Tree Species Evaluation using the new CITES Listing Criteria

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1. Introduction

The Convention on International Trade in Endangered Species (CITES) has been utilised for over twenty years as a tool to help conserve wild species which are traded internationally. Species which are covered by the provisions of the Convention are included in appendices. To qualify for Appendix I, the Convention states that taxa must be "threatened by extinction" and that they "are or may be threatened by trade". Species included in Appendix II are those which are "not now necessarily threatened with extinction, may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilisation incompatible with their survival".

Procedures to amend the appendices are laid down within the Convention. Resolutions providing further guidance on which species to list on the appendices were passed at the first Meeting of the Parties to the Convention in 1976 in Berne. The so-called "Berne Criteria" provided guidance on the biological and trade status information required for inclusion in a proposal to amend the appendices. In 1994, the Parties adopted Resolution Conf. 9.24 which contains new criteria for amendment of Appendices I and II. These are summarised in Section 2 below. The CITES listing criteria were developed at the same time as the development of the new IUCN Red List Categories and are loosely related to them. The general aim of the new IUCN system of categorising is "to provide an explicit, objective framework for the classification of species according to their extinction risk" (IUCN Species Survival Commission, 1994). The IUCN categories indicate the degree to which species are threatened by extinction and are thus highly relevant to the CITES listing process.

As well as detailing the new CITES listing criteria, CITES Resolution Conf. 9.24 also sets out in general terms the information requirements for amendment proposals. It points out that sufficient information, of sufficient quality and in sufficient detail to judge the proposal against the listing criteria should be provided to the extent available. It also acknowledges that for some species the amount of scientific information will be limited.

The CITES appendices include a wide range of plant and animal species including at present around twenty tree species which are traded internationally as timber. The provisions of the Convention and subsequent guidance on listing do not generally distinguish between different species groups in their application. There has, however, been informal international debate about the suitability of the Convention as a tool to help conserve particular species groups. Increased interest in the use of CITES for timber species over recent years has contributed to this debate. Various amendment proposals have been submitted to CITES for timber species and have been considered by the Parties at the Eighth and Ninth Conferences, prior to the adoption of Resolution Conf. 9.24.

This report reviews the application for the first time of the new CITES listing criteria to timber species. The work has been carried out as part of the validation of the new CITES criteria for plant species coordinated by the Royal Botanic Gardens, Kew.

2. The new CITES listing criteria

The new CITES listing criteria as set out in Resolution Conf. 9.24 include biological criteria for inclusion in Appendix I; criteria for the inclusion in Appendix II of species in need of trade regulation in order to avoid utilisation incompatible with their survival; and criteria for inclusion in Appendix II of species which should be included for "look-alike purposes". The main criteria (leaving out those for Appendix II look-alike species) are summarised in the Box below. It should be emphasised that each criterion for Appendix I listing is subject to further qualifications, at least one of which should be met for the criterion to apply. The Appendix I criteria are given in full in Annex 1 to this report.

Box 1

Summary of the Biological Criteria for listing in Appendix I:

A. it has a small wild population (<5000 individuals).
B. it has a restricted area of distribution (<10,000km²).
C. the wild population has been or is inferred to be in decline (50% in 5 years or 2 generations or for a small population 20% in 10 years or 3 generations).
D. it is likely to meet one of the above within 5 years if not listed on Appendix I.

For Appendix I, it is considered that a species is or may be affected by trade if:

i. it is known to be in trade
ii. it is probably in trade
iii. there is potential international demand for it, or
iv. it would enter trade if not subject to Appendix I controls.

Summary of the Criteria for listing in Appendix II:

A. It is known or inferred that unless the species is subject to strict regulation, it will meet AT LEAST ONE of the Appendix I criteria in the near future.
B. It is known or inferred that the harvesting of specimens from the wild for international trade has, or may have, a detrimental impact on the species by EITHER:

i) exceeding, over an extended period, the level that can be continued in perpetuity.

OR

ii) reducing it to a population level at which its survival would be threatened by other influences.

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3. Activities undertaken in the tree species evaluation

3.1. Selection of species

The timber species selected for evaluation were chosen to illustrate a wide range of differing degrees of threat to wild populations and levels of international trade. The

majority of species are tropical in distribution but some temperate species were also considered. In general it is relatively difficult to find examples of temperate timber species which are threatened by international trade because the species composition of the temperate timber trade is relatively heterogenous and is restricted to a narrower range of widespread timber species. This is particularly true of the north temperate timber trade which is dominated by a limited range of conifers and hardwoods. Several of the species chosen are already listed on CITES and others have been subject to amendment proposals in recent years. In total, species were selected for evaluation, and summary information profiles for these species are given in Annex 2.

3.2 Collection of information

Information has been collected for the tree species selected on distribution, habitat, population status and trends, ecology, threats, uses, conservation status, conservation measures, and recent trade data. These headings broadly correspond to the categories of information specified for inclusion in CITES amendment proposals in Resolution Conf. 9.24.

Information held at WCMC for the selected species was reviewed and supplemented by literature survey and correspondence with experts. The main source of information on the conservation status of tree species maintained by WCMC has been the Plants Database. This records information on distribution (mainly at national or state level) and conservation status for over 100,000 plants, around 15,000 of which are tree species. Conservation status is recorded using the old IUCN categories of threat. Under the *Conservation and Sustainable Management of Trees* project, the new IUCN categories of threat are being applied to tree species and a range of additional information is being collected for tree species of conservation concern. In general, the *Conservation and Sustainable Management of Trees* project has concentrated on endemic and restricted range species and so additional enquiries have been made for the more widespread timber species selected for the tree species evaluation.

For the African timber species, draft species profiles were prepared and distributed to participants in the Regional Workshop for the *Conservation and Sustainable Management of Trees* project held in Harare, Zimbabwe, 9-11 July. Participants reviewed the information, added supplementary comments and applied the new IUCN categories of threat. For additional African countries not represented at the workshop, notably Benin, Burundi, Central African Republic, Côte d'Ivoire, Senegal and Togo, requests for information focusing on legislation and levels of exploitation for the relevant species were sent to national Forestry Departments.

Information on the conservation status of conifer species has been compiled by the IUCN/SSC Conifer Specialist Group as part of the *Conservation and Sustainable Management of Trees* with species evaluated using the new IUCN categories of threat. This information was added to the appropriate species profiles and additional enquiries were addressed to the Group concerning the presence of the species in international trade.

Information for the selected timber species occurring in Brazil, was collected within the country by a consultant contracted by WCMC.

For the majority of timber species selected for evaluation, current information is limited, fragmentary and, in some cases, access is restricted. The difficulties of obtaining appropriate information are discussed in Section 5.

3.3. Application of the criteria

An evaluation of the selected timber species using the new CITES listing criteria was carried out by Sara Oldfield, Marianne Sandison and Amy MacKinven based mainly on the information in the species profiles. The procedure adopted was to assess each species initially under the new criteria for inclusion on CITES Appendix I, these being the more explicit criteria. If the tree species did not meet the criteria for Appendix I then the new criteria for Appendix II were applied. As explained in Section 2, one of the criteria for Appendix II listing is *It is known, inferred or projected that unless trade in the species is subject to strict regulation, it will meet at least one of the criteria listed in Annex 1* (ie for Appendix I listing) *in the near future*. It was, therefore, considered necessary to test the species first against the more stringent criteria for Appendix I. Recording forms developed by Marianne Sandison (Sandison, 1995) were used in the evaluation process.

4. Results of the tree species evaluation

A summary of the results of the tree species evaluation is presented in Table 1. It is emphasised that these are a preliminary evaluation based on limited information for a wide range of species. More detailed information and quantitative information would, of course, be required to develop CITES amendment proposals.

