9. Zanzibar-Inhambane transitional rain forest (Fg)

9.1. Description

White describes the summits of the transitional rain forests of the East Usambara mountains as a typical example of Zanzibar-Inhambane transitional rain forest. The East Usambara mountains are not high enough for the occurrence of Afromontane rain forest (Fa), but several Afromontane species occur at altitudes that are much lower than their normal limits on other mountains. Other examples of Zanzibar-Inhambane transitional rain forest, although floristically poorer, occur in Malawi (Misuku Hills [1370 m], Machemba Hill, Mt. Nchisi, Lisau Saddle and Chaone Hill) and Zimbabwe (Chirinda forest, White 1983 p. 187).

More than 40 percent of the species are endemic to the East Usambara mountains. Most of these endemic species are floristically related to species that occur in the lowland rain forests of the Guineo-Congolian regional centre of endemism. The pattern that many species are separated by a wide interval with their congeneric species suggests that the East Usambara mountains is a refugium for a flora that was previously distributed over a much larger area. Almost 30 percent the species are either Afromontane or upland ('**lower** transitional rain forest') species. Most of the remaining species also occur in the Guineo-Congolian regional centre of endemism (White 1983 p. 187). Lovett (1990 p. 292) suggests that in the future, Zanzibar-Inhambane transitional rain forest should be regarded as an Afromontane forest type rather than a Zanzibar-Inhambane forest type since the proportion of Afromontane species is greater.

Regional indicator species (characteristic species listed by White (1983) that were only provided for Zanzibar-Inhambane transitional forest and no other Zanzibar-Inhambane forest types) that were listed as characteristic species for one or several national maps can be further classified into endemic species, Afromontane species, upland species ('lower transitional rain forest') and Guineo-Congolian species (White 1983 p. 187):

- Endemic species include ***Anonidium usambarense, Cephalosphaera usambarensis*** (endemic genus), ***Enantia kummeriae***, ***Englerodendron usambarense*** (endemic genus), ***Isolona heinsenii*** and ***Polyceratocarpus scheffleri***
- Afromontane species include ***Alangium chinense*** (also a indicator for Lake Victoria transitional rain forest [Ff]), ***Allanblackia stuhlmannii, Cylicomorpha parviflora*** (also an indicator for Afromontane rain forest [Fa]), ***Isoberlinia scheffleri, Myrianthus holstii*** (also a indicator for Afromontane rain forest [Fa]), ***Ocotea usambarensis*** (also a indicator for Afromontane rain forest [Fa]), ***Pouteria adolfi-friedericii*** (also an indicator for Afromontane rain forest [Fa]), ***Strombosia scheffleri*** (also an indicator for Afromontane rain forest [Fa]), ***Syzygium sclerophyllum, Xymalos monospora*** (a characteristic species both of Afromontane rain

forest [Fa] and Afromontane undifferentiated forest [Fbu]) and ***Zenkerella capparidacea***.

- Upland species include ***Morinda asteroscepa, Strychnos mitis*** and ***Trichilia dregeana***
- Guineo-Congolian species include ***Chrysophyllum perpulchrum, Cleistanthus polystachyus, Ficus sur, Funtumia africana, Greenwayodendron suaveolens*** (an endemic subspecies), ***Magnistipula butayei*** (an endemic subspecies), ***Pterocarpus mildbraedii*** (an endemic subspecies), ***Rauvolfia caffra, Schefflerodendron usambarense, Synsepalum cerasiferum, Synsepalum msolo*** and ***Treculia africana***.

Figure 9.1 View from a gap inside Zanzibar-Inhambane transitional rain forest at Mbomole Hill (Amani Nature Reserve, Tanzania). Altitude approximately 970 m. Photograph by H. N. Moshi (2009).

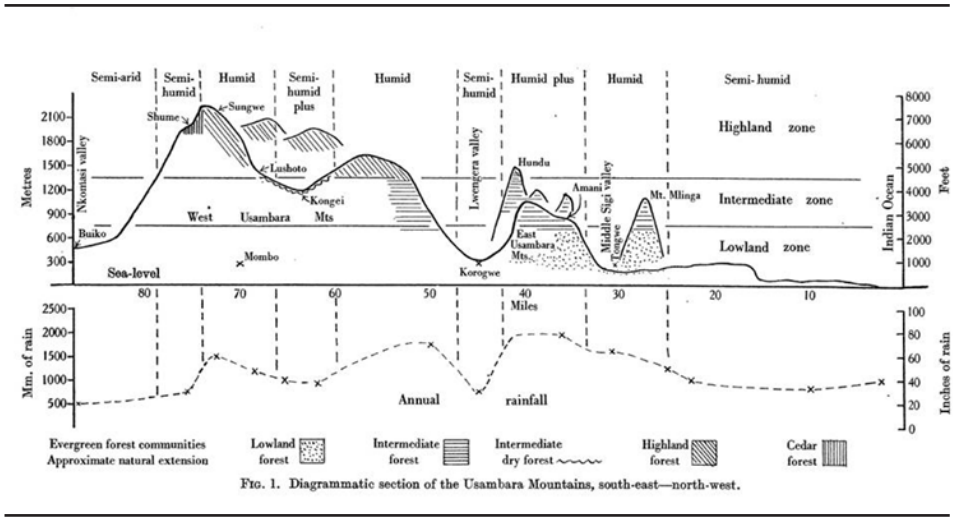


Fig. 1. Diagrammatic section of the Usambara Mountains, south-east—north-west.

Figure 9.2 Zanzibar-Inhambane transitional rain forest (synonym: intermediate forest) forest occurs at lower altitudes than Afromontane forests (Fa and Fb; the figure gives the synonyms of "highland forest" and "Cedar forest") and at higher altitudes than Zanzibar-Inhambane lowland rain forest (Fo; the figure gives the synonym of "lowland forest"). Moreau (1935). Figure obtained from URL: *http://www.jstor.org/stable/2256144*

9.2. VECEA region

Within the VECEA region, Zanzibar-Inhambane transitional rain forest occurs in Malawi, Tanzania and probably also in Kenya (Figure 9.3, see also Volume 6).

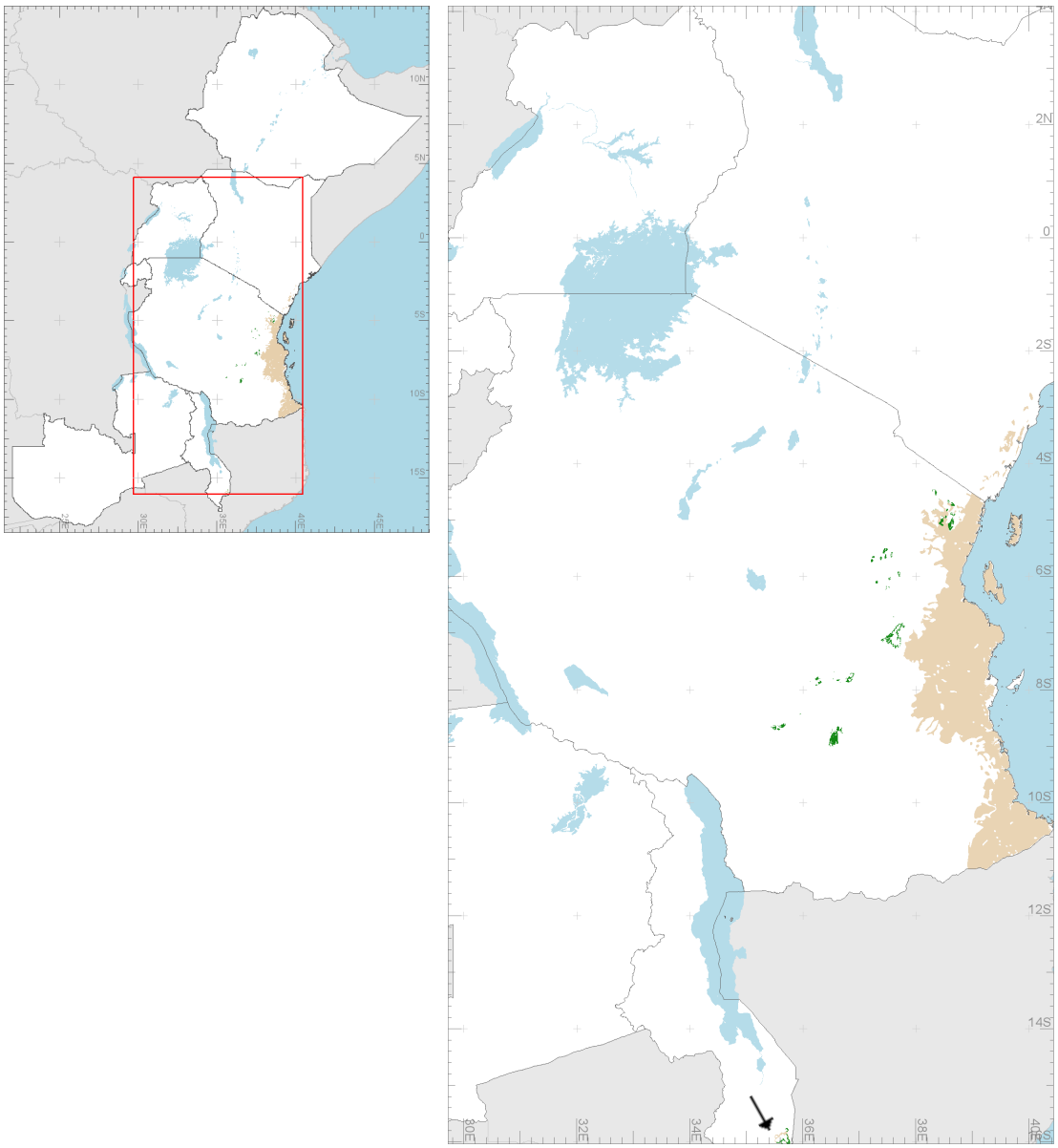


Figure 9.3. Mapped distribution of Zanzibar-Inhambane transitional rain forest in the VECEA region (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia). Where this vegetation type does not occur in mosaic, it is depicted by green polygons. In Malawi and Tanzania, it is also mapped as part of different mosaics (shown in greyish-brown, see the arrow for Malawi). We expect that this forest type also occurs in Taita Hills (Kenya), although we did not map this forest in the VECEA map in that location (this was a consequence of not having forest in that location in a Kenyan base map and a consequence of the long-term fragmented distribution of the forest in that location).

In Malawi, Zanzibar-Inhambane transitional rain forest was originally classified as mid-altitude rain forest. It was mapped by expanding original mapping unit 46d with the contour lines of 800 and 1500 m on Mt. Mulanje (see Volume 6).

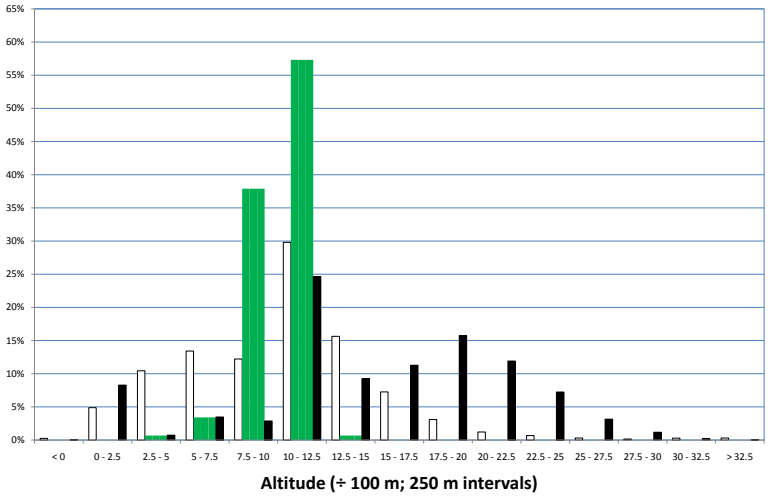
In Tanzania, Zanzibar-Inhambane transitional rain forest was described originally as submontane forest. One of the synonyms listed by Lovett (1993a) for submontane forest is "Zanzibar-Inhambane transitional rain forest". In the VECEA map, we combined altitude limits of 900 and 1250 m with the Gillman (1949) physiognomic map to infer the distribution of this forest type in Tanzania (see Volume 6).

We expect that Zanzibar-Inhambane transitional rain forest also occurs in Taita Hills in Kenya. Lovett (1998) gives the northern limit of the eastern arc as Taita and Shimba Hills (*see also URL http://www.easternarc.org/html/map.html* [last accessed July 2011]). Dale (1939) mentions that "upper montane evergreen rain-forest" is limited to the Bura and Sagalla Hills (Teita Hills [sic]) above 4500 ft (~ 1500 m). He describes that there were only a few patches of forest remnants with a total acreage not more than two square miles (~ 5 km^2). These forests are of the "*Ocotea usambarensis* type" (an indicator for Zanzibar-Inhambane transitional rain forest in the Zanzibar-Inhambane floristic region; this species is also a indicator for Afromontane rain forest in the Afromontane floristic region). Other trees found in the "high forest" include *Albizia gummifera* (near streams in Afromontane dry transitional forest [White 1983] and **potentially** an indicator of Afromontane moist transitional forest [Fe]), *Allophylus abyssinicus, Ekebergia capensis, Garcinia volkensii, Macaranga capensis* (Afromontane species in the Lake Victoria transitional rain forest [Ff]), *Neoboutonia macrocalyx, Newtonia buchananii* (a characteristic species of Zanzibar-Inhambane lower transitional rain forest, but also near streams in Afromontane dry transitional forest, in Zanzibar-Inhambane lowland rain forest (near Tavetta) and **potentially** an indicator of Afromontane moist transitional forest [Fe]), *Nuxia floribunda* (an indicator for Afromontane undifferentiated forest), *Polyscias kikuyuensis, Prunus africana* (Afromontane rain forest [Fa], Afromontane undifferentiated forest [Fb] and Afromontane species in Lake Victoria transitional rain forest [Ff]), *Rapanea melanophloeos* (an indicator for Afromontane undifferentiated forest [Fb]), *Tabernaemontana pachysiphon* and *Xymalos monospora* (a indicator for Zanzibar-Inhambane transitional rain forest in the Zanzibar-Inhambane region; this species is also characteristic for Afromontane rain forest, Afromontane undifferentiated forest and is furthermore a indicator for Lake Victoria transitional rain forest in the Lake Victoria region).

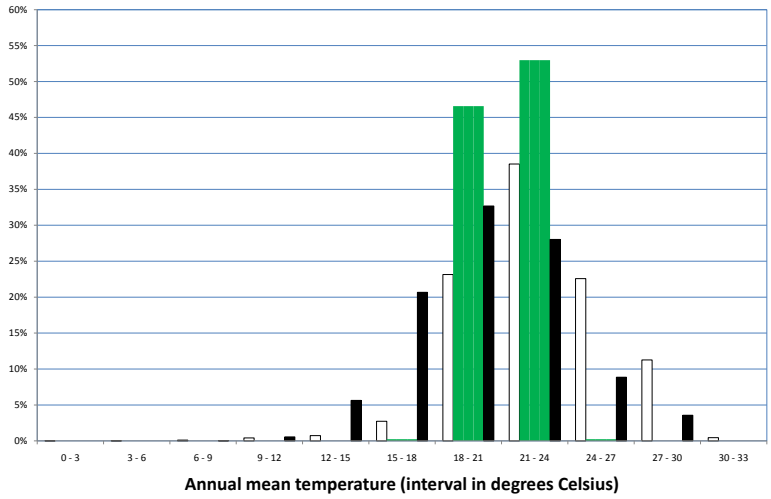
Investigation of environmental distribution of Zanzibar-Inhambane transitional rain forest in the VECEA region (Figure 9.4; limits are for areas of the VECEA map where this forest is not mapped as mosaic) suggests that, with the exception of the Ethiopian manifestation of Afromontane moist transitional rain forest (FeE), this is the transitional forest that occurs at the lowest altitudes (> 95% of samples occur at altitudes of 750 – 1250 m). The altitude interval where most of samples occur is the same for this vegetation type (1000 – 1250 m; 57.3% of samples) as for all forests combined

(24.7%). Rainfall conditions are somewhat above those for other transitional rain forests (with highest number of samples in the 1600 – 1800 mm interval; 24.4%). However, there were only a limited number of samples in this forest type.

(a)



(b)



(c)

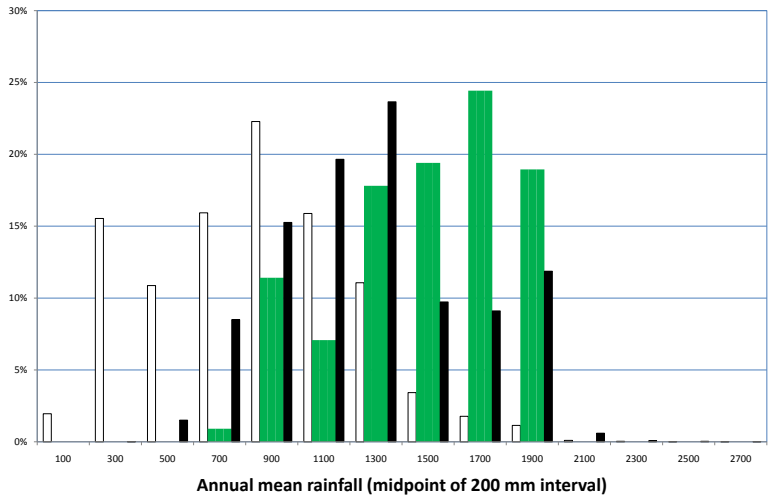


Figure 9.4. Histograms of the distribution of altitude (a), mean annual temperature (b) and mean annual rainfall (c). Bars at the centre of each interval show the percentage of samples within Zanzibar-Inhambane transitional rain forest (Fg, *n* = 438). Bars on left (open) show the overall percentage of samples (*n* = 740,047). Bars on the right (black) show the percentages of samples within forests (*n* =59,013).

9.3. Species composition

Species assemblages were obtained from the following references:

- Malawi: White *et al.* (2001). Only species that were clearly stated as occurring in "mid-altitude rain forest" were included. These species were coded "x" (unless they were characteristic species).
- Tanzania: Lovett (1993a). Species that were mentioned for "sub-montane forest" in Lovett (1993a; altitude 800 - 1400 m; annual rainfall > 1500 mm [5 and 6] were coded "C" (since these species were interpreted as characteristic species). Species that were listed as Eastern Arc endemic species that occur in "lowland forest" in Lovett (1998) were coded "e").

Characteristic species were determined as:

- Malawi: Species identified to be present as emergent trees (30 - 45 m) or large trees (20 - 30 m, including stranglers) were coded as "C". Liana species or species of marginal occurrence were not listed as characteristic species.
- Tanzania: Species listed by Lovett (1993a) were coded "C".

Within the information on assemblages, coding "f " indicates that there is information that the species potentially occurs in the vegetation type since it occurs in the focal country and in the same forest type in other countries (see section 2.3).

All species listed by White (1983) for Zanzibar-Inhambane transitional rain forest were listed, even if their presence was not listed in the national references that we consulted (these species only had entries of "f").

5: Lovett defines the Eastern Arc as "those forests occurring on crystalline mountains in south-east Kenya and eastern Tanzania under the direct climatic influence of the Indian Ocean" (Lovett 1990 p. 292). Whereas the volcanoes of Mt. Meru and Mt. Kilimanjaro have been formed in the last million years, the crystalline block-faulted mountains of the Eastern Arc were created 7 million years ago. The moist forests on the eastern slopes have probably been under a stable high rainfall throughout the Pleistocene and possibly before the end of the Miocene (Lovett 1993a). See also URL *http://www.easternarc.org/html/map.html*

6: Lovett (1993b) gives different limits for Zanzibar-Inhambane transitional rain forest of altitude 800 - 1250 m and rainfall 2000 - 3000 m (with "Afromontane rain forest sensu Lovett 1990" occurring at altitudes of 1200 - 2500 m under rainfalls of 1250 - 2500 mm).

Table 9. Species composition of Zanzibar-Inhambane transitional rain forest (Fg)

Species	Regional status	(Malawi)	(Tanzania)
Alangium chinense	indicator (Afromontane species)		f
Albizia gummifera		C	f
Albizia schimperiana		C	f
Allanblackia stuhlmannii	indicator (Afromontane species)		C
Anonidium usambarense	indicator (endemic species)		e
Anthocleista grandiflora		C	f
Antiaris toxicaria	characteristic (Guineo-Congolian species)		f
Blighia unijugata		x	f
Cassipourea malosana		C	f
Celtis africana		C	f
Celtis gomphophylla		C	f
Cephalosphaera usambarensis	indicator (endemic genus)		C
Chrysophyllum gorungosanum		C	f
Chrysophyllum perpulchrum	indicator (Guineo-Congolian species)		f
Cleistanthus polystachyus	indicator (Guineo-Congolian species)	x	f
Cordia africana		x	f
Croton macrostachyus		C	f
Croton sylvaticus		C	f
Cussonia spicata		x	f
Cylicomorpha parviflora	indicator (Afromontane species)	C	C
Diospyros abyssinica	not characteristic (indicator for moister variants of Zanzibar-Inhambane undifferentiated forest [very rare])	C	f
Dovyalis macrocalyx		x	f
Ekebergia capensis		C	f
Embelia schimperi		C	f
Enantia kummeriae	indicator (endemic species)		e
Englerodendron usambarense	indicator (endemic genus)		C
Ensete ventricosum		x	f
Ficalhoa laurifolia		C	f
Ficus sur	indicator (Guineo-Congolian species)	C	f
Ficus thonningii		C	f
Ficus vallis-choudae	not characteristic (indicator for moister variants of Zanzibar-Inhambane undifferentiated forest)	C	f
Funtumia africana	indicator (Guineo-Congolian species)	C	f
Greenwayodendron suaveolens	indicator (Guineo-Congolian species, endemic subspecies)		e
Harrisonia abyssinica		x	f
Harungana madagascariensis		x	C
Ilex mitis		C	f
Isoberlinia scheffleri	indicator (Afromontane species)		C
Isolona heinsenii	indicator (endemic species)		e
Khaya anthotheca	not characteristic (indicator for Zanzibar-Inhambane lowland rain forest)	C	f
Landolphia buchananii		x	f
Macaranga capensis	characteristic (upland species)	C	C

Species	Regional status	(Malawi)	(Tanzania)
Maesopsis eminii			C
Magnistipula butayei	indicator (Guineo-Congolian species, endemic subspecies)	x	f
Maranthes goetzeniana	characteristic (upland species)		f
Maytenus acuminata		C	f
Milicia excelsa	not characteristic (characteristic for Zanzibar-Inhambane lowland rain forest and Zanzibar-Inhambane undifferentiated forest)	f	C
Morinda asteroscepa	indicator (upland species)	x	f
Myrianthus holstii	indicator (Afromontane species)	x	C
Newtonia buchananii	characteristic (upland species)	C	C
Ocotea usambarensis	indicator (Afromontane species)	f	f
Olea capensis		x	f
Oreobambos buchwaldii	(bamboo species indigenous to Africa)	x	f
Parinari excelsa		C	C
Parkia filicoidea	characteristic (Guineo-Congolian species)	f	C
Polyceratocarpus scheffleri	indicator (endemic species)		e
Polyscias fulva		x	f
Pouteria adolfi-friedericii	indicator (Afromontane species)	f	f
Prunus africana		C	f
Pterocarpus mildbraedii	indicator (Guineo-Congolian species, endemic subspecies)		f
Pterocarpus tinctorius		C	f
Rapanea melanophloeos		x	f
Rauvolfia caffra	indicator (Guineo-Congolian species)	C	f
Ricinodendron heudelotii	characteristic (Guineo-Congolian species)		f
Schefflera abyssinica		C	f
Scheffl erodendron usambarense	indicator (Guineo-Congolian species)		f
Shirakiopsis elliptica		x	C
Strombosia scheffleri	indicator (Afromontane species)	x	C
Strychnos mitis	indicator (upland species)	x	f
Synsepalum cerasiferum	indicator (Guineo-Congolian species)	C	C
Synsepalum msolo	indicator (Guineo-Congolian species)		C
Syzygium guineense		C	f
Syzygium sclerophyllum	indicator (Afromontane species)		e
Treculia africana	indicator (Guineo-Congolian species)	f	f
Trema orientalis		x	C
Trichilia dregeana	indicator (upland species)	C	C
Trilepisium madagascariense	characteristic (Guineo-Congolian species)	C	C
Xymalos monospora	indicator (Afromontane species)	x	f
Zanha golungensis		C	f
Zenkerella capparidacea	indicator (Afromontane species)		e

10. Afromontane dry transitional forest (Fh)

10.1. Description

Afromontane dry transitional forest occurs on the drier lower slopes of those East African mountains and uplands which rise from the plains covered with Somalia-Masai bushlands (Bd and Be, volume 4). Afromontane and non-afromontane species occur together within these forests. Only small fragments remain and there is little published information (White 1983 p. 166).

