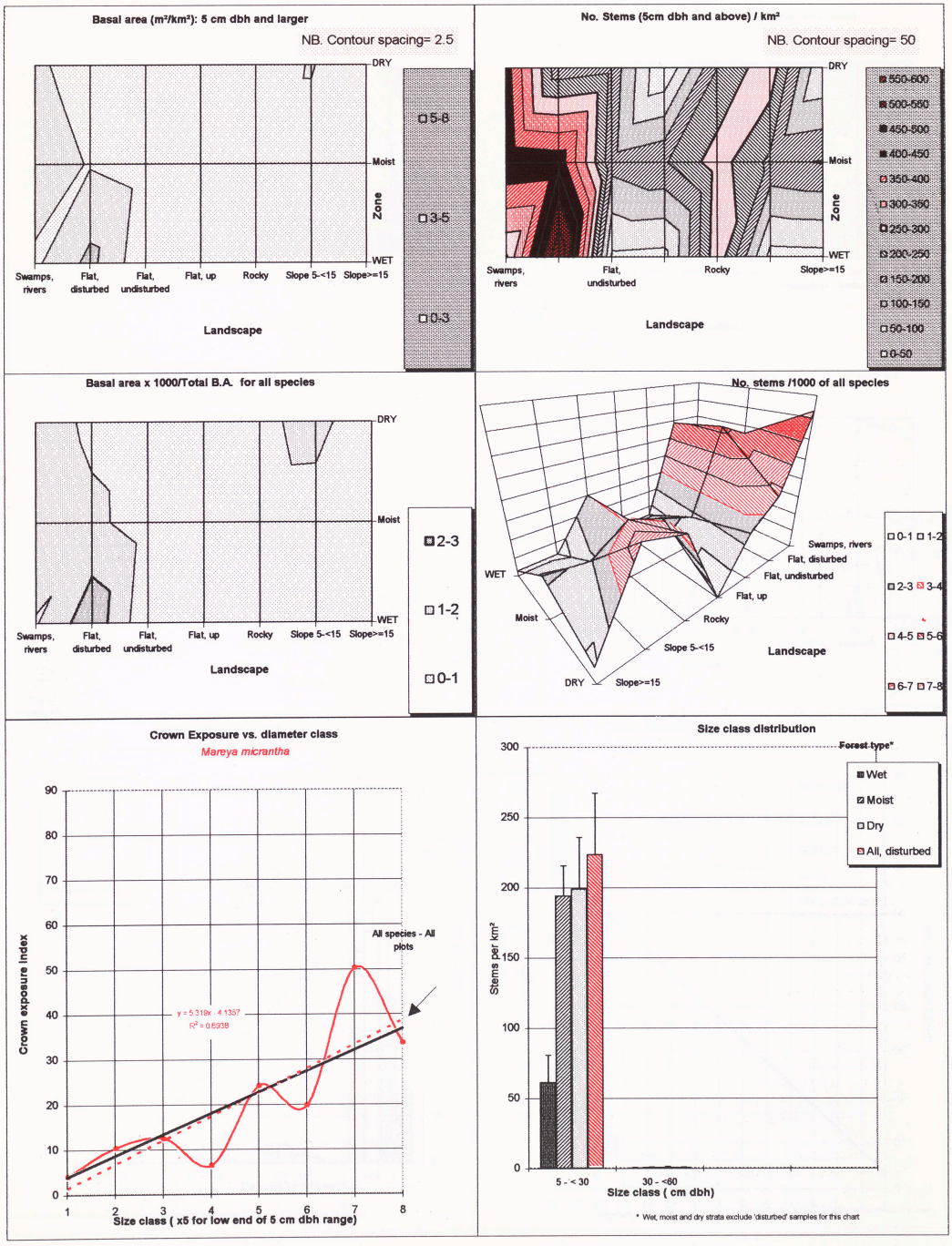
Memecylon cinnamonoides see *Warneckea cinnamonoides*

Memecylon lateriflorum (G.Don.) Bremek.
Common name: oTWESE **MELASTOMATACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 47 Group: 6 No. 428
An understorey tree which exercises little control over transpiration [Lawson *et al.*, 1970].
DISTRIBUTION
Common in Ghana, mainly but not entirely in evergreen forest, and strongly associated with base-poor soils (Hall and Swaine sp. 379); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 77

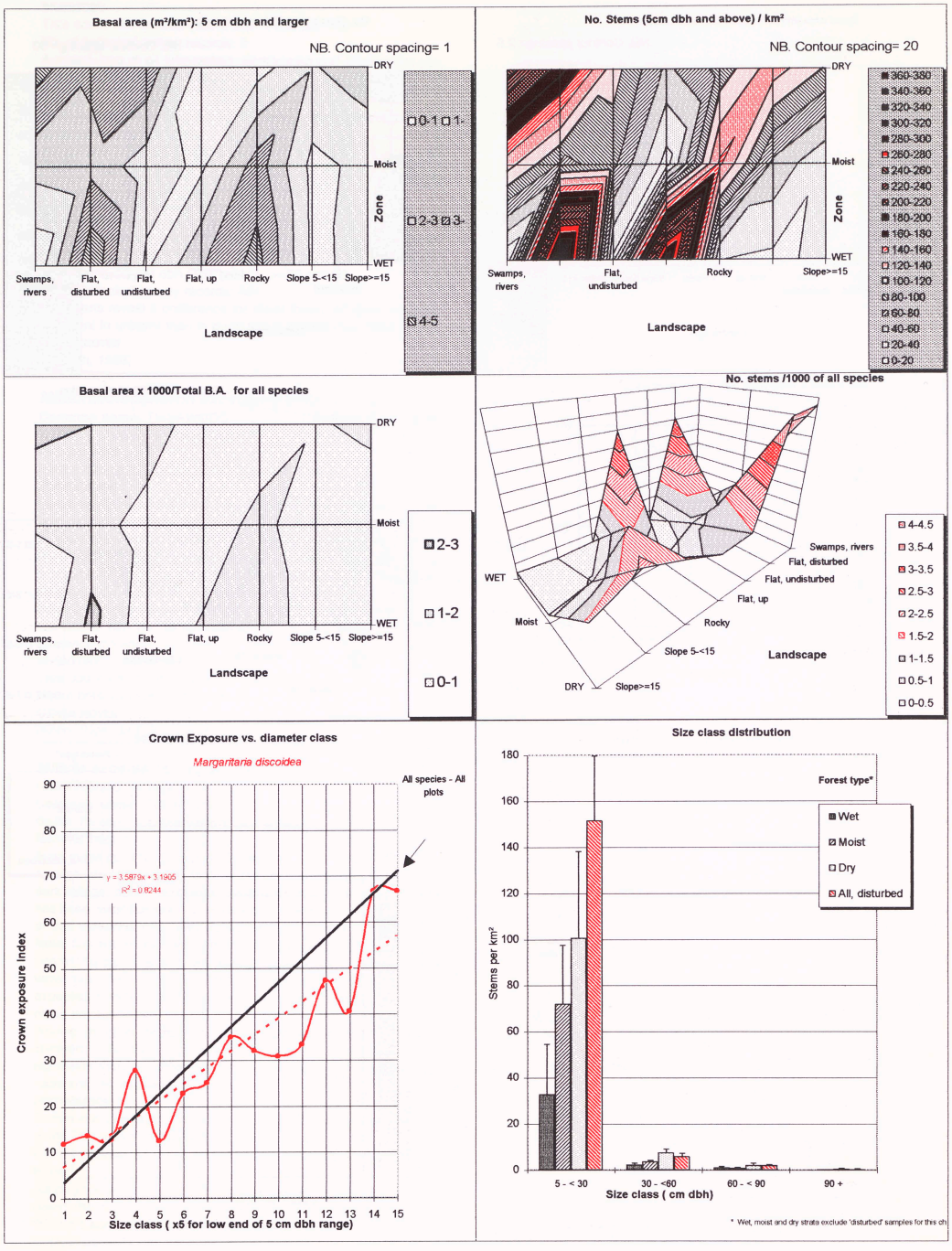
Memecylon normandii Jac.-Fel. **MELASTOMATACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 47 Group: 6 No. 430
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 381); Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 20

Memecylon spp. **MELASTOMATACEAE**
Common name: OTWESE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 47 No. 1428

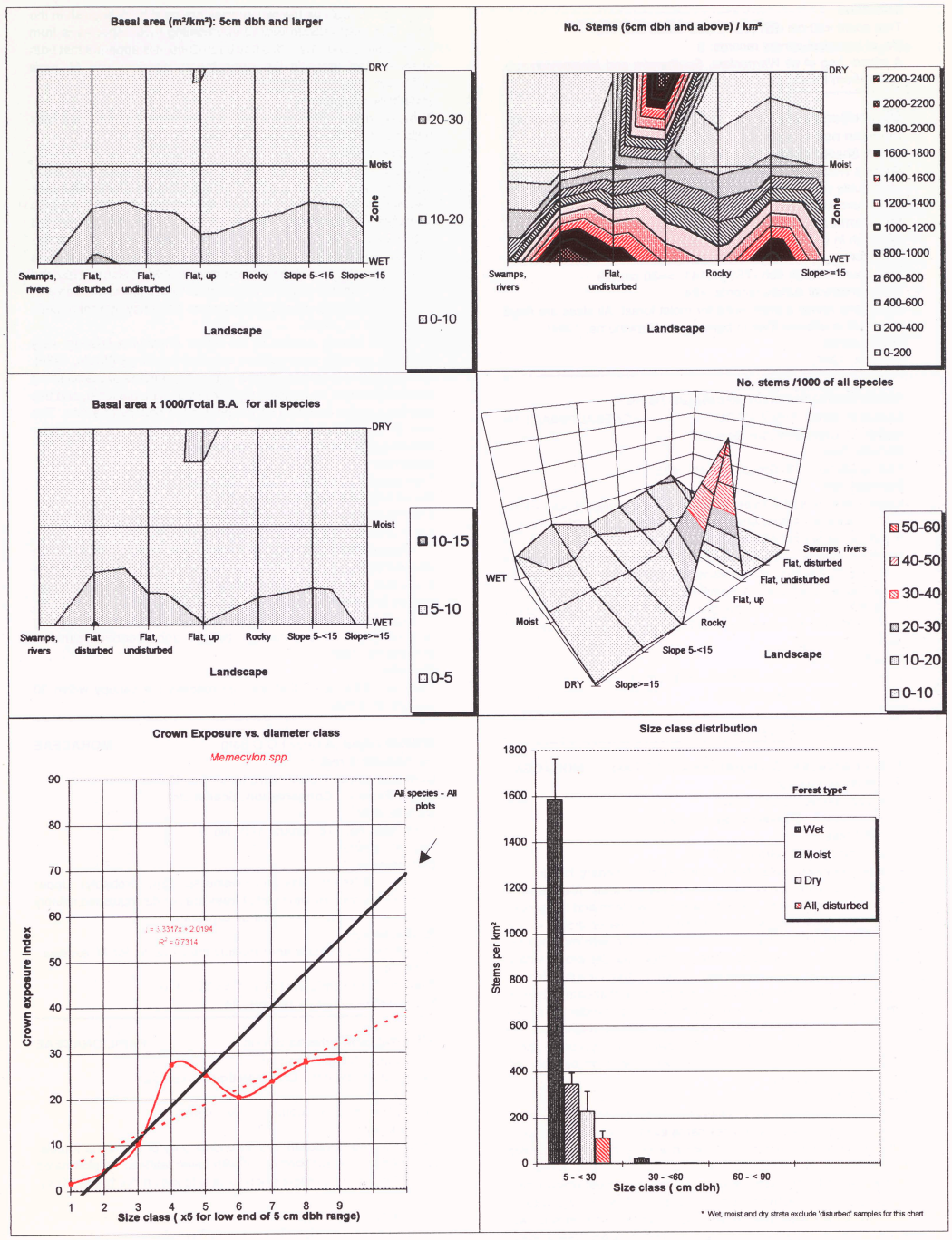
Mareya micrantha



Margaritaria discoidea



Memecylon spp.



INVENTORY
Tree count <30 cm dbh (TSP): 920 >=30 cm: 142
No. of botanical survey records: 3
A mixed- bag of all *Warneckea*, *Spathandra* and *Memecylon* spp, mostly from the understorey.

Microdesmis puberula Hook.f. *ex* Planch. **PANDACEAE**
Common name: oFEMA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 107 Group: 17D No. 431
Small, understorey, evergreen tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 382); Guineo-Congolian.
INVENTORY
Tree count <30 cm dbh (TSP): 4141 >=30 cm: 19
No. of botanical survey records: 424
The charts reveal a preference for moist forest. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].
OTHER NOTES
[Forman, 1986]

Mildbraediodendron excelsum Harms
Common name: TWEAWODO **CAESALPINIACEAE**
Guild: 0 **Conservation:** Gold star
MATURE TREE
Field guide pp. 213 Group: 37I No. 432
DISTRIBUTION
Large, deciduous, dry forest tree. Guineo-Congolian [Lock, 1989], but very rare in Ghana. Much commoner in e.g. Uganda, where it is sometimes planted [Anon., 1947]. Only one definite record of this species in Ghana, cited vaguely as on hills near Sunyani. In Uganda it occurs in forest-savanna transition areas and is likely to be dispersed by elephants (A.Hamilton pers.comm.). Synnott [1985] notes that it is a frequent emergent there. Saplings of *Dalbergiella welwitschii* can be deceptively similar, on the basis of meagre reference material.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 1
OTHER NOTES
[Anon. (Uganda F.D.), 1972]

Milicia excelsa (& regia) (Welw.) C.C.Berg **MORACEAE**
(=*Chlorophora excelsa*)
Common name: ODUM, Iroko
Guild: Pioneer **Conservation:** Scarlet star
MATURE TREE
Field guide pp. 118 Group: 19B No. 1
A large, deciduous tree, fairly common in secondary forest, with dark foliage, rather pendulous towards branch ends. A correlation has been noted [Lawton, 1955] between crown form and the gender of this dioecious tree, with males having a smaller crown with a flatter top and more nearly vertical boughs, and with most leaves nearer the top. The females have a larger, rounder crown with a wider branching angle. As these crown patterns might also be expected to vary with competition, it is possible that competitive or other environmental affects may influence the gender of a tree (known in other dioecious plants); age effects might also be involved. This type of variation in crown form is probably more significant than any differences in overall crown form between *M. regia* and *M. excelsa*.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 124). Widespread in Africa. In the TSP inventory this species name includes also all records of the very similar *M. regia* (*q.v.*), which apparently has equivalent timber.
Although noted for its occurrence in the fire zone forest which Taylor called the Antiaris-Chlorophora association, it is found scattered throughout the forest zone. *M. excelsa* shows no preference for wet or dry forest soils (base-poor or base-rich) [Swaine and Veenendaal, 1994].
FIELD IDENTITY
Inventory records for this species have been amalgamated with those for *M. regia* as the two species are hard to distinguish in the field. The most reliable way of segregating these species is from fallen leaves, and where this has been done, it is apparent that both species often occur in the same forest, possibly with *M. regia* preferring moister forests.
PHENOLOGY/DISPERSAL
The very many, small seeds are dispersed by the birds and bats [Osmaston, 1965] which eat their fruits.
REGENERATION
Germination occurs in 2-3 weeks with viability good but falling rapidly [Taylor]. Kyereh *et al.* [1993] reported a significant difference between % germination in the light and in the dark, with few seeds germinating in the dark. Macgregor (1934), however, found that seeds germinated and survived best in half shade, with similar survival levels after 2 years in full light, but with very few survivors in shaded plots. Seedlings are common in medium-large gaps and are absent from the shade of undisturbed forest. A pioneer tree with high stomatal conductance and quantum efficiency, typical of gaps [Riddoch *et al.*, 1991].

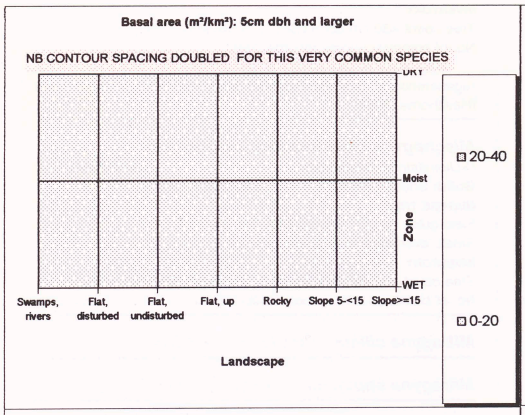
Galled leaves, caused by the insect *Phytolyma lata*, are very common, possibly more so than ungalled seedlings [White, 1966]. The infestation is said to affect a higher percentage of the seedling population where many occur together (e.g. in plantations), and this may be a major limitation on the population density of adults. The rate of mortality, whether due to galls or other causes, under different circumstances needs investigation.
INVENTORY
Tree count <30 cm dbh (TSP): 120 >=30 cm: 1165
No. of botanical survey records: 81
The charts show a strong preference of the species, combined, for flat, dry forest; and a generally exposed crown.

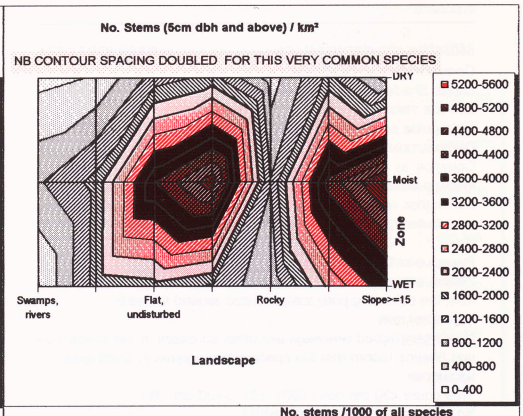
Regeneration (stems 5-30 cm dbh) and larger stems are more abundant in burnt than in unburnt forest, although the effect declines in the size classes above the felling limits, presumably due to past logging [Hawthorne, 1994]. Seedlings and saplings are, however, more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].
GROWTH
Templer [1949] noted that the tree reaches the canopy within 30 years in E. Africa.

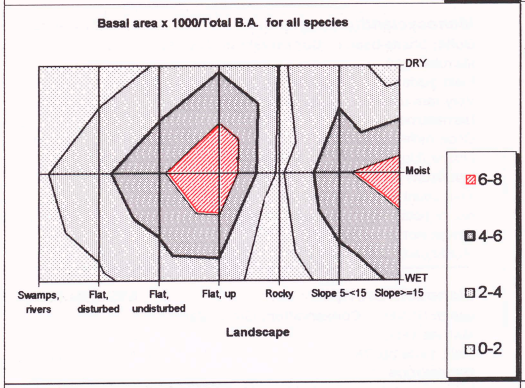
Milicia regia (A.Chev.) C.C.Berg **MORACEAE**
(=*Chlorophora regia*)
Common name: ODUM-NUA, Iroko, Ep, Af.Oak
Guild: Pioneer **Conservation:** Scarlet star
MATURE TREE
Field guide pp. 118 Group: 19B No. 2
See *M. excelsa*.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 124) (probably). Upper Guinea endemic. However adult trees are not distinguished reliably by tree spotters, and not at all by exploiters.
REGENERATION
The germination details are probably the same as for *M. excelsa*.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 24

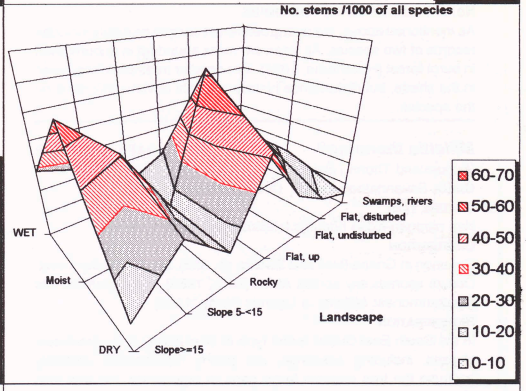
Millettia griffoniana Baillon **PAPILIONACEAE**
(=Lonchocarpus griffonianus)
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 213 Group: 37I No. 433
DISTRIBUTION
Small, Guineo-Congolian tree, in understorey of Wet zone forests, confused with *M. rhodantha*, but with fewer leaflets. Amalgamated for TSP inventory. In Nigeria, it is usually found on riverbanks [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 21
The charts join this species with *M. griffoniana*, yielding a rather nebulous distribution chart, but a strong indication of low crown

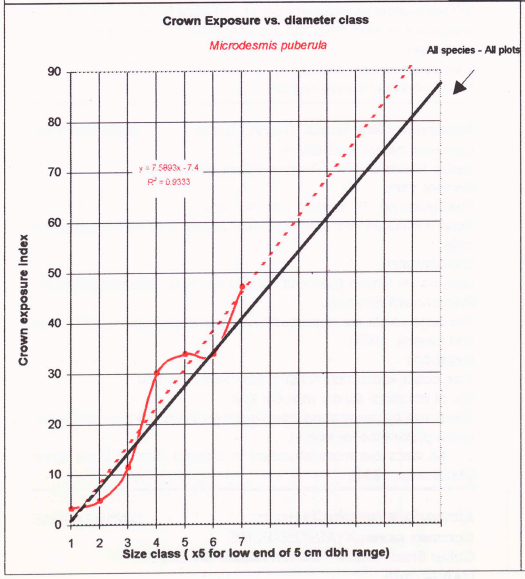
Microdesmis puberula

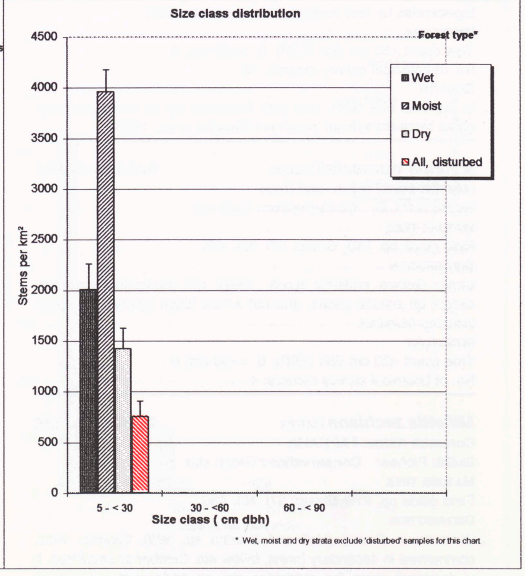












exposure.

Millettia rhodantha Baillon **PAPILIONACEAE**
Common name: TETETOA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 213, 237 Group: 37I No. 434
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 387). Guinea-wide. A medium-sized, rather slender tree common in a variety of forests, with rather variable foliage. A similar species, *M. griffoniana*, has contributed many of the records from evergreen forest - see *Millettia* spp.
PHENOLOGY/DISPERSAL
Seeds, with no obvious dispersal mechanism apart from propulsion from the dehiscing pod, are produced around the year.
REGENERATION
Newly germinated seedlings are often abundant in the shade. Hall and Swaine record that the species regenerates in small gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 287 >=30 cm: 361
No. of botanical survey records: 85
As mentioned above, the evergreen forest sample probably includes records of two species. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The smaller trees are often found in the shade, but disturbance history has little obvious influence on the species.

Millettia thonningii **PAPILIONACEAE**
(Schum.and Thonn.) Baker
Guild: Savanna/non-forest **Conservation:** Blue star
MATURE TREE
Has nitrogen-fixing nodules [Halliday and Nakao, 1982].
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 388), but only in dry forest. Occurs sporadically across Africa [Lock, 1989]. Often planted. It is the commonest *Millettia* in Uganda [Keay, 1989].
REGENERATION
In the South East Outlier forest type at Shai hills G.P.R., small size classes, including seedlings, are poorly represented, probably because the tree requires large gaps to regenerate; the tree also regenerates by root suckers [Swaine *et al.*, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 16
GROWTH
In the Shai hills GPR, tree girth fluctuates by 10 mm seasonally, about twice the annual increment [Swaine *et al.*, 1990].

Millettia warneckei Harms **PAPILIONACEAE**
(*Millettia irvinei* Hutch. and Dalz)
Guild: N.P.L.D. **Conservation:** Gold star
MATURE TREE
Field guide pp. 213 Group: 37I No. 435
DISTRIBUTION
Upper Guinea endemic [Lock, 1989]; not particularly common, except on coastal plains, and not a true forest species. Probably includes *M.irvinei*.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

Millettia zechiana Harms **PAPILIONACEAE**
Common name: FAFRAHA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 213 Group: 37I No. 436
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 389). Guinea- wide, commonest in secondary forest, fallow etc. Climber or small tree. It is dominant along the roadsides etc. on parts of the Mampong scarp.
INVENTORY
Tree count <30 cm dbh (TSP): 119 >=30 cm: 13
No. of botanical survey records: 159
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to thrive in burnt forest [Hawthorne, 1994]

Mischogyne elliotiana (Engl.and Diels) Friis **ANNONACEAE**
(=*Uvariastrum elliotianum*)
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 77 Group: 12D No. 437
Small, evergreen tree. Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 0
No. of botanical survey records: 30

Mitragyna ciliata see *Hallea ledermannii*

Mitragyna stipulosa see *Hallea stipulosa*

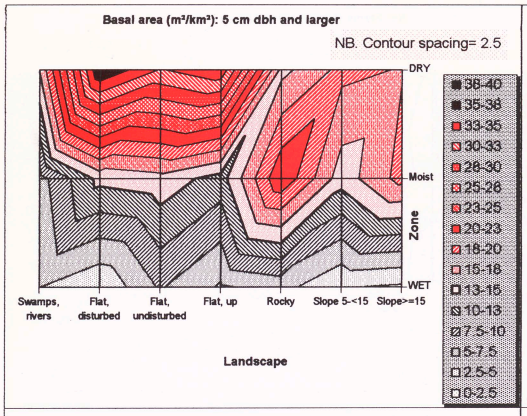
Monocyclanthus vignei Keay **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 77 Group: 12D No. 438
Very rare understorey tree known from Ankasa.
DISTRIBUTION
Once believed endemic to Ghana, now known from wet forest in Liberia (Upper Guinea endemic), but very rare in Ghana.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4
OTHER NOTES
[Achenbach and Frey, 1982]

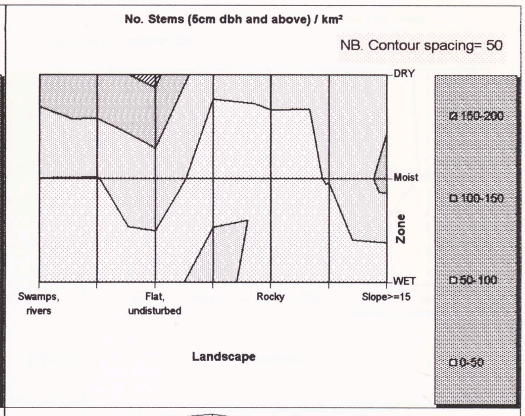
Monodora brevipes **ANNONACEAE**
Guild: Shade? **Conservation:** Green star
MATURE TREE
Field guide pp. 78
DISTRIBUTION
Not adequately segregated from *M. tenuifolia* by field teams: sterile specimens of *Monodora* spp are very difficult to distinguish.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

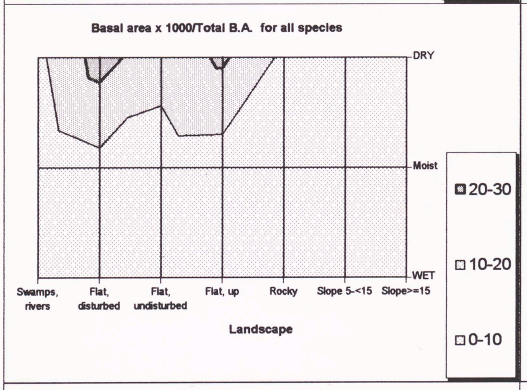
Monodora myristica (Gaertn.) Dunal **ANNONACEAE**
Common name: WEDEABA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 78 Group: 12E No. 440
Small deciduous tree with large, thick leaves towards the end of the twigs.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 391); Guineo-Congolian.
PHENOLOGY/DISPERSAL
The large seeds are dispersed by elephants [Alexandre, 1977; Hall and Swaine, 1981].
INVENTORY
Tree count <30 cm dbh (TSP): 505 >=30 cm: 914
No. of botanical survey records: 209
The crown exposure charts clearly shows its understorey tendency, and a preference for slopes.
All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

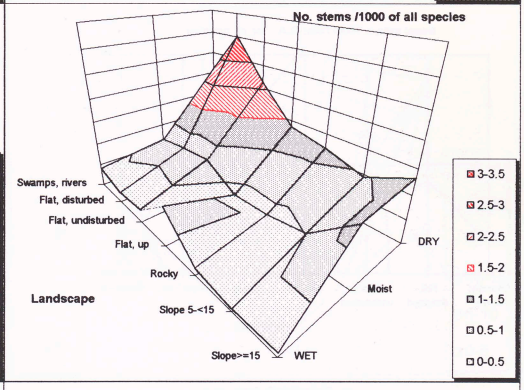
Monodora tenuifolia Benth. **ANNONACEAE**
Common name: NYANKUMABERE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 78 Group: 12F No. 444
Deciduous small tree which becomes completely leafless for the first time after 20 months [Amobi, 1972].

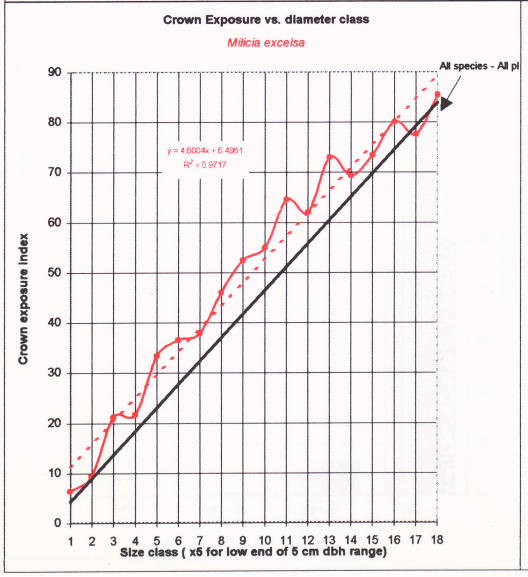
Millicia excelsa & regia

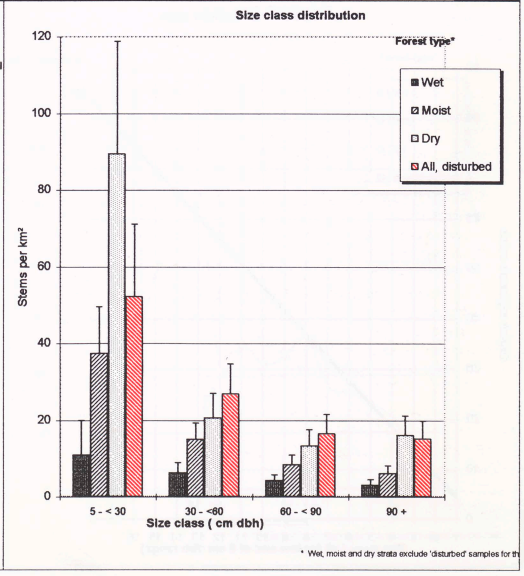




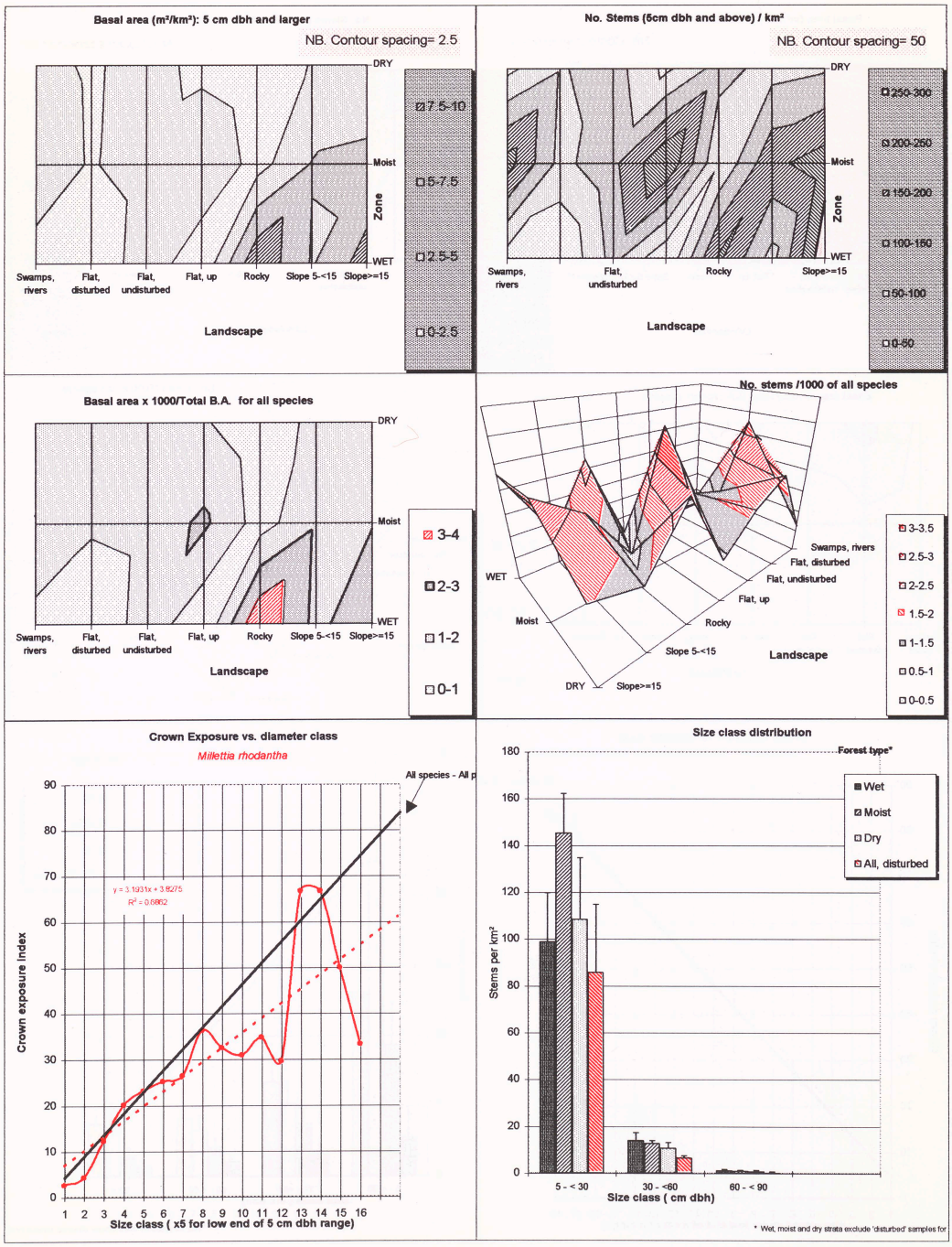




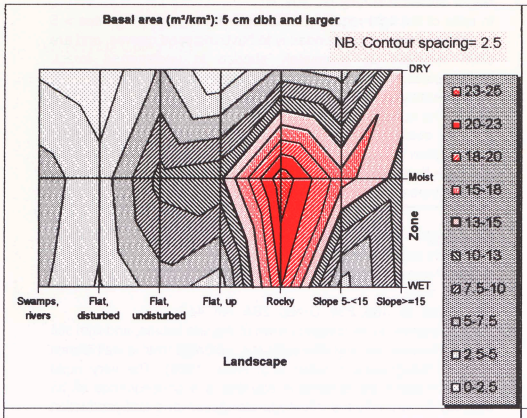


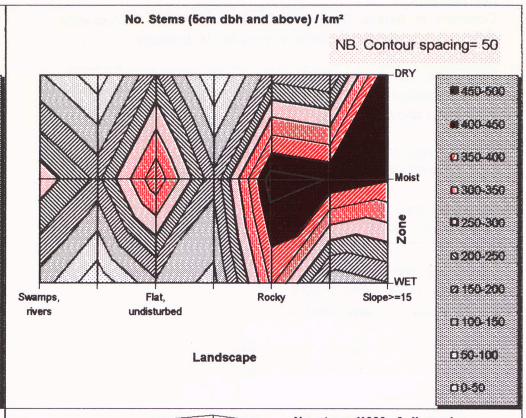


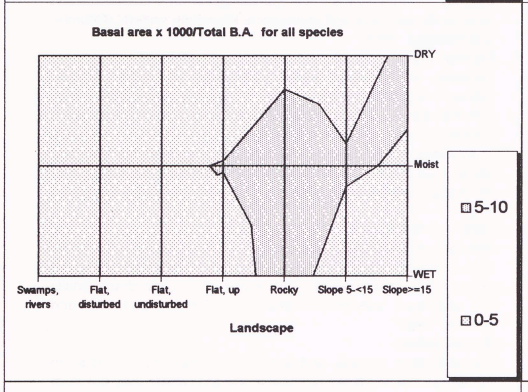
Millettia rhodantha & griffoniana

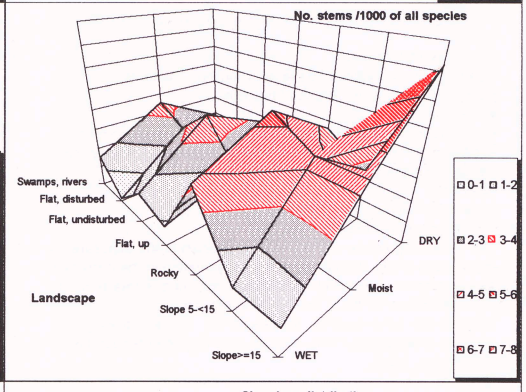


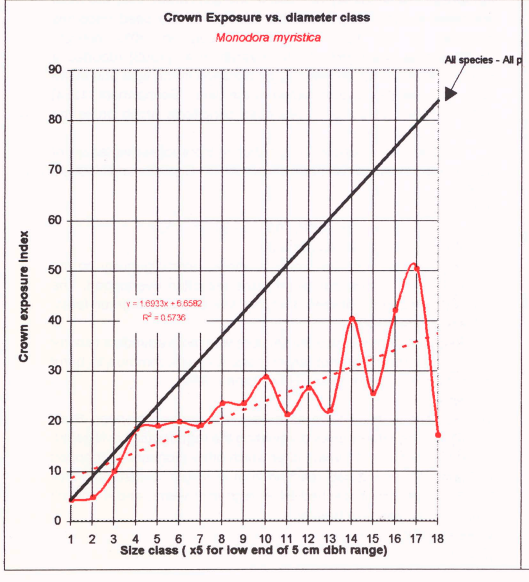
Monodora myristica

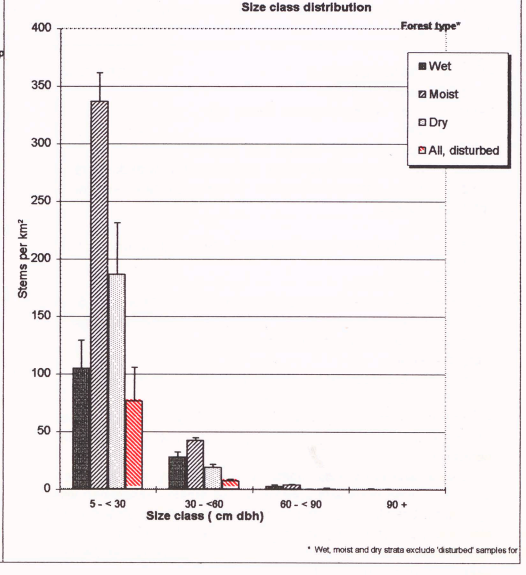












DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 392); Guinea-wide. Inventory records may include records for *M. brevipes*.
INVENTORY
Tree count <30 cm dbh (TSP): 1190 >=30 cm: 997
No. of botanical survey records: 159
The charts show this species abounds in disturbed, moist forest.
GROWTH
Growth rings in seedlings non-annual [Amobi, 1972], although Amobi [1973] records older trees as producing one growth ring each year.
OTHER NOTES
[Oguntimein, 1989]

Morinda lucida Benth. **RUBIACEAE**
Common name: KONKROMA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 29 Group: 1A No. 442
Medium-sized tree with slightly irregular bole and dense, shady crown.
DISTRIBUTION
Widespread in tropical Africa, especially in secondary forest [Keay, 1989].
PHENOLOGY/DISPERSAL
Seed production seems to be rather irregular. The fruits are rather fleshy and likely to be dispersed by birds.
REGENERATION
Germination is normal [Taylor]. Seedlings, however, are common in secondary forest and absent from shaded understorey. The species clearly requires medium-large gaps for establishment.
INVENTORY
Tree count <30 cm dbh (TSP): 62 >=30 cm: 59
No. of botanical survey records: 31
The pioneering nature of the tree is suggested in the exposure of crowns and in the abundance of the regeneration in the disturbed forest samples. Regeneration (5-30 cm dbh) of this tree is much more abundant in burnt than in unburnt semideciduous forest, although the trend reverses for trees > 30 cm dbh, presumably because of larger trees killed by fire not having been replaced (yet) [Hawthorne, 1994].
GROWTH
Plants can reach 1m in a year, and up to 18m (65 cm gbh) in 14 years [Taylor].

Morus mesozygia Stapf **MORACEAE**
Common name: WoNTon
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 117, 235 Group: 19A No. 47
Medium-sized, or sometimes large, deciduous tree with dark green, compact crown, without buttresses. Large trees can have large, spherical crowns.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 395); widespread pioneer in tropical Africa.
PHENOLOGY/DISPERSAL
Bird (and other animal)-dispersed, fleshy ('African Mulberry') fruits with small seeds are produced at the end of the dry season-beginning of the rainy season (Mar.-May).
REGENERATION
Germination is said to be normal [Taylor], although on the basis of the distribution of seedlings one might expect a requirement of exposure for germination. Unlike *Trema*, which has otherwise similar seedlings and seeds, there is no record of this species in soil seed banks.

Young seedlings are commonly seen in very exposed sites, such as in large gaps with substantial soil erosion associated with log-loading bays in Bia South G.P.R. Scattered individuals are found also in any forest with some daily exposure to full sunlight.
Taylor records a height increment of almost 2 metres in the first year in unshaded nursery beds.
INVENTORY
Tree count <30 cm dbh (TSP): 377 >=30 cm: 421
No. of botanical survey records: 82
In spite of the light-requiring seedlings, the regenerating trees > 5 cm dbh show no strong tendency to have exposed crowns, and are often recorded as completely shaded in undisturbed forest. Nevertheless, the regenerating trees are commoner, or approximately as dense in burnt MS-ME forest as in undisturbed forest. The species prefers dry forest.

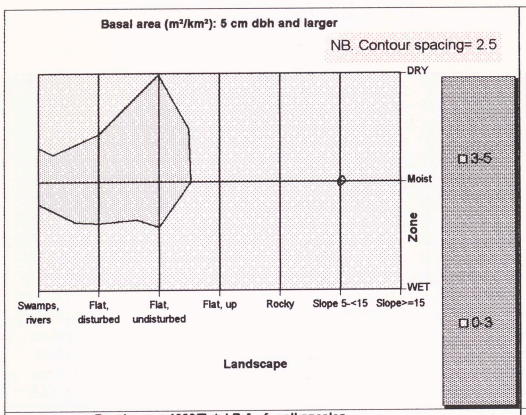
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to thrive in burnt forest; in spite of a large number of records, the preference for burnt/unburnt forest reverses wildly between size classes [Hawthorne, 1994]

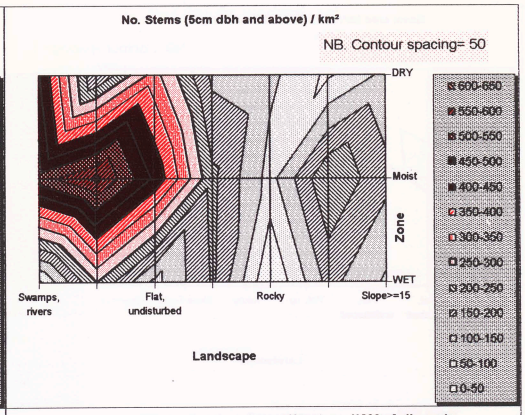
Musanga cecropioides F.Br. **MORACEAE**
Common name: oDWUMA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 155, 234 Group: 28A No. 443
Very distinctive dome-shaped crown of digitate leaves, and with stilt roots. This common and characteristic 'umbrella tree' is well known to be a fast-growing pioneer (e.g. Ross, 1954). The very rapid growth of which the species is capable is a consequence of 'its capacity for unrestricted internode elongation and leaf production (and) in its restricted and economical branching pattern' [Coombe and Hadfield, 1962].
DISTRIBUTION
Common in disturbed areas particularly in wetter forests. Guineo-Congolian pioneer typical of recently secondary forest, where it often suppresses other light-demanding trees [Deval, 1967; Lancaster, 1961; Wilkie and Finn, 1990]. Dies out after c. 15 years or so [Ross, 1954]. Grown also elsewhere [e.g. Ardikoesoema and Kamil, 1955]. Although the timber is of little value, the potential of the fast growing wood in other contexts has often been expressed (e.g.
Poinsier,[1947]).
PHENOLOGY/DISPERSAL
Fruit production occurs throughout the year. The small seeds are distributed by bats and birds. This is one of the most characteristic soil seed-bank species in some areas [Deval, 1969; Hall and Swaine, 1980].
REGENERATION
Germination is unusual, and seedlings are very hard to raise in nurseries. The seeds lay dormant in the soil (where they are most abundant in the evergreen forest zone) until the seed becomes exposed to the sun. Germinates freely in 90% sunlight [Ardikosoema and Kamil, 1955]. Kyereh *et al.* [1993] reported a significant difference between % germination in the light and in the dark, with few seeds germinating in the dark. Bouharmont [1954] and Nkansah Kyere [1970] described conditions which broke the dormancy of the seeds.

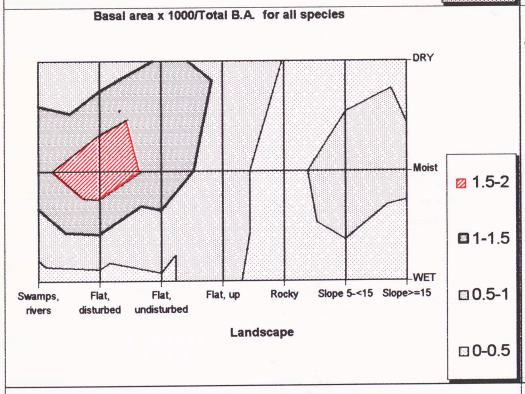
The remarkable degree of variation in the successive leaves of developing seedlings has been discussed by Coombe and Hadfield [1962].
INVENTORY
Tree count <30 cm dbh (TSP): 936 >=30 cm: 1636
No. of botanical survey records: 60
The high exposure of the crown is shown unambiguously on the charts for small trees, but larger sizes are often overtopped. The bimodal distribution between dry forest slopes and evergreen forest flat land is interesting.

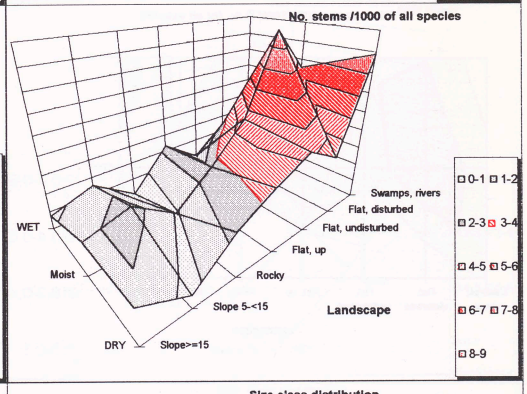
Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest, but larger trees are less common in burnt forest than in unburnt forest [Hawthorne, 1994].
GROWTH
This species is well-known as a very fast growing pioneer. Ross [1954] recorded the species dominating the regeneration in Nigerian forest for the first c. 15 years after which other pioneers overtopped it. During this time it had reached 20m in height. Swaine and Hall [1983] record that it reached 24 m high in 9 years, and it doesn't often exceed this size greatly.
OTHER NOTES
[Duval, 1967]

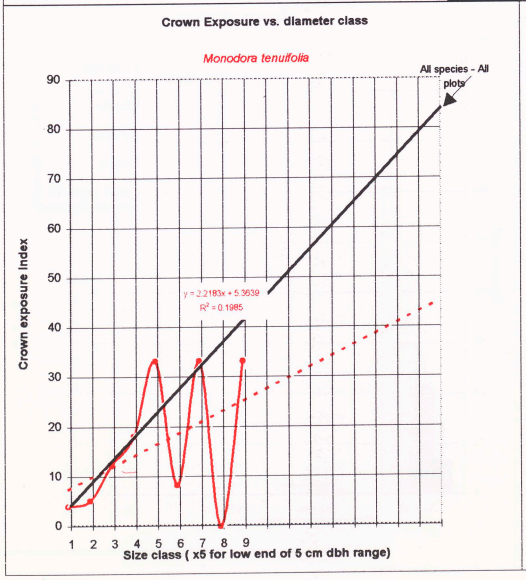
Monodora tenuifolia

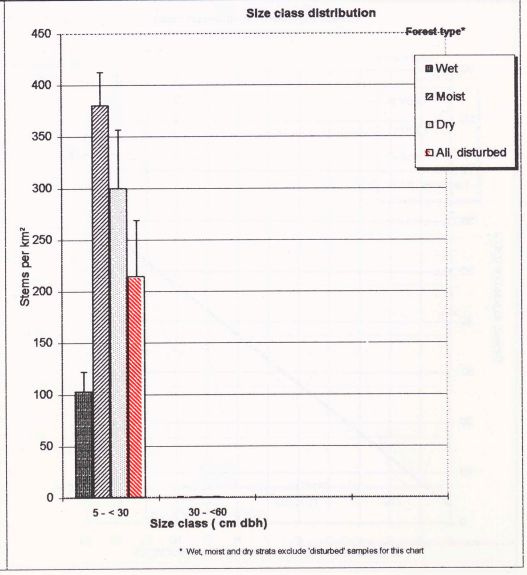


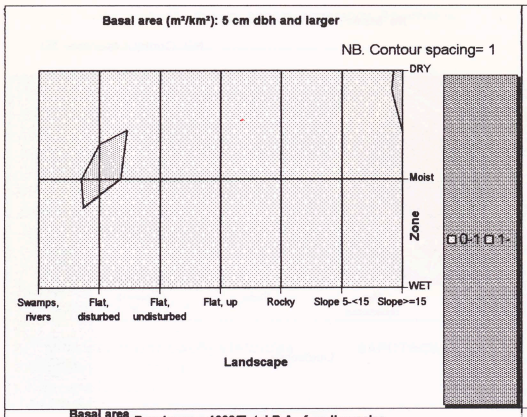


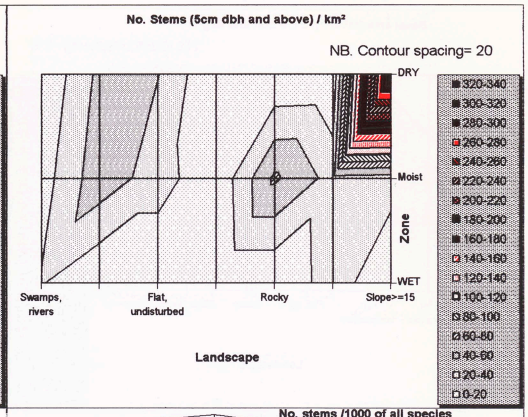


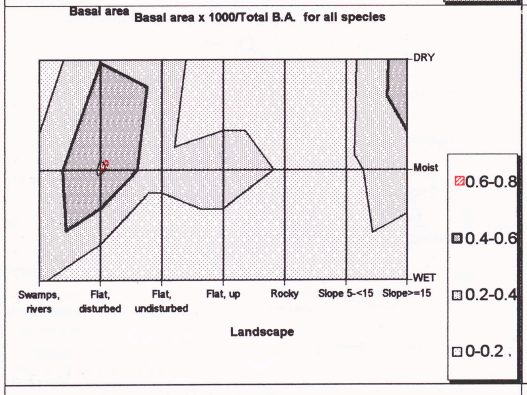


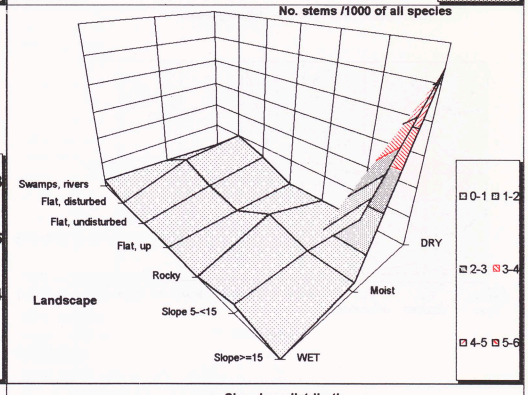


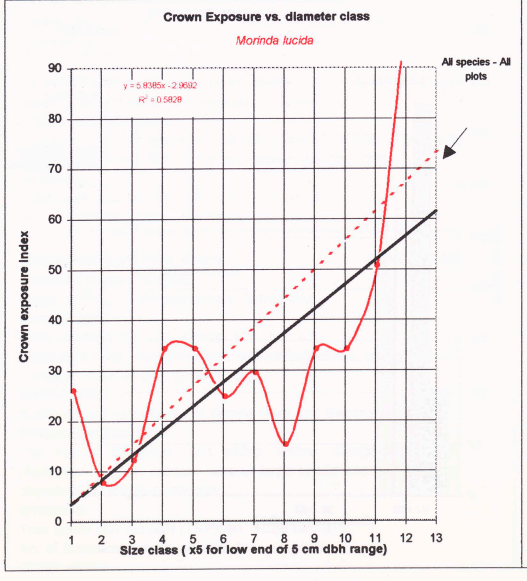


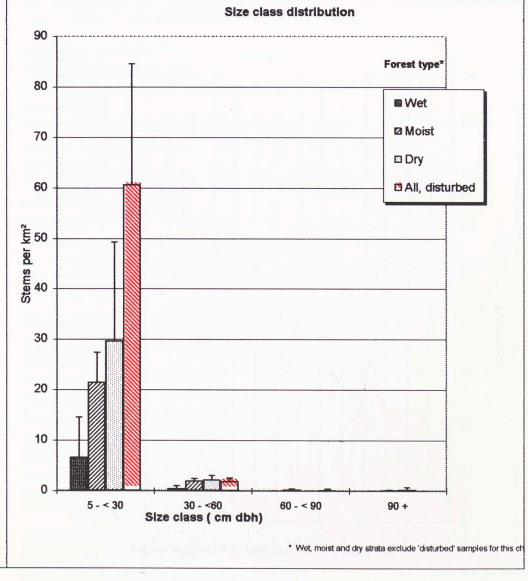

Basal area (m²/km²): 5 cm dbh and larger
NB. Contour spacing= 1
DRY
Moist
WET
Zone
0-1
1-
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape


No. Stems (5cm dbh and above) / km²
NB. Contour spacing= 20
DRY
Moist
WET
Zone
320-340
300-320
280-300
260-280
240-260
220-240
200-220
180-200
160-180
140-160
120-140
100-120
80-100
60-80
40-60
20-40
0-20
Swamps, rivers
Flat, undisturbed
Rocky
Slope>=15
Landscape

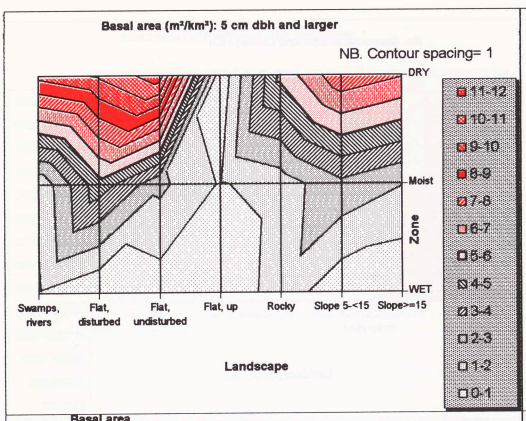

Basal area
Basal area x 1000/Total B.A. for all species
DRY
Moist
WET
0.6-0.8
0.4-0.6
0.2-0.4
0-0.2
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape

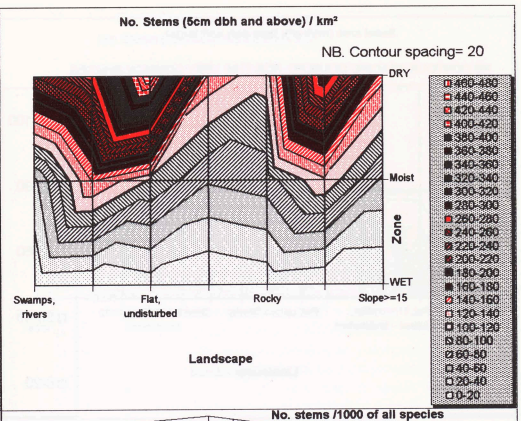

No. stems /1000 of all species
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
DRY
Moist
WET
0-1
1-2
2-3
3-4
4-5
5-6

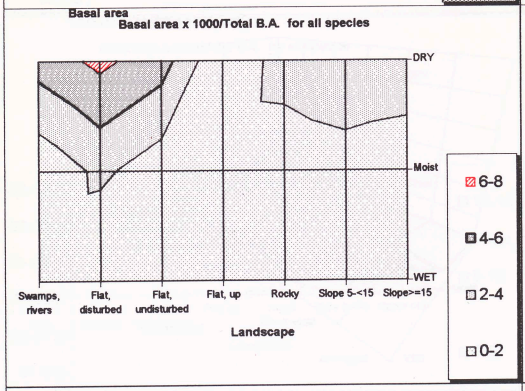

Crown Exposure vs. diameter class
Morinda lucida
All species - All plots
y = 5.8385x - 2.9692
R² = 0.5828
Crown exposure index
Size class (x5 for low end of 5 cm dbh range)

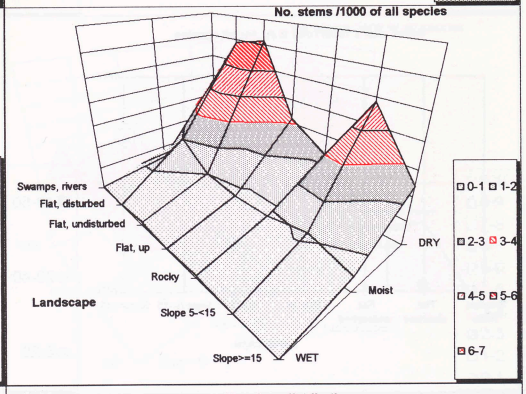

Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
90 +
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this ch

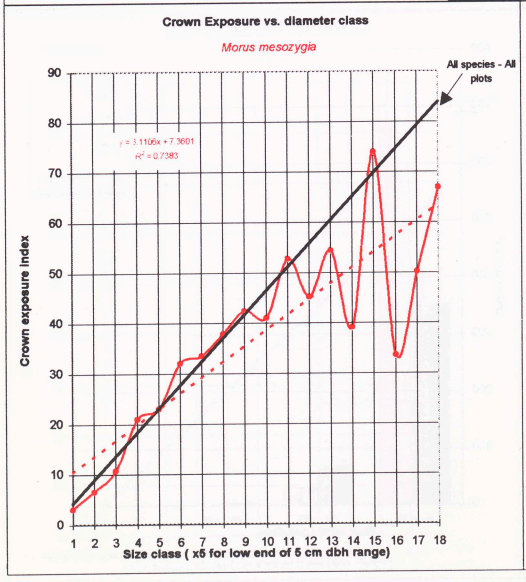
Morus mesozygia

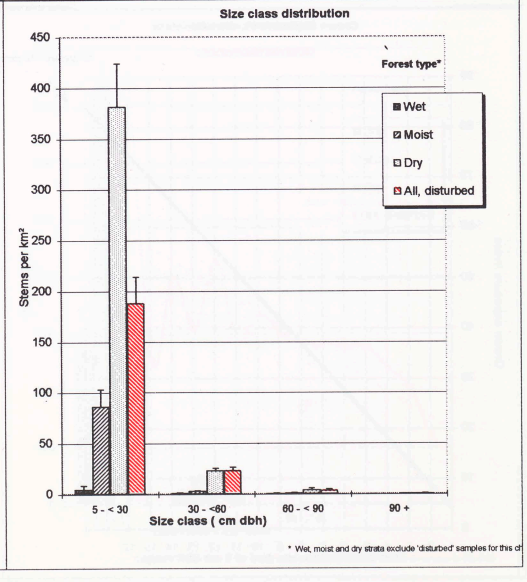




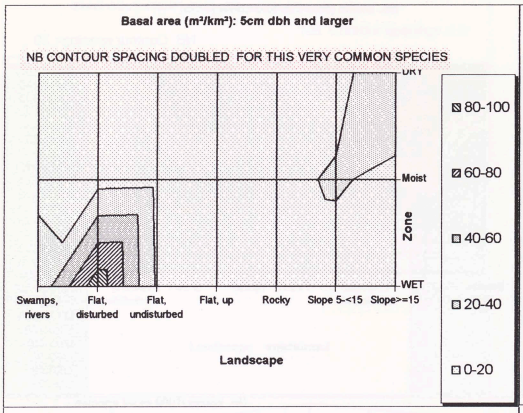


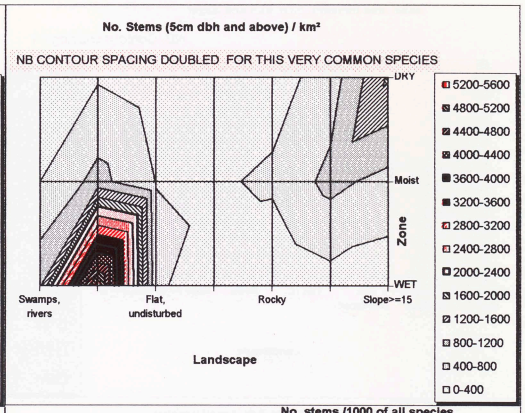


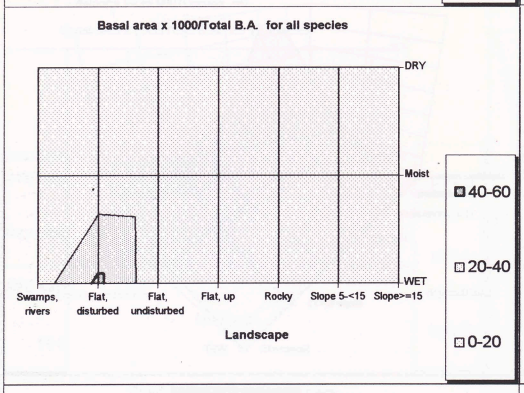


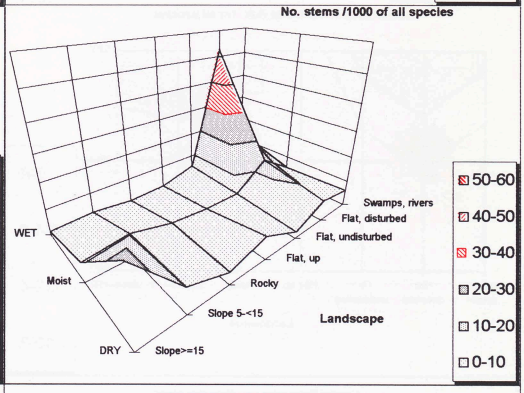


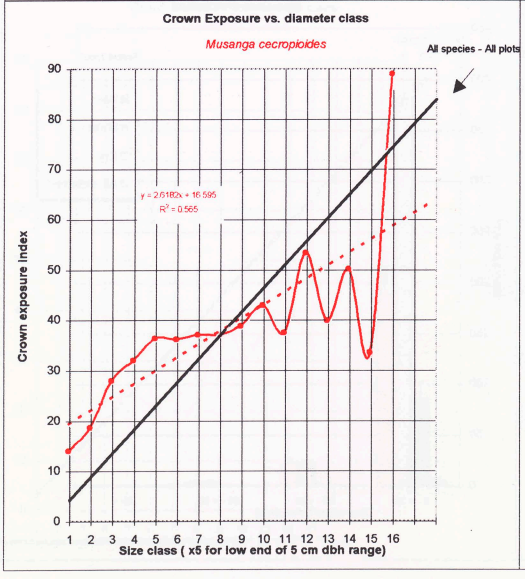
Musanga cecropioides

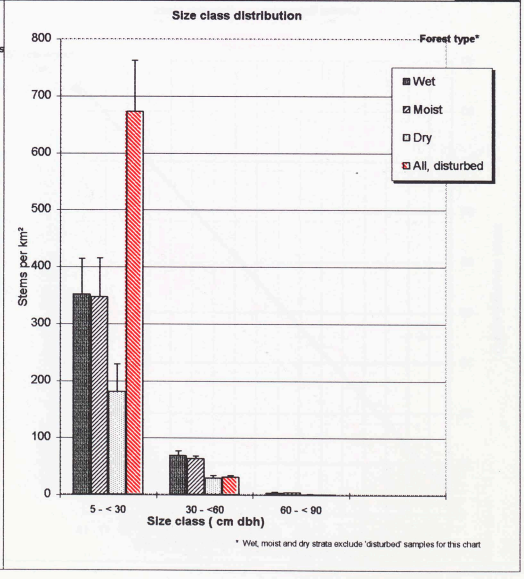




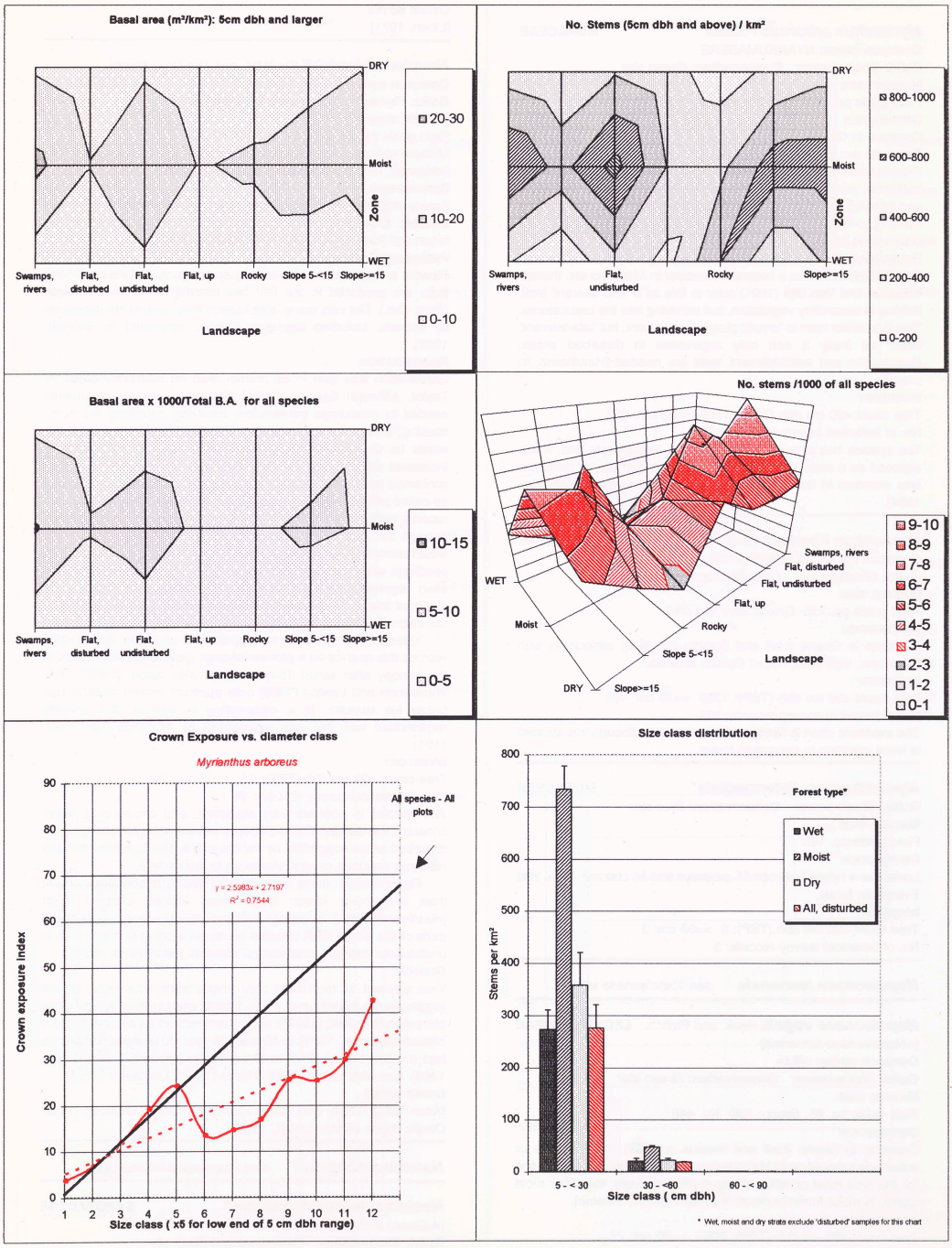








Myrianthus arboreus



Myrianthus arboreus P.Beauv. **MORACEAE**
Common name: NYANKUMABERE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 155, 234 Group: 28A No. 444
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 397); Guineo-Congolian. The fruits are edible [Abbiw, 1990].
PHENOLOGY/DISPERSAL
In Gabon, primates enjoy the fruits and disperse the seeds [Hladik and Hladik, 1967]. Seeds of this species were found in 2% (dry season) to 66% (rainy season) of piles of elephant dung in Bia South GPR [Martin, 1991].
REGENERATION
Kahn [1982] cited it as a common coloniser in *Musanga* etc. thicket. Oldeman and Van Dijk (1991) refer to this as a 'late-tolerant' tree, thriving in secondary vegetation, but surviving into the understorey. This is a similar term to 'cryptic pioneer' used here, but 'late-tolerant' need not imply it can only regenerate in disturbed areas. Germination and establishment tests are needed [Hawthorne, in press].
INVENTORY
Tree count <30 cm dbh (TSP): 1190 >=30 cm: 997
No. of botanical survey records: 159
The species has a rather central peak in moist forest and, whilst exposed as a small tree, is shaded when larger. Larger trees are less common in burnt forest than in unburnt forest [Hawthorne, 1994].