In general, it was found to be relatively easy to apply the CITES listing criteria to those species which had already been evaluated using the new IUCN categories of threat, if these were accepted as given. However, it should be noted that the criteria by which the IUCN categories are applied are, in themselves, subject to differing interpretation by individuals. This is discussed further under the review of species for Appendix II listing.

Table 1 Summary of results of the tree species evaluation

Species	meets criteria for:		Result		Notes
	App.I	App. II			
Abies nordmanniana subsp. *equi-troujani*	x	x	x		**NOT** in International trade.
Afzelia africana	x	?	II?		Not sure which category this species fits into.
Afzelia bipindensis	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- habitat loss, only few seed trees.
Afzelia pachyloba	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- habitat loss, only few seed trees.
Amburana cearensis	x	✓	II	Bii	Bii- isolated populations needing cross pollination. Based on limited information.
Araucaria angustifolia	✓	-	I	Bi,iv or D	Based on the IUCN category VU (B1+2) the extent of occupancy is < 20,000km² but > 5,000km².
Aspidosperma polyneuron	x	✓	II	Bi	Bi- heavily exploited Based on limited information.
Aucoumea klaineana	x	✓?	II	Bi,ii?	Bi- heavily exploited.
Autranella congolensis	✓	-	I	Ci	Based on IUCN category (CR A1).
Baikiaea plurijuga	x	x	x		
Baillonella toxisperma	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- habitat loss, extremely slow to reach maturity, has restricted regeneration.
Brachylaena huillensis syn. *Brachylaena hutchisonii*	x	?	II?		Not enough information to assign Appendix II criteria.
Cedrela fissilis	x	✓	II	Bi	Bi- heavily exploited Based on limited information.

Species	meets criteria for:		Result		Notes
	App.I	App. II			
Cedrela odorata	x	x	x		
Cephalotaxus oliveri	x	✓	II	Bii	Bii- habitat loss, dioecious species therefore infrequent regeneration. Unsure if this species is in international trade (Trade criteria ii?).
Chamaecyparis lawsoniana	✓	-	I	Ci	Although given an IUCN threat category of LR near threatened, this species has declined > 50 per cent in the last century.
Chamaecyparis obtusa var. *formosana*	x	✓?	II	Bi,ii?	Bi- exploited, general deforestation for other timber species. Unsure if this species is in international trade (Trade criteria ii?).
Copaifera salikounda	x	✓	II	Bi	Bi- based on Hawthorne's (1995a) analysis for Ghana and assuming the evergreen forests in the neighbouring countries are similarly exploited.
Cordia millenii	x	x	x		
Cordia playthyrsa	x	x	x		
Cupressus dupreziana	✓	-			**NOT** in International trade.
Dalbergia cochinchinensis	x	✓	II	Bi	Awaiting confirmation of threat status
Dalbergia stevensonni	x	✓	II	Bi	Awaiting confirmation of threat status
Diospyros celebica	?	?			No recent threat categorisation
Diospyros crassiflora	x	?	II?		Not enough information.
Diospyros philipinensis	x	✓?	II?		Information needed for Sulawesi
Diospyros pilosanthera	x	x			
Eribroma oblonga	x	x			

Species	meets criteria for:		Result		Notes
	App.I	App. II			
Fitzroya cupressoides	✓		I	Bi	
Gossweilerodendron balsamiferum	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- specific habitat type being lost.
Guarea cedrata	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- habitat loss, shade required for growth.
Guarea thompsonii	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- habitat loss, slow growth.
Guibourtia ehie	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- habitat loss.
Hallea ledermannii	x	x	x		
Haplormosia monophylla	x	?	II?		Not enough information.
Khaya ivorensis	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- very little regeneration after disturbance (e.g. logging).
Lophira alata	x	✓	II	Bi	Bi- heavily exploited.
Lovoa swynnertonii	x	✓	II	Bi,ii	Bi- heavily exploited. Bii- habitat loss, poor regeneration.
Lovoa trichilioides	x	✓	II	Bi	Bi- exploited.
Mansonia altisima	x	✓	II	Bi	Bi- heavily exploited.
Microberlinia bisulata	✓	-	I	Ci	Based on IUCN category (CR A1) & very little additional information.
Microberlinia brazzavillensis	✓	-	I	Ci	Based on IUCN category (CR A1) & very little additional information.
Milicia excelsa	x	✓	II	Bi?	Bi- heavily exploited but considered marginal due to widespread distribution.
Milicia regia	x	✓	II	Bi	Bi- heavily exploited.
Millettia laurentii	x	✓	II	Bi,ii?	Bi- heavily exploited. Bii- not enough information.

Species	meets criteria for:		Result	Notes
	App.I	App. II		
Monopetalanthus heitzii	?	?	?	Not enough information.
Nauclea diderrichii	x	x	x	
Nesogordonia papaverifera	x	✓	II Bi	Bi- considered marginal because although this species is heavily exploited, it also occurs in plantations.
Pouteria altissima	x	x	x	
Prunus africana				
Pterocarpus angolensis	x	x	x	This species is of concern in Zambia and Mozambique but is of no concern in South Africa.
Santalum album	x	x	x	
Swartzia fistuloides	x	?	II?	Not enough information to assign Appendix II criteria.
Testulea gabonensis	x	✓	II Bi	Bi- based on IUCN threat category EN (A1c,d).
Tieghemella africana	x	?	II?	Not enough information to assign Appendix II criteria.
Tieghemella heckelii	x	✓	II Bi,ii	Bi- heavily exploited. Bii- habitat loss, elephants are required for regeneration.
Triplochiton scleroxylon	x	x	x	
Turraeanthus africanus	x	x	x	

x = Does not meet the criterion.
✓ = Meet the criterion.
? = Not enough information available to apply the criterion.
- = Not applicable.
N.B. All species are in international trade unless mentioned in the Notes section.

4.1. Review of species for Appendix I listing.

Criteria for Appendix I listing generally have a quantitative element which is elaborated on in the guidelines provided by Annex 5 of CITES Resolution Conf. 9.24. It is emphasised in these guidelines that the figures given are indicative only

and that there any many cases where they will not apply. As with much of the rest of the guidelines, there is considerable room for interpretation. Nevertheless, application of the CITES criteria for Appendix I tended to be a straightforward exercise when sufficient information on the species was available and, in such cases, there was little doubt when a species fulfilled the criteria.

Criteria A and B concern small population sizes and ranges respectively. Species must also fulfil certain additional, often loosely specified, sub-criteria. Criterion A requires that the species has a small wild population. Population size is intended to refer to the total number of individuals. Resolution Conf. 9.24 indicates that information on population status in amendment proposals, should *give an estimate of the total population or number of individuals with: i) date and nature of census; ii) justification for any inferences made about population size and/or number of individuals*. In fact there are very few overall population estimates for tree species so this criterion is generally not of major relevance. Furthermore, assuming that most tree species occur within their area of distribution at densities higher than 0.5 per km^2, a tree species which meets the major part of Criterion A (population < 5000) will, in general, also meet Criterion B (area of distribution < 10,000 km^2).

One species for which data are available meets Criterion A: *Cupressus dupreziana* from Algeria has a recorded population of 153. It almost certainly meets one of the sub-criteria (very small sub-populations or the majority of individuals in one sub-population) but does not appear to meet the trade requirements for CITES listing as there is no evidence of international trade, nor does such trade seem likely.