Remnants of Afromontane dry transitional forest occur near Nairobi at altitudes between 1650 and 1800 m and annual rainfall around 800 mm (White 1983 p. 166).

Regional indicator species (characteristic species listed by White (1983) that were only provided for Afromontane dry transitional rain forest and no other Afromontane forest types) that were listed as characteristic species for one or several national maps (' indicators', see section 3.2) include ***Calodendrum capense*** (a species that also occurs as stunted individuals at higher altitudes in evergreen bushland [Be]), ***Cassipourea malosana, Chaetacme aristata, Chrysophyllum viridifolium, Croton megalocarpus, Euclea divinorum, Fagaropsis angolensis, Markhamia lutea, Olea europaea* ssp. *cuspidata***, (synonym: *Olea africana*), ***Schrebera alata*** (a species that also occurs as stunted individuals at higher altitudes in evergreen bushland [Be]), ***Strychnos usambarensis, Suregada procera, Trichocladus ellipticus, Uvariodendron anisatum*** and ***Warburgia ugandensis. Albizia gummifera and Newtonia buchananii*** were listed as characteristic species that occur near streams. We hypothesize that these can therefore be categorized as indicator species for Afromontane moist transitional forest (FeK).

White (1983 p. 129) also describes rain-fed dry evergreen forest that occurs as relicts within the greater Serengeti region. The main canopy of this forest consists of *Diospyros abyssinica* (also characteristic of Afromontane dry transitional forest near Nairobi), *Drypetes gerrardii* (also characteristic of Afromontane dry transitional forest near Nairobi), *Elaeodendron buchananii*, *Lecaniodiscus fraxinifolius*, ***Suregada procera*** (an indicator for Afromontane dry transitional forest near Nairobi), and *Vepris nobilis* (White mentions that *Vepris* [syn. *Teclea*] species are characteristic of Afromontane dry transitional forest near Nairobi). Less frequent constituents of the main canopy include ***Chaetacme anisata*** (an indicator of Afromontane dry transitional forest near Nairobi), ***Euclea divinorum*** (an indicator of Afromontane dry transitional forest near Nairobi), ***Olea europaea*** ssp. ***cuspidata*** (synonym: *Olea africana*, an indicator of Afromontane dry transitional forest near Nairobi) and ***Schrebera alata*** (an indicator of Afromontane dry transitional forest near Nairobi). *Capparis erythrocarpos*, *Croton dichogamus* and *Vepris trichocarpa* are the most common species of the understorey. This similarity in species composition and environmental conditions lead us to include this forest into Afromontane dry transitional forests.

Figure 10.1 Profile diagram of Afromontane dry transitional forest in the Kithoka area north-east of Mt. Kenya (0° 08.065′ N; 37° 39.564′ E). Altitude 1514 m. This forest was classified by Trapnell *et al*. (1966, 1969, 1976, 1986) as dry intermediate forest. Species shown are: *Calodendrum capense* (4); *Celtis africana* (1); *Croton megalocarpus* (8); *Ehretia cymosa* (11); unidentified *Ficus sp* (9); *Olea europaea* (10, B); *Pittosporum viridiflorum* (3, A); *Ritchiea albersii* (5); *Strychnos henningsii* (12); *Uvariodendron anisatum* (2); *Vepris simplicifolia* (7) and *Vepris trichocarpa* (6). Obtained from Matingi (2011).

10.2. VECEA region

Within the VECEA region, Afromontane dry transitional forest is only mapped for Kenya and Tanzania (Figure 10.2, see also Volume 6).

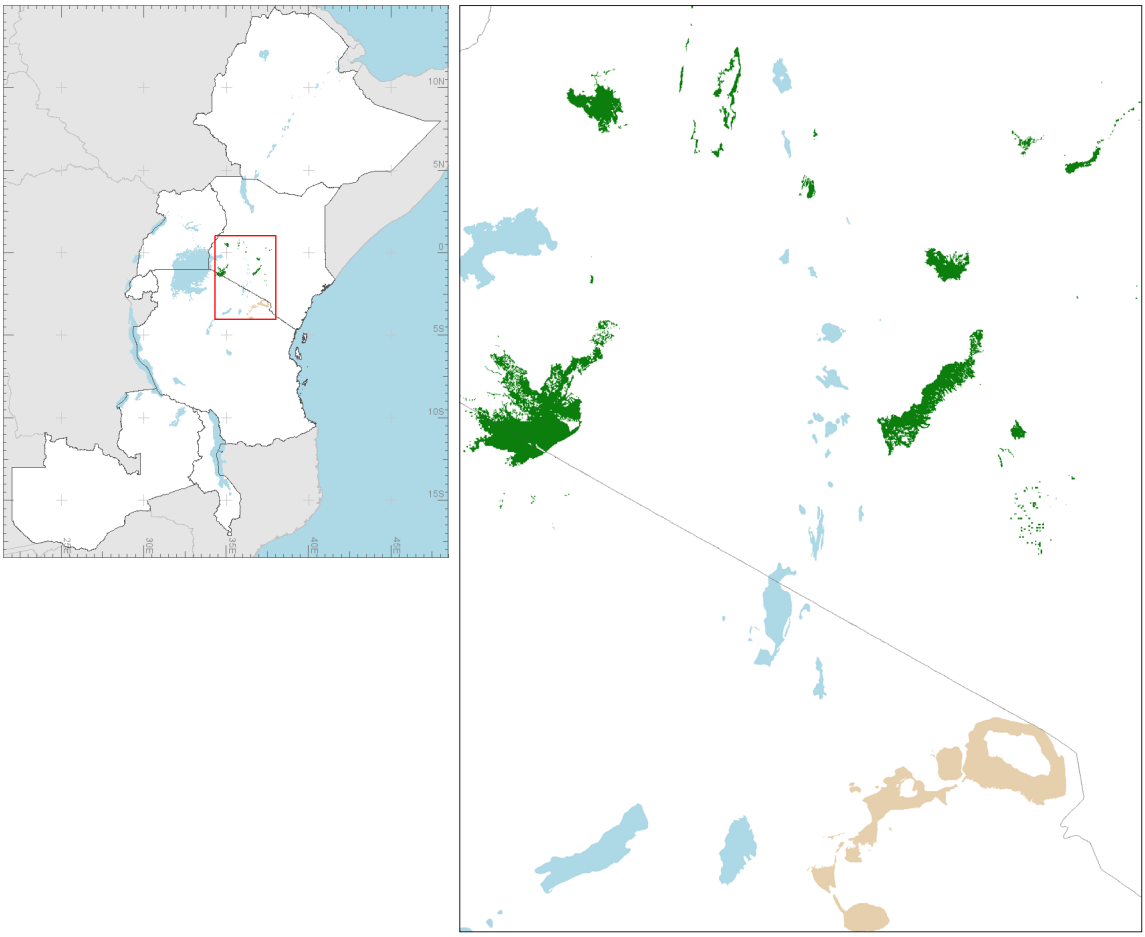


Figure 10.2. Mapped distribution of Afromontane dry transitional forest in the VECEA region (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia). Where this vegetation type does not occur in mosaic, it is depicted by green polygons. In Tanzania, it is also mapped as part of different forest mosaics (shown in greyish-brown), as on Mt. Kilimanjaro and Mt. Meru. We further expect that this forest type is distributed more widely than depicted here.

In Kenya, some of the Afromontane dry transitional forest was originally mapped as dry intermediate forest. The Trapnell *et al.* (1966, 1969, 1976, 1986) maps for central and south-western Kenya contained "intermediate *Diospyros - Olea* forest" (original mapping unit 18) in vegetation sheets 2 and 3. This forest type was not classified together with "dry intermediate forest types" (*i.e.* Afromontane dry transitional forest) and was placed in different "decline zones" than "dry intermediate forest" .[7] (Trapnell and Brunt [1987 p. 7] further mention that *Diospyros - Olea* forest may have extended further south towards the Menangai crater on vegetation sheet 2.) Since we expect that this is the same type of forest that was described for the greater Serengeti region (see section 10.1), we also mapped this forest as Afromontane dry transitional forest in the VECEA map. Unfortunately, Trapnell [1997] did not give species composition for intermediate *Diospyros - Olea* forest (see section 10.3). However, Beentje (1990) described a forest type of *Diospyros abyssinica – Olea europaea* forest with species composition of *Diospyros abyssinica* (also mentioned in section 10.1), ***Olea europaea*** (also mentioned in section 10.1), *Drypetes gerrardii* (also mentioned in section 10.1), ***Euclea divinorum*** (also mentioned in section 10.1), *Strychnos mitis* (a characteristic species of "dry intermediate forest" according to Trapnell [1997]), *Olea capensis* (listed in section 10.3) and *Aphania senegalensis* (synonym: *Lepisanthes senegalensis*, listed in section 10.3). Based on this correspondence in species composition between the *Diospyros abyssinica – Olea europaea* forest and Afromontane dry transitional forest, we hypothesize that *Diospyros abyssinica – Olea europaea* forest is a subtype of Afromontane dry transitional forest.

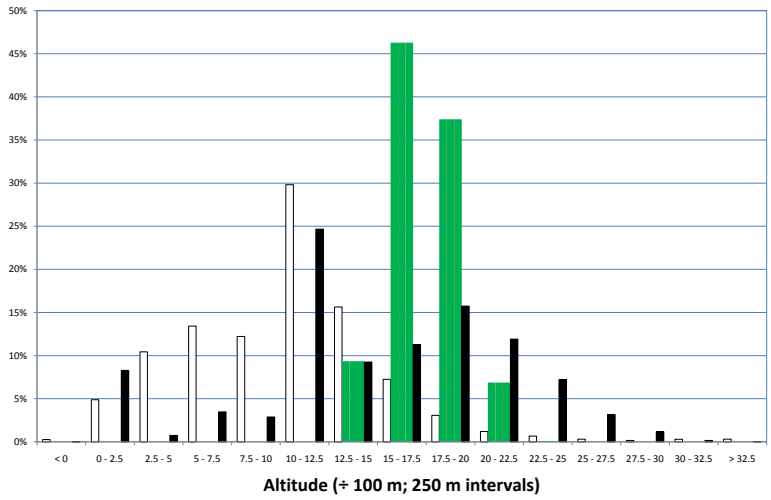
In Tanzania, Afromontane dry transitional forest was originally described as lower altitude dry montane forest. Lovett (1993a) lists two synonyms for "dry montane forest": (i) drier types of Afromontane undifferentiated forest sensu White (1983); and (ii) dry transitional montane forest sensu White (1983). However, Lovett (1993a) does not provide information in differences in altitude between these two synonyms. Moreover, although Lovett (1990; this is the main reference that we used to allocate forest types to the physiognomic map of Gillman [1949]) lists Afromontane dry transitional forest among forest types that occur in Tanzania, he does not list it for any specific Tanzanian forest area. As a consequence, we treated "dry montane forest" sensu Lovett (1993a) only as a synonym of Afromontane undifferentiated forest (Fbu) for most of the VECEA map. Various areas that were mapped as (mosaics containing) Afromontane undifferentiated forest (Fb) in Tanzania could thus also contain some Afromontane dry transitional forest (Fh). Further evidence for a wider distribution of Afromontane undifferentiated forest includes the mapping by Moreau (1935) of "intermediate dry forest" on the West Usambara Mts. see Figure 9.2, the mention of a "dry evergreen forest" zone between 1500 and 1700 m on Mt. Meru by Beesley (1972) and the differentiation of a "relatively dry submontane *Croton – Calodendrum* forest" by Hemp (2006) on Mt. Kilimanjaro (this forest is dominated by *Croton megalocarpus*, *Calodendrum capense*, *Olea europaea* ssp. *cuspidata* [synonym: *Olea africana*] and *Diospyros abyssinica* and occurs on the western slopes below 1600 m and on the northern slopes below 2000 m). In response, we mapped Afromontane dry transitional forest to occur in forest mosaics on Mt. Kilimanjaro and Mt. Meru.

7: in between montane bamboo (B) and deciduous bushland (Bd, synonym: lowland *Acacia* and *Commiphora* bushland), Trapnell and Brunt (1987) described three "decline zones": (i) the eastern decline zones from upper eastern moist forest (i.e. Afromontane rain forest), eastern moist intermediate forest (i.e. Afromontane moist transitional forest), eastern dry intermediate forest (i.e. Afromontane dry transitional forest) to eastern *Combretum* wooded grassland (Wc); (ii) the western decline zones from western moist forests (i.e. Afromontane rain forest and Afromontane moist transitional forest), western *Diospyros* forest, western *Combretum* wooded grassland (Wc) to western semi-evergreen thicket (Be); and (iii) the Rift Valley decline zones from montane sclerophyll forest (i.e. Afromontane undifferentiated forest), *Diospyros* forest (local, coded RD), upland evergreen bushland (Be) to upland *Acacia* bushland (We).

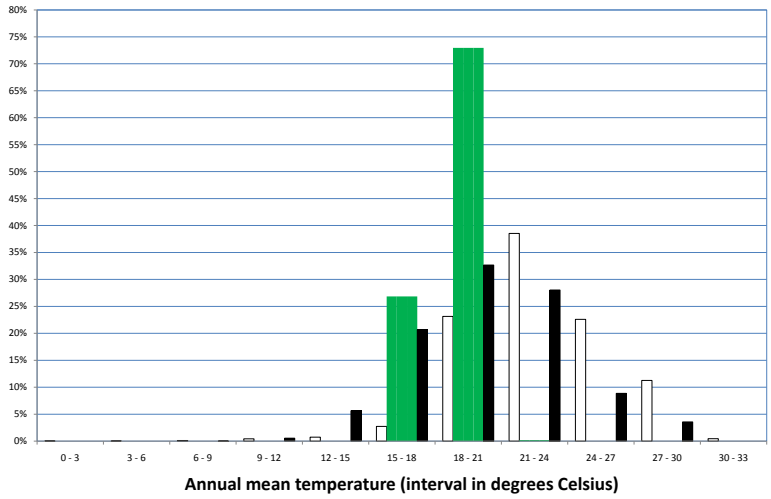
It is possible that this forest type previously existed in Ethiopia, but it is not obvious what distinguishes the presence of Afromontane dry transitional forest or the alternative vegetation type of evergreen bushland (Be) in areas that are located between deciduous bushland (Bd) and Afromontane undifferentiated forest (Fbu).

Investigation of environmental distribution of Afromontane dry transitional forest in the VECEA region (Figure 10.3; limits are for areas of the VECEA map where this forest is not mapped as mosaic) shows a slightly higher distribution in altitude than the Kenyan Afromontane moist transitional rain forest (FeK). The altitude range where most of this forest type occurs (with > 90% of samples occurring at altitudes from 1250 – 2000 m) includes the altitude range for forests near Nairobi mentioned by White (1983, see previous section). Although the rainfall was somewhat lower than for Kenyan Afromontane moist transitional rain forest (FeK), it was similar to rainfall for several transitional forests: the 1200 – 1400 mm contained the highest number of samples for Afromontane dry transitional forest (32.7%), Ethiopian moist transitional rain forest (70.7%), Lake Victoria transitional rain forest (29.6%) and all forests combined (23.7%). All samples had rainfall above 800 mm (this was the rainfall mentioned by White [1983] for this forest type, see previous section). We hypothesize that this could be in part a consequence of White (1983) describing manifestations of the forest type near the lower end of its rainfall range (*i.e.* near Nairobi).

(a)



(b)



(c)

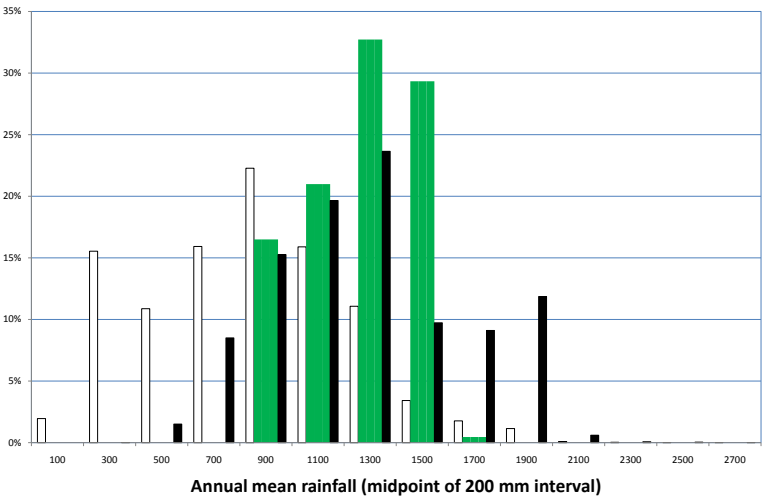


Figure 10.3. Histograms of the distribution of altitude (a), mean annual temperature (b) and mean annual rainfall (c). Bars at the centre of each interval show the percentage of samples within Afromontane dry transitional forest (Fh, *n* = 1,091). Bars on left (open) show the overall percentage of samples (*n* = 740,047). Bars on the right (black) show the percentages of samples within forests (*n* =59,013).

Table 10. Species composition of Afromontane dry transitional forest (Fh)

Species	**regional status** (see section 2.3)	**(Kenya)**	**(Tanzania)**
Acacia brevispica		x	f
Acokanthera oppositifolia		x	
Acokanthera schimperi		Cs12	f
Albizia gummifera	indicator (but near streams)	Cg30	x
Albizia schimperiana		Cs	f
Allophylus abyssinicus		x	f
Allophylus rubifolius		x	f
Antidesma venosum		x	f
Aphania senegalensis		x	f
Apodytes dimidiata	characteristic	x	f
Bersama abyssinica		Cg15	x
Blighia unijugata		x	f
Brachylaena huillensis		C24	f
Bridelia micrantha		Cefs12	f
Bridelia scleroneura		x	f
Caesalpinia decapetala		x	f
Caesalpinia volkensii		x	f
Calodendrum capense	indicator	Cs15	f
Carissa spinarum		x	f
Cassipourea malosana	indicator (but near streams)	Cg24	f
Catha edulis		x	f
Celtis africana		x	f
Chaetacme aristata	indicator	x	f
Chrysophyllum viridifolium	indicator	C18	
Clausena anisata		x	f
Clerodendrum myricoides		x	f
Combretum schumannii		x	f
Commiphora eminii		x	f
Cordia africana		x	f
Cornus volkensii		x	f
Craibia brownii		C12	f
Crateva adansonii		x	f
Crotalaria agatiflora		x	f
Croton macrostachyus		Cgs24	f
Croton megalocarpus	indicator	Cefs37	f
Cussonia spicata		x	f
Diospyros abyssinica	characteristic	Cg27	f
Dodonaea viscosa		x	f
Dombeya kirkii		x	f
Dovyalis abyssinica		x	f
Dovyalis macrocalyx		x	f
Dracaena steudneri		Cg12	f
Drypetes gerrardii	characteristic	Cef12	x
Ehretia cymosa		Cg9	

Species	**regional status** (see section 2.3)	**(Kenya)**	**(Tanzania)**
Ekebergia benguelensis		x	f
Ekebergia capensis		Cg24	f
Elaeodendron buchananii	characteristic (greater Serengeti region)	C24	f
Englerophytum natalense		x	f
Euclea divinorum	indicator	Cs	f
Euclea racemosa		x	f
Euphorbia abyssinica		x	f
Euphorbia candelabrum		x	f
Fagaropsis angolensis	indicator	Cef21	f
Ficus natalensis		x	f
Ficus sur		Cg24	f
Ficus thonningii		C12	f
Filicium decipiens		x	f
Flacourtia indica		x	f
Flueggea virosa		x	f
Grewia similis		x	f
Ilex mitis	not characteristic (indicator for Afro-montane undifferentiated forest)	x	f
Indigofera swaziensis		x	f
Juniperus procera		x	f
Kigelia moosa		x	f
Lannea schweinfurthii		x	f
Lepidotrichilia volkensii		x	f
Manilkara sulcata		x	f
Margaritaria discoidea		C15	x
Markhamia lutea	indicator	Cef18	f
Maytenus arbutifolia		x	f
Maytenus undata		x	f
Meyna tetraphylla		x	f
Mimusops bagshawei		Cef40	f
Mimusops kummel		Cef27	f
Myrsine africana		x	f
Newtonia buchananii	indicator (but near streams)	x	f
Nuxia congesta	not characteristic (indicator for Afro-montane undifferentiated forest)	Cg21	f
Nuxia floribunda	not characteristic (indicator for Afro-montane undifferentiated forest)	x	f
Olea capensis	not characteristic (indicator for Afromontane rain forest)	x	f
Olea europaea	indicator [*Olea europaea* ssp. *cuspidata*, synonym: *Olea africana*]	Cs	f
Olinia rochetiana		x	f
Osyris lanceolata		x	f
Pappea capensis		x	f
Pavetta oliveriana		x	f
Phoenix reclinata	(palm species)	x	f

Species	**regional status** (see section 2.3)	**(Kenya)**	**(Tanzania)**
Phytolacca dodecandra		x	f
Pistacia aethiopica		x	f
Pittosporum viridiflorum		x	f
Plectranthus barbatus		x	f
Podocarpus falcatus	not characteristic (indicator for Afromontane undifferentiated forest)	x	f
Podocarpus latifolius	not characteristic (characteristic for Afromontane rain forest and Afromontane undifferentiated forest)	x	f
Podocarpus usambarensis		x	f
Psydrax schimperiana		C12	f
Pterolobium stellatum		x	f
Rapanea melanophloeos	not characteristic (indicator for Afromontane undifferentiated forest)	x	f
Rhamnus staddo		x	f
Rhoicissus revoilii		x	f
Rhus natalensis		x	f
Rhus vulgaris		x	f
Ritchiea albersii		x	f
Rothmannia urcelliformis		Cef9	f
Rubus apetalus		x	f
Rubus volkensii		x	f
Schefflera volkensii		x	f
Schrebera alata	indicator	C24	f
Scutia myrtina		x	f
Senecio hadiensis		x	f
Senna didymobotrya		x	f
Senna septemtrionalis		x	f
Shirakiopsis elliptica		Cef15	f
Solanecio cydoniifolius		x	f
Solanecio mannii		x	f
Solanum aculeastrum		x	f
Sorindeia madagascariensis		x	f
Stereospermum kunthianum		x	f
Strychnos henningsii		C9	f
Strychnos innocua		x	f
Strychnos mitis		C18	x
Strychnos usambarensis	indicator	x	f
Suregada procera	indicator	x	f
Synsepalum brevipes		x	f
Syzygium guineense	not characteristic (indicator for Afromontane rain forest [*Syzygium guineense* ssp. *afromontanum*])	x	f
Tarenna graveolens		x	f
Trema orientalis		Cefs12	f
Trichocladus ellipticus	indicator	x	f
Uvaria scheffleri		x	f
Uvariodendron anisatum	indicator	C9	

Species	**regional status** (see section 2.3)	**(Kenya)**	**(Tanzania)**
Vangueria apiculata		x	f
Vangueria infausta		x	f
Vangueria madagascariensis		x	f
Vepris nobilis	characteristic genus, characteristic species in greater Serengeti region	Cg12	f
Vepris simplicifolia		C9	f
Vepris trichocarpa	characteristic in greater Serengeti region	C10	f
Vernonia auriculifera		x	f
Warburgia ugandensis	indicator	Cef30	f
Zanthoxylum chalybeum		x	f
Zanthoxylum usambarense		x	f

10.3. Species composition

Species assemblages were obtained from the following references:

- Kenya: Species listed in Annex 1 of Trapnell (1997) for "dry intermediate forest", moist intermediate and dry intermediate forest" and "of more general distribution" were coded "C". Suffix "e" indicates that the species was also listed for Afromontane moist transitional forest (Fe; synonym: moist intermediate forest, east). Suffix "f" indicates that the species was also listed for Lake Victoria transitional rain forest (Ff; synonym: moist intermediate forest, west). Suffix "g" indicates species of more general distribution. Suffix "s" indicates secondary species. Numbers show the maximum height of the species provided in the Annex (Trapnell 1997). Species that were expected to occur in the forest type based on information from Beentje (1994), the Flora of Tropical East Africa and field experience from our Kenyan co-author (F. Gachathi) were coded "x".
- Tanzania: Lovett (1993a). Species that were mentioned for "lower altitude dry montane forest" were coded "x" (these species were mentioned in a description of "dry montane forest" [altitude > 1500 m, annual rainfall: 1000 - 1200 mm], but altitude limits for the "lower altitude dry montane forest" were not given).

