

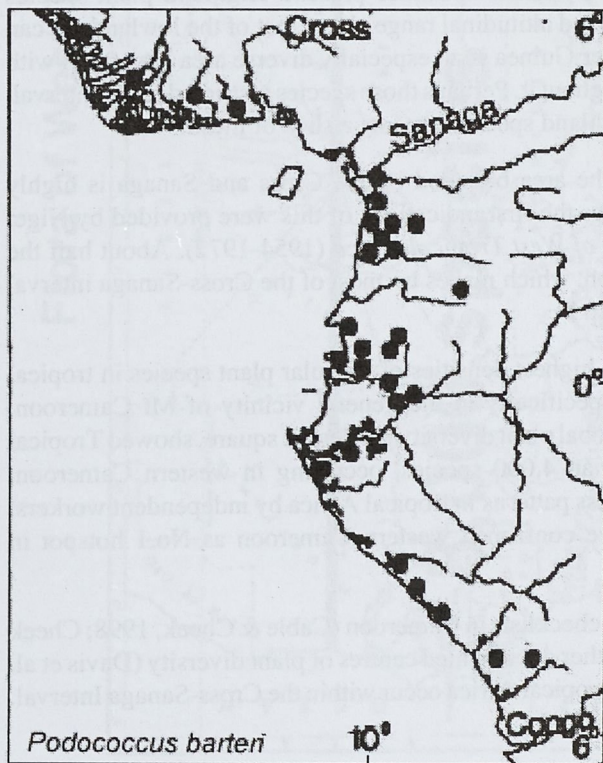
THE IMPORTANCE OF THE CROSS-SANAGA RIVER INTERVAL FOR PLANTS

NFS Kew Symposium Paper 1

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The Cross River – Sanaga River Interval is well-known in zoological circles, (e.g. Kingdon 1977), for housing a unique set of animals, particularly primates, that occur nowhere else. Africa's most threatened primate, the drill, is one of these. The Sanaga River is also a significant boundary for frogs according to Amiet. In such cases these two major rivers appear to act as physical boundaries to the ranges of the species. Why these rivers and not others equally large, or larger, such as the Niger or the Wouri? It is possible that the Niger once joined the sea through the lower reaches of the Cross, and perhaps the Congo basin drained to the Atlantic through the Sanaga, making these more sizeable barriers than they are today.



Does the Interval hold for plants? This matter was reviewed recently, with an inconclusive answer: plants are both less well-worked out and less well mapped than are primates – there are, after all, more species of plants than of primates or frogs (Cheek et al. 2001). However, the distribution of the understory palm *Podococcus barteri* does appear dictated by the Interval. This palm occurs in Lower Guinea (*sensu* White 1983) everywhere except within the Cross-Sanaga Interval (see Map 1, from Bullock 1980). It has been conjectured that it may once have occurred within the Interval also, but been rendered extinct there by large mammals, such as the drill through consumption of edible stem apices (Cheek et al. 2001). The

Cross River was proposed by Léonard in 1965 as the best contender for the primary E-W break in the Guineo-Congolian region (rather than the Dahomey Gap), based on Euphorbiaceae distributions. Clayton and Hepper, in 1974, using Gramineae data, supported this, while White, in 1979, disputed its importance, based on *Diospyros* distributions. Botanically the Cross is well known as a barrier.

The Sanaga appears not to have figured in phytogeographic literature and evidence for its importance in this context is weaker than for the Cross. Sampling 300 distribution maps of the *Distributiones Plantarum Africanum* series located two species of Guttiferae that have the Sanaga as their Western boundary. But in other groups, such as species of *Dacryodes*, it is the Nyong, south of the Sanaga, that is more important as a boundary. In several plant groups, species can be found which are restricted to the Interval, such as the two species that comprise one of the few plant families endemic to tropical Africa, the Medusandraceae.