Myrianthus libericus Rendle **MORACEAE**
Common name: NYANKUMANINI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 155 Group: 28A No. 445
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 398); associated with base-poor, acid soils; Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 1339 >=30 cm: 402
No. of botanical survey records: 198
The exposure chart is like that of *M.arboreus*, although this species is more common in evergreen forest.

Myrianthus sp. 'intermediate' **MORACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 155
DISTRIBUTION
Looks like a hybrid between *M. arboreus* and *M. libericus*, from Wet Evergreen forest.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

Napoleonaea leonensis see *Napoleonaea vogelii*

Napoleonaea vogelii Hook. and Planch. **LECYTHIDACEAE**
(=*Napoleonaea leonensis*)
Common name: oBUA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 85 Group: 13B No. 446
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 399). Two species or subspecies should probably be recognised (or rather reinstated) one for the type most common along dry forest rivers, the other most typical in moist forest understorey [see Hall and Swaine].
INVENTORY
Tree count <30 cm dbh (TSP): 3059 >=30 cm: 22
No. of botanical survey records: 371
Larger trees are less common in burnt forest than in unburnt forest [Hawthorne, 1994].
OTHER NOTES
[Liben, 1971]

Nauclea diderrichii (De Wild. and The.Dur.) Merrill
Common name: KUSIA, Opepe **RUBIACEAE**
Guild: Pioneer **Conservation:** Scarlet star
MATURE TREE
Field guide pp. 29, 240 Group: 1B No. 10
Medium to large tree with cylindrical, unbuttressed bole and rather horizontal, whorled boughs, in a narrow crown.
DISTRIBUTION
Across tropical Africa from Sierra Leone to Mozambique [Hall and Swaine]. Dispersed by elephants. Seeds can lie dormant in the forest soil [Keay, 1960; Hall and Swaine, 1980].
PHENOLOGY/DISPERSAL
Flowers are produced between May and August, and the ripe fleshy fruits are produced in the first few months of the drier season (Sept.-Oct.). The very many, small seeds they contain are dispersed by animals, including elephants [Taylor, confirmed by Gyimah, 1986].
REGENERATION
Germination was said to be normal, with no dormancy noted by Taylor, although Sawyerr [1960] describes extreme treatments needed to encourage germination, involving pounding the fruits, soaking, and burial in damp soil. Hall and Swaine note that the seeds lie dormant in the soil until stimulated to germinate by increased exposure to the sun. The latter proposition has been confirmed by Kyereh *et al.* [1993], who record this as one of few so-called pioneers with a much higher % germination in the sun. No records have been made of the effects on germination of passage through the guts of the animals which eat the fruit. However, it would seem that this species is often dispersed by animals, and the seedlings with their distinctive, large glossy leaves, are commonly seen regenerating in Bia South GPR, along open tracks and elephant tracks. Taylor mentions a high seedling mortality, due to too much shading, or too great exposure leading to borer attack.

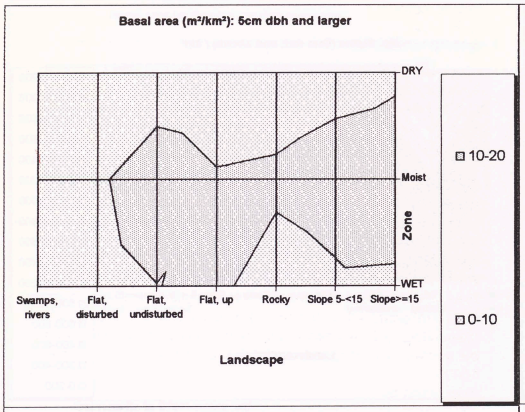
This certainly seems to be a species of big gaps. Ross [1954] records this species as a pioneer of large gaps in Nigeria, reaching the canopy after about 15 years (see also Anon. [1956]). Yet, Wadsworth and Lawton [1968] note optimum growth rates at well below full daylight. In a clear-felling in Nigeria, this species regenerated well, but was suppressed by *Musanga* [Lancaster, 1961].
INVENTORY
Tree count <30 cm dbh (TSP): 71 >=30 cm: 344
No. of botanical survey records: 24
The species is nowhere very abundant, and occurs in a rather constant, low density, with a slight preference of the regeneration for disturbed areas suggested by the bar chart. The tendency to have relatively exposed crowns shows up in the sample.

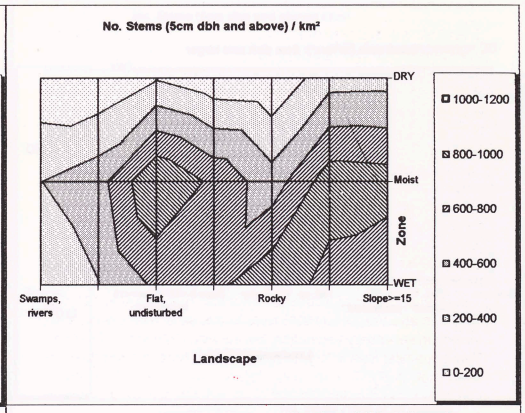
Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest; larger trees 'prefer' unburnt forest [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].
GROWTH
Tree attained 12 m (10 cm dbh) height within four years on old logging tracks [Hawthorne, 1993]. Widely used in taungya and other plantation (e.g. Neil, [1983]); and recommended as a nurse crop for Meliaceae [Anon., 1951]. In Nigeria, 26 year old taungya plantations had a mean height of 16 m and a mean dbh of 27 cm [Okojie, 1985]. See also Henry [1960]; Horne [1962]; Lancaster [1952].
OTHER NOTES
[Anon 1949, 1950; Eidt, 1965; Germain, 1945; Lancaster, 1952; Okojie, 1985; Riddoch *et al.*, 1991]

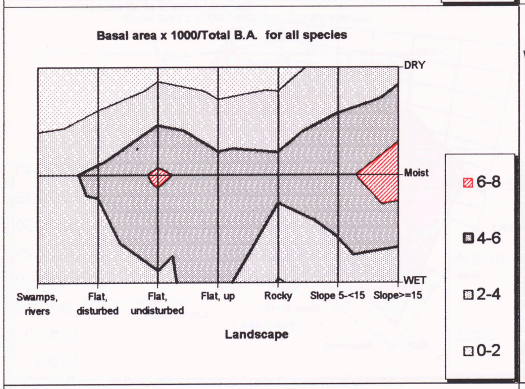
Nauclea pobeguinii see *Sarcocephalus pobeguinii*

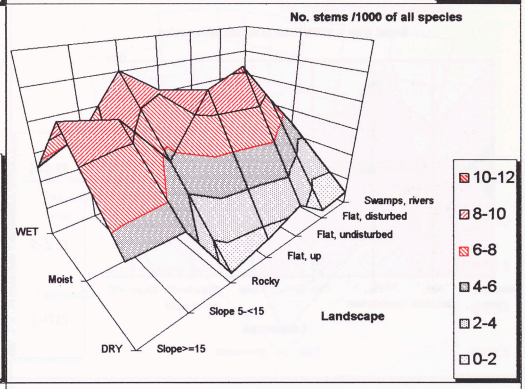
Neolemonniera clitandrifolia **SAPOTACEAE**
(A.Chev.) Heine
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 65 Group: 10D No. 449
Large, evergreen tree with whorled boughs, at least when young,

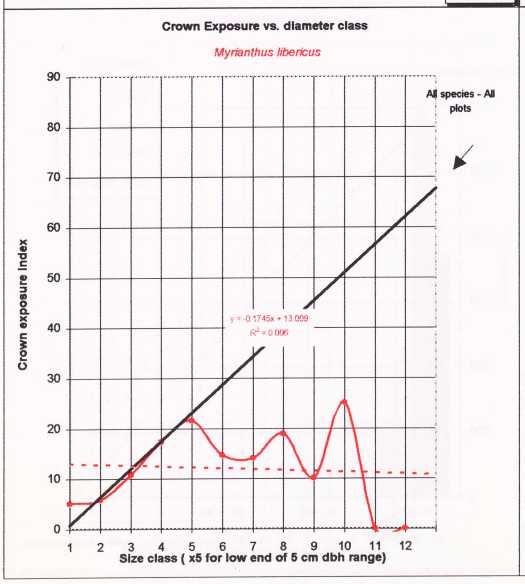
Myrianthus libericus

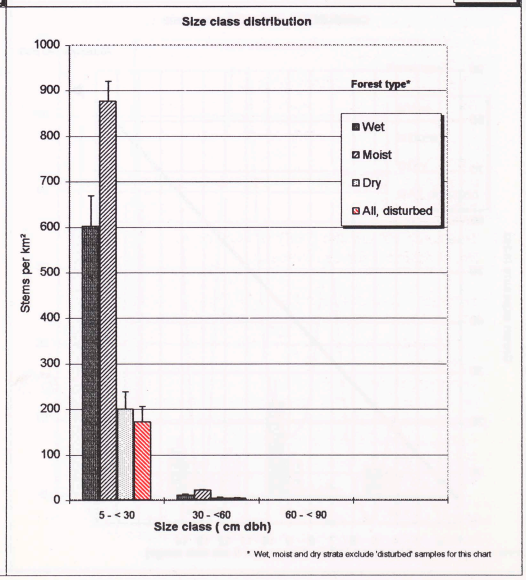


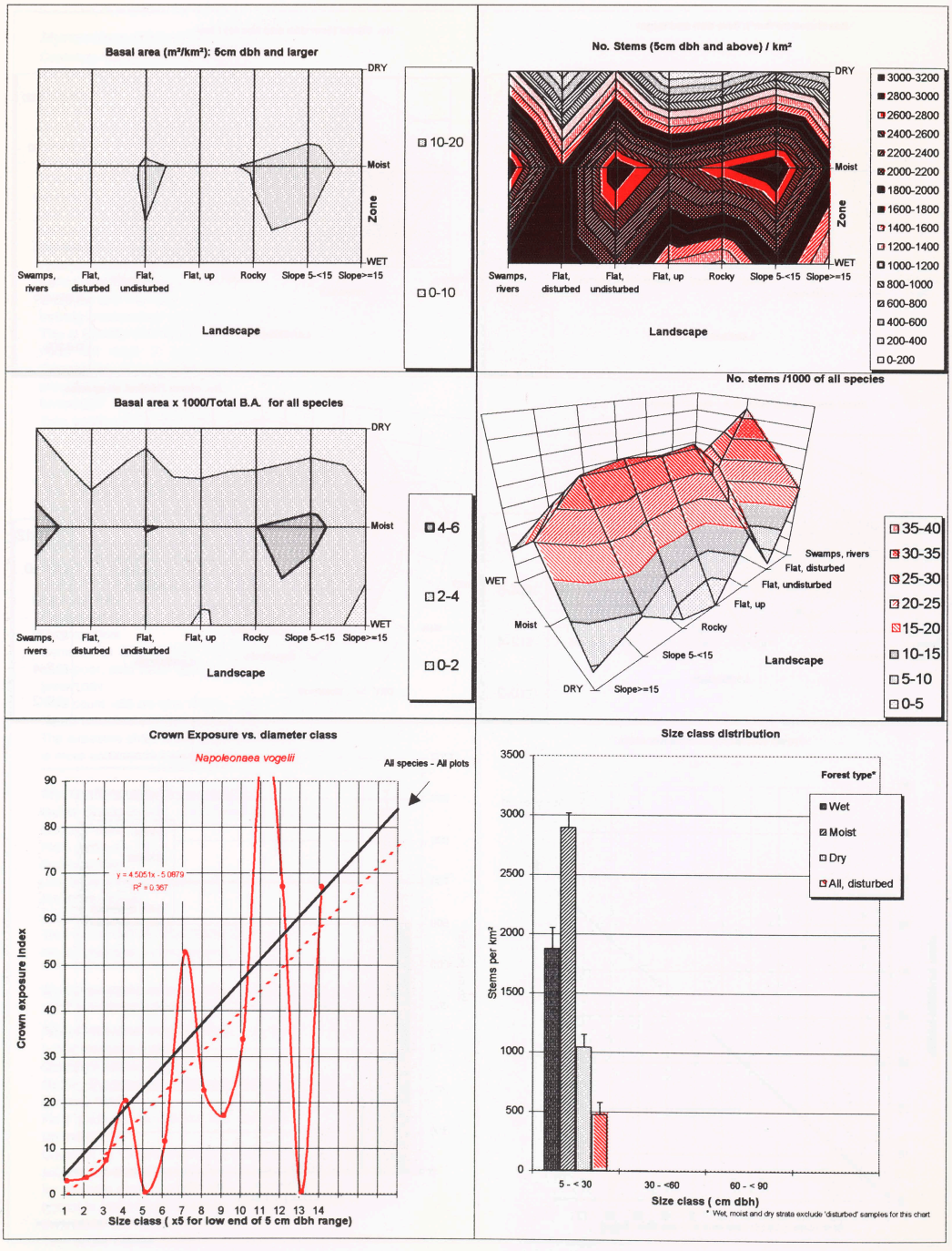




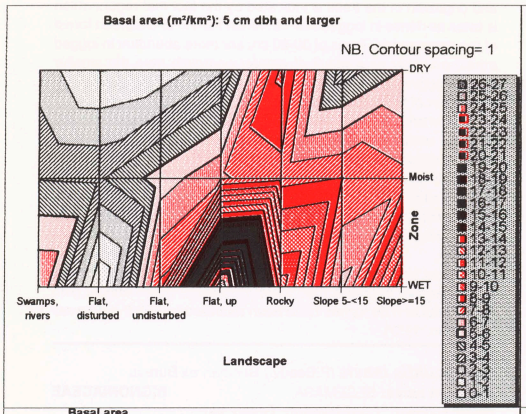


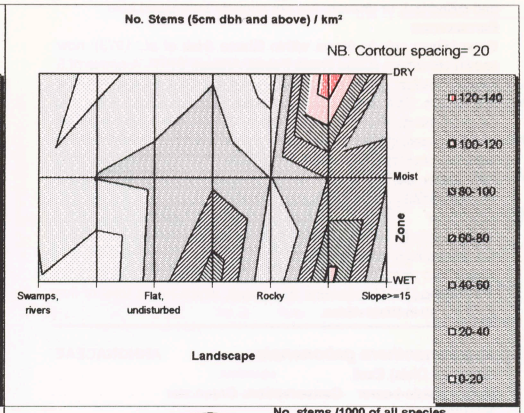


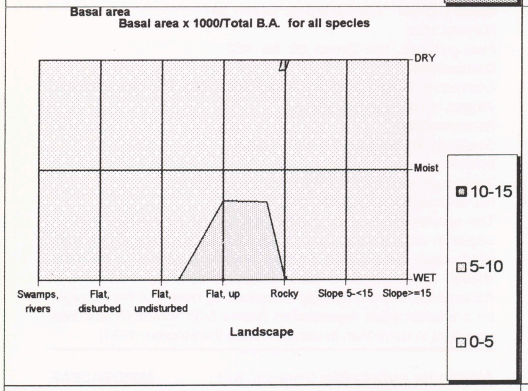


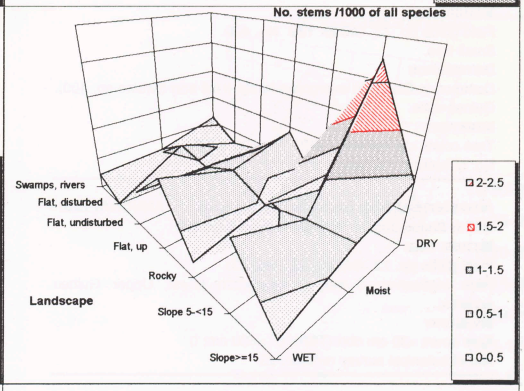

Basal area (m²/km²): 5cm dbh and larger
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
10-20
0-10
No. Stems (5cm dbh and above) / km²
3000-3200
2800-3000
2600-2800
2400-2600
2200-2400
2000-2200
1800-2000
1600-1800
1400-1600
1200-1400
1000-1200
800-1000
600-800
400-600
200-400
0-200
Basal area x 1000/Total B.A. for all species
4-6
2-4
0-2
No. stems /1000 of all species
35-40
30-35
25-30
20-25
15-20
10-15
5-10
0-5
Crown Exposure vs. diameter class
Napoleonaea vogelii
All species - All plots
y = 4.5051x - 5.0879
R² = 0.367
Crown exposure index
Size class (x5 for low end of 5 cm dbh range)
Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

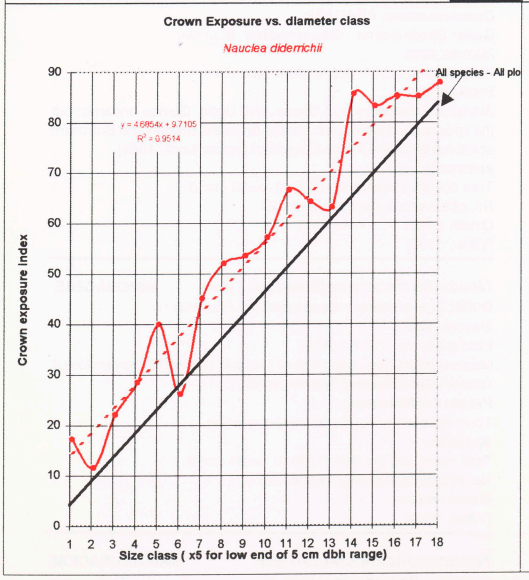
Nauclea diderrichii

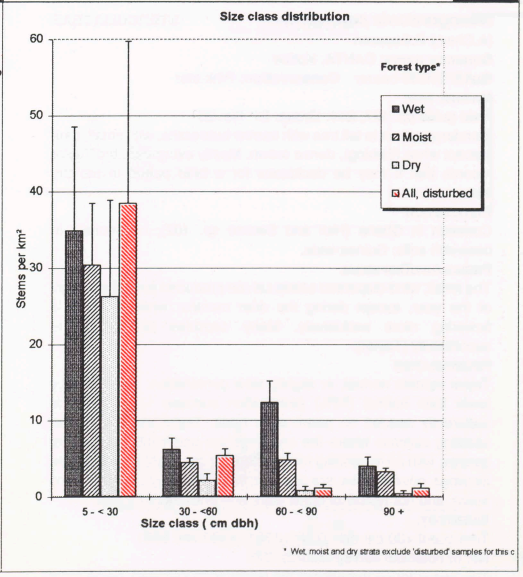












and cylindrical, or uneven, but not strongly buttressed bole.

DISTRIBUTION

Once known only in Atewa within Ghana (Hall *et al.*, 1973); now known elsewhere (Cape Three Points, Ankasa GPR). A genus of 5 species in West Africa, this one known also in Sierra Leone, Liberia and South East Nigeria [Keay, 1989] (Guinea-wide). Probably common nowhere, although in Sierra Leone it is found in small groups especially on rocky slopes [Savill and Fox, 1967]. Young saplings have strongly tiered foliage. Becomes an immense tree, with seeds dispersed explosively over short distances. Species almost certainly rapidly declining in numbers.

INVENTORY

Tree count <30 cm dbh (TSP): 3 >=30 cm: 0
No. of botanical survey records: 14

TAXONOMIC NOTE

Pennington [1991] maintains this genus, which has a total of five species, all in West Africa.

Neostenanthera gabonensis **ANNONACEAE**
(Engl.and Diels) Exell
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 73 Group: 12B No. 450
Small tree.

DISTRIBUTION

Common in Ghana in evergreen forest (Hall and Swaine sp. 400). Guinea-wide.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 42

Neostenanthera hamata (Benth.) Exell **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 73 Group: 12B No. 451
Rare medium-sized tree of evergreen forest; Upper Guinea endemic.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 23

Nesogordonia papaverifera **STERCULIACEAE**
(A.Chev.) R.Capuron
Common name: DANTA, Kotibe
Guild: Shade-bearer **Conservation:** Pink star

MATURE TREE

Field guide pp. 127, 244 Group: 21 No. 26
Slender, medium to tall tree with narrow buttresses, with small, dark (except when flushing), dense crown. Mostly evergreen, but Taylor records that it may be deciduous for a brief period in the dry season.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 402); commonest in base-rich soils; Guinea-wide.

PHENOLOGY/DISPERSAL

The small, wind-dispersed seeds can be produced throughout most of the year, except during the drier months, when the tree is flowering more exclusively. Many capsules fail to mature successfully [Taylor].

REGENERATION

Taylor records normal, or slightly slow germination, with a slightly lower than normal (73%) germination success. Light shade is apparently needed on germination beds. Taylor records greater seedling success where the seedlings are under moderate forest canopy, with an increasing requirement for overhead light with age. Saplings, nevertheless, are common in medium-large gaps in some areas, and not typical of small gaps and undisturbed forest.

INVENTORY

Tree count <30 cm dbh (TSP): 1781 >=30 cm: 5821
No. of botanical survey records: 278
The tree is found throughout the forest zone sampled, being more common in dry (e.g. MSNW) forest than elsewhere. Smaller trees tend to be relatively shaded whereas larger trees are relatively exposed. A beneficial effect of greater light levels on the survival and ongrowth of the trees is indicated by the fact that regeneration is twice as dense in logged MS-ME forest than in undisturbed forest of the same zones. Trees of 30-60 cm are more abundant in logged areas, probably as a result of greater ongrowth from the smaller sizes. Logging itself does not seem to have affected greatly the population of the larger trees, even in logged areas.

Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest, although seedlings show less of an imbalance [Hawthorne, 1994].

Saplings (> 1m height) are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples, but the converse is true of smaller plants [Hawthorne, 1993].

GROWTH

In Tropical shelterwood plots the saplings can reach 1-1.5 m in 4 years [Taylor]. In undisturbed forest in Nigeria, mean annual girth increments of 0.66 inches have been recorded for 3-6 ft girth trees [Dommen, 1957].

Newbouldia laevis (P.Beauv.) Seeman *ex* Bureau
Common name: SESEMASA **BIGNONIACEAE**
Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 163 Group: 30 No. 452

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 406). The tree produces winged, wind-dispersed seeds.

REGENERATION

Seedlings are not found in the shade.

INVENTORY

Tree count <30 cm dbh (TSP): 667 >=30 cm: 8
No. of botanical survey records: 161
The species reaches its greatest abundance in swamps and on slopes in drier forests. Surprisingly, the larger sizes of the tree, which rarely exceeds 30 cm dbh, show a tendency to be more shaded than the smaller ones. Although seedling distribution in Asukese FR was not strongly influenced by history of fire damage, on a broader scale regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest [Hawthorne, 1994].

Newtonia aubrevillei (Pellegrin) Keay **MIMOSACEAE**
Common name: ADADABA
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 217 Group: 38A No. 454

DISTRIBUTION

Subsp. *aubrevillei*, rare in Ghana, and Upper Guinea endemic; but the species as a whole (inc. subsp. *lasiantha* Brenan and Brummitt) scattered through Guineo-Congolian region [Lock, 1989].

INVENTORY

Tree count <30 cm dbh (TSP): 5 >=30 cm: 6
No. of botanical survey records: 27

OTHER NOTES

[Villier, 1990]

Newtonia duparquetiana (Baill.) Keay **MIMOSACEAE**
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 217 No. 454
Medium-sized, buttressed tree of Wet and Upland Evergreen forest. Guinea-wide (Hall and Swaine sp. 407).

PHENOLOGY/DISPERSAL

The seeds are winged and wind-dispersed.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 27

OTHER NOTES

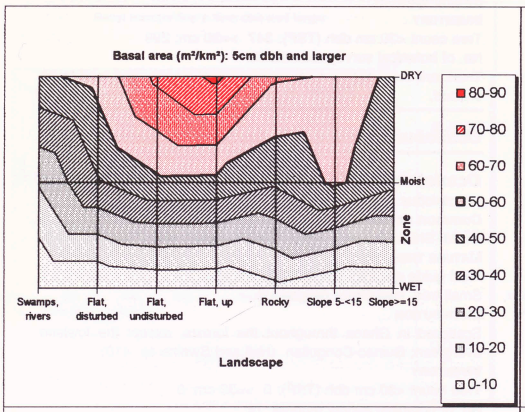
[Villier, 1990]

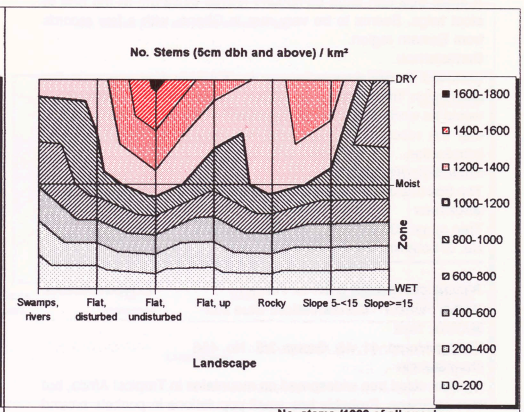
Nothospondias staudtii Engl. **SIMAROUBACEAE**
Guild: 0 **Conservation:** Gold star

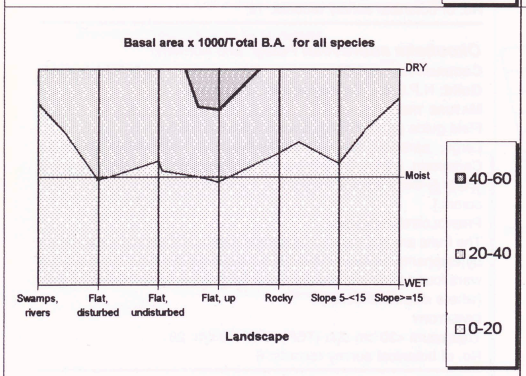
MATURE TREE

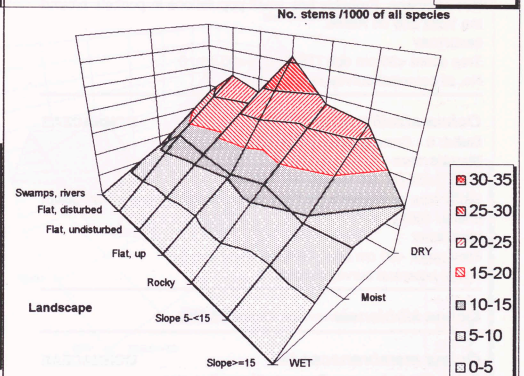
Field guide pp. 171 Group: 32 No. 455

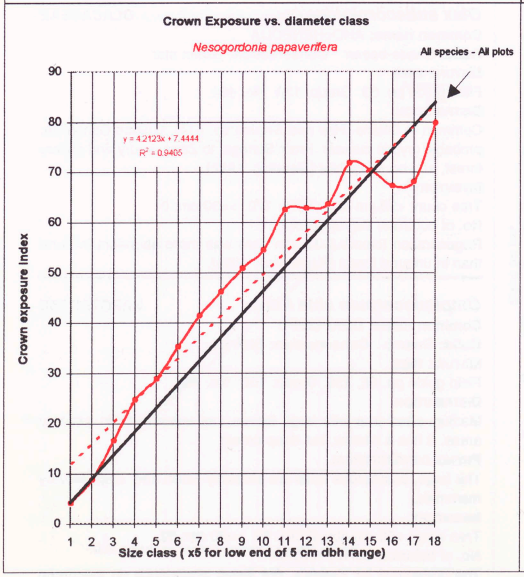
Nesogordonia papaverifera

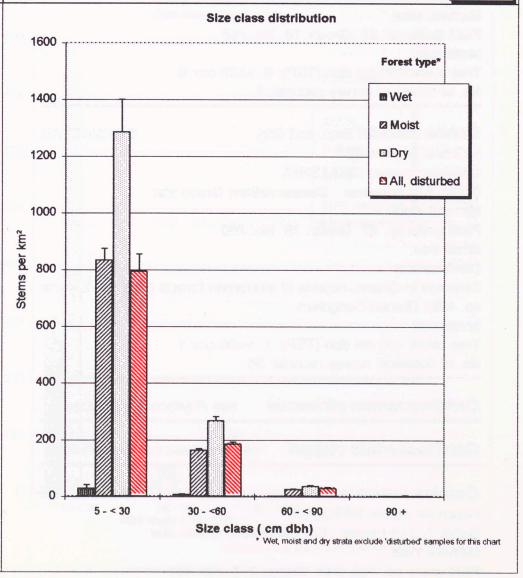












A small tree with large compound leaves clustered at the end of stout twigs. Seems to be very rare in Ghana, with a few records from Eastern region.

DISTRIBUTION

(Included in the Anacardiaceae in [FWTA]). Keay records the distribution 'from Nigeria to Gabon' i.e. Guinea-wide, although it would be worth confirming a) the match of these specimens and b) that the records in Ghana are not likely to be due to human introduction.

PHENOLOGY/DISPERSAL

The tree has drupes, said to resemble *Spondias* fruits [Keay, 1989].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

Nuxia congesta R.Br. ex Fresen **LOGANIACEAE**

Guild: Pioneer **Conservation:** Blue star

MATURE TREE

Field guide pp. 41, 45 Group: 3/5 No. 456

DISTRIBUTION

Medium sized tree widespread on mountains in Tropical Africa, but rare in Ghana. Probably has small populations in pockets around the Volta and on Atewa.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1

Ochna afzelii R.Br. ex Oliv. **OCHNACEAE**

Guild: 0 **Conservation:** Blue star

MATURE TREE

Field guide pp. 97 Group: 16 No. 457
Small tree of savanna and dry forest margin; Guineo-Congolian [Irvine, 1961].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Ochna kibbiensis see *Ochna staudtii*

Ochna membranacea Oliv. **OCHNACEAE**

Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 97 Group: 16 No. 458

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Ochna staudtii Engl. and Gilg. **OCHNACEAE**

(=*Ochna kibbiensis*)

Common name: KWAASIWA

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 97 Group: 16 No. 460
Small tree.

DISTRIBUTION

Common in Ghana, outside of evergreen forests (Hall and Swaine sp. 408); Guineo-Congolian.

INVENTORY

Tree count <30 cm dbh (TSP): 1 >=30 cm: 1
No. of botanical survey records: 35

Ochthocosmus africanus see *Phyllocosmus africanus*

Ochthocosmus chippii see *Phyllocosmus sessiliflorus*

Octoknema borealis Hutch. and Dalz. **OLACACEAE**

Common name: WISUBONI

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 146, 245 Group: 27B No. 461

DISTRIBUTION

Fairly common in Ghana and Upper Guinea endemic (Hall and Swaine sp. 409).

INVENTORY

Tree count <30 cm dbh (TSP): 347 >=30 cm: 299
No. of botanical survey records: 39
Trees are most common on moister forest slopes, and tend to be shaded.

Octolobus angustatus see *Octolobus spectabilis*

Octolobus spectabilis Welw. **STERCULIACEAE**

(=*Octolobus angustatus*)

Common name: AFINAFI

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 145 Group: 27A No. 462
Small tree, sometimes gregarious.

DISTRIBUTION

Scattered in Ghana throughout the forests, except the lowland evergreen; Guineo-Congolian (Hall and Swaine sp. 410).

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 12

Okoubaka aubrevillei Pellegr. and Normand

Common name: ODII **SANTALACEAE**

Guild: N.P.L.D. **Conservation:** Gold star

MATURE TREE

Field guide pp. 111, 246 Group: 18A No. 463
Large, parasitic tree without buttresses. From Ivory Coast to Cameroun, with a different variety in Zaire [Keay, 1989]. Seems to prefer N-fixing legume hosts, like *Pericopsis* [Swaine (*et al.*), pers. comm.].

PHENOLOGY/DISPERSAL

The fruits are like those of *Balanites* and hence might be dispersed by elephants, although there is no evidence for this. The saplings were found to be not uncommon in large gaps in the Krokosua hills (where elephants occur).

INVENTORY

Tree count <30 cm dbh (TSP): 4 >=30 cm: 28
No. of botanical survey records: 6

Olax subscorpioidea Oliv. **OLACACEAE**

Common name: AHOoHENEDUA

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 83 Group: 13A No. 464

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 414); Guineo-Congolian; probable cryptic pioneer. From Senegal to Zaire, in dry and gallery forest, and on rocky hills [Geerling, 1982].

INVENTORY

Tree count <30 cm dbh (TSP): 170 >=30 cm: 0
No. of botanical survey records: 51
Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest [Hawthorne, 1994].

Omphalocarpum ahia A.Chev. **SAPOTACEAE**

Common name: DUAPOMPO

Guild: Swamp **Conservation:** Blue star

MATURE TREE

Field guide pp. 65, 236 Group: 10D No. 465

DISTRIBUTION

Medium-sized tree with large leaves, not uncommon in swampy areas. It has a narrow, but deep crown.

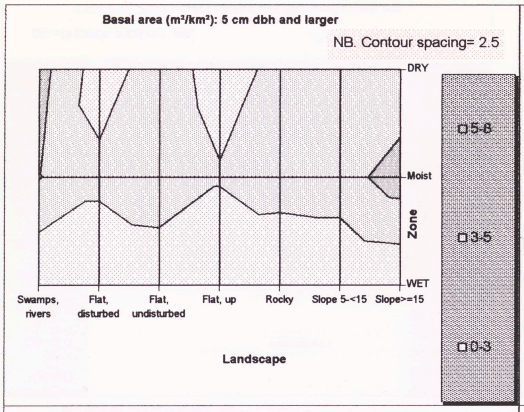
PHENOLOGY/DISPERSAL

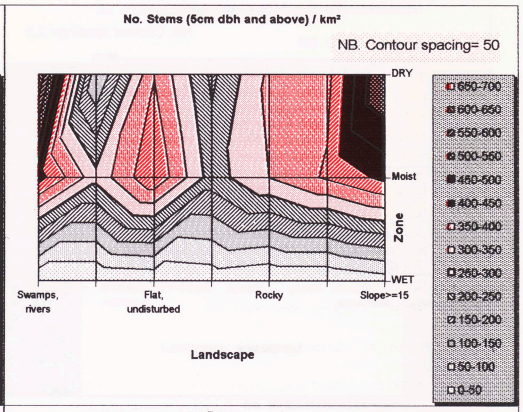
The large, cauliflorous fruits are probably eaten and dispersed by mammals.

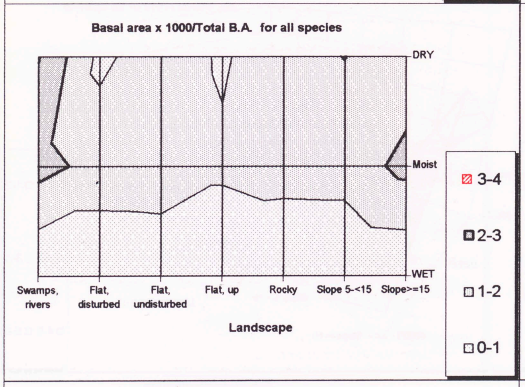
INVENTORY

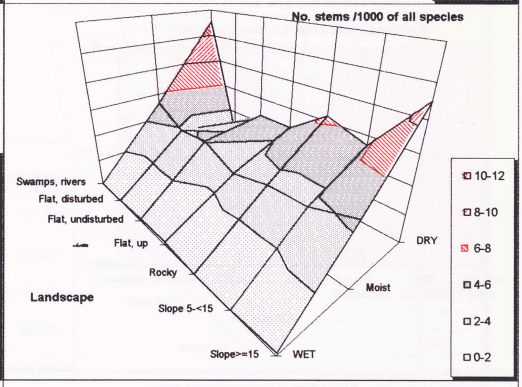
Tree count <30 cm dbh (TSP): 69 >=30 cm: 92
No. of botanical survey records: 17
The preference for swamps, but lesser abundance on evergreen forest slopes matches the pattern for *Gilbertiodendron limba*. All sizes of tree are very much less common in burnt forest than in

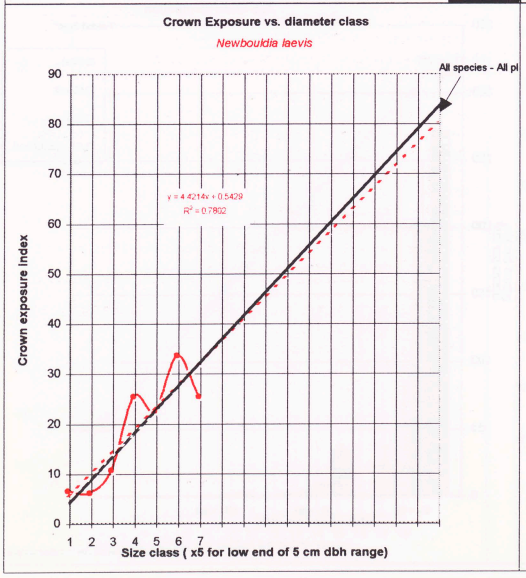
Newbouldia laevis

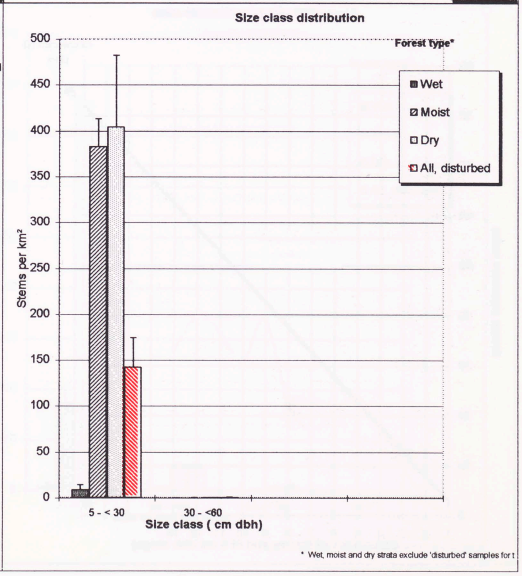




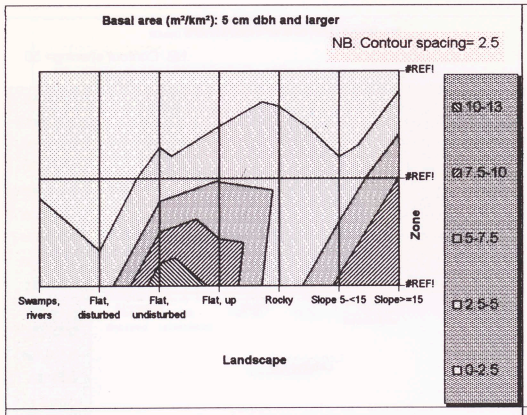


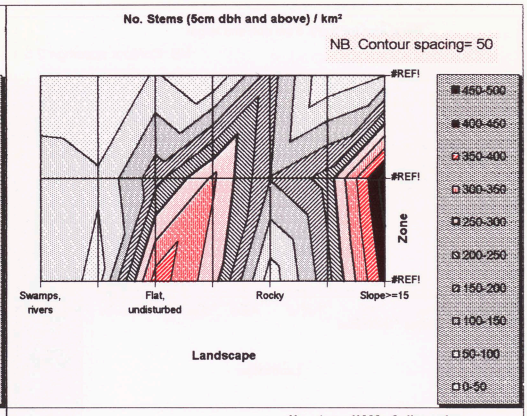


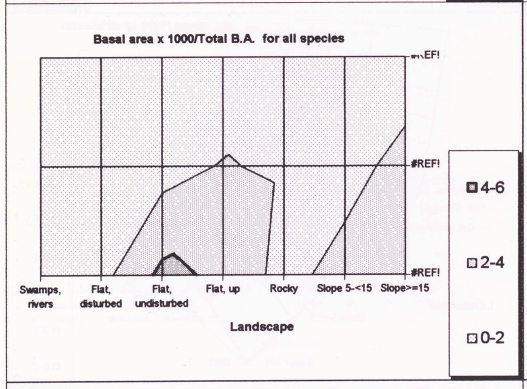


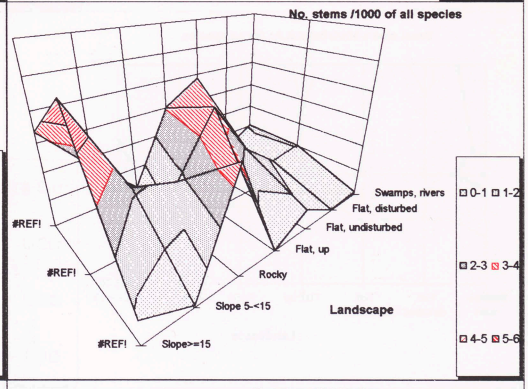


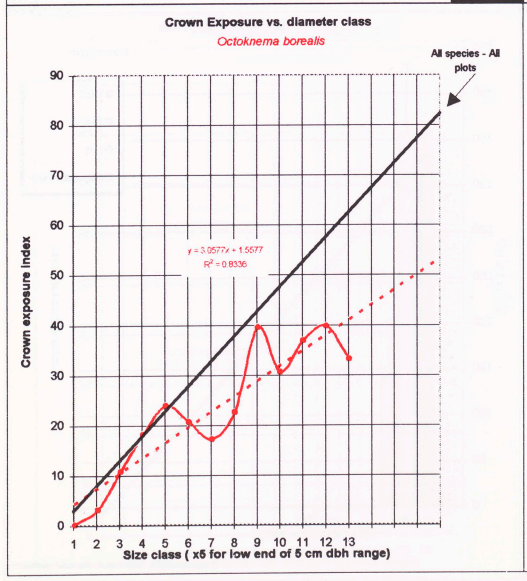
Octoknema borealis

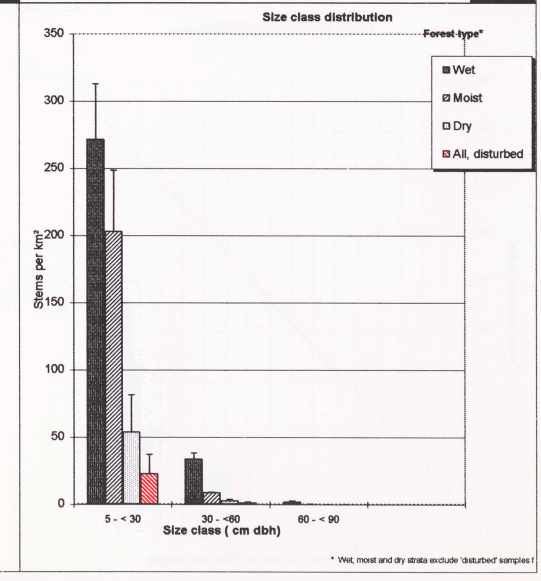




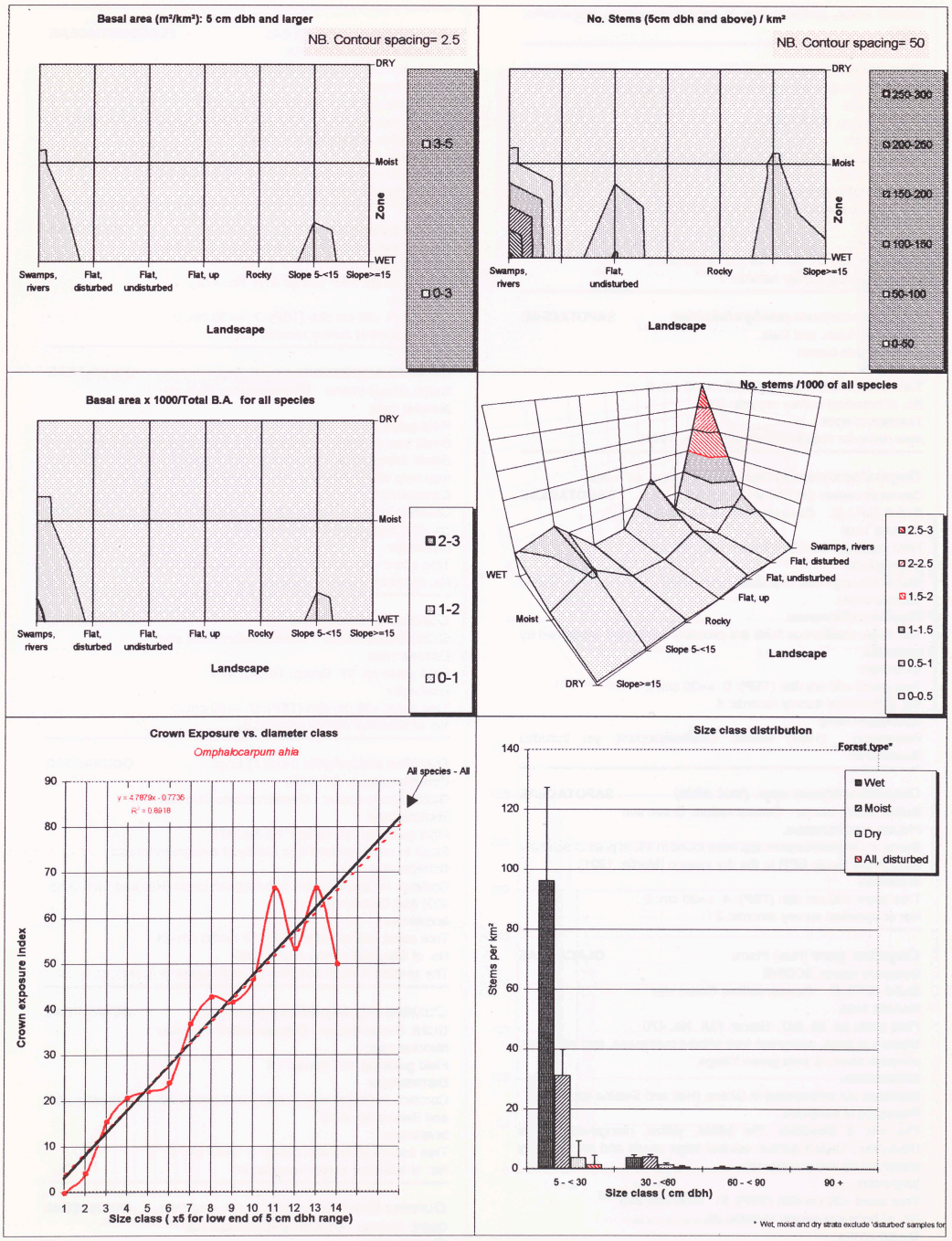








Omphalocarpum ahia



unburnt forest, probably due to habitat preference [Hawthorne, 1994].

Omphalocarpum elatum Miers **SAPOTACEAE**
Guild: Shade-bearer? **Conservation:** Green star
MATURE TREE
Field guide pp. 65 No.466
DISTRIBUTION
Large tree of scattered occurrence from Sierra Leone to Gabon (Guinea-wide].
PHENOLOGY/DISPERSAL
The large, cauliflorous fruits are probably eaten and dispersed by mammals.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 7

Omphalocarpum pachysteloides **SAPOTACEAE**
Mildbr. *ex* Hutch. and Dalz.
Guild: Shade-bearer
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0
TAXONOMIC NOTE
New name for *Ituridendron* [Pennington, 1991].

Omphalocarpum procerum de Beauv. *ex* A.Juss.
Common name: OGYATAFONKONWA **SAPOTACEAE**
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 65, 236 Group: 10D No. 467
DISTRIBUTION
Medium to large tree, of scattered occurrence from Ghana to Gabon (Guinea-wide).
PHENOLOGY/DISPERSAL
The large, cauliflorous fruits are probably eaten and dispersed by mammals.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 2
No. of botanical survey records: 4
TAXONOMIC NOTE
Pennington (1991) retains *Omphalocarpum*, yet includes *Ituridendron*.

Omphalocarpum spp. (not ahia) **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Green star
PHENOLOGY/DISPERSAL
Seeds of *Omphalocarpum* spp were found in 4% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 2
No. of botanical survey records: 2

Ongokea gore (Hua) Pierre **OLACACEAE**
Common name: BODWE
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 83, 247 Group: 13A No. 470
Medium to large, evergreen tree without buttresses, and with thick, compact crown of pale green foliage.
DISTRIBUTION
Scattered but widespread in Ghana (Hall and Swaine sp. 418).
PHENOLOGY/DISPERSAL
The tree is dioecious. The edible, yellow, mango-sized fruits (April-Nov., Taylor) contain several large seeds and are probably dispersed by larger mammals.
INVENTORY
Tree count <30 cm dbh (TSP): 81 >=30 cm: 373
No. of botanical survey records: 21
OTHER NOTES
[Monteiro *et al.*, 1965]

Ophiobotrys zenkeri Gilg. **FLACOURTIACEAE**
Common name: AKWANA
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 111 Group: 18A No. 471
Slender, medium to tall tree with modest crown. Fruit a capsule; Guinea-wide, at least [Irvine, 1961].
INVENTORY
Tree count <30 cm dbh (TSP): 60 >=30 cm: 162
No. of botanical survey records: 10

Oricia suaveolens (Engl.) Verdoorn **RUTACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 165 Group: 31A No. 472
INVENTORY
Tree count <30 cm dbh (TSP): 7 >=30 cm: 0
No. of botanical survey records: 12

Ouratea amplectens (Stapf) Engl. **OCHNACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 97 Group: 16 No. 473
Small tree or shrub, with leaf base clasping stem, and collecting debris there; aerial roots sometimes penetrate the leaf litter, and may help with nutrition on the infertile evergreen forest soils.
DISTRIBUTION
Common in Ghana only in (Wet) Evergreen forest (Hall and Swaine sp. 422) and Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 24

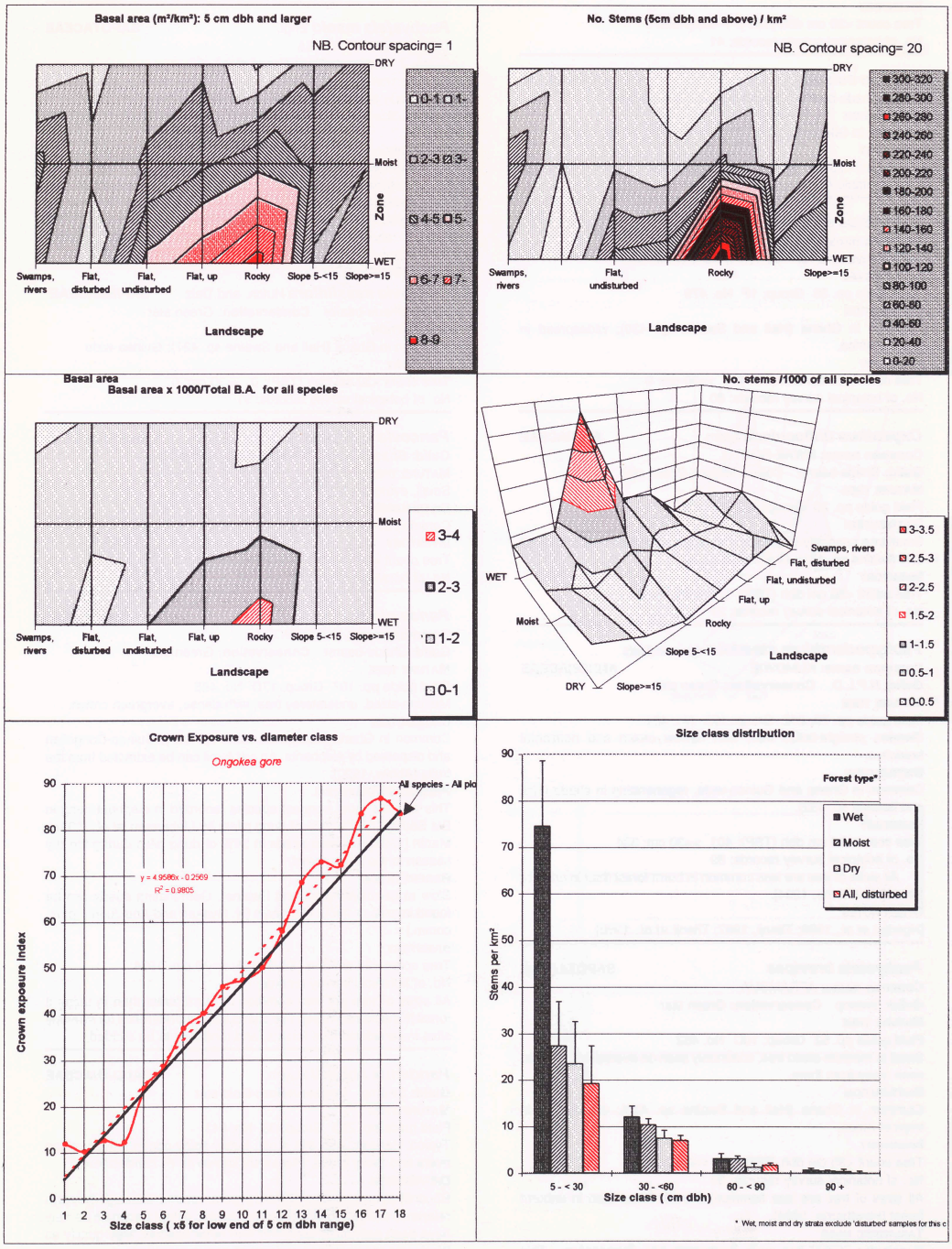
Ouratea calantha Gilg **OCHNACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 97 Group: 16 No. 474
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 8

Ouratea calophylla (Hook.f.) Engl. **OCHNACEAE**
Common name: OPUNINI
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 97 Group: 16 No. 475
Small to medium-sized tree mainly of evergreen forests.
DISTRIBUTION
Common in Ghana mainly in evergreen forest (Hall and Swaine sp. 423) and Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 87 >=30 cm: 84
No. of botanical survey records: 64
The species is most common on mild slopes in evergreen forest.

Ouratea duparquetiana (Baill.) Gilg **OCHNACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 97 Group: 16
DISTRIBUTION
Common in Ghana only in evergreen forest, but Guinea-wide (Hall and Swaine sp. 424)
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 27

Ouratea flava (Schumach.) Hutch. and Dalz. **OCHNACEAE**
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 97 Group: 16 No. 477
DISTRIBUTION
Small tree of drier forests, often by rivers.

Ongokea gore



INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 41

Ouratea sulcata (Van Tiegh.) Keay **OCHNACEAE**
Guild: Shade-bearer **Conservation:** Green star
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 426); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 39

Oxyanthus speciosus DC. **RUBIACEAE**
Common name: KORANTEMA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 36 Group: 1F No. 479
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 430); widespread in tropical Africa.
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 0
No. of botanical survey records: 60

Oxyanthus unilocularis Hiern **RUBIACEAE**
Common name: KWAE-BONTO
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 30 Group: 1C No. 480
DISTRIBUTION
Small tree generally in gaps and at edges; common in Ghana (Hall and Swaine sp. 431); Guineo-Congolian.
INVENTORY
Tree count <30 cm dbh (TSP): 11 >=30 cm: 2
No. of botanical survey records: 27

Pachypodanthium staudtii Engl. and Diels
Common name: KUMDWIE **ANNONACEAE**
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 73, 242 Group: 12A No. 481
Slender, straight-boled tree, with narrow crown and horizontal branches.
DISTRIBUTION
Common in Ghana and Guinea-wide, regenerating in shade (Hall and Swaine sp. 432).
INVENTORY
Tree count <30 cm dbh (TSP): 401 >=30 cm: 334
No. of botanical survey records: 89
All sizes of tree are less common in burnt forest than in unburnt forest [Hawthorne, 1994].
OTHER NOTES
[Ngadjui *et al.*, 1989; Titanji, 1987; Titanji *et al.*, 1990]

Pachystela brevipes **SAPOTACEAE**
Common name: AFRAMSUA
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 62 Group: 10C No. 482
Small to medium-sized tree, commonly seen on riverbanks, but also seen away from them.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 433); widespread in tropical Africa.
INVENTORY
Tree count <30 cm dbh (TSP): 39 >=30 cm: 36
No. of botanical survey records: 31
All sizes of tree are less common in burnt forest than in unburnt forest [Hawthorne, 1994].
TAXONOMIC NOTE
Pennington [1991] has sunk *Pachystela* into *Synsepalum*. This species should now become ***Synsepalum brevipes*** (Baker) Pennington.

Pachystela msolo Engl. **SAPOTACEAE**
Common name: ASABA
Guild: ? **Conservation:** Green star
MATURE TREE
Field guide pp. 62 Group: 10C No. 483
Medium-sized tree, most commonly seen in swampy or riverside areas.
INVENTORY
Tree count <30 cm dbh (TSP): 99 >=30 cm: 9
No. of botanical survey records: 12
TAXONOMIC NOTE
Pennington [1991] has sunk *Pachystela* into *Synsepalum*. This species should now become ***Synsepalum msolo*** (Engler) Pennington.

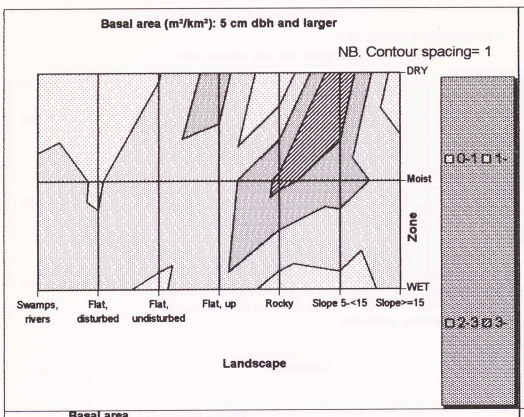
Pancovia sessiliflora Hutch. and Dalz. **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Green star
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 437); Guinea-wide
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 91

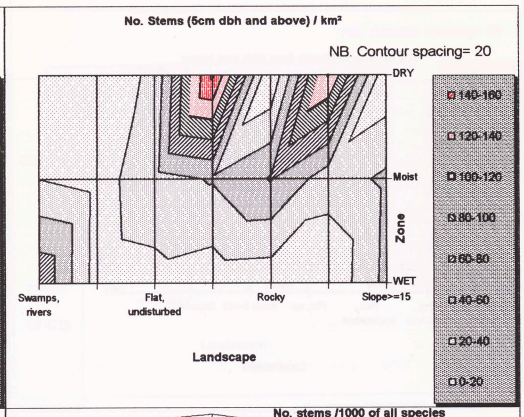
Pancovia turbinata Radlk. **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Small, evergreen tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 438) and Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 57

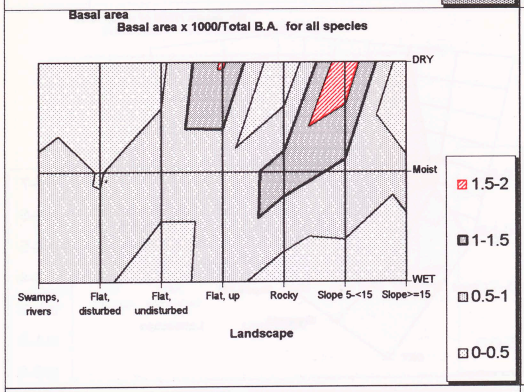
Panda oleosa Pierre **PANDACEAE**
Common name: KOKROBOBA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 107 Group: 17D No. 486
Medium-sized, understorey tree, with dense, evergreen crown.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 439); Guineo-Congolian and dispersed by elephants. An edible oil can be extracted from the fruits [Abbiw, 1990].
PHENOLOGY/DISPERSAL
This was the most frequent species recorded in elephant dung in Bia South GPR (in 84% of dung piles) by Lieberman *et al.*, [1987]. Martin [1991] recorded seeds in 34% of dung piles during the dry season in the same forest.
REGENERATION
Slow to germinate [Hall and Swaine]. Germinating seeds can be found in areas without elephants [N. Gyakari and Abu Juam, pers. comm.]
INVENTORY
Tree count <30 cm dbh (TSP): 195 >=30 cm: 1534
No. of botanical survey records: 40
All sizes of tree are less common in burnt forest than in unburnt forest [Hawthorne, 1994]. The charts show a preference for swampy sites in semideciduous forests, and tendency to be shaded.