Characteristic species were determined as:

- Kenya: Species that were listed by Trapnell (1997) were assumed to be characteristic species (these were coded "C").
- Tanzania: Characteristic species were not identified.

Within the information on assemblages, coding "f " indicates that there is information that the species potentially occurs in the vegetation type since it occurs in the focal country and in the same forest type in other countries (see section 2.3).

11. Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest (Fi)

11.1. Description

White (1983 p. 46) restricted semi-evergreen forests to forests where some canopy species are briefly deciduous, but not necessarily at the same time, and most members of the understorey are evergreen.

The Lake Victoria regional mosaic consists of floristically impoverished variants of the characteristic vegetation types of the Guineo-Congolian, Sudanian, Zambezian and Somalia-Masai regional centres of endemism, sometimes with an admixture from Afromontane species (White 1983 p. 181). Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest is therefore expected to be a floristically impoverished variant of drier peripheral semi-evergreen Guineo-Congolian rain forests described for the Guineo-Congolian region (White 1983 p. 79). Most of the species of secondary grassland and wooded grassland in the Lake Victoria region also occur in Guineo-Congolian secondary grassland (White 1983 p. 181).

Regional indicator species (characteristic species listed by White (1983) [1983] that were only provided for Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest and no other Lake Victoria forest type) that were listed as characteristic species for one or several national maps include ***Alstonia boonei, Antiaris toxicaria, Chrysophyllum albidum, Entandrophragma cylindricum, Entandrophragma utile, Holoptelea grandis, Khaya anthotheca, Khaya grandifoliola, Mildbraediodendron excelsum, Milicia excelsa, Morus mesozygia, Piptadeniastrum africanum*** and ***Pycnanthus angolensis.***

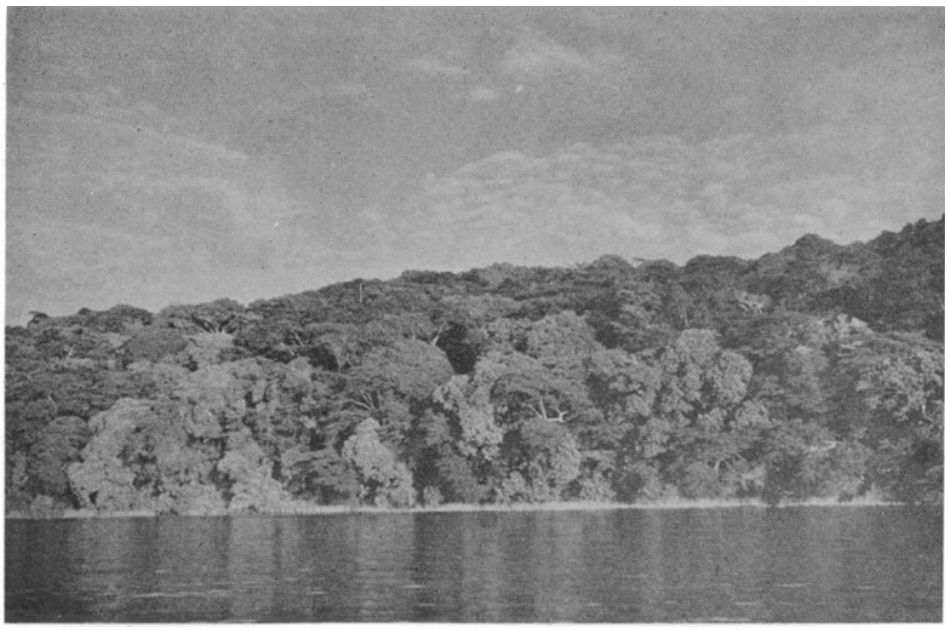


Figure 11.1 Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest on Bukasa Island (Ssese Islands, Uganda). Species shown include *Newtonia buchananii* and *Uapaca guineensis*. In the Uganda national map, this forest type was classified as *Piptadeniastrum - Uapaca* forests (C1). Thomas 1941. Image obtained from URL: *http://www.jstor.org/stable/2256396*

Figure 11.2 Profile diagram of Ironwood forest in Budongo (Uganda). This forest type was classified as Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest in the VECEA map and as *Cynometra - Celtis* forest (D2) in the Uganda national map. Characteristic species include *Cynometra alexandri* ("Cyn" in the figure; ironwood) and *Celtis zenkeri* ("Cz" in the figure). Eggeling 1947. Image obtained from URL: *http://www.jstor.org/stable/2256760*

Figure 11.3 Profile diagram of mixed forest in Budongo (Uganda). This forest type may represent a successional stage towards *Cynometra - Celtis* forest (D2; see Figure 11.2). Emergent species include: *Alstonia congensis* ("Ac"), *Khaya anthotheca* ("Kh") and *Mildbraediodendron excelsum* ("Ml"). Eggeling 1947. Image obtained from URL: *http://www.jstor.org/stable/2256760.*

11.2. VECEA region

Within the VECEA region, Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest is only mapped for Kenya, Tanzania and Uganda (Figure 11.4, see also Volume 6).

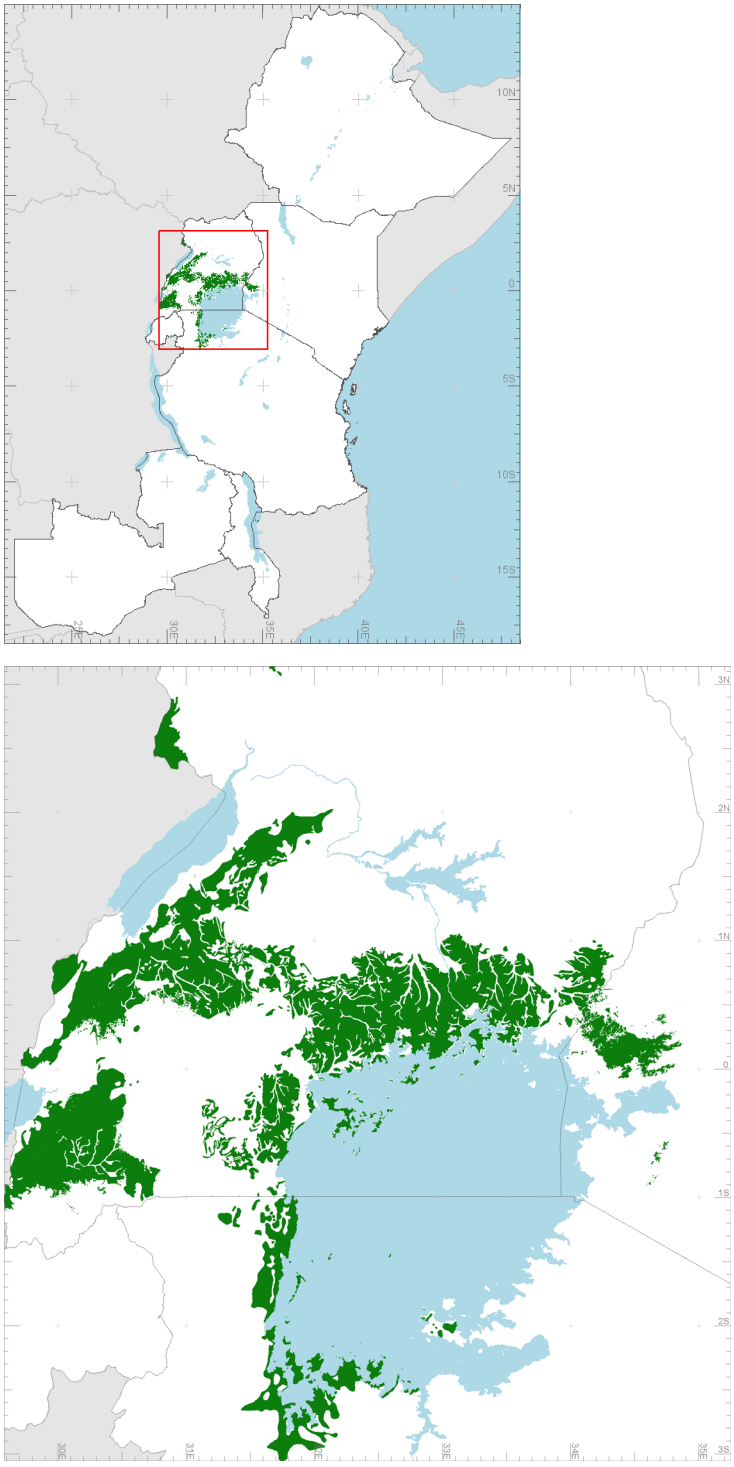


Figure 11.4. Mapped distribution of Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest in the VECEA region (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia). Green polygons depict where this forest type is mapped by the VECEA project.

In Kenya, Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest corresponds partially to the area mapped by Trapnell *et al.* (1966, 1969, 1976, 1986) as "moist intermediate forest, west"). We assume that no remnants of Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest existed when Trapnell *et al.* (1966, 1969, 1976, 1986) produced their maps for south-western Kenya. They did not differentiate between Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest and Lake Victoria transitional rain forest (Ff) and mapped both forests as "moist intermediate forest, west". We used an altitude limit of 1520 m to infer the boundary between these forest types (see volume 6).

Lovett (1990) described that Guineo-Congolian drier peripheral semi-evergreen rain forest occurred in Tanzania in Rubondo, but did not provide species composition.

In Uganda, Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest was originally mapped as 3 subtypes of medium-altitude moist evergreen forest (original mapping units C1 - C3) and 4 subtypes of medium-altitude moist semi-deciduous forest (original mapping units D1 - D4). We did not distinguish between the different Ugandan subtypes for the VECEA map, but maintained a floristic discrimination between these types in section 11.3. White (1983 p. 181) completely ignored the division between the two types despite making an explicit reference to page numbers 44 to 51 in the Langdale-Brown *et al.* (1964) text (*i.e.* the distinct description of both C- and D-types of forests) when describing Lake Victoria drier peripheral semi-evergreen Guineo-Congolian forest. Although Langdale-Brown *et al.* (1964) discriminated between moist evergreen "C" and moist semi-deciduous "D" types, they also mentioned that there is no sharp distinction between these forests types, but rather a gradual increase in the number of species that shed all their leaves and a gradual increase in the period for which these species are leafless. They further mention that no quantitative data were available to support their subdivision in the two categories - and that most features are similar in the various forests.

Medium-altitude moist evergreen forests contain a large number of genera whereby many genera are only represented by one species in any particular forest. Buttressed trees and large woody lianas are common. Strangling figs (that start their life epiphytically but eventually become huge self-supporting trees) and large antler ferns are the most conspicuous species of an abundant epiphytic flora (Langdale-Brown *et al.* 1964 pp. 44 -45). Langdale-Brown *et al.* (1964) discriminate the medium altitude moist evergreen forests in three subtypes:

- *Piptadeniastrum - Uapaca* forests (C1) occur on the Ssese Islands in Lake Victoria. They are characterized by *Uapaca guineensis*, a species that is ubiquitous (even on beach sands) on these islands but that also is a typical swamp forest tree in mainland Uganda. It is possible that this species was dominant because these forests became established when the islands were evacuated between 1902 and 1906 (following sleeping sickness epidemics) and that it would be mainly restricted to swamp forests if forest succession continues.

- *Piptadeniastrum - Albizia - Celtis* forests (C2) are characterized by a young stage in which various *Albizia* spp. (see section 11.3) and ***Piptadeniastrum africanum*** (sometimes forming nearly pure stands; this is also a characteristic species of the C1 forest subtype) are abundant and ***Antiaris toxicaria*** and *Maesopsis eminii* are also common. The more mature stages are dominated by *Celtis mildbraedii* (White [1983 p. 181] listed unspecified *Celtis* species as characteristic for Lake Victoria drier peripheral semi-evergreen Guineo-Congolian forest), *Celtis zenkeri* (not classified by VECEA as a useful tree species), various *Chrysophyllum* species (see section 11.2), ***Pouteria altissima*** and ***Pycnanthus angolensis.*** This is probably the forest climax as fossil records suggest that this forest occurred on Rusinga Island in the Miocene. *Parinari excelsa* occurs in some C2 forests, which is a characteristic species of forests of higher locations (*e.g.* C3 forests).
- *Parinari excelsa* forest (C3). *Parinari excelsa* is not fast growing, so it seems to be characteristic of the climax vegetation (White 1983 [p. 181] listed it as characteristic of Lake Victoria transitional rain forest [Ff] and not as characteristic of Lake Victoria drier peripheral semi-evergreen Guineo-Congolian forest; this species is also an indicator of Afromontane rain forest [Fa]). The presence in mud below volcanic tuffs of fruits and leaves that are thousands of years old further suggest that this species has been present in these forests for a long time. These forests are appreciable more moist than C2 forests as a result of their greater altitude and reduced evapotranspiration.

The four subtypes of medium-altitude moist semi-deciduous forests that Langdale-Brown *et al.* (1964) discriminate are:

- *Celtis - Chrysophyllum* forest (D1). This forest is floristically similar to the C2 forest. *Celtis* and *Chrysophyllum* species occur in both C2 and D1 forests, but these species are more abundant and more clearly a part of the climax vegetation in D1 forests.
- *Cynometra - Celtis* forest (D2). Langdale-Brown *et al.* (1964 p. 49) speculate whether ***Cynometra alexandri*** (ironwood) could be the climax on poor soils or soils with impeded drainage, whereas *Celtis* and *Chrysophyllum* species could replace this species on better soils. It is also possible that ***Cynometra alexandri*** particularly benefits from large elephant populations and their daily movements to and from waterholes (Langdale-Brown *et al.* 1964 p. 50). ***Cynometra alexandri*** is also a characteristic species of some Lake Victoria scrub forests (see fe).
- *Albizia - Markhamia* forest (D3). Most of these forests were formed relatively recently (during the first half of the 20th century). *Markhamia lutea* (synonym *Markhamia platycalyx*) forms an almost pure stand in many places where the forests are more narrowly confined to valley bottoms. The ultimate stage may be a form of *Celtis* forest (Langdale-Brown *et al.* 1964; in the VECEA project, we assume particularly a D1 or D2 forest).
- *Albizia - Chlorophora* (now: *Milicia*) forest (D4). The area where this

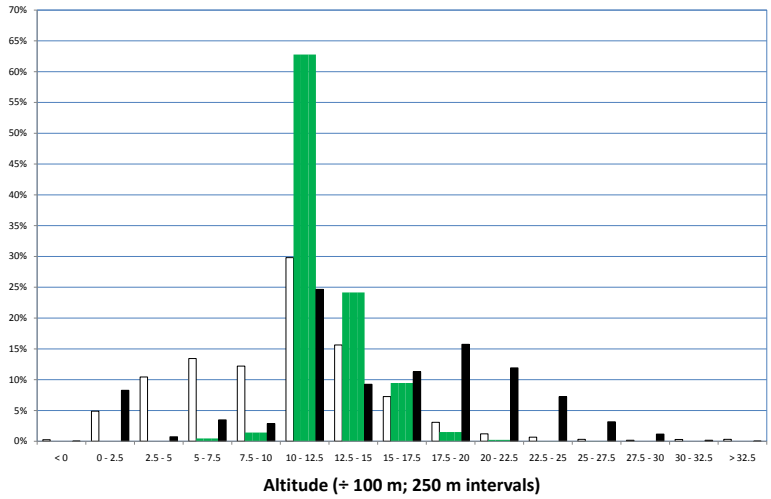
forest occurred was densely populated at the end of the 19th century until the sleeping sickness endemics of 1902 - 1906 killed over 100,000 people and the remainder of the population was evacuated. ***Milicia excelsa*** (Mvule, synonym: *Chlorophora excelsa*) grew within banana gardens as it was protected by locals customs and was probably a remnant from a previous forest type. It is possible but not certain that these forests could **potentially** develop into a *Celtis - Chrysophyllum* forest (D1; Langdale-Brown *et al.* 1964). Investigations by means of geographical information systems of the D1 and D4 vegetation types concluded that it is likely that D4 forests are transitional to D1 forests (P. van Breughel, personal investigations).

Lovett (1990 p. 292) describes that Lake Victoria dried up during the last glacial maximum (18,000 years ago) and that forests supported by convectional rains from this lake subsequently disappeared. The species occurring in Lake Victoria drier peripheral semi-evergreen rain forest and Lake Victoria swamp forest in Tanzania (and elsewhere in the Lake Victoria region) therefore dispersed in the area relatively recently.

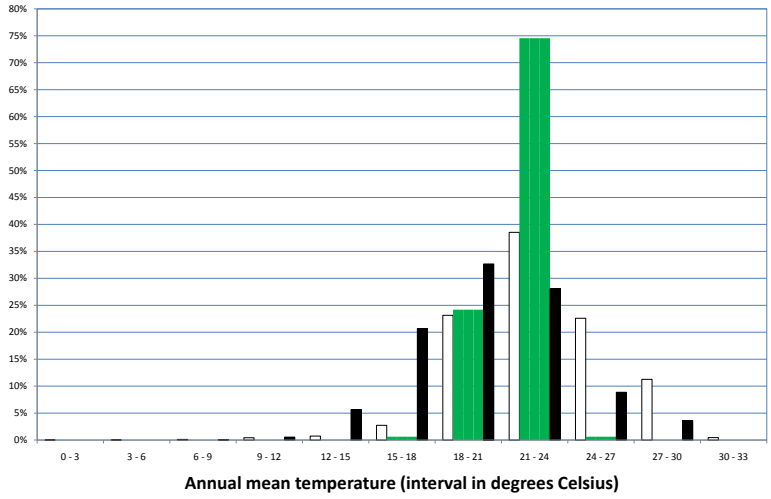
White (1983 p. 90) briefly describes a semi-evergreen variant of Zambezian dry evergreen forest (Fm) that occurs in Mbala district of Zambia. This forest is characterized by Guineo-Congolian species including *Celtis gomphophylla* (synonym *Celtis durandii*), *Pouteria altissima* and *Trichilia prieuriana.* These are characteristic species for Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest, so possibly this forest should be classified as one of the variants of drier peripheral semi-evergreen Guineo-Congolian rain forest.

Investigation of environmental distribution of Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest in the VECEA region (Figure 11.5) shows that most of this forest occurs between 1000 and 1750 m (with > 95% of the samples in this interval). The altitude interval where most of samples occur is the same for this vegetation type (1000 – 1250 m; 62.8% of samples) as for all forests combined (24.7%). Similarly, the rainfall interval that contains the highest number of samples is the same (1200 – 1400 mm) for this forest type (49.3%) as for all forests combined (23.6%).

(a)



(b)



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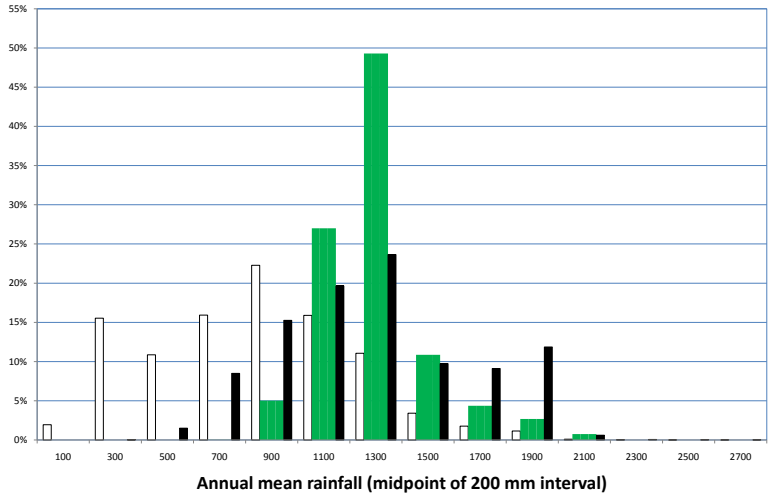


Figure 11.5 Histograms of the distribution of altitude (a), mean annual temperature (b) and mean annual rainfall (c). Bars at the centre of each interval show the percentage of samples within Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest (Fi, *n* = 11,967). Bars on left (open) show the overall percentage of samples (*n* = 740,047). Bars on the right (black) show the percentages of samples within forests (*n* =59,013).

11.3. Species composition

White (1983 p. 181) did not distinguish *Albizia* species. We identified 5 *Albizia* species as potential indicators as only one Albizia species (*Albizia gummifera*) was listed for Lake Victoria transitional rain forest (Ff).

Species composition was obtained from the following references:

- Kenya: Information was only available from floristic references and were coded "f". Species that were listed as characteristic species in Kenya for "Lake Victoria transitional rain forest" were coded "fK". Species listed within assemblages of "Lake Victoria transitional rain forest" were coded "fk". Species that were only available from the UNEP-WCMC database were coded "fw".
- Tanzania: Information was only available from floristic references and were coded "f". Species that were only available from the UNEP-WCMC database were coded "fw".
- Uganda: Langdale-Brown *et al.* (1964) and Howard & Davenport (1996). All species that were listed to occur in one of the C1 - C2 or D1 - D4 forests in the Appendix were coded "x" (unless they were characteristic species). Forests indicated on page 107 to only contain only one primary forest type were coded "xb": these referred to the Mpanga forest (C2) and Budongo, Bugoma, Semliki and Zoka forests (D2). A suffix of "s" indicated that the species were listed for "forest - savanna mosaic at medium altitudes [F2].[8]

Characteristic species were determined as:

- Kenya: characteristic species were not determined
- Tanzania: characteristic species were not determined
- Uganda. Species characterized as large trees ("trees" for the D3 and D4 forests) in the appendix or that were mentioned in the main text where the forest type was described were coded "C".