Criterion B takes into account species with restricted areas of distribution. Adherence to the guidelines for Criterion B means that any tree species qualifies for inclusion in Appendix I which: has an area of distribution less than 10,000 km^2; which meets one of a series of sub-criteria (fragmentation of range, vulnerability owing to biology, any decline); and is known to be actually or potentially in trade. In general the timber species examined do not fulfil these criteria because of their widespread distributions. One taxon examined, however, *Chamaecyparis obtusa* var. *formosana* from Taiwan, meets the biological criteria although it is not known whether it is in international trade. It should also be noted that the guidelines for amending the appendices counsel against inclusion of infraspecific taxa whenever possible. Another species, *Araucaria angustifolia* from South America, on the basis of its IUCN category (VU (B1+B2) (indicating an "extent of occupancy" of less than 20,000 km^2 or "area of occupancy" of less than 2000 km^2) may well qualify for CITES Appendix I according to the biological criteria and is currently in international trade.

Criterion C concerns species known or suspected to be undergoing, or to have undergone, a decline. It should be noted that the word "decline" is not qualified in the criterion itself, nor is any upper limit to the size of the population of the species concerned given, so that theoretically extremely abundant and widespread species may qualify. The notes to assist in interpreting the criteria indicate that a decrease of 50 per cent or more in total within five years or two generations, whichever is the longer, may be an appropriate guideline. For timber-producing species the greater length of time is invariably two generations.

Information on generation time is not generally available for tree species. In broad terms estimated generation time for trees could be proposed as 5-10 years for pioneer, fast growing species; 50 years for most tree species and 100 years for slow growing species. These generation times have been proposed as working figures in guidelines on the application of the IUCN threat categories to tree species (Jenkins, 1996).

As information on the rate of decline of tree populations is unlikely to be available for individual species, in most cases it will be necessary to use inference or extrapolation, considering, for example, the species in relation to habitat decline. Given the generally long generation times known or presumed for most timber species, a large number of tree species are likely to qualify under Criterion C in that any species whose range has halved through deforestation in the past 100 years (for most trees) or 200 years (for slow-growing species) can be inferred as having its population halved and therefore meeting the Criterion as long as it is, or may be, in international trade.

Good data on forest loss over the past 100 or 200 years are scanty. For some areas, however, such as the Philippines and south-east Brazil it can be confidently stated that more than half the forest cover has been lost in the past century. There may then be good grounds for asserting that **all** tree species confined to these areas, which are in trade, merit inclusion in Appendix I, according to the listing criteria.

Criterion C for CITES Appendix I listing can be related to the Criterion A used in the application of the new IUCN categories of threat as they both deal with population decline.

IUCN Criterion A is based on *an observed, estimated, inferred or suspected reduction* of:

at least 80 per cent decline in 10 years or 3 generations (Critically Endangered)

at least 50 per cent decline in 10 years or 3 generations (Endangered)

at least 20 per cent decline in 10 years or 3 generations (Vulnerable)

If a tree species has been assigned an IUCN threat category of Endangered according to Criterion A, this species would not necessarily fall into Criterion C for Appendix I listing because the rate of decline is over three generations (ie. 150 years) as opposed to two generations (ie. 100 years). However, if a tree species has been assigned an IUCN threat category of Critically Endangered according to Criterion A, then it can be extrapolated that the species does fit into Criterion C for Appendix I listing. Assuming that the population decline is fairly linear then an 80 per cent decline over three generations (IUCN Critically Endangered) is equivalent to a 53 per cent decline over two generations (CITES Appendix I).

Of the species assessed, one species would definitely appear to meet Criterion C: *Chamaecyparis lawsoniana* from the U.S.A. has declined in standing volume by 50

per cent in less than 30 years and is in international trade. Other species assessed which appear to meet Criterion C for Appendix I listing are *Autranella congolensis*, *Microberlinia bisulcata* and *Microberlinia brazzavillensis*. These have previously been evaluated as Critically Endangered on the basis of population decline. It would however be desirable to have additional supporting information to back up these IUCN threat category applications and this is being sought through the *Conservation and Sustainable Management of Trees* project.

4.2. Review of species for Appendix II listing

The criteria for Appendix II were found to be more ambiguous than criteria for Appendix I; terms are not precisely defined, making application of these criteria considerably more difficult.

Listing according to Criterion A requires that species will fulfil listing criteria for Appendix I in the near future, unless the species is subject to strict regulation. There is no definition of 'near future' given in Resolution Conf. 9.24. Criterion A of Appendix II is very similar to Criterion D of Appendix I, with Criterion A having a presumed time scale of longer than that outlined in Criterion D (ie. five years). None of the timber species evaluated were considered to satisfy Criterion A for Appendix II listing, although this result would have to be reconsidered if a clear definition of 'near future' is provided.

In contrast to criteria for listing in Appendix I, where international trade must merely be known or suspected to take place, Criteria B (i and ii) for listing on Appendix II require that international trade has a deleterious effect on the species concerned. The criteria specify either that trade will exceed over an extended period the level that can be continued in perpetuity (Criterion Bi) or will cause or has caused the taxon to become threatened for other reasons (Criterion Bii). Guidance is not given as to interpretation of the term "extended period" within Resolution Conf. 9.24.

In evaluation of the selected timber species, Criterion Bi was understood to mean that the level of exploitation from the wild for international trade was greater than that deemed to be sustainable and Bii was assumed to mean that the level of exploitation from the wild for international trade would reduce the population to a level where threats other than exploitation would jeopardise the species. In practice it was found to be difficult to make the distinction between Criteria Bi and Bii when evaluating tree species. In general, if a forest tree species is being cut down at a level exceeding that which can be continued in perpetuity (Criterion Bi), the species may also be more likely to suffer from the impacts of general forest loss (Criteria Bii).

The main difficulty in application of Criteria B(i and ii) during the evaluation exercise was in determining whether or not sufficient information was available in order to reach a decision. The rationale adopted was to follow the new IUCN categories of threat where they had been previously applied to species, even though these themselves may have been applied using limited data and mainly rely on inference. Where species have been categorised as Endangered using the new IUCN threat categories and criteria, these have generally been considered to meet Criterion B for

Appendix II listing but in some cases, not enough information was available. this is the case for example with *Diospyros crassiflora*.

As previously outlined, the IUCN category, Vulnerable (Criterion A) indicates that the population of a species has declined by at least 20 percent over three generations. Very many tropical tree species could be placed in this category given the rate of deforestation over the past century. Eighteen of the African tree species considered during the evaluation process, had previously been evaluated as VU (A), on the basis of either: decline in area of occupancy, extent of occurrence and/or quality of habitat; or: actual or potential levels of trade. Given these threat categorisations, and the fact that for all these species, international trade is known or inferred to have a detrimental impact on wild populations, they could be said to meet the CITES listing criterion B for Appendix II listing. It was decided however that further considerations should be taken into account notably information on regeneration, growth rate, habitat specificity, and population density.

It should be noted that for widespread species, overall assessments of conservation status invariably become to some extent subjective and expert opinions tend to vary. This can be seen, for example, for *Pterocarpus angolensis* (species profile on p.) where experts from Southern Africa have considered the species to be Low Risk according to the new IUCN categories whereas experts from west and central Africa considered that the species should be evaluated as Vulnerable.

Opinions may also vary with regard to species with smaller ranges. For example, logging of *Aucoumea klaineana* in Gabon (which comprises the great majority of the species's range) is considered probably sustainable by one expert. The species would therefore not be appropriate for consideration for inclusion in Appendix II. However, other experts at the African Regional Workshop on the Conservation and Sustainable Management of Trees allocated a category of Endangered on the basis of both actual or potential levels of exploitation and a decline in range or habitat quality, leading to an observed, estimated, inferred or suspected population reduction of at least 50 per cent over three generations. If the latter categorisation is reliable, and given that the species is in international trade at high volume then clearly it qualifies for inclusion in Appendix II.