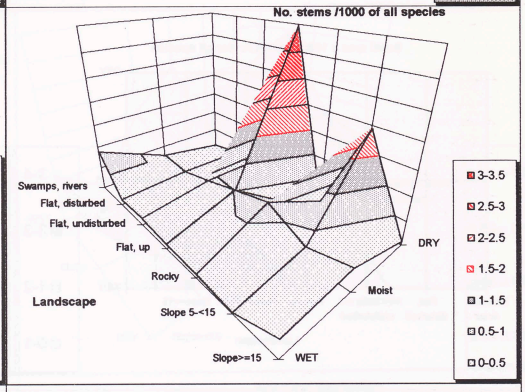
Pandanus abbiwii Huynh **PANDANACEAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 223 Group: 39 No. 811
Typical Pandan, with stilt roots, large, spiny-edged leaves, along rivers and rocky areas. Previously known as *P. candelabrum*.
DISTRIBUTION
Recently named species [D. Abbiw, pers. comm.), although literature reference not yet obtained; biogeographic extent uncertain as may have been previously confused with other species. May qualify as Black star species when revision of genus is settled.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

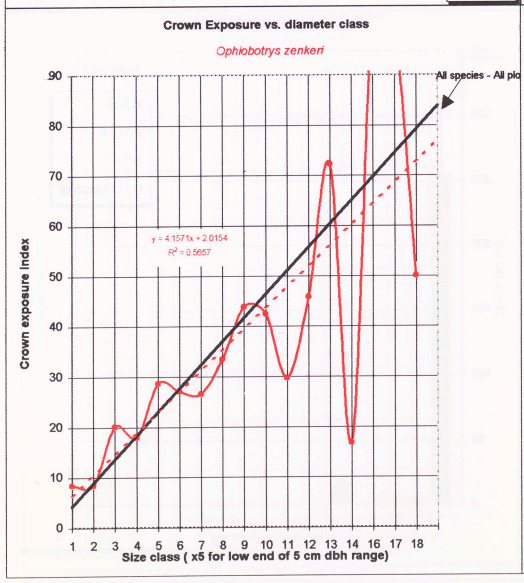
Ophiobotrys zenkeri

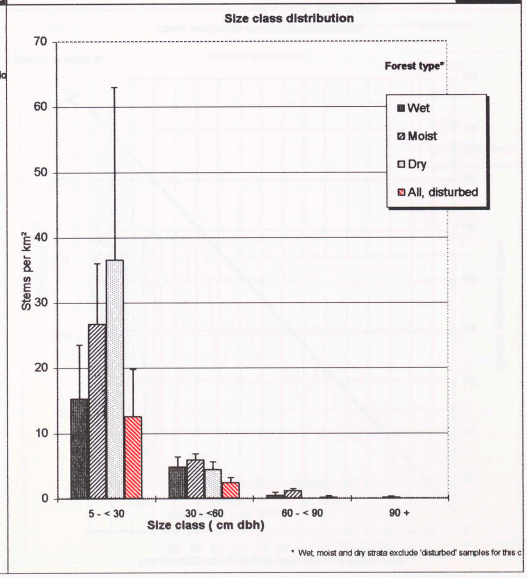




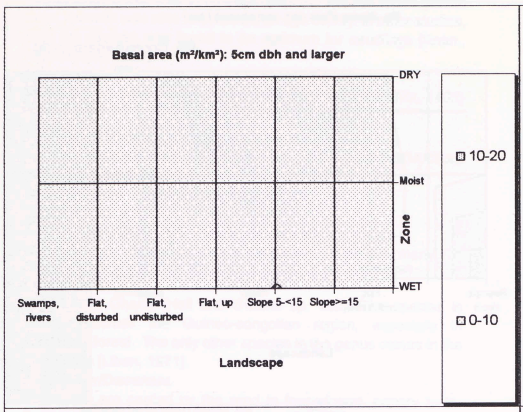


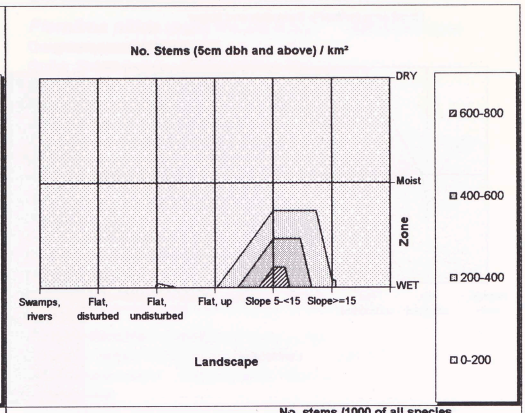


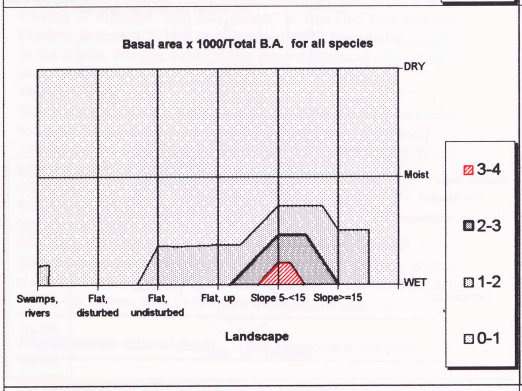


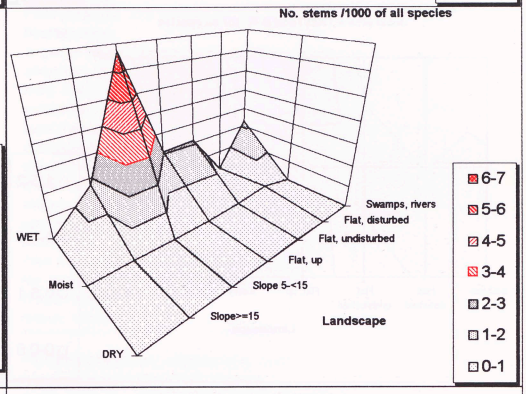


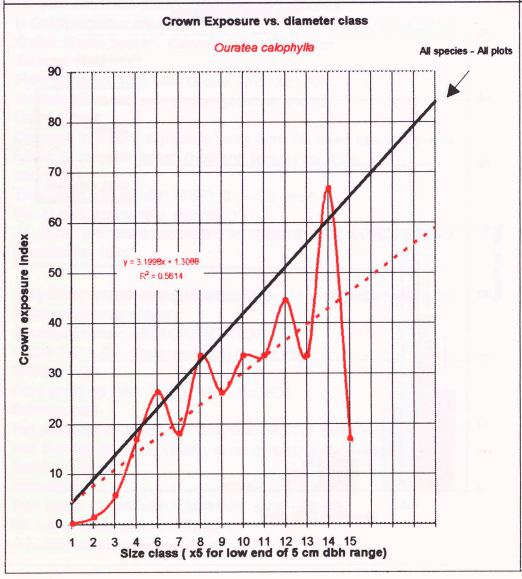
Ouratea calophylla

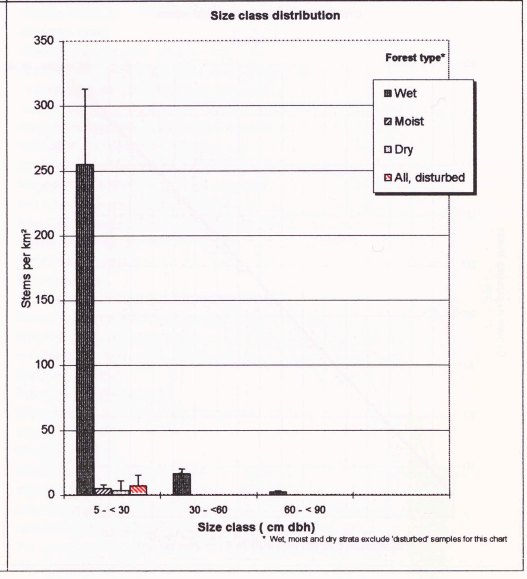




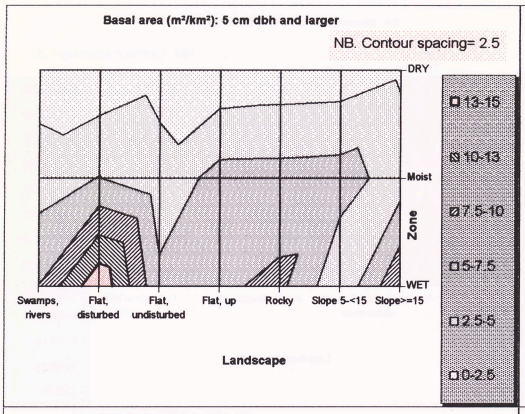


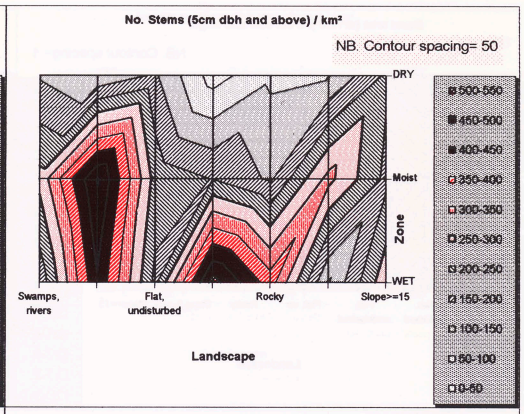


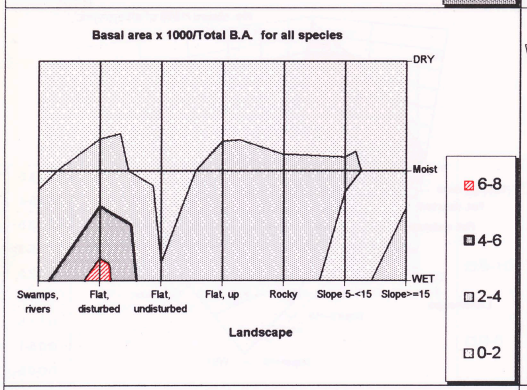


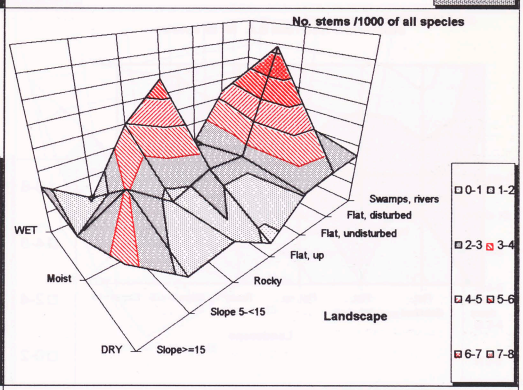


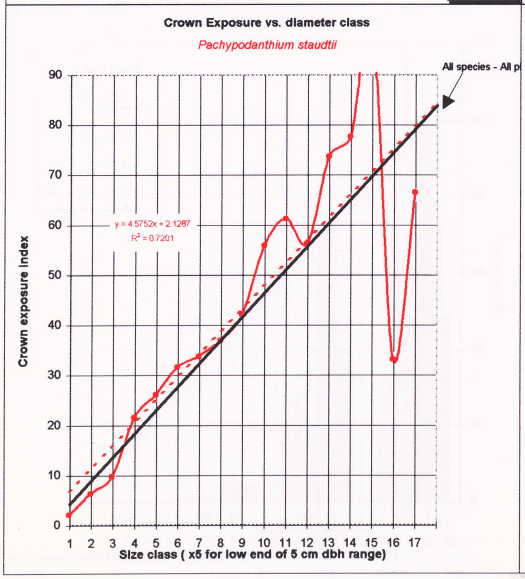
Pachypodanthium staudtii

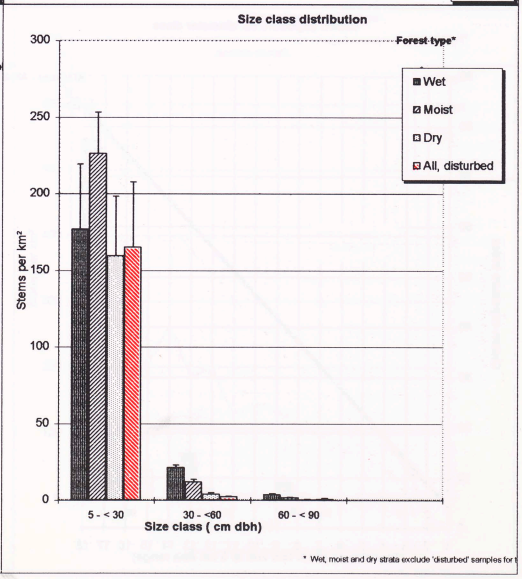




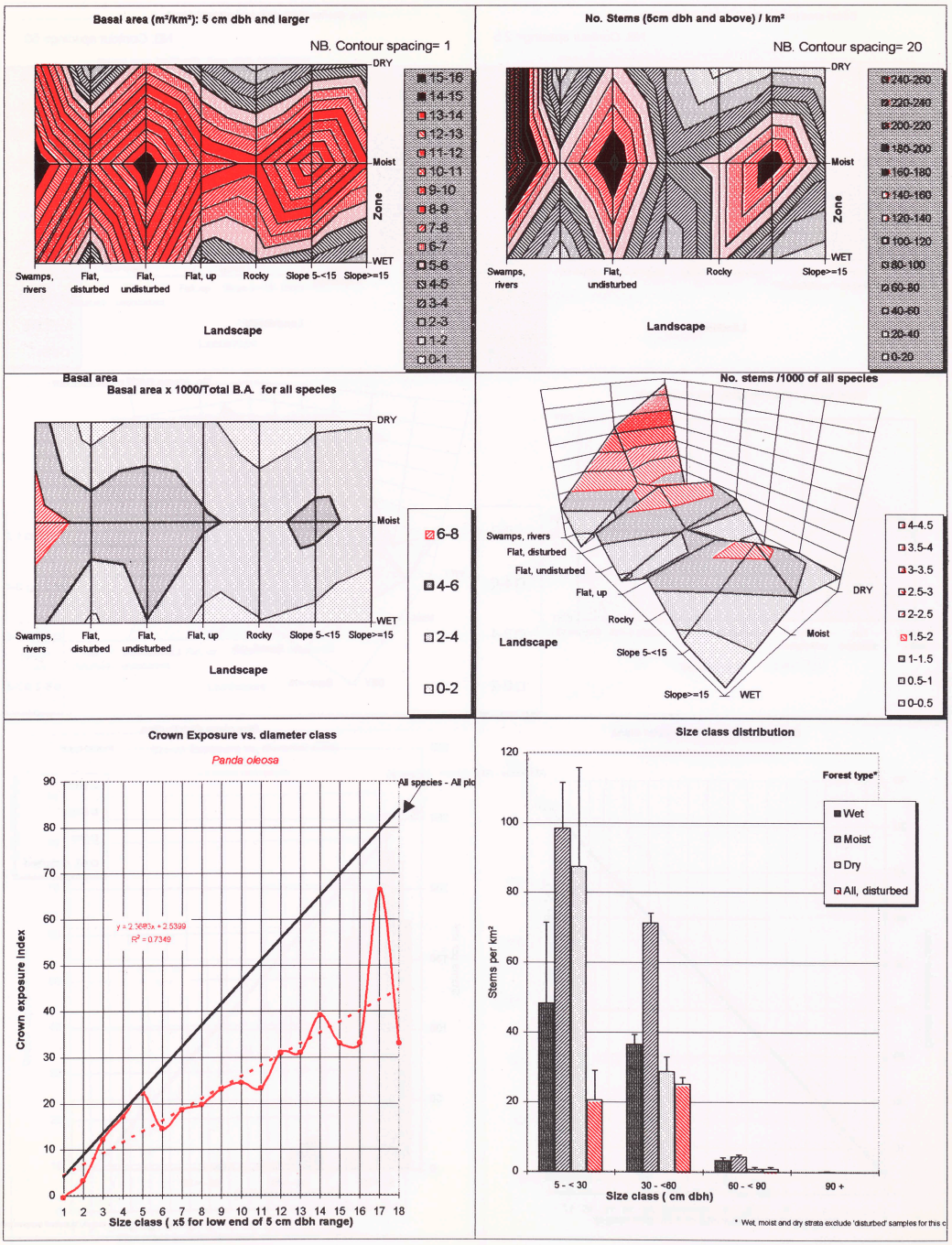




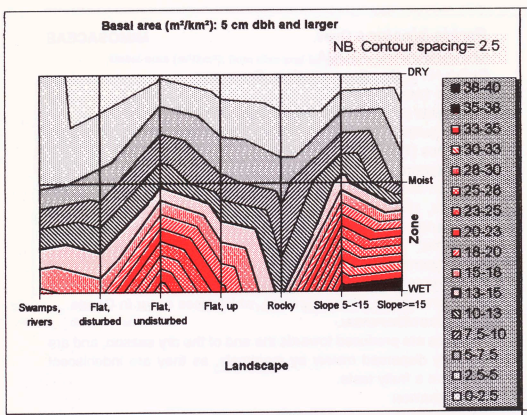


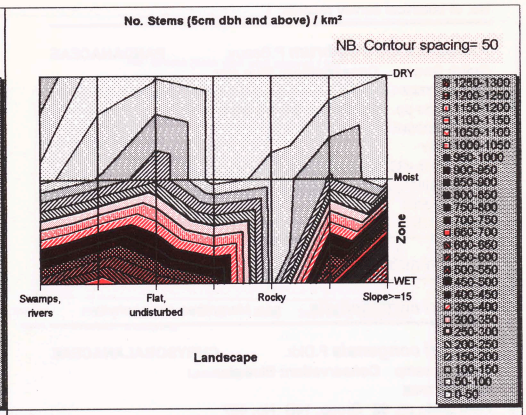


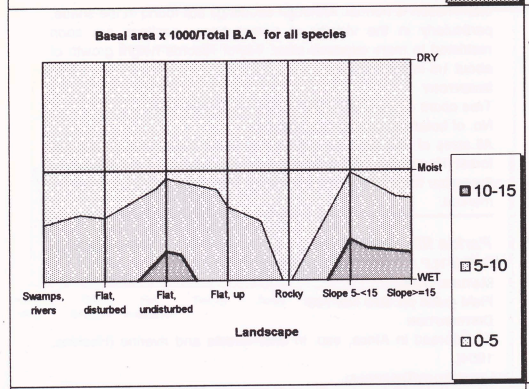
Panda oleosa

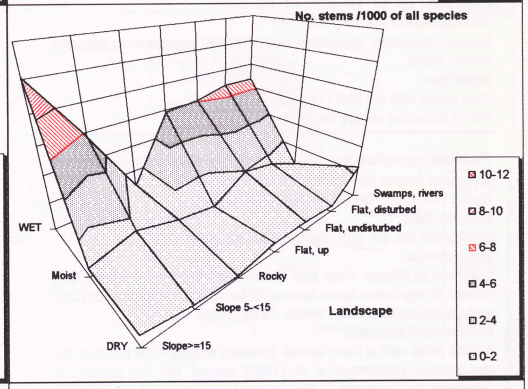


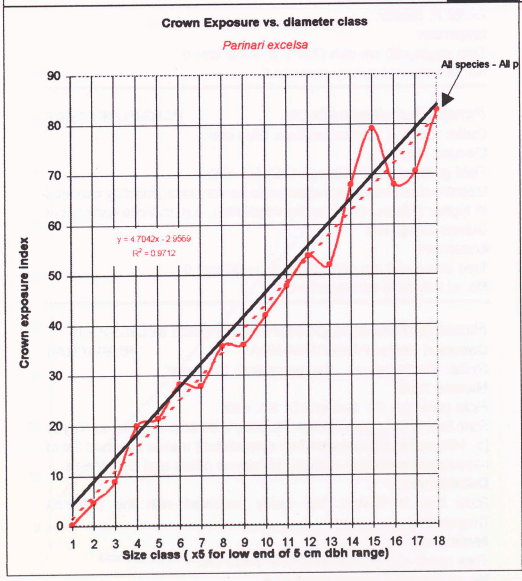
Parinari excelsa

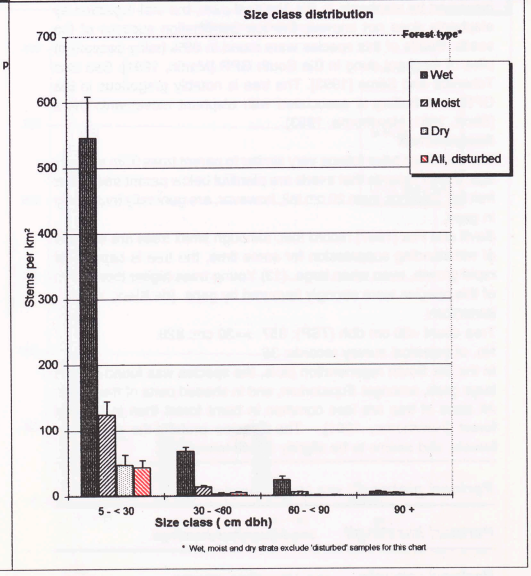












No. of botanical survey records: 1

Pandanus candelabrum P.Beauv. **PANDANACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 223 Group: 39 No. 811
See *P. abbiwii.*
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0
OTHER NOTES
[Stone, 1973]

Parinari aubrevillei see *Maranthes aubrevillei*

Parinari chrysophylla see *Maranthes chrysophylla*

Parinari congensis F.Didr. **CHRYSOBALANACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 92 Group: 14B No. 487
DISTRIBUTION
Guineo-Congolian, spreading tree of rivers, especially in savanna [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Parinari excelsa Sabine **CHRYSOBALANACEAE**
Common name: AFAM, African Greenheart
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 92, 239 Group: 14B No. 488
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 442); widespread in a variety of vegetation types across Africa, e.g. montane forest [Coe and Curry-Lindahl, 1965; White, 1976, 1983].
PHENOLOGY/DISPERSAL
Fleshy fruits with a hard 'stone' (drupes) are produced during the dry season. Lieberman *et al.* [1987] record that this species is dispersed by elephants in Bia National park, but that ingestion by elephants does not improve the low germination success of the seeds. Seeds of this species were found in 66% (rainy season) of piles of elephant dung in Bia South GPR [Martin, 1991]. See also Tchamba and Seme [1993]. The tree is notably gregarious in Bia GPR, and fruiting is associated with elephant movements there [Short, 1981; Hawthorne, 1993].
REGENERATION
The seedlings have foliage very similar to parent trees from an early age. Taylor records that seeds are plentiful below parent trees after fruit fall. Saplings even 20 cm tall, however, are generally found only in gaps.
Savill and Fox [1967] record that, although small trees are capable of withstanding suppression for some time, the tree is capable of rapid growth, even when large. (13) Young trees higher than 1.5 m of this species were strongly favoured by gaps [de Klerk, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 357 >=30 cm: 826
No. of botanical survey records: 36
In the Bia South regeneration plots, the species was found both in large gaps, amongst *Eupatorium*, and in shaded parts of the forest. All sizes of tree are less common in burnt forest than in unburnt forest [Hawthorne, 1994]. The species prefers the evergreen forests, and seems to be slightly shade-tolerant.

Parinari glabra see *Maranthes glabra*

Parinari kerstingii see *Maranthes kerstingii*

Parinari robusta see *Maranthes robusta*

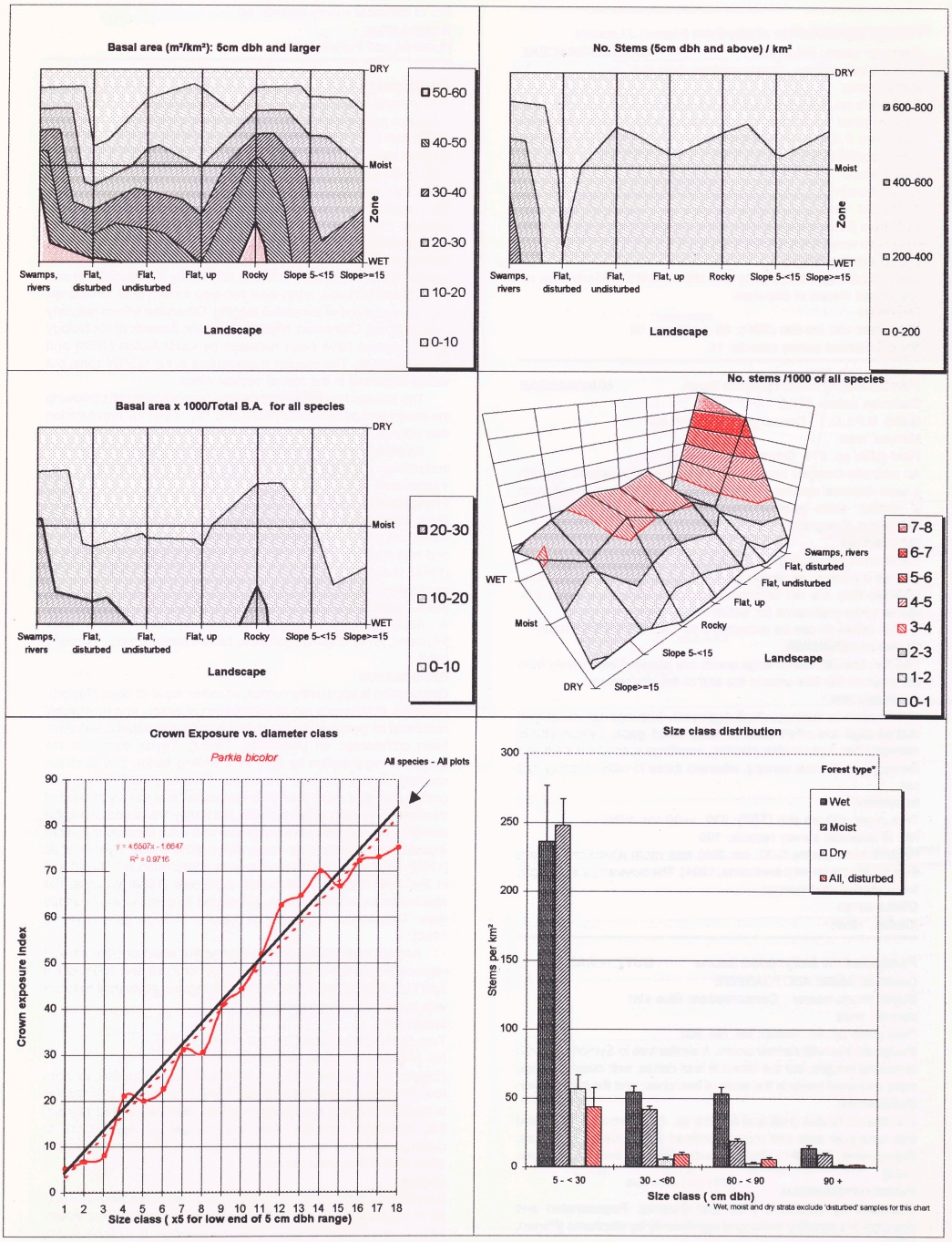
Parkia bicolor A.Chev. **MIMOSACEAE**
Common name: ASOMA
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 220, 239 Group: 38C No. 489
Large, buttressed tree with large, spreading crown. Not quite deciduous [Taylor]. The new leaves are copper-coloured.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 443); Guineo-Congolian [Hopkins, 1984]. Mature trees, although found as emergents in a wide variety of sites, show some preference for wet areas, like riverbanks.
FIELD IDENTITY
It is possible that some of the records in the dry fire zone forest are of the similar tree *Parkia filicoidea*, which does occur in Ghana.
PHENOLOGY/DISPERSAL
The pods are produced towards the end of the dry season, and are probably dispersed mainly by mammals, as they are indehiscent and have a fruity taste.
REGENERATION
Germination is normal. Although seedlings are found in the shade, particularly in the vicinity of parent trees, saplings are soon restricted to more exposed sites. Taylor records height growth of about 1m in the first year.
INVENTORY
Tree count <30 cm dbh (TSP): 398 >=30 cm: 1645
No. of botanical survey records: 100
All sizes of tree are less common in burnt forest than in unburnt forest [Hawthorne, 1994]. The greater abundance of the species in the wetter forests, and swamps within the semideciduous zones, is marked.

Parkia filicoidea Oliver **MIMOSACEAE**
Guild: N.P.L.D (?) **Conservation:** Green star
MATURE TREE
Field guide pp. 220 No. 708
DISTRIBUTION
Widespread in Africa, esp. in drier forests and riverine [Hopkins, 1984].
PHENOLOGY/DISPERSAL
As for *P. bicolor.*
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 6

Paropsia guineensis Oliv. **PASSIFLORACEAE**
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 105 Group: 17C No. 490
Medium-sized tree which appears to be very rare; possibly confined to higher altitude, dry or rocky vegetation, e.g. in Volta region; but Guineo-Congolian.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 3

Pausinystalia lane-poolei (Hutch.) Hutch *ex* Lane-Poole
Common name: PAMPRANA-NUA **RUBIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 32 Group: 1D No. 493
Rare tree of evergreen forest. Possibly a swamp species, as Taylor [p. 148, under *Gilbertiodendron splendidum*] makes a casual list of associates as *Raphia vinifera*, *Mitragyna ciliata* and *Symphonia.*
DISTRIBUTION
Rare tree in Ghana, but easily confused with the common Corynanthe.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 6
OTHER NOTES
[LeBoeuf, 1981]

Parkia bicolor



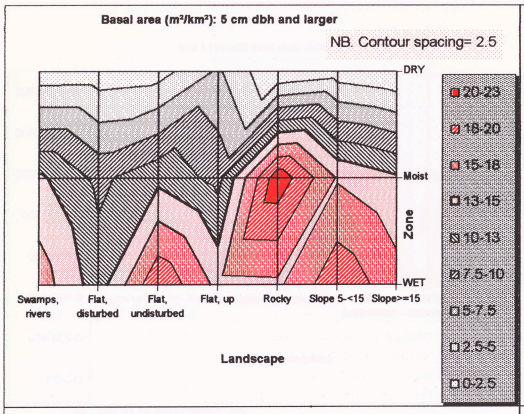
Pellegriniodendron diphyllum (Harms) J.Leonard
Common name: FeLeFeLe **CAESALPINIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 199 Group: 37B No. 500
Medium sized tree in the Wet Evergreen zone [Taylor records it from Yoyo F.R. as well]. Low-branched and very shade-tolerant. Ectomycorrhizal [Alexander, 1989].
DISTRIBUTION
Known from Ivory Coast, Cameroun, Ghana and Gabon (Guinea-wide), but very restricted distribution in Ghana and probably elsewhere [Lock, 1989]. The only member of its genus and almost certainly a very slow-growing tree.
PHENOLOGY/DISPERSAL
The species regenerates in its own shade, and the seeds have no specialised means of dispersal.
INVENTORY
Tree count <30 cm dbh (TSP): 48 >=30 cm: 59
No. of botanical survey records: 15

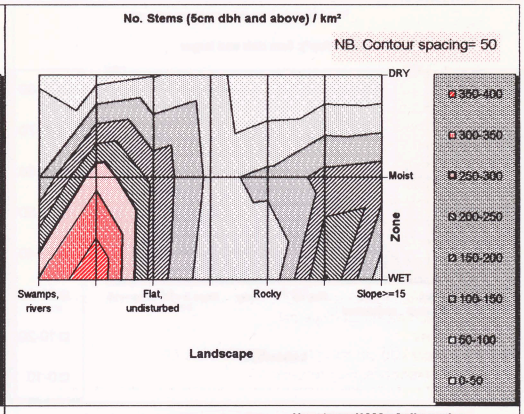
Pentaclethra macrophylla Benth. **MIMOSACEAE**
Common name: ATAA
Guild: N.P.L.D.? **Conservation:** Green star
MATURE TREE
Field guide pp. 219 Group: 38B No. 501
An umbrella-crowned tree like *Parkia* or *Piptadeniastrum*, but with a seed dispersal syndrome different from both of them, usually with a shorter, more twisted bole, and usually with insignificant buttresses. Evergreen.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 450); Guineo-Congolian. May be a pioneer, as seedlings have not been seen in full shade, whereas they are not uncommon in gaps. Like *Parkia*, the tree shows some preference for wetter sites.
An edible oil can be extracted from the fruits [Abbiw, 1990].
PHENOLOGY/DISPERSAL
The flat, smooth, rather large seeds are expelled explosively from the pods on the tree around the end of the dry season.
REGENERATION
Germination is normal, albeit hypogeal. Saplings up to several metres high are often seen in fairly small gaps. Davies [1958] recorded that 3 years after planting, seedlings spaced 4 ft x 4 ft had formed a continuous canopy, whereas those in wider spacing had not.
INVENTORY
Tree count <30 cm dbh (TSP): 230 >=30 cm: 1020
No. of botanical survey records: 109
Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest [Hawthorne, 1994]. The trees are, surprisingly, more shaded than normal.
OTHER NOTES
[Davies, 1958]

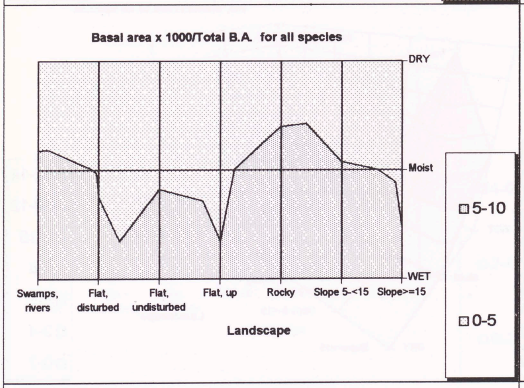
Pentadesma butyracea Sabine **GUTTIFERAE**
Common name: ABOTOASEBIE
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 50 Group: 8B No. 502
Evergreen tree with narrow crown. A similar tree to *Symphonia*, with horizontal boughs, but the crown is less dense, with heavier foliage more clustered towards the ends of branches; and the bole darker.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 451), strongly associated with base-poor soils and mostly confined to the evergreen forests; Guinea-wide. An edible oil can be extracted from the seeds [Abbiw, 1990].
PHENOLOGY/DISPERSAL
Dispersed by elephants [Hall and Swaine]. Regeneration and dispersal are possibly enhanced significantly by elephants [Parren, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 324 >=30 cm: 1210
No. of botanical survey records: 50
OTHER NOTES
[Koechlin and Trahain, 1953]

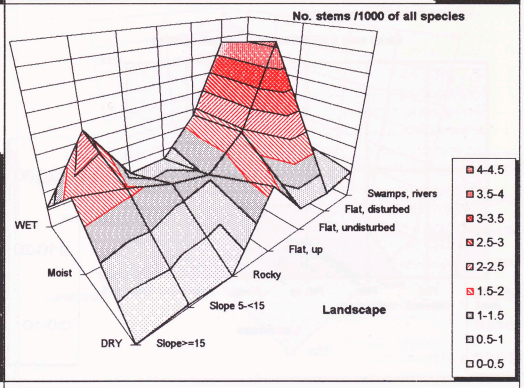
Pericopsis elata (Harms) Van Meeuwen **PAPILIONACEAE**
(=*Aformosia elata*)
Common name: KOKRODUA, Afrormosia
Guild: N.P.L.D. **Conservation:** Scarlet star
MATURE TREE
Field guide pp. 209, 247 Group: 37G No. 11
Large tree, with spreading branches, graceful foliage and a rather flat topped, triangular crown; bole characterised by small, red patches. It has high or no buttresses merging into slight flutes. Has nitrogen-fixing nodules [Halliday and Nakao, 1982].
DISTRIBUTION
Timber tree once common in Brong Ahafo (Dry Semideciduous and Moist Semideciduous, north-west sub-type forest), now threatened as a consequence of excessive logging. Otherwise known naturally in Ivory Coast, Cameroun, Nigeria and Zaire. Aspects of the biology of this species have been reviewed by Quist-Arcton [1958] and Howland [1979]. The species is gregarious in the MSNW zone, but widely dispersed in the rest of tropical Africa.
The species had attracted attention from silviculturists following the statements of Aubréville [1938] and Taylor that the regeneration was remarkably poor.
Seedlings are remarkably drought-tolerant and show little preference between wet and dry forest soils [Swaine and Veenendaal, 1994].
PHENOLOGY/DISPERSAL
Ripe, indehiscent pods, which may be wind-dispersed in strong winds, are produced around the start of the dry season (Aug-Nov), and may hand on the tree for some time. Gilbert and Wagemans [1944] found that in 7 years of observation there was no fruit produced in two of them, and the yield was variable in the other years. Years of abundant seed generation have been recorded, but in many fruiting years germination is said to be poor [Howland,1979]. Saplings generally have a rather spreading, bushy habit.
REGENERATION
Germination is apparently normal, or rather rapid (8 days [Taylor]). However, in spite of a regular production of seeds, and no obvious restriction on germination, the lack of natural regeneration has often been commented on [Aubréville, Taylor]. Taylor dismisses the control of regeneration by light as a limiting factor, and does not consider insect damage important. Pieters [1958] found that germination was more than 80% successful in a variety of shaded treatments, up 50% of full sunlight, but barely 5% successful in full sunlight. Seedling growth and survival was most successful in more exposed sites, particularly those with c. 50% shade. Kyereh *et al.* [1993] reported no difference between germination in the light and in the dark, though Swaine and Whitmore [1988] believed the species to be a true pioneer, stimulated to germinate by canopy gaps. Germination is equally successful in large gaps [Kyereh, 1994].
Ampofo and Lawson [1972] studied the effect of different light regimes on growth of the seedlings. Out of 7, 18 and 100% of full light the seedlings preferred the middle regime, equivalent to forest with numerous canopy gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 9 >=30 cm: 81
No. of botanical survey records: 6
Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest [Hawthorne, 1994]. The peak of this species in the MSNW forest zone is very marked, especially in swampy and flat, disturbed samples. The low number of adult trees in undisturbed forest, however, does suggest an influence from factors other than disturbance history.
GROWTH
Growth in suitable conditions is rapid, with trees capable of attaining 26 m height (av. 14.5 m) in 16 years (dbh 97 cm); at Pra Anum, after 7 years planted trees grew on average 8 m (dbh 9 cm) [Howland, 1979]. A detailed study of the growth of this species has been made by Schmitz [1962] who concluded that the ideal sites for seedling growth are where they receive full morning sunlight but are

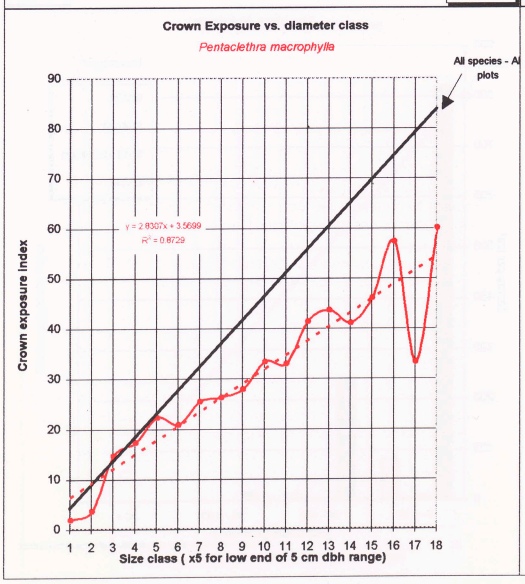
Pentaclethra macrophylla

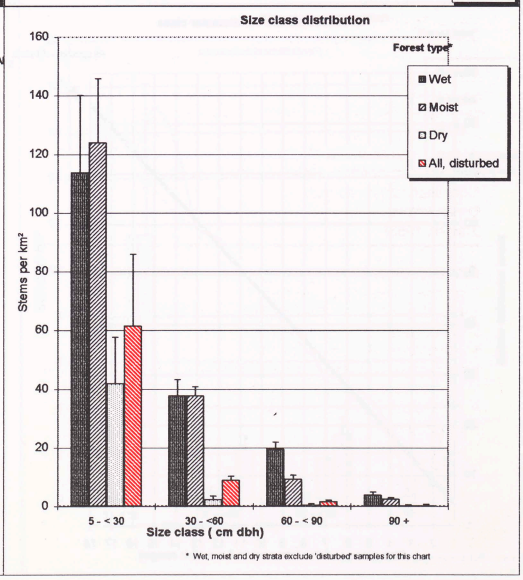




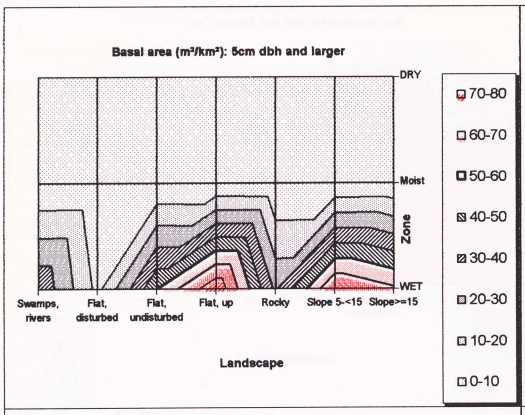


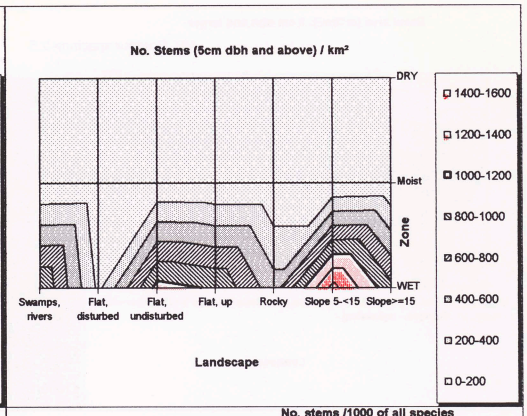


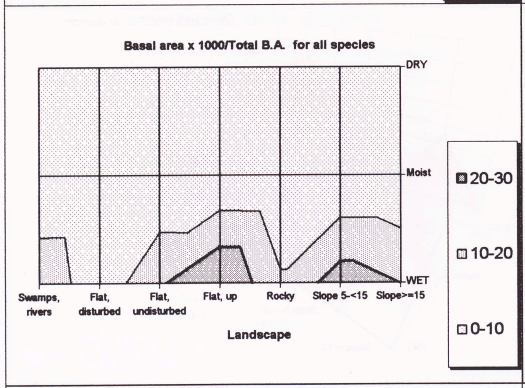


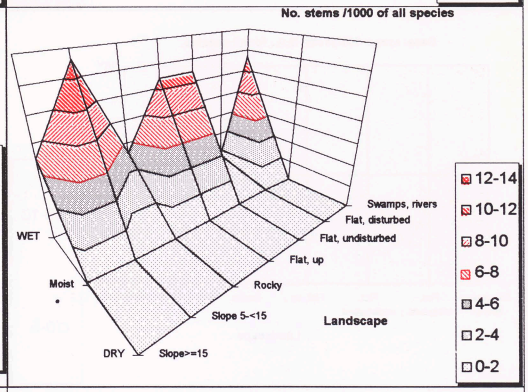


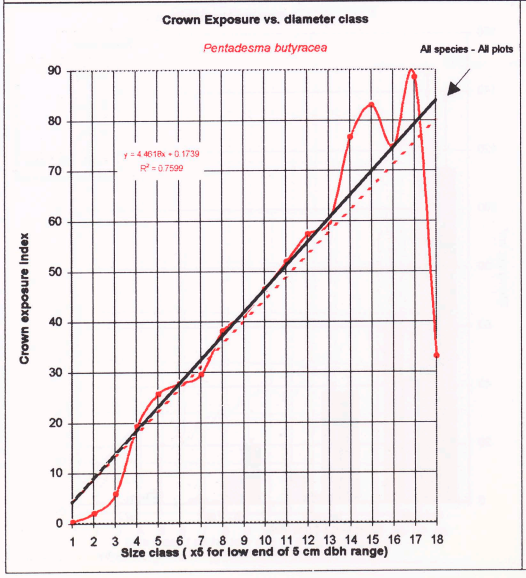
Pentadesma butyracea

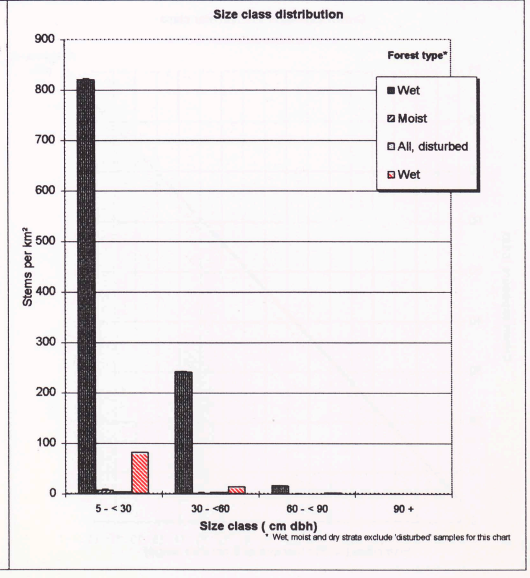




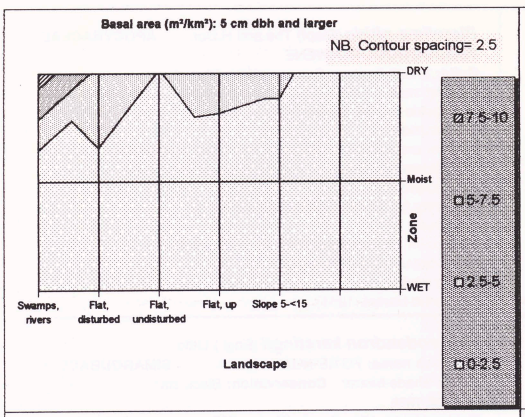


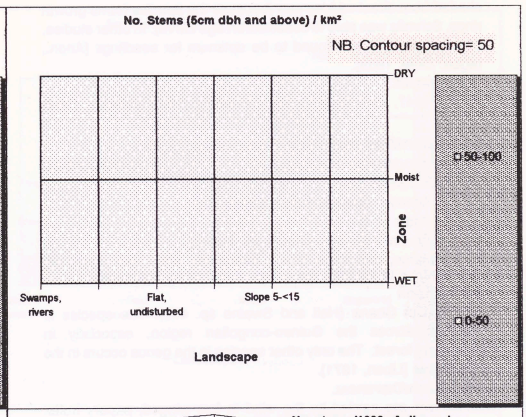


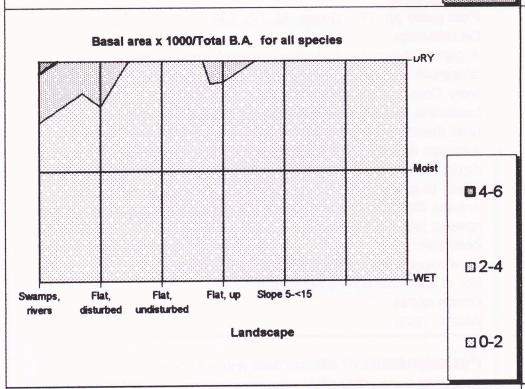


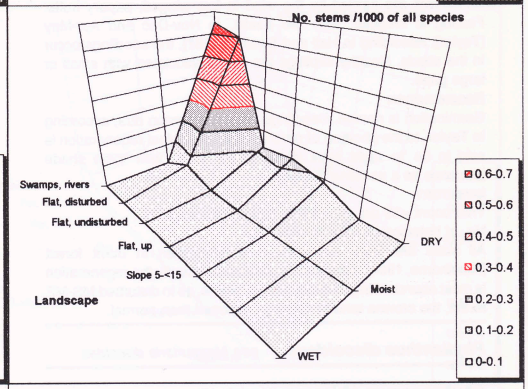


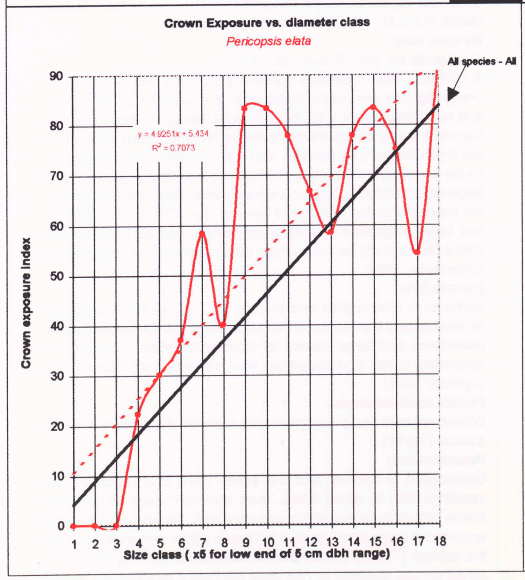
Pericopsis elata

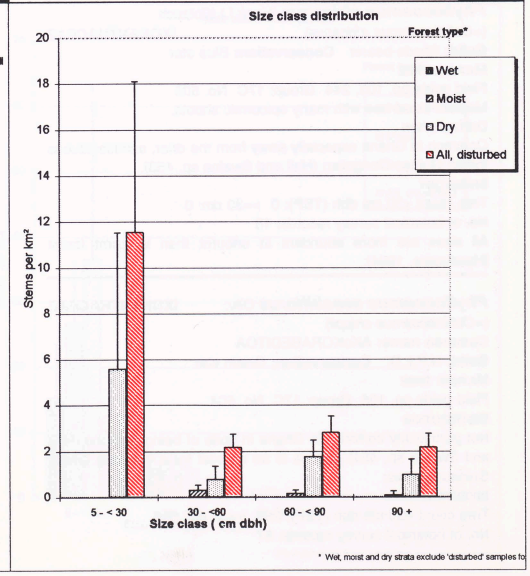












shaded from direct midday sun (because the species forms growth rings, Schmitz was able to construct an age curve). In other studies, 50% full daylight was found to be optimum for seedlings [Anon., regen. Zaire, 1959].

OTHER NOTES

[Anon., 1947, 1949 (forest fallow); Howland, 1979; Schmitz, 1962]

Petersianthus macrocarpus (Beauv.) Liben
(=*Combretodendron macrocarpum*) **LECYTHIDACEAE**
Common name: ESIA
Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 139, 245 Group: 25 No. 48
Medium-large, deciduous tree ± evergreen, often with many red leaves about to fall from the crown. Small or no buttresses.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 452). The species is common across the Guineo-congolian region, especially in secondary forest. The only other species in the genus occurs in the Philippines [Liben, 1971].

PHENOLOGY/DISPERSAL

The seeds are carried by the wind in four-winged, papery fruits. Fruiting is irregular, with two peaks, in Nov-Dec and Apr-May [Taylor]. According to Hall and Swaine [1981], the seedlings occur in the shade. Healthy saplings are soon associated with small or large gaps.

REGENERATION

Germination is normal. Seedlings are not common due, according to Taylor, to the abortion of much of the seed. Most regeneration is said to be 'in slight gaps in the forest' albeit with some shade tolerance as a seedling [Taylor].

INVENTORY

Tree count <30 cm dbh (TSP): 528 >=30 cm: 3572
No. of botanical survey records: 115
All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The species, and consequently the regeneration is most abundant in evergreen forest, where, as in disturbed MS-ME forest, the crowns tend to be more exposed than normal.

Phyllanthus discoideus see *Margaritaria discoidea*

Phyllocosmus africanus (Hook.f.) Klotzsch
(=*Ochthocosmus africanus*) **IXONANTHACEAE**
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 105, 244 Group: 17C No. 505
Medium-sized tree with many epicormic shoots.

DISTRIBUTION

Common in Ghana especially away from the drier, semideciduous forest; Guineo-Congolian (Hall and Swaine sp. 453).

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 15
All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Phyllocosmus sessiliflorus Oliv. **IXONANTHACEAE**
(=*Ochthocosmus chippii*)
Common name: AKoKORABEDITOA
Guild: N.P.L.D. **Conservation:** Green star

MATURE TREE

Field guide pp. 105 Group: 17C No. 504

DISTRIBUTION

Not particularly common in Ghana in spite of being mapped (Hall and Swaine sp. 454). Ghana is an outpost for a basically Lower Guinea species.

INVENTORY

Tree count <30 cm dbh (TSP): 293 >=30 cm: 646
No. of botanical survey records: 67

Picralima nitida (Stapf) The.and H.Dur. **APOCYNACEAE**
Common name: KANWENE
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 54 Group: 9C No. 506

DISTRIBUTION

A rather uncommon understorey tree often confused with *Hunteria* spp (Kanwene). Guineo-Congolian [Vivien and Faure, 1985].

FIELD IDENTITY

See entry for *Hunteria/Picralima* spp.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 16

OTHER NOTES

[Raymond-Hamet, 1951]

Pierreodendron kerstingii (Engl.) Little
Common name: FOTIE-NUA **SIMAROUBACEAE**
Guild: Shade-bearer **Conservation:** Black star

MATURE TREE

Field guide pp. 171 Group: 32 No. 507

DISTRIBUTION

A genus of two (or one very variable) species [Keay, 1989]: *P. africanum* occurs from Nigeria to Angola; *P. kerstingii* is known in Ivory Coast, Ghana (where it is uncommon) and Togo. This is a borderline Gold Star species, depending on the taxonomic status (and therefore to some extent subjective opinion) of *P.africanum*. Although the trees in the two extremes are remarkably similar, the discontinuous distribution in Ghana between specimens in very dry forest (e.g. Awura F.R.) and in very wet evergreen forest [e.g. Ankasa GPR), with few cases in between, does suggest that two species may be involved.

INVENTORY

Tree count <30 cm dbh (TSP): 1 >=30 cm: 4
No. of botanical survey records: 8

OTHER NOTES

[Mbah, 1993]

Piptadeniastrum africanum (Hook.f.) Brenan
Common name: DAHOMA, Dabema **MIMOSACEAE**
Guild: N.P.L.D. **Conservation:** Pink star

MATURE TREE

Field guide pp. 220 Group: 38C No. 20
A common, very distinctive spreading-crowned tree with smooth, orangeish bark and plank buttresses. It is sometimes deciduous, and sometimes drops a lot, but not all,its leaves. As trees develop, the crown starts sub-spherical; develops two distinct layers; and the top layer develops by growing with a strong horizontal component as the lower crown layer dies. Ultimately, the upper crown starts to fragment and displays 'crown-shyness', with gaps between parts of the crown becoming wider, until the tree dies [Offermans, 1986]. It has been suggested that these patterns could be used to help define the maturity of the tree for use in silvicultural prescriptions [Offermans, 1986].

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 456); Guineo-Congolian. An ecologically important component of many forests, because of its abundance and large crown. In Uganda it regenerates best in colonising forest and clearings, and survives into older forest [Synnott, 1985].

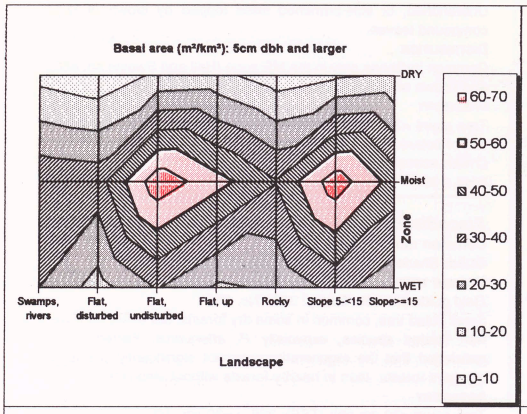
PHENOLOGY/DISPERSAL

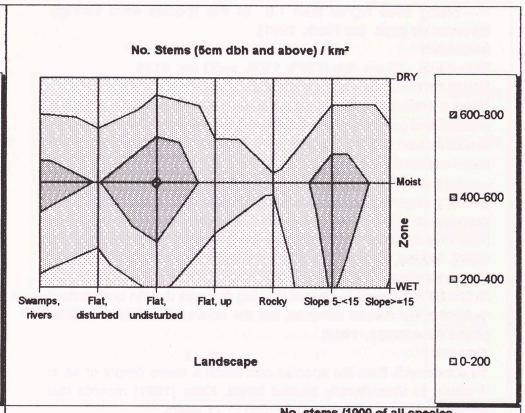
Wind-dispersed fruits are produced towards the end of the dry season [Taylor].

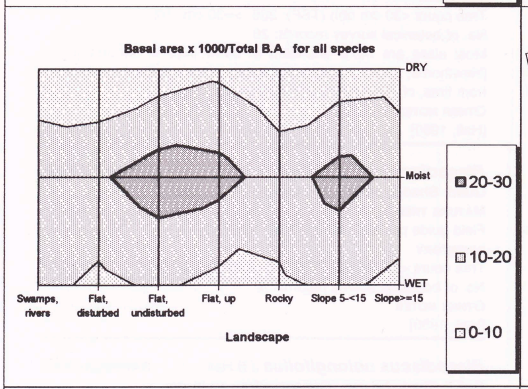
REGENERATION

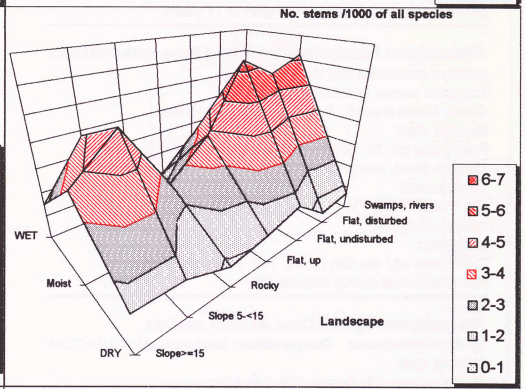
Germination is normal, and the seeds have short viability. The seedlings are, in many areas, very common, even in complete shade (shade is necessary in nursery beds). Saplings are also not uncommon under small gaps. It becomes a light demander to attain the canopy [Taylor]. 3 year old, shaded seedlings may be only c. 20-35 cm tall, whereas in TSS plots the height ranges from 50-150 cm tall [Taylor] after 4 years. (Mean annual increments of 1.5 inches over the first 20 years recorded in Sierra Leone [Savill and Fox, 1967]).

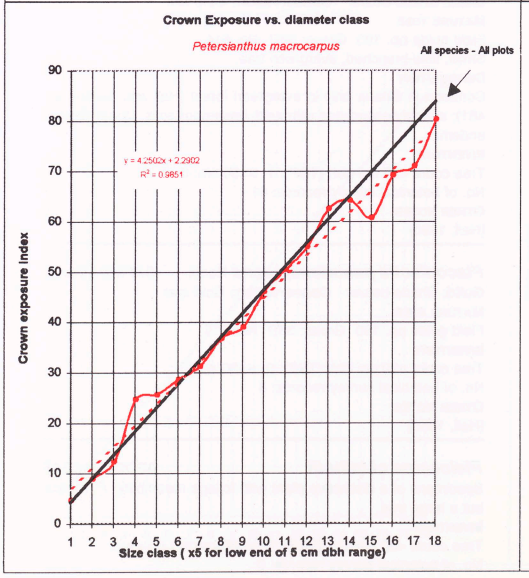
Petersianthus macrocarpus

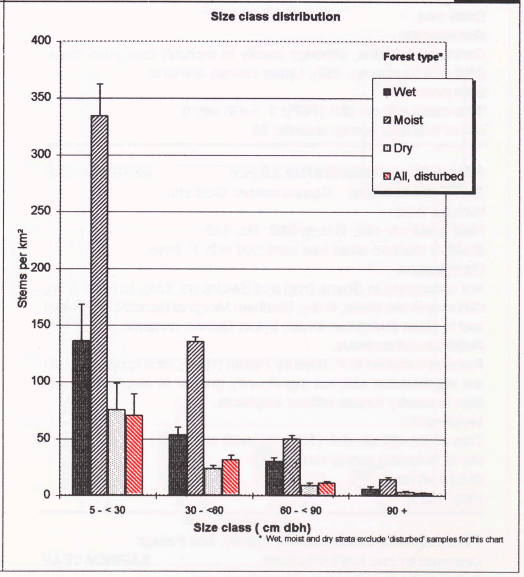












Young trees higher than 1.5 of this species were strongly favoured by gaps [de Klerk, 1991].

INVENTORY

Tree count <30 cm dbh (TSP): 1108 >=30 cm: 5175
No. of botanical survey records: 229

It has a preference for evergreen forest, where the regeneration is plentiful and generally with relatively exposed crowns, as is the case in undisturbed MS-ME forest. The species is generally common and more exposed than average, especially when large.

In a study of the effects of fire in Asukese and other F.R.s, seedling regeneration of this species was found to be obviously depleted in burnt forest. Regeneration (stems 5-30 cm dbh) was also less abundant in burnt than in unburnt forest [Hawthorne, 1994]. Indeed, all sizes are more abundant in unburnt than in burnt forest. Saplings (> 1 height) are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples, but the converse is true of smaller plants [Hawthorne, 1993].

GROWTH

Taylor records than the species can reach a metre height or so in 4 years, in silviculturally treated forest. Keay [1961] records fast growth in Nigeria, reaching 9 ft. girth in 71 years.

Piptostigma fasciculatum (De Wild) Paiva **ANNONACEAE**
(=*Brieya fasciculata* (De Wild) Paiva)
Common name: DUASIKA-FUFUO
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 73 Group: 12B No. 508
Medium-sized, evergreen tree.

DISTRIBUTION

Not uncommon in Ghana (Hall and Swaine sp. 457); Guineo-Congolian.

INVENTORY

Tree count <30 cm dbh (TSP): 113 >=30 cm: 5
No. of botanical survey records: 49

Piptostigma fugax A.Chev. *ex* Hutch and Dalz.
Guild: Shade-bearer **Conservation:** Gold star **ANNONACEAE**

MATURE TREE

Field guide pp. 73 Group: 12B No. 509
Small tree.

DISTRIBUTION

Common in Ghana, although mainly in (upland) evergreen forest (Hall and Swaine sp. 458); Upper Guinea endemic.

INVENTORY

Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 25

Placodiscus attenuatus J.B.Hall **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 190 Group: 36D No. 510
Small or medium-sized tree confused with *P. boya*.

DISTRIBUTION

Not uncommon in Ghana (Hall and Swaine sp. 459), but occurring, curiously in two areas, in dry, Southern Marginal (coastal, dry) forest and in Moist Evergreen forest. Upper Guinea endemic.

PHENOLOGY/DISPERSAL

Probably included in *P. boya* by Parren [1991], who concluded that the regeneration was not significantly greater in elephant forests than in nearby forests without elephants.

INVENTORY

Tree count <30 cm dbh (TSP): 1 >=30 cm: 1
No. of botanical survey records: 23

OTHER NOTES

[Hall, 1980]

Placodiscus bancoensis Aubrev. and Pellegr.
Common name: KAFUOSONINI **SAPINDACEAE**
Guild: N.P.L.D. **Conservation:** Black star

MATURE TREE

Field guide pp. 190 Group: 36D No. 511
Unbranched, or little-branched trees topped by crown of large compound leaves.

DISTRIBUTION

Common in Ghana only in the ME zone (Hall and Swaine sp. 460), and known only from Ivory Coast and Ghana.

INVENTORY

Tree count <30 cm dbh (TSP): 12 >=30 cm: 2
No. of botanical survey records: 23

OTHER NOTES

[Hall, 1980]

Placodiscus boya Aubrev. and Pellegr. **SAPINDACEAE**
Common name: KAFUOSO
Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 190 Group: 36D No. 512
Small fluted tree, common in some dry forests, but easily confused with related species, especially *P. attenuatus*. Parren [1991] concluded that the regeneration was not significantly greater in elephant forests than in nearby forests without elephants.