Floristics:

- Within the information on assemblages, coding "f " indicates that there is information that the species potentially occurs in the vegetation type since it occurs in the focal country and in the same forest type in other countries (see section 2.3).
- fK = species characteristic in Kakamega forest; fk = species occurs in Kakamega forest; fw = floristic evidence only from UNEP-WCMC
- fc = species occurs in forests that contain mixtures of C forests
- fd = species occurs in forests that contain mixtures of D forests

8: the only two species that were only listed in forest - savanna mosaics were *Acacia polyacantha* and *Mangifera indica* (exotic). We added *Acacia polyacantha* to the species assemblages (coded "s").

Table 11. Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest (Fi)

Species	Regional status (see section 2.3)	(Kenya)	(Tanzania)	LC1U (Uganda subtype)	LC2U (Uganda subtype)	LC3U (Uganda subtype)	LD1U (Uganda subtype)	LD2U (Uganda subtype)	LD3U (Uganda subtype)	LD4U (Uganda subtype)
Acacia polyacantha		f	f	s	s	s	s	s	s	s
Albizia adianthifolia	potential indicator (genus)	f	f	f	f	f	fd	xb	fd	fd
Albizia coriaria	potential indicator (genus)	f	f	fs	fs	fs	Cs	fds	Cs	Cs
Albizia glaberrima	potential indicator (genus)	f	f	fc	C	fc	C	xb	fd	C
Albizia grandibracteata	potential indicator (genus)	fK	f	fcs	Cs	fcs	Cs	Cs	Cs	Cs
Albizia gummifera		fK	f	fc	C	C	fd	xb	C	fd
Albizia zygia	potential indicator (genus)	fK	f	fcs	Cs	fcs	Cs	xbs	fds	Cs
Alchornea hirtella		f	f	fc	fc	fc	fd	xb	fd	fd
Allophylus abyssinicus		fk	f	fc	fc	fc	fd	xb	fd	fd
Allophylus africanus		f	f	f	f	f	x	fd	fd	fd
Alstonia boonei	indicator			fc	fc	fc	C	C	fd	C
Antiaris toxicaria	indicator	fK	f	Cs	Cs	fcs	Cs	xbs	Cs	Cs
Antidesma venosum		f	f	fc	fc	fc	fd	xb	fd	fd
Apodytes dimidiata		fk	f	fc	fc	fc	fd	xb	fd	fd
Baikiaea insignis			f	fcs	fcs	fcs	fds	xbs	fds	fds
Balanites wilsoniana		f	f	fc	xb	fc	fd	C	fd	fd
Beilschmiedia ugandensis			f	fc	x	fc	fd	xb	fd	fd
Bersama abyssinica		fK	f	fc	xb	fc	fd	xb	fd	fd
Blighia unijugata		fK	f	fc	xb	fc	x	xb	C	fd
Bombax buonopozense				f	f	f	fd	C	fd	fd
Bridelia brideliifolia			f	f	f	f	fd	xb	fd	fd
Bridelia micrantha		fK	f	fc	xb	fc	fd	xb	fd	fd
Canarium schweinfurthii			f	Cs	xbs	fcs	fs	xbs	fds	Cs
Carapa procera			f	fc	fc	x	f	f	f	f
Cassipourea malosana		fK	f	fc	xb	fc	fd	xb	fd	fd
Cassipourea ruwensoriensis		fK	f	fc	fc	x	fd	xb	fd	fd
Celtis adolfi-fridericii	characteristic genus			fc	fc	fc	x	C	fd	fd

Species	Regional status (see section 2.3)	(Kenya)	(Tanzania)	LC1U (Uganda subtype)	LC2U (Uganda subtype)	LC3U (Uganda subtype)	LD1U (Uganda subtype)	LD2U (Uganda subtype)	LD3U (Uganda subtype)	LD4U (Uganda subtype)
Celtis africana	characteristic genus	fk	f	fc	C	fc	C	C	C	C
Celtis gomphophylla	characteristic genus	fK	f	fc	C	fc	C	xb	fd	fd
Celtis mildbraedii	characteristic genus	fK	f	fc	C	fc	C	C	fd	fd
Celtis philippensis	characteristic genus	f	f	f	f	f	C	x	fd	fd
Celtis zenkeri	characteristic genus		f	fc	C	fc	C	C	fd	C
Chrysophyllum albidum	indicator	fK		fc	C	C	C	xb	fd	fd
Chrysophyllum gorungosanum		f	f	fc	fc	C	f	f	f	f
Clausena anisata		fk	f	fc	xb	fc	x	x	x	x
Cordia africana		fK	f	fc	fc	fc	fd	xb	fd	fd
Cordia millenii		fK	f	fc	xb	fc	fd	xb	fd	fd
Cordia monoica		f	f	f	f	f	fd	xb	fd	fd
Craibia brownii		fk	f	fc	fc	fc	fd	xb	fd	fd
Croton macrostachyus		fK	f	fc	xb	fc	fd	xb	C	C
Croton megalocarpus		fK	f	fc	fc	C	fd	xb	fd	fd
Croton sylvaticus		fK	f	fc	xb	fc	fd	xb	fd	fd
Cussonia holstii		f	f	f	f	f	fd	xb	fd	fd
Cyathea manniana		fk	f	fc	fc	x	fd	fd	fd	fd
Cynometra alexandri	characteristic		f	f	f	f	fd	C	fd	fd
Diospyros abyssinica		fK	f	fc	xb	x	C	x	fd	x
Discopodium penninervium		f	f	f	f	f	fd	xb	fd	fd
Dombeya kirkii		f	f	f	f	x	x	xb	fd	fd
Dovyalis abyssinica		fk	f	f	f	f	fd	xb	fd	fd
Dovyalis macrocalyx		f	f	fc	fc	fc	fd	xb	fd	fd
Dracaena fragrans		fk	f	x	x	fc	x	fd	fd	fd
Dracaena steudneri		fK	f	fc	xb	fc	fd	xb	fd	fd
Ehretia cymosa		fK		fc	xb	fc	fd	xb	fd	fd
Ekebergia capensis		fK	f	fc	xb	fc	fd	xb	fd	fd
Elaeis guineensis	(palm species)	f	f	fc	fc	fc	fd	xb	fd	fd
Elaeodendron buchananii		f	f	f	f	f	fd	xb	fd	fd

Species	Regional status (see section 2.3)	(Kenya)	(Tanzania)	LC1U (Uganda subtype)	LC2U (Uganda subtype)	LC3U (Uganda subtype)	LD1U (Uganda subtype)	LD2U (Uganda subtype)	LD3U (Uganda subtype)	LD4U (Uganda subtype)
Entandrophragma angolense	characteristic	fK	fw	fc	C	fc	C	C	fd	fd
Entandrophragma cylindricum	indicator			fc	C	fc	fd	C	fd	fd
Entandrophragma excelsum			f	fc	xb	C	fd	fd	fd	fd
Entandrophragma utile	indicator			fc	C	fc	C	C	fd	fd
Erythrina abyssinica		f	f	fcs	xbs	fcs	fds	xbs	fds	fds
Erythrina excelsa		f	f	fc	x	fc	fd	xb	fd	fd
Erythrophleum suaveolens		f	f	fc	fc	fc	C	C	fd	fd
Erythroxylum fischeri		f	f	f	f	f	fd	xb	fd	fd
Euclea divinorum		f	f	f	f	f	fd	fd	fd	x
Euclea racemosa		f	f	f	f	f	fd	xb	fd	fd
Fagaropsis angolensis		fK	f	fc	xb	fc	fd	xb	C	C
Ficus exasperata		fK	f	fc	xb	fc	fd	xb	fd	fd
Ficus mucuso		fk	f	fc	C	fc	fd	xb	fd	fd
Ficus natalensis		fk	f	fc	xb	fc	fd	xb	fd	fd
Ficus sur		fK	f	fc	xb	fc	fd	xb	fd	fd
Ficus sycomorus		f	f	f	f	f	fd	xb	fd	fd
Ficus thonningii		fK	f	fc	fc	fc	fd	xb	fd	fd
Flueggea virosa		f	f	fc	xb	fc	fd	xb	fd	x
Funtumia africana		fK	f	xs	xs	xs	Cs	xs	fds	fds
Funtumia elastica				f	f	f	C	x	fd	fd
Galiniera saxifraga		fk	f	f	f	f	fd	xb	fd	fd
Garcinia buchananii		fK	f	fc	fc	fc	fd	xb	fd	fd
Guarea cedrata				f	f	f	fd	xb	fd	fd
Hallea stipulosa				fc	x	fc	fd	xb	fd	fd
Harrisonia abyssinica		f	f	f	f	f	fd	xb	fd	x
Harungana madagascariensis		fK	f	fc	xb	fc	fd	xb	fd	fd
Hexalobus monopetalus			f	f	f	f	fd	xb	fd	fd
Holoptelea grandis	indicator			fc	xb	fc	C	C	fd	fd

Species	Regional status (see section 2.3)	(Kenya)	(Tanzania)	LC1U (Uganda subtype)	LC2U (Uganda subtype)	LC3U (Uganda subtype)	LD1U (Uganda subtype)	LD2U (Uganda subtype)	LD3U (Uganda subtype)	LD4U (Uganda subtype)
Khaya anthotheca	indicator		f	fc	fc	fc	fd	C	fd	fd
Khaya grandifoliola	indicator			f	f	f	fd	C	fd	fd
Kigelia africana		fk	f	fc	fc	fc	fd	xb	fd	fd
Lannea barteri				fc	fc	fc	fd	xb	fd	fd
Lannea welwitschii		f	fw	fc	x	fc	fd	xb	fd	fd
Lepidotrichilia volkensii		fk	f	fc	xb	fc	fd	xb	fd	fd
Lovoa swynnertonii		f	f	fc	xb	C	fd	xb	fd	fd
Lovoa trichilioides			f	Cs	Cs	fcs	fds	xbs	fds	fds
Maesa lanceolata		fk	f	fc	xb	x	fd	xb	fd	fd
Maesopsis eminii	characteristic	fK	f	Cs	Cs	Cs	Cs	Cs	fds	fds
Manilkara butugii		fK		f	f	f	fd	xb	fd	fd
Manilkara dawei			f	fc	x	fc	fd	xb	fd	fd
Margaritaria discoidea		fk	f	fc	x	fc	fd	C	C	C
Markhamia lutea		fK	f	fcs	xbs	fcs	xs	xbs	Cs	Cs
Maytenus undata		fk	f	fc	xb	fc	fd	xb	fd	fd
Mildbraediodendron excelsum	indicator			f	f	f	C	C	fd	fd
Milicia excelsa	indicator	fK	f	fcs	xbs	fcs	fds	xbs	fds	Cs
Millettia dura		f	f	f	f	f	fd	xb	fd	fd
Mimusops bagshawei		fK	f	C	C	fc	C	xb	fd	C
Mimusops kummel		fK	f	f	f	f	fd	xb	fd	fd
Monodora myristica		fK	f	fc	xb	fc	fd	x	fd	fd
Morinda lucida			f	fc	x	fc	fd	xb	fd	fd
Morus mesozygia	indicator	fK	f	fc	C	fc	fd	xb	fd	fd
Myrianthus arboreus			f	fc	fc	fc	fd	xb	fd	fd
Myrianthus holstii		f	f	fc	fc	fc	fd	xb	fd	fd
Nauclea diderrichii				fc	fc	fc	fd	xb	fd	fd
Neoboutonia macrocalyx		fK	f	fc	xb	fc	fd	xb	fd	fd
Newtonia buchananii		f	f	Cs	fcs	Cs	fds	xbs	fds	fds

Species	Regional status (see section 2.3)	(Kenya)	(Tanzania)	LC1U (Uganda subtype)	LC2U (Uganda subtype)	LC3U (Uganda subtype)	LD1U (Uganda subtype)	LD2U (Uganda subtype)	LD3U (Uganda subtype)	LD4U (Uganda subtype)
Nuxia congesta		fK	f	f	f	f	fd	xb	fd	fd
Olea capensis		fK	f	fc	fc	C	fd	C	C	fd
Oncoba spinosa		f	f	fc	fc	fc	fd	xb	fd	fd
Oreobambos buchwaldii	(bamboo species indigenous to Africa)	f	f	fc	fc	fc	fd	xb	fd	fd
Ozoroa insignis		f	f	f	f	f	fd	xb	fd	fd
Parinari excelsa			f	fc	C	C	fd	xb	fd	fd
Parkia filicoidea		f	f	fc	xb	fc	fd	xb	fd	fd
Pavetta crassipes		f	f	fc	fc	fc	fd	xb	fd	fd
Pavetta oliveriana		f	f	fc	fc	fc	fd	xb	fd	fd
Peddiea fischeri		f	f	fc	fc	fc	fd	xb	fd	fd
Phoenix reclinata	(palm species)	fk	f	fcs	xs	fcs	fs	fs	fs	fs
Phytolacca dodecandra		fk	f	fc	xb	fc	fd	xb	fd	fd
Piptadeniastrum africanum	indicator			Cs	Cs	fcs	fds	xbs	fds	fds
Pleiocarpa pycnantha		f	f	fc	xb	x	fd	xb	fd	fd
Polyscias fulva		fK	f	x	xb	x	fd	xb	C	fd
Pouteria adolfi-friedericii		fk	f	f		f	fd	xb	fd	fd
Pouteria altissima	characteristic	fK	f	fc	C	C	fd	xb	fd	fd
Prunus africana		fk	f	fc	x	C	fd	xb	C	C
Pseudospondias microcarpa		fK	f	Cs	xbs	fcs	fds	xbs	fds	Cs
Psychotria mahonii		fk	f	fc	xb	fc	fd	xb	fd	fd
Psydrax parviflora		fK	f	fc	xb	fc	fd	xb	fd	fd
Pterolobium stellatum		fk	f	fc	xb	fc	x	xb	fd	fd
Pterygota mildbraedii			fw	f	f	f	fd	C	fd	fd
Pycnanthus angolensis	indicator		f	Cs	Cs	fcs	fds	xbs	fds	fds
Raphia farinifera	(palm species)	f	f	fc	x	fc	fd	xb	fd	fd
Rauvolfia caffra		f	f	f	f	f	fd	xb	fd	fd
Rauvolfia vomitoria			f	fc	x	fc	fd	xb	fd	fd
Rhus natalensis		f	f	fc	fc	fc	fd	xb	fd	fd

Species	Regional status (see section 2.3)	(Kenya)	(Tanzania)	LC1U (Uganda subtype)	LC2U (Uganda subtype)	LC3U (Uganda subtype)	LD1U (Uganda subtype)	LD2U (Uganda subtype)	LD3U (Uganda subtype)	LD4U (Uganda subtype)
Rhus vulgaris		f	f	fc	xb	fc	fd	xb	fd	fd
Ricinodendron heudelotii		f	f	fc	fc	fc	fd	xb	fd	fd
Rinorea angustifolia		f	f	f	f	f	fd	x	fd	fd
Ritchiea albersii		fk	f	fc	fc	fc	fd	xb	fd	fd
Rothmannia urcelliformis		fK	f	fc	xb	fc	fd	x	fd	fd
Schefflera volkensii		fk	f	fc	xb	fc	f	f	f	f
Schrebera arborea		fw		f	f	f	C	C	fd	fd
Scutia myrtina		fk	f	fc	fc	fc	x	xb	fd	x
Senna didymobotrya		fk	f	f	f	f	fd	xb	fd	fd
Shirakiopsis elliptica		fK	f	fc	x	C	fd	x	C	C
Spathodea campanulata		fK	f	fcs	xbs	fcs	fds	xbs	fds	fds
Sterculia dawei				fc	fc	fc	fd	xb	fd	fd
Strombosia scheffleri		fK	f	fc	xb	C	fd	xb	fd	fd
Strychnos mitis		f	f	fc	xb	fc	C	C	fd	fd
Symphonia globulifera			f	C	xb	C	fd	xb	fd	fd
Synsepalum brevipes		f	f	C	xb	fc	x	xb	fd	fd
Syzygium guineense		fk	f	fc	xb	fc	fd	xb	fd	fd
Tabernaemontana pachysiphon		fK	f	x	xb	fc	fd	x	fd	fd
Treculia africana			f	fc	xb	fc	fd	xb	fd	fd

Species	Regional status (see section 2.3)	(Kenya)	(Tanzania)	LC1U (Uganda subtype)	LC2U (Uganda subtype)	LC3U (Uganda subtype)	LD1U (Uganda subtype)	LD2U (Uganda subtype)	LD3U (Uganda subtype)	LD4U (Uganda subtype)
Trema orientalis		fK	f	fc	xb	x	fd	xb	fd	fd
Trichilia dregeana		fK	f	C	xb	fc	fd	C	fd	fd
Trilepisium madagascariense		fK	f	x	x	fc	C	x	fd	fd
Uapaca guineensis	Lake Victoria swamp forest		f	C	fc	fc	f	f	f	f
Uvaria scheffleri		f	f	f	f	f	fd	xb	fd	fd
Vangueria apiculata		f	f	fc	fc	fc	fd	xb	fd	fd
Vangueria madagascariensis		f	f	fc	xb	fc	fd	xb	fd	fd
Vepris nobilis		fK	f	fc	x	fc	C	x	x	C
Vernonia amygdalina		fk	f	fc	xb	fc	fd	xb	x	fd
Vernonia auriculifera		fk	f	f	f	f	fd	fd	x	C
Vitex ferruginea		f	f	f	f	f	fd	xb	fd	fd
Warburgia ugandensis		fK	f	f	f	f	C	xb	fd	fd
Xylopia aethiopica		f	f	x	fc	fc	fd	xb	fd	fd
Xylopia parviflora		f	f	f	f	f	fd	xb	fd	fd
Xymalos monospora		fk	f	fc	xb	fc	fd	fd	fd	fd
Zanha golungensis		f	f	fc	fc	fc	fd	xb	fd	fd
Zanthoxylum gilletii		fK	f	fc	x	fc	fd	xb	fd	fd
Zanthoxylum rubescens		fK	f	fc	xb	fc	fd	xb	fd	fd

12. Zambezian dry evergreen forest (Fm)

12.1. Description

Zambezian dry evergreen forest rarely exceeds 25 m in height except for a few emergents. This forest represents a physiognomic and floristic transition from Guineo-Congolian rain forest to Zambezian woodland (*e.g.*, Miombo woodland [Wm]), but also contains Afromontane species. Zambezian dry evergreen forest is simpler in structure than Guineo-Congolian rain forest, the leaves of the dominant trees are more coriaceous ('leathery') and have few drip-tips (White 1983 p. 89).

White (1983 p. 46) restricted dry forests to those forests that experience a dry season lasting several months and during which atmospheric humidity is low. Dry forests are shorter than rain forests and also simpler in structure and floristics (White 1983 p. 46)

Compared to Guineo-Congolian rain forest, Zambezian dry evergreen forest is floristically relatively poor. Floristic composition varies greatly from place to place. There are eight dominant and emergent tree species that overlap considerably with each other, although no species occurs throughout: ***Berlinia giorgii, Cryptosepalum exfoliatum* ssp. *pseudotaxus, Daniellia alsteeniana, Entandrophragma delevoyi, Marquesia acuminata, Marquesia macroura, Parinari excelsa*** and ***Syzygium guineense* ssp. *afromontanum. Cryptosepalum exfoliatum* ssp. *pseudotaxus*** dominates the most distinct type of Zambezian dry evergreen forest which occurs on Kalahari Sand [9] (White 1983 pp. 89 - 90).

In the Zambezian region, Zambezian dry evergreen forest is confined to the wetter northern parts where the mean annual rainfall is more than 1200 mm. On Kalahari Sand, however, Zambezian dry evergreen forest extends into regions where mean annual rainfall is more than 900 mm. Fire exclusion experiments suggest that Zambezian dry evergreen forest is confined to areas with deeper soils, whereas Miombo woodland (Wm) occurs on shallower soils[10]. Zambezian transition woodland (not included in the VECEA classification system) forms an ecotone between Zambezian dry evergreen forest and Miombo woodland on soils of intermediate depth; forest shrubs and climbers exist in dynamic equilibrium with miombo species in this ecotone (White 1983 pp. 89 - 92).

Regional indicator species (characteristic species listed by White (1983) [1983] that were only provided for Zambezian dry evergreen forest and no other Zambezian forest type) that were listed as characteristic species for the national map include ***Cryptosepalum exfoliatum*** ssp. ***pseudotaxus, Entandrophragma delevoyi, Marquesia acuminata, Marquesia macroura, Parinari excelsa*** (also an indicator of Afromontane rain forest [Fa] and Lake Victoria transitional rain forest [Ff]) and ***Syzygium guineense*** ssp. ***afromontanum*** (also an indicator of Afromontane rain forest [Fa] and Lake Victoria transitional rain forest [Ff]).

9: Kalahari Sand is a Pleistocene lacustrine deposit and possibly the erosion product from the weak Upper Karroo sandstones. The soil is deep, well drained and moderately acid (pH 5 -5.5). These soils are able to support dry evergreen forest because high rainfall compensates for the rapid drainage of the sands. (Fanshawe pp. 7, 11 and 16).

10: The interpretation that areas within the Zambezian floristic region that have deeper soils would only have Zambezian dry evergreen forest as the climax vegetation type - and not miombo woodland - is not generally accepted. It is known that miombo woodland occurs in areas with deeper soils, and it is not certain that all these areas with deeper soils previously supported Zambezian dry evergreen forest (P. Smith and J. Timberlake, pers. comm.; see also comments for miombo woodland in Volume 3).

Figure 12.1 *Cryptosepalum exfoliatum* forest on Kalahari Sand (Zambia). Right: *Cryptosepalum exfoliatum*. Left: *Brachystegia spiciformis* (dominant in miombo woodland). Photograph by M. Bingham.