5. Discussion

It is clear from the evaluation exercise that the new CITES listing criteria can be applied to timber species and that many timber species are likely to qualify for listing on the Appendices of CITES. Difficulties in application of the criteria relate to ambiguities in the wording of Annexes of Resolution Conf. 9.24 which may apply equally to the use of the criteria for any species. Ensuring that the criteria are sufficiently flexible for widespread use has resulted in a system with scope for considerable divergences in interpretation.

The limited availability of detailed information for timber species is another problem faced in applying the criteria. Again this is not unique to timber species. It is, in fact, likely that considerably more information is collected at a national level on the distribution, production

and trade in timber species, particularly those of international economic importance, than for most other groups of plant or animal species. Collection and collation of data on a particular timber species throughout its range is not, however, an easy task.

The present short study has illustrated the difficulties in compiling adequate information for the evaluation of timber species particularly on the detailed distribution, production and trade for species which are widespread. The main source of trade data for the present evaluation has been the international timber trade statistics compiled by ITTO for member states. Attempts to supplement this data have been of limited success.

At a national or state level, timber production and trade data may be collected by both governmental and commercial organisations. Lack of coordination of data collection is a frequent limitation. Other problems associated with forestry statistics in the Latin American region, for example, have recently been highlighted as:

> low reliability, because of a high degree of subjective estimations
> rarely available on time or in forms appropriate for user needs
> insufficient in quantity (Abad Arrambide, 1995)

Attempts to collect trade information in Brazil for the present study have illustrated various difficulties. In Brazil, production and trade data in timber species are collected by both state and national government agencies, various of which were contacted during the study. The Ministry of Industry, Commerce and Tourism (MICT) collates and publishes import and export information. Data on the production of timber was formerly collected by a division of the Ministry called CACEX (Carteria de Comercio Exterior) generally grouped as products, rather than individual species, except for *Araucaria angustifolia*. In 1994, CACEX was replaced by SECEX (Secretaria de Comércio Exterior) who route information to SERPO (Servico Federal de Procesamento de Dados), the government computing agency. Access to this information is governed by a special decree (Portaria 334/95 of 17 October 1995; Annex 6). Information on timber production is also maintained by IBAMA, various state environmental agencies and private industry groups (Sindicatos de Madereiros). Information is not generally available from the latter groups (Varty and Guadagnin, 1996). During the period of the study, government agencies in Brazil were on strike, and so access to trade information was further hindered.

To demonstrate for timber species that trade is detrimental to wild populations and unsustainable in the sense required for CITES Appendix II listing, information should ideally be available on standing stocks, increment rates (taking into account both growth rates and regeneration rates) and volumes exported throughout the range. As a crude measure, if annual volume exported overall is greater than annual increment rate then trade can be assumed to be unsustainable. In practice these data are very rarely available in good quantitative form, and if they are it is almost invariably for a small part of the taxon's range. In all cases detailed consideration of the ecology and reproductive strategies of the different tree species would be helpful to assess the impact of trade.

As mentioned in the introduction, Resolution Conf. 9.24 specifies that CITES amendment proposals should provide sufficient information on which to judge the proposal against the listing criteria. Given the relatively controversial nature of timber listing proposals it would

appear important to provide thorough documentation to support such proposals. Previous CITES amendment proposals for timber species have failed to win support, in part, because of weak supporting information. Recently it has been suggested that a scientific protocol is required enhancing transparency and compatibility of proposals for (plant) species to be listed. *Such a protocol should describe crucial parameters of population dynamics and geographical distribution which should be assessed as well as methods and (sampling) procedures to carry out the actual assessment. Execution of such a protocol would result in verifiable scientific judgement of the actual status of the species.* (Lammerts van Bueren, *in litt.* 1996)

Given the nature of tree species in helping to define the ecosystems in which they occur, and the scale of the international trade in certain species the following steps may be helpful in a process of initial selection of internationally traded timber species for inclusion in the CITES appendices prior to preparation of listing proposals.

i. Determination of the habitat specificity of the species, the extent and rate of decline of the habitat. This will give a quantifiable indication of the extent to which the species is *threatened with extinction* according to the new IUCN categories of threat. If the timber species meets at least the criteria for listing as Vulnerable it may be appropriate for further consideration.

ii. Collection of inventory, production and trade statistics for at least part of the range of the species, over a period of time, to determine the likelihood of the trade in the species being sustainable (capable of being maintained at the current level in perpetuity). If the trade in the timber species does not appear to be sustainable it may be appropriate for further consideration.

iii. Collection of information on the application of silvicultural techniques and extent of plantation development for the species. This will give further indirect indication as to likely impact of trade on wild populations. Where the species does not respond to silvicultual techniques, or these are not applied, and where plantations are not developed for the species, further consideration of the need for CITES listing is appropriate.

In general, where a timber species is in international trade, the trade is contributing to the decline in wild populations, and the species is *threatened with extinction* it can be considered to meet the criteria for CITES listing. In reality, other considerations are likely to be of major importance in any development of the CITES appendices for timber species, not least the perceived value of the Convention in relation to the conservation of timber resources.

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Biological Criteria for Appendix I

The following criteria are intended to be read in conjunction with the definitions, notes and guidelines listed in Annex 5 of Resolution Conf. 9.24.

A species is considered to be threatened with extinction if it meets, or is likely to meet **at least one** of the following criteria.

A. The wild population is small and is characterized by **at least one** of the following:

i) an observed, inferred or projected decline in the number of individuals or the area and quality of habitat; or

ii) each sub-population being very small; or

iii) a majority of individuals, during one or more life-history phases, being concentrated in one sub-population; or

iv) large short-term fluctuations in the number of individuals; or

v) a high vulnerability due to the species' biology or behaviour (including migration).

B. The wild population has a restricted area of distribution and is characterized by **at least one** of the following:

i) fragmentation or occurrence at very few locations; or

ii) large fluctuations in the area of distribution or the number of sub-populations; or

iii) a high vulnerability due to the species' biology or behaviour (including migration); or

iv) an observed, inferred or projected decrease in any one of the following:

- the area of distribution; or
- the number of sub-populations; or
- the number of individuals; or
- the area or quality of habitat; or
- reproductive potential.

C. A decline in the number of individuals in the wild, which has been **either**:

i) observed as ongoing or having occurred in the past (but with a potential to resume); or

ii) inferred or projected on the basis of any one of the following:

- a decrease in area or quality of habitat; or
- levels or patterns of exploitation; or
- threats from extrinsic factors such as the effects of pathogens, competitors, parasites, predators, hybridization, introduced species and the effects of toxins and pollutants; or
- decreasing reproductive potential.

D. The status of the species is such that if the species is not included in appendix I, it is likely to satisfy one or more of the above criteria within a period of five years.

Abies nordmanniana subsp. equi-troujani

Distribution
This species is endemic to Kaz-Dagh and Ulu-Dagh in western Turkey.

Habitat
This temperate species is found in moist coniferous montane forest and is found in both open and closed forest. It is found in seasonal climates between 1000-2000 m (Conifer SSC, 1996).

Population Status and Trends
Usually found in pure stands, this species is locally abundant but has a scattered distribution (Conifer SSC, 1996).

Regeneration
Seeds of this shade tolerant species are wind dispersed.

Role of Species in its Ecosystem
Not known.

Threats
This species is threatened by habitat degradation, changes in land use, and overgrazing (Conifer SSC, 1996).

Utilisation
A. nordmanniana subsp. *equi-troujani* is a timber species.

Trade
Not known.