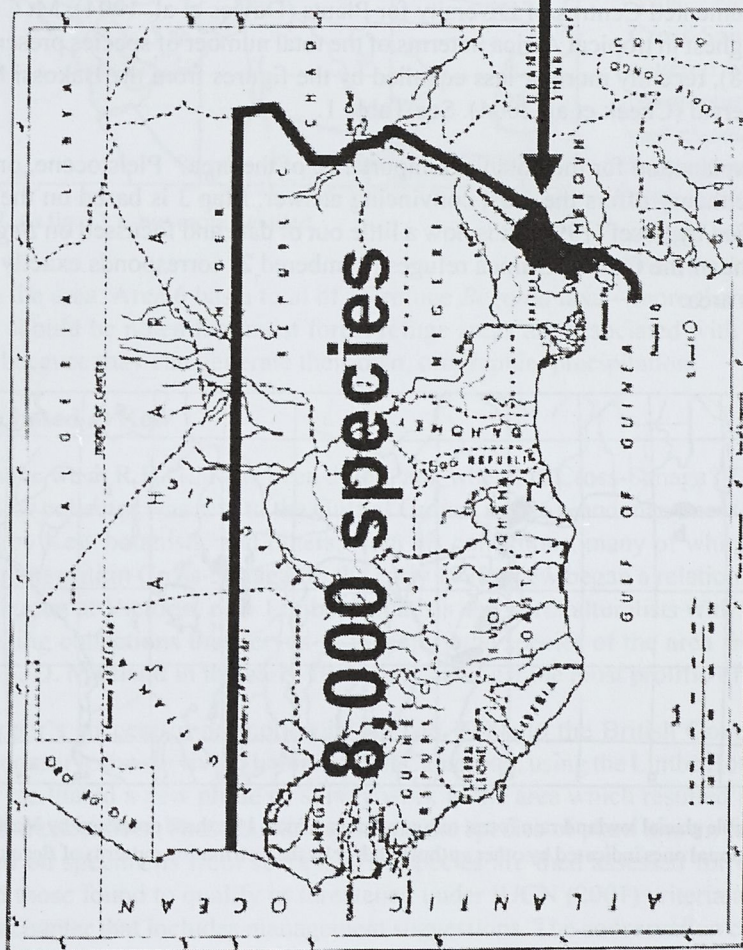
Most of the above information was presented in a paper published in Cheek et al. 2001. The evidence then suggested that the endemism in the area is less well-defined by the Cross and Sanaga than by the Cameroon Highlands. Indeed, in ornithological circles it is not the Cross-Sanaga Interval, but the Cameroon Highlands, that are referred to as an "Important Bird Area", based on the number of narrow endemics present. Highland plant species generally have a requirement for a fixed altitudinal range above that of the lowlands. It can also be argued that, for plants, Lower Guinea is an especially diverse area generally, with many local endemics scattered throughout it. Perhaps those species restricted to the Interval, those which are not specifically highland species, are just a slice of these?

There is no doubt, however, that the area bounded by the Cross and Sanaga is highly important for plant diversity. Perhaps the first indications of this were provided by Nigel Hepper's and Ronald Keay's *Flora of West Tropical Africa* (1954-1972). About half the taxa of FWTA occur in W Cameroon, which makes up most of the Cross-Sanaga interval (Cheek et al. 2006), as shown in map 2.

Several studies have shown that the highest densities of vascular plant species in tropical Africa occur within the interval, specifically in the general vicinity of Mt Cameroon. Barthlott et al. (1996), mapping of global plant diversity per degree square, showed Tropical Africa's hottest spot, with more than 4,000 species, occurring in western Cameroon. Subsequent studies of species richness patterns in tropical Africa by independent workers: Linder 1998, and later Lovett, have confirmed western Cameroon as No.1 hotspot in tropical Africa.

Data from some of our conservation checklists in Cameroon (Cable & Cheek, 1998; Cheek et al. 2004), placed in context with other documented centres of plant diversity (Davis et al. 1994), show that the top two sites in tropical Africa occur within the Cross-Sanaga Interval.

Flora of West Tropical Africa



West Africa, showing the area dealt with in this article.

FWTA

	Total vascular plant taxa	No. endemic taxa	Area (km ²)
Mt Nimba	2000	13	c.480
Mt Cameroon	2435	49	c.2700
Bakossi Mts	2440	82	c.2390
E. Usambaras	1921	64	231

Table 1. Top Centres of Documented Plant Diversity in Tropical Africa.

Amongst documented Centres of Diversity for Plants (Davies et al. 1994), Mt Cameroon rated as the highest in tropical Africa in terms of the total number of species present (Cable & Cheek 1998), recently more or less equalled by the figures from the Bakossi Mts, also within the Interval (Cheek et al. 2004). See Table 1.