INVENTORY

Tree count <30 cm dbh (TSP): 205 >=30 cm: 169
No. of botanical survey records: 26

Most sizes are more abundant in burnt than in unburnt forest [Hawthorne, 1994]. Possibly the fluting helps protect the cambium from fires, cf. *Trilepisium* and *Duboscia*.

OTHER NOTES

[Hall, 1980]

Placodiscus bracteosus J.B.Hall **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 190 Group: 36D No. 513

INVENTORY

Tree count <30 cm dbh (TSP): 2 >=30 cm: 0
No. of botanical survey records: 9

OTHER NOTES

[Hall, 1980]

Placodiscus oblongifolius J.B.Hall **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 190 Group: 36D No. 514
Small, little-branched, evergreen tree.

DISTRIBUTION

Common in Ghana only in evergreen forest (Hall and Swaine sp. 461); strongly associated with acid, base-poor soils; Upper Guinea endemic.

INVENTORY

Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 41

OTHER NOTES

[Hall, 1980]

Placodiscus pseudostipularis Radlk. **SAPINDACEAE**
Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 190 Group: 36D No. 515

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

OTHER NOTES

[Hall, 1980]

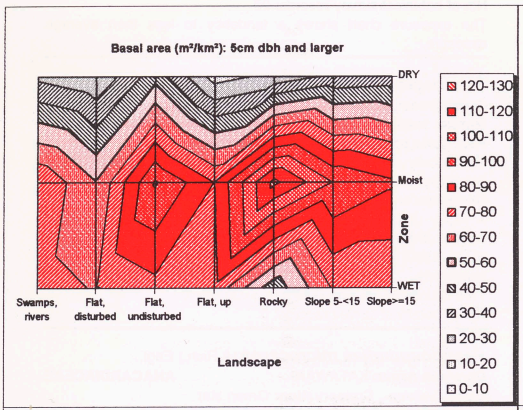
Pleiocarpa cf.talbotii **APOCYNACEAE**

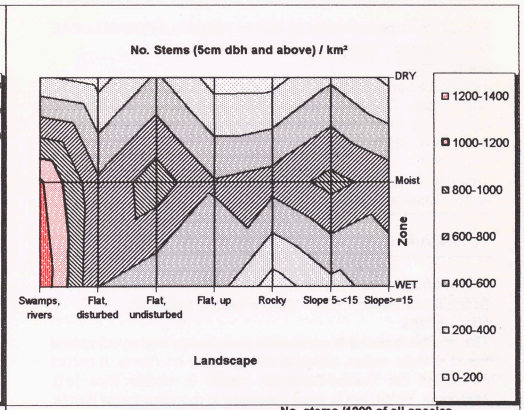
Specimens of a distinctive plant with foliage resembling *P. mutica*, but a large tree.

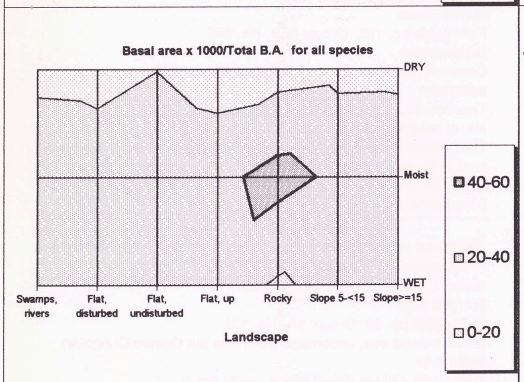
INVENTORY

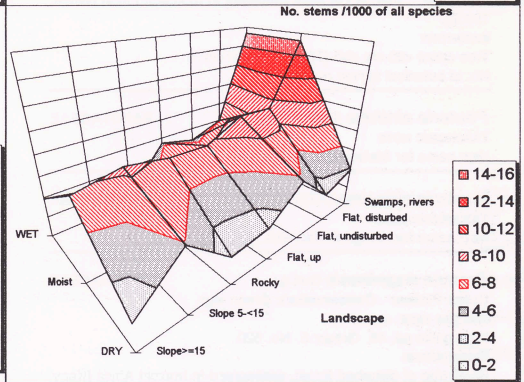
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

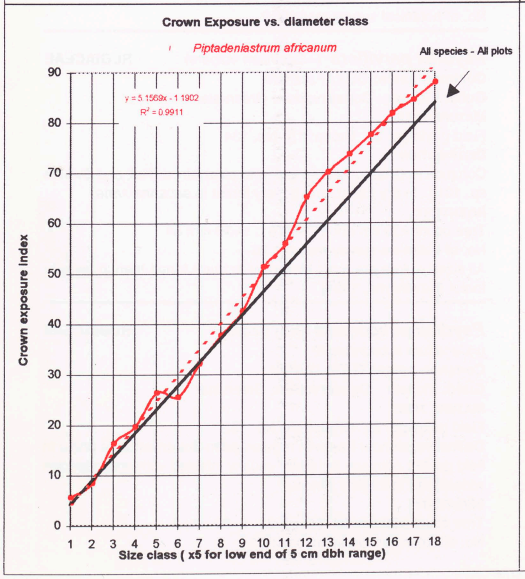
Piptadeniastrum africanum

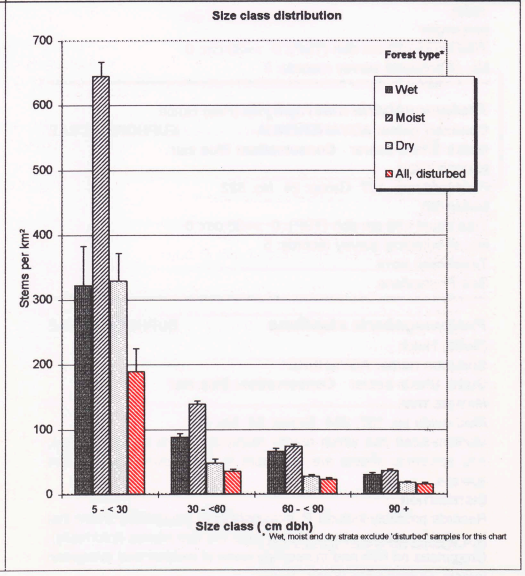












Pleiocarpa pycnantha (K.Schum.) Stapf **APOCYNACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 53 Group: 9A No. 517
Rare small, Guineo-Congolian tree or shrub. Probably once common in Volta region, as it occurs on mountains in Togo [Akpagana, 1992].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 7

Polyalthia oliveri see *Greenwayodendron oliveri*

Polyscias fulva (Hiern) Harms **ARALIACEAE**
Guild: Savanna/non-forest **Conservation:** Blue star
MATURE TREE
This species is probably confined to (now largely destroyed) upland forest in Volta region, although it may occur on Atewa. It occurs throughout the Guineo-Congolian region in similar sites [e.g. Akpagana, 1992], but is most abundant in montane forest [White, 1983b].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Pouteria alnifolia (Baker) Roberty **SAPOTACEAE**
TAXONOMIC NOTE
New name for *Malacantha alnifolia* [cf.]

Pouteria altissima (A.Chev.) Bailey **SAPOTACEAE**
TAXONOMIC NOTE
New name for *Aningeria altissima* (cf.).

Premna angolensis Gurke **VERBENACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 45 Group: 5 No. 520
DISTRIBUTION
Small tree of disturbed forest, widespread in tropical Africa [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

Protomegabaria macrophylla (Pax) Hutch
Common name: AGYAHERENUA **EUPHORBIACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 137 Group: 24 No. 522
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5
TAXONOMIC NOTE
See *P. stapfiana*.

Protomegabaria stapfiana **EUPHORBIACEAE**
(Beille) Hutch
Common name: AGYAHERE
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 137, 234 Group: 24 No. 523
Medium-sized tree which readily resprouts where it falls or leans, and epicormic shoots are abundant in forest dominated by this species.
DISTRIBUTION
Records probably include *P. macrophylla* in the unlikely event that is a distinct species. Keay [1989] joins the two names (informally). Gregarious on hills and in swampy parts of moister and evergreen forests. Guinea-wide [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 822 >=30 cm: 1633
No. of botanical survey records: 23
The exposure chart shows a tendency to less than average exposure.

Pseudagrostistachys africana (Muell.Arg.) Pax and K.Hoffm.
Guild: Swamp **Conservation:** Black star **EUPHORBIACEAE**
MATURE TREE
Field guide pp. 132 Group: 22B No. 524
Tree locally common along occasional stretches of river bank in (Wet) evergreen forest, but nationally extremely rare.
DISTRIBUTION
A highly unusual occurrence in Ghana because this species is known otherwise only in Cameroun, Bioko, Tome' and Nigeria [Keay, 1989] where it is rare and occurs at high altitudes.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 0

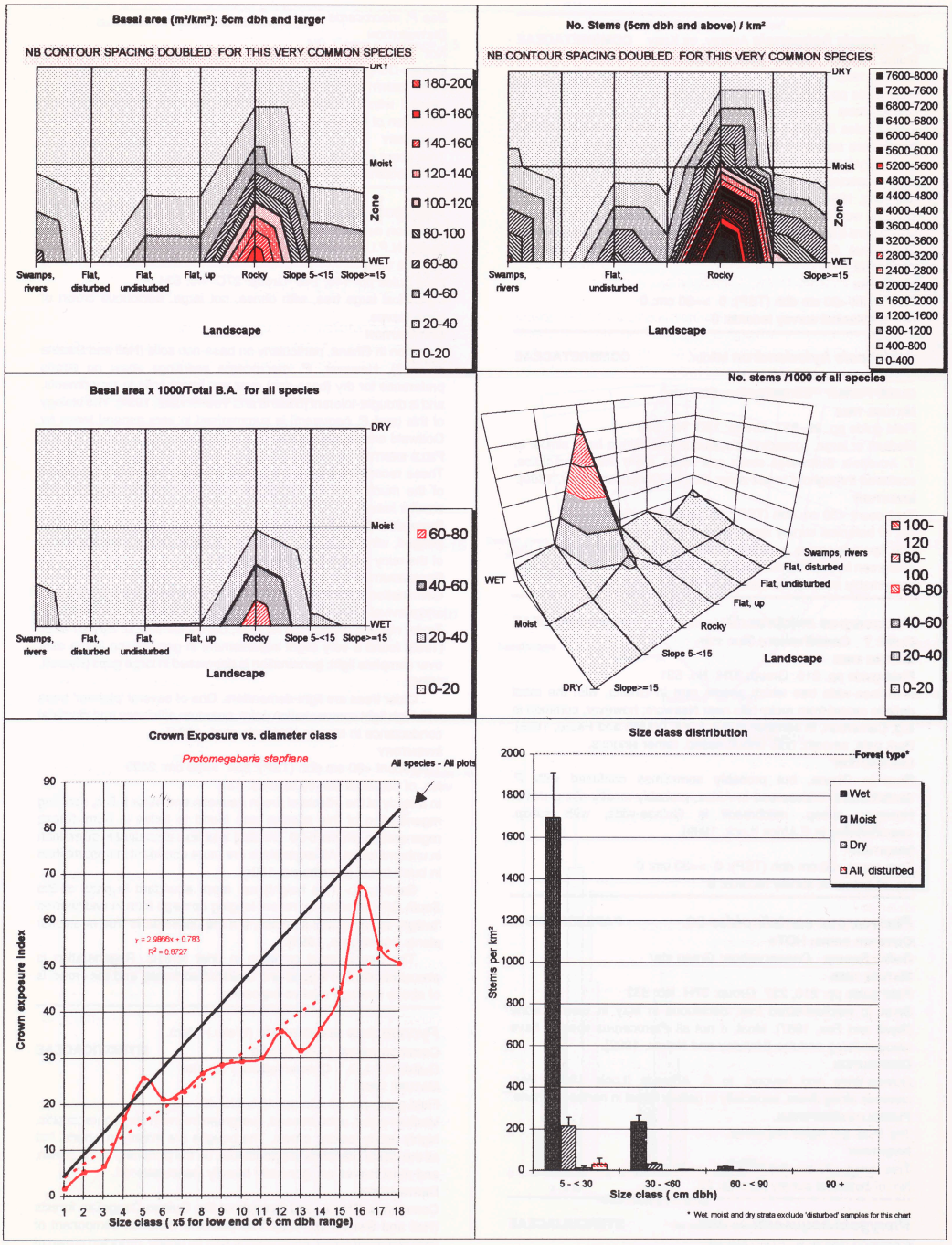
Pseudospondias microcarpa (A.Rich.) Engl.
Common name: KATAWANI **ANACARDIACEAE**
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 182 Group: 35B No. 525
DISTRIBUTION
Common particularly along rivers and in swamps.
INVENTORY
Tree count <30 cm dbh (TSP): 106 >=30 cm: 800
No. of botanical survey records: 37
The preference for drier forest, swampier sites is marked, and trees tend to be more shaded than average.
All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Psydrax arnoldiana **RUBIACEAE**
(= *Canthium arnoldianum*)
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 29 Group: 1A No. 131
Medium-sized tree, uncommon in Ghana but Guineo-Congolian.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 2

Psydrax parviflora (=*Canthium vulgare*) **RUBIACEAE**
Common name: OGYAPAMNINI
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 29 Group: 1A No. 134
DISTRIBUTION
Common in Ghana; widespread in tropical Africa (Hall and Swaine sp. 101). In dry forest, and gallery forest in savanna zone.
INVENTORY
Tree count <30 cm dbh (TSP): 81 >=30 cm: 51
No. of botanical survey records: 26
All sizes of tree are more abundant in burnt forest than in unburnt forest [Hawthorne, 1994].

Psydrax subcordata (DC.) Bridson **RUBIACEAE**
(=*Canthium subcordatum*)
Common name: TETIA-DUPoN
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 29 Group: 1A No. 132
Distinctive, slender tree with regular, palm-like crown (see photo in field guide); common in fallow; usually infested with ants. Species widespread in tropical Africa.
INVENTORY
Tree count <30 cm dbh (TSP): 21 >=30 cm: 3
No. of botanical survey records: 21

Protomegabaria stapfiana



Pteleopsis habeensis Aubrev. ex Keay **COMBRETACEAE**
Guild: Pioneer **Conservation:** Black star
MATURE TREE
Field guide pp. 139 Group: 25 No. 529
DISTRIBUTION
This species is known only from three localities in the world: the Bandiagara scarps in Mali; the Yankari Game reserve in Nigeria; and in dry forest at Bui and Akosombo in Ghana. *P. tetraptera* is a similar species in the dry, rocky, coastal forests in East Africa [Geerling, 1984]. In the Yankari game reserve, which is otherwise savanna woodland, it occurs in more or less dense stands on rocky hills, where it is protected from fires by the rocks. Its associates are (in Ghana) *Sanseviera liberica*, *Talbotiella gentii* and *Hunteria ghanensis*.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Pteleopsis hylodendron Mildbr. **COMBRETACEAE**
Common name: KWAE-KANE
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 89, 237 Group: 13D No. 530
Medium or large, spreading, deciduous tree, with a habit similar to *T. ivorensis*. Buttresses steep and slight, more like broad flutes, scattered throughout forest zone; Guineo-Congolian [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 56 >=30 cm: 92
No. of botanical survey records: 14
The species shows a strong preference for steep slopes in the evergreen forests. Some records of *Anogeissus* from these sites are presumably mis-representations of this (cf. local names).

Pterocarpus mildbraedii Harms **PAPILIONACEAE**
Guild: ? **Conservation:** Blue star
MATURE TREE
Field guide pp. 210 Group: 37H No. 531
A Guinea-wide tree which seems rare in Ghana, with the most definite record from rocky hills near Nsawam; however, common in e.g. Cameroun, in semideciduous forest [Vivien and Faure, 1985]. Bark pale, smooth; bole unbuttressed, rather sinuous.
DISTRIBUTION
Rare in Ghana, but probably sometimes confused with *P. santalinoides*. Widespread in Africa, probably mostly along rivers. However, subsp. *mildbraedii* is Guinea-wide, with subsp. *usambarensis* in E.Africa [Lock, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 8

Pterocarpus santalinoides DC. **PAPILIONACEAE**
Common name: HOTe
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 210, 237 Group: 37H No. 532
Small to medium-sized tree, deciduous in May in Sierra Leone [Savill and Fox, 1967]. Most, if not all *Pterocarpus* species have nitrogen-fixing nodules [Halliday and Nakao, 1982].
DISTRIBUTION
Guinea-Wide and beyond, to S. America [Lock, 1989]. Very common along rivers, especially in gallery forest in northern Ghana.
PHENOLOGY/DISPERSAL
The fruits are water-dispersed.
INVENTORY
Tree count <30 cm dbh (TSP): 6 >=30 cm: 15
No. of botanical survey records: 22

Pterygota bequaertii De Willd. **STERCULIACEAE**
Common name: KYEREYeBERE
Guild: N.P.L.D. **Conservation:** Red star
MATURE TREE
Field guide pp. 149, 243 Group: 27C No. 533
See *P. macrocarpa*
DISTRIBUTION
Not very common in Ghana (Hall and Swaine sp. 482); Guineo-Congolian.
FIELD IDENTITY
Joined with *P. macrocarpa* for inventory results, due to easy confusion of the trees.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 6

Pterygota macrocarpa K.Schum. **STERCULIACEAE**
Common name: KYEREYe, Koto
Guild: N.P.L.D. **Conservation:** Red star
MATURE TREE
Field guide pp. 149, 240 Group: 27C No. 534
Cylindrical large tree, with dense, not large, deciduous crown of large leaves.
DISTRIBUTION
Common in Ghana, particularly on base-rich soils (Hall and Swaine sp. 483). However, *P. macrocarpa* seedlings show no strong preference for dry (base-rich) over wet forest soils in experiments, and is drought-tolerant [Swaine and Veenendaal, 1994]. The biology of this (and *P. bequaerti)* is summarised in very general terms by Gottwald and Richter [1984].
FIELD IDENTITY
These records include a few, albeit probably insignificant, records of the much rarer *P. bequaertii* which is a similar species with smaller leaves.
PHENOLOGY/DISPERSAL
Winged, wind-dispersed seeds are released around the beginning of the rainy season from the large follicles.
REGENERATION
Germination is normal. Macgregor [1934] found that the germination and survival of seedlings of this species are best in shade, although Taylor notes a preference for high, not dense shade. Kyereh *et al.* [1993] found a very slight improvement in germination in the dark over complete light; germination is depressed in large gaps [Kyereh, 1994].

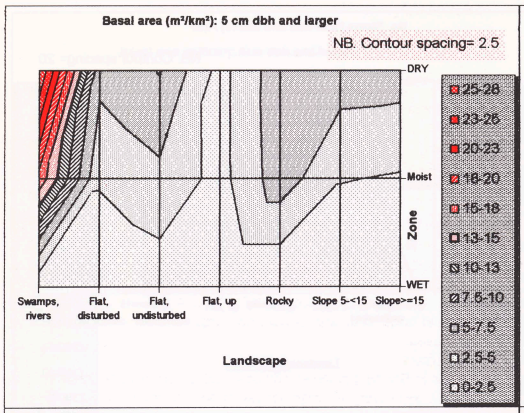
Older trees are light-demanders. One of several 'pioneer' trees with high light compensation point, quantum efficiency and stomatal conductance in Nigeria [Riddoch *et al.*, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 554 >=30 cm: 2439
No. of botanical survey records: 137
In a study of the effects of fire in Asukese and other F.R.s, seedling regeneration of this species was found to thrive in burnt forest; regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest. All larger sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

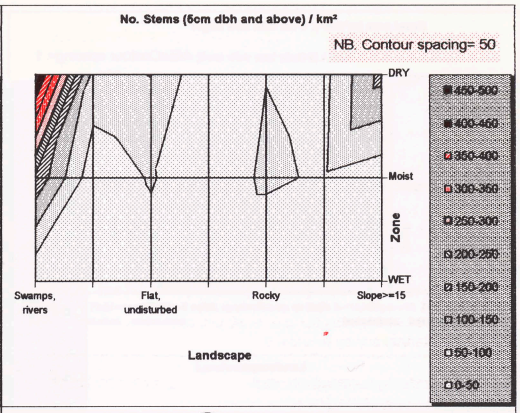
Saplings (> 1 m height) are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples, but the converse is true of smaller plants [Hawthorne, 1993].

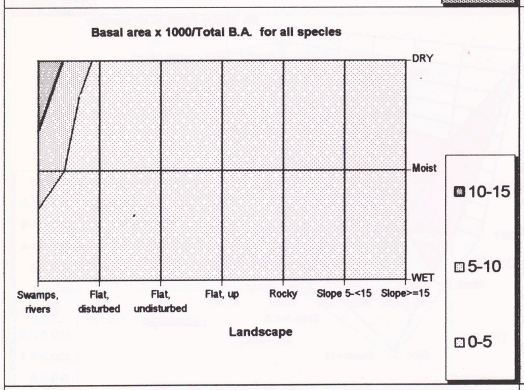
The tree is most common in drier forests. Regeneration is almost identical in logged and undisturbed forest, and the crown is of above average relative exposure.

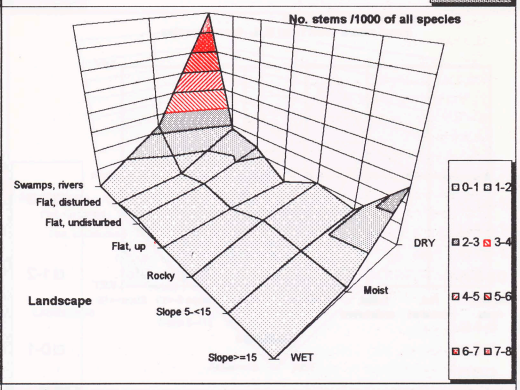
Pycnanthus angolensis (Welw.) Warb.
Common name: OTIE, Ilomba **MYRISTICACEAE**
Guild: N.P.L.D. **Conservation:** Pink star
MATURE TREE
Field guide pp. 83 Group: 13A No. 49
Medium-sized, unbuttressed, evergreen tree with very characteristic, highly untidy looking crown. The boughs are initially in whorls, but all the lesser branches are pendulous on the periphery of the crown, and most leaves are generally heavily insect-tattered.
DISTRIBUTION
Common in Ghana, and throughout the Guineo-Congolian forests (Hall and Swaine sp. 485). The tree is a common component of very disturbed forest, conspicuous with its untidy, drooping crown of tattered leaves. Swaine and Veendendall [1994] found the species to be highly drought-sensitive as a seedling.

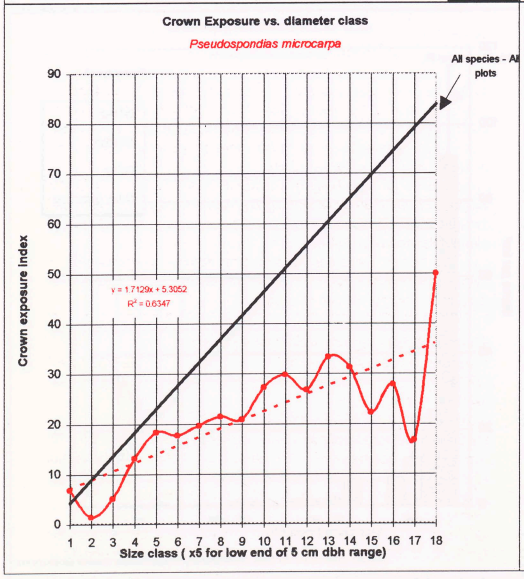
Pseudospondias microcarpa

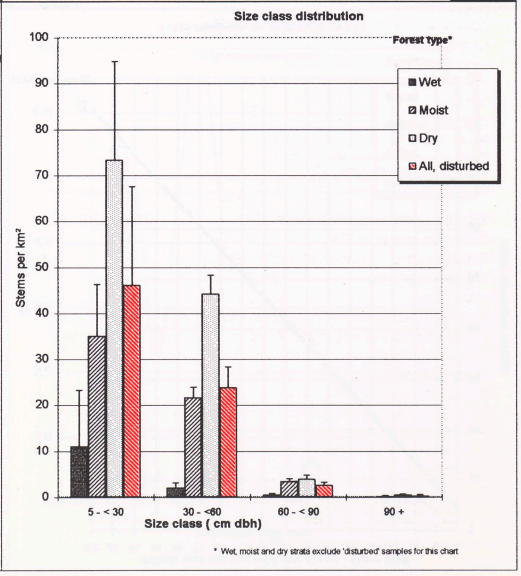




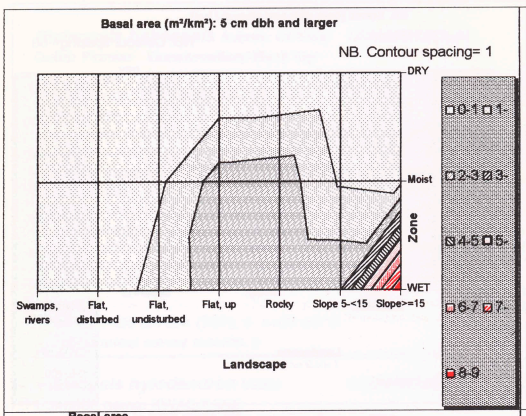


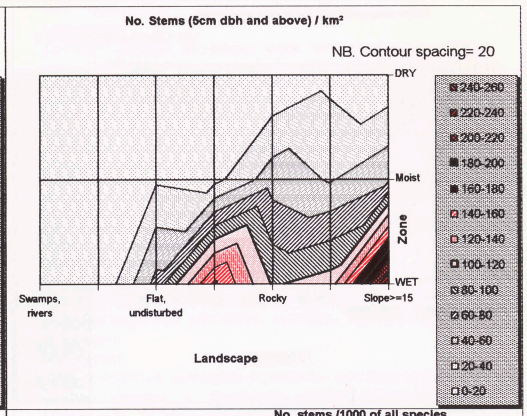


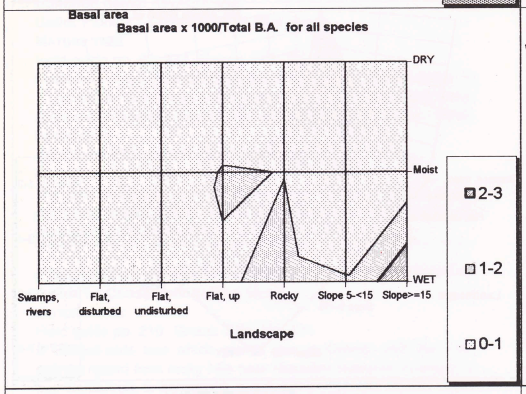


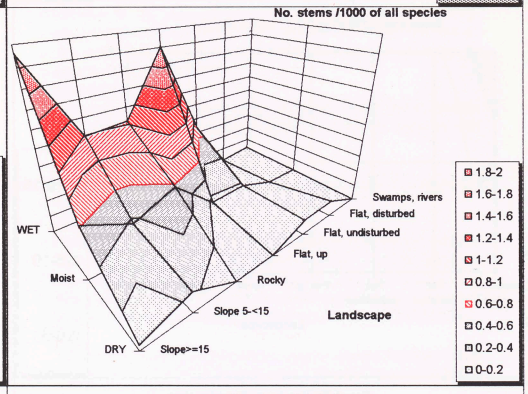


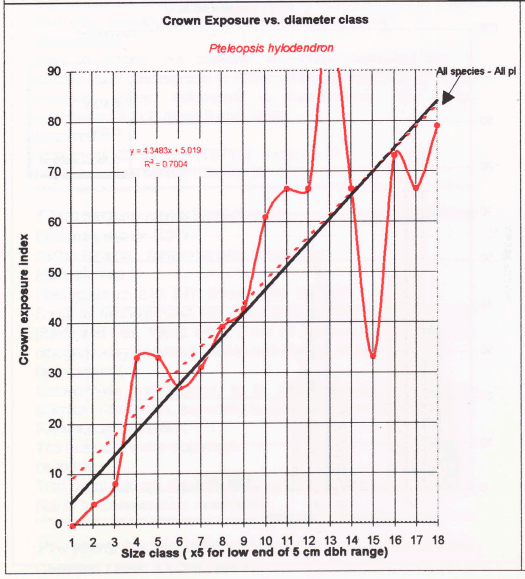
Pteleopsis hylodendron

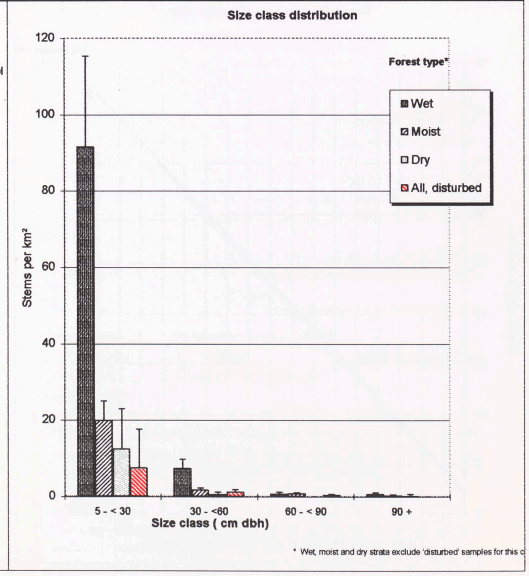




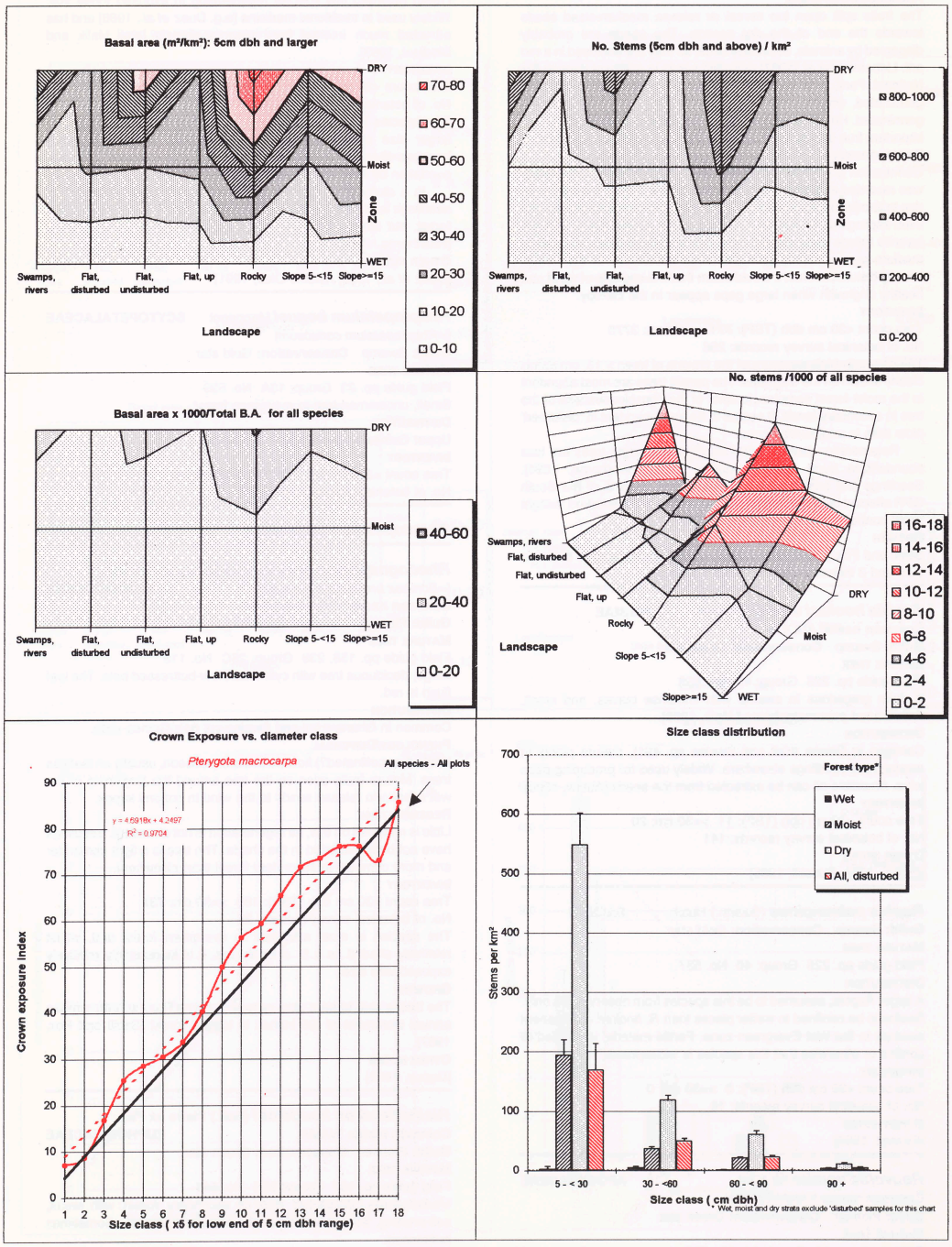








Pterygota macrocarpa



PHENOLOGY/DISPERSAL
The fruits split open too reveal or release medium-sized seeds towards the end of the dry season. The seeds are probably dispersed by animals, especially birds, as they are enclosed in a red aril. Lieberman *et al.* [1987] recorded seeds in elephant dung in Bia National Park, and found that these two ingested seeds both germinated, whereas not one of 21 ripe but not ingested seeds germinated. Hence elephants can be effective dispersal agents. An important fruit tree for birds [Gautier-Hion and Michaloud, 1989].
REGENERATION
Germination is normal, except that it is hypogeal. Poor germination was recorded in Sierra Leone [Savill and Fox, 1967], thought to be due to short viability. Seedlings are common in complete shade, and even saplings up to several metres in height can be found, with the juvenile foliage quite distinct from that of mature trees, in small to medium gaps. Judging from the conspicuousness of the tree in heavily disturbed forest it would seem that it is capable of rapid and healthy ongrowth when large gaps appear in the canopy.
INVENTORY
Tree count <30 cm dbh (TSP): 771 >=30 cm: 3775
No. of botanical survey records: 256
The generally high exposure of the crowns of trees > 15 cm dbh is clearly shown on the diagrams. The parent trees are most abundant in the moist forest samples. In spite of the conspicuousness of the tree in secondary forest, it seems to be less abundant in 'disturbed' plots than in undisturbed ones.

Regeneration (stems 5-30 cm dbh) and larger trees are less abundant in burnt than in unburnt forest [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].
GROWTH
Savill and Fox [1967] record mean annual increments of between 0.75 and 3 inches in girth in Sierra Leone.

Raphia hookeri Mann and Wendl. **PALMAE**
Common name: ADOBe
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 225 Group: 40 No. 536
A palm gregarious in swamp with immense leaves, and small, unthickened pneumatophores [Jénik, 1969].
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 491), mature plants in swamps but seedlings elsewhere. Widely used for producing palm wine. An edible oil can be extracted from the seeds [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 11 >=30 cm: 20
No. of botanical survey records: 141
OTHER NOTES
[Profizi, 1988; Russell, 1965]

Raphia palma-pinus (Gaertn.) Hutch. **PALMAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 225 Group: 40 No. 537
DISTRIBUTION
A larger Raphia, assumed to be this species from observations only. Seems to be confined to wetter places than *R. hookeri* - permanent swamps in the Wet Evergreen zone. Fertile material is needed to confirm or otherwise that this species is widespread.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 16
OTHER NOTES
[Russell, 1965]

Rauvolfia vomitoria Afzel. **APOCYNACEAE**
Common name: KAKAPENPEN
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 53 Group: 9A No. 538
DISTRIBUTION
A common small pioneer tree found only in disturbed forest. Keay [1960] recorded this species regenerating in exposed forest soil. Widely used in traditional medicine [e.g. Duez *et al.*, 1986] and has attracted much interest from pharmacologists [e.g. Malik and Siddiqui, 1983].
INVENTORY
Tree count <30 cm dbh (TSP): 220 >=30 cm: 39
No. of botanical survey records: 113
The species is most abundant in disturbed forest. Some of the larger size classes appear to be relatively shaded, probably because these are overmature trees in the process of being overtaken by later successional species.

In a study of the effects of fire in Asukese and other F.R.s, seedlings and trees < 30 cm dbh were found to thrive in burnt forest, but larger sizes were depleted, relative to unburnt forest [Hawthorne, 1994].
OTHER NOTES
[Duez *et al.*, 1986; Kweifio-Okai, 1991]

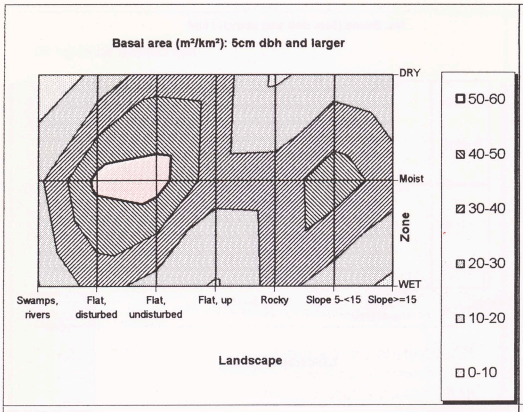
Rhaptopetalum beguei Mangenot **SCYTOPETALACEAE**
(=*Rhaptopetalum coriaceum*)
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 83 Group: 13A No. 539
Small, uncommon tree in evergreen forest.
DISTRIBUTION
Upper Guinea endemic [Flore du Gabon]
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 0
No. of botanical survey records: 23

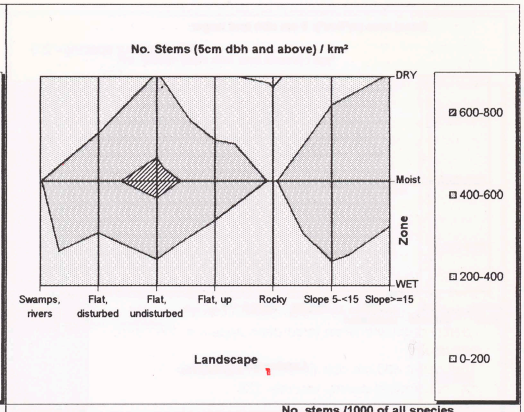
Rhaptopetalum coriaceum see *Rhaptopetalum beguei*

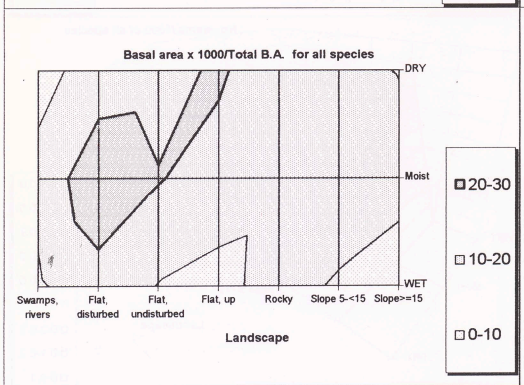
Rhodognaphalon brevicuspe (Sprague) Roberty
(=*Bombax brevicuspe* Sprague) **BOMBACACEAE**
Common name: ONYINAKoBEN
Guild: Pioneer **Conservation:** Red star
MATURE TREE
Field guide pp. 158, 238 Group: 28C No. 118
Large, deciduous tree with cylindrical, low-buttressed bole. The leaf flush is red.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 81); Guinea-wide.
PHENOLOGY/DISPERSAL
White (bat-pollinated?) flowers in the dry season, usually on leafless trees. Mature fruits open on the tree around the beginning of the wet season to release seeds to the wind in cottony kapok.
REGENERATION
Little is recorded on this, as regeneration is not abundant. Seedlings have not been recorded in the shade. The tree is a light demander and more common in secondary forest than elsewhere.
INVENTORY
Tree count <30 cm dbh (TSP): 189 >=30 cm: 787
No. of botanical survey records: 29
The species is most abundant in evergreen forest and, whilst relatively shaded as a 5 cm dbh tree, it is increasingly relatively exposed with size.
GROWTH
The tree is said to be a slow-grower in SierraTLeone, with a mean annual increment of .25 inches in logged forest [Savill and Fox, 1967].
OTHER NOTES
[Dupuy, 1992]

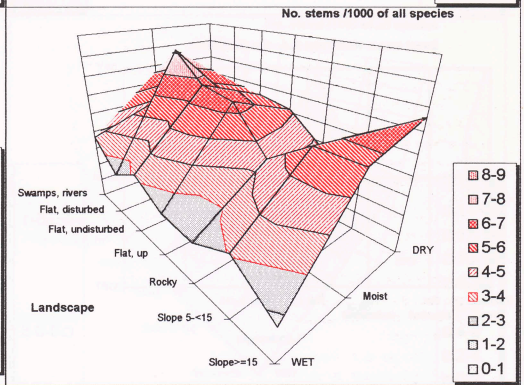
Ricinodendron heudelotii (Baill.) Pierre *ex* Pax
Common name: WAMA **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 157 Group: 28B No. 541
Medium-large, deciduous tree of secondary forest with weak, self-pruning, weak-wooded boughs and dense crown. Sometimes buttressed.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 497) and across to East

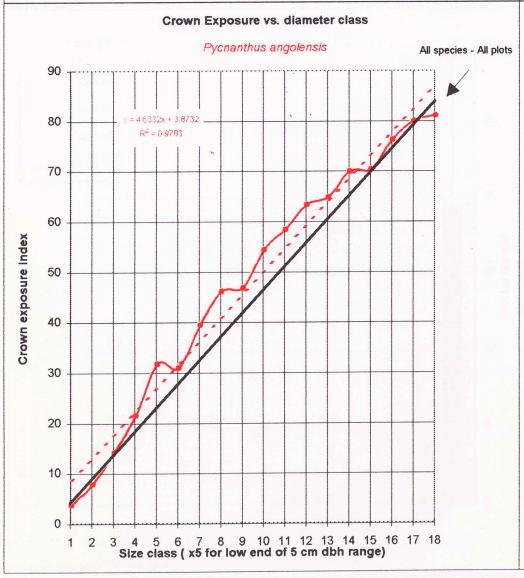
Pycnanthus angolensis

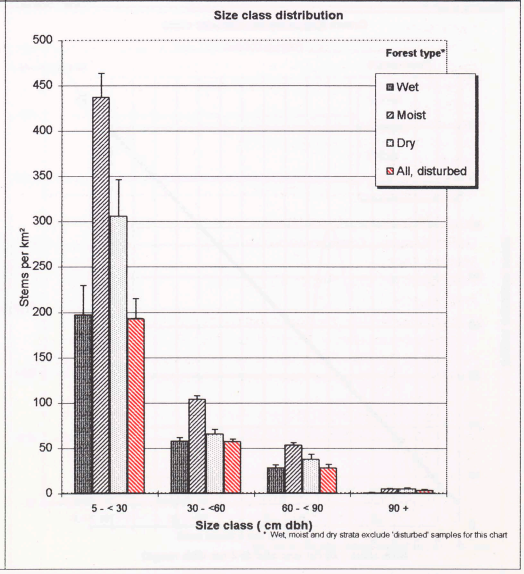




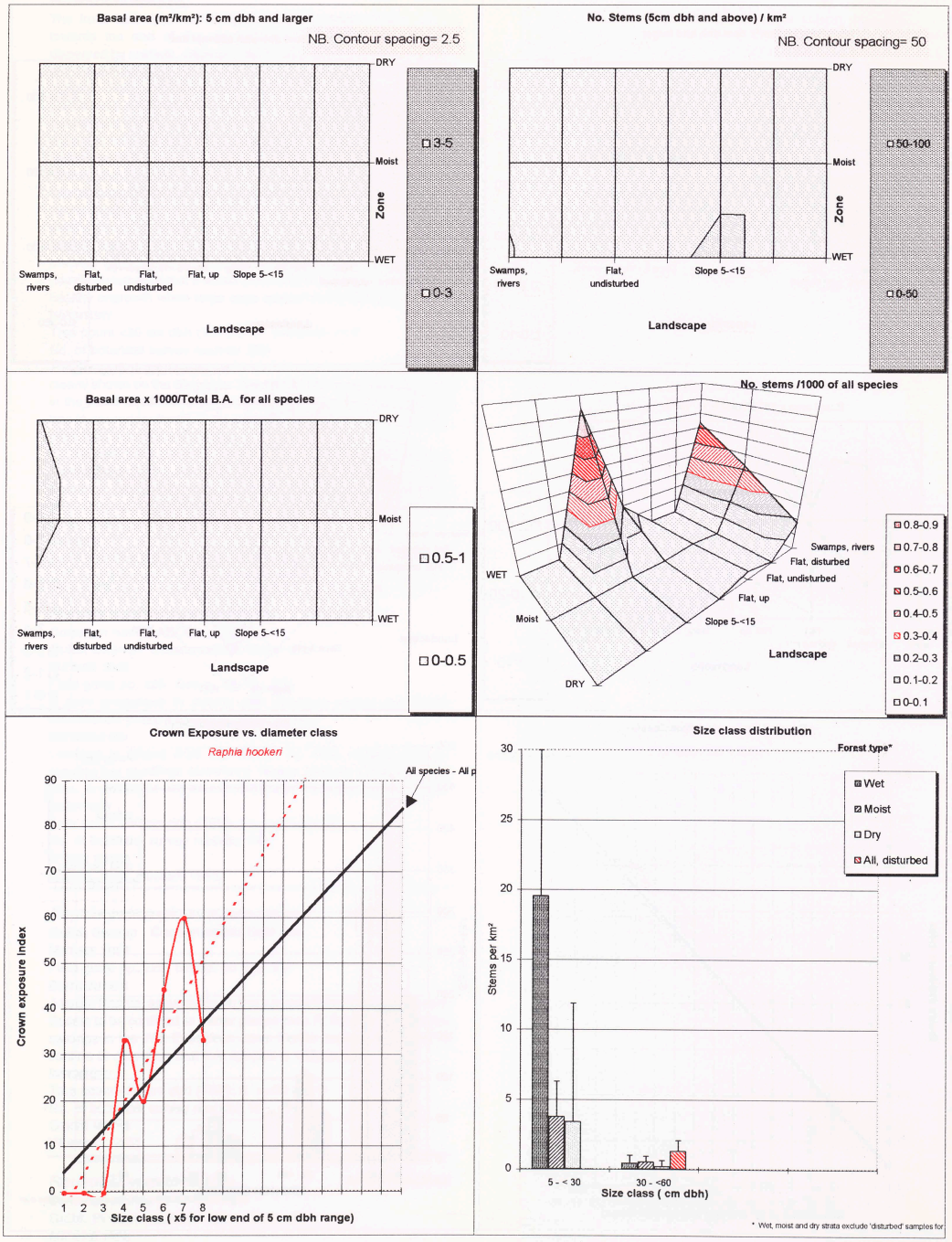




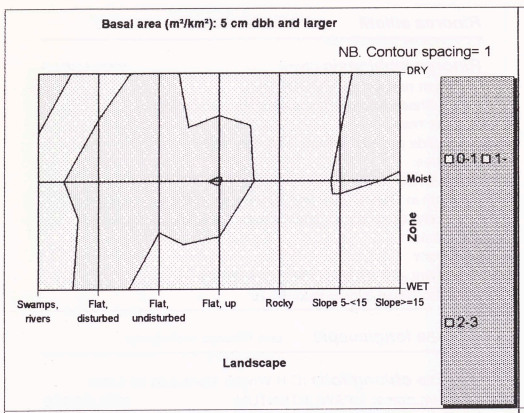


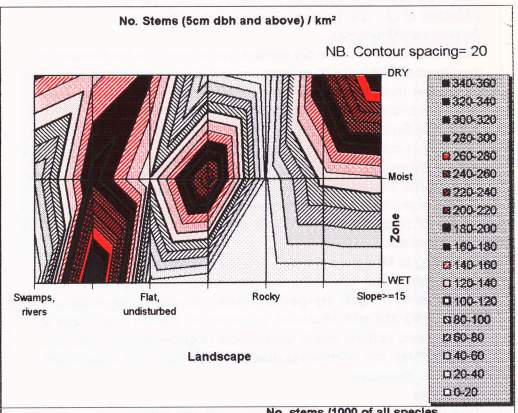


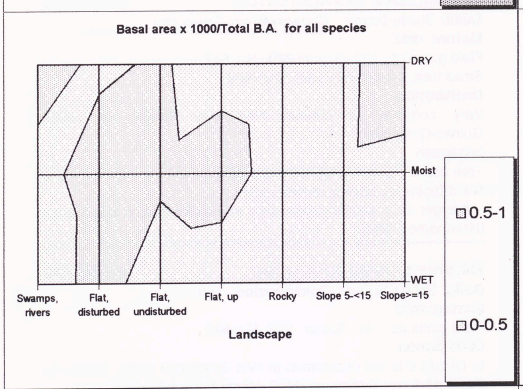
Raphia hookeri

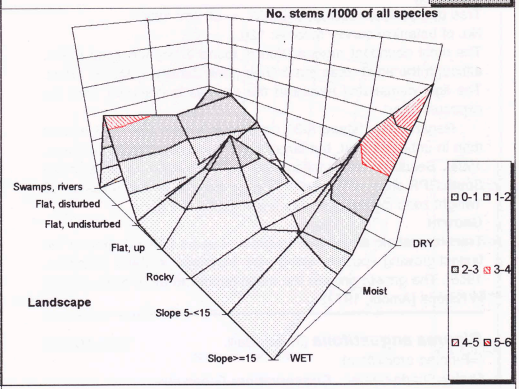


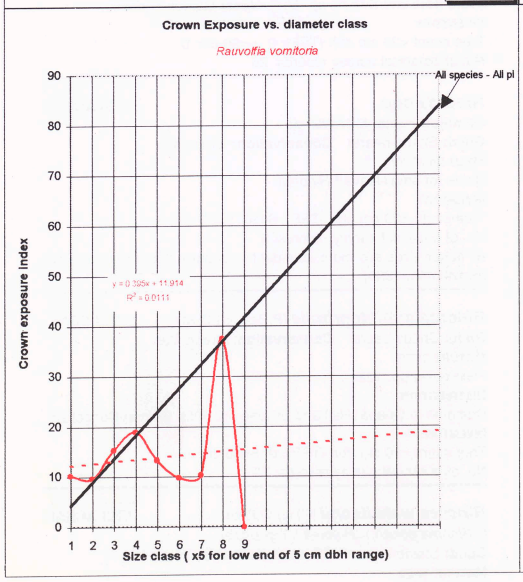
Rauvolfia vomitoria

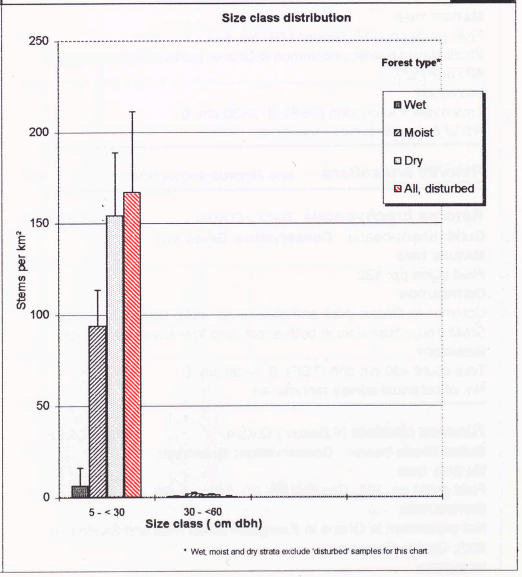












Africa, particularly in secondary forest. A 'pioneer' species in Nigeria [Riddoch *et al.*, 1991].

PHENOLOGY/DISPERSAL

Flowers at the end of the dry season, coincident with the flushing of new leaves. The fruits (3-seeded drupes) are produced throughout the rainier months. The large seeds are dispersed by birds (e.g. hornbills) and mammals (e.g. bats) [Taylor].

In Bia South, the seedlings were uncommon in most areas, but occurred in dense thickets along some roadsides, possibly having been dispersed there by elephants (or soil or vicinity of many fruiting trees at the time of clearance?) [Hawthorne, 1993]. Seeds of this species were found in 1% (dry season) to 15% (small rainy season) of piles of elephant dung in Bia South GPR [Martin, 1991].

REGENERATION

According to Macgregor [1934], seeds are stimulated to germinate by exposure to the sun, although the seedlings are then subsequently helped by partial shade, because over-exposure encourages leaf curl. However, according to Kyereh [1993] this is not the case, and the seeds are capable of germinating in the dark. The seedlings are common in medium-large gaps, yet absent from shaded understorey.

INVENTORY

Tree count <30 cm dbh (TSP): 932 >=30 cm: 1833
No. of botanical survey records: 120

The most abundant regeneration is found in dry fire zone forest, although the adult trees reach their peak density in MSSE forest. The light demanding nature of the species is apparent from the exposure chart.

Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest, but larger sizes were depleted [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

GROWTH

Trees can attain about 10m height in 4 years [Taylor]. One of the fastest-growing species, along with *Musanga*, in Zaire [Hombert, 1958]. The growth rings in the wood appear to be annual, at least in Nigeria [Amobi, 1973].

Rinorea angustifolia (Thou.) Baill. **VIOLACEAE**
(=Rinorea ardisiiflora)
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 102 Group: 17B No. 542
Small-leaved treelet; uncommon in Ghana, but found across tropical Africa [FTEA].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

Rinorea ardisiiflora see *Rinorea angustifolia*

Rinorea brachypetala (Turcz.) O.Ktze. **VIOLACEAE**
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 132

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 498); Guineo-Congolian. Small tree, unusual as in both driest, and Wet Evergreen forests.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 48

Rinorea dentata (P.Beauv.) O.Ktze. **VIOLACEAE**
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 102 Group: 17B No. 545

DISTRIBUTION

Not uncommon in Ghana in Evergreen forest (Hall and Swaine sp. 500); Guineo-Congolian.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 10

Rinorea elliotii see *Rinorea welwitschii*

Rinorea kibbiensis Chipp **VIOLACEAE**
Common name: DUOBOROBAE
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 102 Group: 17B No. 546
Small tree.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 502); Guineo-Congolian. Especially common in drier forests, gregarious on slopes and river-banks.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 79

Rinorea longicuspis see *Rinorea welwitschii*

Rinorea oblongifolia (C.H.Wright) Marquand *ex* Chipp
Common name: MPAWUNTUNTUM **VIOLACEAE**
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 132 Group: 22B No. 547
Small tree, often locally very abundant.

DISTRIBUTION

Very common in Ghana (Hall and Swaine sp. 503); Guineo-Congolian.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 259
All larger sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Rinorea prasina (Stapf.) Chipp **VIOLACEAE**
Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 102 Group: 17B No. 548

DISTRIBUTION

In Ghana it is not uncommon in Wet Evergreen forest, mainly by rivers (Hall and Swaine sp. 504). Upper Guinea endemic.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 26

Rinorea spp. **VIOLACEAE**
Common name: MPAWU etc
Guild: Shade-bearer **Conservation:** Green star

FIELD IDENTITY

Name for small-leaved *Rinorea*.

INVENTORY

Tree count <30 cm dbh (TSP): 3420 >=30 cm: 8
No. of botanical survey records: 8
All larger sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Rinorea subintegrifolia (P.Beauv.) O.Ktze. **VIOLACEAE**
Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 132

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 505); Guineo-Congolian

INVENTORY

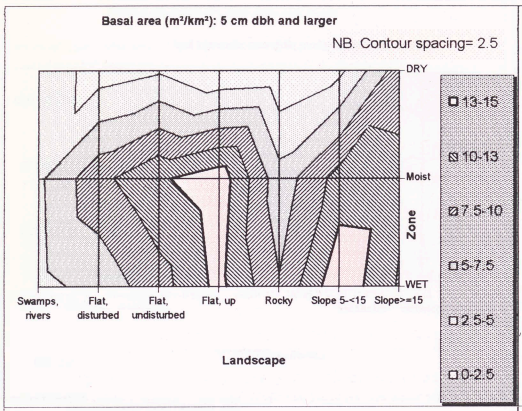
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 73

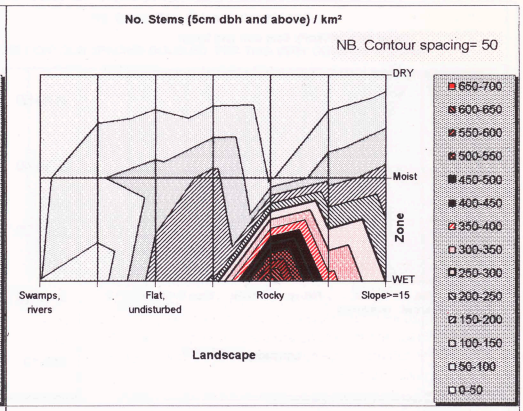
Rinorea welwitschii (Oliv.) O.Ktze. **VIOLACEAE**
(=*Rinorea elliotii*) (=*Rinorea longicuspis*)
Guild: Shade-bearer **Conservation:** Green star

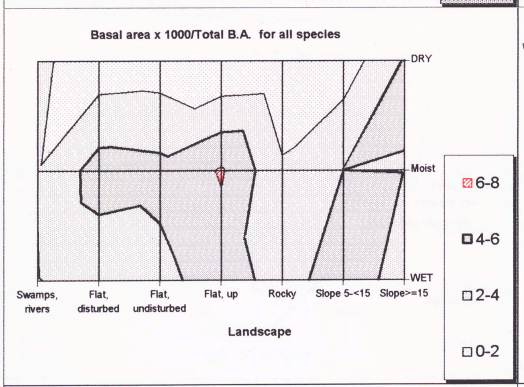
MATURE TREE

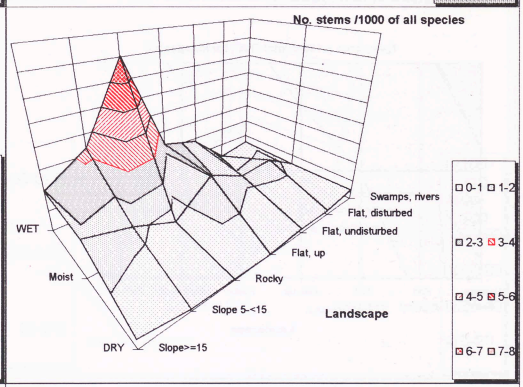
Field guide pp. 132

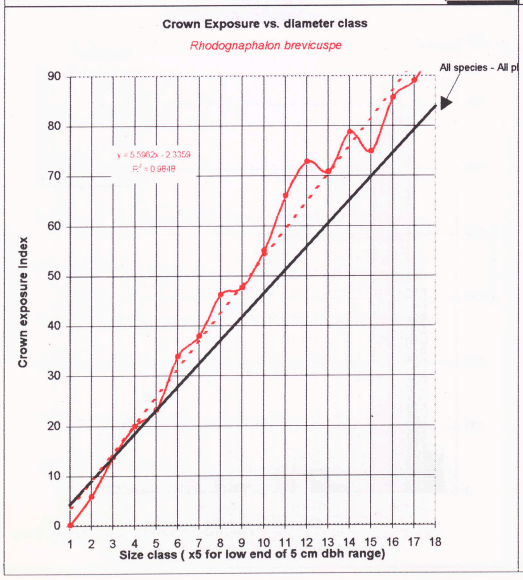
Rhodognaphalon brevicuspe

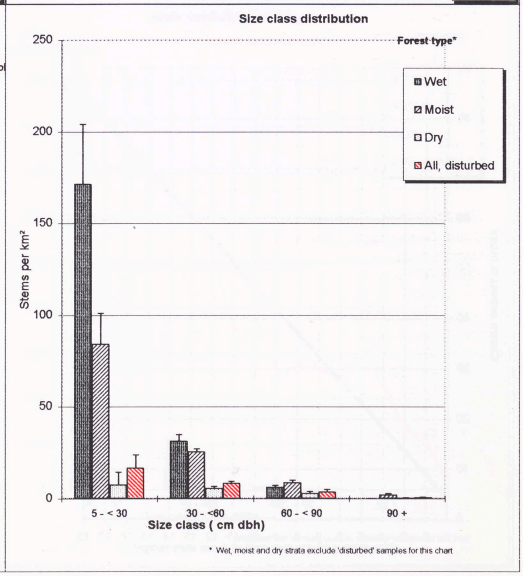




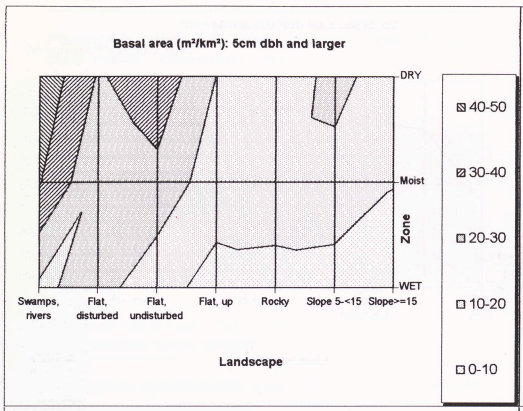


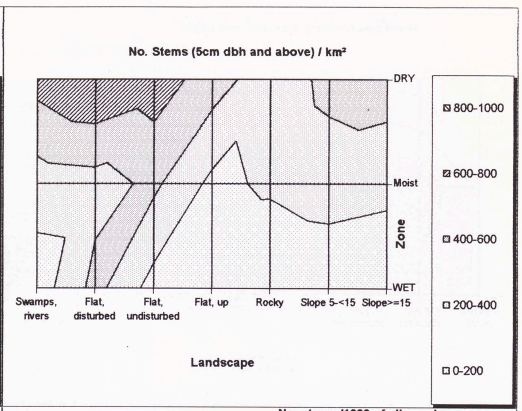


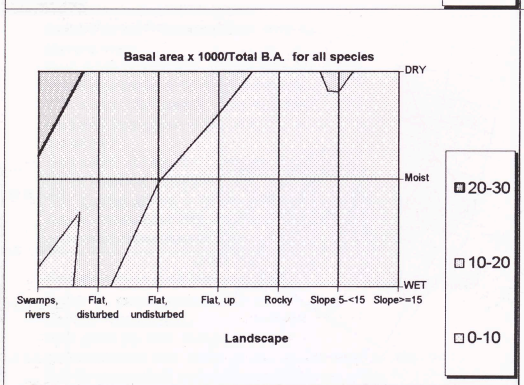


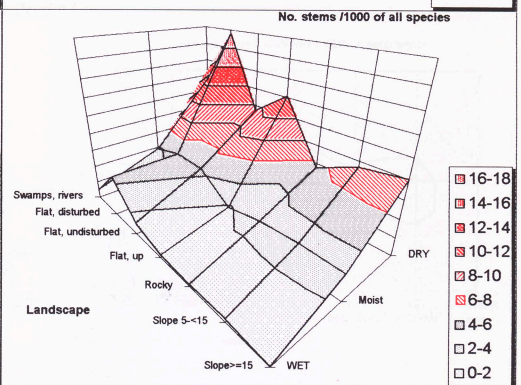


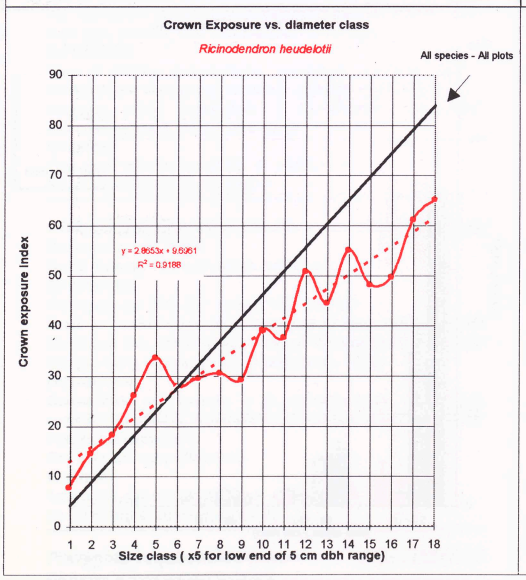
Ricinodendron heudelotii

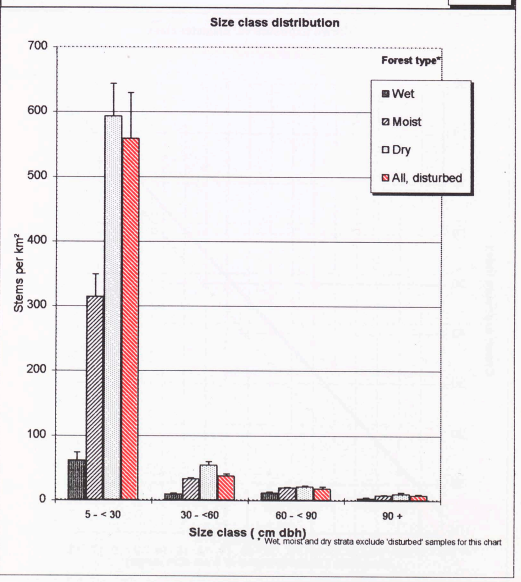




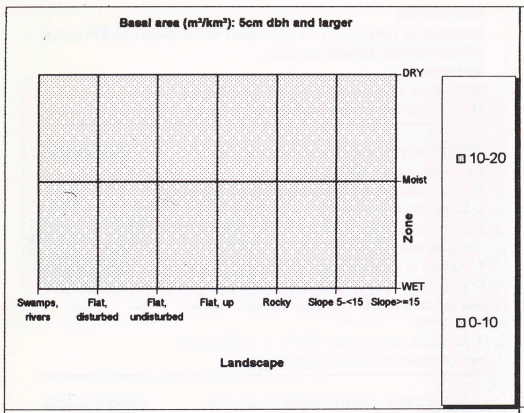


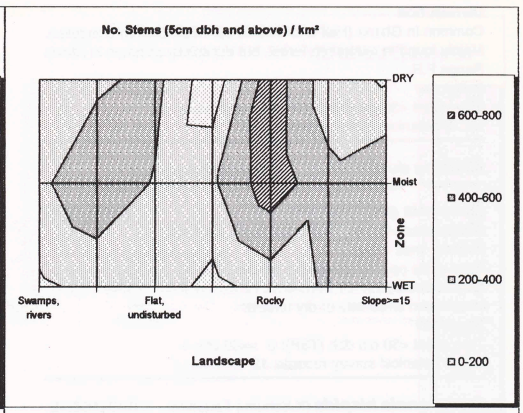


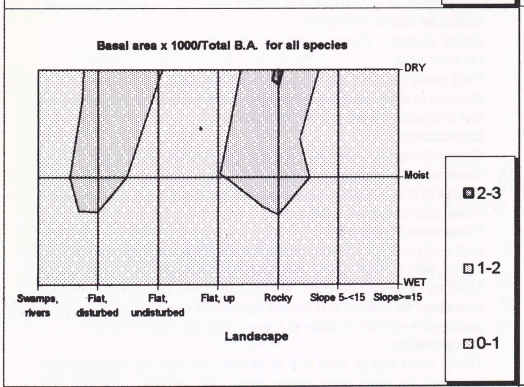


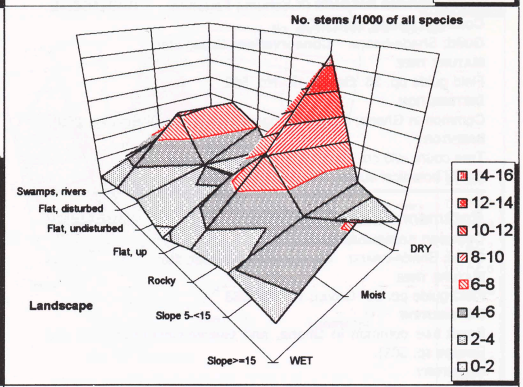


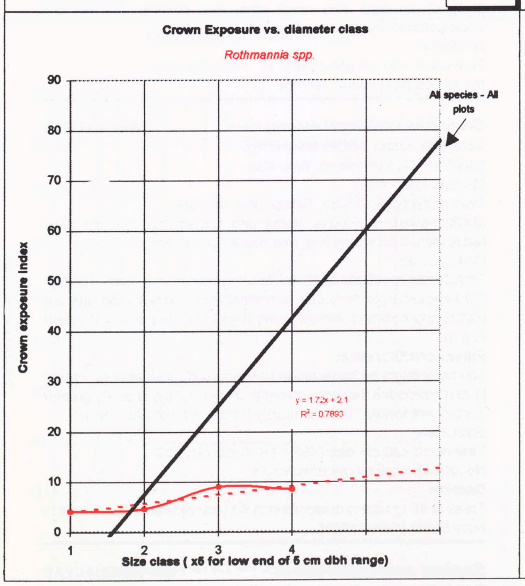
Rothmannia spp.