Conservation Status
IUCN Threat Category and Criteria: LR lc (Conifer SSC, 1996)

Conservation Measures
No information.

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Afzelia africana

Afzelia; Doussie

Distribution

This widespread species occurs in Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Ghana, Guinea, Guinea-Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone, Sudan, Togo, Uganda and Zaire.

Habitat

Vegetation types according to White (1983)

1. Guineo-Congolian rain forest
Drier peripheral semi-evergreen Guineo-Congolian rain forest and similar forest in the transition zones. *Afzelia africana* is absent from the wetter forest types and is a distinguishing feature of the 'fire-zone' between Guinea-Congolian rain forest and savanna.
2. Guineo-Congolian transition woodland
3. Guineo-Congolian secondary grassland and wooded grassland
4. Sudanian woodland
5. The Coastal Plain of Basse Casamance
N.B. In the Guinea-Congolia/Sudania regional transition zone phytochoria.

In Ghana, this species is found in dry forest, especially in the forest-savanna borders. It tends to be scattered in areas with rocky soils (Hawthorne, 1995a).

Population Status and Trends

A. africana is common in Ghana (Hawthorne, 1995a). This species is also common in Nigeria and Cameroon (African Regional Workshop, 1996).

Role of Species in its Ecosystem

No information.

Threats

This species is under pressure from exploitation in Ghana (Hawthorne, 1995a).

Utilisation

Timber of *Afzelia* spp. in general is used for exterior joinery, flooring, heavy construction, furniture, vats and tanks. The seeds are used as a thickening agent (African Regional Workshop, 1996).

Trade

A. africana was exported from Ghana as sawnwood in 1994; 2550 m^3 of air dried sawnwood was exported at an average price of US$572.00/$m^3$ and kiln dried sawnwood sold for an average price of US$630.00/$m^3$ (ITTO, 1995a).

Conservation Status

IUCN Threat Category and Criteria: VU (A1d) (African Regional Workshop, 1996)
A. africana has been given a red star in Ghana meaning it is common but under pressure from exploitation and conservation measures are necessary (Hawthorne, 1995a). This species is considered Vulnerable according to the 1994 IUCN threat categories (Hawthorne, 1995b).

Conservation Measures

Protected by law in Côte d'Ivoire. FAO selected this species for conservation action in Cameroon because of the heavy utilisation pressures on the species (Palmberg, 1987).

This species can be vegetatively propagated by budding (African Regional Workshop, 1996).

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Afzelia bipindensis

Afzelia; (Red) Doussié

Distribution

A. bipindensis is found mostly in the Guineo-Congolian regional centre of endemism, but also extends into the Zambezian region (White, 1983). This species occurs in Angola, Central African Republic, Cameroon, Congo, Gabon, Nigeria, Uganda and Zaire.

Habitat

This is a rainforest species.

Population Status and Trends

There are reportedly only a few seed trees distributed in a narrow range (African Regional Workshop, 1996).

Role of Species in its Ecosystem

No information.

Threats

This species is heavily exploited throughout its range (African Regional Workshop, 1996).

Utilisation

Timber of *Afzelia* spp. in general is used for exterior joinery, flooring, heavy construction, furniture, vats and tanks.

Trade

5000m^3 of *A. bipidensis* sawnwood was exported from Cameroon in 1994 at an average price of US$1000.00/m^3 and the Congo exported 33m^3 in 1994 (ITTO, 1995 a). In 1987, Gabon exported 2,595m^3 of Doussie from Owendo (IUCN, 1990). Gabon exported 5,302.258 m^3 of Doussie in 1994 and 7,560.274 m^3 in 1995 (DIAF, 1996).

Conservation Status

IUCN Threat Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)

Conservation Measures

FAO selected this species for conservation action in Cameroon because of the heavy utilisation pressures it faces (Palmberg, 1987). Vegetative propagation by budding/grafting could be feasible (African Regional Workshop, 1996).

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Afzelia pachyloba
Afzelia

Distribution
This species occurs in Angola, Cameroon, Congo, Gabon, Nigeria and Zaire.

Habitat
A. pachyloba is a rainforest species.

Population Status and Trends
There are only a few seed trees throughout its range (African Regional Workshop, 1996).

Role of Species in its Ecosystem
No information.

Threats
This species is heavily exploited.

Utilisation
Timber of *Afzelia* spp. in general is used for exterior joinery, flooring, heavy construction, furniture, vats and tanks.

Trade
A. pachyloba is an important commercial species in Cameroon, Nigeria and Congo (African Regional Workshop, 1996).

Conservation Status
IUCN Category and Criteria: VU (A1d) (African Regional Workshop, 1996)

Conservation Measures
FAO has selected this species for conservation action in Cameroon because of the heavy utilisation pressures on the species (Palmberg, 1987).

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Amburana cearensis

Amburana; Cerejeira

Distribution

This species occurs in Argentina, Bolivia, Brazil, Paraguay and Peru.

Habitat

In Argentina *A. cearensis* occurs in cloud forests in the provinces of Salta and Jujuy (Herran, pers. comm., 1996).

Population Status and Trends

There is concern about the increasing isolation of populations of the species which depends on cross-pollination (Herran, pers.comm., 1996).

Role of Species in its Ecosystem

No information.

Threats

Exploitation for the international market is one of the threats faced by this species.

Utilisation

The timber is used for construction, furniture and decorative veneers.

Trade

A. cearensis is exported as sawnwood by Peru and Brazil. In 1994, 6000 m^3 at an average price of US$430.00/$m^3$ was exported out of Brazil (ITTO, 1995).

Wood of this species is imported from Bolivia to Argentina, the point of entry being Salta. From April 1995 to April 1996 18,240m^3 were imported (Herran, pers. comm., 1996).

Exports of *Amburana cearensis* from Brazil

Year	Sawnwood		Veneer	
	Tonne	US$ FOB	Tonne	US$ FOB
1993	3.205	1,351	.874	1,732
1994	3.592	1,494	1.457	2,730
1995	3.245	1,696	1.066	2,820

Source: IBAMA, 1996

Conservation Status

This species is recorded as Vulnerable (old IUCN threat category) in Argentina and Peru in the WCMC Plants Database. It has not yet been evaluated with the new IUCN Red List Categories.

Conservation Measures

Brazil has both state and federal legislation protecting trees and forests. The federal law allows for the restriction or prohibition of the felling of threatened trees the state laws tend to be more specific and restrictive. The Brazilian legislation is fragile and state laws are sometimes reversed to allow deforestation. In reality almost any species can be cut if the proper licence is obtained (Varty & Guadagnin, 1996).

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Araucaria angustifolia
Parana Pine

Distribution
Parana pine occurs in Argentina, Brazil and Paraguay. Within Brazil, *Araucaria angustifolia* grows naturally in the states of Rio Grande do Sul, Santa Catarina, Paraná, Sao Paulo, Rio de Janeiro and Minas Gerais. In Argentina *A. angustifolia* is only found in the Territory of Misiones (FAO, 1986).

Habitat
Parana pine is found in humid subtropical areas that have no dry season and a mild to hot summer. In the northern part of its range it is found at altitudes over 800m but in the south this species can occur at lower altitudes if the temperature is cool enough. (FAO, 1986).

Population Status and Trends
Araucaria forests virtually disappeared in the space of a few decades under pressure of logging and conversion to agriculture: of the area present in 1900, less than half remained by 1950, and less than 20% by 1991. The 1991 estimate of total area is 30,000 km (Harcourt and Sayer, 1996). According to the SSC Conifer Specialist Group, 1996, the natural range of *A. angustifolia* now covers less than 20,000 km^2 and its distribution is severely fragmented. Over the past 60 years the natural *Araucaria* forest has been reduced to 4.3% of its original area in Sao Paulo province, Brazil (FAO, 1986).