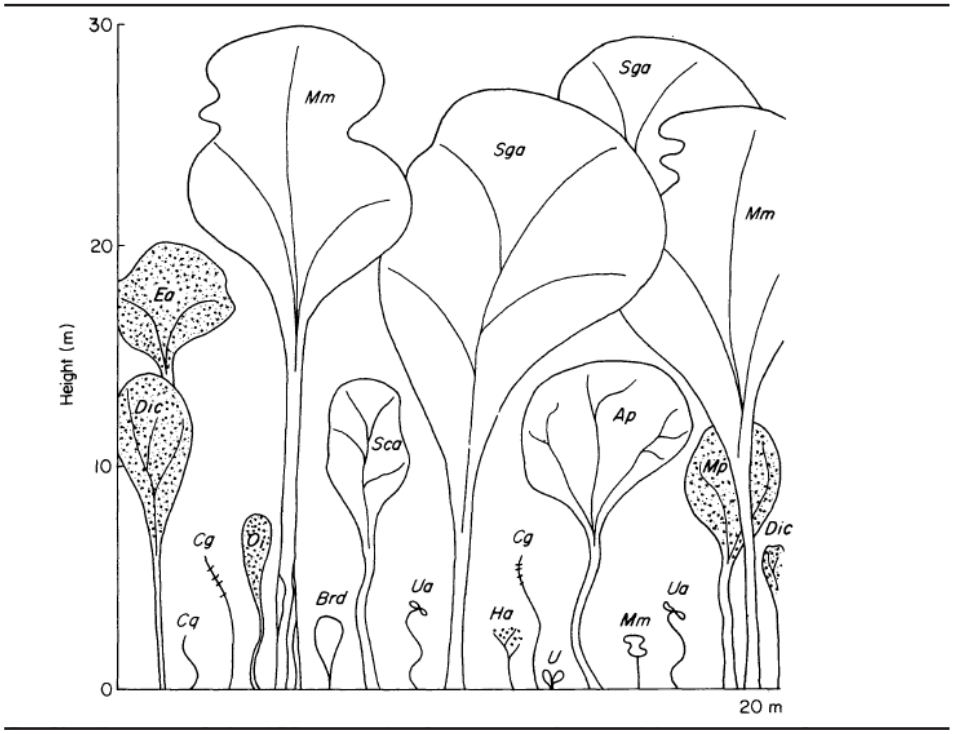


Figure 12.2 Profile diagram of a patch of Zambezian dry evergreen forest. Dominant species in the canopy are *Marquesia macroura* (Mm) and *Syzygium guineense* ssp. *afromontanum* (Sga). Species that are typical in Chipya woodland (Wy; see Volume 3) are stippled, including *Diplorhynchus condylocarpon* (Dic), *Erythrophleum africanum* (Ea) and *Maranthes polyandra* (Mp). Lawton 1978. Image obtained from URL: *http://www.jstor.org/stable/2259187*.

12.2. VECEA region

Within the VECEA region, Zambezian dry evergreen forest is only mapped for Zambia (Figure 12.3, see also Volume 6).

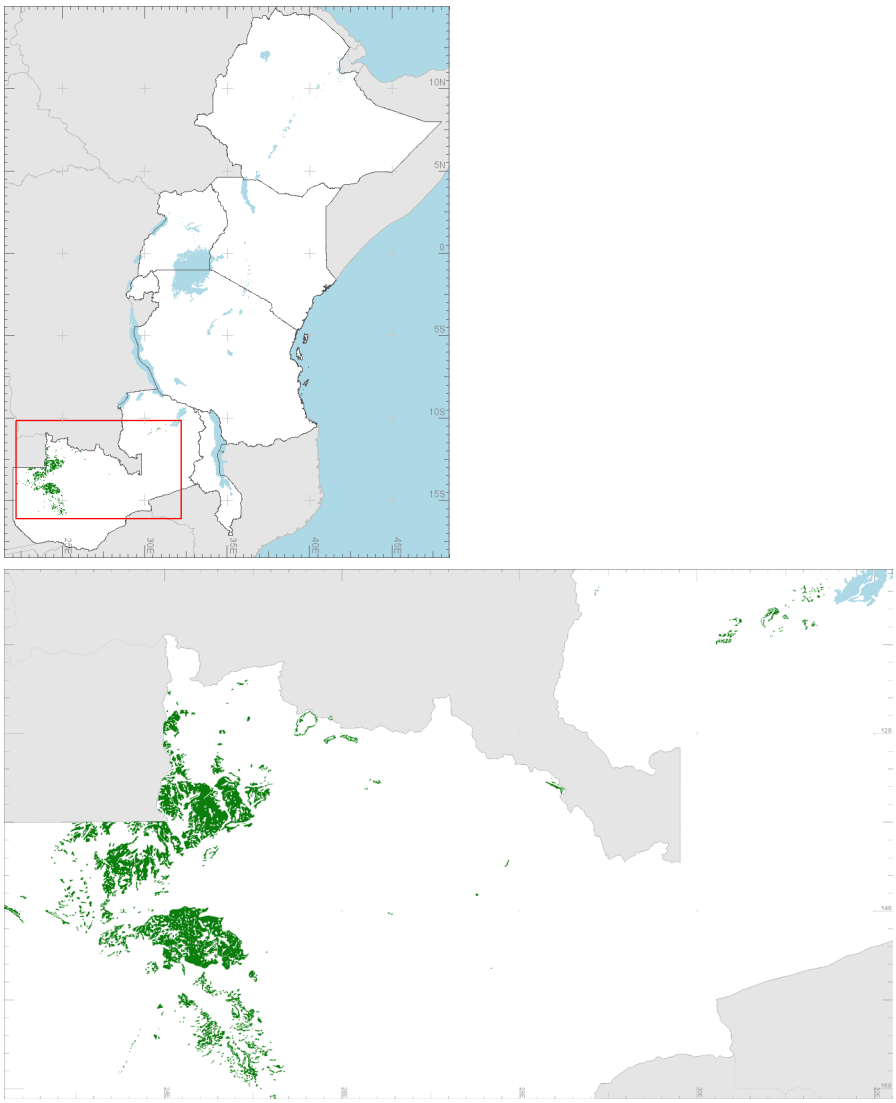


Figure 12.3. Mapped distribution of Zambezian dry evergreen forest in the VECEA region (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia). Green polygons depict where we mapped this forest type.

In Zambia, Zambezian dry evergreen forest was originally mapped as subtypes of *Cryptosepalum* forest on Kalahari Sand, *Marquesia* forest in the lake basin and *Parinari* forest on the plateau; see below [11]).

The three Zambian subtypes of dry evergreen forest are described as three-storeyed forests with a closed evergreen or semi-deciduous canopy of 25 to 27 m high, with occasional emergents, a discontinuous evergreen understorey of 9 to 15 m high and a dense evergreen shrub - scrambler thicket of 1.5 to 6 m high and sometimes a well-marked lower storey of 0.3 - 1.3 m high (Fanshawe 1971 p. 11).

Cryptosepalum forest (original mapping unit 4) occurs in the northern Kalahari basin. In lower rainfall areas, canopy dominants are restricted to ***Cryptosepalum exfoliatum* ssp. *pseudotaxus* and** *Guibourtia coleosperma*. In higher rainfall areas, ***Cryptosepalum exfoliatum* ssp. *pseudotaxus*** is associated with ***Marquesia acuminata, Marquesia macroura, Parinari excelsa*** and ***Syzygium guineense* ssp. *afromontanum***. Partial destruction of *Cryptosepalum* forest followed by an invasion of dominant species from miombo woodland (Wm; especially *Brachystegia longifolia* and *Brachystegia spiciformis*) leads to miombo - Kalahari woodland (Wk). Total or almost total destruction of Cryptosepalum forest (or any of the regression stages to Kalahari woodland) eventually leads to Kalahari Sand Chipya woodland (Wy) where fire-hardy species occupy the canopy (Fanshawe 1971 pp. 16 - 17).

Marquesia forest (original mapping unit 2) occurs in the Bangweulu lake basin. Canopy dominants are restricted to *Anisophyllea pomifera*, ***Marquesia macroura***, *Podocarpus latifolius* (synonym *Podocarpus milanjianus*; this species occurs locally [in the Mukabe Protected Forest Area which lies in a slightly higher rainfall belt than most of the lake basin proper and drainage is impeded at depth by underlying rock] and is also characteristic for Afromontane rain forest [Fa] and Afromontane undifferentiated forest [Fbu]) and ***Syzygium guineense* ssp. *afromontanum***. Partial destruction of *Marquesia* forest results in a gradual regression to miombo woodland (Wm). During this regression, the forest is invaded by *Brachystegia* species (mainly *Brachystegia spiciformis*, one of the dominant species of miombo woodland) and *Isoberlinia* species (*Isoberlinia angolensis* is a dominant species of miombo woodland). Total destruction of *Marquesia* forest (essentially the destruction of the canopy) results in lake basin Chipya woodland (Wy) where fire-hardy species occupy the canopy (Fanshawe 1971 pp. 14 - 16).

Parinari forest (original mapping unit 1) occurs on the plateau. Dominant species of the canopy are restricted to ***Parinari excelsa*** and ***Syzygium guineense* ssp. *afromontanum***, with odd emergent species of *Entandrophragma delevoyi*. *Marquesia macroura* and *Erythrophleum suaveolens* are canopy associates in the South Mutundu block which is close to Katanga (Democratic Republic of Congo) where *Erythrophleum suaveolens* is a dominant species. Partial destruction of *Parinari* forests results in Copperbelt Chipya woodland (Wy, included with *Parinari* forest in original mapping unit 1), which is a vegetation type that has resulted from gradual regression to miombo woodland (Wm)([12]). Total destruction of *Parinari* forest results in Chipya woodland (Cy) that is

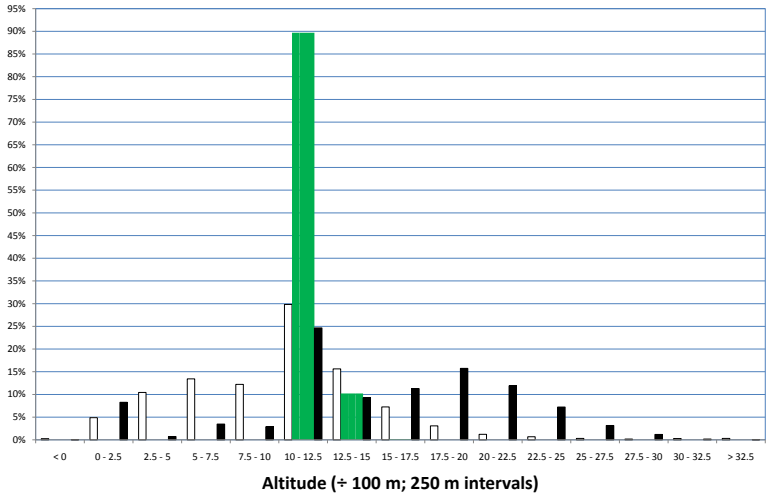
11: The coding of the Trapnell *et al.* (1950) soil - vegetation map is based on the soil type with a suffix for the vegetation type. In the legend of the Fanshawe vegetation map (Edmonds 1976), an indicating is given that *Cryptosepalum* forest corresponds to the Trapnell mapping unit K1 (*Cryptosepalum* low forest and woodland on Kalahari Sand), *Marquesia* forest corresponds to B1 (*Marquesia* and *Marquesia* woodlands on marginal Lake Basin soils) and *Parinari* forest together with Copperbelt chipya correspond to R (undifferentiated *Brachystegia - Isoberlinia* woodlands on red earths and allied red loams).

12: Remains of evergreen thickets are widespread in wetter miombo woodland; in several of these cases these could be relicts that suggest that evergreen forest was in former pluvial periods more widespread and have now been converted to wetter miombo woodland [Fanshawe 1971 p. 13]). In the Trapnell *et al.* (1950) vegetation - soil map, the *Parinari* forest and Copperbelt chipya (mapping unit 1) of Fanshawe corresponds to mapping unit R (Undifferentiated *Brachystegia - Isoberlinia* woodlands on red earths and allied red loams).

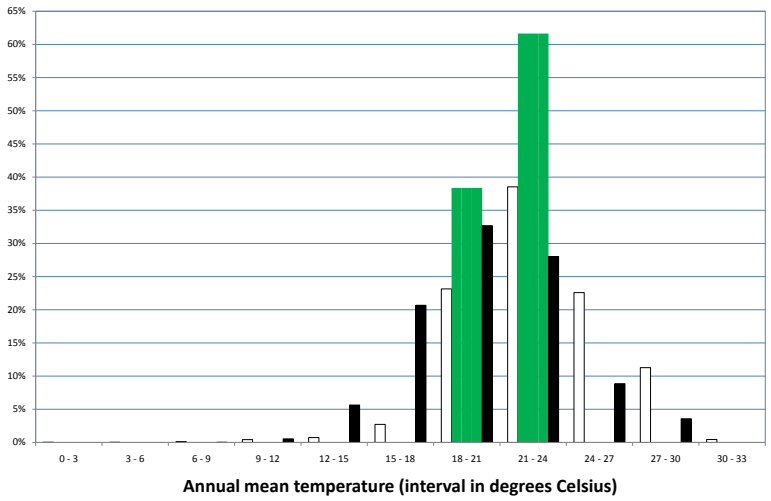
identical to Lake Basin Chipya (the result from total destruction from *Marquesia* forest) and where fire-hardy species have replaced the canopy species of *Parinari* forest (Fanshawe 1971 pp. 12 - 14).

Investigation of environmental distribution of Zambezian dry evergreen forest in the VECEA region (Figure 12.4) shows that most of this forest occurs between 1000 and 1500 m (with nearly all samples in this interval). The altitude interval where most of samples occur is the same for this vegetation type (1000 – 1250 m; 89.7% of samples) as for all forests combined (24.7%). Rainfall in Zambezian dry evergreen forest is below average with more than 95% of samples receiving 800 to 1400 mm annually. The only forest types that have a lower rainfall interval that contains the highest number of samples are Zambezian dry deciduous forest and scrub forest (Fn) and Zanzibar-Inhambane scrub forest (Fq).

(a)



(b)



(c)

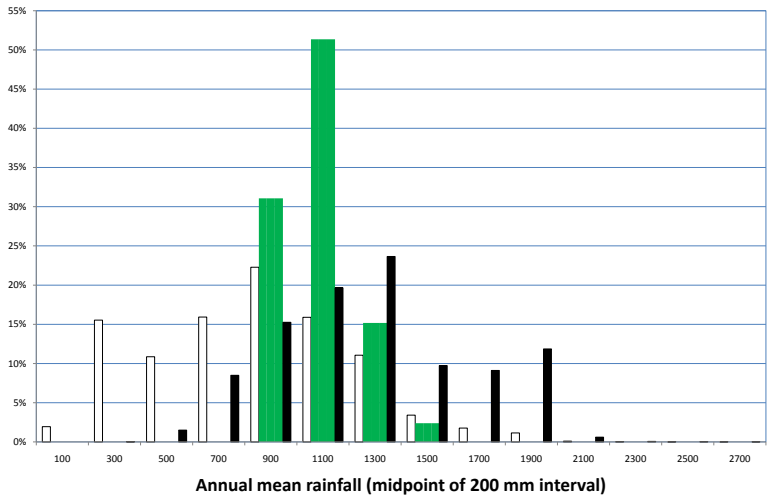


Figure 12.4. Histogrammes of the distribution of altitude (a), mean annual temperature (b) and mean annual rainfall (c). Bars at the centre of each interval show the percentage of samples within Zambezian dry evergreen forest (Fm, *n* = 4,512). Bars on left (open) show the overall percentage of samples (*n* = 740,047). Bars on the right (black) show the percentages of samples within forests (*n* =59,013).

12.3. Species composition

Species composition was obtained from the following references:

- Zambia: Fanshawe (1971). Species listed for the species composition table for "dry evergreen forest" provided on pages 17 to 18 were coded "x" (unless they were characteristic species).

Characteristic species were determined as:

- Zambia: Species that were listed in the main text as understorey species for *Cryptosepalum* forest were coded "Cc", whereas canopy dominant species were coded "Dc". Species that were listed in the main text as understorey species for *Marquesia* forest were coded "Cm", whereas canopy dominant species were coded "Dm". Species that were listed in the main text as understorey species for *Pariniri* forest were coded "Cp", whereas canopy dominant species were coded "Dp." Species that were only locally dominant were coded "C" instead of "D".

Within the information on assemblages, coding "f " indicates that there is information that the species potentially occurs in the vegetation type since it occurs in the focal country and in the same forest type in the regional information (White 1983).

Table 12. Species composition of Zambezian dry evergreen forest (Fm)

Species	**Regional status** (see section 2.3)	**FmZ (Zambia)**
Albizia adianthifolia		x
Apodytes dimidiata		x
Baphia massaiensis	not characteristic (indicator for *Baikiaea* forest)	Cc
Berlinia giorgii	indicator (dominant)	f
Bersama abyssinica		x
Cassipourea malosana		Cp
Chrysophyllum gorungosanum		x
Cryptosepalum exfoliatum	indicator (dominant, dominates dry evergreen forest on Kalahari Sand [*Cryptosepalum exfoliatum* ssp. *pseudotaxus*])	Dc
Daniellia alsteeniana	indicator (dominant)	f
Diospyros abyssinica		x
Entandrophragma delevoyi	indicator (dominant)	Cp
Erythrophleum suaveolens		Cp
Guibourtia coleosperma		Cc
Margaritaria discoidea		x
Marquesia acuminata	indicator (dominant)	Dm Cc
Marquesia macroura	indicator (dominant)	Dm Ccp
Maytenus acuminata		x
Olea capensis		Ccmp
Parinari excelsa	indicator (dominant)	Dp Cc
Peddiea fischeri		x
Podocarpus latifolius		Cm
Psydrax parviflora		x
Rinorea angustifolia		x
Smilax anceps		x
Strychnos lucens		x
Syzygium guineense	indicator (dominant [*Syzygium guineense* ssp. *afromontanum*])	Dmp Cc
Tabernaemontana pachysiphon		Cp
Vepris nobilis		Cp

13. Zambezian dry deciduous forest and scrub forest (Fn)

13.1. Description

Zambezian dry deciduous forests have a canopy that varies from 12 to 25 m that is not always continuous (White 1983 p. 90).

White (1983 p. 46) restricted dry forests to those forests that experience a dry season lasting several months and during which atmospheric humidity is low. Dry forests are shorter than rain forests and also simpler in structure and floristics. White (1983 pp. 46 - 47) further restricted deciduous forests to forests where the majority of individuals of the upper and lower canopy usually lose their leaves simultaneously and remain bare for several weeks. However, on favourable sites or in favourable years, the largest trees of Zambezian dry evergreen forest may remain evergreen over an almost completely deciduous lower canopy (White 1983 p. 47).

Zambezian dry deciduous forests occur in those parts of the Zambezian region where rainfall is between 600 and 900 mm per year. These forests are characteristically found on certain deep (usually sandy) soils which absorb all the rainfall and lateral seepage water and thereby remain moist at depth throughout the greater part of the dry season (White 1983 p. 90).

White (1983 p. 90) distinguishes between *Baikiaea* forests (where ***Baikiaea-plurijuga*** forms an almost pure canopy and ***Pterocarpus lucens*** [synonym *Pterocarpus antunesii*] is an abundant subdominant species) and related forests where ***Baikiaea plurijuga*** is absent, that occur in the valleys of the middle and lower Zambezi and that show continuous floristic change towards the east (*i.e.* towards Malawi). ***Baikiaea*** forests are almost confined to Kalahari Sand where ***Baikiaea plurijuga*** forms an almost pure canopy usually about 20 m high and the shrub layer (the 'mutemwa') forms a well-defined deciduous thicket of tall coppicing shrubs of 5 to 8 m high. *Pterocarpus-Newtonia* forests occur in the Lower Shire Valley of Malawi; here ***Baikiaea plurijuga*** is absent, ***Pterocarpus lucens*** and *Newtonia hildebrandtii* are co-dominant species and floristic composition is significantly different from ***Baikiaea-plurijuga*** forest (White 1983 p. 90).

Regional indicator species (characteristic species listed by White (1983) that were only provided for Zambezian dry deciduous forest and no other Zambezian forest type) that were listed as characteristic species for one or several national maps can be further classified as dominant, co-dominant or local emergent species, subdominant or associated species, 'mutemwa' species or other subclassifications (see section 13.2).

- Dominant, co-dominant or local emergent species include ***Baikiaea-plurijuga*** (dominant in ***Baikiaea*** forest), ***Entandrophragma caudatum*** (local emergent in ***Baikiaea*** forest), ***Newtonia hildebrandtii*** (co-dominant in *Pterocarpus-Newtonia* forest) and ***Pterocarpus lucens*** (dominant in ***Baikiaea*** forest, co-dominant in

Pterocarpus-Newtonia forest).

- Subdominant or associated species include ***Adansonia digitata*** (associate in *Pterocarpus-Newtonia* forest, absent in ***Baikiaea*** forest), ***Balanites maughamii*** (associate in *Pterocarpus-Newtonia* forest, absent in ***Baikiaea*** forest), ***Boscia albitrunca*** (subdominant in ***Baikiaea*** forest), ***Cordyla africana*** (associate in *Pterocarpus-Newtonia* forest, absent in ***Baikiaea*** forest), ***Croton gratissimus*** (subdominant in ***Baikiaea*** forest), ***Diospyros quiloensis*** (associate in *Pterocarpus-Newtonia* forest, absent in ***Baikiaea*** forest), ***Excoecaria bussei*** (subdominant in ***Baikiaea*** forest), ***Lonchocarpus nelsii*** (subdominant in ***Baikiaea*** forest) and ***Strychnos potatorum*** (subdominant in ***Baikiaea*** forest; this species also occurs in some types of Lake Victoria scrub forests [fe]).
- 'Mutemwa' species from ***Baikiaea*** forests include ***Acacia ataxacantha*** (most common), ***Acalypha chirindica, Alchornea occidentalis, Baphia massaiensis*** (most common), ***Bauhinia petersiana*** (most common), ***Canthium glaucum, Citropsis daweana, Combretum celastroides*** (most common), ***Combretum elaeagnoides*** (most common), ***Dalbergia martini*** (most common), ***Friesodielsia obovata*** (most common), ***Grewia flavescens, Markhamia zanzibarica, Rourea orientalis, Tarenna luteola*** and ***Tricalysia allenii***.

Kalahari thicket is similar to the 'mutemwa' deciduous understorey of ***Baikiaea plurijuga*** Zambezian dry deciduous forest (Fn). It is different from ***Baikiaea*** forest as it contains dwarf individuals (< 2 m tall) of ***Baikiaea plurijuga***. Since this vegetation type occurs near the edges or heads of certain dambos, dwarfing of ***Baikiaea plurijuga*** is probably a result from imperfect drainage (White 1983 p. 98). Whereas White (1983) described Kalahari thicket as a distinct vegetation type, we could not relate it to any national vegetation types. We assume that it was mapped together with Zambezian dry evergreen forest in the Zambian base map that we used (see section 13.2)

Figure 13.1 Zambezian dry deciduous forest (synonym: Namalembo thicket) in Liwonde National Park (Malawi). Photograph by C. Dudley.