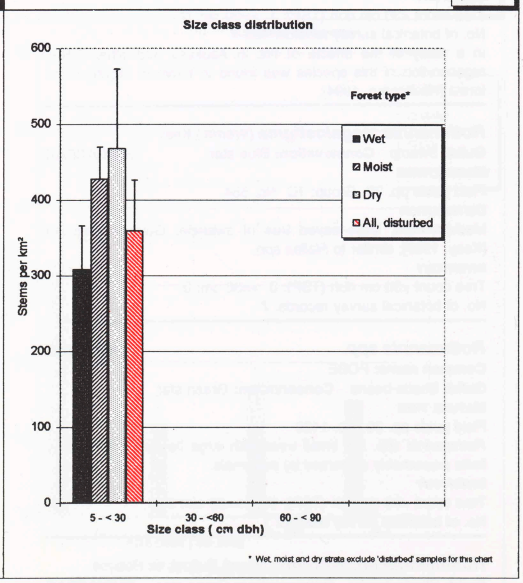












DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 506); Guineo-Congolian. Mainly found in evergreen forest, but especially common in Atewa Range F.R.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 29

Ritchiea duschesnei see *Maerua duchesnei*

Robynsia glabrata Hutch. **RUBIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 36, 39 Group: 1F No. 551
DISTRIBUTION
Uncommon small tree of dry forests.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 4
No. of botanical survey records: 12

Rothmannia hispida (K.Schum.) Fagerlind **RUBIACEAE**
Common name: TUKOBO
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 36 Group: 1F No. 552
DISTRIBUTION
Common in Ghana; Guineo-Congolian (Hall and Swaine sp. 508).
INVENTORY
Tree count <30 cm dbh (TSP): 155 >=30 cm: 1
No. of botanical survey records: 95

Rothmannia longiflora Salisb. **RUBIACEAE**
Common name: SAMANKUBE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 36 Group: 1F No. 553
DISTRIBUTION
Small tree common in Ghana, and Guineo-Congolian (Hall and Swaine sp. 509).
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 182
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to thrive in slightly burnt forest [Hawthorne, 1994].

Rothmannia megalostigma (Wernh.) Keay
Guild: Swamp **Conservation:** Blue star **RUBIACEAE**
MATURE TREE
Field guide pp. 30 Group: 1C No. 554
DISTRIBUTION
Medium-sized, large-leaved tree of swamps; Guineo-Congolian [Keay, 1989]; similar to *Hallea spp.*
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 7

Rothmannia spp. **RUBIACEAE**
Common name: POBE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 30 No. 1420
Rothmannia spp. are small trees with large flowers and leathery fruits presumably dispersed by mammals.
INVENTORY
Tree count <30 cm dbh (TSP): 689 >=30 cm: 5
No. of botanical survey records: 1

Rothmannia urcelliformis (Hiern) Bullock ex Robyns
Guild: Shade-bearer **Conservation:** Green star **RUBIACEAE**
MATURE TREE
Field guide pp. 36 Group: 1F No. 555
DISTRIBUTION
Common in Ghana only in dry forest but widespread in tropical Africa (Hall and Swaine sp. 510).
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 21

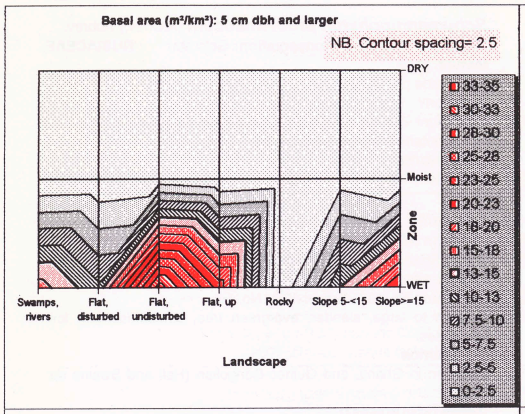
Rothmannia whitfieldii (Lindl.) Dandy **RUBIACEAE**
Common name: SABOBE
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 36 Group: 1F No. 556
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 511), and widespread in tropical Africa, e.g. one of the 10 most common trees in dry evergreen forest in Zaire [Dikumbwa, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 103

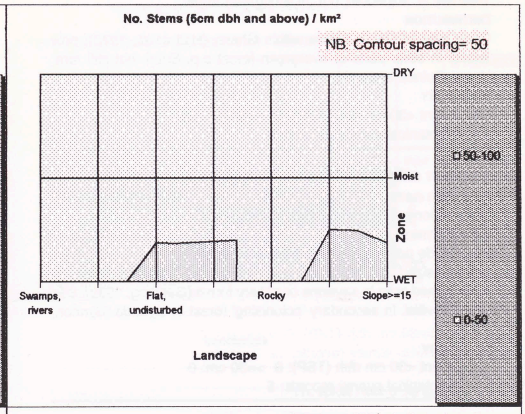
Sacoglottis gabonensis (Baill.) Urb. **HUMIRIACEAE**
Common name: FAWERE
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 105, 244 Group: 17C No. 557
Medium to large, evergreen tree with dense, dark crown and deeply and irregularly fluted and twisted bole.
DISTRIBUTION
Guineo-Congolian, usually riverine or swampside tree [Keay, 1989]. Confined to the evergreen forest. Bark (which hisses when slashed) is used to impart a bitter taste to palm-wine, and is an anticoagulant [Madusolumuo *et al.*, 1991].
PHENOLOGY/DISPERSAL
Fruits July to Sept. [Taylor], but in the drier season in Nigeria [Keay, 1989]) with a hard stone, presumably dispersed by mammals or hornbills. Elephants relish the seeds, and eat them in large quantities: although this does not improve germination, it makes the seedlings healthier at least in appearance [de Klerk, 1991].
REGENERATION
Young trees higher than 1.5 m of this species are less strongly favoured by gaps than many other tree species, but still are disproportionately common there [de Klerk, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 13 >=30 cm: 210
No. of botanical survey records: 11

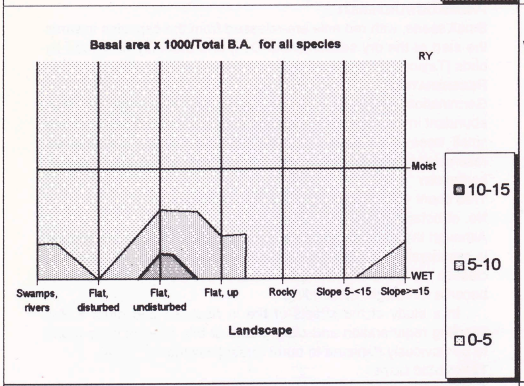
Samanea dinklagei (Harms) Keay **MIMOSACEAE**
Common name: ABOBoNKAHYIRE
Guild: 0 **Conservation:** Blue star
MATURE TREE
Field guide pp. 220, 239 Group: 38C No. 558
Medium-sized, deciduous, fluted and twisted tree, without clear buttresses. It branches low, and has a light crown.
DISTRIBUTION
Transferred to *Albizia dinklagei* (Harms) Harms (e.g. Lock, [1989]), but kept separate here due to distinctness; Guinea-wide and not particularly common, except along river banks in parts of Western region.
PHENOLOGY/DISPERSAL
The fruits might be expected to be dispersed by elephants. Parren [1991] concluded that the regeneration was not significantly greater in elephant forests than in nearby forests without elephants.
INVENTORY
Tree count <30 cm dbh (TSP): 26 >=30 cm: 103
No. of botanical survey records: 14
GROWTH
Trees of 45 cm dbh are recorded in 40 year old secondary forest in Ivory Coast [Kahn, 1982].

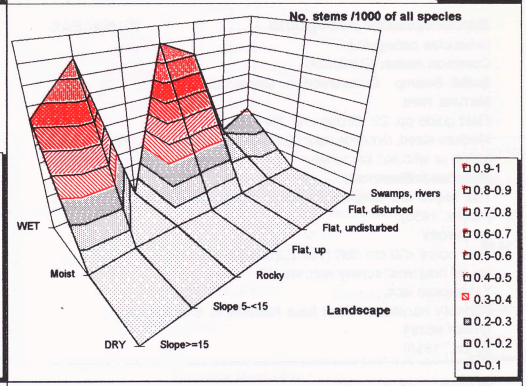
Sapium aubrevillei Leandri **EUPHORBIACEAE**
Guild: Pioneer? **Conservation:** Black star
MATURE TREE
Field guide pp. 117 Group: 19A No. 559

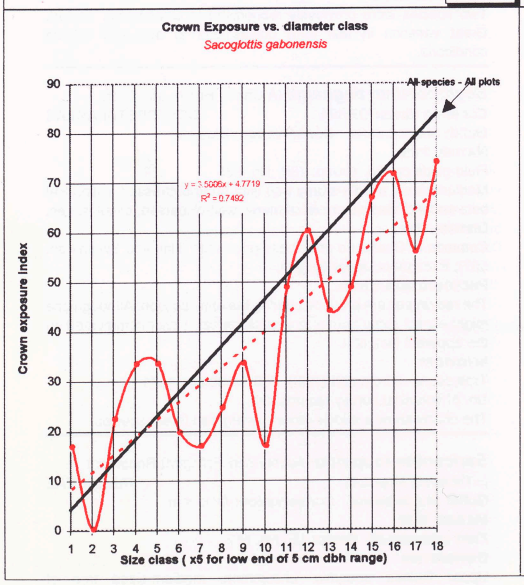
Sacoglottis gabonensis

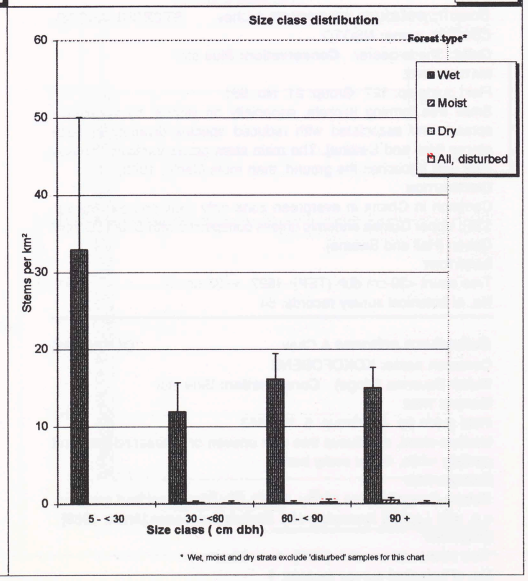












Tree like *S. ellipticum*, but in evergreen forest.

DISTRIBUTION

Once only known in Atewa within Ghana (Hall *et al.*, 1973); now known in other parts of evergreen forest e.g. Subri, but still rare. Upper Guinea endemic.

INVENTORY

Tree count <30 cm dbh (TSP): 6 >=30 cm: 42
No. of botanical survey records: 6

Sapium ellipticum (Hochst. *ex* Krauss) Pax
Common name: KETEBONTORE **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 117 Group: 19A No. 560
Medium-sized tree, fluted at base. Widespread in tropical Africa, on well-drained soils in savanna or gallery forest [Geerling, 1982]. See *S. aubrevillei*. In secondary 'colonising' forest in Uganda [Synnott, 1985].

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Sarcocephalus pobeguinii **RUBIACEAE**
(=*Nauclea pobeguinii*)
Common name: SUKUSIA
Guild: Swamp **Conservation:** Green star

MATURE TREE

Field guide pp. 29 Group: 1B No. 447
Medium-sized, riverside tree; Guineo-Congolian [Keay, 1989]. Small crown or whorled branches.

PHENOLOGY/DISPERSAL

The seeds are adapted to water dispersal, with small air sacs [Abbiw, 1985].

INVENTORY

Tree count <30 cm dbh (TSP): 25 >=30 cm: 71
No. of botanical survey records: 19

TAXONOMIC NOTE

Recently transferred back from *Nauclea* to *Sarcocephalus*.

OTHER NOTES

[Anon., 1950]

Scaphopetalum amoenum A.Chev. **STERCULIACEAE**
Common name: NSOTO
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 127 Group: 21 No. 561
Small tree forming thickets, especially on slopes, by vegetative spread, and associated with reduced species diversity in such places [Hall and Swaine]. The main stem grows vertically, arches over until it touches the ground, then roots [Jenìk, 1969].

DISTRIBUTION

Common in Ghana in evergreen zone only (Hall and Swaine sp. 535); Upper Guinea endemic unless conspecific with *S. blackii* from Gabon [Hall and Swaine].

INVENTORY

Tree count <30 cm dbh (TSP): 1527 >=30 cm: 8
No. of botanical survey records: 54

Schrebera arborea A.Chev. **OLEACEAE**
Common name: KOKOFOBENE
Guild: Savanna (fringe) **Conservation:** Blue star

MATURE TREE

Field guide pp. 45 Group: 5 No. 563
Medium-sized, deciduous tree with uneven or buttressed bole and partially white, rather corky bark.

DISTRIBUTION

Guineo-Congolian tree [Keay, 1989]; of v. dry forest and savanna, e.g. with *Lophira lanceolata* and *Dialium guineense* [Anon. 1959].

INVENTORY

Tree count <30 cm dbh (TSP): 1 >=30 cm: 4
No. of botanical survey records: 1

Schumanniophyton problematicum (A.Chev.) Aubrev.
Guild: Shade-bearer **Conservation:** Gold star **RUBIACEAE**

MATURE TREE

Field guide pp. 30 Group: 1C No. 564

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 14

OTHER NOTES

[Houghton, 1988]

Scottellia klaineana Pierre **FLACOURTIACEAE**
Common name: TIABUTUO, Korokon
Guild: Shade-bearer **Conservation:** Pink star

MATURE TREE

Field guide pp. 107 Group: 17D No. 50
Medium to large, slender, evergreen tree, sometimes with low buttresses.

DISTRIBUTION

Common in Ghana, and Guineo-Congolian (Hall and Swaine sp. 536).

PHENOLOGY/DISPERSAL

Small seeds, with red arils are released from the capsules towards the start of the dry season (Aug.-Oct.) and probably dispersed by birds [Taylor].

REGENERATION

Germination, as far as is known, is normal. Seedlings are often abundant in the understorey around the parent trees. Saplings and small trees of all sizes seem fairly shade tolerant and, indeed, resemble some of the permanently understorey species of *Drypetes*.

INVENTORY

Tree count <30 cm dbh (TSP): 2348 >=30 cm: 1970
No. of botanical survey records: 141
Although the tree is rarer in the driest forests sampled, the species is regenerating abundantly in most areas. The 5-10 cm dbh size classes are generally relatively shaded, but older trees appear to become more light demanding.

In a study of the effects of fire in Asukese and other F.R.s, seedling regeneration and older plants of this species were found to be obviously depleted in burnt forest [Hawthorne, 1994].

TAXONOMIC NOTE

Two species were previously recognised in Ghana [e.g. Taylor]. Great variation in leaf form occurs due to age and lighting conditions.

Scytopetalum tieghemii (A.Chev.) Hutch. and Dalz.
Common name: OPRIM **SCYTOPETALACEAE**
Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 85 Group: 13B No. 565
Medium-sized, middle-storey tree with an unbuttressed, cylindrical bole and a distinctive crown of many, well-dispersed, small leaves.

DISTRIBUTION

Common in Ghana on acid, base-poor soils (Hall and Swaine sp. 537); throughout Upper Guinea.

PHENOLOGY/DISPERSAL

The red drupes are produced during the rainy season. Although one might expect some form of animal dispersal, Taylor commented on the apparent lack of it.

INVENTORY

Tree count <30 cm dbh (TSP): 656 >=30 cm: 1671
No. of botanical survey records: 80
The charts show a middle-storey, evergreen forest species.

Sericanthe toupetou (Aubrev.and Pellegrin) Robbrecht
(=*Tricalysia toupetou*) **RUBIACEAE**
Guild: Shade-bearer **Conservation:** Gold star

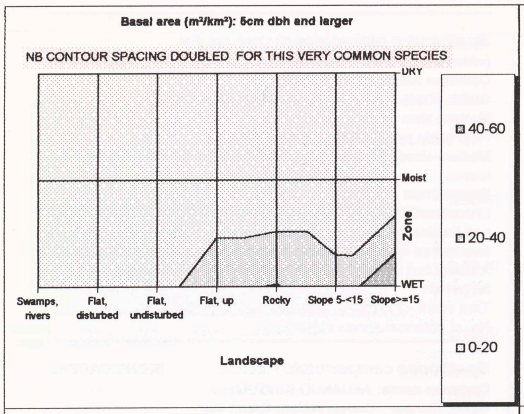
MATURE TREE

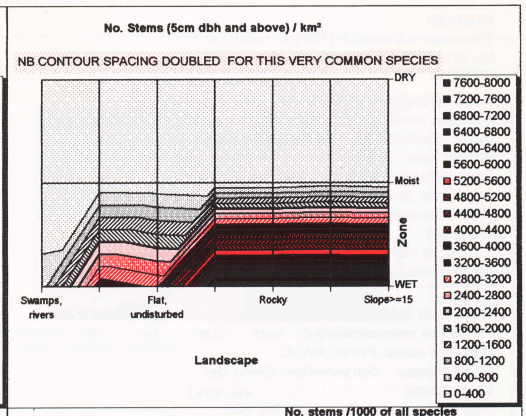
Field guide pp. 35 Group: 1E No. 567

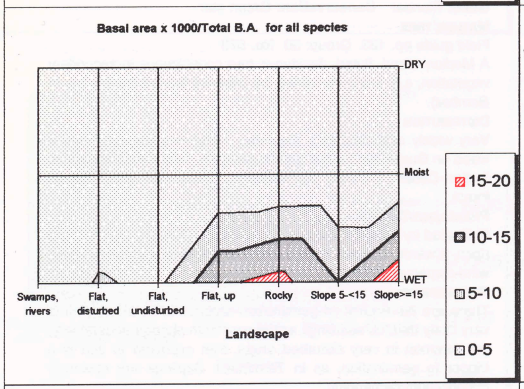
DISTRIBUTION

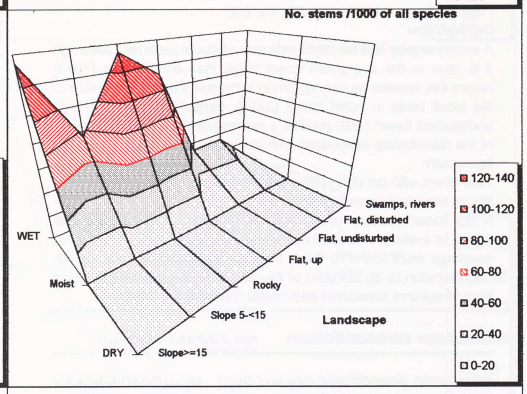
Upper Guinea endemic; uncommon, medium-sized tree of evergreen forests.

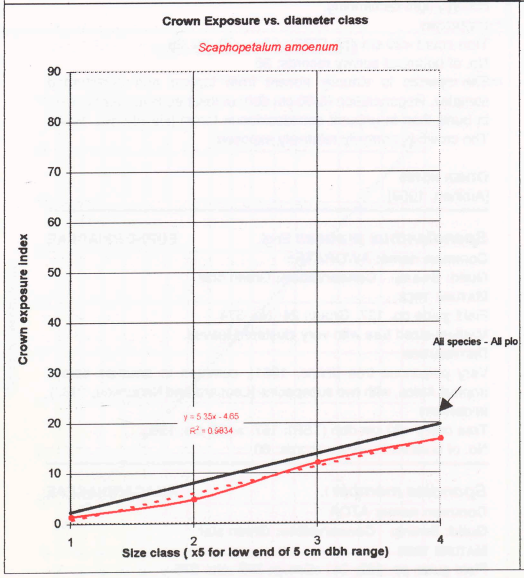
Scaphopetalum amoenum

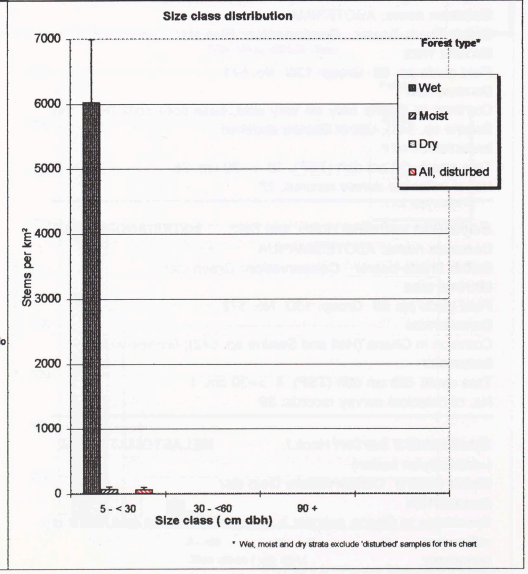












INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 1
No. of botanical survey records: 15

Smeathmannia pubescens Soland. *ex* R.Br.
Common name: TURUNNUA **PASSIFLORACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 105 Group: 17C No. 569
Small tree found throughout the forest zone, but particularly common in disturbed, dry forest. Guinea-Wide [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 40 >=30 cm: 2
No. of botanical survey records: 59

Solanum erianthum **SOLANACEAE**
(=*Solanum verbascifolium*)
Common name: PePeDIAWUO
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 141 Group: 26 No. 803
DISTRIBUTION
A small pioneer, and sensitive indicator of disturbed forest, although it is rarer in the evergreen forest zone. Hall and Swaine [1980] record this species as very common in the seed bank. The levels of the small trees in burnt forest (3257), logged forest (1282) and undisturbed forest (160) provide a reasonable index of the severity of the disturbance associated with these plots.
INVENTORY
Tree count <30 cm dbh (TSP): 785 >=30 cm: 10
No. of botanical survey records: 58
A dry forest species which invades moister zones in disturbed areas. In a study of the effects of fire in Asukese and other F.R.s, seedlings were found to thrive in burnt forest [Hawthorne, 1994]. Regeneration (5-30 cm dbh) of this tree is more abundant in burnt than in unburnt semideciduous forest [Hawthorne, 1994].

Solanum verbascifolium see *Solanum erianthum*

Soyauxia grandifolia Gilg and Stapf **MEDUSANDRACEAE**
Common name: ABOTESIMA
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 86 Group: 13C No. 571
DISTRIBUTION
Common in Ghana only on very acid, base-poor soils (Hall and Swaine sp. 541); Upper Guinea endemic.
INVENTORY
Tree count <30 cm dbh (TSP): 18 >=30 cm: 25
No. of botanical survey records: 32

Soyauxia velutina Hutch. and Dalz. **MEDUSANDRACEAE**
Common name: ABOTESIMANUA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 89 Group: 13D No. 572
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 542); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 1
No. of botanical survey records: 39

Spathandra barteri Hook.f. **MELASTOMATACEAE**
(=*Memecylon barteri*)
Guild: Swamp **Conservation:** Gold star
DISTRIBUTION
Specimens in Ghana suggest a riverside or swamp tree, but it is rather rare.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Spathandra blakeoides (G.Don) Jac.-Fel.
(=*Memecylon blakeoides* G.Don.) **MELASTOMATACEAE**
Common name: oTWESENINI
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 47 Group: 6 No. 424
Medium-sized, evergreen tree with very hard wood and leathery leaves.
DISTRIBUTION
Uncommon in Ghana, and confined to Wet Evergreen forest (Hall and Swaine sp. 376); Guinea-wide. Keay [1989] refers to this as a swamp tree in Nigeria. Probably very slow-growing with hard wood. A useful fruit tree in Cameroun [Vivien and Faure, 1988].
INVENTORY
Tree count <30 cm dbh (TSP): 5 >=30 cm: 0
No. of botanical survey records: 15

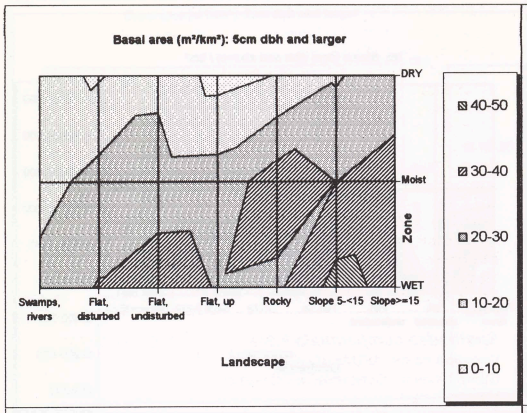
Spathodea campanulata P.Beauv. **BIGNONIACEAE**
Common name: AKUAKUO-NINSUO
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 163 Group: 30 No. 573
A Medium-sized, fluted, deciduous tree conspicuous in secondary vegetation, e.g. along roadsides, by virtue of the red flowers (as in *Bombax*).
DISTRIBUTION
Very widely cultivated [e.g. Neginhal, 1986]; e.g. escaped and a weed on Guam [McConnell and Muniappan, 1989]. Also known as 'Indian Cedar'. Probably commoner in abandoned farms than in forest.
PHENOLOGY/DISPERSAL
Pollinated by (non-hovering) birds in Mexico [Toledo, 1977]. Fruits ripen towards the end of the dry season, and release winged, wind-dispersed seeds.
REGENERATION
There are no records of germination requirements, although it is very likely that, as seedlings are absent from shaded understorey, yet common in very disturbed areas, that exposure to sun is a trigger to germination, as in *Terminalia*. Saplings are obviously strongly light-demanding.
INVENTORY
Tree count <30 cm dbh (TSP): 50 >=30 cm: 28
No. of botanical survey records: 36
The species is virtually absent from logged and undisturbed samples. Regeneration (5-30 cm dbh) of this tree is more abundant in burnt than in unburnt semideciduous forest [Hawthorne, 1994]. The crown is normally relatively exposed.

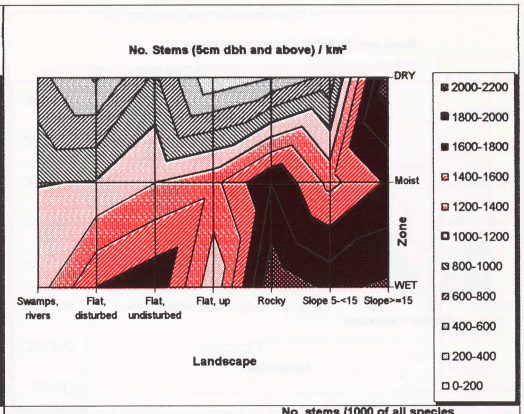
OTHER NOTES
[Amihan, 1959]

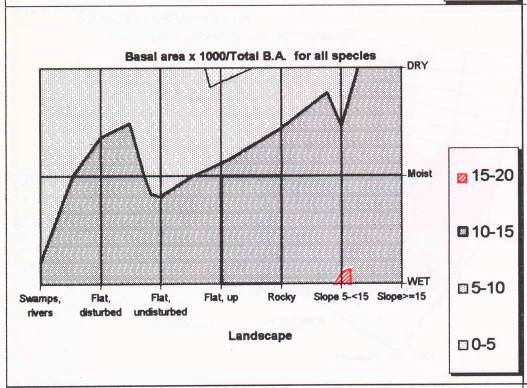
Spondianthus preussii Engl. **EUPHORBIACEAE**
Common name: AWORATEe
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 137 Group: 24 No. 574
Medium-sized tree with very clustered leaves.
DISTRIBUTION
Very poisonous tree [Irvine, 1961], common in swamps across tropical Africa, with two subspecies [Leonard and Nkounkou, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 157 >=30 cm: 199
No. of botanical survey records: 60

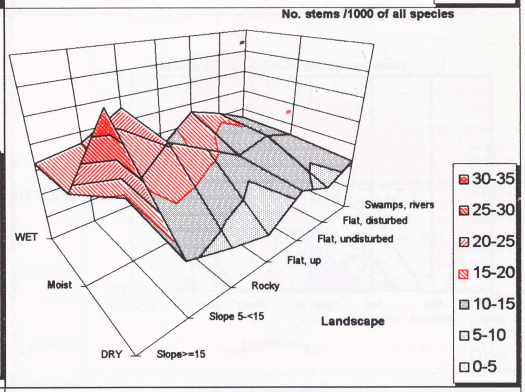
Spondias mombin L. **ANACARDIACEAE**
Common name: ATOA
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 182, 241 Group: 35B No. 575
Deciduous tree originating from Central America, but widespread in SE Asia and Africa; often cultivated for its plum-like fruits, and used in traditional medicine [Courthout *et al.*, 1991].

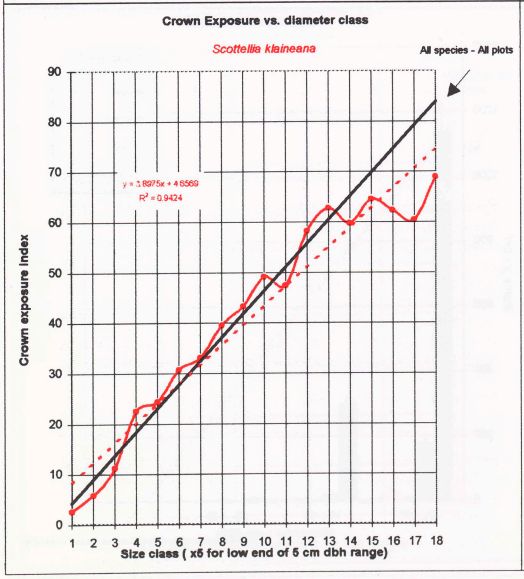
Scottellia klaineana

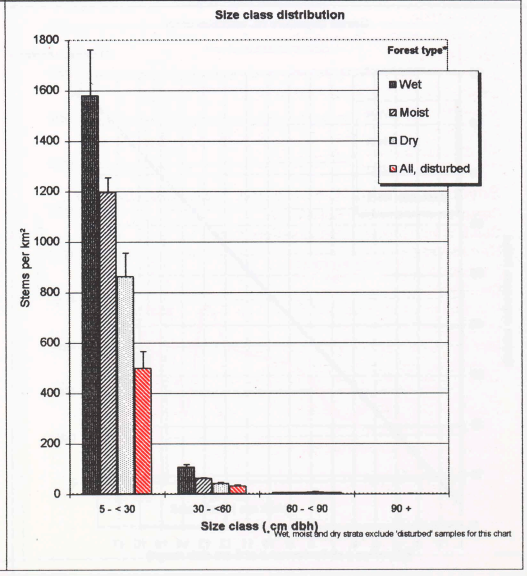




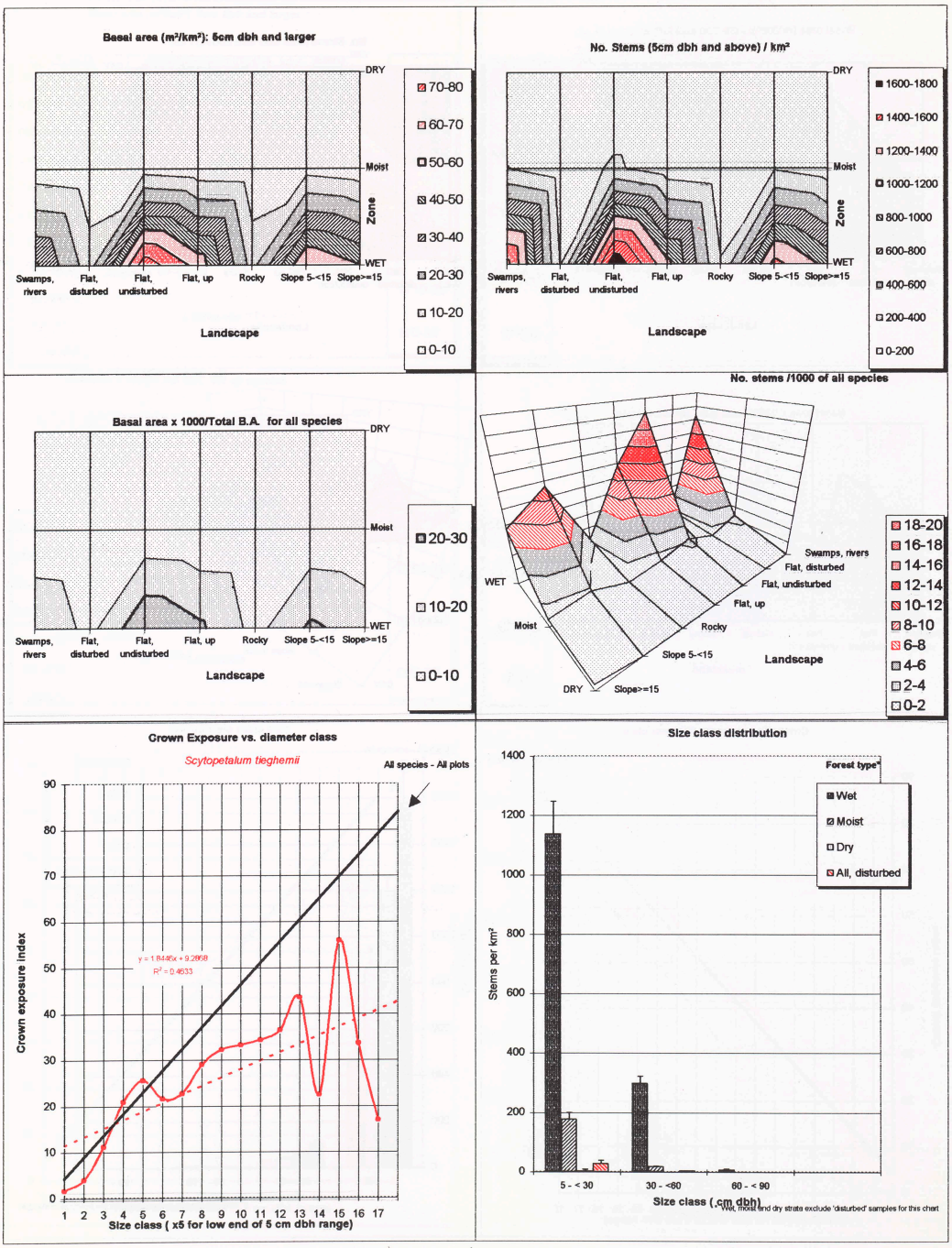




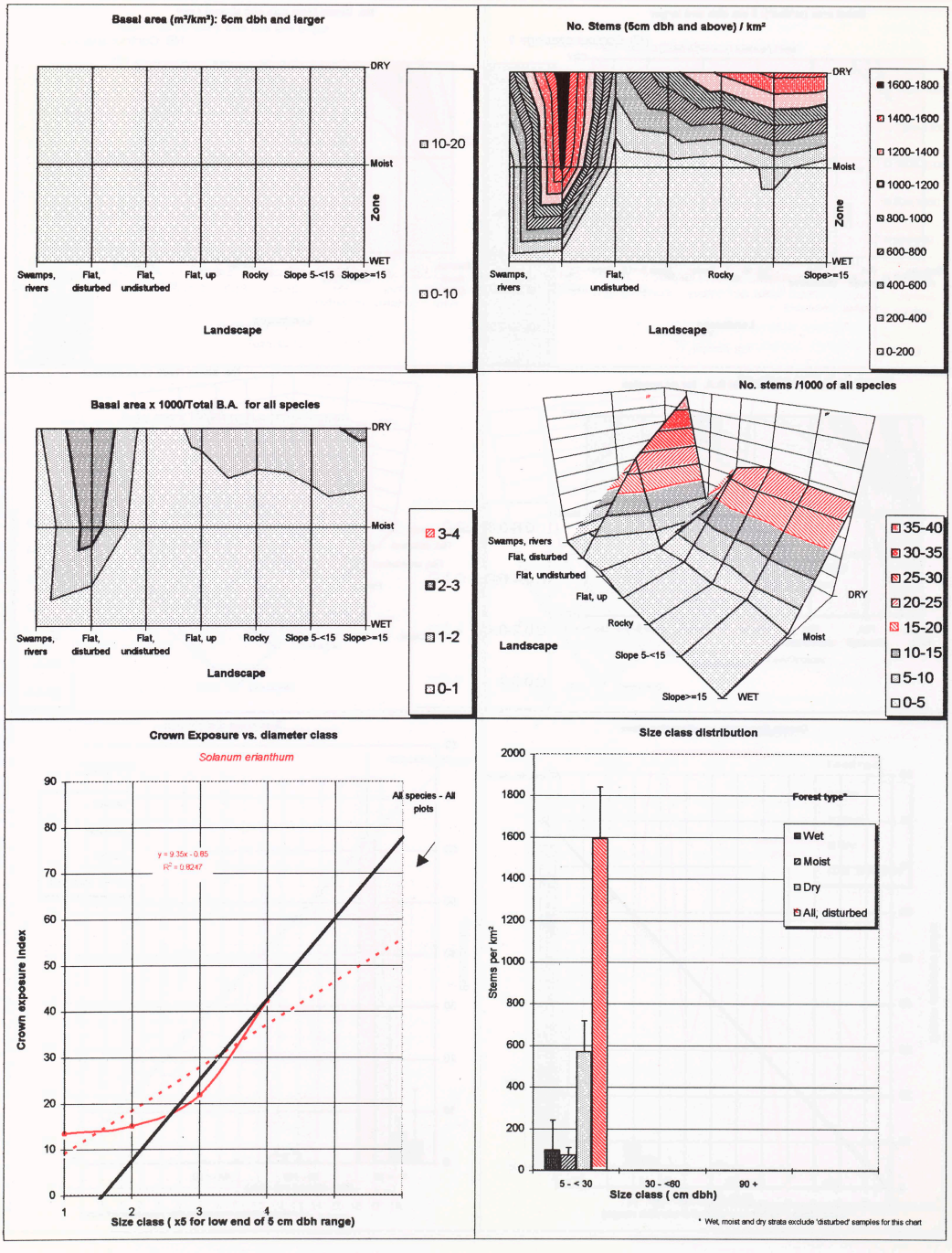




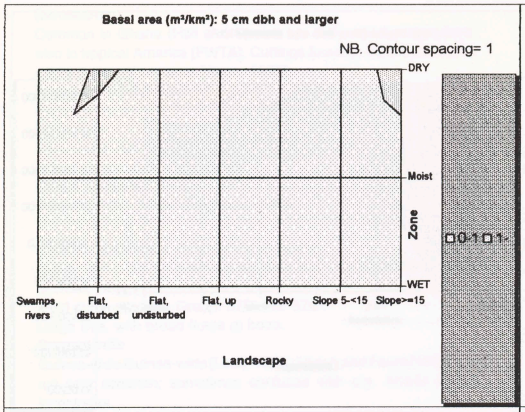
Scytopetalum tieghemii

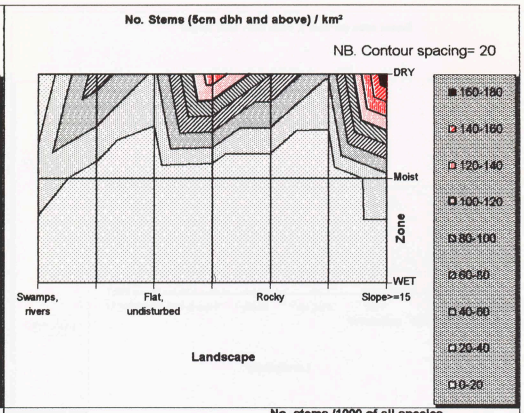


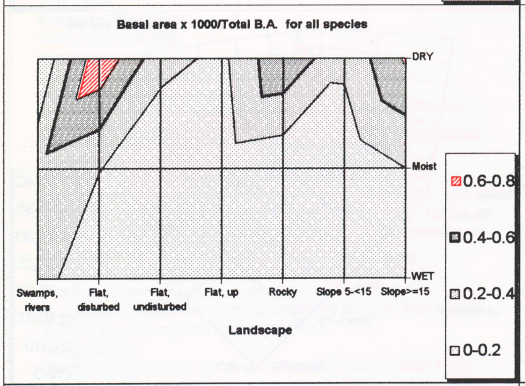
Solanum erianthum

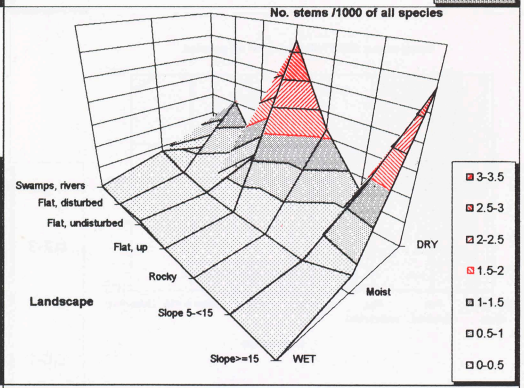


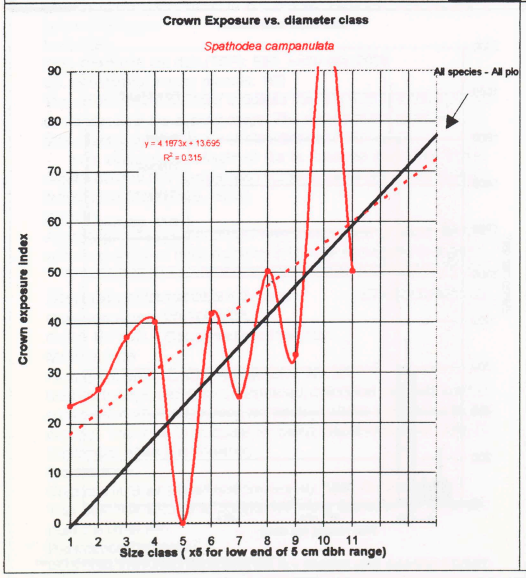
Spathodea campanulata

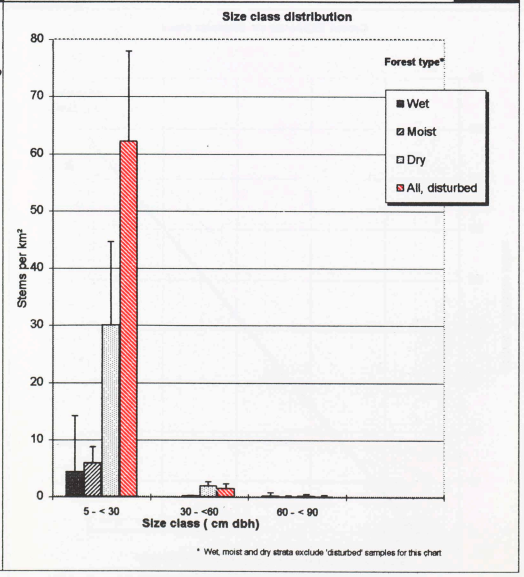




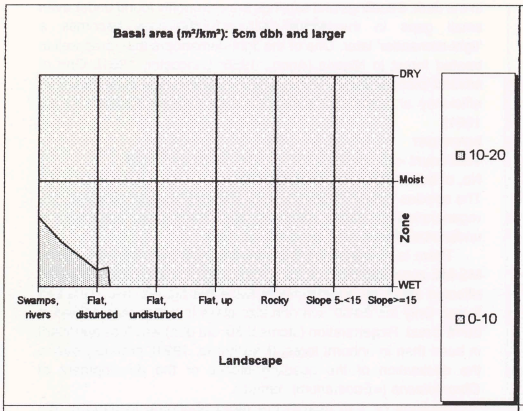


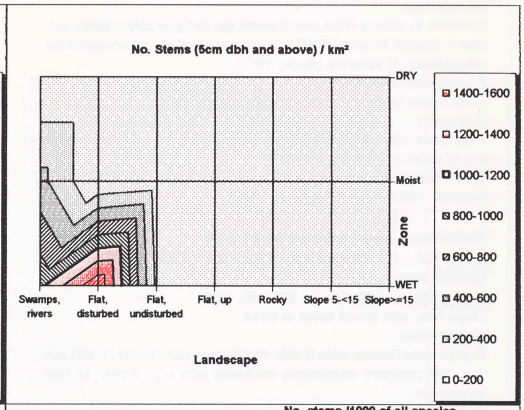


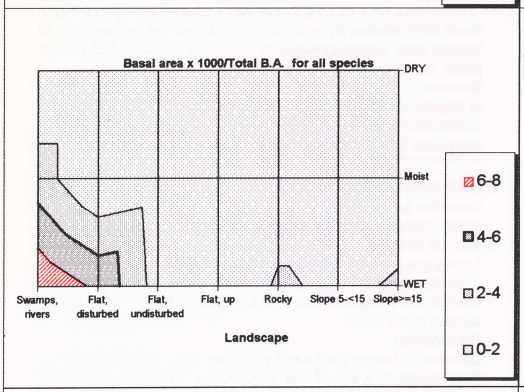


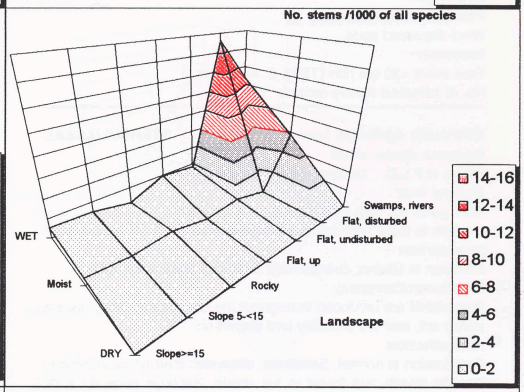


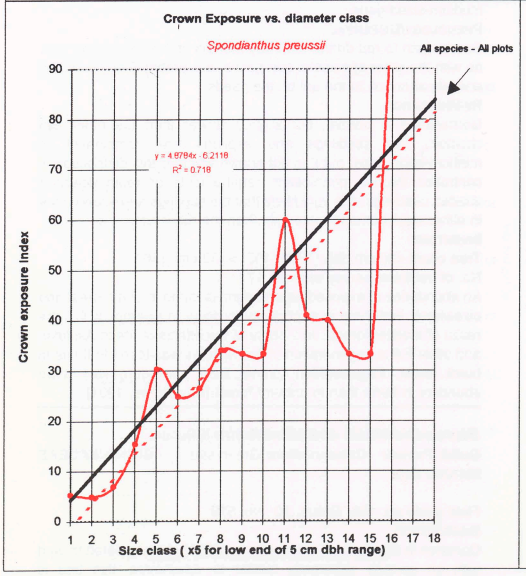
Spondianthus preussii

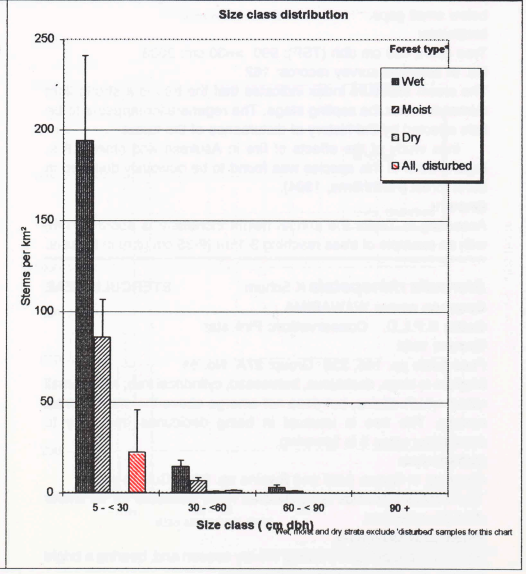












DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 546); widely naturalised, also in tropical America [FWTA]. Cuttings found to be successful for reforestation of savanna [Anon, 1953].
PHENOLOGY/DISPERSAL
Fruits eaten by bats [Orozco Segovia *et al.*, 1985].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 5
No. of botanical survey records: 7
OTHER NOTES
[Herwitz, 1981; Vega Esponoza, 1981]

Stemonocoleus micranthus Harms
Guild: N.P.L.D. **Conservation:** Blue star **CAESALPINIACEAE**
MATURE TREE
Field guide pp. 202 Group: 37D No. 576
Large tree, with broad flutes at base.
DISTRIBUTION
Guinea-wide Guinea-wide [Lock, 1989]; Vivien and Faure [1985], but not very common; sometimes confused with e.g. *Afzelia* in tree inventories.
PHENOLOGY/DISPERSAL
Wind-dispersed pods.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 3
No. of botanical survey records: 19

Sterculia oblonga Mast. **STERCULIACEAE**
Common name: oHAA
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 145, 243 Group: 27A No. 577
Medium to large, deciduous, buttressed tree.
DISTRIBUTION
Common in Ghana; Guinea-wide (Hall and Swaine sp. 548).
PHENOLOGY/DISPERSAL
Ripe seeds are produced throughout the dry season. They have a yellow aril, and are probably bird dispersed.
REGENERATION
Germination is normal. Seedlings, often with their unusual 3-lobed juvenile leaves, are found in full shade. Saplings grow up even below small gaps.
INVENTORY
Tree count <30 cm dbh (TSP): 990 >=30 cm: 2033
No. of botanical survey records: 162
The crown exposure index indicates that the tree is a strong light demander after the sapling stage. The regeneration appears to be little affected by the history of disturbance of the forest.

In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].
GROWTH
According to Taylor the annual height increment is about 30 cm, with an example of trees reaching 3-15m (9-35 cm gbh) in 9 years.

Sterculia rhinopetala K.Schum. **STERCULIACEAE**
Common name: WAWABIMA
Guild: N.P.L.D. **Conservation:** Pink star
MATURE TREE
Field guide pp. 145, 238 Group: 27A No. 51
Medium to large, deciduous, buttressed, cylindrical tree, with a small crown which attains, but does not emerge above the mature forest canopy. The tree is unusual in being deciduous from July to September when it is flowering.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 549); Guinea-wide.
This *Sterculia* species is considered more desirable for its timber than the other two.
PHENOLOGY/DISPERSAL
Ripe fruits are produced during the dry season and, bearing a bright red aril, are probably dispersed by birds.
REGENERATION
Germination is normal, albeit rather rapid (8 days). Kyereh *et al.* [1993] reported no difference between germination in the light and in the dark. Seedlings and saplings are commonly found under even small gaps in the forest, although the tree becomes a 'light-demander' later. One of the light-demanders that fares well in treated forest in Nigeria [Anon., 1956; Lancaster, 1961]. One of several 'pioneer' trees with high light compensation point, quantum efficiency and stomatal conductance in Nigeria [Riddoch *et al.*, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 1514 >=30 cm: 3828
No. of botanical survey records: 185
The species thrives in drier forests. Beyond the sapling stage, the regeneration is clearly relatively light demanding, especially in undisturbed forest, and up to 60 cm dbh.

There is a suggestion that the effects of the 1983 fires in the MS-ME zone has been to swell the 30-60 cm size classes in the affected areas by approximately twice the figures in undisturbed forest. Only the 30-60 cm dbh size class is better represented in burnt forest. Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest [Hawthorne, 1994], probably due to the decimation of the seedling stocks or the development of *Chromolaena* (=*Eupatorium*) tangles.

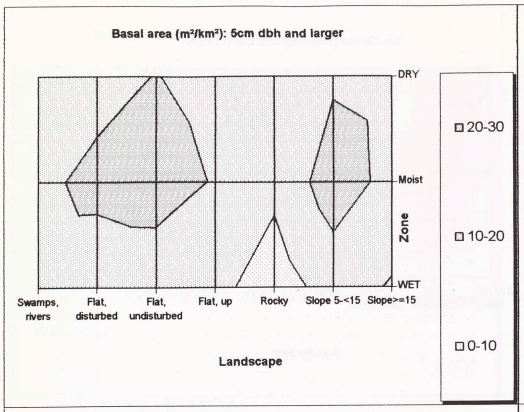
Saplings (> 1 m height) are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples, but the converse is true of smaller plants [Hawthorne, 1993].
GROWTH
In Nigeria, mean annual girth increments over the first 21 years in undisturbed forest have been recorded as 0.4 inches (3-6ft girth class) and 0.31 inches (6-9 ft girth class) [Dommen, 1956].

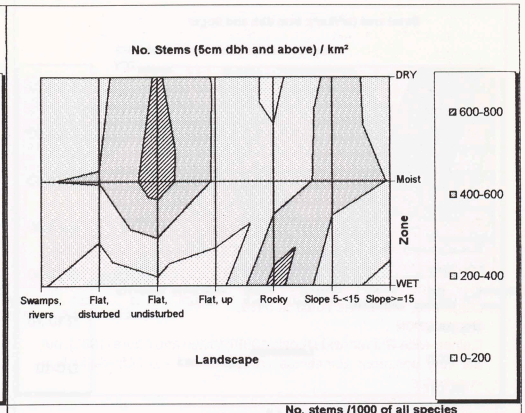
Sterculia tragacantha Lindl. **STERCULIACEAE**
Common name: SOFO
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 149, 238 Group: 27C No. 578
A medium-sized, deciduous tree with more obviously whorled boughs and clustered leaves (*Terminalia* fashion) than the other species of *Sterculia*.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 550); Guineo-Congolian. Often found in areas of low canopy, e.g. slight swamps or old medium-sized gaps.
PHENOLOGY/DISPERSAL
Seeds ripen to red during the early months of the dry season and, as with the other species of this genus, are probably dispersed by animals attracted to the aril on the seeds.
REGENERATION
Germination is normal, but slightly slower than the other two species. The seedlings and saplings are commonest in medium-large gaps, but it is not known whether this distribution is controlled through germination requirements or rapid death in shaded seedlings. It is very likely that the saplings and young trees in either case demand more light than the other *Sterculia*.
INVENTORY
Tree count <30 cm dbh (TSP): 493 >=30 cm: 1267
No. of botanical survey records: 172
An abundance of exposed regeneration is found in burnt forest and elsewhere; and there is a tendency to occur in swamps within the realm of moister forests. In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to thrive in burnt forest. Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest [Hawthorne, 1994].

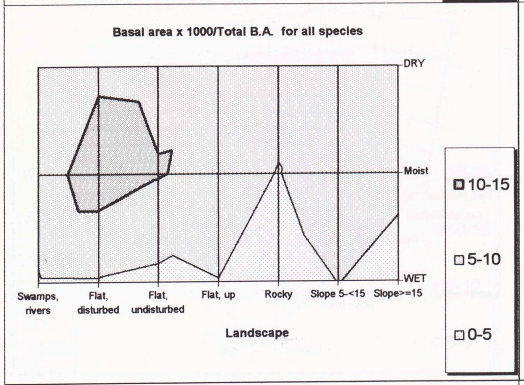
Stereospermum acuminatissim K.Schum.
Guild: Pioneer **Conservation:** Green star **BIGNONIACEAE**
MATURE TREE

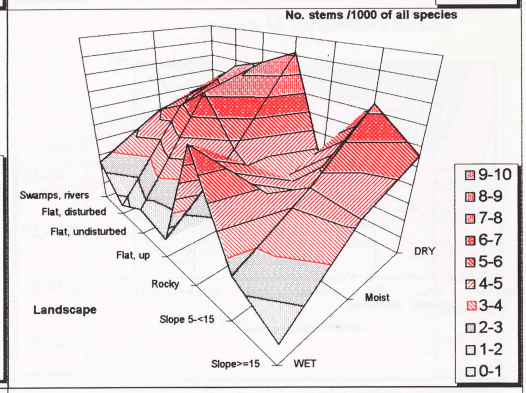
Field guide pp. 162 Group: 30 No. 579
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 551). A tree related to, and with an ecology apparently similar to *Spathodea*, this tree is particularly abundant in some of the fire damaged forests.
INVENTORY
Tree count <30 cm dbh (TSP): 110 >=30 cm: 229

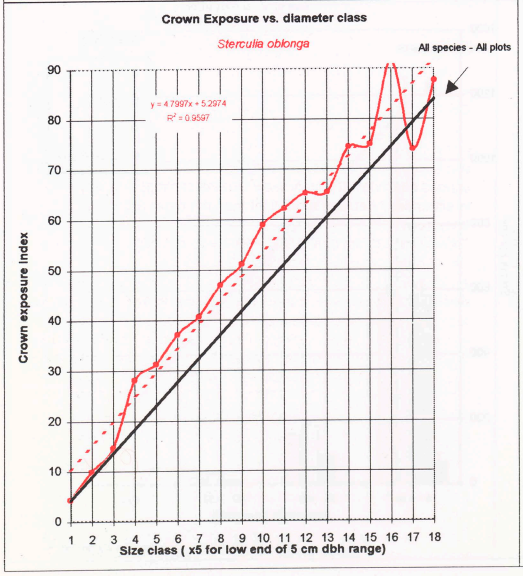
Sterculia oblonga

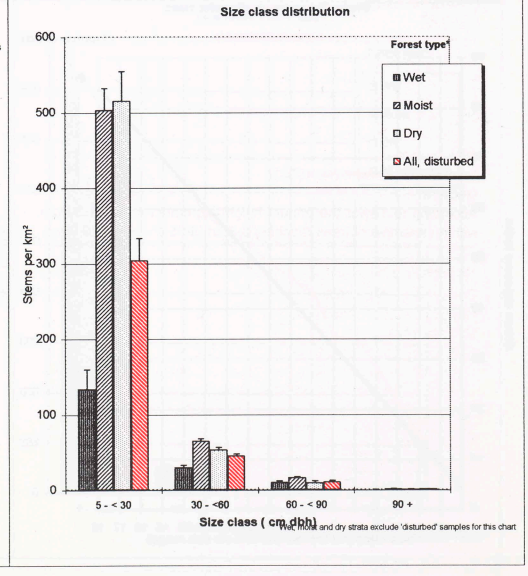




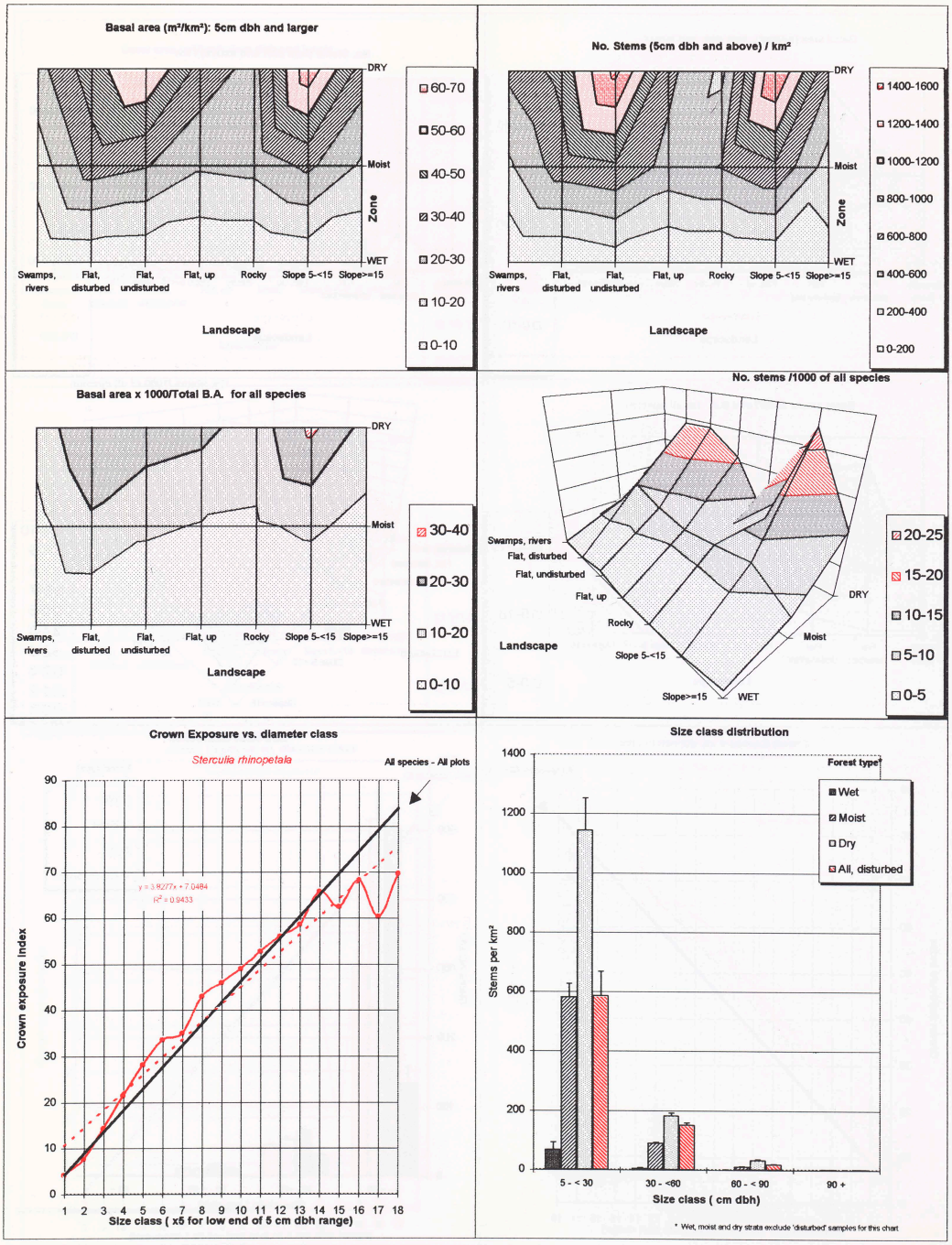




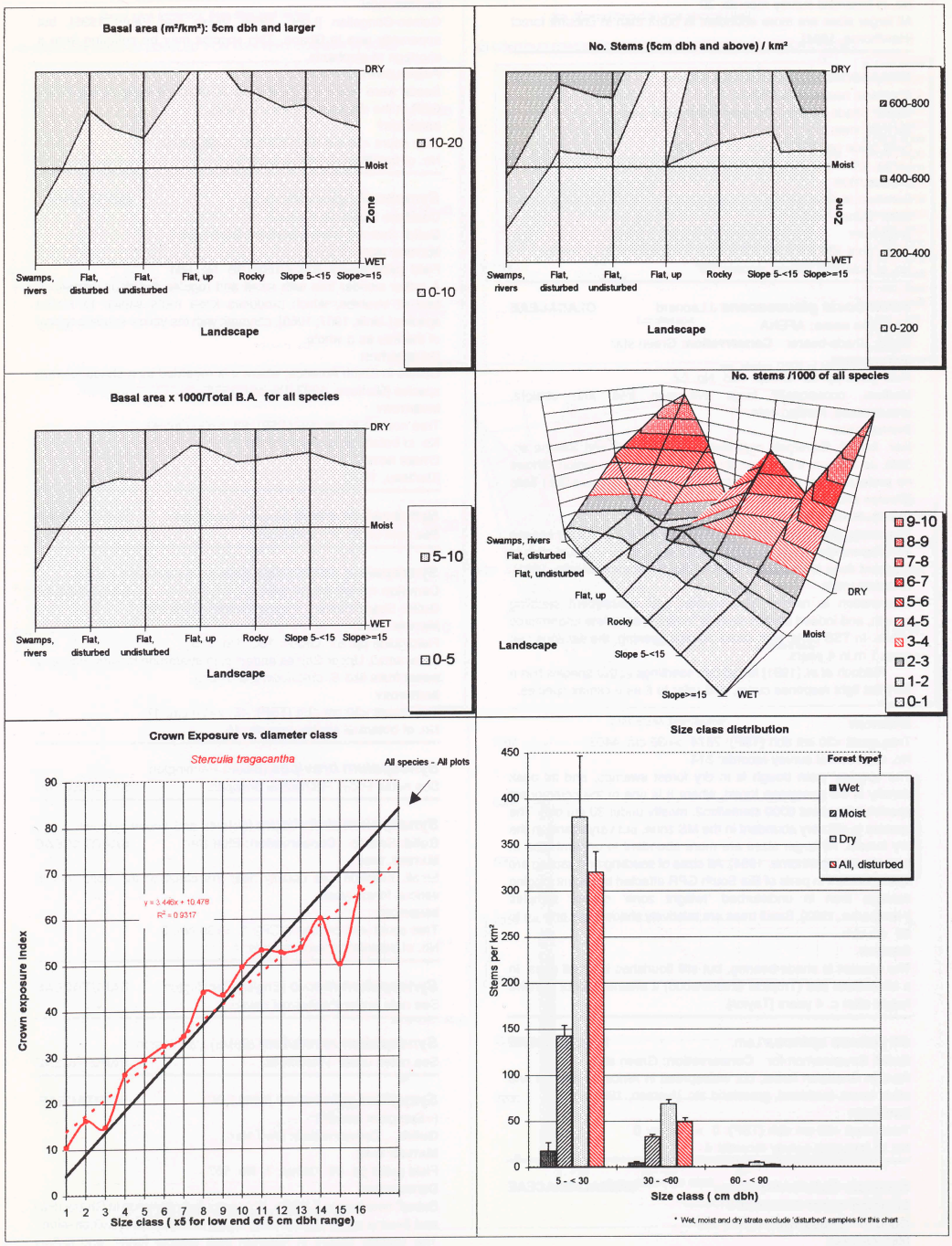




Sterculia rhinopetala



Sterculia tragacantha



No. of botanical survey records: 20
All larger sizes are more abundant in burnt than in unburnt forest [Hawthorne, 1994].