Regeneration
The seeds of this species have a short period of viability. The seedlings are not shade tolerant. (FAO, 1986)

Role of Species in its Ecosystem
The understorey of the Parana pine forests contain an abundance of bamboo spp of the genera *Merostachys* and *Chusquea* as well as tree ferns. *Podocarpus lambertii* frequently occurs (Harcourt and Sayer, 1996).

Threats
A. angustifolia has been heavily exploited for timber for approximately 60 years (FAO, 1986).

Utilisation
Principal uses of the timber include framing lumber, interior trim, sash and door stock, furniture and veneer. Used in Brazil for plywood and is considered suitable for pulp and paper products. The timber is used locally to make musical instruments, boxes and matches.

The seeds of this species are cooked as food and the wood is also used locally as fuelwood. The resinous bark can be made into good fuel and can be fermented to make a beverage (FAO, 1986).
This species also has ornamental value and is found in gardens and parks.

Trade

Production of *Araucaria angustifolia*, Brazil, 1989-1993

Year	Logs (m^3)	Felled Trees ('000 Trees)
1989	1,407,572	680
1990	1,050,715	542
1991	832,664	415
1992	645,662	326
1993	600,064	282

Source: FAO, 1996

A. angustifolia was exported by Brazil as sawnwood at an average price of US$471.00/m^3; a total volume of 35,000m^3 left the country in 1994 (ITTO, 1995). From the Porto de Paranaguá and Foz do Iguaçu, Paraná, Brazil in 1995, 40,194m^3 was exported at an average price of US$508/m^3 (Varty & Guadagnin, 1996).

Exports of *Araucaria angustifolia* from Brazil, 1993-1995

Year	Sawnwood		Veneer	
	Tonnes	US$ FOB	Tonnes	US$ FOB
1993	25.189	16,339	1.734	1,021
1994	25.370	16,614	2.149	1,316
1995	20.341	16,126	.865	452

Source: IBAMA, 1996

Conservation Status
IUCN Threat Category and Criteria: VU (B1&2) (SSC Conifer Specialist Group, 1996).

Conservation Measures
This species is found in various protected areas in Brazil (FAO, 1986).

The Brazilian Institute for Forestry Development (IBDF) have maintained a few stands of this species (both planted and natural) for seed production (FAO, 1986). In Brazil the parana pine is considered to be a slow grower and because of this reforestation has greatly decreased (FAO, 1986).

A licence to cut *A. angustifolia* in Brazil can only be obtained if the applicant can prove that the logging will follow an agreed management plan, that the area to be logged is a plantation or the area was previously under cultivation (Varty & Guadagnin, 1996). In Rio Grande do Sul, Brazil the state forest code has set the minimum cutting dbh at 40 cm. In reality there is very little control and many documents are forgeries (Varty & Guadagnin, 1996).

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Aspidosperma polyneuron
Peroba Rosa

Distribution
This species occurs in Argentina, Brazil, Colombia, Paraguay, and Peru.

Habitat
Peroba rosa occurs in subtropical moderate humid and subtropical regions and is found in a few forest types i.e. low altitude forest, seasonal evergreen mountainous forests and seasonal evergreen forest (FAO, 1996).

Population Status and Trends
The surviving trees of this species are found in small remaining clusters of forest (FAO, 1986).

Role of Species in its Ecosystem

Threats
This popular timber species is threatened by intense exploitation over the past few decades, as it is valued for its resistance and strength. In addition, *A. polyneuron*'s habitat has been taken over for pastures and agriculture (FAO, 1986).

Utilisation
Peroba rosa timber is used in construction, flooring, furniture, wagons, sleepers and veneers

Trade
180 m^3 of an *Aspidosperma* spp. (trade name: Peroba) was exported as sawnwood from Brazil at an average price of US$420.00 (ITTO, 1995).

Conservation Status
Within the WCMC Plants Database, the status of *A. polyneuron* is recorded as Endangered in Argentina, Indeterminate in Bolivia, Indeterminate in Brazil, Endangered in Colombia, Vulnerable in Paraguay and Endangered in Peru, following the old IUCN threat categories. This species has not yet been evaluated according to the new IUCN threat categorisation system.

Conservation Measures
Brazil has both state and federal legislation protecting trees and forests. The federal law allows for the restriction or prohibition of the felling of threatened trees the state laws tend to be more specific and restrictive. The Brazilian legislation is fragile and state laws are sometimes reversed to allow deforestation. In reality almost any species can be cut if the proper licence is obtained (Varty & Guadagnin, 1996).

References
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Aucoumea klaineana
Okoumé

Distribution
Okoumé is restricted to west and central Gabon and a few small areas in Equatorial Guinea, Congo and Cameroon. In Cameroon

Habitat
It is found between sea level and 700 m in lowland broadleaf forests (White, 1996).

Vegetation types according to White (1983)
1. Guineo-Congolian rain forest
Hygrophilous coastal evergreen Guineo-Congolian rain forest. *Aucoumea klaineana* is one of the most abundant species in this forest type especially in old secondary forest on well-drained sites.

Population Status and Trends
In Gabon the species remains widespread and abundant, and is common in secondary forest; the population is more or less stable (Wilks *in litt.*, 1992).

Regeneration
Oukomé trees flower only once in every 7 - 15 years (Anon, 1994). This light-demanding species is gregarious in secondary forests (N'Sosso *in litt*, 1995). It regenerates naturally where the recuperation period between logging cycles is sufficient (Wilks *in litt*, 1990). However, according to White, *in litt.* 1996, Okoumé is not regenerate regenerating. It is a light lover which only regenerates in old farms and unburnt savannas. Few tree below 30cm dbh are now seen (White, *in litt.*).

Role of Species in its Ecosystem
No information.

Threats
Repeated logging particularly in the Première zone (near coast) restricts regeneration, although it is considered by Wilks *in litt.*, 1992, that the logging is probably sustainable in Gabon. In contrast experts at the Regional Workshop for the *Conservation and Sustainable Management of Trees* project considered that the restricted range of this species and the destruction of its ecosystem puts the future survival of this species in danger (African Regional Workshop, 1996).

Utilisation
Okoumé is considered an excellent timber for veneer and plywood and also produces good quality sawn timber.

Trade
This species is Gabon's most important commercial timber and contributes about 90% of annual production. At present international market forces regulate Okoumé logging in Gabon and state controls are considered ineffective (Wilks, *in litt.*, 1990). France is the main importer of Okoumé. Italy, Japan and Israel are also important importers. This species is traditionally absent from UK markets.(WCMC, 1991). Disappointing oil revenues have resulted in the export of Okoumé timber to Western Europe and Japan becoming increasingly important to the Gabonese economy (Anon, 1994).

Congo exported 53,188m^3 of Okoumé logs and 23 665m^3 of veneer in 1994 (ITTO, 1995). In 1987, Gabon exported 603,740m^3 of *A. klaineana* from Owendo (IUCN, 1990). An unknown volume of logs was exported by Gabon for an average price of US$239.59/m^3 (ITTO, 1995a). In addition Gabon exported 371m^3 of Okoumé as sawnwood for an average price of US$287.77/m^3, 2,106m^3 of veneer at an average price of US$97.16/m^3, and 10,225m^3 of plywood at an average price of US$300.32/m^3 (ITTO, 1995a).

Total export of Okoumé from Gabon in 1994 was 1,327,957.181 m^3 and in 1995 the total export was 1,573,702.100 m^3 (DIAF, 1996).

Conservation Status
IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996). The gene pool of Okoumé has been seriously deteriorated by decades of selective harvesting (Anon, 1992).