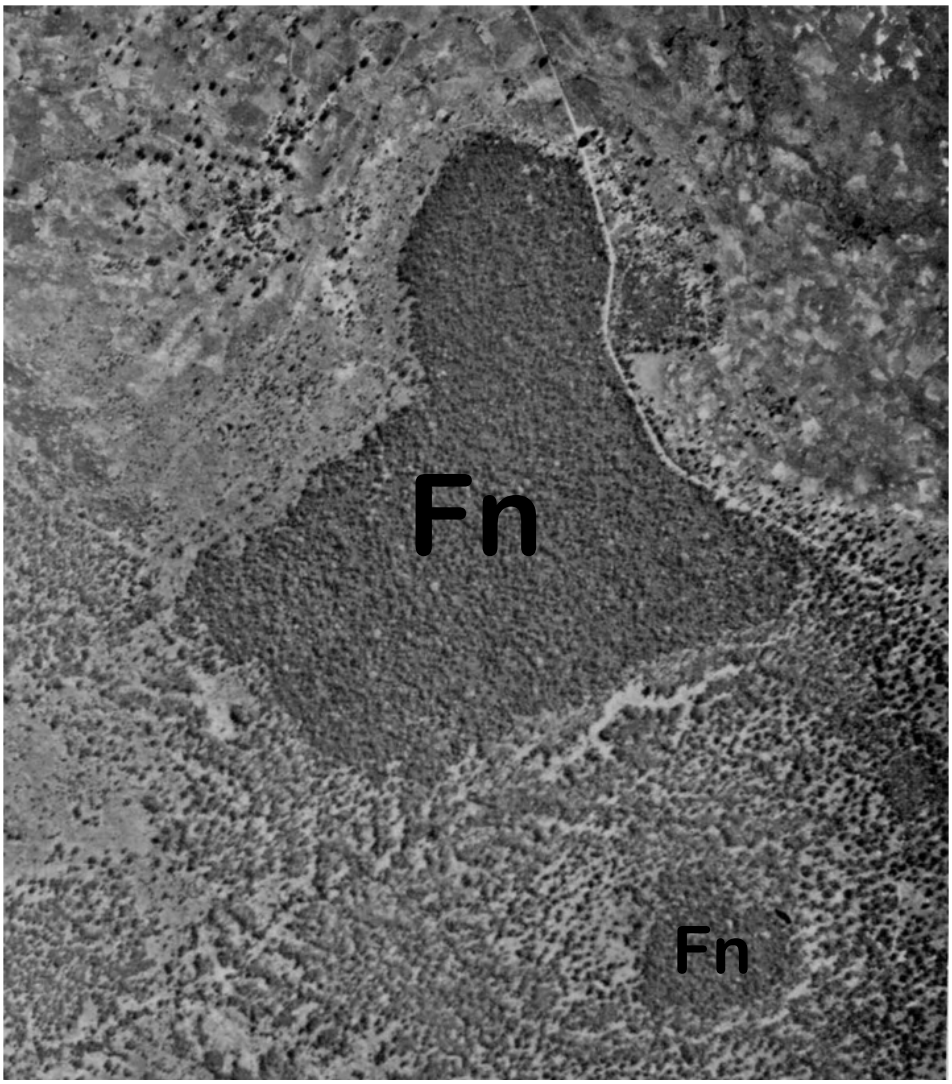


Figure 13.2 Aerial photographs of two patches of Zambezian dry deciduous forest and scrub forest (Fn, synonym: Namalembo thicket) in Liwonde National Park (Malawi). These two patches correspond to locations with coordinates of 14° 46.32′ S - 35° 21.15 E and 14° 47.12′ S - 35° 21.67′ S mentioned in the text. Photograph by C. Dudley.

13.2. VECEA region

Within the VECEA region, Zambezian dry deciduous forest and scrub forest is only mapped for Zambia (see Figure 13.3). This vegetation type also occurs in Malawi, but patches are too small to be mapped (C. Dudley, pers. comm.).

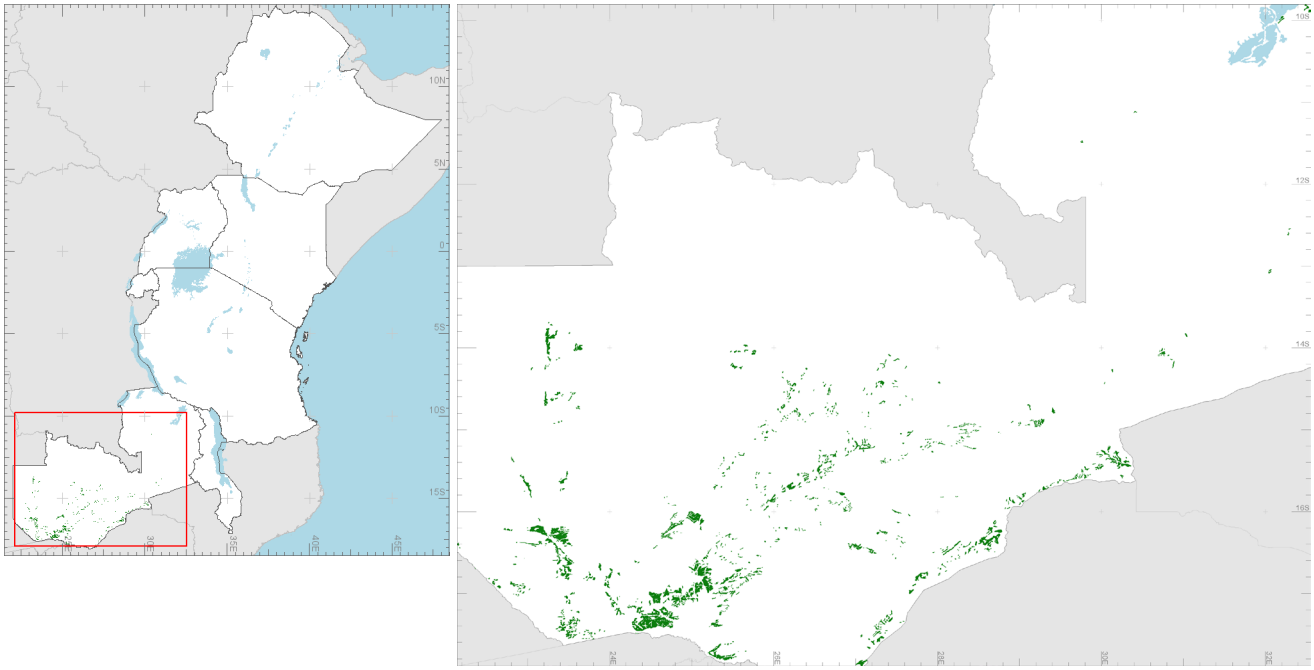


Figure 13.3. Mapped distribution of Zambezian dry deciduous forest and scrub forest (Fn) in the VECEA region (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia). Green polygons depict where this forest type was mapped. This forest type occurs in Malawi, but patches were too small to be mapped.

In Malawi, Zambezian dry deciduous forest and scrub forest was orginally described as deciduous forest and thicket. In this country, Zambezian dry deciduous forests are found only in the southern end of the country in its Rift Valley. They are remnants of what historically was a much larger vegetation community. Through the impact of human activity and perhaps climate change, this type is now broken up into a mosaic of sizes, dispersion patterns and serial stages (thicket - forest). All presently lie within protected areas but continue to be altered through the activities of large mammals (elephants) and fire. These areas are too small to be mapped (C. Dudley, personal observations).[13]

Two subtypes can be distinguished in Malawi (C. Dudley, personal observations):

(i) the Upper Shire Valley forests are smaller (total area approximately 3 km^2) and lie within an extensive Mopane woodland (Wo, see volume 3) and relative uniform soil and topographic features; and
(ii) the Lower Shire Valley forests are more extensive (total area approximately 10 km^2) and occur in a wider range of woodland types and topographic characteristics.

In Zambia, Zambezian dry deciduous forest and scrub forest was originally mapped as *Baikiaea* forest together with Trapnell's K10 and L2 forests[14] (see also volume 6).

Fanshawe (1971 p. 21) describes *Baikiaea* forest as a two-storeyed forest with an open or closed and usually deciduous canopy of 9 to 18 (exceptionally 27) m high. The canopy is composed of ***Baikiaea plurijuga*** (dominant) and ***Pterocarpus lucens*** (subdominant in the best developed forests), with ***Entandrophragma caudatum*** as a local emergent. *Acacia erioloba* and *Combretum collinum* are widespread invasive species. The shrub layer (the 'mutemwa') is a well-defined deciduous thicket of 3 to 6 m high composed of shrubs and scramblers with a vague understorey of 0.6 - 1.3 m high.

Baikiaea plurijuga is the only species of the *Baikiaea* genus that is found south of the Congo-Kasai basin (for example, *Baikiaea insignis* is co-dominant in swamp forest [fs] on alluvial deposits of the Kagera river). Fanshawe (1971 p. 22) theorizes that *Cryptosepalum* forest (Fm) outcompeted *Baikiaea* forest in higher rainfall Kalahari Sands areas (where *Baikiaea* forest was first established), but that *Baikiaea* forests persisted in low rainfall Kalahari Sands areas since *Cryptosepalum exfoliatum* ssp. *pseudotaxus* was not able to adapt to low rainfall by becoming deciduous (as ***Baikiaea plurijuga*** did).

Baikiaea plurijuga must have a well-aerated and free draining soil. Where these conditions are not met, variants of Zambezian dry deciduous forest may occur that do not contain ***Baikiaea plurijuga*** but are otherwise almost identical in species composition:

(i) *Commiphora angolensis - Combretum - Pterocarpus lucens* forests (originally mapped by Trapnell as K10) that occur on transitional Kalahari sands where drainage is impeded;
(ii) *Commiphora angolensis - Kirkia acuminata* forests (originally mapped

13: locations of remnants known by our Malawian co-author (C. Dudley) include: 14° 37.14' S - 35° 22.67' E; 14° 38.26' S - 35° 22.83' E; 14° 46.32' S - 35° 21.15 E; 14° 47.12' S - 35° 21.67' E in Liwonde National Park (Upper Shire Valley); and 16° 13.65' S - 34° 44.88' E in Lengwe National Park (Lower Shire Valley) ; 15° 44.44' S - 35° 28.45' E in Sombani Forest Reserve; 16° 45 S - 35° 00' E in Mwabvi Wildlife Reserve

14: The coding of the Trapnell *et al.* (1950) soil – vegetation map is based on the soil type with a suffix for the vegetation type. In the legend of the Fanshawe vegetation map (Edmonds 1976), an indicating is given that "*Baikiaea* forest and deciduous thicket" corresponds to K6 (*Baikiaea plurijuga* forests on transitional Kalahari Sand), K10 (*Commiphora - Combretum - Pterocarpus* thicket or forest occurring on transitional Kalahari Sand) and L2 *(Commiphora - Combretum - Pterocarpus* thicket or forest occurring on Lower Valley soils).

by Trapnell as L2, these forests are very similar to K10 forests except for the presence of *Kirkia acuminata* in the valley) that occur on Karroo sands in the valleys of the lower Luano, Luangwa and Zambezi rivers (with very similar characteristics as transitional Kalahari sands);

(iii) a deciduous forest closely related to the K10 forests that occurs on the Nambala ironstone hills (characteristic emergent species include ***Adansonia digitata, Entandrophragma caudatum,*** *Kirkia acuminata* and *Millettia eetveldeana*); and

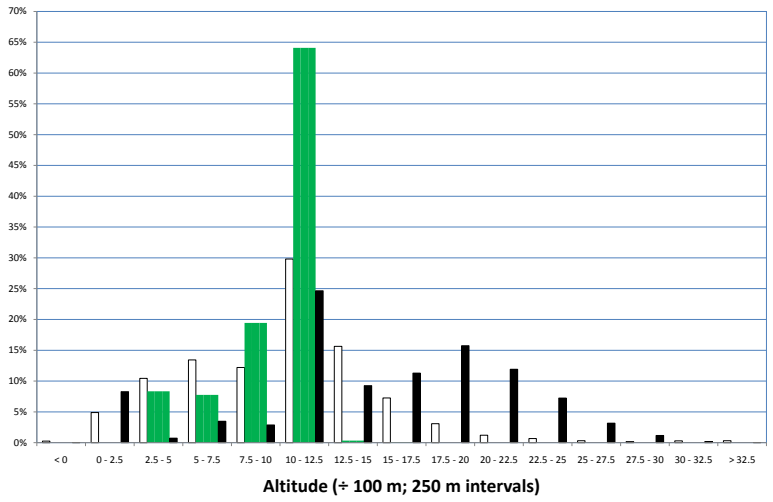
(iv) a deciduous forest with affinities to *Baikiaea* and *Commiphora* forests that occurs on dolomitic limestone around Lake Kashiba (where the common emergents are riparian species, mainly *Albizia glaberrima*, *Mimusops zeyheri* and *Xylopia katangensis*; Fanshawe 1971 pp. 22 - 23).

Xylia torreana (not a "useful tree species" and not listed in PROTA either) is a major constituent of the dry deciduous forests of the mid- and lower-Zambezi Valleys, and may well be regarded as the characteristic species of these forests (M. Bingham, pers. comm.).

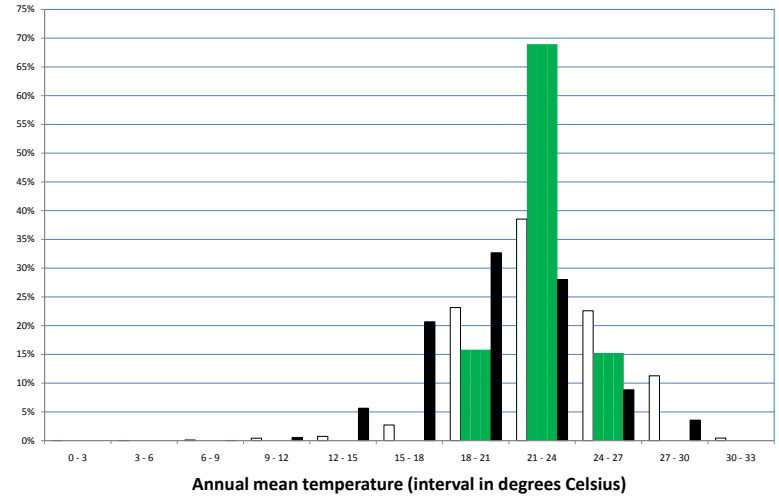
Partial destruction of *Baikiaea* forest (thinning of the overwood and gradual removal of the thicket by cultivation) leads to Kalahari woodland (Wk). Total or almost total destruction of *Baikiaea* forest results in a secondary type of *Baikiaea* forest where invasive species from Kalahari woodland (Wk) or Undifferentiated woodland (Wn) such as *Acacia erioloba*, *Combretum collinum* and *Terminalia sericea* superimpose on 'mutemwa' regrowth and where ***Baikiaea plurijuga*** or ***Pterocarpus lucens*** may not be present (depending whether crown fires occurred during the initial disturbance or not; Fanshawe 1971 p. 24).

Investigation of environmental distribution of Zambezian dry deciduous forest and scrub forest in the VECEA region (Figure 13.4) shows that most of this forest occurs between 250 and 1250 m (with almost all samples in this interval). The altitude interval where most of samples occur is the same for this vegetation type (1000 – 1250 m; 64.1% of samples) as for all forests combined (24.7%) and also for Zambezian dry evergreen forest (Fm, 89.7%). Much of this forest occurs at considerably lower altitudes than Zambezian dry evergreen forest (Fm). Rainfall in Zambezian dry deciduous forest and scrub forest is low with more than 95% of samples receiving 600 to 1000 mm annually. The only forest type that has the same low rainfall interval that contains the highest number of samples (600 – 800 mm; 64.9%) is Zanzibar-Inhambane scrub forest (Fq; 41.0%).

(a)



(b)



(c)

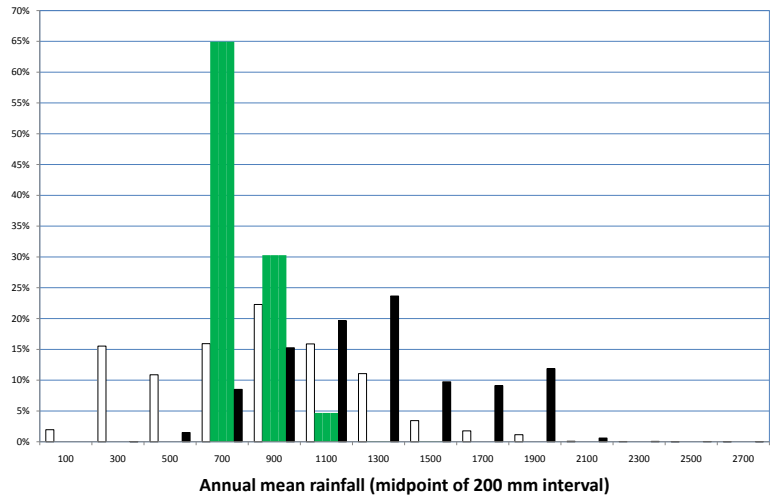


Figure 13.4 Histograms of the distribution of altitude (a), mean annual temperature (b) and mean annual rainfall (c). Bars at the centre of each interval show the percentage of samples within Zambezian dry deciduous forest and scrub forest (Fn, *n* = 2,074). Bars on left (open) show the overall percentage of samples (*n* = 740,047). Bars on the right (black) show the percentages of samples within forests *(n* =59,013).

13.3. Species composition

Species composition was obtained from the following references:

- Malawi: Dowset-Lemaire and Dowsett (2002), Dudley (1994), Hall-Martin (1972), Hall-Martin and Drummond (1980) and Palgrave (2002). Species were included in species assemblages partially based on the interpretation of our Malawian co-author (C. Dudley) since, given the range of environmental conditions that many of the species can tolerate, it becomes a value judgment whether to include the species as a common species of the forest type rather as just an accidental or very occasional species These species were coded "x" (unless they were characteristic species).A suffix of "l" indicates that the species is expected to only occur in the Lower Shire Valley. A suffix of "u" indicates that the species is expected to only occur in the Upper Shire Valley
- Zambia: Fanshawe (1971). Species listed for the species composition table for "dry deciduous forest - *Baikiaea* forest" provided on pages 26 to 27 were coded "x" (unless they were characteristic species). Species that were indicated to be restricted to Trapnell's K10 and L2 *Commiphora* thickets were coded "xc" (unless they were characteristic species). Species that were indicated to be secondary invasive species were coded "xs". Species listed in the main text for the "deciduous forest closely related to the K10 forests that occur on the Nambala ironstone hills" (Fanshawe [1971 p. 23]) were coded "y".

Characteristic species were determined as:

- Malawi: Species identified to be present as emergent trees (30 - 45 m) or large trees (20 - 30 m) were coded as "C". Liana species and species of marginal occurrence were not listed as characteristic species.
- Zambia: Species that were listed in the main text as canopy species for *Baikiaea* forest were coded "Db", whereas locally dominant or subdominant species were coded "Cb". Species that were listed in the main text as characteristic species for Trapnell's K10 and L2 Commiphora thickets were coded "Cc". [(15)]

Within the information on assemblages, coding "f " indicates that there is information that the species potentially occurs in the vegetation type since it occurs in the focal country and in the same forest type in other countries (see section 2.3).

15: retaining the "useful tree species" or those listed by Frank White resulted only in *Kirkia acuminata*, a species that does not occur in the K10 Commiphora thicket (Fanshawe 1971 p. 23).

Table 13. Species composition of Zambezian dry deciduous forest and scrub forest (Fn)

Species	Regional status	(Malawi)	(Zambia)
Acacia ataxacantha	indicator (shrub layer ['mutemwa'])	x	x
Acacia erioloba	invasive		Cb xs
Acacia fleckii	indicator (common in old fireholes)		x
Acacia nigrescens		f	xb
Acalypha chirindica	indicator (shrub layer ['mutemwa'])	f	x
Achyranthes aspera	indicator (shrubby herbs)	f	x
Adansonia digitata	indicator (associate in the Lower Shire Valley, not in *Baikiaea* forest)	C	xs
Afzelia quanzensis		x	f
Albizia glaberrima	(comment: in odd deciduous forest with affinities with *Baikiaea* or *Commiphora* forest)	f	y
Alchornea occidentalis	indicator (shrub layer ['mutemwa'])		x
Allophylus africanus		x	f
Baikiaea plurijuga	indicator (almost confined to Kalahari Sand)		Db
Baissea wulfhorstii	indicator (climber)		x
Balanites aegyptiaca			xc
Balanites maughamii	indicator (associate in the Lower Shire Valley, not in *Baikiaea* forest)	C	f
Baphia massaiensis	indicator (shrub layer ['mutemwa'])		x
Bauhinia petersiana	indicator (shrub layer ['mutemwa'])	f	x
Berchemia discolor		C	x
Blepharis maderaspatensis	indicator (shrubby herbs)		x
Boscia albitrunca	indicator (subdominant)		Cb
Brachystegia longifolia		f	xs
Canthium glaucum	indicator (shrub layer ['mutemwa'])	x	x
Capparis tomentosa		f	x
Cassia abbreviata		xu	f
Citropsis daweana	indicator (shrub layer ['mutemwa'])	x	f
Combretum celastroides	indicator (shrub layer ['mutemwa'])		x
Combretum collinum	invasive	f	Cb xs
Combretum elaeagnoides	indicator (shrub layer ['mutemwa'])		xs
Combretum imberbe		f	xb
Combretum mossambicense	indicator (climber)	x	x
Combretum schumannii		x	f
Combretum zeyheri		f	xb
Commiphora angolensis	indicator (locally subdominant)		Cb
Cordyla africana	indicator (associate in the Lower Shire Valley, not in *Baikiaea* forest)	C	f
Croton gratissimus	indicator (subdominant)	f	Cb xs
Croton pseudopulchellus	indicator (common in old fireholes)	xl	x
Croton scheffleri	indicator (smaller shrubs)	f	x
Dalbergia martinii	indicator (shrub layer ['mutemwa'])		x
Dichrostachys cinerea		x	x
Diospyros quiloensis	indicator (associate in the Lower Shire Valley, not in *Baikiaea* forest)	x	xc
Dombeya kirkii		x	f
Entandrophragma caudatum	indicator (local emergent)	C	Cb
Erythrococca menyhartii	indicator (smaller shrubs)		x

Species	Regional status	(Malawi)	(Zambia)
Euphorbia candelabrum	(comment: in odd deciduous forest with affinities with *Baikiaea* or *Commiphora* forest)	x	y
Excoecaria bussei	indicator (subdominant)	x	x
Friesodielsia obovata	indicator (shrub layer ['mutemwa'])	f	x
Garcinia livingstonei		x	f
Gardenia volkensii		xu	
Grewia avellana	indicator (smaller shrubs)		x
Grewia bicolor		f	x
Grewia flavescens	indicator (shrub layer ['mutemwa'])	x	x
Hypoestes forskaolii	indicator (shrubby herbs)		xs
Kirkia acuminata	(comment: not in *Commiphora* thicket K10)	xl	Cc xc
Lecaniodiscus fraxinifolius		x	f
Loeseneriella parvifolia	indicator (climber)	f	x
Lonchocarpus nelsii	indicator (subdominant)		Cb
Manilkara mochisia		x	f
Margaritaria discoidea		f	x
Markhamia obtusifolia	indicator (common in old fireholes)	x	x
Markhamia zanzibarica	indicator (shrub layer ['mutemwa'])	x	x
Newtonia hildebrandtii	indicator (codominant in the Lower Shire Valley)	C	f
Oncoba spinosa		x	f
Plumbago zeylanica	indicator (shrubby herbs)	f	x
Pterocarpus lucens	indicator (codominant in the Lower Shire Valley, subdominant in *Baikiaea* forest)	Cl	Cb
Pupalia lappacea	indicator (shrubby herbs)		x
Rhus tenuinervis		f	x
Rourea orientalis	indicator (shrub layer ['mutemwa'])	xu	x
Salvadora persica		x	f
Smilax anceps			xs
Sterculia quinqueloba	(comment: in odd deciduous forest with affinities with *Baikiaea* or *Commiphora* forest)	f	y
Strychnos innocua		f	Cb
Strychnos potatorum	indicator (subdominant)	x	Cb xs
Strychnos spinosa		x	f
Tarenna luteola	indicator (shrub layer ['mutemwa'])		x
Terminalia sericea		f	x
Tricalysia allenii	indicator (shrub layer ['mutemwa'])	x	x
Triumfetta annua	indicator (shrubby herbs)		x
Vitex ferruginea		xu	f
Vitex payos			x
Ximenia americana		xu	x
Xylia torreana		xu	f
Ziziphus pubescens		x	f

14. Zanzibar-Inhambane lowland rain forest (Fo)

14.1. Description

Zanzibar-Inhambane lowland rain forest has a main canopy that is almost evergreen and up to 20 m high. Emergents are 40 m or taller. This forest differs from Guineo-Congolian rain forests in greater degrees of bud protection, less developed drip-tips of leaves and low numbers of epiphytes (White 1983 p. 186).