Strephonema pseudocola A.Chev. **COMBRETACEAE**
Common name: AWURUKU
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 127 Group: 21 No. 580
Large, cylindrical tree with narrow, dense, evergreen crown.
DISTRIBUTION
Common in Ghana only in evergreen forest (Hall and Swaine sp. 552). Guinea-Wide.
INVENTORY
Tree count <30 cm dbh (TSP): 202 >=30 cm: 160
No. of botanical survey records: 49

Strombosia glaucescens J.Leonard **OLACACEAE**
Common name: AFENA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 85 Group: 13B No. 52
Medium, occasionally large evergreen tree with straight, unbuttressed, mottled bole.
DISTRIBUTION
(var. *lucida*). Extremely common in Ghana (Hall and Swaine sp. 554), and occurs throughout the Guineo-Congolian region. Shows no preference for wet or dry forest (base-poor or base-rich) soils [Swaine and Veenendaal, 1994].
PHENOLOGY/DISPERSAL
The purple, fleshy fruits (drupe) are produced during the dry season and dispersed by birds [Taylor]. Seeds were found in 4% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991].
REGENERATION
Germination is normal. Germination and subsequent seedling growth, and indeed all size classes, occur in complete understorey shade. In TSS plots, with some canopy opening, the saplings can grow 1 m in 4 years.

Riddoch *et al.* [1991] found that seedlings of this species has a very flat light response curve, and refer to it as a climax species.

INVENTORY
Tree count <30 cm dbh (TSP): 7874 >=30 cm: 4403
No. of botanical survey records: 314
The species' main trough is in dry forest swamps, and its peak density in the evergreen forest, where it is one of the commonest species with about 6000 stems/km2, mostly under 30 cm dbh. The species is still very abundant in the MS zone, but very scanty in the dry forests. All larger sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. All sizes of seedling and sapling are less abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993]. Small trees are relatively shaded, but only up to 20 cm dbh.
GROWTH
The species is shade-bearing, but still flourishes in small gaps. In a silvicultural trial (Tropical Shelterwood) it attained about 1 metre height after c. 4 years [Taylor].

Strychnos spinosa Lam. **LOGANIACEAE**
Guild: Savanna/non-for **Conservation:** Green star
Rare in Ghanaian forest, but widespread in Africa, in riverine and other forest, bushland, grassland etc. [Iversen, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

Swartzia fistuloides Harms **CAESALPINIACEAE**
Common name: ASOMANINI
Guild: 0 **Conservation:** Blue star
MATURE TREE
Field guide pp. 209 Group: 37G No. 583
Medium-sized tree with rough bark.
DISTRIBUTION
Guineo-Congolian [Lock, 1989; Vivien and Faure 1985], but apparently rare in Ghana. This species may be suffering from a shortage of elephants.
PHENOLOGY/DISPERSAL
Seeds were found in 1% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Symphonia globulifera L.f. **GUTTIFERAE**
Common name: EHUREKE
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 50, 235 Group: 8B No. 584
A rather slender tree with small and regular, but dense crown. A tree of swamps, which produces knee roots similar to *Hallea* species [Jénik, 1967; 1969], although with the yellow exudate typical of the tree as a whole.
DISTRIBUTION
Occurs in South America, where it is regarded as a shade-tolerant species [Bariteau, 1992; Ducrey, 1992].
INVENTORY
Tree count <30 cm dbh (TSP): 63 >=30 cm: 90
No. of botanical survey records: 35
OTHER NOTES
[Bariteau, 1992]

Synsepalum afzelii (Engler) Pennington **SAPOTACEAE**
See note under *Afrosersalisia*.

Synsepalum aubrevillei (Pellegr.) Aubrev. and Pellegr.
Common name: ASAA-NINI **SAPOTACEAE**
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 62 Group: 10C No. 585
Rare, small, Upper Guinea endemic, in evergreen forests. Has very sweet fruits like *S. dulcificum* [pers.obs.].
INVENTORY
Tree count <30 cm dbh (TSP): 42 >=30 cm: 47
No. of botanical survey records: 15

Synsepalum brevipes (Baker) Pennington
See notes under *Pachystela brevipes*. **SAPOTACEAE**

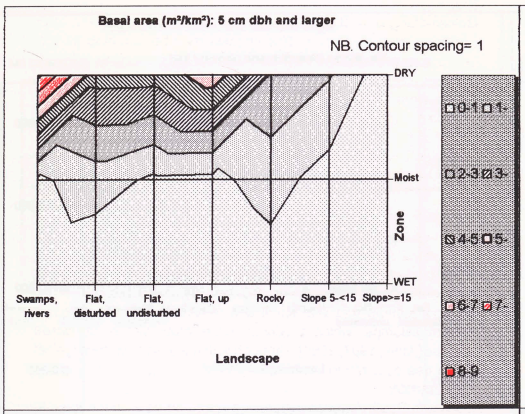
Synsepalum dulcificum (Schum. and Thonn.) Danieli
Guild: Swamp **Conservation:** Blue star **SAPOTACEAE**
MATURE TREE
Small, riverside tree usually near the coast or the Volta, but in various forest types.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

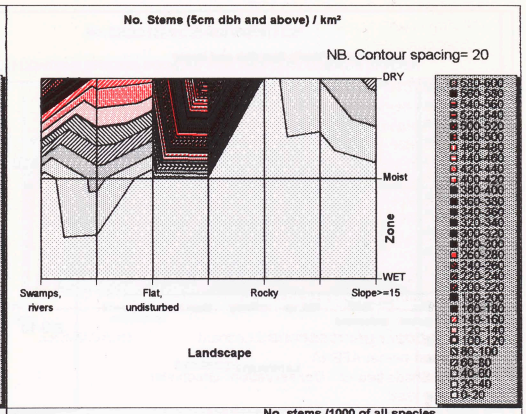
Synsepalum msolo (Engler) Pennington **SAPOTACEAE**
See note under *Pachystela msolo*.

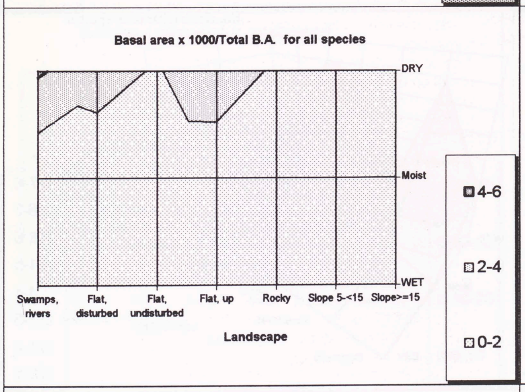
Synsepalum revolutum (Baker) Pennington
See notes under *Vincentella*. **SAPOTACEAE**

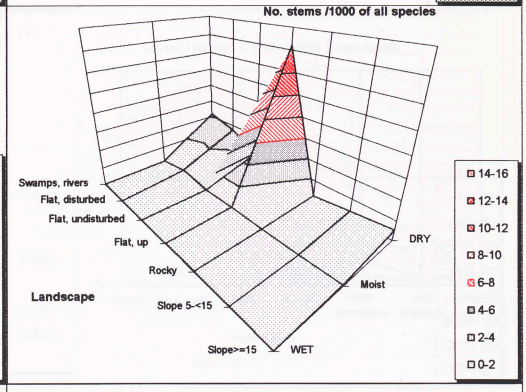
Syzygium guineense (Willd.) DC. **MYRTACEAE**
(=*Syzygium staudtii*)
Guild: **Conservation:** Blue star
MATURE TREE
Field guide pp. 49 Group: 7 No. 587
DISTRIBUTION
Subsp. occidentale F.White. Not particularly common in Ghana (Hall and Swaine sp. 571); from Ivory Coast to Cameroun (Guinea-wide). The species occurs in Nigerian peat swamp forest, and gallery forest in Sudan [Clayton, 1958; Anon., 1953]; and common in Afromontane forest [White, 1983b].

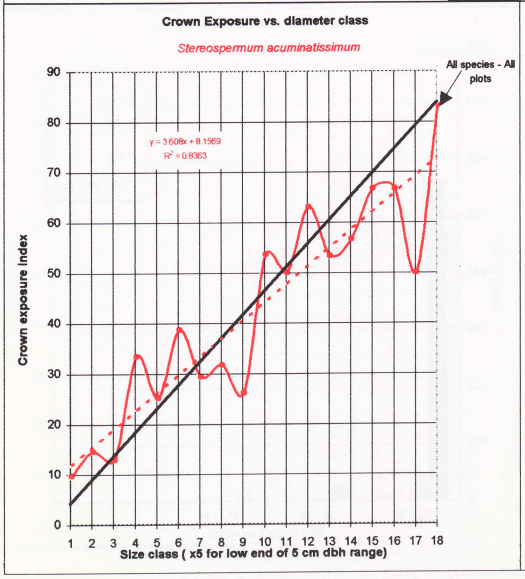
Stereospermum acuminatissimum

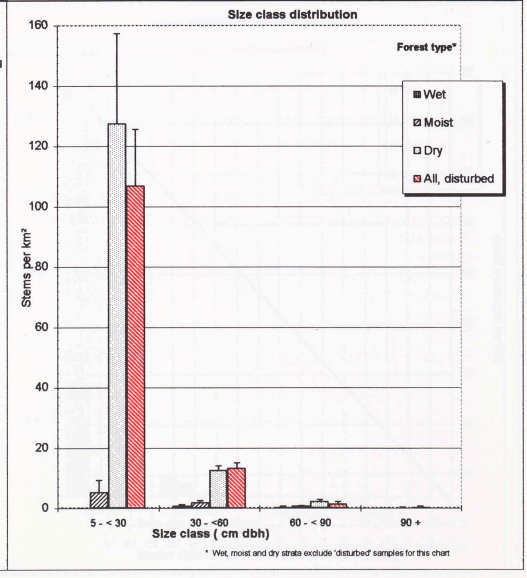




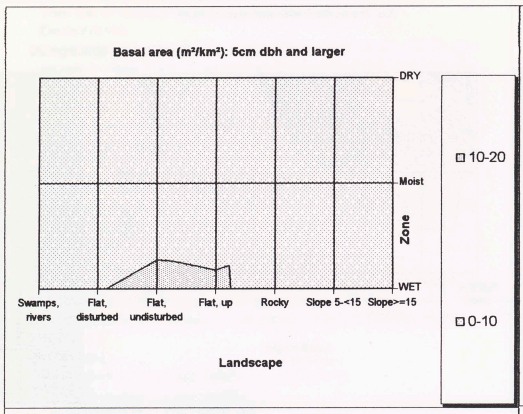


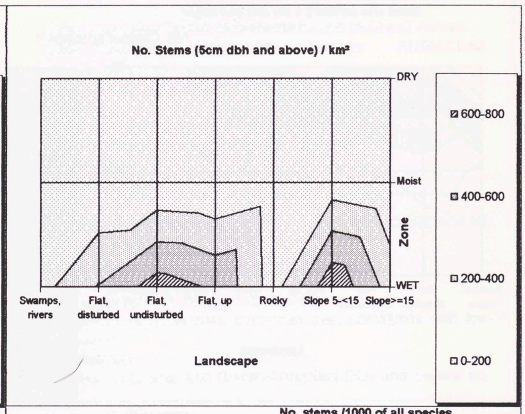


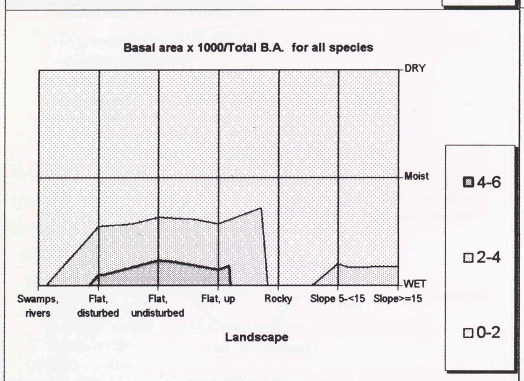


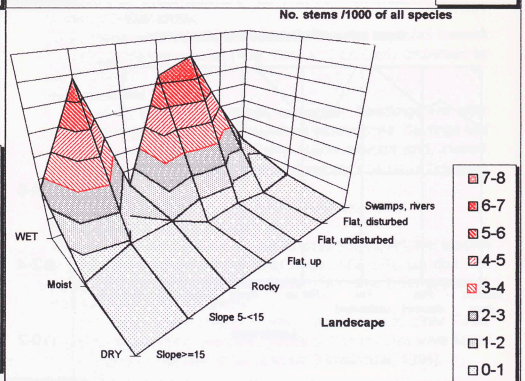


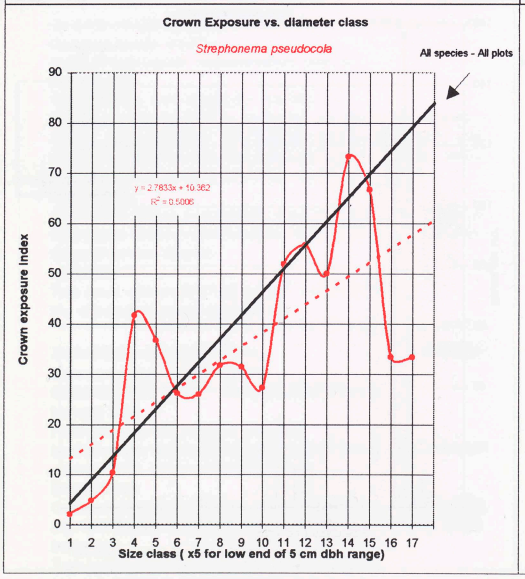
Strephonema pseudocola

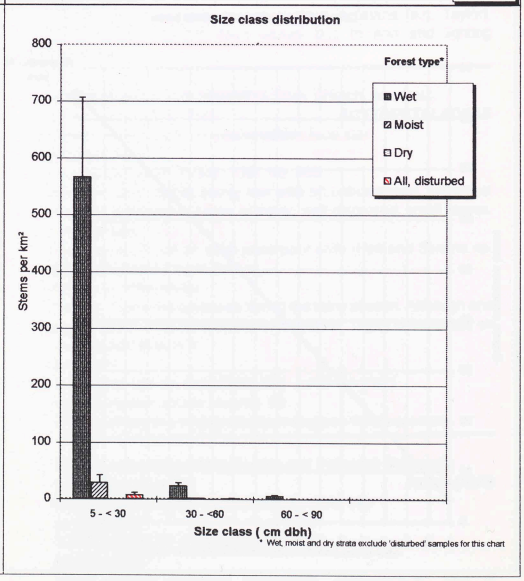




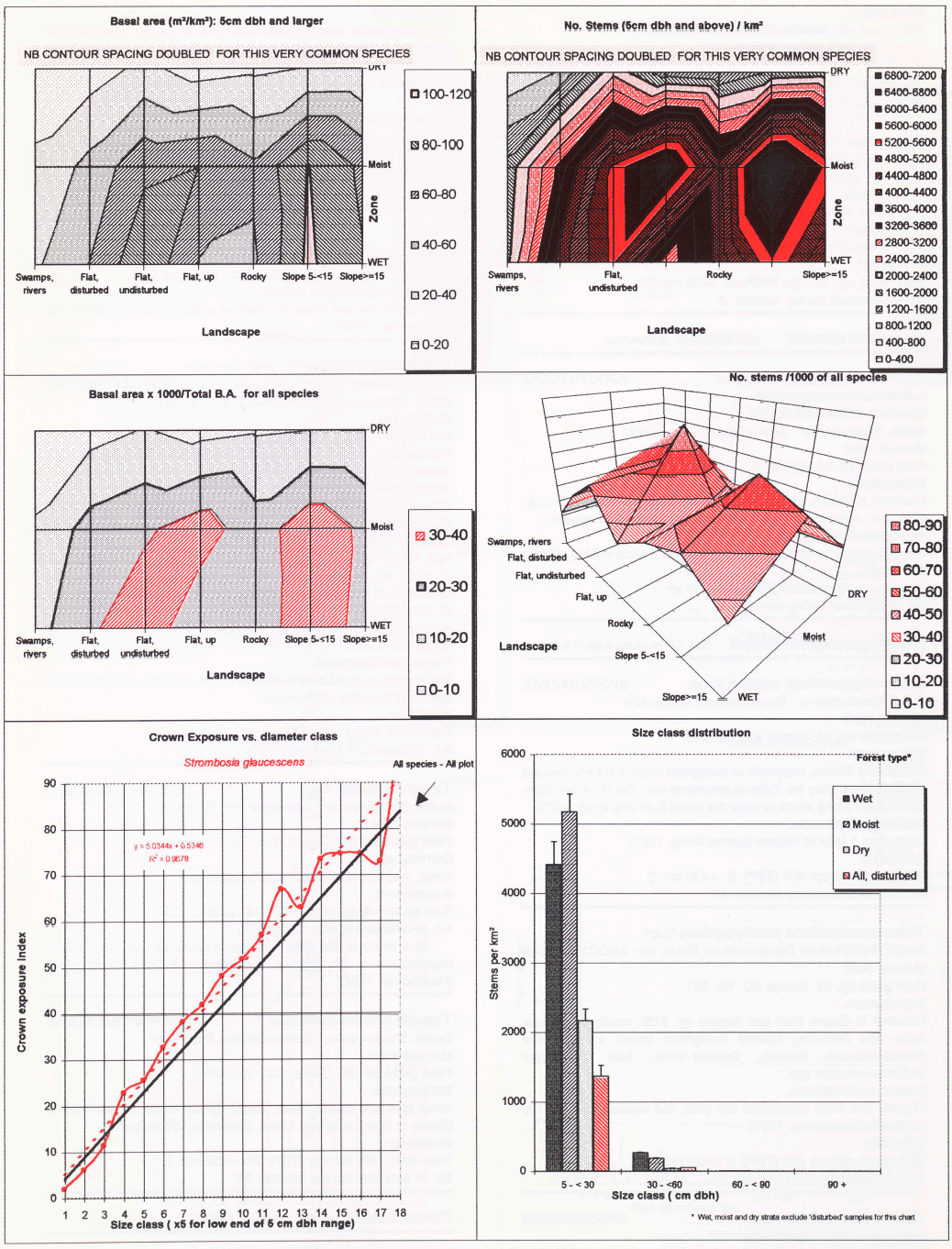








Strombosia glaucescens



INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 5
No. of botanical survey records: 14

Syzygium owariense **MYRTACEAE**
Medium-sized tree of freshwater swamps.

Syzygium rowlandiii Sprague **MYRTACEAE**
Common name: ASIBENYANYA
Guild: 0 **Conservation:** Blue star
MATURE TREE
Field guide pp. 49 Group: 7 No. 588
DISTRIBUTION
Medium-sized tree of riverbanks in forest.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 2

Syzygium staudtii see *Syzygium guineense*

Tabernaemontana africana **APOCYNACEAE**
(=*Tabernaemontana chippii*)
Common name: OBONAWA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 54 Group: 9C No. 589
DISTRIBUTION
Common in Ghana, especially on drier forests (Hall and Swaine sp. 572). See entry for *Tabernaemontana* spp. Guineo-Congolian.
PHENOLOGY/DISPERSAL
Flowers and fruits mainly in the dry season [Leeuwenberg, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 37

Tabernaemontana chippii see *Tabernaemontana africana*

Tabernaemontana crassa Benth. **APOCYNACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 54 Group: 9C No. 590
DISTRIBUTION
Common in Ghana, especially in evergreen forest (Hall and Swaine sp. 573). See entry for *Tabernaemontana* spp. Guineo-Congolian, where often along rivers or near the coast [Leeuwenberg, 1991].
PHENOLOGY/DISPERSAL
Fruits take 1 year to mature [Leewenberg, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 37

Tabernaemontana pachysiphon Stapf.
Guild: Shade-bearer **Conservation:** Green star **APOCYNACEAE**
MATURE TREE
Field guide pp. 54 Group: 9C No. 591
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 575); mostly on or near rocky hills (including Upland Evergreen forest) in the Moist Semideciduous forests; Guinea-wide. See entry for *Tabernaemontana* spp.
PHENOLOGY/DISPERSAL
Flowers and fruits throughout the year, but especially in the dry season [Leeuwenberg, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 39

Tabernaemontana spp. **APOCYNACEAE**
Common name: (oBANAWA)
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 54 No. 1589
DISTRIBUTION
The tree species have not been distinguished during either the TSP inventory or botanic survey, except when fertile material has been available. A key based on Leeuwenberg's [1991] pan-African synopsis, to replace that in the field guide [Hawthorne, 1990]:

Stamens inserted >24 mm above flower base
=*T.africana*
Stamens nearer base
Corolla 5-angled, not twisted or inflated
=*T.pachysiphon*
Not so; hairy inside at base
=*T. crassa*

INVENTORY
Tree count <30 cm dbh (TSP): 1804 >=30 cm: 32
No. of botanical survey records: 91
All sizes of tree are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Talbotiella gentii Hutch. and Greenway
Common name: TAKOROWANUA **CAESALPINIACEAE**
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 201 Group: 37C No. 592
Dense, dark crowned, evergreen tree of dry, rocky forest. Not ectomycorrhizal [I.J. Alexander, pers. comm.].
DISTRIBUTION
Although included in Hall and Swaines' maps (Hall and Swaine sp. 576), this is a very rare, albeit gregarious, species on the edge of extinction and Ghana's greatest conservation priority [Swaine and Hall, 1981]. The record for Cameroun [e.g. Lock, 1989] seems to be in error, as no specimen like *T. gentii* has been seen from Cameroun at Kew. It would not be surprising to find isolated pockets of this species in dry, rocky forest remnants in the Guinea sub-region, however, and this would not be likely to alter its threatened status.
PHENOLOGY/DISPERSAL
The species regenerates in its own shade, and the seeds have no specialised means of dispersal.
INVENTORY
Tree count <30 cm dbh (TSP): 38 >=30 cm: 262
No. of botanical survey records: 8

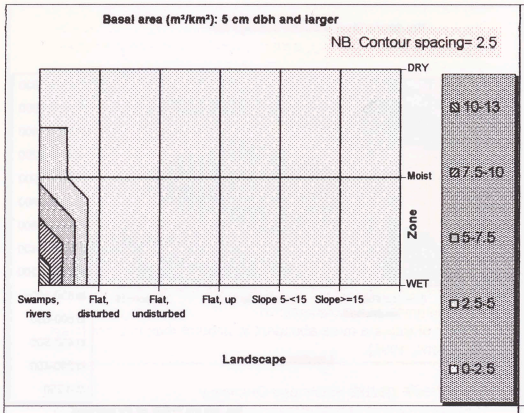
Tapura fischeri Engl. **DICHAPETALACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 89 Group: 13D No. 593
DISTRIBUTION
Small, well-branched, Guineo-Congolian tree.
INVENTORY
Tree count <30 cm dbh (TSP): 38 >=30 cm: 0
No. of botanical survey records: 36
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to thrive in burnt forest [Hawthorne, 1994].

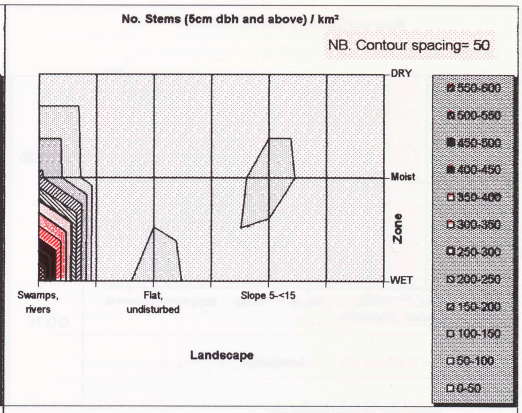
Tapura ivorensis Breteler **DICHAPETALACEAE**
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 89 Group: 13D No. 594
DISTRIBUTION
Small tree with knobbly bole. Upper Guinea endemic, confined in Ghana to Wet Evergreen forest, especially stream banks.
INVENTORY
Tree count <30 cm dbh (TSP): 84 >=30 cm: 1
No. of botanical survey records: 36

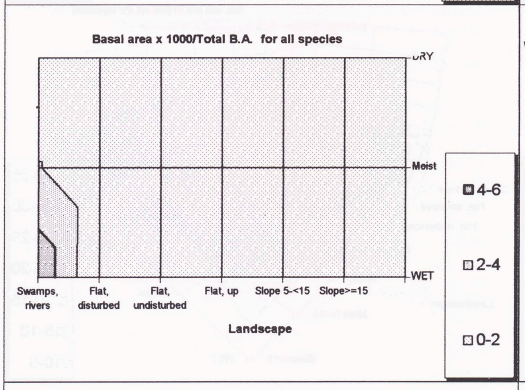
Tarrietia utilis see *Heritiera utilis*

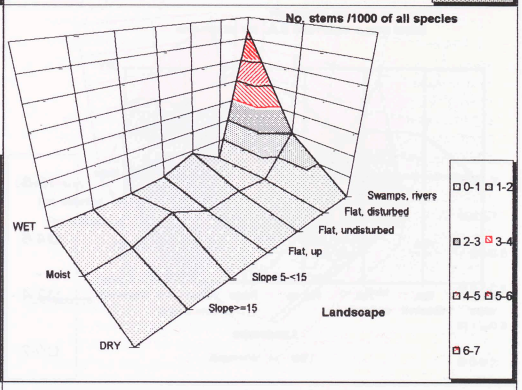
Teclea sudanica see *Vepris heterophylla*

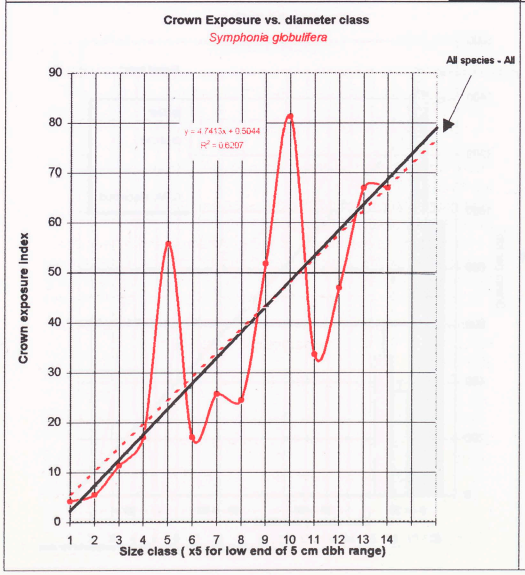
Symphonia globulifera

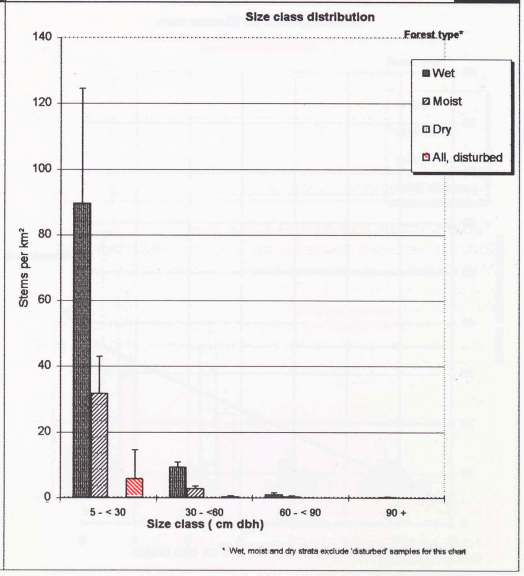




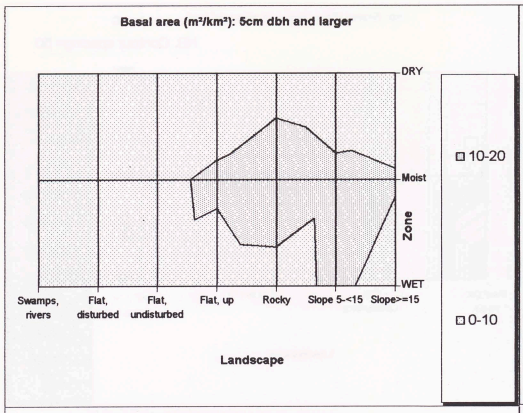


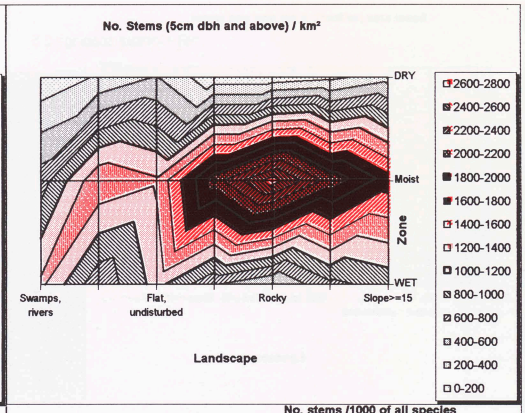


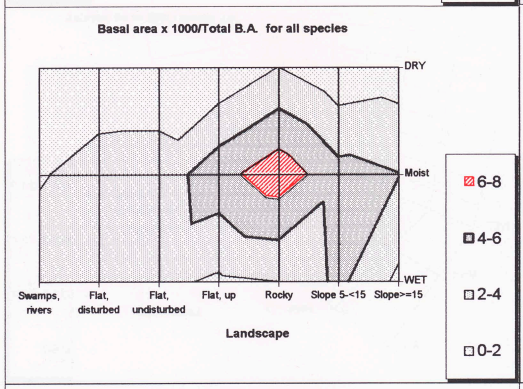


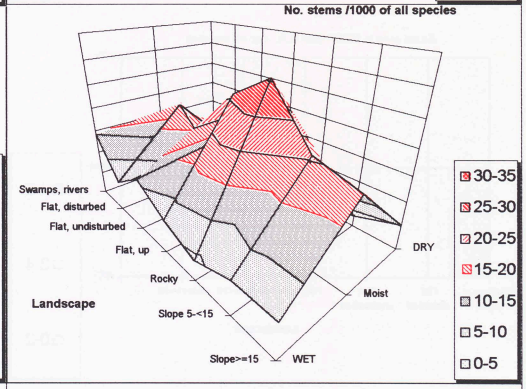


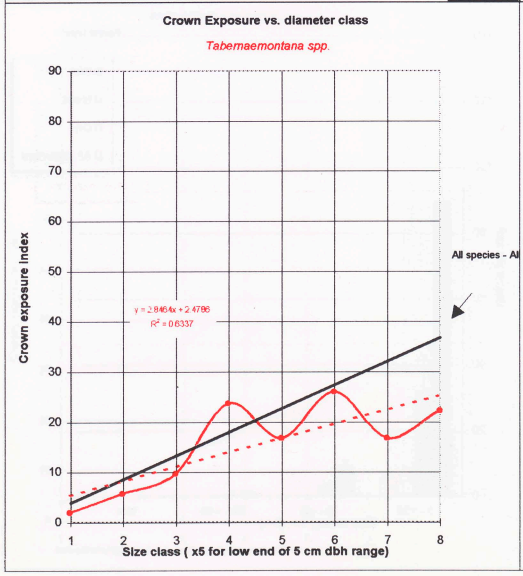
Tabernaemontana spp.

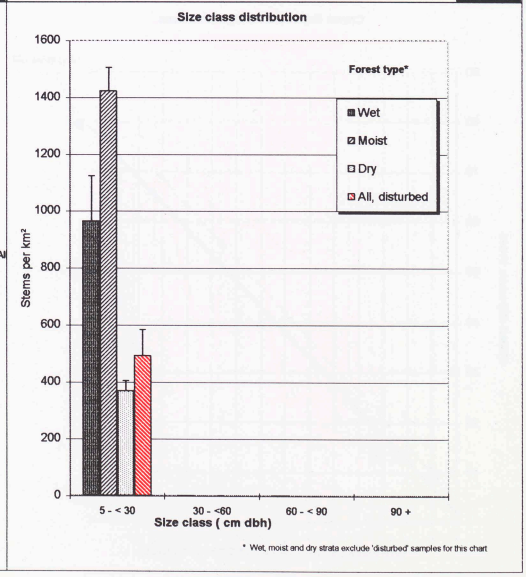




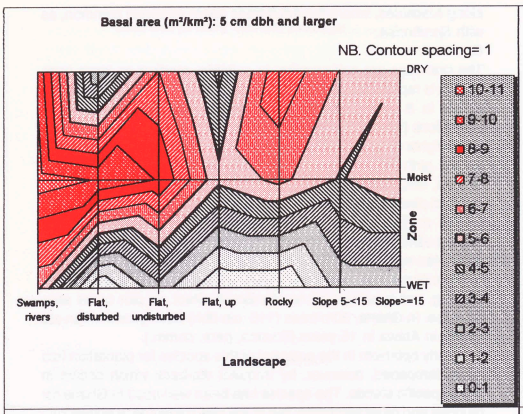


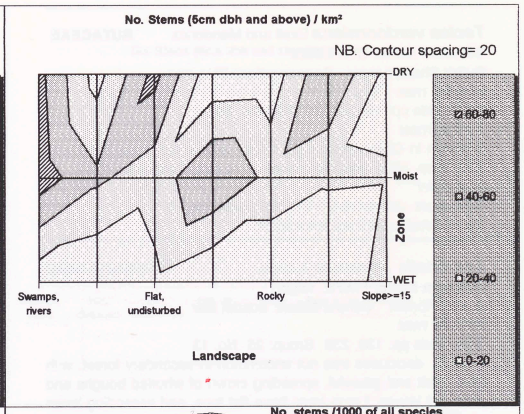


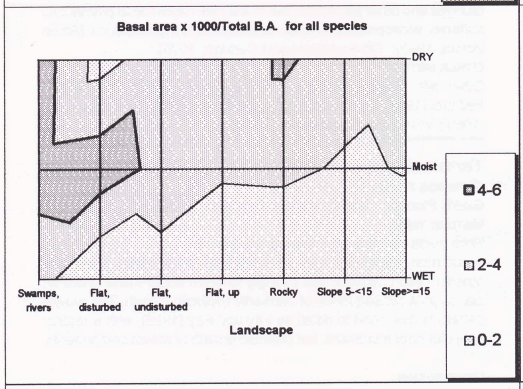


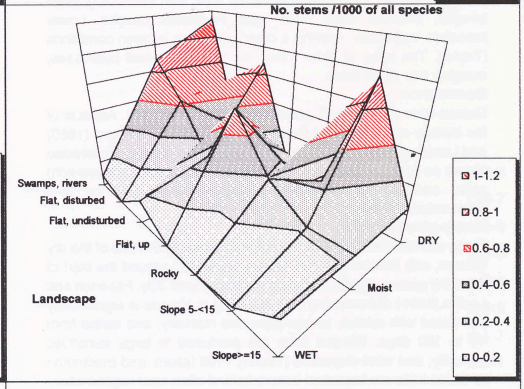


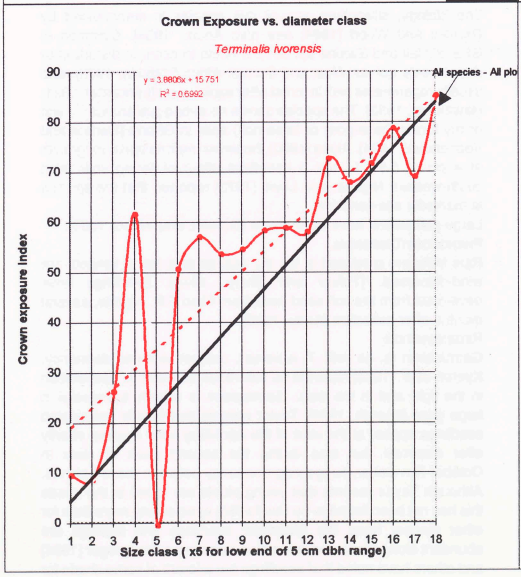
Terminalia ivorensis

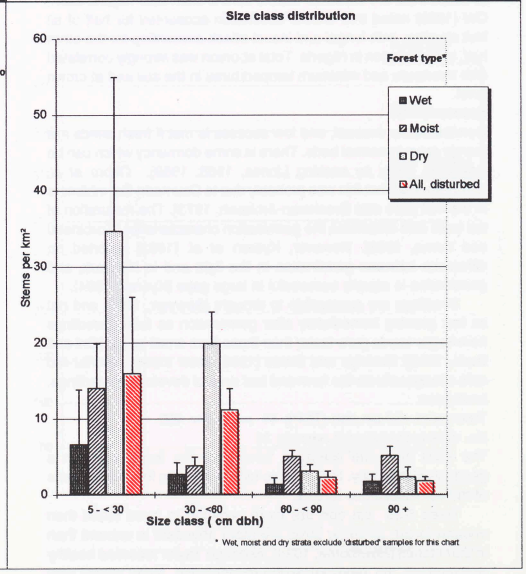












Teclea verdoorniana Exell and Mendonca **RUTACEAE**
Common name: OWEBIRIBI
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 165 Group: 31A No. 599
DISTRIBUTION
Common in Ghana only in dry forest; Guineo-Congolian (Hall and Swaine sp. 580). Used as a chew-stick [Adu-Tutu *et al.*, 1979].
INVENTORY
Tree count <30 cm dbh (TSP): 69 >=30 cm: 13
No. of botanical survey records: 51

Terminalia ivorensis A.Chev. **COMBRETACEAE**
Common name: EMIRE, Idigbo
Guild: Pioneer **Conservation:** Scarlet star
MATURE TREE
Field guide pp. 139, 238 Group: 25 No. 13
A large, deciduous tree not uncommon in secondary forest, with black bark and graceful, spreading crown of whorled boughs and clustered leaves. Large trees have flat tops, and ascending lower boughs, whereas small trees have horizontal boughs. Lower branches 'self-clean', leaving a clear bole even in open conditions [Taylor]. The base of older trees has high, but small buttresses, merging into slight flutes.
DISTRIBUTION
Guinea-wide (Guinea to Cameroun [Hall and Swaine]). Aspects of the biology of this species have been reviewed by Sawyerr (1960) and Lamb and Ntima (1970). In experimental conditions, the species shows no preference for wet or dry forest (base-poor or base-rich) soils, and is not especially drought-sensitive [Swaine and Veenendaal, 1994].
PHENOLOGY/DISPERSAL
Trees are deciduous and carry ripe fruits towards the end of the dry season, with flowers and new leaves appearing around the start of the rainy season (April); flowering continues until July. Fasehun and Ladipo [1991] demonstrate that flowering in Nigeria is significantly correlated with rainfall, temperature and humidity, and lasted from 40 to 100 days. Winged fruits are produced in large qunatities annually, and wind-dispersed [Taylor]. Fruit failure, and production of unripe fruits are important factors behind often poor regeneration. Oni (1990) noted that natural abscission accounted for half of all fruit abortion, with fungal and insect attack accounting for the other half, in a plantation in Nigeria. Total abortion was strongly correlated with maximum and minimum temperatures in the soil and at crown level.
REGENERATION
Germination is unusual, and low success is met if fresh seeds are merely sown in normal beds. There is some dormancy which can be overcome partly by soaking [Jones, 1968; 1969]. Okoro *et al.* [1977] showed that this was probably due to Coumarin-like inhibitors in the fruit [See also Brookman-Amissah, 1973]. The maturation of the fruits also influences the germination characteristics [Corbineau and Come, 1993]. However, Kyereh *et al.* [1993] reported no difference between germination in the light and in the dark, and germination is equally successful in large gaps [Kyereh, 1994].

Seedlings are susceptible to drought [Sawyerr, 1960] and not as fast growing immediately after germination as later. Seedlings from larger seeds grow faster than those from small seeds [Oni and Bado, 1992]. Kwesiga and Grace [1986] show that the red/far-red ratio strongly affects the form and leaf area of developing seedlings.
INVENTORY
Tree count <30 cm dbh (TSP): 41 >=30 cm: 460
No. of botanical survey records: 31
The adult trees are scattered throughout the forest zone, in a generally low density. Larger trees tend to occur in lower-lying parts of the semideciduous forests.

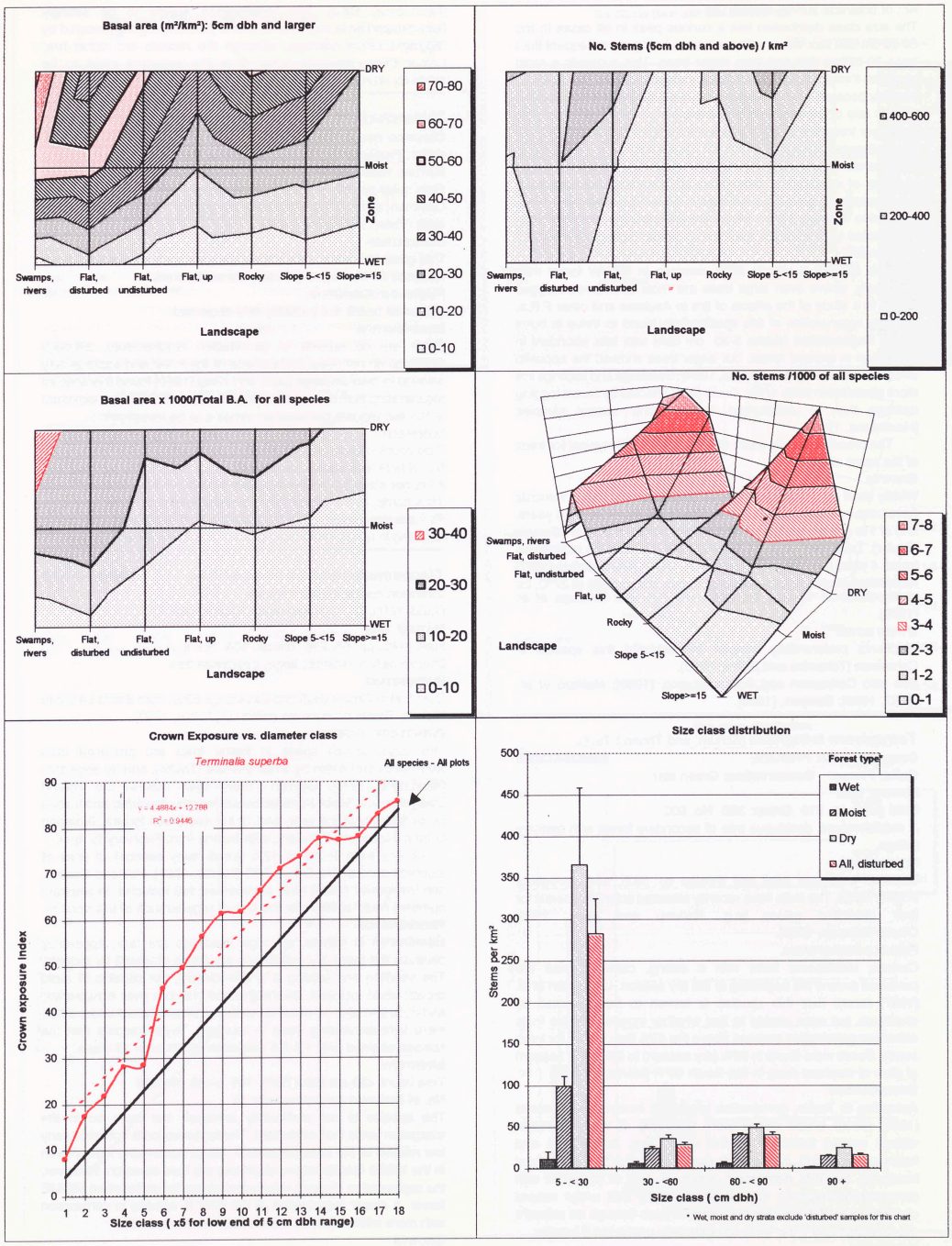
Trees 5-30 cm dbh are more common in burnt forest than unburnt forest: all larger sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. Although Taylor recorded healthy regeneration, the seedling/sapling regeneration today seems very sparse in Ghana, even relative to the adult population, except in Upland Evergreen forest where saplings are conspicuous along track sides. It seems that the largest stocks of this species may be along roadsides, where the adult trees seem relatively common, as with *Spathodea*.
GROWTH
The branches are self-pruning. In suitable, medium to large gaps growth is rapid, with records of trees reaching 80 cm GBH and 17m height in 8 years, or almost 1m girth in 14 years in taungya plantations [Taylor]. Lamb and Ntima (1970) records girths of 2.4m and heights of 36.5m for trees 22 years old. Horne [1962] recorded annual girth increments of 2 to 3 inches in moist forest areas of Nigeria, and anticipated trees of 9 feet girth in fifty years. In a 21 year old plantation in Nigeria investigated by Akindele and Owoeye [1991], average survival (from the time of trial establishment 22 years before) varied between 12% and 64%, greater significantly correlated with greater spacing (1.8m x 1.8m up to 6.6m x 6.6m). Girth, volume and height increment were also best at the widest spacing, but spacing had no significant effect on plot basal area increase. In Ghana, 30m trees (116 cm dbh) have grown on an old quarry in Atewa in 15 years [Swaine, pers. comm.].

Early optimism in the potential of this species for plantation has been dampened, however, by frequent die-back which occurs in monospecific stands. The species has been well-used in Ghana for taungya and other plantation, but in the mid 1960s these plantations suffered widespread die-back in 30 year old plantations [Annin Bonsu, 1968]; [Ofusu-Asiedu and Cannon, 1976].
OTHER NOTES
Other refs: Borota, [1969]; Castaneda-Amaya, [1981]; Kanga and Fediere, [1991]; Lamb and Ntima, [1970]; Mbakwe, [1990]; Sawyerr, [1960]; Yared and Carpanezzi, [1982].

Terminalia superba Engl. and Diels **COMBRETACEAE**
Common name: oFRAM, Limba
Guild: Pioneer **Conservation:** Pink star
MATURE TREE
Field guide pp. 139, 238 Group: 25 No. 53
A common, deciduous tree of secondary forest which, like many others in such habitats, has strongly whorled boughs and clustered leaves as a consequence of markedly rhythmic growth. The growth pattern is described in detail by Fay and Fay [1992], with a regular bole diameter increment, but periodic growth of crown components.

DISTRIBUTION
The biology, silviculture etc. of this species is summarised by Groulez and Wood [1984; see also Anon., 1958]. Common in Ghana (Hall and Swaine sp. 581). It tends to occur in disturbed or drier forests across West and Central Africa [Caballe, 1978], and usually regenerates well in forest after exploitation [Lancaster, 1961; Hawthorne, 1993]. The species shows no strong preference for wet or dry forest (base-poor or base-rich) soils in Ghana [Swaine and Veenendaal, 1994]. Aluko [1990), however, reports optimum growth at a pH of 5.9-6.1, and a beneficial effect of liming soils from south-western Nigeria; and Lowe [1973] reported that the species is markedly site-sensitive.
Large plantations have been made [Groulez and Wood, 1985].
PHENOLOGY/DISPERSAL
Ripe fruits are produced in the dry season and, being winged, are wind-dispersed. [Tufuor and Sharp, 1978]. Seedlings have developed from the soil seed bank from Omo F.R. Nigeria, several months after collection [Keay, 1960].
REGENERATION
Germination is, as with *T. ivorensis*, subject to some dormancy. Kyereh *et al.* [1993] reported no difference between % germination in the light and in the dark. Germination is equally successful in large gaps [Kyereh, 1994]. Taylor records that freshly germinated seedlings appear at the start of the April-May rainy season, shortly after dispersal, but also during the second peak of rains in October-November, suggesting dormancy between these batches. Although Taylor records that young plants are found in the shade this has not been found to be true for this species any more than for other pioneer trees like *Musanga*: seedlings and saplings are abundant along roads and in medium-large gaps. Macgregor [1934] and others have noted that seedlings are tolerant of some shade for several years.
INVENTORY
Tree count <30 cm dbh (TSP): 389 >=30 cm: 2349

Terminalia superba



No. of botanical survey records: 86
The size class distribution has a curious peak in all cases in the 60-90 cm dbh size class, with such trees being more frequent than trees 30-60 cm dbh and than larger trees. This suggests a rapid transition through the 30-60 cm class relative to the 60-90 cm class, possibly because of complications of measurement arising from the greater rate of development of buttressess in the 60-90 class (i.e. the larger trees being measured further and further up the bole as the buttresses develop, giving an illustration of a decrease in diameter increment). Alternatively, the 'middle-age hump' could arise because of a period of stagnation of diameter increment as a consequence of greater investment in crown development or fruit production with age. Other effects are also possible, and PSP data are needed to resolve the question. A similar pattern is shown by *Triplochiton*.

This species is slightly more common in MSNW forest than elsewhere, where even large trees are most abundant in logged forest. In a study of the effects of fire in Asukese and other F.R.s, seedling regeneration of this species was found to thrive in burnt forest. Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest, but larger trees showed the opposite effect more markedly [Hawthorne, 1994]. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

The crown is usually much more exposed than typical for trees of the same size.

GROWTH

Widely used as a plantation species [e.g. Groulez, 1961]. Records have been made of about 1.5 m to 3 m height increment in 4 years, and of 1 m gbh being attained in Taungya plantations after 13 years [Taylor]. Trees can attain 14 m height (22 cm dbh) on old logging tracks 4 years after logging [Hawthorne, 1993]. Maillard *et al.* [1987] record that growth at 22°C was continuous, but periodic at 27°C, for photoperiods of 14-16h, the optimum. See also Kwesiga *et al.* [1986].

OTHER NOTES

Elephants preferentially remove the bark of this species in Cameroun [Tchamba and Seme, 1993].
See also Corbasson and Souvannavong, [1988]; Maillard *et al.*, [1987, 1989]; Sawyerr, [1960].

Tetrapleura tetraptera (Schum. and Thonn.) Taub.
Common name: PReKeSE **MIMOSACEAE**
Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 219 Group: 38B No. 600
A medium-sized, deciduous tree of secondary forest with feathery foliage.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 583), and throughout tropical Africa. The fruits have recently attracted scientific interest for their medicinal values [e.g. Nwaiwu and Akah, 1986; Owusu-Bempah, 1988].

PHENOLOGY/DISPERSAL

Curious, indehiscent fruits with a strong, caramel smell are produced around the beginning of the dry season. Lieberman *et al.* [1987] record that this species is known to be dispersed by elephants, but were unable to find whether ingestion of the fruits enhances germination success above the 43% they record for fresh seeds. Seeds were found in 65% (dry season) to 5% (rainy season) of piles of elephant dung in Bia South GPR [Martin, 1991].

REGENERATION

According to Taylor, germination is normal; however, Odoemena [1988] record erratic germination, with little or no germination without special treatment of the seeds (e.g. scarification and hormone treatment). A few seeds germinated after 56 days without treatment, but 90% germinated within 10 days of treatment with concentrated sulphuric acid. It seems likely that under natural circumstances this species may have to pass through an animal's gut. Saplings and older trees are generally unshaded if healthy.

INVENTORY

Tree count <30 cm dbh (TSP): 138 >=30 cm: 423
No. of botanical survey records: 35
Most sizes are more abundant in burnt than in unburnt forest [Hawthorne, 1994]. The regeneration seems to be strongly light-demanding in most areas, and is probably slightly favoured by logging and fire damage, although the records are rather few. Larger trees, however, seem from the exposure chart to be relatively shaded.

Tetrorchidium didymostemon (Baill.) Pax and K.Hoffm.
Common name: ANENEDUA **EUPHORBIACEAE**
Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 83 Group: 13A No. 601
Common, small or medium-sized, sometimes fluted tree with edible fruits [Vivien and Faure, 1988].

DISTRIBUTION

This generally rather small tree of secondary forest has not been recorded in the inventory in dry, fire zone forest.

PHENOLOGY/DISPERSAL

The small seeds are probably bird-dispersed.

REGENERATION

There are no records of germination requirements, although seedlings do not occur in the shade of the forest and saplings only develop in medium-large gaps, and Keay [1960] found this species regenerating from boxes of illuminated forest soil. Whether exposure to the sun triggers germination remains to be investigated.

INVENTORY

Tree count <30 cm dbh (TSP): 201 >=30 cm: 29
No. of botanical survey records: 64
All larger sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The crown of smaller trees is generally exposed. Perhaps this species also regenerates from seed banks which are depleted in forest which happens to have been recently logged.

Tieghemella heckelii Pierre *ex* Chev. **SAPOTACEAE**
Common name: BAKU, Makore
Guild: N.P.L.D. **Conservation:** Scarlet star

MATURE TREE

Field guide pp. 58, 236 Group: 10A No. 9
Impressively cylindrical, large, evergreen tree

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 586); from Sierra Leone to Nigeria. Seeds produce an edible oil [Abbiw, 1990].

PHENOLOGY/DISPERSAL

The large, oil-rich seeds in fleshy fruits are produced from Aug-March and eaten by small animals [Taylor], and by elephants [Alexandre, 1978]. Gyimah [1986] adds that in the Upland Evergreen and Moist Semideciduous forests, flowering and fruiting occur throughout the year, and, in the evergreen forests, flowering is from January to February, with fruiting from February to April.

Seeds were found in 12% (small rainy season) of piles of elephant dung in Bia South GPR [Martin, 1991]. Hall and Swaine, and Voorhoeve [1965] have commented that reduction in elephant numbers could account for the lack of regeneration of this species.

REGENERATION

Germination is normal, although seedlings are rare, apparently because the large oily cotyledons are much predated by rodents. The seedling and sapling is shade-tolerant, but capable of rapid growth when exposed, reaching almost 1m in a year in nurseries, and up to 2 m after 18 months. However, when planted under other, more light-demanding trees in taungya, Taylor records that the species attained only 1.5-3.5 metres in height after 13 years.

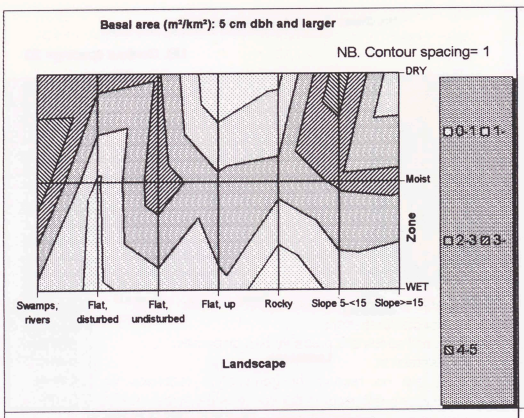
INVENTORY

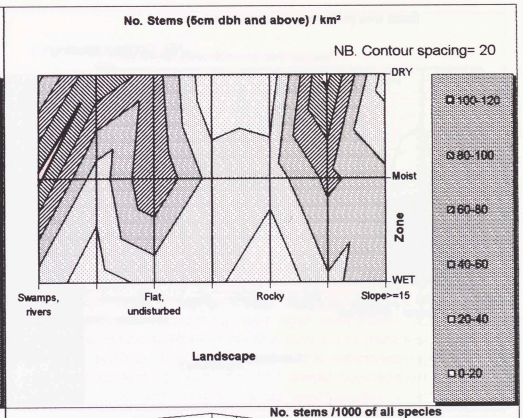
Tree count <30 cm dbh (TSP): 161 >=30 cm: 329
No. of botanical survey records: 41
The species is not particularly common, but more so in the evergreen forest than elsewhere. The regeneration is not particularly low relative to the adult population, but at reasonable levels, even in the MSSE forests where elephants are less common. However, the regeneration shows a strong preference for undisturbed MS-ME forest. A closer examination of the data is needed in conjunction with more information on the distribution of elephants.

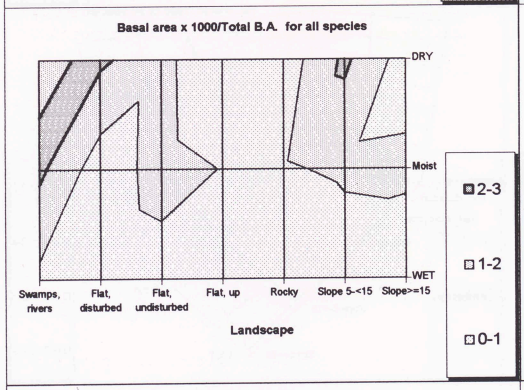
GROWTH

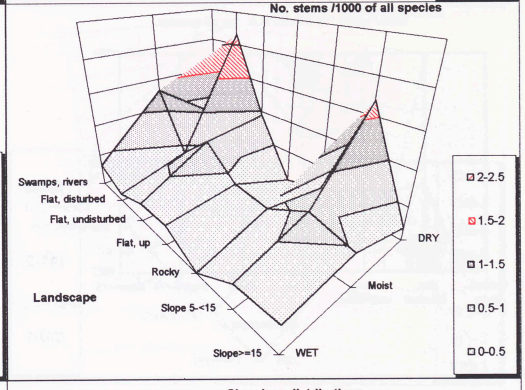
22 year old plantations of this species in Nigeria included trees c. 30 m tall and 1m girth [Mackay, 1953]. The tree is a strong light-demander in Sierra Leone [Savill and Fox, 1967].