Conservation Measures
A. klaineana is considered a priority species for *in situ* conservation by FAO (1984).
More than 29,000 ha have been planted with Okoumé in Gabon but reforestation does not compensate for felling in natural forests. Introduction of this species west of Kribi in Cameroon has been discontinued because of its poor form (African Regional Workshop, 1996).

Minimum logging diameter in Gabon is 70 cm in forest reserves, although this restriction is not enforced (Wilks, *in litt.*, 1990).

A project "Biology of Okoumé", has been funded by ITTO and implemented by the government of Gabon, through the Ministère des Eaux et Fôrets. Scientific and technical support is provided by the Tropenbos Foundation. The aim of this project is to improve understanding of species specific characteristics of Okoumé, with the objective of realizing high yielding plantations that at least can keep track of the current logging rate. The establishment of such plantations will help reduce the pressure on Gabon's forest area and its biological diversity. (Anon, 1994). The first phase of the project ended in December 1995.

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Autranella congolensis
Mukulungu

Distribution
This species occurs in Cameroon, Congo, Gabon and Nigeria.

Habitat
This species is found in dense forest (N'Sosso *in litt*, 1995).

Population Status and Trends
This species is fairly rare (African Regional Workshop, 1996).

Regeneration
This is a recalcitrant species (African Regional Workshop, 1996).

Role of Species in its Ecosystem
No information.

Threats
A. congolensis is heavily exploited for timber (African Regional Worshop, 1996).

Utilisation
The timber is used for heavy construction, flooring, furniture and cabinet-making, acid vats, turnery and joinery. Locally the seeds are used and traded as rattlers for dancers (African Regional Workshop, 1996).

Trade
Gabon reported export of 51.2 m^3 of Mukulungu in 1995 and reported no export of this species in 1994 (DIAF, 1996).

Conservation Status
IUCN Category and Criteria: CR (A1c,d) (African Regional Workshop, 1996)

Conservation Measures
None.

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Baikiaea plurijuga

Zambezi Teak; Zambezi Redwood

Distribution

This species occurs in Angola, Botswana, Namibia, Zambia and Zimbabwe.

Habitat

Vegetation type according to White (1983)

1. Zambezian dry deciduous forest and scrub forest (Zambezian Kalahari woodland)

This species is confined to lowland tropical forest on the Kalahari sands. *Baikiaea plurijuga* is the dominant component of the *Baikiaea* forest canopy (White, 1983). *Baikiaea* forest is the most extensive deciduous forest on the Kalahari Sand in the south of the Upper Zambezi basin and *B. plurijuga* is essentially limited to this area (White, 1983). In Zimbabwe, *B. plurijuga* is found in higher areas of thicket on Kalahari sands of the Lupane and Nkayi districts and in higher areas of woodland thicket on colluvium in the Binga district (Timberlake *et al*, 1991).

Population Status and Trends

Precise limits of individual populations of the species are not known but *B. pluijuga* is the dominant species in the Zambesi teak forests the area of which has been measured. In the early 1980s, Zambesi teak forests were reported to cover an area of 700,000 ha (Mubiti, 1984 in draft CITES proposal, 1986). More recent surveys have shown that 800,000 ha exist in forest commissioned land in Zimbabwe (African Regional Workshop, 1996).

In Zambia this forest type formerly covered almost all of the Western Province, the North-Western Province and the western area of the Southern Province (CITES draft proposal, 1986). The increased logging activities of the last fifty years have led to changes in the ecology of the forest; gaps in the canopy allow for thicket species to develop (this is especially a problem in Zambia). It is thought that these changes might inhibit the re-establishment of the Zambezi teak forests (CITES draft proposal, 1986). These forests are expected to disappear within 50 years and to be irretrievably diminshed much sooner (WCMC, 1991). Populations of older individuals (about 500 years old) have now completely disappeared (African Regional Workshop, 1996).

Although the Zambesi teak forests are threatened, the range of *B. plurijuga* has only been fractionally reduced (African Regional Workshop, 1996). Grassland quickly replaces the Zambesi teak forests once they have been cleared, making grassland a more common habitat for *B. plurijuga* (African Regional Workshop, 1996). Populations in fallow fields and national parks are regenerating well (African Regional Workshop, 1996).

There are thought to be intact populations in forests in Botswana and Zambia, where levels of exploitation are less well known (African Regional Workshop, 1996).

Regeneration

This species coppices well (African Regional Workshop, 1996).

Role of Species in its Ecosystem

B. plurijuga is associated with *Entandrophragma caudatum*, *Pterocarpus antunesii* and *Combretum collinum* (Huckabay, 1986).

Threats
This species is exploited for its timber. The Zambesi teak forest as a habitat type is undeniably threatened, however, the *Baikiaea* thickets that grow on grassland are still fairly widespread and timber from these thickets can be utilised (African Regional Workshop, 1996).

Utilisation
The timber is mainly used in flooring. Locally the species is used for medicinal purposes and for tanning. *B. plurijuga* is not locally exploited for its wood because it is too hard to cut.

Trade
Sales values in Zambia over recent years have been around US$1 million annually, 80% in the domestic market and 20% from exports. It is one of the two major commercial timber species of Botswana (WCMC, 1991).

Conservation Status
IUCN Threat Category and Criteria: LR lc (African Regional Workshop, 1996)

Conservation Measures
This species is considered to be a priority for *in situ* conservation by FAO, 1984. *In situ* conservation stands have been established in Zambia. The Forest Reserves in Botswana contain *B. plurijuga* (African Regional Workshop, 1996).

This species is not suitable for a plantation programme because of its slow growth and fire sensitivity (African Regional Workshop, 1996).

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Baillonella toxisperma
Moabi

Distribution
Moabi occurs mainly in Cameroon, Gabon and Nigeria, and is also found in Angola, Congo and Equatorial Guinea.

Habitat
The monotypic genus *Baillonella* is endemic to the Guineo-Congolian region (White, 1983).
B. toxisperma is limited to dense primary evergreen rain forests. It requires shade for regeneration to occur (Wilks *in litt*, 1990).

Population Status and Trends
If this species continues to be over-exploited it will most likely vanish from large areas of its distribution (Schneemann, 1995). In areas of Cameroon that have been logged for several decades (i.e. Central, South, South-West and the Littoral provinces) there is a decrease and in some cases disappearance of Moabi (Schneemann, 1995). Moabi still remains in East Cameroon where there has been no logging.

Role of Species in its Ecosystem
Elephants play a part in regeneration and dispersal of Moabi as they eat the fruits and deposit the seeds elsewhere (Schneemann, 1995). Wild pigs and porcupines eat the seeds.

Threats
Moabi is heavily exploited in West Africa. This species is further threatened by its restricted regeneration (Wilks *in litt.*, 1990). It takes between 50 and 70 years before *B.toxisperma* starts to flower and regular fruit production doesn't occur until the tree is 90-100 years old (Schneemann, 1995).

Utilisation
The timber is used for furniture, cabinet work, decorative flooring, turnery and carving, decorative veneers, joinery, and stove fittings.

The edible oil (huile de karité) that is extracted from the seeds is of great importance to the local people. The oil can fetch high prices at the local markets in Cameroon; in the larger cities the oil can be worth as much as US$12/litre (Schneemann, 1995). The pulp of the fruit is eaten. The bark is used for medicinal purposes and has ethnobotanical uses (e.g. the Baka pygmies use the bark to become invisible for elephant hunting) (Schneemann, 1995).