Zanzibar-Inhambane lowland rain forests (Fo) differ from Zanzibar-Inhambane transitional rain forests (Fg) by occurring at lower altitudes (< 900 m) and having no admixture of Afromontane species (White 1983 p. 186) Zanzibar-Inhambane lowland rain forests were formerly extensively developed along the lower parts of the eastern highlands arc (especially the Nguru, Uluguru and Usambara Mts. of Tanzania), but only small fragments remain. Similar forests occur further inland as exclaves of the Zanzibar-Inhambane floristic region in other floristic regions such as on the Malawi Hills (within the Zambezian region) or near Tavetta (within the Somalia-Masai region; its presence is a result from the high water table in that location [16]; White 1983 p. 186).

Regional indicator species (characteristic species listed by White (1983) [1983] that were only provided for Zanzibar-Inhambane lowland rain forest and no other Zanzibar-Inhambane forest type) that were listed as characteristic species for one or several national maps (' indicators', see section 14.2) only include ***Burttdavya nyasica, Khaya anthotheca*** and ***Pouteria pseudoracemosa***. Most of the other characteristic species listed by White were also listed as characteristic species for other Zanzibar-Inhambane forest types (see section 14.2).

16: Dale (1939) mapped two patches of forests near Tavetta (and north of Lake Jipe) and classified these as "lowland evergreen edaphic forest". He describes them as forests that are unique in Kenya, but are similar in composition with the Lower Pare forests in Tanganyika and have also affinities with the S. Digo forests on the coast. These forests already were of small extent (not more than two square miles [~ 5 km²]) and occurred on volcanic ash in the vicinity of streams and rivers. Based on the description of the high water table, an alternative classification method could be as swamp forest (fs).

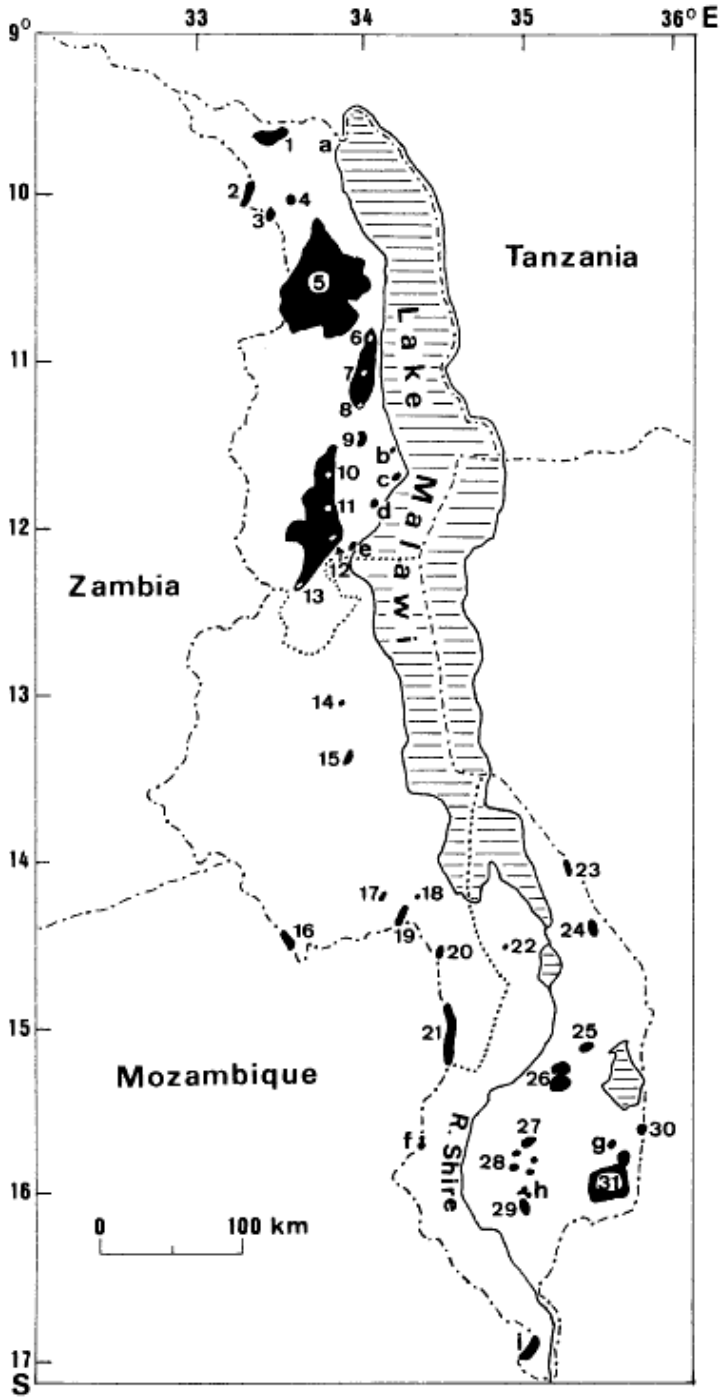


Figure 14.1 Distribution of Zanzibar-Inhambane lowland rain forest (Fo) in Malawi according to Dowsett-Lemaire 1990. a: Igembe Hill; b: Kalwe (Nkhata Bay), c: Nkuwadzi; d: Mzuma (Chintheche), e: Kuwilwe Hill; f: Thambani and Zobue Hills, g: Machemba Hill; h: Thyolo tea estates; i: Malawi Hills and 31: foot of Mt. Mulanje (locations with numbers 1 – 30 refer to areas of Afromontane forests and Zanzibar-Inhambane transitional rain forest in Malawi). Image obtained from URL: *http://www.jstor.org/stable/3668330*.

14.2. VECEA region

Within the VECEA region, Zanzibar-Inhambane lowland rainforest occurs in Kenya, Malawi and Tanzania (see Figure 14.4 and also Volume 6).

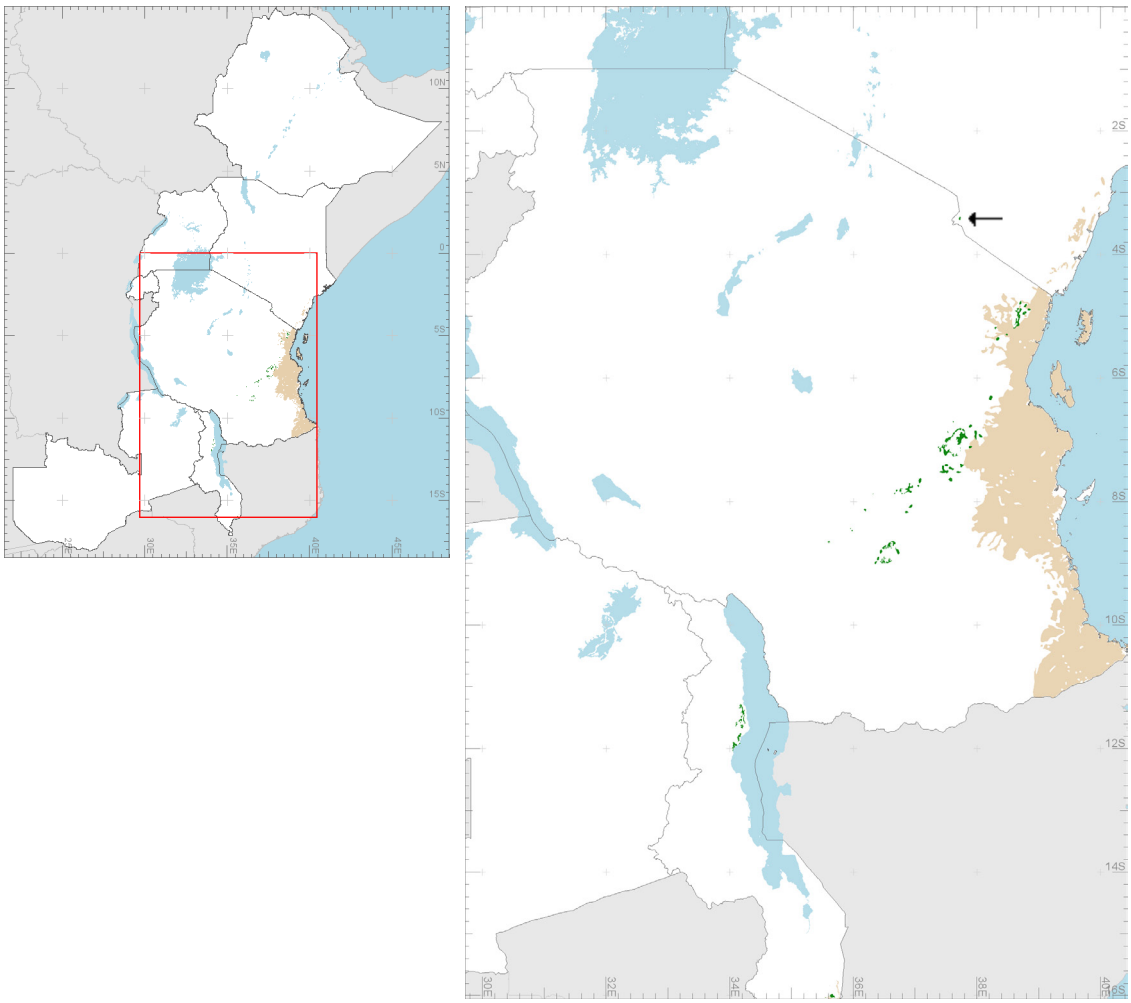


Figure 14.4 Mapped distribution of Zanzibar-Inhambane lowland rainforest in the VECEA region (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia). Where this vegetation type does not occur in mosaic, it is depicted by green polygons. This forest type is also mapped as part of different vegetation complexes (shown in greyish-brown). A variant of this forest type occurs near Tavetta in Kenya; an arrow indicates its location. Dowsett-Lemaire (1990; Fig FoA) provides a wider range of locations of this forest type in Malawi than depicted on the map (see Figure 14.1).

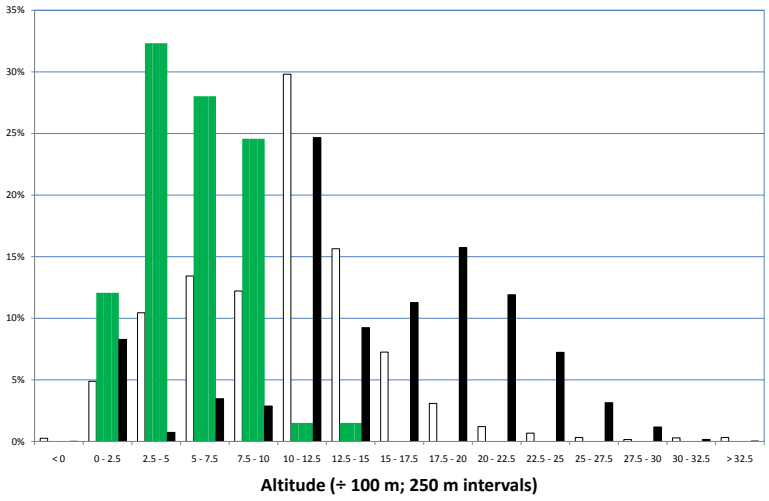
In Kenya, Zanzibar-Inhambane lowland rain forests occurred near Tavetta where its presence is a result from the high water table in that location (see previous section).

In Malawi, Zanzibar-Inhambane lowland rainforest was originally mapped as lowland rain forest. This forest type has long been under pressure from human activities and is the least preserved forest type in Malawi. Chapman and White's (1970) description of this forest type already showed serious declines in the extent of Lowland Rain Forest (they reported forest remnants to occupy about 20 km^2), whereas the extent of these forest is nowadays much smaller (C. Dudley, personal observations). Dowsett-Lemaire (1990) listed the following locations for lowland rain forest in Malawi: Nkuwadzi (600 m, 600 ha), Thyolo tea estates (1000 – 1100 m, 600 ha), Mzuma (Chintheche; 600 – 650 m, ~ 600 ha), Malawi Hills (600 – 940 m, ~ 400 ha), Kuwilwe Hill (500 – 1200 m, ~ 200 ha), the foothills of Mt. Mulanje (600 – 950 m, ~ 200 ha), Kalwe (Nkhata Bay; 500 m altitude, 80 ha), Thambani Hill (1100 – 1200 m, 78 ha), Machemba Hill (1150 – 1300 m, ~ 40 ha), Zobue Hill (900 – 1100 m, 20 ha), Mpita Estate (1100 m, 6 ha) and Igembe Hill. Only a subset of these locations were mapped in VECEA (see Figure 14.2 and Volume 6).

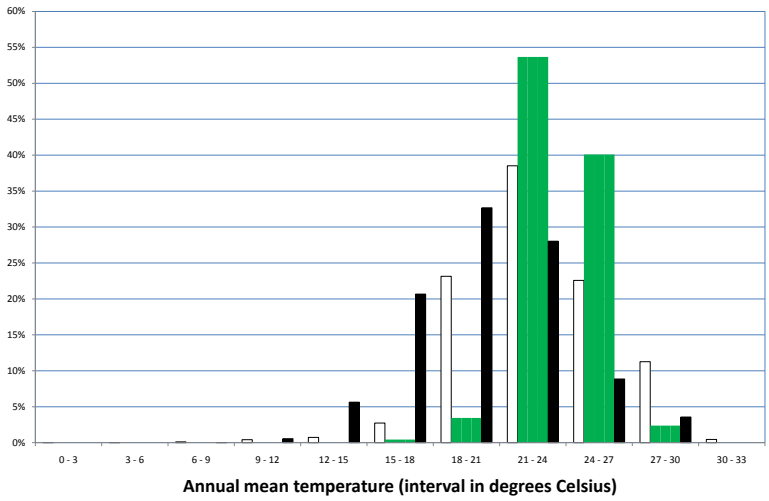
In Tanzania, Zanzibar-Inhambane lowland rain forests were originally described as "lowland forest". One of the synonyms listed by Lovett (1993a) for lowland forest is "Zanzibar-Inhambane lowland rain forest". Lovett (1998) clearly differentiated the Eastern Arc (including Zanzibar-Inhambane lowland rain forest) from coastal forests by having a separate column in the Appendix for lowland species that also occur in coastal forests (*i.e.* species that are no strict endemics of the Eastern Arc). In the VECEA map, we used the altitude limit of 900 m with the Gillman (1949) physiognomic map to infer the distribution of this forest type in Tanzania (see Volume 6).

Investigation of environmental distribution of Zanzibar-Inhambane lowland rain forest in the VECEA region (Figure 14.5; limits are for areas of the VECEA map where this forest is not mapped as mosaic) shows that the distribution in altitude (with > 95% of the samples in an interval from 0 – 1000 m) corresponded to the 900 m upper limit reported by White (1983; also see section 3.1). Note, however, that relatively few samples were obtained for this forest type. Moreover, finding this pattern is not surprising at all given that we used altitude limits to delineate this forest type in Tanzania. Annual rainfall of Zanzibar-Inhambane lowland rain forest is mainly between 800 and 1800 mm (94.4% of samples), representing average rainfall conditions for forests.

(a)



(b)



(c)

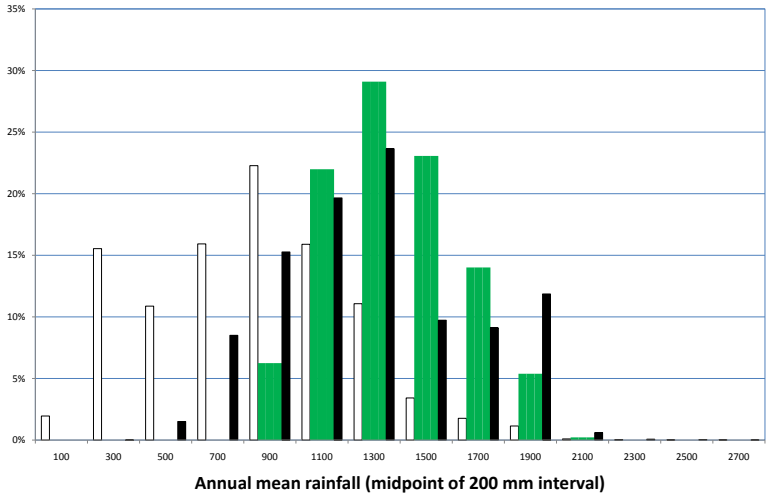


Figure 14.5. Histograms of the distribution of altitude (a), mean annual temperature (b) and mean annual rainfall (c). Bars at the centre of each interval show the percentage of samples within Zanzibar-Inhambane lowland rain forest (Fo, *n* = 464). Bars on left (open) show the overall percentage of samples (*n* = 740,047). Bars on the right (black) show the percentages of samples within forests (*n* =59,002).

14.3. Species composition

Species assemblages were obtained from the following references:

- Malawi: Chapman (1988) and Chapman and White (1970). These species were coded "x" (unless they were characteristic species).
- Tanzania: Lovett (1993a, 1998). Species that were mentioned for "lowland forest" in Lovett (1993a; altitude < 800 m; rainfall > 1500 mm) were coded "C" (since these species were interpreted as characteristic species).

Characteristic species were determined as:

- Malawi: Species identified to be present as emergent trees (30 - 45 m) or large trees (20 - 30 m, including stranglers) were coded as "C". Liana species were not listed as characteristic species.
- Tanzania: Species listed by Lovett (1993a) were coded "C".

Within the information on assemblages, coding "f " indicates that there is information that the species potentially occurs in the vegetation type since it occurs in the focal country and in the same forest type in other countries (see section 2.3).

All species listed by White (1983) for Zanzibar-Inhambane lowland rain forest were listed, even if their presence was not listed in the references that we consulted to obtain information on species assemblages (these species only had entries of "f").

Table 14. Species composition of Zanzibar-Inhambane lowland rain forest (Fo)

Species	Regional status (see section 2.3)	(Malawi)	(Tanzania)
Albizia adianthifolia	not characteristic (indicator for moister variants of Zanzibar-Inhambane undifferentiated forest)	C	f
Anthocleista grandiflora		C	C
Antiaris toxicaria	characteristic		f
Blighia unijugata		x	f
Bombax rhodognaphalon		C	C
Brachystegia spiciformis		C	f
Burttdavya nyasica	indicator	C	f
Calodendrum capense		x	f
Celtis africana		x	f
Celtis gomphophylla		C	f
Cordyla africana	characteristic	x	f
Croton sylvaticus		C	f
Diospyros abyssinica	not characteristic (indicator for moister variants of Zanzibar-Inhambane undifferentiated forest [rare])	C	f
Diospyros mespiliformis	characteristic	C	f
Dovyalis macrocalyx		x	f
Ekebergia capensis		x	f
Englerophytum natalense		x	C
Erythrophleum suaveolens	not characteristic (indicator for moister variants of Zanzibar-Inhambane undifferentiated forest)	C	C
Ficus exasperata		x	f
Ficus sur		C	f
Ficus thonningii		C	
Ficus vallis-choudae	not characteristic (indicator for moister variants of Zanzibar-Inhambane undifferentiated forest)	C	f
Filicium decipiens		x	C
Funtumia africana	not characteristic (indicator for Zanzibar-Inhambane transitional rain forest [Guineo-Congolian linking species])	C	C
Garcinia buchananii		x	C
Harrisonia abyssinica		x	f
Khaya anthotheca	indicator	C	C
Landolphia buchananii		x	
Landolphia kirkii		x	f
Lecaniodiscus fraxinifolius		x	f
Lovoa swynnertonii	characteristic		f
Macaranga capensis	not characteristic (characteristic for Zanzibar-Inhambane transitional rain forest and undifferentiated forest)	x	f
Maranthes goetzeniana	characteristic		f
Margaritaria discoidea		x	f
Milicia excelsa	characteristic	C	C
Newtonia buchananii	characteristic	C	f
Olyra latifolia			C
Oreobambos buchwaldii	(bamboo species indigenous to Africa)	x	
Parinari excelsa		f	C
Parkia filicoidea	characteristic	C	C

Species	Regional status (see section 2.3)	(Malawi)	(Tanzania)
Phoenix reclinata	(palm species)	x	f
Pouteria pseudoracemosa	indicator (very local)		Ce
Pterocarpus tinctorius		C	f
Rauvolfia caffra	not characteristic (indicator for Zanzibar-Inhambane transitional rain forest [Guineo-Congolian linking species])	C	f
Ricinodendron heudelotii	characteristic		C
Saba comorensis		x	
Shirakiopsis elliptica		x	C
Sorindeia madagascariensis		C	C
Sterculia appendiculata	characteristic	f	f
Synsepalum brevipes	not characteristic (indicator for moister variants of Zanzibar-Inhambane undifferentiated forest)	x	f
Syzygium guineense		x	f
Tabernaemontana pachysiphon		x	C
Terminalia sambesiaca	characteristic	C	C
Treculia africana	not characteristic (indicator for Zanzibar-Inhambane transitional rain forest [Guineo-Congolian linking species])	f	C
Trichilia dregeana		C	f
Trilepisium madagascariense	not characteristic (indicator for Zanzibar-Inhambane transitional rain forest [Guineo-Congolian linking species])	C	C
Zanha golungensis		C	C

15. Zanzibar-Inhambane undifferentiated forest (Fp)

15.1. Description

White (1983) reserved the term of "undifferentiated forests" to forests that undergo rapid and kaleidoscopic changes in structure and species composition over short distances (White 1983 p. 47).

A distinction can be made between moister and drier variants of Zanzibar-Inhambane undifferentiated forest:

- The moister variants have a main canopy at 15 to 20 m with emergents of 30 to 35 m. Many of the canopy species are briefly deciduous, although not concurrently, but appreciably more deciduous than semi-evergreen lowland rain forests (*e.g.,* Lake Victoria drier peripheral semi-evergreen Guineo-Congolian rain forest [Fi]). The floristically richest types of moister variants of Zanzibar-Inhambane undifferentiated forests occur in Kenya and northern Tanzania (White 1983 p. 187).
- The drier forest variants are floristically more diverse than the moister variants. Most of the larger tree species are locally dominant or co-document and sometimes gregarious. The drier forests cover a larger area than the moister forests and also extend further to the north and south (White 1983 p. 187).

Regional indicator species (characteristic species listed by White (1983) [1983] that were only provided for Zanzibar-Inhambane undifferentiated forest and no other Zanzibar-Inhambane forest type) that were listed as characteristic species for one or several national maps can be further classified as characteristic species only listed for moister forest variants, only listed for drier forest variants or listed for both moister and drier variants:

- Characteristic species for moister forest variants: ***Albizia adianthifolia, Apodytes dimidiata*** (also characteristic of Afromontane undifferentiated forest [Fbu], Afromontane dry transitional forest [Fh] and Lake Victoria transitional rain forest [Ff]), ***Bombax rhodognaphalon, Celtis philippensis, Cola clavata, Diospyros abyssinica*** (also a characteristic species of Afromontane rain forest [Fa] and Afromontane dry transitional forest [Fh]), ***Erythrina sacleuxii, Erythrophleum suaveolens, Fernandoa magnifica, Ficus vallis-choudae, Inhambanella henriquesii, Lannea welwitschii, Malacantha alnifolia, Mimusops aedificatoria, Nesogordonia holtzii, Paramacrolobium coeruleum, Synsepalum brevipes*** and ***Xylopia parviflora***.
- Characteristic species for drier forest variants: ***Acacia robusta, Albizia petersiana, Brachylaena huillensis, Cassipourea euryoides, Cussonia zimmermannii, Cynometra webberi, Manilkara sulcata, Oldfieldia somalensis, Pleurostylia africana, Scorodophloeus fischeri, Tamarindus indica*** and ***Warneckea sansibarica.***

- Characteristic species both for moister and drier forest variants: ***Afzelia quanzensis, Balanites wilsoniana, Combretum schumannii, Hymenaea verrucosa, Julbernardia magnistipulata, Manilkara sansibarensis and Newtonia paucijuga***.