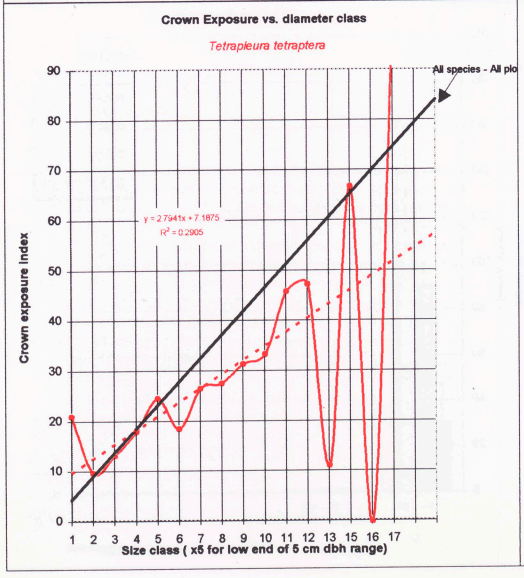
Tetrapleura tetraptera

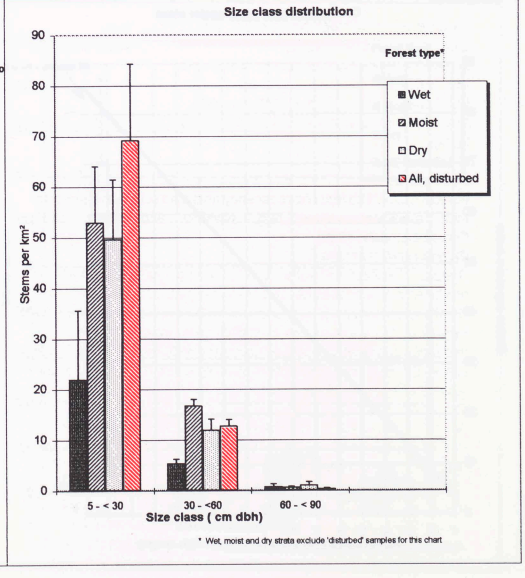




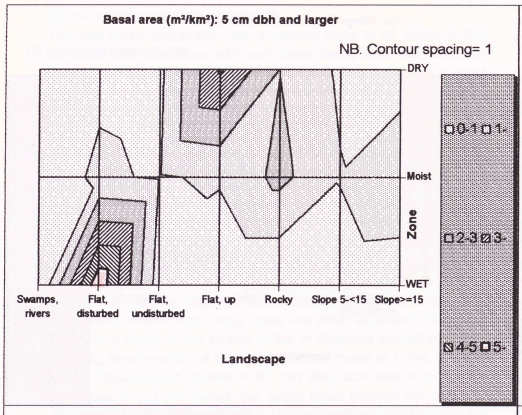


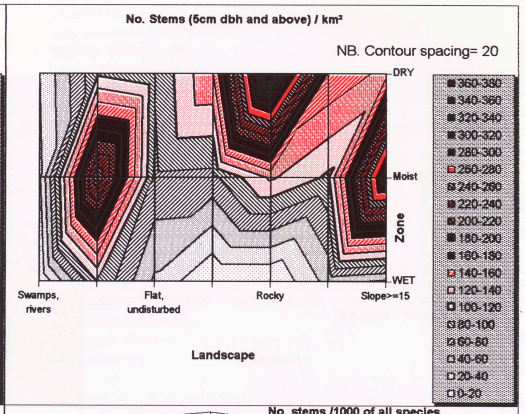


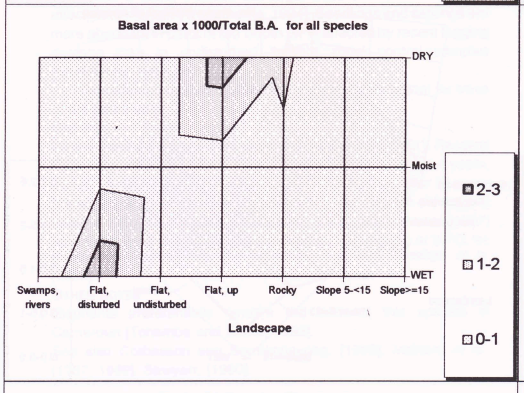


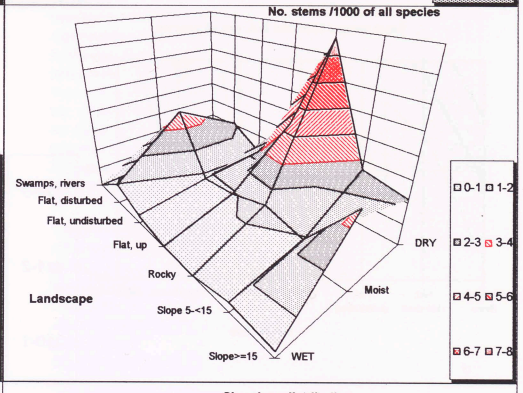


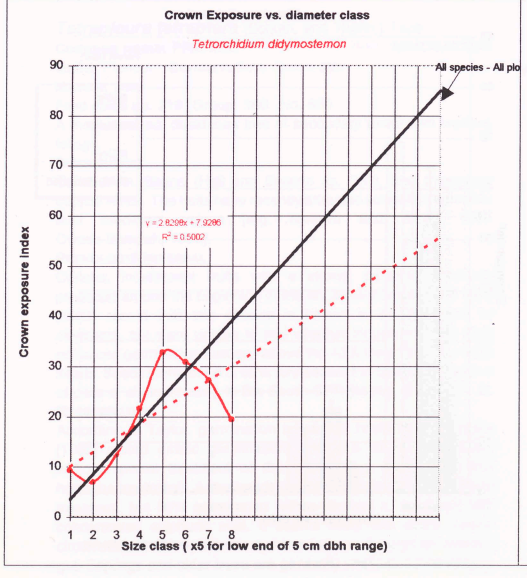
Tetrorchidium didymostemon

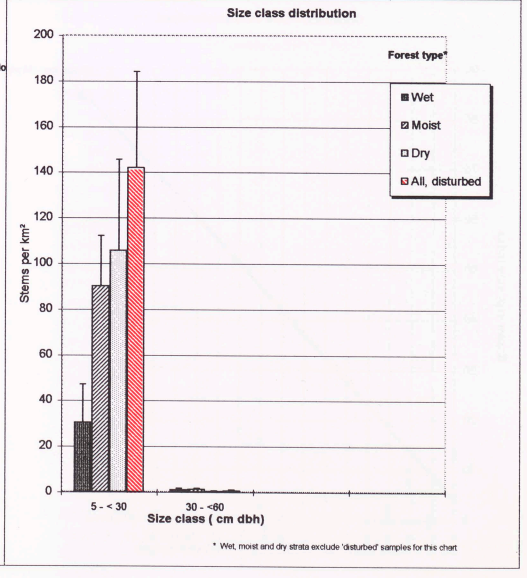




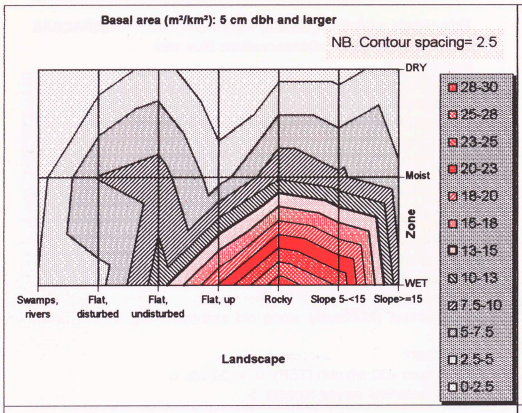


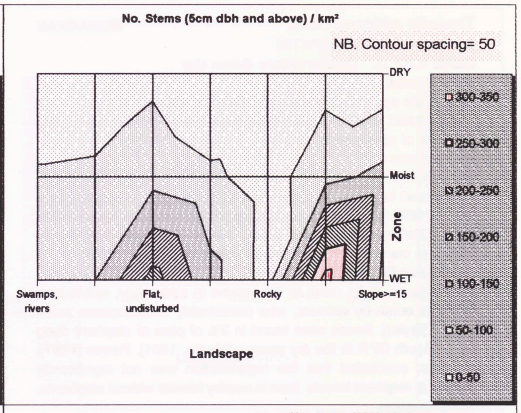


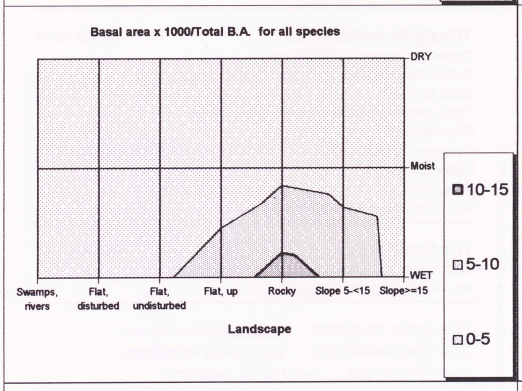


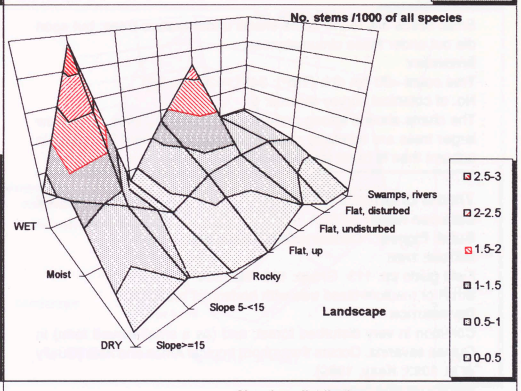


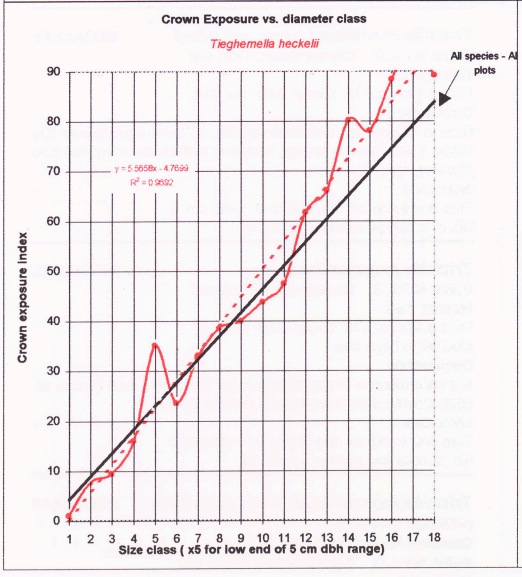
Tieghemella heckelii

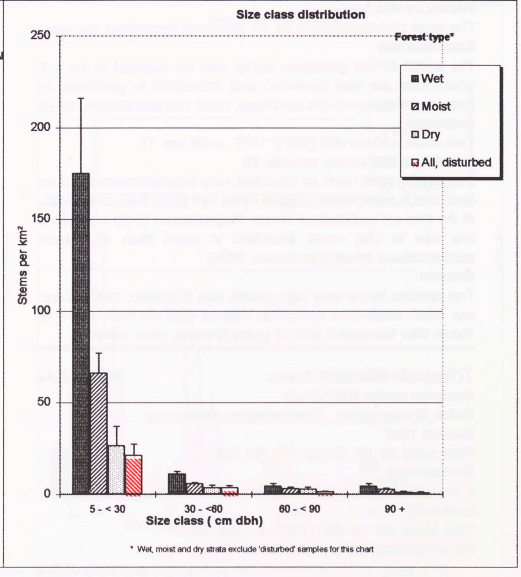












Treculia africana Decne **MORACEAE**
Common name: BReBReTIM
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 117, 235 Group: 19A No. 603
Deeply fluted, medium-sized, evergreen tree with small crown, and red flush of new leaves.
DISTRIBUTION
The Ghanaian trees are of subsp. *africana* var. *africana*. Species is widespread in Africa, from Senegal to Sudan and to Mozambique [Keay, 1989]. Valued, apparently especially in Nigeria, for its edible fruits [Okafor, 1988; Ejiofor *et al.*, 1988]. The fruits are sold in Ghana in markets, for food and an edible oil [Abbiw, 1990].
PHENOLOGY/DISPERSAL
The immense fruits crash to the ground in about July, whereupon they are eaten by animals, who presumably also disperse some seeds [Taylor]. Seeds were found in 3% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991]. Parren [1991], however, concluded that the regeneration was not significantly greater in elephant forests than in nearby forests without elephants.
REGENERATION
Small seeds are found in the shade under mature trees, but soon die out under these circumstances.
INVENTORY
Tree count <30 cm dbh (TSP): 343 >=30 cm: 991
No. of botanical survey records: 51
The charts show a strong preference for swampy sites, and show larger trees are relatively shaded. All sizes are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Trema orientalis (L.) Blume **ULMACEAE**
Common name: SESEA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 113 Group: 18B No. 604
Small or medium-sized tree with horizontal branches.
DISTRIBUTION
Common in very disturbed forest, and (as a small-leaved form) in Guinea savanna. Occurs throughout tropical Africa and Asia [Guelly *et al*, 1993; Keay, 1989].
PHENOLOGY/DISPERSAL
The small bird-dispersed fruits are produced throughout the year.
REGENERATION
The seeds do not germinate easily, and lay dormant in the soil, where they are very common, until stimulated to germinate by increased exposure to the sun [Keay, 1960; Hall and Swaine, 1980].
INVENTORY
Tree count <30 cm dbh (TSP): 1177 >=30 cm: 17
No. of botanical survey records: 28
The smaller trees have, as expected, very exposed crowns and are abundant in burnt forest. Logged forest has about the same density of the tree as 'undisturbed' forest. Regeneration (5-30 cm dbh) of this tree is (5x) more abundant in burnt than in unburnt semideciduous forest [Hawthorne, 1994].
GROWTH
This species has a very high growth rate [Coombe, 1960]. Trees can reach maturity in 6 months; they all died out from a plot on Atewa after between 5 and 15 years [Swaine, pers. comm.].

Tricalysia discolor Brenan **RUBIACEAE**
Common name: KWAEKoFI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 32 Group: 1D No. 608
DISTRIBUTION
A probable 'cryptic' or understorey pioneer.
INVENTORY
Tree count <30 cm dbh (TSP): 9 >=30 cm: 1
No. of botanical survey records: 57
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].

Tricalysia elliotii (K.Schum) Hutch. and Dalz. **RUBIACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 32 Group: 1D No. 609
DISTRIBUTION
Rare in Ghana, but easily confused with *T.discolor.*
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 5

Tricalysia macrophylla K.Schum. **RUBIACEAE**
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 32 Group: 1D No. 610
DISTRIBUTION
Regenerates abundantly along old skid-trails, e.g. in Bia South GPR.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 5
No. of botanical survey records: 5

Tricalysia pallens Hiern **RUBIACEAE**
Common name: TUROMDUA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 35 Group: 1E No. 612
DISTRIBUTION
Common in Ghana Guineo-Congolian (Hall and Swaine sp. 589).
INVENTORY
Tree count <30 cm dbh (TSP): 120 >=30 cm: 4
No. of botanical survey records: 166

Tricalysia spp. **RUBIACEAE**
Tree count <30 cm dbh (TSP): 704 >=30 cm: 53
No. of botanical survey records: 5

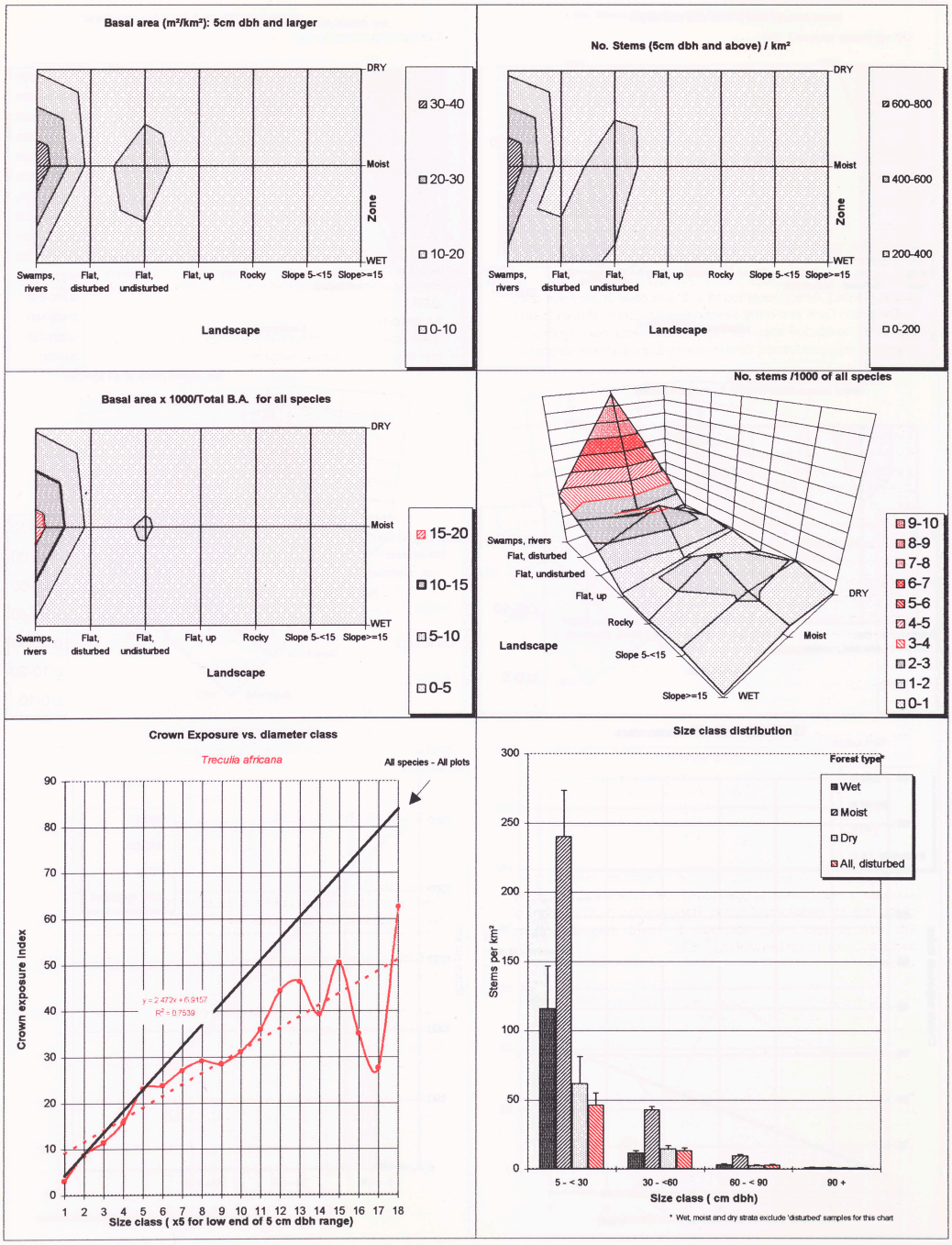
Tricalysia toupetou see *Sericanthe toupetou*
Trichilia heudelotii see *Trichilia monadelpha*
Trichilia lanata see *Trichilia tessmannii*

Trichilia martineaui Aubrev. and Pellegr. **MELIACEAE**
Guild: N.P.L.D. **Conservation:** Gold star
MATURE TREE
Field guide pp. 178 Group: 34D No. 616
DISTRIBUTION
Rare in Ghana, but Guineo-Congolian, to Zaire and Uganda [De Wilde, 1986]. Occurs as rare, scattered individuals in Uganda also [Synnott, 1985].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 11

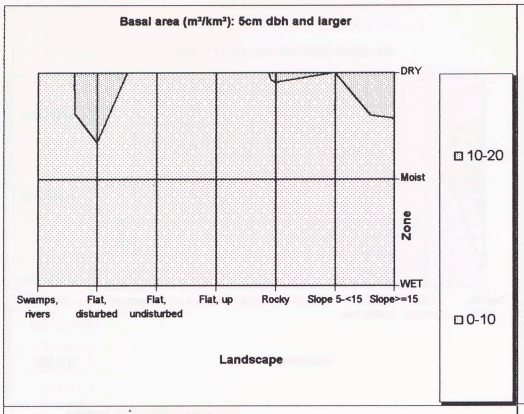
Trichilia megalantha Harms **MELIACEAE**
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 178 Group: 34D No. 617
Medium to large tree.
DISTRIBUTION
Not uncommon in Ghana in drier forest types (Hall and Swaine sp. 592); Guinea-wide (from Nigeria to Ivory Coast).
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 22

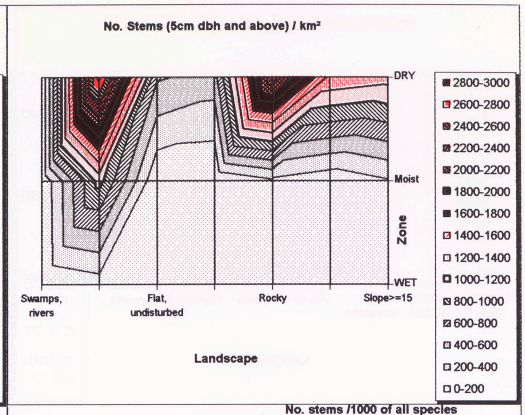
Trichilia monadelpha (Thon.) J.J.De Wilde **MELIACEAE**
(=*Trichilia heudelotii*)
Common name: TANDRO
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 178 Group: 34D No. 618
Medium-sized, spreading, evergreen tree, commonly seen thriving

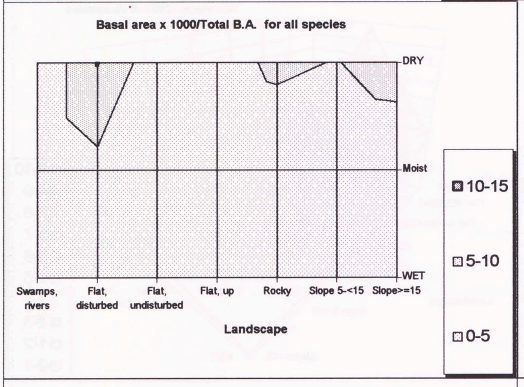
Treculia africana

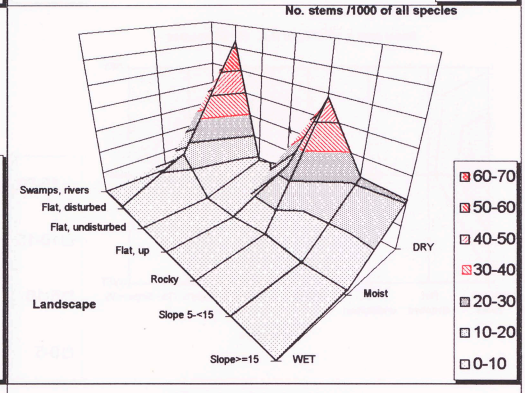


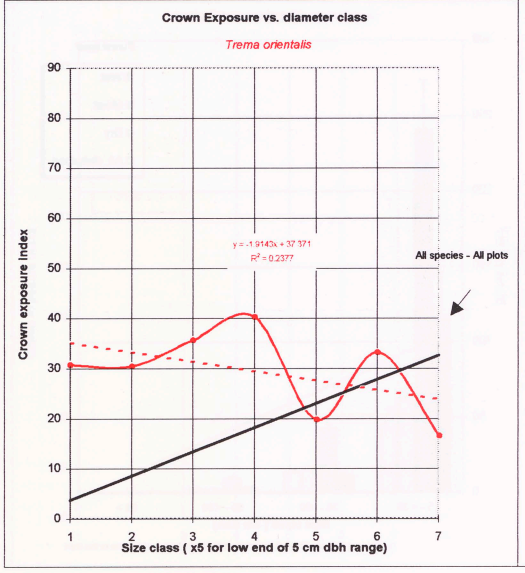
Trema orientalis

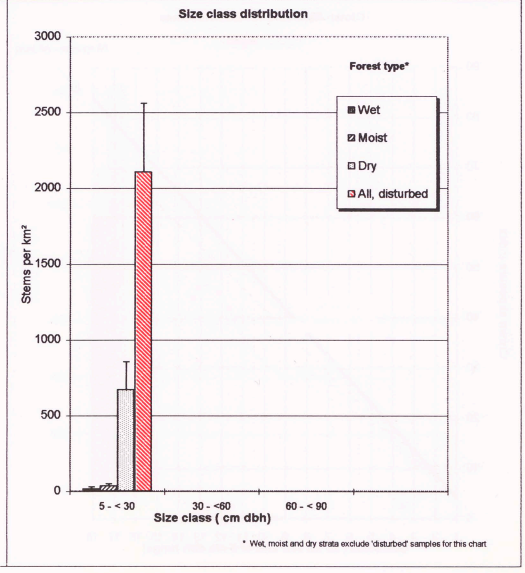




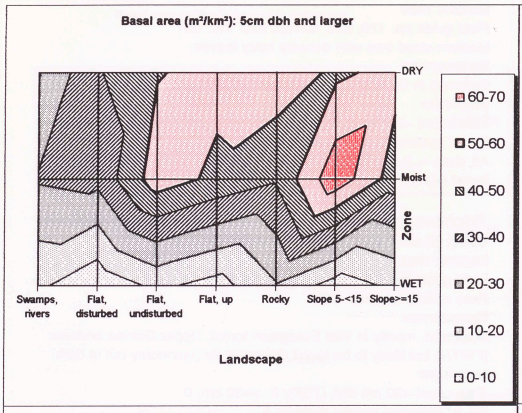


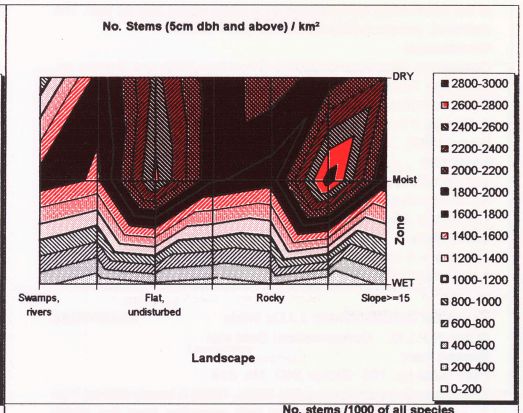


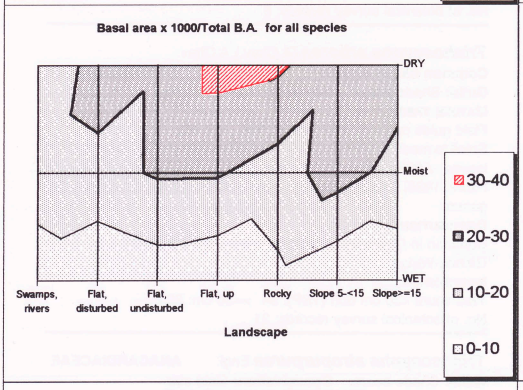


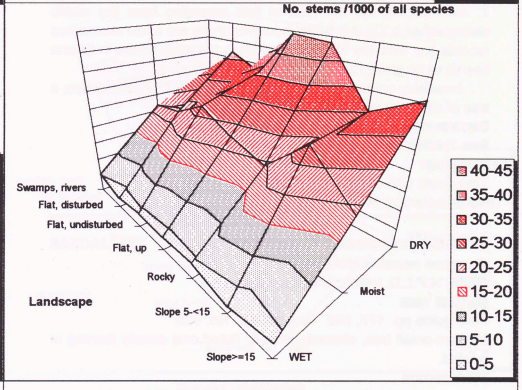


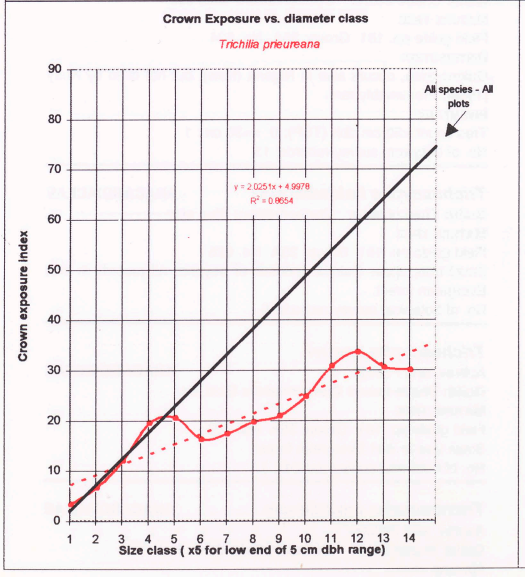
Trichilia prieureana

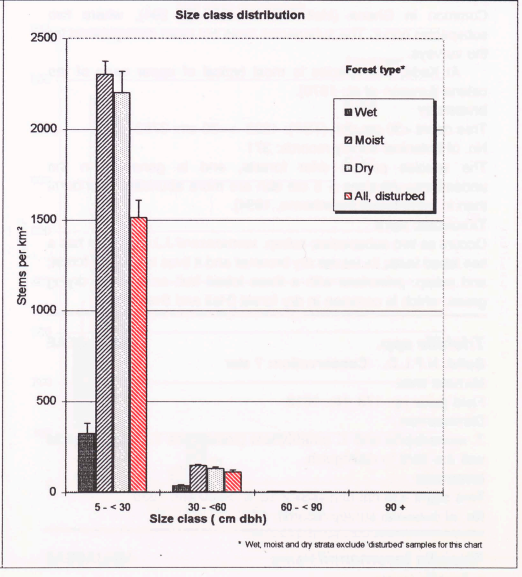












at the forest edge, but common as a lower storey tree as well. The clustered, compound leaves flush a paler colour.

DISTRIBUTION

Common in Ghana, and Guineo-Congolian (Hall and Swaine sp. 593). See *Trichilia spp.*

PHENOLOGY/DISPERSAL

In Nigeria, it flowers in the dry season and fruits from June-August [Keay, 1989].

INVENTORY

see *Trichilia* spp.

No. of botanical survey records: 246

The charts are joined for this and similar species, especially *T. ornithothera.*

All sizes > 5 cm dbh are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Trichilia ornithothera J.J.De Wilde **MELIACEAE**

Guild: N.P.L.D. **Conservation:** Gold star

MATURE TREE

Field guide pp. 178 Group: 34D No. 619

This Upper Guinean species [De Wilde, 1968] is barely distinct from *T. monadelpha*, but the tufts of hair emerging from the midrib distinguishes it. On this basis, however, there are a few anomalous records e.g. from dry forest even though the main centre in Ghana seems to be wet forest.

Invariably counted as *T. monadelpha* in the TSP inventories; a tree of similar form, but slightly larger leaves.

DISTRIBUTION

See *Trichilia* spp.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 30

Trichilia prieureana A.Juss. **MELIACEAE**

Common name: KAKADIKURO

Guild: N.P.L.D. **Conservation:** Green star

MATURE TREE

Field guide pp. 177, 242 Group: 34C No. 620

Medium-small tree, characteristically fluted and usually leaning or twisted.

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 594), where two subspecies occur. The subspecies have not been distinguished for the surveys.

At Kade, this species is most typical of upper parts of the catena [Lawson *et al.*, 1970].

INVENTORY

Tree count <30 cm dbh (TSP): 4328 >=30 cm: 3763

No. of botanical survey records: 371

The species prefers drier forests, and is generally in the understorey. All sizes > 5 cm dbh are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

TAXONOMIC NOTE

Occurs as two subspecies; subsp. *vermoesenii* J.J. de Wilde has a two lobed fruits; its leaves dry browner and it lives in moister forest; and subsp. *prieuriana* with a three lobed fruit and leaves drying green, which is common in dry forest [Hall and Swaine].

Trichilia spp. **MELIACEAE**

Guild: N.P.L.D. **Conservation:** ? star

MATURE TREE

Field guide pp. 178 No. 1618

DISTRIBUTION

T. monadelpha and *T. ornithothera* (sometimes *T. megalantha* as well are hard to distinguish.

INVENTORY

Tree count <30 cm dbh (TSP): 1376 >=30 cm: 1829

No. of botanical survey records: 11

Trichilia tessmannii Harms **MELIACEAE**

(=*Trichilia lanata*)

Common name: TANUNINI

Guild: N.P.L.D. **Conservation:** Green star

MATURE TREE

Field guide pp. 178, 236 Group: 34D No. 621

Medium-sized tree with densely hairy leaves.

DISTRIBUTION

Common in Ghana; Guineo-Congolian (Hall and Swaine sp. 595).

INVENTORY

Tree count <30 cm dbh (TSP): 576 >=30 cm: 695

No. of botanical survey records: 99

All sizes > 5 cm dbh are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

Trichoscypha albiflora Engl. **ANACARDIACEAE**

Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 181 Group: 35A No. 622

Rare in Ghana; small tree.

DISTRIBUTION

Scattered, mostly in Wet Evergreen forest. Upper Guinea endemic [FWTA], but likely to be found Guinea-wide (taxonomy out of date).

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 8

Trichoscypha arborea (A.Chev.) A.Chev.

Common name: ANAKU **ANACARDIACEAE**

Guild: Shade-bearer **Conservation:** Green star

MATURE TREE

Field guide pp. 181, 236 Group: 35A No. 623

Small to medium-sized tree with conspicuously clustered compound leaves. Appreciated for its edible fruit in Cameroun [Vivien and Faure, 1988]. The only common and well-recognised species in the genus.

DISTRIBUTION

Common in Ghanaian evergreen forest (Hall and Swaine sp. 597); Guinea-Wide.

INVENTORY

Tree count <30 cm dbh (TSP): 94 >=30 cm: 300

No. of botanical survey records: 31

Trichoscypha atropurpurea Engl. **ANACARDIACEAE**

Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 181 Group: 35A No. 624

DISTRIBUTION

Guinea-wide, occurs also in Nigeria (Kew), but not cited by Keay [1989]. Presumably rare.

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 1

No. of botanical survey records: 13

Trichoscypha baldwinii Keay **ANACARDIACEAE**

Guild: Shade-bearer **Conservation:** Blue star

MATURE TREE

Field guide pp. 181 Group: 35A No. 625

Small tree; upper Guinea endemic or beyond. All records in Wet Evergreen forest.

No. of botanical survey records: 6

Trichoscypha beguei

Aubrev. and Pellegr. **ANACARDIACEAE**

Guild: Shade-bearer **Conservation:** Gold star

MATURE TREE

Field guide pp. 181 Group: 35A No. 626

Small tree in Wet Evergreen forest.

No. of botanical survey records: 11

Trichoscypha cavalliensis **ANACARDIACEAE**

Aubrev. and Pellegr.

Guild: Shade-bearer **Conservation:** Gold star

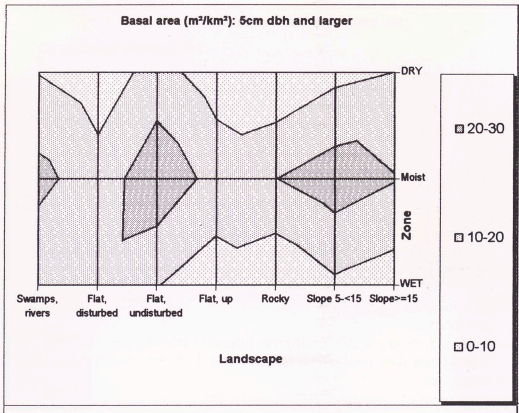
MATURE TREE

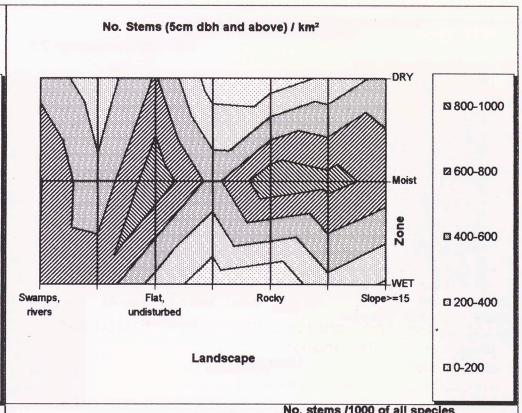
Field guide pp. 181 Group: 35A No. 627

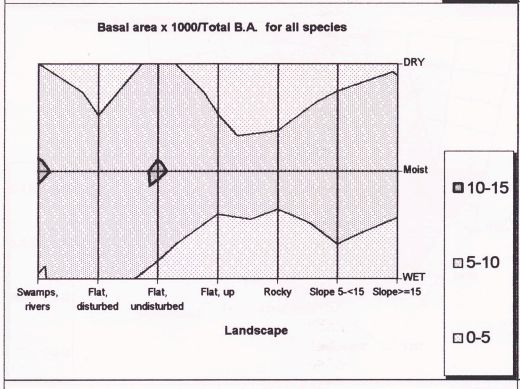
Medium-sized tree in Wet Evergreen forest.

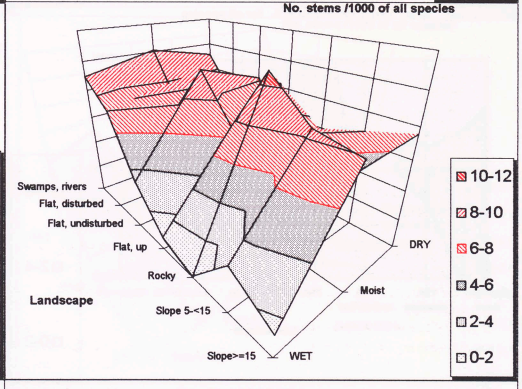
No. of botanical survey records: 6

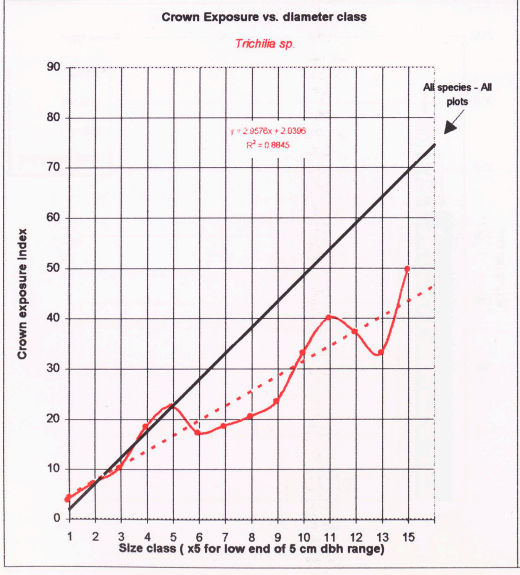
Trichilia sp.

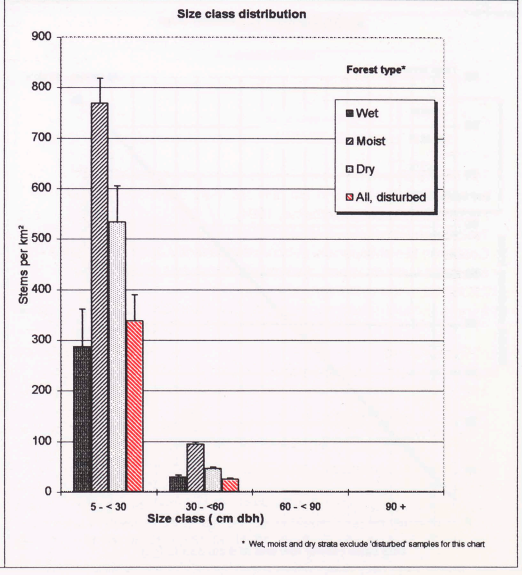




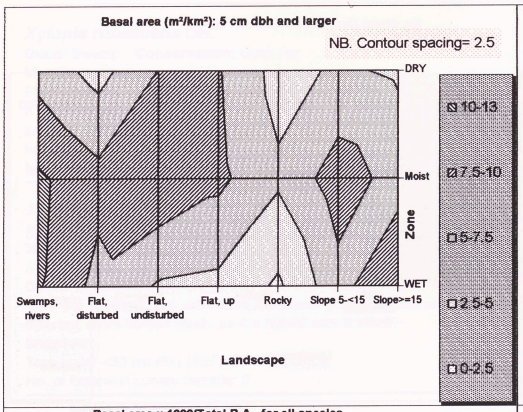


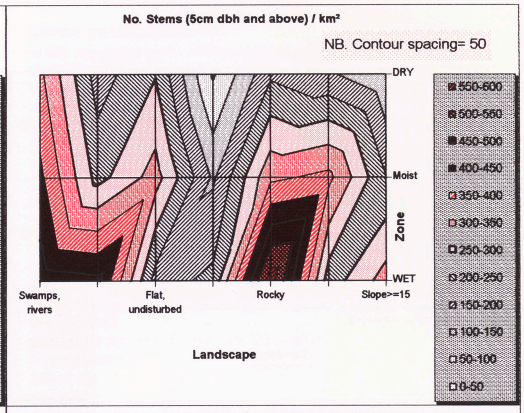


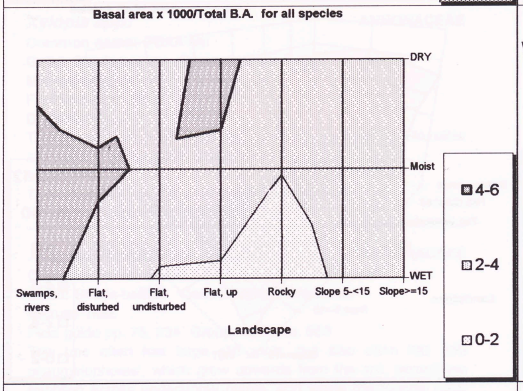


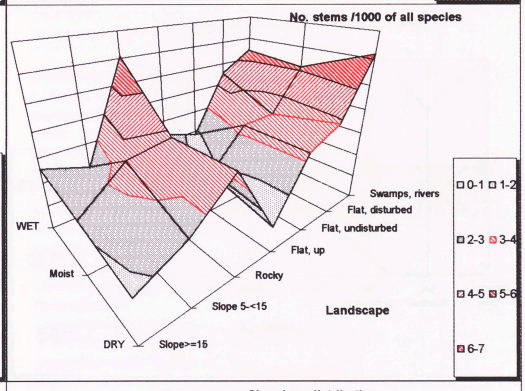


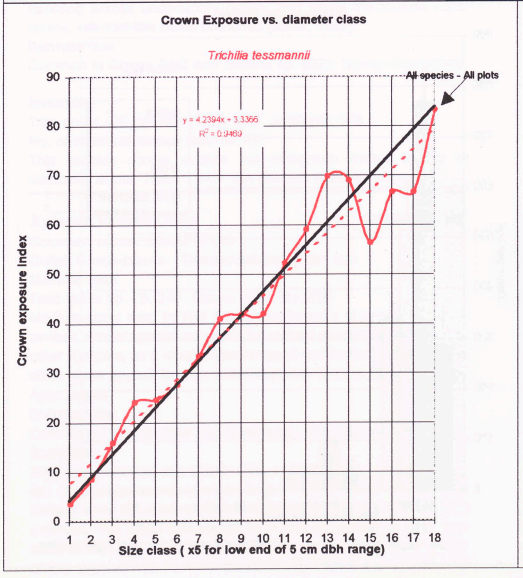
Trichilia tessmannii

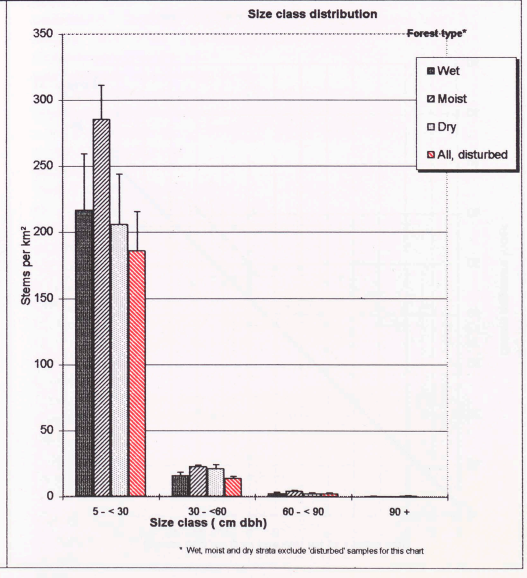




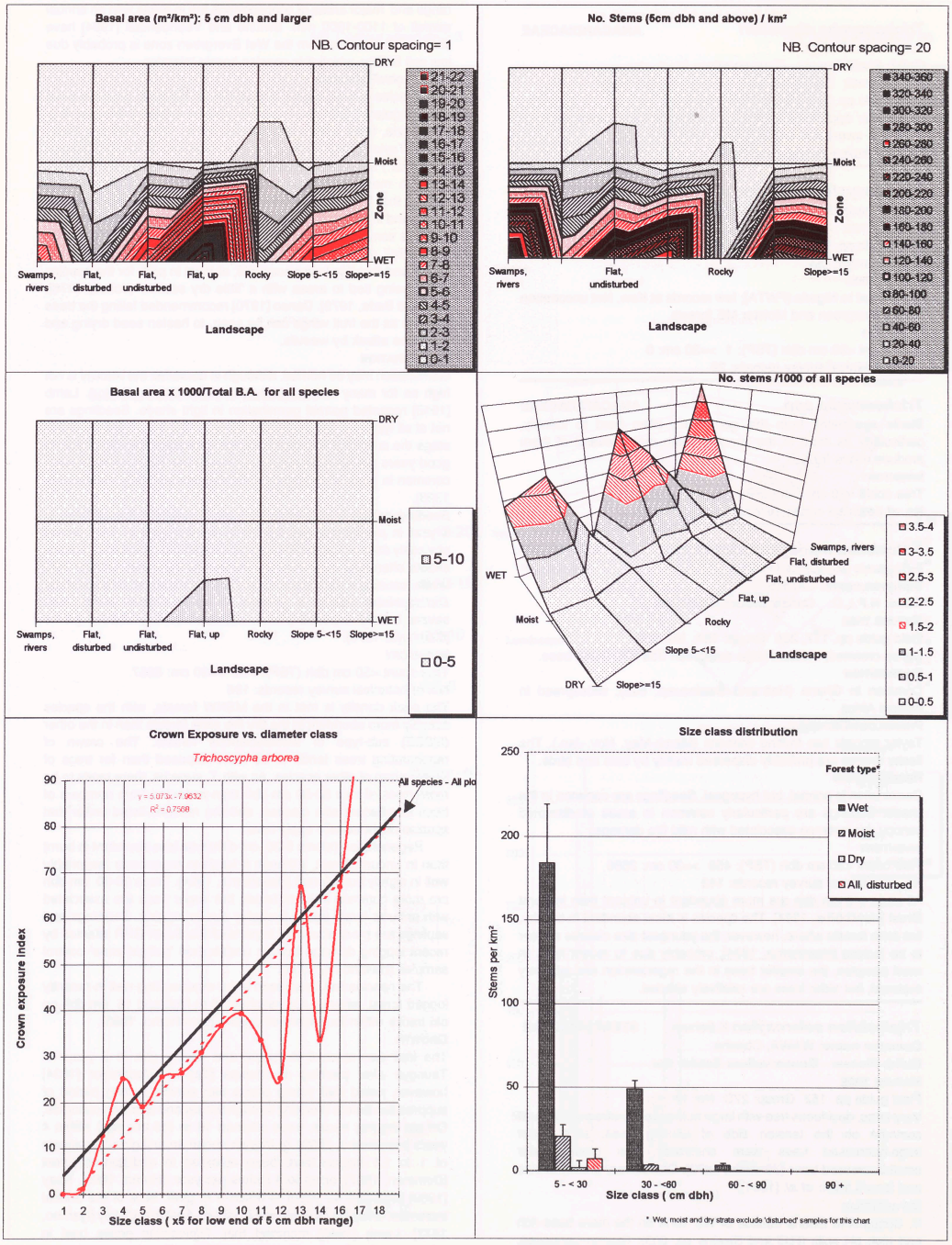








Trichoscypha arborea



Trichoscypha chevalieri **ANACARDIACEAE**
Aubrev. and Pellegr.
Guild: Shade-bearer **Conservation:** Black star
MATURE TREE
Field guide pp. 181 Group: 35A No. 628
Small tree; apparently v. rare in Ghana; in Ivory Coast as well. Fruits are sweet and edible [Irvine, 1961].
No. of botanical survey records: 2

Trichoscypha oba Aubrev. and Pellegr. **ANACARDIACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 181 Group: 35A No. 629
Shrub or small tree.
DISTRIBUTION
Ivory Coast to Nigeria [FWTA]; few records at Kew. Not uncommon in Wet Evergreen and Moister ME forests.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 29

Trichoscypha spp. **ANACARDIACEAE**
Sterile specimens from this genus are often hard to identify, particularly as most of the species seem rare. Several of them produce edible fruit.
INVENTORY
Tree count <30 cm dbh (TSP): 12 >=30 cm: 40
No. of botanical survey records: 20

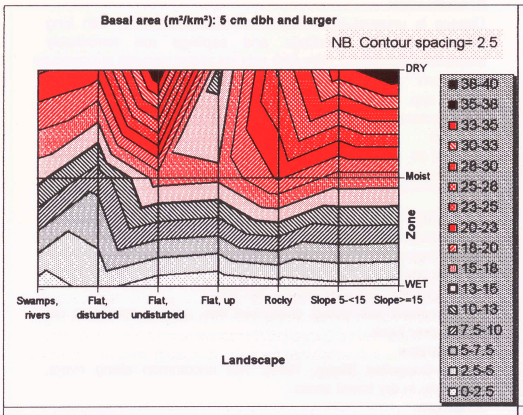
Trilepisium madagascariense DC. **MORACEAE**
(=*Bosqueia angolensis* Ficalho)
Common name: OKURE
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 117, 235 Group: 19A No. 630
Dense-crowned, medium-large evergreen tree with fluted base.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 602); widespread in tropical Africa.
PHENOLOGY/DISPERSAL
Taylor records two fruiting seasons (March-May, Nov.-Jan.). The fleshy drupes are probably dispersed mainly by bats and birds.
REGENERATION
Germination is normal, but hypogeal. Seedlings are common in the shade. Saplings are particularly common in areas of disrupted canopy, for instance associated with mild fire damage.
INVENTORY
Tree count <30 cm dbh (TSP): 459 >=30 cm: 2686
No. of botanical survey records: 142
All sizes > 5 cm dbh are more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The species is most abundant in the dry, fire zone forests where, however, the youngest size classes appear to be lacking [Hawthorne, 1994], probably due to recent fires. In most samples, the smaller trees in the regeneration are relatively exposed, but older trees are relatively shaded.

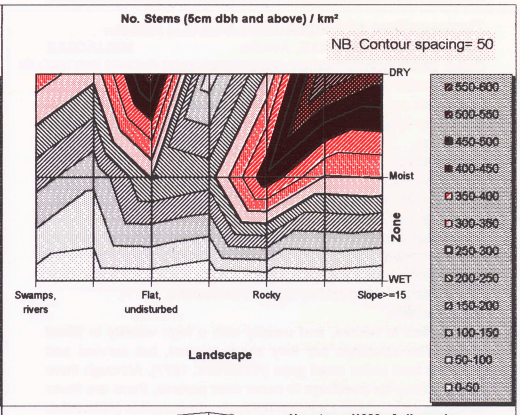
Triplochiton scleroxylon K.Schum. **STERCULIACEAE**
Common name: WAWA, Obeche
Guild: Pioneer **Conservation:** Scarlet star
MATURE TREE
Field guide pp. 152 Group: 27D No. 14
Very large, deciduous tree with large buttresses. Buttressing is most common on the tension side of leaning trees; soils under large-buttressed trees were shallower than those under small-buttressed trees [Johnson, 1972]. Clones vary greatly in size and form [Ladipo *et al.* [1991].
DISTRIBUTION
V. Common in Ghana outside of WE zone on the more base-rich and high pH soils (Hall and Swaine sp. 603); Guineo-Congolian. *Triplochiton* 'zones' where the species is particularly abundant, are summarised for West Africa by Hall and Bada [1979] who note that the species is associated with a two-peak rainfall throughout its range and major areas of concentration are in areas with an annual rainfall of 1100-1800 mm. Swaine and Veendendall [1994] have shown that absence from the Wet Evergreen zone is probably due low soil fertility, which this species barely tolerates.
PHENOLOGY/DISPERSAL
The species is well-known throughout its range to produce seed very irregularly, both on an annual and on a seasonal basis [e.g. Mackenzie, 1959; Lowe, 1968; Jones, 1974, 1976; Hall and Bada, 1979]. Taylor [1960] stated the tree flowered in the dry season (Nov.-Mar.) and fruited around the start of the rains (March-May), but with mast years every 4-5 years. However, Gyima [1986] records that fruiting can start in November in the Moist Evergreen forest, and in December elsewhere, and that fruiting ends in March. There is some suggestion that unusual, low rainfall periods within the rainfall season may be a stimulus to flowering [Mackenzie, 1959], and that this factor accounts, at least in part, for the species range being tied to areas with a 'little dry season' [Jones, 1976], [Hall and Bada, 1979]. Danso [1970] recommended felling the trees as soon as the fruit wings can be seen, to hasten seed drying and to reduce attack by weevils.
REGENERATION
Germination may be normal, although in nurseries the viability is not high as for many species (only 55% according to Taylor). Lamb [1940] recorded normal germination in light shade. Seedlings are not at all typical of shaded understorey, and it is not clear at which stage the control of this distribution is exercised. Seedlings are, in good years (as seemed to be the case in Bia South in 1987) very common in gaps of all sizes except the smallest [e.g. Hawthorne, 1993].
Seedling growth is apparently very rapid, reaching 3 m or more in a year in plantations, yet 1.5-2m in the 4th year of TSS (which obviously does not represent optimal silvicultural conditions). Lateral shoots often take over from the leaders in the quest for high light levels, causing a misshapen trunk [Taylor]. However, infestation by *Diclidophlebia* insects is greatest in lightly shaded plants, less severe in fully exposed plants, but least in fully shaded plants [Osisanya, 1970].
INVENTORY
Tree count <30 cm dbh (TSP): 733 >=30 cm: 8867
No. of botanical survey records: 196
The peak density is met in the MSNW forests, with the species actually more abundant in the dry fire zone forests than in the other (MSSE) sub-type of semideciduous forests. The crown of regenerating trees tends to be more exposed than for trees of similar sizes of other species. As with *T. superba*, there tends to be more trees of size 60-90 cm dbh than expected from numbers of trees in adjacent size classes, and the reasons listed under that species might equally apply here.

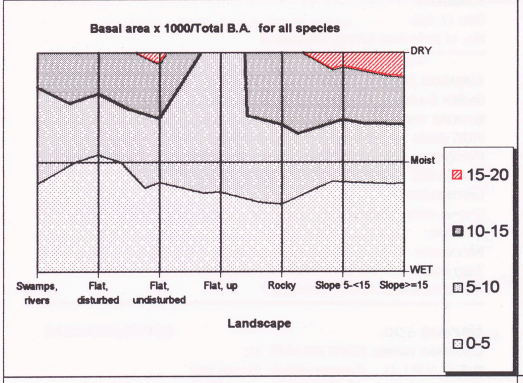
Regeneration (stems 5-30 cm dbh) was less abundant in burnt than in unburnt forest, although it tends to regenerate reasonably well in sightly burnt forest [Hawthorne, 1994]. Trees 30-90 cm dbh are more common in burnt forest, but larger trees are associated with unburnt forest again, probably due to logging. Seedlings and saplings are more abundant in parts of Bia South GPR affected by recent logging damage than in undisturbed 'twilight zone' control samples [Hawthorne, 1993].

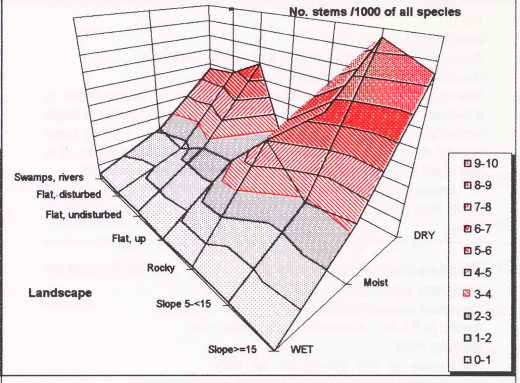
The species has been seen to be regenerating well in recently logged forest, where it has reached 15 m high and 15 cm dbh on old tracks within four years of logging [Hawthorne, 1993].
GROWTH
The tree can reach 8 m height and 40 cm gbh in 3 years of Taungya after planting as stumps [Taylor]. Macgregor [1934] however, noted that young plants can survive a long period of suppression before breaking through the second and third canopies. On old logging tracks, trees attained 15 m (15 cm dbh) within 4 years [Hawthorne, 1993]. In Nigeria, mean annual girth increments of 1 to 1.1 inches have been recorded in undisturbed forest [Dommen, 1957]; or up to 3 inches per year. [Horne, 1962]. Keay [1989] predicted 42 years to reach 9 ft. girth. 50% of the annual increment takes place in Nigeria from mid-April to mid-July [Iyambo, 1971]. Lamb [1940] recorded that *Triplochiton* grows best in mixtures with other species, such as *Khaya*, than in monocultures.
OTHER NOTES
Other refs: Adedigba, [1978]; Boland *et al.*, [1977]; Igboanugo [1991]; Roberts, [1968]; Thompson, [1959]; Kwesiga *et al.*, [1986].

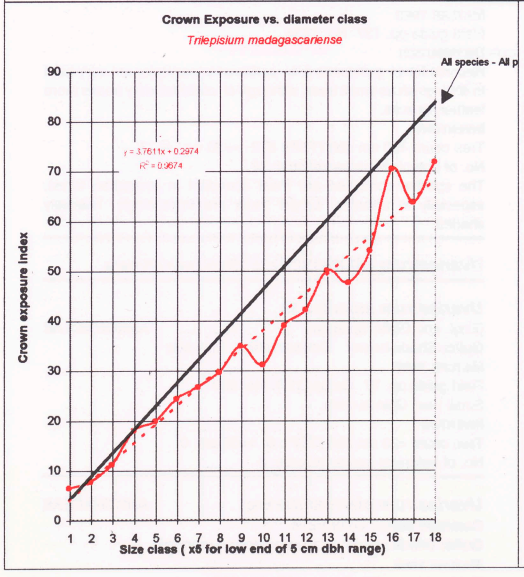
Trilepisium madagascariense

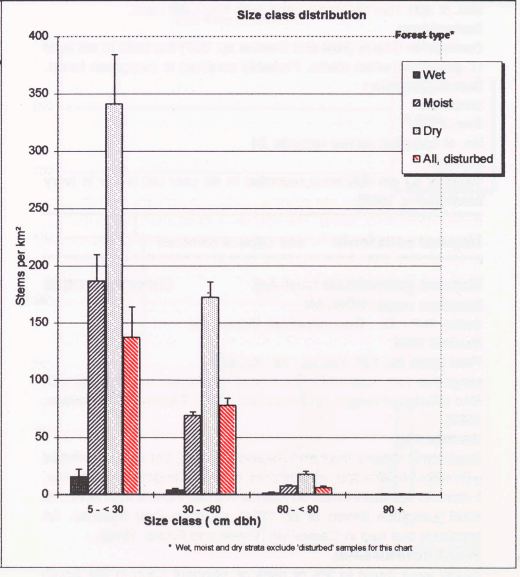












Turraeanthus africanus (Welw. ex C.DC.) Pellegr.
Common name: APAPAYE, Avodire **MELIACEAE**
Guild: Shade-bearer **Conservation:** Pink star
MATURE TREE
Field guide pp. 177, 242 Group: 34C No. 27
Medium or large, but usually low-branched, evergreen tree without buttresses.
DISTRIBUTION
Common in Ghana; Guineo-Congolian (Hall and Swaine sp. 605). Important timber tree, which avoids the wettest and driest forests.
PHENOLOGY/DISPERSAL
The orange capsular fruits are produced, in the Ivory coast at least, rather irregularly, but usually with two peaks in a year. Only some trees (smaller) produce fruits; taller (?male) trees tend not to fruit. The seeds are dispersed by animals [Alexandre, 1977].
REGENERATION
Germination is normal, and usually with a high viability in forest shade. The seedlings are very shade-tolerant, but survival and growth is best under small gaps [Alexandre, 1977]. Although there is a tendency for seedlings to occur near parents, there are fewer seedlings over adults' roots, probably due to parasites [Alexandre, 1977].
INVENTORY
Tree count <30 cm dbh (TSP): 812 >=30 cm: 4748
No. of botanical survey records: 106
The species is most abundant in MSSE forest, where there is adequate regeneration. It is less common in logged forest, though probably more as a consequence of its range not having been heavily exploited by loggers more than as a consequence of a response to logging. Stems > 30 cm dbh tend to be shaded.

Regeneration (stems 5-30 cm dbh) and larger stems are very much less abundant in burnt than in unburnt forest [Hawthorne, 1994].

Uapaca corbisieri De Wild. **EUPHORBIACEAE**
(=*Uapaca esculenta*)
Common name: KONTAMMIRI
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 137 Group: 24 No. 633
See *U.* spp. Has the same habit, with hugh stilt roots.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 607) but hard to tell from *U. guineense* when sterile. Probably confined to evergreen forest. Guineo-Congolian.
INVENTORY
See *U.* spp.
No. of botanical survey records: 24
GROWTH
Trees of 53 cm dbh were recorded in 40 year old fallow in Ivory coast [Kahn, 1982].

Uapaca esculenta see *Uapaca corbisieri*

Uapaca guineensis Muell.Arg. **EUPHORBIACEAE**
Common name: KONTAN
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 137 Group: 24 No. 634
Large tree with huge stilt roots. Forms ectotrophic mycorrhizae with nine species of fungus in Guinea [Ba, 1987; Thoen and Ducousso, 1989].
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 607), but easily confused with other *Uapaca* spp. when sterile; Guineo-Congolian. In Uganda, it came to dominate forest on islands in Lake Victoria abandoned in 1905 [Langdale Brown *et al.* 1964], even on their beaches. An important fruit tree in Cameroun [Vivien and Faure, 1988].
PHENOLOGY/DISPERSAL
Seeds were found in 9% of piles of elephant dung in Bia South GPR in the dry season [Martin, 1991].
REGENERATION
Uapaca is unusual for a stilt-tooted Euphorbiaceae, with long petioles, as the seedlings and saplings are remarkably shade-tolerant.
INVENTORY
See *U.* spp.
No. of botanical survey records: 46
GROWTH
Trees of 30 cm dbh have been recorded in 40 year old secondary forest in Ivory Coast [Kahn, 1982].

Uapaca heudelotii Baill. **EUPHORBIACEAE**
Common name: KONTANAKOA
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 137 Group: 24 No. 632
Medium-sized, stilt-rooted, evergreen tree, usually spreading out from a river bank.
DISTRIBUTION
Guineo-Congolian [Keay, 1989]. Not uncommon along rivers, especially in dry forest areas.
INVENTORY
See *U.* spp.
No. of botanical survey records: 9

Uapaca paludosa Aubrev. and Leandri **EUPHORBIACEAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 137 Group: 24 No. 635
Evergreen, stilt-rooted tree similar, particularly as a sapling, to *U. guineensis*. Young leaves are copper-coloured.
DISTRIBUTION
Gunea-wide, from Ivory Coast to Cameroun [Keay, 1989]. In swamps.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 7

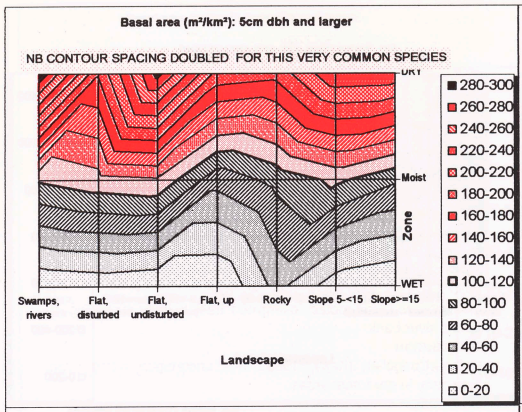
Uapaca spp. **EUPHORBIACEAE**
Common name: KONTAN-MIRI etc
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 137 No. 1634
DISTRIBUTION
Records for *U. guineense* & *U. corbisieri* in particular are very hard to distinguish as small trees, although *U. corbisieri* may heave more leathery leaves.
INVENTORY
Tree count <30 cm dbh (TSP): 572 >=30 cm: 1473
No. of botanical survey records: 32
The species combined are most abundant in evergreen forest, especially in swamps. Larger trees are increasingly, relatively shaded.

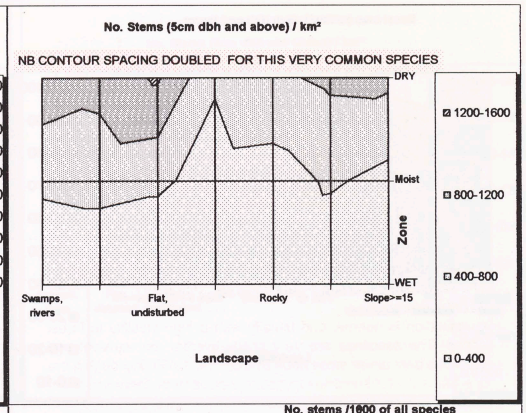
Uvariastrum elliotianum see *Mischogyne elliotiana*

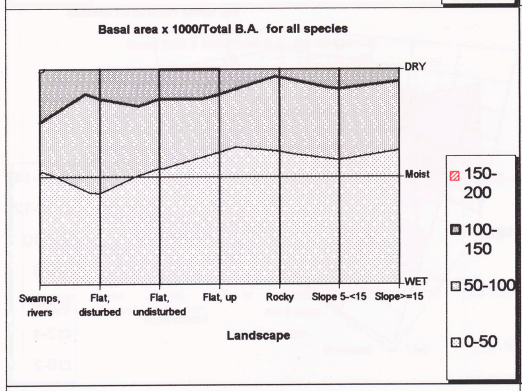
Uvariastrum insculptum
(Engl. and Diels) Sprague **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 77 Group: 12D No. 636
Small tree; Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

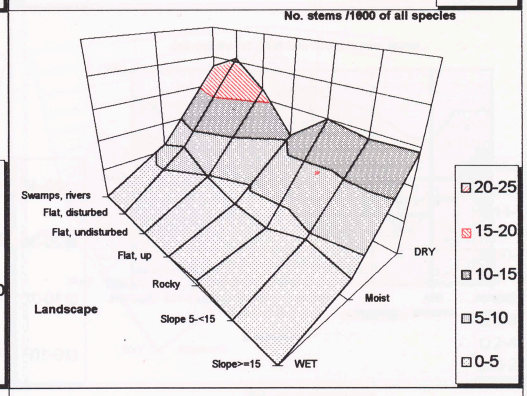
Uvariastrum pierreanum Engl. **ANNONACEAE**
Common name: OTWE-EHI
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 77 Group: 12D No. 637
Medium-sized tree.