What is the explanation for the botanical importance of the area? Pleistocene, or Glacial, Forest Refuge theory offers the most convincing answer. Map 3 is based on the work of Maley, modified by Sosef (1994). It is now a little out of date and focussed on *Begonia* but shows how one of the Gulf of Guinea refuges (numbered 2) corresponds exactly with the Cross-Sanaga area.

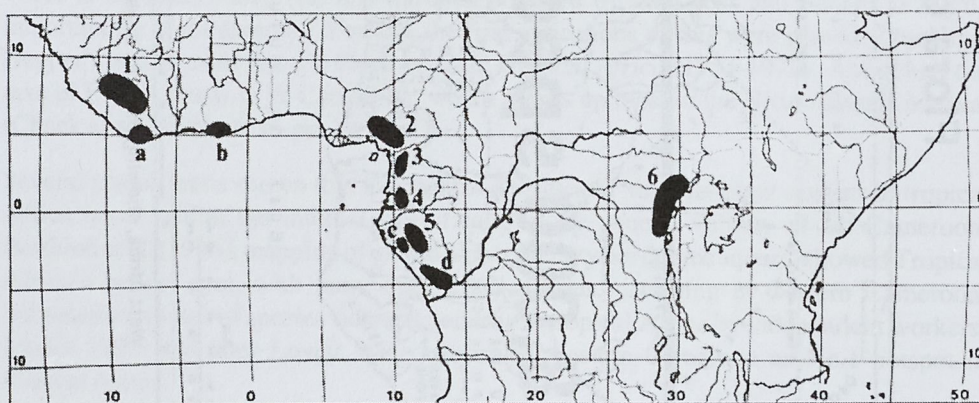


Figure 12.1. Possible glacial lowland rain forest refuge areas in Africa. 1-6: those proposed by Maley (1987); a-d: additional ones indicated by other authors and/or by the distribution patterns of *Begonia* taxa.

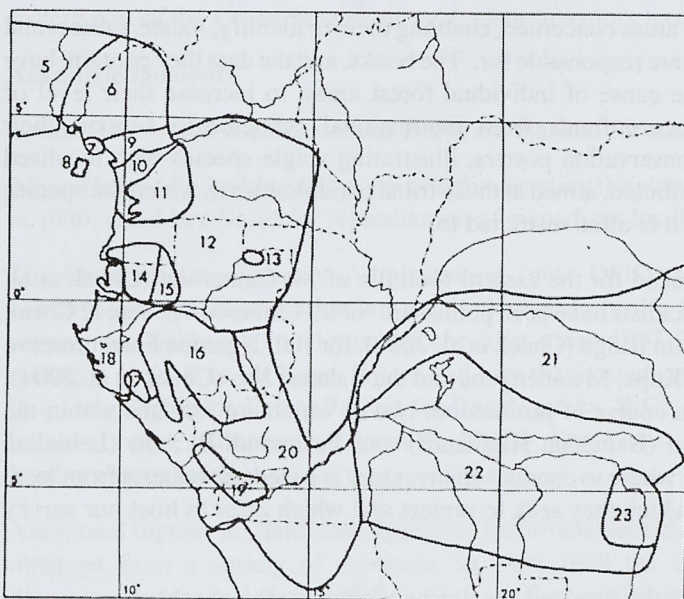


Figure 13.2. As fig. 13.1, but more detailed.

figures in the area. Area 6 has a total of 15 refuge *Begonia* taxa – more than any other in Africa. It should be noted that most forest refuge areas are associated with mountains – probably because they can generate their own, orographic, precipitation.

Research based at Kew

So what have we at R.B.G., Kew been doing, and where, in Cross-Sanaga? Gustav Mann, the first Kew collector was sent to the Gulf of Guinea in 1861, and many new species were described by Kew botanists, and others, from his collections, many of which were made from locations within Cross-Sanaga. In the early 1920s Kew began a relationship with the Botanic Garden at Victoria, now Limbe. Botanists and horticulturalists with links to Kew began making collections that served to inventory the species of the area from that date onwards. T. D. Maitland in the early 1930s was amongst the most prolific of these.