More information on coastal forests can be obtained from URL http://coastalforests.tfcg.org/ (last accessed June 2011).

15.2. VECEA region

Within the VECEA region, Zanzibar-Inhambane undifferentiated forest only occurs in the coastal areas of Kenya and Tanzania (Figure 15.1, see also Volume 6).

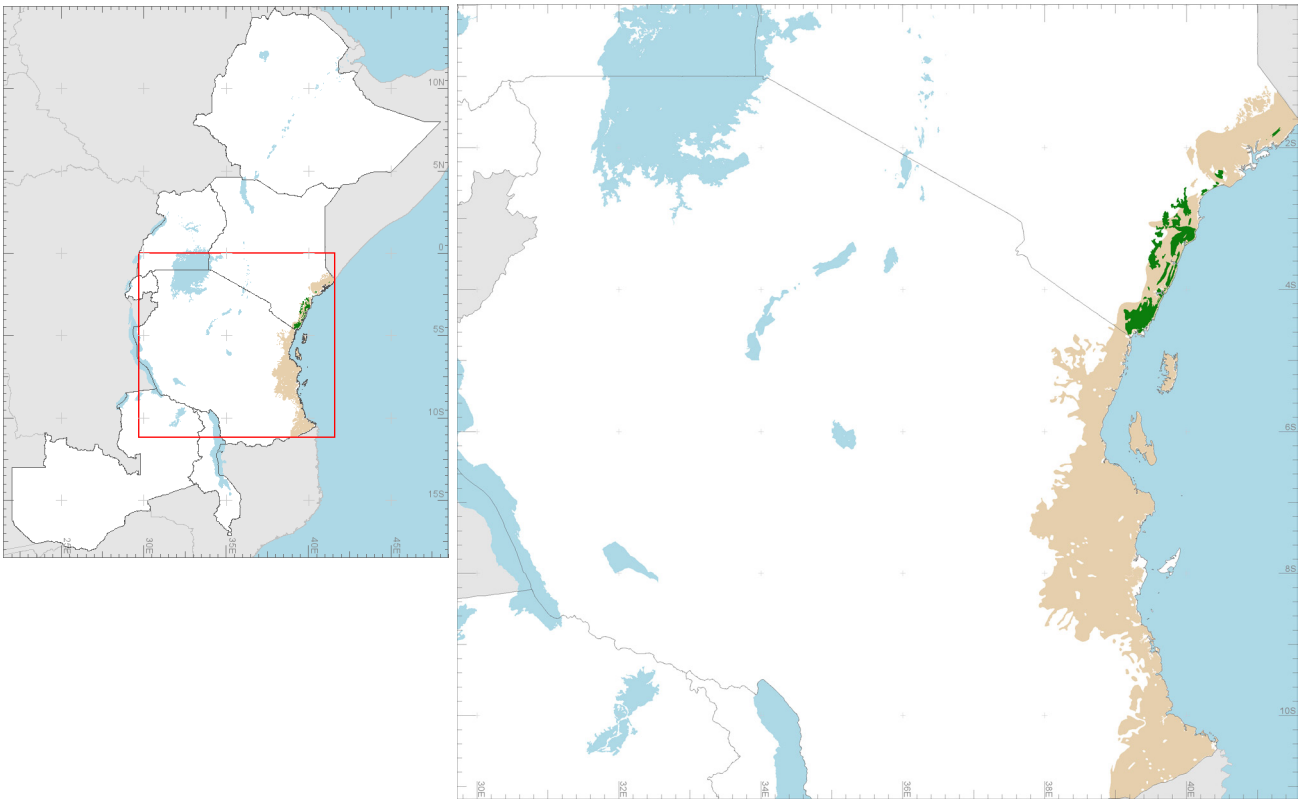


Figure 15.1. Mapped distribution of Zanzibar-Inhambane undifferentiated forest in the VECEA region (Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia). Where this vegetation type does not occur in mosaic, it is depicted by green polygons. This vegetation type is mainly mapped as part of vegetation mosaics

In the main reference that we consulted (Clarke and Robertson 2000), Zanzibar-Inhambane undifferentiated forest was originally classified as the subtypes of legume-dominated dry forest, mixed dry forest and Eastern African coastal - Afromontane transitional forest. [17]

Dry forest (sensu White 1983 p. 46; *i.e.* forests that experience low atmospheric humidity for several months) is the predominant vegetation type of the eastern African coastal forests and much of the area was probably covered by this forest type before human intervention. Two types of dry coastal forests can be distinguished: (i) legume-dominated dry forest; and (ii) mixed dry forest (Clarke and Robertson 2000):

- **Legume-dominated dry forest**. Many areas of coastal forest are dominated by trees of the *Fabaceae* (synonym: *Leguminosae*) family, with one or two *Fabaceae* species accounting for 50 to 95% percent of all individual trees (stems with diameter at breast height > 10 cm). From the species that were mentioned by White (1983, see above), ***Cynometra webberi, Erythrophleum suaveolens, Hymenaea verrucosa, Julbernardia magnistipulata, Paramacrolobium coeruleum, Scorodophloeus fischeri*** belong to *Caesalpinioideae* genera that are particularly well represented in legume-dominated dry forest. Legume-dominated dry forests appear not to be limited by edaphic conditions, apart from requiring free-draining sites, and have been found on infertile white coastal sands, clay soils and limestone karsts. The Arabuko-Sokoko forest (Kenya) contains areas that are dominated by ***Cynometra webberi***, sometimes together with ***Afzelia quanzensis*** and ***Hymenaea verrucosa*** (Clarke and Robertson 2000).
- **Mixed dry forest.** Classifying mixed dry forest communities that are not dominated by legumes is difficult. The experience of Clarke and Robertson (based on over a decade of field work within coastal forests) is that the more forests are visited, the harder it becomes to distinguish any recurring floristic patterns. 152 different tree species are documented to be dominant in at least one forest area. Among the most frequently encountered dominant tree species, those that were also listed by White (1983) (1983, see above) include ***Afzelia quanzensis, Albizia adianthifolia, Bombax rhodognaphalon, Brachylaena huillensis, Cassipourea euryoides, Combretum schumannii, Cussonia zimmermannii, Erythrophleum suaveolens, Hymenaea verrucosa, Julbernardia magnistipulata, Manilkara sansibarensis, Manilkara sulcata, Nesogordonia holtzii*** and ***Scorodophloeus fischeri***. Clarke and Robertson (2000) further mention that many of these species are geographically widespread, or distinctive or economically important timber species, which may have partially biased their status in available literature on being common species in mixed dry forests. Apart from ***Combretum schumannii***, species from the *Combretum* and *Grewia* genus are virtually absent - these are typical species for Zanzibar-Inhambane scrub forest (Fq). It is possible that mixed dry forests are a regeneration climax from legume-dominated dry forest since the wind or animal dispersed seeds of many species typical of mixed dry forest

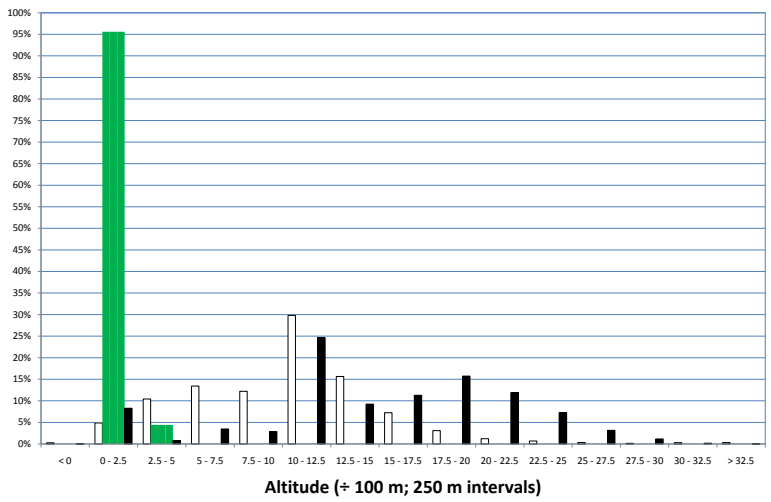
17: Lovett (1993a) describes "dry lowland forest" (altitude < 800 m; annual rainfall 1000 - 2000 mm) for which he gives the synonym of "Zanzibar-Inhambane undifferentiated forest". However, Lovett (1993a) described the forests from the Eastern Arc mountains, where this forest only occurs on fringes according to this author. Lovett (1993a) only lists two species: the woodland species *Pteleopsis myrtifolia* and the riverine species *Sterculia appendiculata*. Moreover, Lovett (1990) gives the altitudinal limits of Zanzibar-Inhambane undifferentiated forest as 300 - 800 m, thereby suggesting that information from forests (formally) occurring closer to the coast is not provided.

disperse much faster than seeds of legumes (especially from the *Caesalpinoideae* family) (Clarke and Robertson 2000).

Clarke and Robertson (2000) described "Eastern African coastal - Afromontane transitional forest". These authors did not distinguish between forest types that occur in areas on the coast that are on higher locations (and often where drainage is also impeded) such as the Shimba Hills of Kenya, and forests that occur in the foothills of the Eastern Arc Mountains such as the East Usambara, Udzungwa and Uluguru mountains. Since we followed White's (1983) differentiation between Zanzibar-Inhambane lowland rain forest (Fo), Zanzibar-Inhambane transitional rain forest (Fg) and Zanzibar-Inhambane undifferentiated forest (Fp, with moister and drier variants) and since we expected that Clarke and Robertson (2000) did not distinguish between these three types of forests, we suggest to crosscheck information on species assemblages with the information provided by White (1983) for the moist variant of Zanzibar-Inhambane undifferentiated forest.

Investigation of environmental distribution of Zanzibar-Inhambane undifferentiated forest in the VECEA region (Figure 15.2; limits are for areas of the VECEA map where this forest is not mapped as mosaic) shows that most of this forest type occurs below 250 m, causing this forest type together with Zanzibar-Inhambane scrub forest (Fq) to be among the two forest types that occur at the lowest altitudes in the VECEA region. Annual rainfall of Zanzibar-Inhambane undifferentiated forest below average as samples receive between 600 and 1400 mm.

(a)



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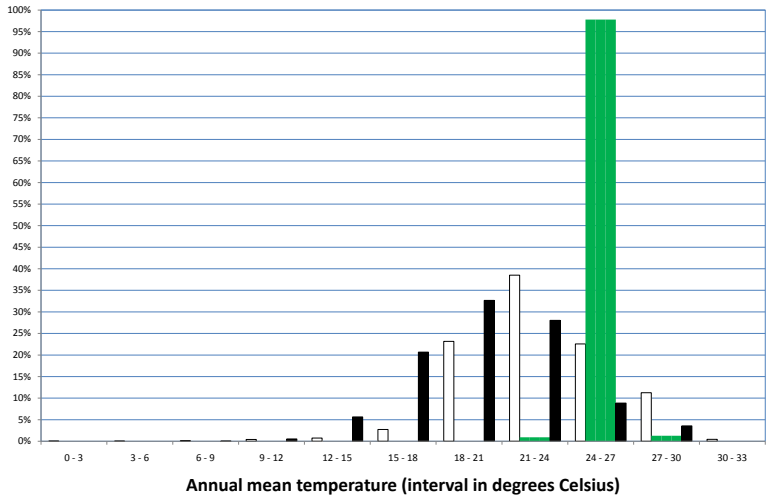

(c)

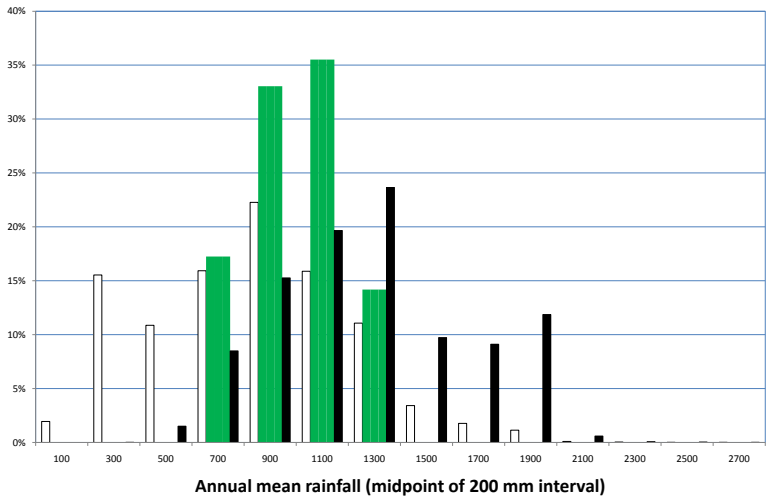

Figure 15.2 Histograms of the distribution of altitude (a), mean annual temperature (b) and mean annual rainfall (c). Bars at the centre of each interval show the percentage of samples within Zanzibar-Inhambane undifferentiated forest (Fp, *n* = 1,177). Bars on the left (open) show the overall percentage of samples (*n* = 740,047). Bars on the right (black) show the percentages of samples within forests (*n* =59,013).

15.3. Species composition

Species assemblages were obtained from the following references:

- Burgess and Clarke (2000 Appendix 2 Table 1). In column "FplC", species listed for "legume-dominated eastern African coastal dry forest" were coded "x" (unless they were characteristic species). Species only listed from sources from Mozambique were excluded.
- Burgess and Clarke (2000 Appendix 2 Table 2). In column "FpdC", species listed for "mixed eastern African coastal dry forest" were coded "x" (unless they were characteristic species). Species only listed from sources from Mozambique, Pemba or Zanzibar were excluded. Suffixes indicate the heights of trees that were listed by White (1983 p. 188) for drier variants of Zanbibar-Inhambane undifferentiated forest.
- Burgess and Clarke (2000 Appendix 2 Table 5). In column "FpmC", species listed for "mixed eastern African coastal - Afromontane transitional forest" were coded "x" (unless they were characteristic species). Species only listed from sources from Malawi, Mozambique or the Selous Game Reserve were excluded. FpmC Excluded Mozambique and Malawi and T5. Suffixes indicate the heights of trees that were listed by White (1983 p. 187 - 188) for moister variants of Zanbibar-Inhambane undifferentiated forest.
- White (1983 p. 189). In column "WsC", species listed for Zanzibar-Inhambane secondary grassland and wooded grassland were coded "x". [18]

Characteristic species were determined as:

- Burgess and Clarke (2000). Species listed to be dominant were coded "C".

Within the information on assemblages, coding "f " indicates that there is information that the species potentially occurs in the vegetation type since it occurs in the focal country and in the same forest type in other countries (see section 2.3).

18: We made an exception in listing secondary vegetation in a separate column as many non-forest species were listed.

Table 15. Zanzibar-Inhambane undifferentiated forest (Fp)

Species	Regional status (see section 2.3)	FplC (coast subtype)	FpdC (coast subtype)	FpmC (coast subtype)	WsC (secondary)
Acacia polyacantha			C		
Acacia robusta	indicator (drier variants)	f	x20		
Acacia senegal	secondary grassland and wooded grassland				x
Adansonia digitata	probably introduced by humans and does not regenerate under a closed forest canopy		C		x
Afzelia quanzensis	indicator (moister and drier variants)	C	C15	f20	
Albizia adianthifolia	indicator (moister variants)	C	C	f25	
Albizia glaberrima		x	C	x	
Albizia gummifera		x	C	x	
Albizia petersiana	indicator (drier variants)	C	C15		
Albizia versicolor			C		
Annona senegalensis	secondary grassland and wooded grassland				x
Anthocleista grandiflora			C	C	
Antiaris toxicaria	characteristic (moister variants)		C	C35	
Antidesma venosum	secondary grassland and wooded grassland				
Aphania senegalensis			x		
Apodytes dimidiata	indicator (moister variants)			f	
Balanites wilsoniana	indicator (moister and drier variants)		C	f30	
Bersama abyssinica			C	x	
Blighia unijugata			x	C	
Bombax rhodognaphalon	indicator (moister variants)		C	C30	
Borassus aethiopum	secondary grassland and wooded grassland				x
Brachylaena huillensis	indicator (drier variants)	x	C15		
Brachystegia spiciformis			C		
Burttdavya nyasica	not characteristic (indicator for Zanzibar-Inhambane lowland rain forest)			x	
Caesalpinia volkensii				x	
Cassia abbreviata			x		
Cassipourea euryoides	indicator (drier variants)	x	C15		
Celtis africana			x		

Species	Regional status (see section 2.3)	FplC (coast subtype)	FpdC (coast subtype)	FpmC (coast subtype)	WsC (secondary)
Celtis gomphophylla			C	f	
Celtis mildbraedii			x	x	
Celtis philippensis	indicator (moister variants)		x	C20	
Cola clavata	indicator (moister variants)		C	f20	
Combretum schumannii	indicator (moister and drier variants)		C15	x25	
Commiphora eminii			x		
Cordyla africana	characteristic (moister variants)		C	C25	
Crossopteryx febrifuga	secondary grassland and wooded grassland				
Croton sylvaticus			C	x	
Cussonia zimmermannii	indicator (drier variants)	f	C15	C	
Cynometra webberi	indicator (drier variants)	C	x12		
Dalbergia melanoxylon	secondary grassland and wooded grassland				x
Dialium orientale			C		
Dichrostachys cinerea	secondary grassland and wooded grassland				x
Diospyros abyssinica	indicator (moister variants, but very rare)		x	C	
Diospyros mespiliformis	characteristic (moister variants)		C	x30	
Ekebergia capensis		x	C	C	
Elaeis guineensis	(palm species)		x	C	
Encephalartos hildebrandtii	cycad species that is locally plentiful in drier variants		f		
Englerophytum natalense				C	
Erythrina sacleuxii	indicator (moister variants)	C	x	x20	
Erythrophleum suaveolens	indicator (moister variants)	C	C	C25	
Euphorbia candelabrum	not characteristic (indicator for Zanzibar-Inhambane scrub forest)		x		
Fagaropsis angolensis			C		
Fernandoa magnifica	indicator (moister variants)		C	C20	
Ficus sur			C		
Ficus sycomorus			x		
Ficus vallis-choudae	indicator (moister variants)			f20	
Flacourtia indica	secondary grassland and wooded grassland		C		x

Species	Regional status (see section 2.3)	FplC (coast subtype)	FpdC (coast subtype)	FpmC (coast subtype)	WsC (secondary)
Flueggea virosa			x		
Funtumia africana	not characteristic (indicator for Zanzibar-Inhambane transitional rain forest [Guineo-Congolian linking species])		C	C	
Garcinia buchananii		x	C		
Garcinia livingstonei			C	x	
Harrisonia abyssinica	secondary grassland and wooded grassland				x
Harungana madagascariensis			x		
Hymenaea verrucosa	indicator (moister and drier variants)	C	C18	x30	
Hyphaene compressa	secondary grassland and wooded grassland (palm species)				x
Inhambanella henriquesii	indicator (moister variants)		C	f25	
Julbernardia magnistipulata	indicator (moister and drier variants)	C	C15	x30	
Khaya anthotheca	not characteristic (indicator for Zanzibar-Inhambane lowland rain forest)	x	C	C	
Kigelia africana			x		
Lannea schweinfurthii	secondary grassland and wooded grassland		C		x
Lannea welwitschii	indicator (moister variants)		x	f25	
Lecaniodiscus fraxinifolius			C	x	
Lovoa swynnertonii	characteristic (moister variants)		x	x35	
Macaranga capensis	characteristic (moister variants)		x	f25	
Malacantha alnifolia	indicator (moister variants)			f20	
Manilkara sansibarensis	indicator (moister and drier variants)	x	C18	f25	
Manilkara sulcata	indicator (drier variants)	x	C10		
Margaritaria discoidea			x		
Markhamia obtusifolia		x	x		
Markhamia zanzibarica			C		
Maytenus senegalensis			x		
Maytenus senegalensis	secondary grassland and wooded grassland				x
Maytenus undata			x		
Milicia excelsa	characteristic (moister variants and drier variants)		C	C35	x
Mimusops aedificatoria	indicator (moister variants)			x25	

Species	Regional status (see section 2.3)	FplC (coast subtype)	FpdC (coast subtype)	FpmC (coast subtype)	WsC (secondary)
Mimusops bagshawei			x		
Mimusops obtusifolia			C		
Mkilua fragrans				f	
Monodora grandidieri			C		
Nesogordonia holtzii	indicator (moister variants)	x	C	x20	
Newtonia buchananii	not characteristic (characteristic for Zanzibar-Inhambane lowland rain forest and Zanzibar-Inhambane transitional rain forest)	C	C	C	
Newtonia paucijuga	indicator (moister and drier variants)	f	C15	C25	
Oldfieldia somalensis	indicator (drier variants)	x	x12		
Paramacrolobium coeruleum	indicator (moister variants)	C	x	x25	
Parinari curatellifolia			MZ1		
Parinari excelsa			C		
Parkia filicoidea	characteristic (moister variants)		x	C30	
Piliostigma thonningii	secondary grassland and wooded grassland				x
Pleurostylia africana	indicator (drier variants)		x15		
Psydrax schimperiana			x		
Pterocarpus angolensis					
Pterocarpus tinctorius			C		
Ricinodendron heudelotii	characteristic (moister variants)	x	C	C35	
Rinorea angustifolia		x			
Sclerocarya birrea	secondary grassland and wooded grassland				x
Scorodophloeus fischeri	indicator (drier variants)	C	C15	C	
Securidaca longipedunculata	secondary grassland and wooded grassland				x
Sideroxylon inerme	negative indicator (Zanzibar-Inhambane scrub forest)		C		
Sorindeia madagascariensis		x	C	C	
Sterculia africana			x		
Sterculia appendiculata	characteristic (moister and drier variants)		C	C35	x
Stereospermum kunthianum	secondary grassland and wooded grassland				x
Strychnos henningsii		x	C		

Species	Regional status (see section 2.3)	FplC (coast subtype)	FpdC (coast subtype)	FpmC (coast subtype)	WsC (secondary)
Strychnos mitis	not characteristic (indicator for Zanzibar-Inhambane transitional rain forest)		x	x	
Strychnos spinosa	secondary grassland and wooded grassland				x
Synsepalum brevipes	indicator (moister variants)	x	C	C25	
Syzygium cordatum			C		
Syzygium guineense			C		
Tabernaemontana pachysiphon			C	C	
Tamarindus indica	indicator (drier variants)		C12		
Terminalia sambesiaca	characteristic (moister variants)		C	x35	
Trema orientalis			C		
Trichilia emetica			C	C	
Trilepisium madagascariense	characteristic (moister and drier variants)		C15	x20	
Uapaca sansibarica					
Uvaria acuminata			f		
Vitex doniana			x	C	
Vitex ferruginea			x		
Vitex mombassae	secondary grassland and wooded grassland				x
Warneckea sansibarica	indicator (drier variants)	f	f9		
Xylopia parviflora	indicator (moister variants)		C	C25	
Zanha golungensis			x	C	
Zanthoxylum chalybeum			C		
Ziziphus pubescens			C		