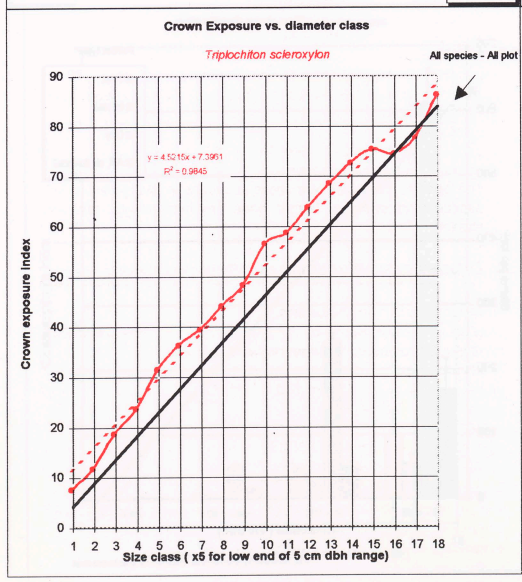
Triplochiton scleroxylon

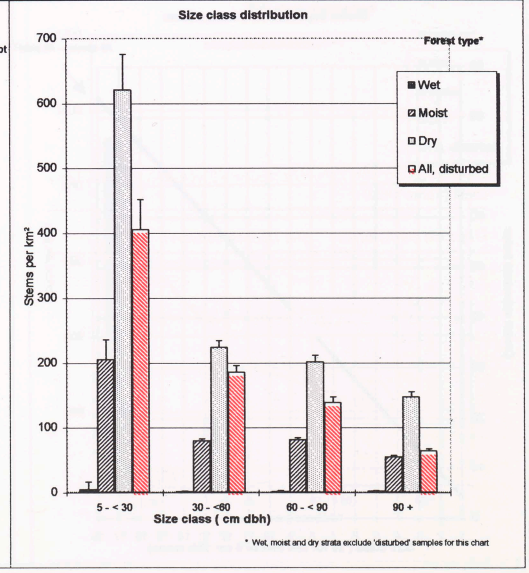




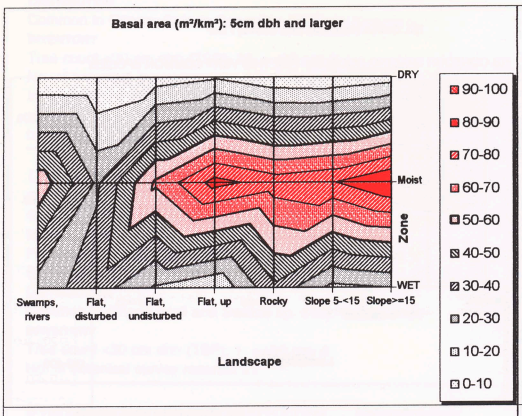


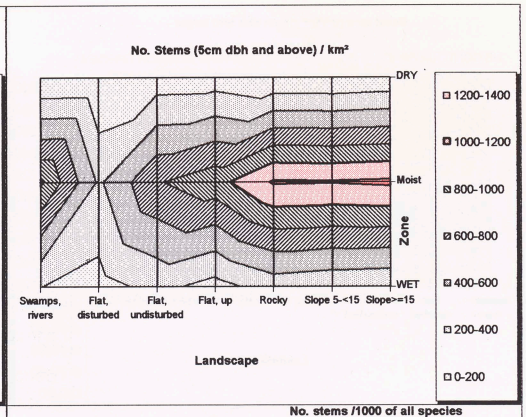


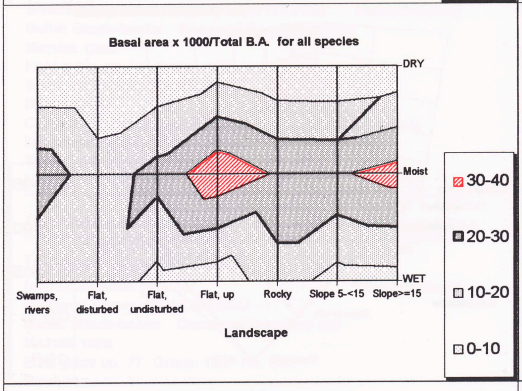


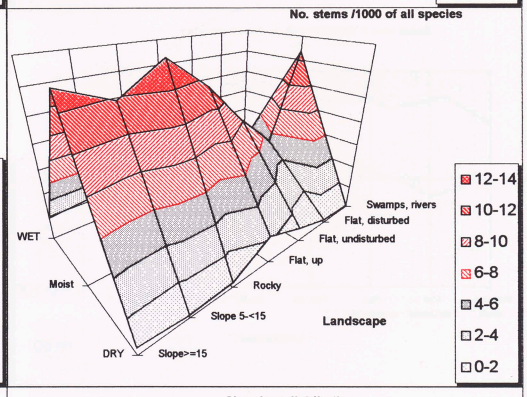


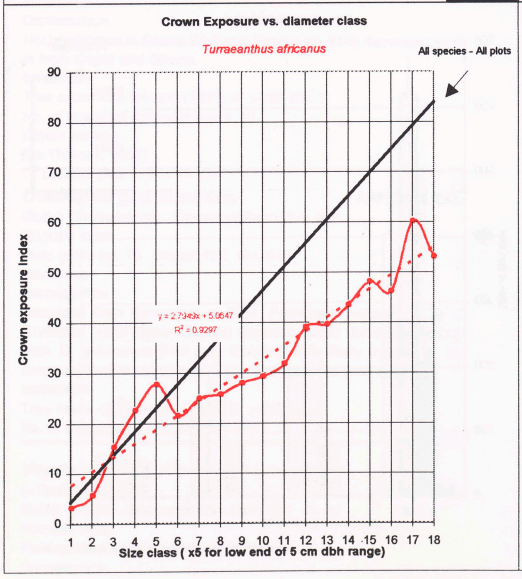
Turraeanthus africanus

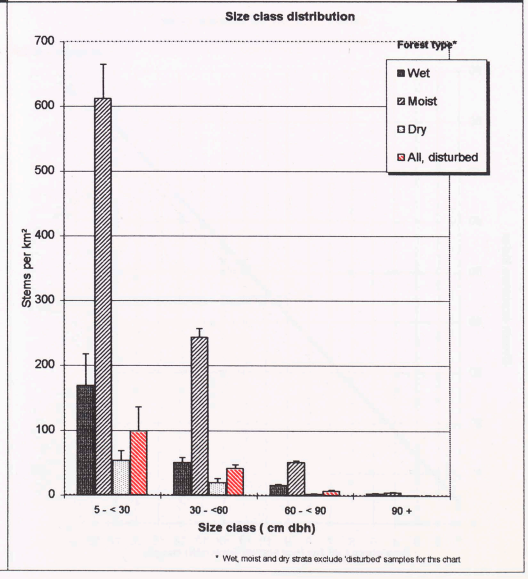




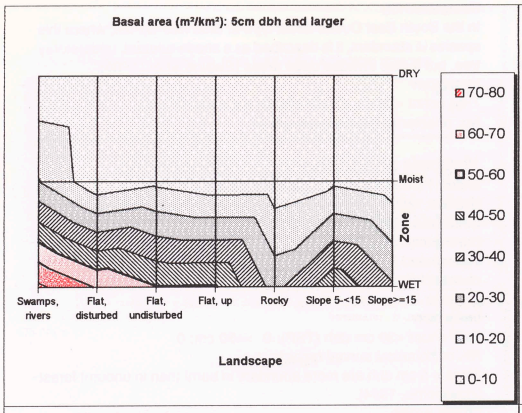


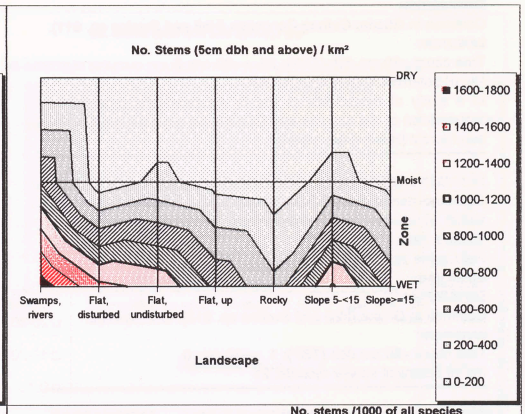


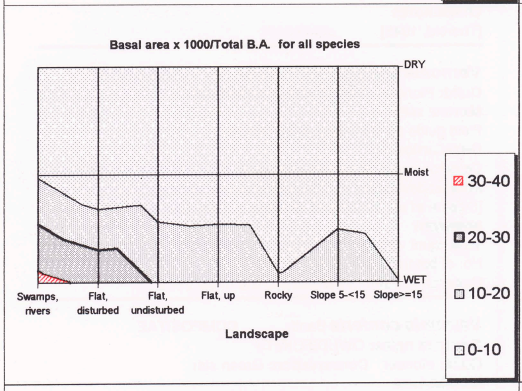


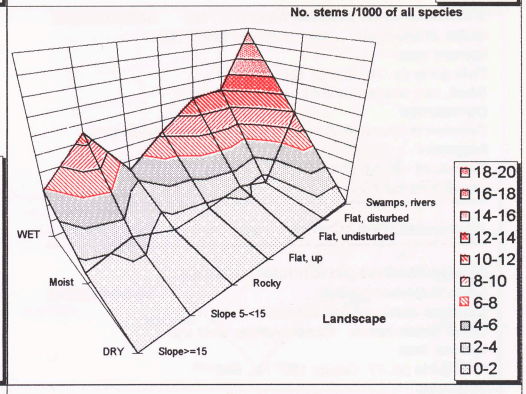


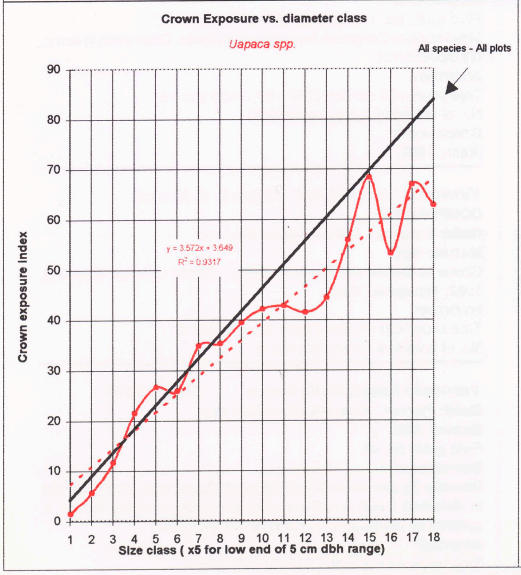
Uapaca spp.

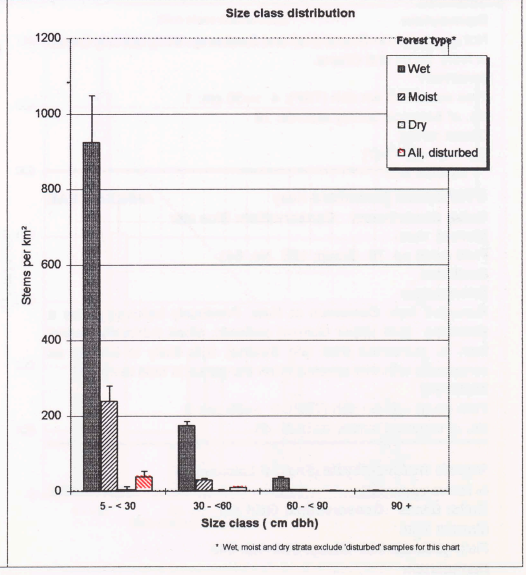

Basal area (m²/km²): 5cm dbh and larger
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
70-80
60-70
50-60
40-50
30-40
20-30
10-20
0-10


No. Stems (5cm dbh and above) / km²
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
1600-1800
1400-1600
1200-1400
1000-1200
800-1000
600-800
400-600
200-400
0-200


Basal area x 1000/Total B.A. for all species
DRY
Moist
WET
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
30-40
20-30
10-20
0-10


No. stems /1000 of all species
WET
Moist
DRY
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
18-20
16-18
14-16
12-14
10-12
8-10
6-8
4-6
2-4
0-2


Crown Exposure vs. diameter class
Uapaca spp.
All species - All plots
y = 3.572x + 3.649
R² = 0.9317
Crown exposure index
Size class (x5 for low end of 5 cm dbh range)


Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
90 +
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

DISTRIBUTION
Common in Ghana; Guineo-Congolian (Hall and Swaine sp. 611).
INVENTORY
Tree count <30 cm dbh (TSP): 25 >=30 cm: 2
No. of botanical survey records: 65
In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].

Uvariodendron angustifolium (Engl. and Diels) R.E. Friis
Common name: BoMMoFOKWADU **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 77 Group: 12D No. 638
Small tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 612); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 21

Uvariodendron calophyllum R.E.Fries **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 78 Group: 12E No. 639
Small, very shade-tolerant tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 613); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 76

Uvariodendron mirabile see *Uvariodendron occidentale*

Uvariodendron occidentale Le Thomas
(=*Uvariodendron mirabile*) **ANNONACEAE**
Common name: eSONOKWADU
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 77 Group: 12D No. 640
Small tree.
DISTRIBUTION
Not uncommon in Ghana (Hall and Swaine sp. 614), but only known in Ivory Coast and Ghana.
INVENTORY
Tree count <30 cm dbh (TSP): 4 >=30 cm: 1
No. of botanical survey records: 18
OTHER NOTES
[Le Thomas, 1967]

Uvariopsis globiflora Keay **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 78 Group: 12E No. 641
Small tree.
DISTRIBUTION
Recorded from Cameroun at Kew. Previously believed to be a Ghanaian (and Upper Guinea) endemic, albeit dubiously distinct from *U. guineensis* [Hall and Swaine]. It is likely to end up as conspecific with that species when the genus is next reviewed.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 40

Vepris heterophylla (Engl.) R.Letouzey
(=*Teclea sudanica*) **RUTACEAE**
Guild: Shade **Conservation:** Gold star
MATURE TREE
Field guide pp. 165 Group: 31A No. 643
DISTRIBUTION
Known only in South East Outlier forest, also in Mali and n. Cameroun.
REGENERATION
In the South East Outlier forest type at Shai hills G.P.R., where this species is abundant, it is described as a shade-tolerant, understorey tree, but it also invades open areas [Swaine *et al.*, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 4

Vernonia amygdalina Del. **COMPOSITAE**
Guild: Pioneer/savanna **Conservation:** - star
MATURE TREE
Small tree of savanna and disturbed dry forest.
DISTRIBUTION
Widespread in tropical Africa. Has bitter leaves and twigs, used for chewsticks in Nigeria [Keay, 1989]. Usually on well-drained soils in savanna.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1
Sizes > 5 cm dbh are more abundant in burnt than in unburnt forest [Hawthorne, 1994].
OTHER NOTES
[Thorold, 1945]

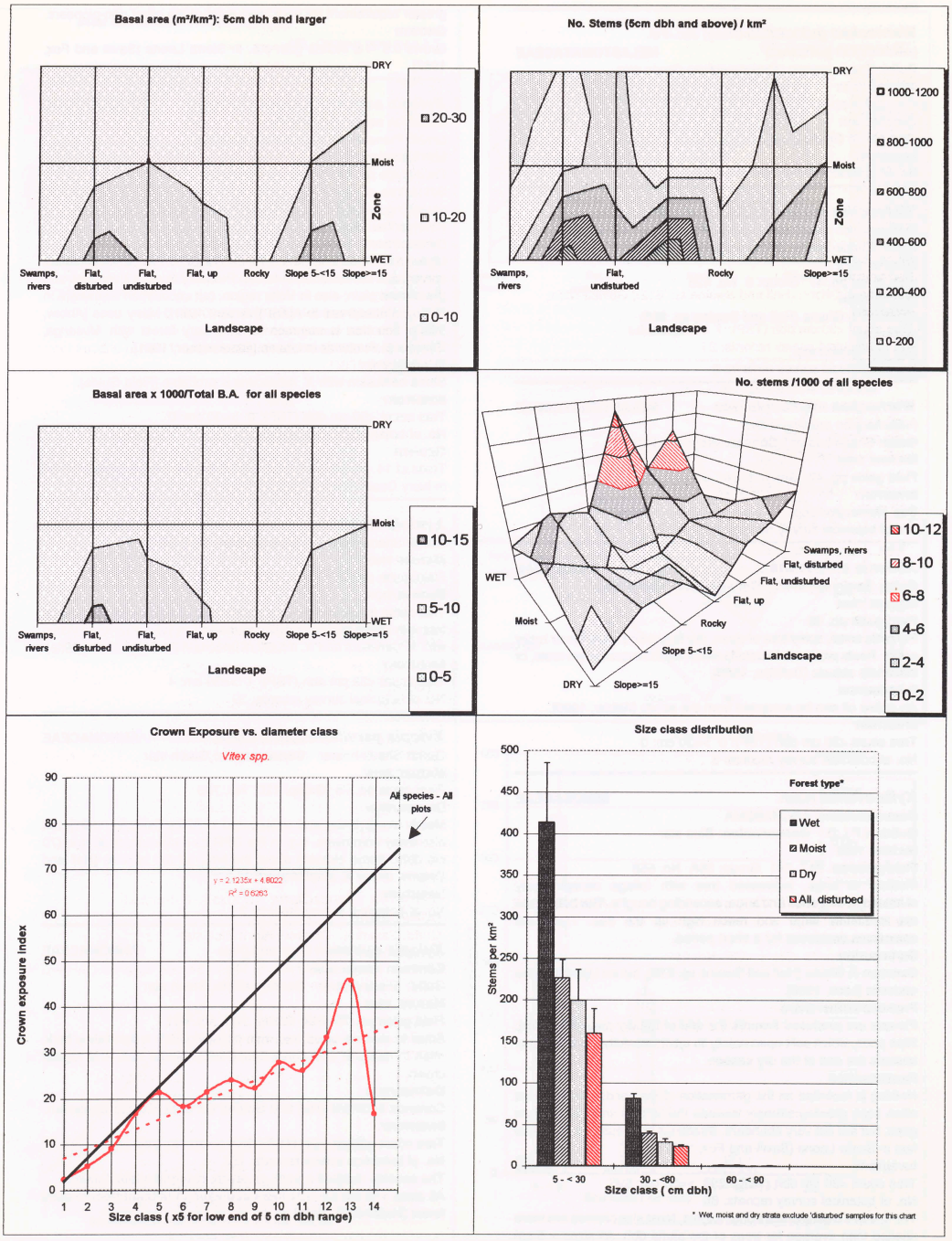
Vernonia colorata (Willd.) Drake **COMPOSITAE**
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 141 Group: 26 No. 645
DISTRIBUTION
Common weedy shrub; widespread in tropical Africa; e.g. important in forest developing from fire-protected savanna on the Accra Plains [Swaine *et al.*, 1990]; and in fallow in Togo [Guelly *et al.*, 1993].
INVENTORY
Tree count <30 cm dbh (TSP): 2 >=30 cm: 0
No. of botanical survey records: 6
Common in burnt forest well into the forest zone.

Vernonia conferta Benth. **COMPOSITAE**
Common name: OWUDIFOKeTe
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 141 Group: 26 No. 646
Small Guineo-Congolian tree with large leaves. Often seen in damp, disturbed forest.
INVENTORY
Tree count <30 cm dbh (TSP): 27 >=30 cm: 16
No. of botanical survey records: 20
OTHER NOTES
[Kahn, 1982]

Vernonia richardiana (O.Ktze.) P.-Sermolli
COMPOSITAE
Guild: Savanna **Conservation:** Blue star
MATURE TREE
Ghana to Sudan and Zaire; In higher altitude savanna [Geerling, 1982; Akpagana, 1992].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

Vernonia titanophylla Brenan **COMPOSITAE**
Guild: Pioneer **Conservation:** Gold star
MATURE TREE
Field guide pp. 41
DISTRIBUTION
Recently discovered in Central Africa [Moutsambote, 1990]. Occurs in disturbed forest on Atewa; distinguishable from the similar *V. conferta* by glandular processes on the petioles.
INVENTORY
Tree count <30 cm dbh (TSP); 0 >=30 cm; 0
No. of botanical survey records: 0

Vitex spp.


Basal area (m²/km²): 5cm dbh and larger
DRY
Moist
WET
Zone
Swamps, rivers
Flat, disturbed
Flat, undisturbed
Flat, up
Rocky
Slope 5-<15
Slope>=15
Landscape
20-30
10-20
0-10
No. Stems (5cm dbh and above) / km²
1000-1200
800-1000
600-800
400-600
200-400
0-200
Basal area x 1000/Total B.A. for all species
10-15
5-10
0-5
No. stems /1000 of all species
10-12
8-10
6-8
4-6
2-4
0-2
Crown Exposure vs. diameter class
Vitex spp.
All species - All plots
y = 2.1235x + 4.8022
R² = 0.6263
Crown exposure index
Size class (x5 for low end of 5 cm dbh range)
Size class distribution
Forest type*
Wet
Moist
Dry
All, disturbed
Stems per km²
5 - < 30
30 - <60
60 - < 90
Size class (cm dbh)
* Wet, moist and dry strata exclude 'disturbed' samples for this chart

Warneckea guineense (Keay) Jac.-Fel.
(=*Memecylon guineense*) **MELASTOMATACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 47 Group: 6 No. 427
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 378).
INVENTORY
No. of botanical survey records: 65

Warneckea membranifolium (Hook.f.) Jac.-Fel.
(=*Memecylon membranifolium* Hook.f.) **MELASTOMATACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 47 Group: 6 No. 426
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 380)
INVENTORY
See *Memecylon* spp.
No. of botanical survey records: 3

Warneckea memecyloides **MELASTOMATACEAE**
(=*Memecylon memecyloides*)
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 47 Group: 6 No. 429
INVENTORY
See *Memecylon* spp.
No. of botanical survey records: 6

Ximenia americana L. **OLACACEAE**
Guild: Savanna/non-for **Conservation:** Green star
MATURE TREE
Field guide pp. 95
Parasitic small, spiny tree of open, dry forest and savanna or rocky areas. Roots produces haustoria which attack even its own roots, or inanimate objects [Defillips, 1969].
DISTRIBUTION
An edible oil can be extracted from the seeds [Abbiw, 1990].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 3

Xylia evansii Hutch. **MIMOSACEAE**
Common name: ABOBABEMA
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 217, 241 Group: 38A No. 658
Medium to large, buttressed tree with foliage conspicuously clustered at twig ends and large, ascending boughs. The buttresses are frequently large and reach high up the tree. Trees are sometimes deciduous for a short period.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 619), but an Upper Guinea endemic [Lock, 1989].
PHENOLOGY/DISPERSAL
Flowers are produced towards the end of the dry season [Taylor]. Ripe pods, which split open noisily to eject forcefully the flat seeds, towards the end of the dry season.
REGENERATION
Nothing is recorded on the germination of the seeds. Saplings are often seen growing strongly towards the light of small to medium gaps, but are not very abundant. Seedlings not abundant, but grow fast in Sierra Leone [Savill and Fox, 1967].
INVENTORY
Tree count <30 cm dbh (TSP): 298 >=30 cm: 696
No. of botanical survey records: 66
The species clearly prefers drier forests. Most size classes are more shaded than average for trees of the same dbh. All sizes > 5 cm dbh are (slightly) more abundant in unburnt than in burnt forest [Hawthorne, 1994]. The regeneration, which is most common in MSNW forest, evidently flourishes in disturbed forest, suggesting a greater requirement for gaps than most of the other non-pioneers.
GROWTH
Grows 0.8 -1.8 inches girth p.a. in Sierra Leone [Savill and Fox, 1967].

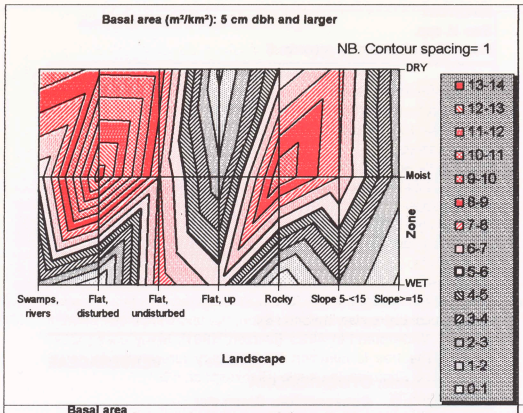
Xylopia aethiopica (Dunal) A.Rich. **ANNONACEAE**
Common name: HWENETIA
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 75 Group: 12C No. 659
Small tree of secondary forest and swampy areas. Moderately spreading, but regular, airy crown of horizontal branches, ascending towards their tips.
DISTRIBUTION
Unusual distribution in Ghana, possibly as a consequence of human spread, but not common in forest. Probably favours riversides and the coastal plain; also in Volta region, but uncommon elsewhere in Ghana. Widespread in Africa [Iversen, 1991]. Many uses [Abbiw, 1990]. The tree is common in secondary forest with *Musanga*, *Elaeis* and *Funtumia* in Liberia [Blankespoor, 1991].
FIELD IDENTITY
Some confusion with *X. rubescens* is probable [Field Guide].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1
GROWTH
Trees of 14 cm dbh were recorded in 15 year old secondary forest in Ivory Coast [Kahn, 1982].

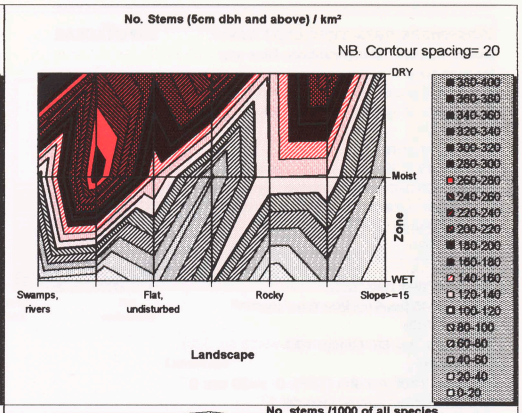
Xylopia elliotii Engl. **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
Field guide pp. 75 Group: 12C No. 660
DISTRIBUTION
This name is used here for a medium sized canopy or subcanopy tree with rather golden/metallic leaves esp. in WE zone; relationship with *X. parviflora* and *X. acutiflora* uncertain [see Hall and Swaine].
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 4
No. of botanical survey records: 39

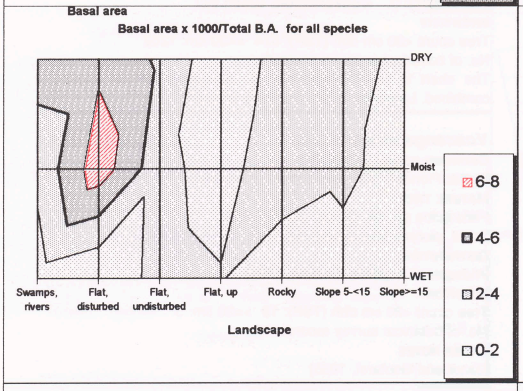
Xylopia parviflora (Bak.f.) Ghesq. **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 75 Group: 12C No. 705
DISTRIBUTION
Mainly along rivers, and widespread in Africa [Iversen, 1991], but also away from rivers, e.g. in Bia GPR as a medium-sized tree (70 cm dbh). Some concern about the limits of the species [Hall and Swaine, under *X. acutiflora*].
INVENTORY
No. of botanical survey records: 2

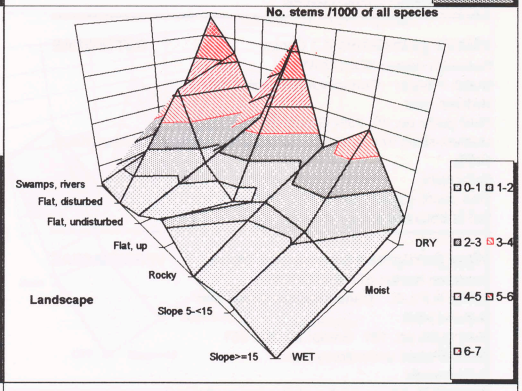
Xylopia quintasii Engl. and Diels **ANNONACEAE**
Common name: oBAA
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 75, 242 Group: 12C No. 661
Small to medium-sized tree, with conspicuously rough-flakey bark, often in damp or secondary forest, with slender bole and regular crown.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 621); Guineo-Congolian.
INVENTORY
Tree count <30 cm dbh (TSP): 554 >=30 cm: 285
No. of botanical survey records: 157
The species reaches a peak on steep, evergreen forest slopes. All sizes > 5 cm dbh are more abundant in unburnt than in burnt forest [Hawthorne, 1994].

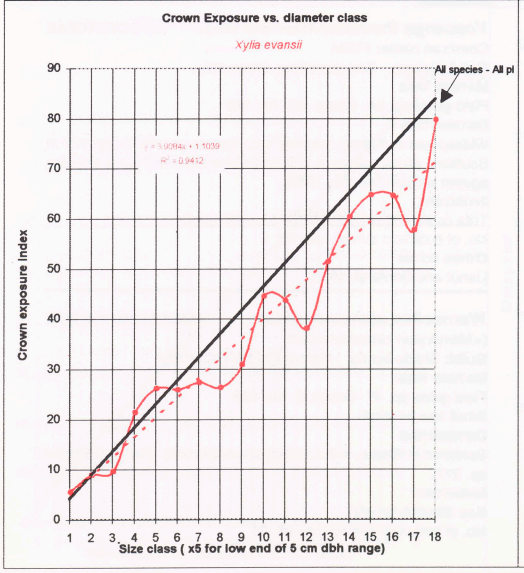
Xylia evansii

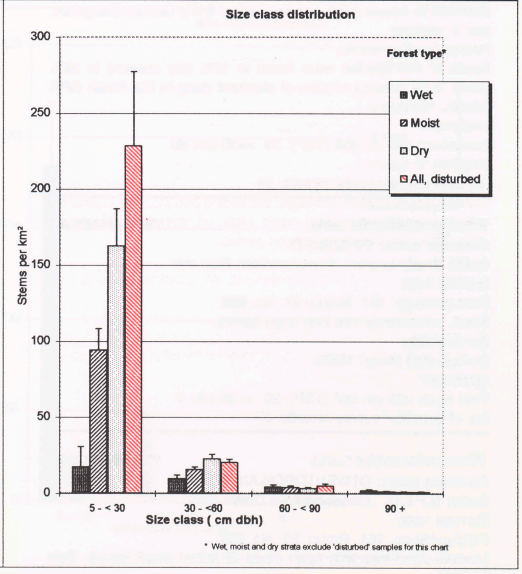












Vincentella passargei (Engl.) Aubrev. **SAPOTACEAE**
Guild: Swamp **Conservation:** Blue star
MATURE TREE
Field guide pp. 65 Group: 10D No. 649
Small tree of gallery forest in savanna. Widespread in tropical Africa.
TAXONOMIC NOTE
Pennington [1991] has sunk *Vincentella* into *Synsepalum*. This species should now become *Synsepalum passargei* (Engler) Pennington. Likewise *V. revoluta*, a very rare Guineo-Congolian tree of riversides in Ghana, becomes *Synsepalum revolutum* (Baker) Pennington.

Vincentella revoluta **SAPOTACEAE**
Guild: 0 **Conservation:** Blue star
MATURE TREE
Field guide pp. 65 Group: 10D
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 1

Vismia guineensis (L.) Choisy **GUTTIFERAE**
Common name: KOSOWANINI
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 49, 235 Group: 8A No. 650
Medium-sized tree similar to *Harungana*. Guineo-Congolian [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 17 >=30 cm: 0
No. of botanical survey records: 10

Vitex ferruginea Schumm. and Thonn. **VERBENACEAE**
Common name: oTWENTOROWA
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 161 Group: 29 No. 651
Medium-sized understorey tree.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 617); Guineo-Congolian; see *V. rivularis*.
PHENOLOGY/DISPERSAL
Seeds of this species were found in 13% (dry season) to 32% (small rainy season) of piles of elephant dung in Bia South GPR [Martin, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 39 >=30 cm: 88
See also *V.* spp.
No. of botanical survey records: 54

Vitex grandifolia Gurke **VERBENACEAE**
Common name: DINSINKRO
Guild: Shade-bearer **Conservation:** Blue star
MATURE TREE
Field guide pp. 161 Group: 29 No. 652
Small, understorey tree with large leaves.
DISTRIBUTION
Guinea-wide [Keay, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 20 >=30 cm: 4
No. of botanical survey records: 67

Vitex micrantha Gurke **VERBENACEAE**
Common name: OTWENTOROWANINI
Guild: N.P.L.D. **Conservation:** Green star
MATURE TREE
Field guide pp. 161 Group: 29 No. 654
Medium-sized tree with open cloud of rather small leaves. Bole uneven.
DISTRIBUTION
Common in Ghana, and associated strongly with base-poor soils (Hall and Swaine sp. 618); Upper Guinea and Cameroun.
INVENTORY
See *V.* spp.
No. of botanical survey records: 5

Vitex rivularis Gurke **VERBENACEAE**
Common name: OTWENTOROWABERE
Guild: N.P.L.D. **Conservation:** Blue star
MATURE TREE
Field guide pp. 161 Group: 29 No. 653
Medium-sized tree with rather sparse, open crown.
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 617); Guineo-Congolian. Not easily distinguished from *V.ferruginea*: amalgamated in TSP inventory.
INVENTORY
See *V.* spp.
No. of botanical survey records: 64

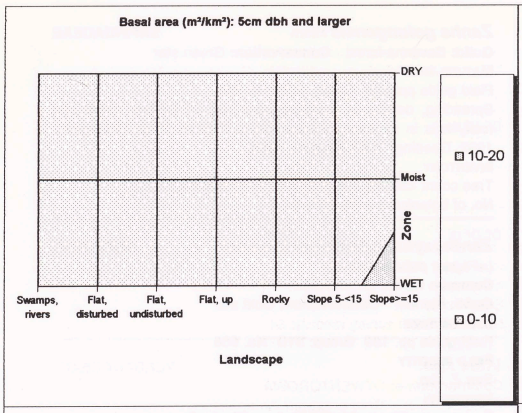
Vitex spp. **VERBENACEAE**
Common name: OTWENTOROWA
Guild: N.P.L.D. **Conservation:** Green star
INVENTORY
Tree count <30 cm dbh (TSP): 574 >=30 cm: 1262
No. of botanical survey records: 9
The chart is for *V. micrantha*, *V. ferruginea* and *V. rivularis* combined. Larger trees are markedly shaded.

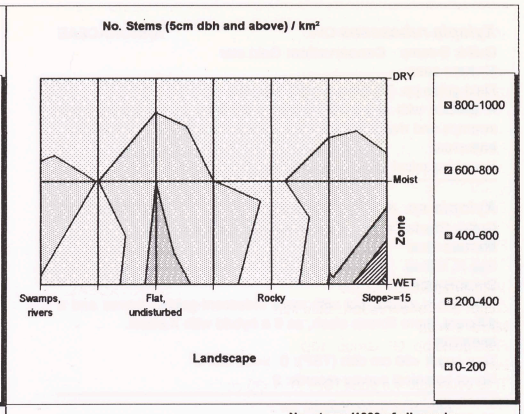
Voacanga africana Stapf **APOCYNACEAE**
Common name: OFURUMA
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 54 Group: 9C No. 655
Small, pioneer tree of very disturbed forest, roadsides etc.
DISTRIBUTION
Widespread in Africa [Iversen, 1991].
INVENTORY
Tree count <30 cm dbh (TSP): 19 >=30 cm: 3
No. of botanical survey records: 14
OTHER NOTES
[Janot and Goutarel, 1955]

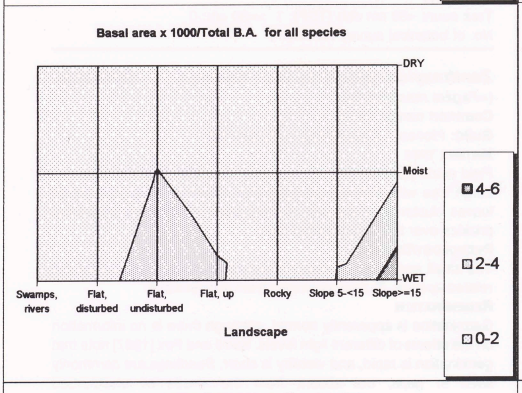
Voacanga thouarsii Roem. and Schult. **APOCYNACEAE**
Common name: FOBA
Guild: Swamp **Conservation:** Green star
MATURE TREE
Field guide pp. 54 Group: 9C No. 656
DISTRIBUTION
Widespread in African swamps etc.; known as wild Frangipani in Southern Africa, where it has been recommended as a defence against erosion [Wielhe, 1989].
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 1
OTHER NOTES
[Janot and Goutarel, 1955]

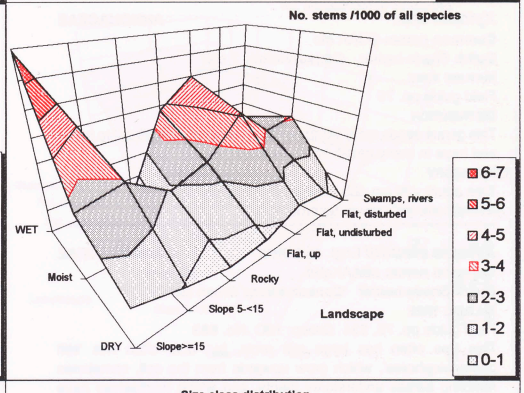
Warneckea cinnamonoides **MELASTOMATACEAE**
(=*Memecylon cinnamonoides*)
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 47 Group: 6 No. 425
Small tree or shrub.
DISTRIBUTION
Scattered in Ghana, in the semideciduous forests (Hall and Swaine sp. 377).
INVENTORY
See *Memecylon* spp.
No. of botanical survey records: 34

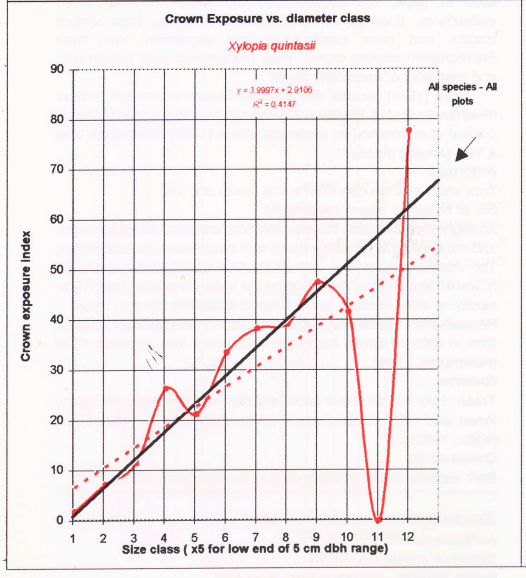
Xylopia quintasii

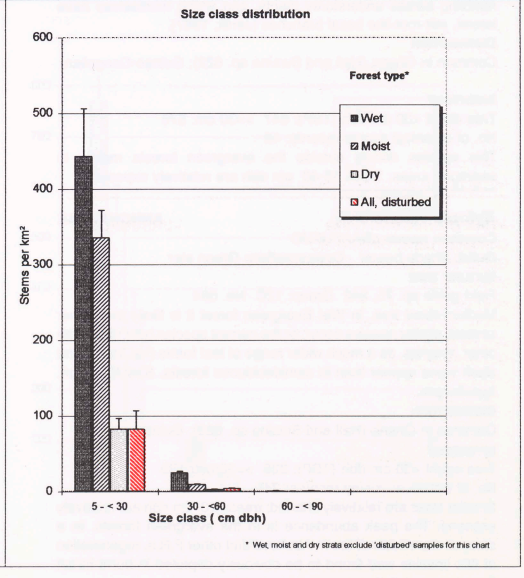












Xylopia rubescens Oliv. **ANNONACEAE**
Guild: Swamp **Conservation:** Gold star
MATURE TREE
Field guide pp. 75 Group: 12C No. 662
A species with stilt roots, probably confined to evergreen forest swamps and rivers, but with very similar foliage to *X. aethiopica.*
INVENTORY
No. of botanical survey records: 16

Xylopia sp. aff. hypolampra **ANNONACEAE**
Guild: Shade-bearer **Conservation:** Gold star
MATURE TREE
See *X. villosa.*
DISTRIBUTION
Tree like X.villosa, but with more iridescent-golden leaves and a different, more fibrous slash, as if a hybrid with X.elliotii.
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 2

Xylopia spp. **ANNONACEAE**
Common name: OBAA etc
Guild: Shade-bearer **Conservation:** ? star
MATURE TREE
Field guide pp. 75
DISTRIBUTION
This genus needs more work; saplings have proved difficult to name and have in many cases been placed here.
INVENTORY
Tree count <30 cm dbh (TSP): 59 >=30 cm: 19
No. of botanical survey records: 7

Xylopia staudtii Engl. and Diels **ANNONACEAE**
Common name: oBAAKoKo
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 75, 234 Group: 12C No. 663
This tree often has large stilt roots, but also often has 'stilt pneumatophores', which grow upwards from the soil, sometimes rambling across understorey plants, and which themselves have lateral, stilt-root-like basal branches [Jénik, 1967].
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 622); Guineo-Congolian.

INVENTORY
Tree count <30 cm dbh (TSP): 647 >=30 cm: 576
No. of botanical survey records: 48
This species occurs outside the evergreen forests mainly in swampier areas. Trees 15-40 cm dbh are relatively exposed.

Xylopia villosa Chipp **ANNONACEAE**
Common name: oBAAFUFUO
Guild: Shade-bearer **Conservation:** Green star
MATURE TREE
Field guide pp. 75, 242 Group: 12C No. 664
Medium-sized tree. In Wet Evergreen forest it is likely that either several, similar species occur, or the current species hybridises with other *Xylopias*, as a much wider range of leaf forms (hairiness) and slash types appear than in semideciduous forests. See *X. sp. aff. hypolampra.*
DISTRIBUTION
Common in Ghana (Hall and Swaine sp. 623); Guinea-wide.
INVENTORY
Tree count <30 cm dbh (TSP): 228 >=30 cm: 180
No. of botanical survey records: 249
Smaller trees are relatively shaded; trees> 20 cm dbh are relatively exposed. The peak abundance is in the evergreen forests. In a study of the effects of fire in Asukese and other F.R.s, regeneration of this species was found to be obviously depleted in burnt forest [Hawthorne, 1994].

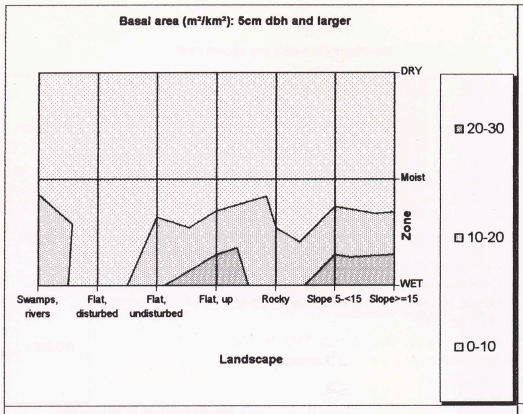
Zanha golungensis Hiern **SAPINDACEAE**
Guild: Savanna-forest **Conservation:** Green star
MATURE TREE
Field guide pp. 188 Group: 36B No. 665
Spreading, deciduous, medium-sized tree of Gallery forest and rocky hills in savanna, widespread in tropical Africa [Akpagana, 1992; Geerling, 1982; Synnott, 1983].
INVENTORY
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0
No. of botanical survey records: 0

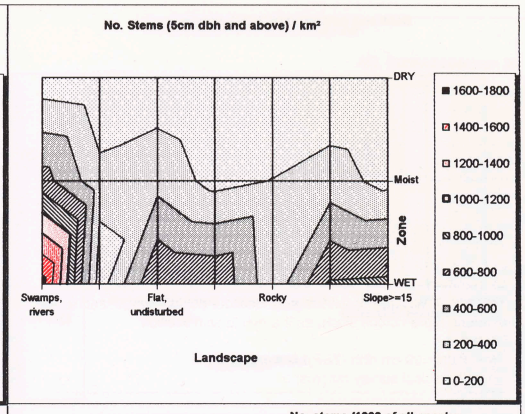
Zanthoxylum chevalieri Waterman **RUTACEAE**
(=*Fagara pubescens)*
Common name: OYAABERE
Guild: Pioneer **Conservation:** Gold star
MATURE TREE
Field guide pp. 169 Group: 31D No. 666
FIELD IDENTITY
See *Z.* spp.
INVENTORY
Tree count <30 cm dbh (TSP): 1 >=30 cm: 0
No. of botanical survey records: 3

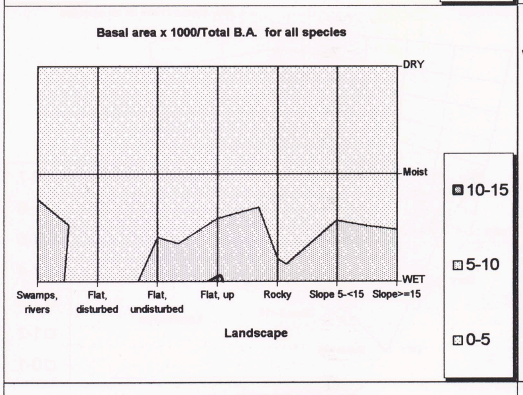
Zanthoxylum gilletii (De Wild.) Waterman **RUTACEAE**
(=*Fagara macrophylla*)
Common name: OKUO
Guild: Pioneer **Conservation:** Green star
MATURE TREE
Field guide pp. 169, 233 Group: 31D No. 667
Large tree with *Entandrophragma*-like crown of large, compound leaves clustered at the end of stout twigs. With many pyramidal prickles over the unbuttressed bole.
PHENOLOGY/DISPERSAL
The small seeds are probably bird-dispersed, as recorded for the related species *Z. zanthoxyloides* [Hall and Swaine].
REGENERATION
Germination is apparently normal, although there is no information on the effects of different light levels. Savill and Fox [1967] note that germination is rapid, and viability is short. Seedlings are commonly seen in gaps, but absent from the shade of undisturbed understorey. Saplings are conspicuous emerging from climber tangles and other patches of low vegetation, with their *Entandrophragma*-like crown. They are obvious light demanders, and indicators of secondary forest.
Ross [1954] records this species as one of several pioneer trees dominating at 15 years, the vegetation of large gaps following a wave of dominance by *Musanga.* Jones [1974] categorises it as a 'fast-growing pioneer'.
INVENTORY
Tree count <30 cm dbh (TSP): 116 >=30 cm: 175
No. of botanical survey records: 64
As might be anticipated, the regeneration flourishes in logged forest, and the species is generally found with a relatively exposed crown. The relative exposure is not as marked as might be expected, however. In a study of the effects of fire in Asukese and other F.R.s, seedlings were found to thrive in burnt forest [Hawthorne, 1994]. Regeneration (stems 5-30 cm dbh) was more abundant in burnt than in unburnt forest, but larger trees were less common there [Hawthorne, 1994].
GROWTH
Trees of 50 cm dbh have been recorded in 40 year old secondary forest, and 105 cm dbh trees in 29 year old forest, in Ivory Coast [Kahn, 1982].
OTHER NOTES
Bark extracts have anti-leukaemia properties [Wall *et al.*, 1987].

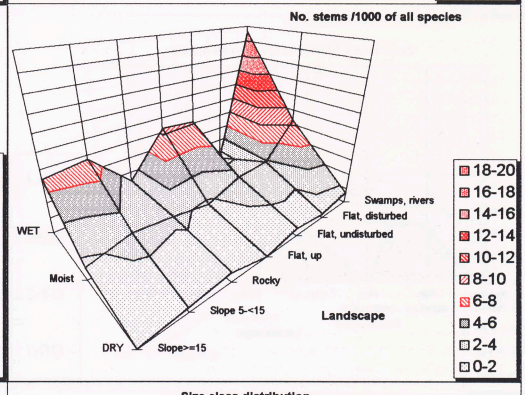
Zanthoxylum lemairei (De Wild.) Waterman **RUTACEAE**
(=*Fagara parvifoliola*)
Common name: OKUONINI
Guild: Pioneer **Conservation:** Blue star
MATURE TREE
Field guide pp. 169 Group: 31D No. 668

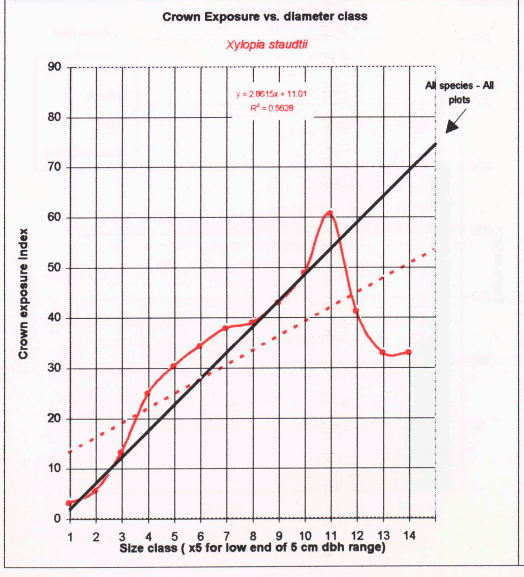
Xylopia staudtii

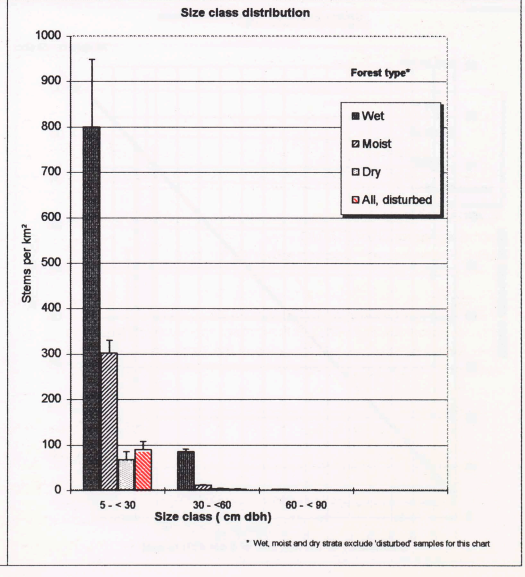




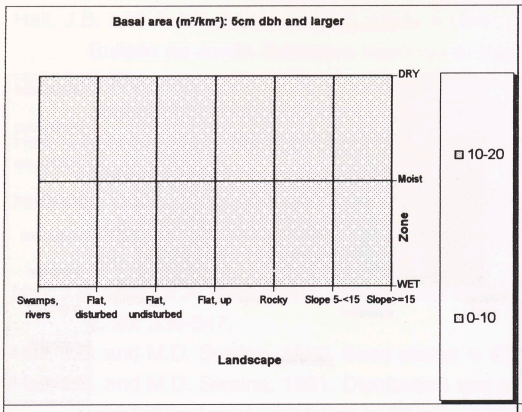


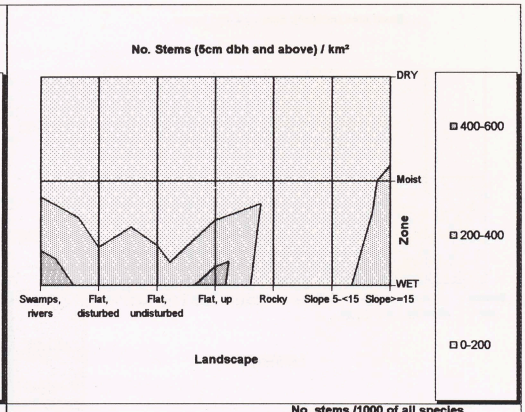


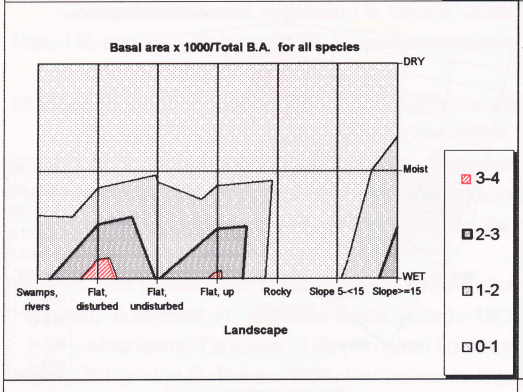


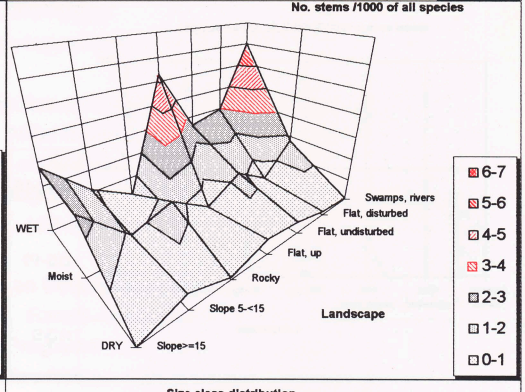


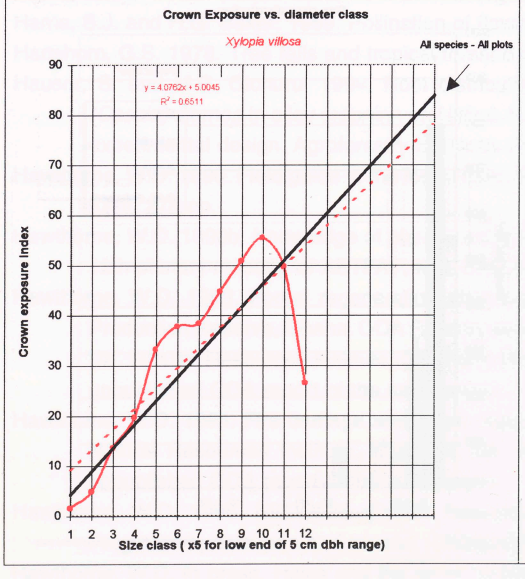
Xylopia villosa

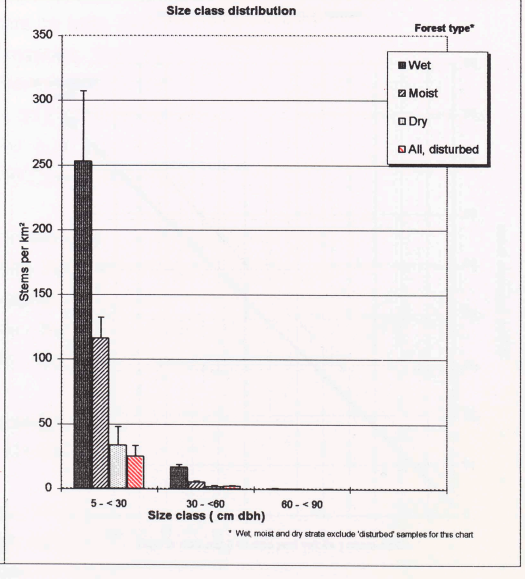




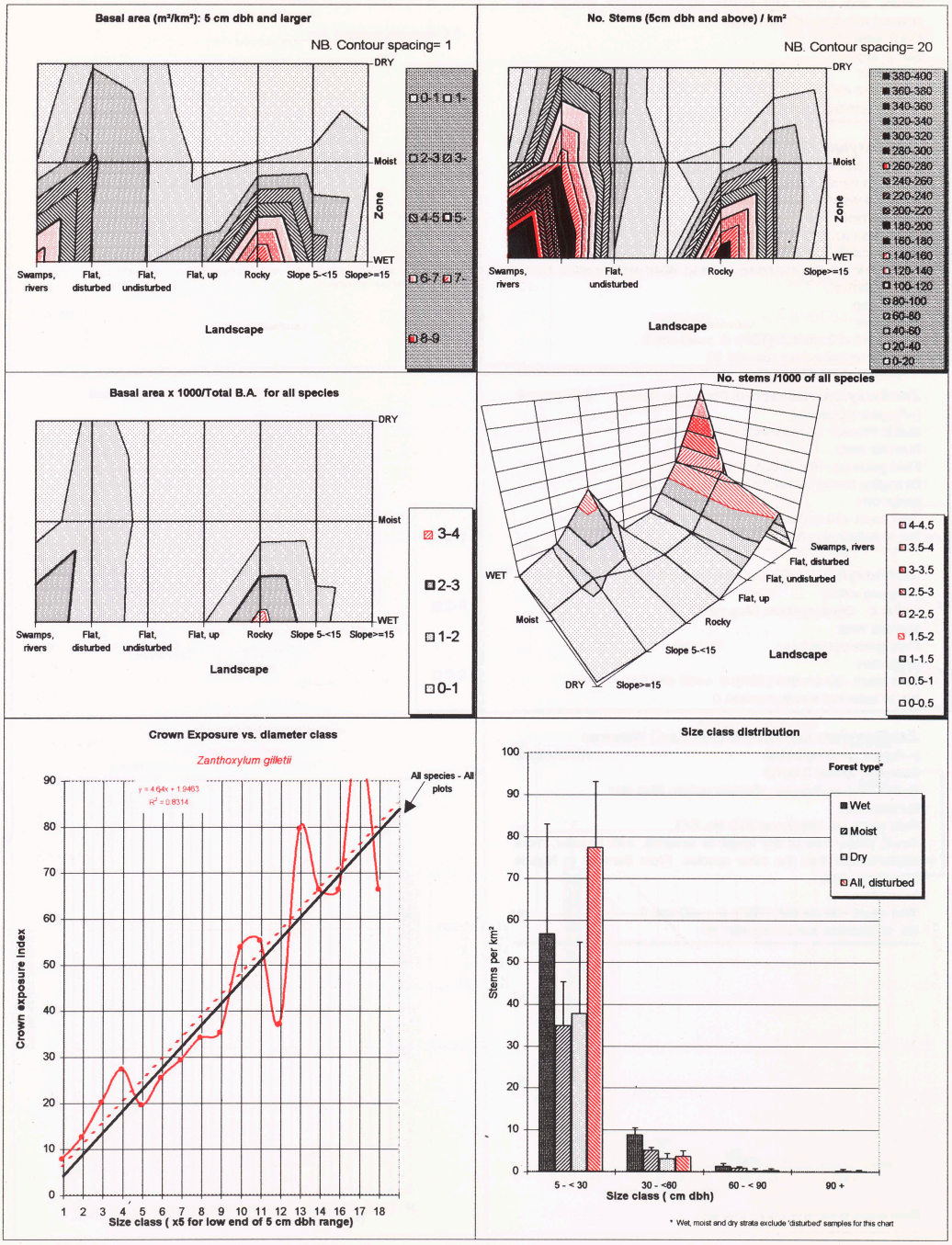








Zanthoxylum gilletii



Dense, dark crown with slightly *Azadirachta*-like foliage; bole covered with pyramidal prickles.

FIELD IDENTITY

See *Z.* spp.

INVENTORY

Tree count <30 cm dbh (TSP): 10 >=30 cm: 16

No. of botanical survey records: 5

Zanthoxylum leprieurii Guill. and Perr. **RUTACEAE**

(=*Fagara leprieurii*)

Common name: OYAA

Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 169 Group: 31D No. 669

DISTRIBUTION

Common in Ghana (Hall and Swaine sp. 624); widespread in Africa.

FIELD IDENTITY

See *Z. spp*

INVENTORY

Tree count <30 cm dbh (TSP): 6 >=30 cm: 8

No. of botanical survey records: 35

Zanthoxylum rubescens Planch. *ex* Hook.f. **RUTACEAE**

(=*Fragara rubescens*)

Guild: Pioneer **Conservation:** Green star

MATURE TREE

Field guide pp. 169 Group: 31D No. 671

Straggling treelet with leaves not unlike *Z. gilletii.*

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 22

Zanthoxylum viride (A.Chev.) Waterman **RUTACEAE**

(=*Fagara viridis*)

Guild: 0 **Conservation:** Blue star

MATURE TREE

Field guide pp. 169

INVENTORY

Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

No. of botanical survey records: 0

Zanthoxylum xanthoxyloides (Lam.) Waterman

(=*Fagara zanthoxyloides*) **RUTACEAE**

Common name: KANTO

Guild: Savanna/non-for **Conservation:** Blue star

MATURE TREE

Field guide pp. 169 Group 31D No. 673

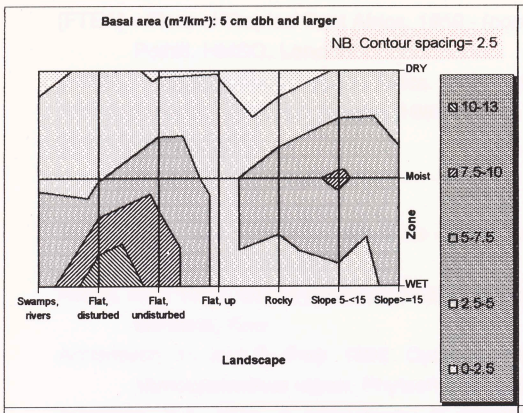
Small, prickly tree of dry forest or savanna, with broader, more elliptic leaves than the other species. From Senegal to Nigeria [Geerling, 1982].

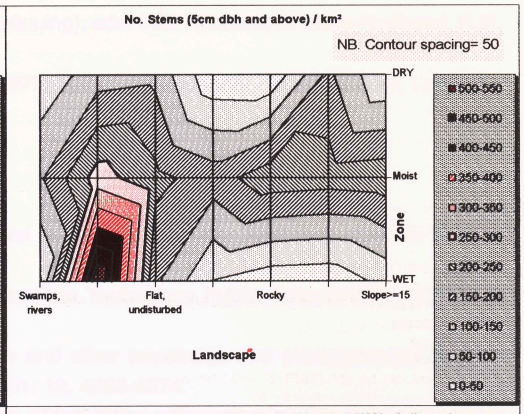
INVENTORY

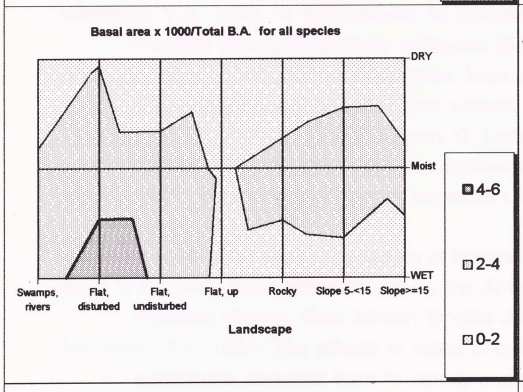
Tree count <30 cm dbh (TSP): 0 >=30 cm: 0

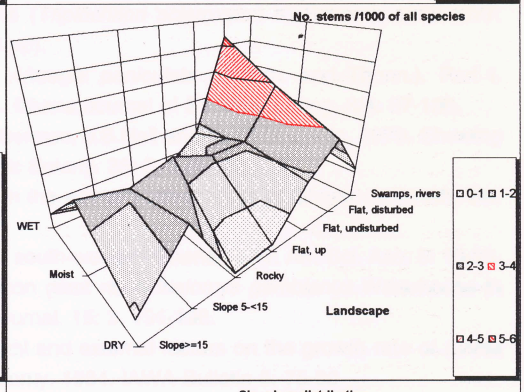
No. of botanical survey records: 15

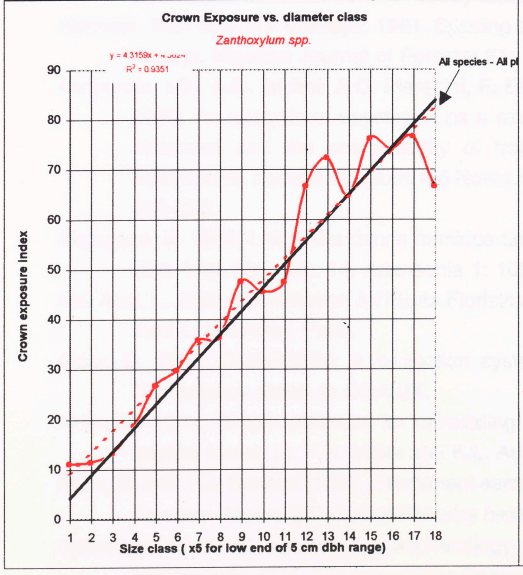
Zanthoxylum spp.

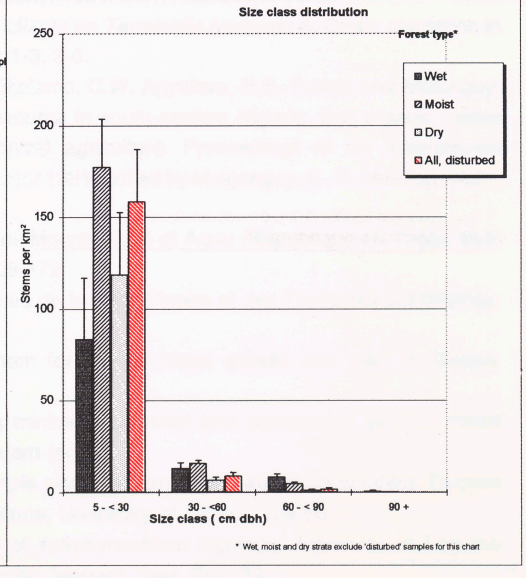












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