Nigel Hepper's successful promotion in the late 1980s to the British Government of a project to conserve the surviving habitat on Mt Cameroon, using the Limbe Botanic Garden as a base, facilitated a new phase of survey work in the area which resulted in a series of conservation checklists. These books catalogue the species of plant known to occur in an area, based on specimens from surveys. The species are then assessed for conservation status, and those found to qualify as threatened under IUCN (2001) criteria are treated in a Red data chapter that includes management suggestions. The conservation checklists are

Refuge *Begonia* are named such because there is good evidence that they indicate the sites of former forest refuges (Sosef 1994). Map 4, also from Sosef, shows the different areas of endemism for Refuge *Begonia* – perhaps indicating forest refuges at a finer scale. Note that the Cross-Sanaga area is covered by three areas (numbered 6, 8,9) of endemism/refugia, or if Bioko is included, four. This concentration of refugia may be linked with the high diversity

aimed at those managing the areas concerned, enabling them to identify, locate, protect and manage the species that they are responsible for. The books, and the data they contain, have also served to champion the cause of individual forest areas, to increase their level of protection and even to secure funds from international agencies to support their management. A range of conservation posters, illustrating single species with localised distributions, have been distributed, aimed at those tribal communities in which the species concerned occurs, and indeed is often restricted to.

Following a prototype produced for the eastern foothills of Mt Cameroon (Cheek et al. 1992), four conservation checklists have been published: for Mt Cameroon (Cable & Cheek 1998), for Mt Oku and the Ijim Ridge (Cheek et al. 2000), for Bali Ngemba Forest reserve (Harvey et al. 2004) and for Kupe, Mwanenguba and the Bakossi Mts (Cheek et al. 2004). Three more checklists are in course of production, two of which are for sites within the Cross-Sanaga Interval: Dom (Bamenda Highlands) and Fosimondi-Bechati (Lebialem Highlands). The decision on where to conduct an inventory is based on requests from local NGOs that nominate areas which they seek to protect and which offer to host our survey teams.

The survey teams that collect the data and specimens needed for the checklist are usually based in local communities near the forests being researched. Typically they reside here for several weeks or months spread over different seasons, in order to capture as completely as possible the species-diversity present. Our surveys in Cameroon are conducted jointly with IRAD-National Herbarium of Cameroon. Specimens are identified primarily at RBG, Kew with the assistance of specialists from around the world. Identifications, specimen data, and taxon descriptions are held on an Access database developed by George Gosline. This database generates the checklist accounts automatically. Further details of this process are given in Cheek et al. 2006.

Numerous new taxa, including two new genera, have come to light as a result of these inventories. In 2005 we publicised the publication of our 50th new species from Cameroon in 10 years. Soon we will reach our 100th, and yet many additional new species have been discovered and await publication. At some locations as many as 1 in 10 specimens have proved to be new taxa to science.

Despite the progress that has been made in improving our knowledge of the plants of the Cross-Sanaga interval in recent years, large areas remain that are effectively unsurveyed or at least very incompletely surveyed. In Nigeria, most of Cross River State, and adjoining areas, have seen little progress in their inventory since the efforts of Talbot at the beginning of the 20th century. In S.W. Province Cameroon, the Rumpi Hills, northern Korup National Park, the Ejagham Forest Reserve, Mawne, Takamanda and Banyang Mbo are all very poorly inventoried for their plant species. In N.W. Province Cameroon, the western flanks of the Highland areas remain mostly unsurveyed, and in Littoral Province, forming the

eastern part of the Cross-Sanaga interval, plant inventory has barely started.

Acknowledgements

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The Overseas Development Administration (now DFID) supported survey work and conservation checklist production at Mt Cameroon in the 1990s. Earthwatch provided support for fieldwork in almost all checklist areas 1993-2004. BirdLife International managed projects at Mt Kupe, Kilum and Ijim that hosted survey programmes, as did the Bamenda Highlands Forest Project for Bali Ngemba. WCS, WWF Cameroon have also hosted survey programmes. Currently, ANCO, Ebo Forest Project and RECODEV are hosting survey teams.

Additional support for fieldwork, specimen identification and checklist production has been obtained from a variety of sponsors. In 1996-1998 the GEF Cameroon biodiversity programme supported, through RBG, Kew, the Botanical Survey and Inventory programme for capacity building at the IRAD-National Herbarium of Cameroon, Kew's main botanical partner in Cameroon. The Darwin Initiative of DEFRA have supported both The Conservation of the Plant Diversity of western Cameroon project (1999-2004) and the current Red Data Plants Cameroon project (2006-2009).

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