Trade
Strong demand for Moabi timber comes from Southern Europe (Schneemann, 1995)

Moabi is an important commercial timber in Cameroon and is a major species in the export trade. Production of *B. toxisperma* in Cameroon has almost doubled since 1989/1990 (Schneemann, 1995). It is also commercially important to Congo (exports in 1988 of 4,517m^3) and Gabon where it is the second most important wood in terms of export earnings (Wilks *in litt*, 1990). Gabon exported 55,884m^3 in 1987 (IUCN, 1990) and 59,891m^3 in 1989.

According to ITTO (1995a) 25,000 m^3 of *B. toxisperma* logs were exported from Cameroon in 1994 at an average price of US$385/$m^3$, and 10,000 m^3 of sawn timber were also exported at an average price of US$700.00/$m^3$. While Gabon exported Moabi logs at an average price of US$70.40/$m^3$ and exported 82m^3 of sawnwood at US$63.13/$m^3$ (ITTO, 1995a). In 1994, Gabon exported a total of 32,572.065 m^3 of Moabi and 44,390.331 m^3 in 1995 (DIAF, 1996).

There is some concern about illegal trade from some of the Moabi producing countries (Draft CITES Proposal, 1991).

Conservation Status
IUCN Category and Criteria: VU (A1d) (African Regional Workshop, 1996)

Conservation Measures
The minimum exploitable diameter of Moabi in Cameroon is 1m and in both Gabon and Congo the minimum exploitable diameter is decreed to be 0.8m. *B.toxisperma* is found in several protected areas in Cameroon (i.e. Forêt de Nki, Forêt de Boumba Bek and Reserve de Faune du Dja). This species is also represented in the Sibang Arboretum, Libreville, Gabon. (Draft CITES Proposal, 1991). Cameroon has planted 389 ha of this species (African Regional Workshop, 1996).

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Brachylaena huillensis

Synonym: *Brachylaena hutchisonii*
Muhuhu

Distribution
This species occurs in Angola, Kenya, Mozambique, Tanzania, Transvaal and Uganda.

Habitat

Vegetation type according to White (1983)
1. Somalia-Masai scrub forest
Brachylaena huillensis occurs on the steep northern slopes of the Western Usambara mountains between 700 and 960 m.
2. Zanzibar-Inhambane undifferentiated forest
This species is found in the drier forests of this region.

In Kenya, *B. huillensis* occurs in the highlands, the coastal belt and in forest remnants (WCMC, 1991). It is found in upland semi-deciduous forest and lowland dry forest or thicket (Beentje, 1994).

It is found in the Usambara steppe and coastal lowland of Tanzania and Uganda (WCMC, 1991). This species is dominant in evergreen bush, is common in dry coastal forests and can be found in lowland dry forests and semi-deciduous dry upland forests (1500m-2000m) (FAO, 1986).

Population Status and Trends
The distribution of this species is patchy (Marshall & Jenkins, 1994).
B. huillensis is locally common in Kenya (Beentje, 1994).

Role of Species in its Ecosystem

Threats
The species is subject to heavy exploitation in Tanzania. In Kenya, much of the habitat of this species has been lost and the remaining trees are subject to increasingly heavy felling (WCMC, 1991). It is also suffering from habitat loss due to settlement and cultivation (FAO, 1986)

Utilisation
This species has been used for sleepers, flooring blocks, furniture, carving and turnery. Its main use internationally is now for wood carvings. It is commonly used in Tanzania for building posts. In Kenya, this species is only used in the carving industry and not for sawn wood (Marshall & Jenkins, 1994).

Perfumed oil can be distilled from the wood (FAO, 1986).

Trade

Conservation Status
This species is considered Rare in Uganda (Katende, 1995).

Conservation Measures
It is considered a priority for *in situ* conservation by FAO, 1984.
B. huillensis is found in the Arabuko-Sokoke Forest Reserve and the Shimba Hills Forest Reserve of Kenya. However in both of these areas this species is being collected. In the Arabuko-Sokoko Forest Reserve licences are issued for collection of dead wood but most of the trees removed are either newly dead (possibly ring-barked trees) or illegally cut trees (Marshall & Jenkins, 1994). It is also collected in the Lamu district and transported to Mombasa for the carving industry (Marshall & Jenkins, 1994).

There are 69 ha of this species in plantations in Kenya (Marshall & Jenkins, 1994).

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Cedrela fissilis
South American Cedar

Distribution
This species occurs in Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Panama, Paraguay, Peru and Venezuela.

Habitat
This species is found in tropical moist areas, specifically in lowland rain forest up to 800 m above sea level. It survives best on well-drained fertile soil and is very light demanding (FAO, 1986).

Population Status and Trends
The distribution is presently very scattered and sparse across its range. In lowland Amazonia the species is now quite rare. Since it suffering from genetic erosion, in some areas only poorly formed trees persist (FAO, 1986).

Role of Species in its Ecosystem
No information.

Threats
The species is suffering from severe genetic erosion, mainly because of over-exploitation of the best stands by logging contractors (FAO, 1986).

Utilisation
This timber species is used locally for furniture and cabinet making, and general carpentry.

Trade
In 1995, 11 064m^3 of *C. fissilis* was exported from the ports of Porto de Paranaguá and Foz do Iguaçu, Paraná, Brazil at an average price of US$298/m^3 (Varty & Guadagnin, 1996).

Exports of *Cedrela* spp. from Brazil

Year	Sawnwood		Veneer	
	Tonnes	US$ FOB	Tonnes	US$ FOB
1993	37.197	21,609	1.098	807
1994	32.598	22,165	833	616
1995	22.125	16,510	416	655

Source: IBAMA, 1996

Conservation Status
This species is recorded as Indeterminate in Argentina and Panama, within the WCMC Plants Database. It has not yet been evaluated using the new IUCN categories of threat.

Conservation Measures
Brazil has both state and federal legislation protecting trees and forests. The federal law allows for the restriction or prohibition of the felling of threatened trees the state laws tend to be more specific and restrictive. The Brazilian legislation is fragile and state laws are sometimes reversed to allow deforestation. In reality almost any species can be cut if the proper licence is obtained (Varty & Guadagnin, 1996).

References

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Cedrela odorata

Central American Cedar; Spanish Cedar

Distribution

This widespread species occurs in Antigua & Barbuda, Argentina, Barbados, Belize, Bolivia, Brazil, Cayman Is., Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Guadeloupe, Montserrat, St.Kitts, Mexico, Nicaragua, Panama, Peru, St.Lucia, Surinam, Venezuela.

Habitat

C. odorata used to be a dominant species in both moist and dry lowland deciduous forest (upto 1200m). This species can live in wet and semi-arid regions, but is most common in areas with richer well-drained soil (FAO, 1986). In Guyana, this species occurs in Mora forest, seasonal forest and mixed forest on poorly drained soil (Polak, 1992).

Population Status and Trends

This species is now rare in Amazonia. Large well-formed trees are only surviving in remote areas (FAO, 1986). *C. odorata* is rare and widespread within Guyana (Polak, 1992).

Regeneration

This light-demanding pioneer species regenerates well in disturbed areas (such as abandoned pastures and agricultural land) and in secondary forest. Seeds are wind dispersed (Polak, 1992).

Role of Species in its Ecosystem

No information.

Threats

This species is suffering somewhat from genetic erosion; the good quality trees have been selectively over-exploited (FAO, 1986). In addition, habitat loss is occurring due to the clearing of lowland forest (FAO, 1986). Plantations often fail from infestations of the shoot borer *Hypsipyla*.

Utilisation

Spanish cedar is used mainly for joinery, cabinet making and is the preferred material for making cigar boxes (FAO, 1986).

It is sometimes used as a shade tree for coffee plantations (FAO, 1986).

Trade

In 1994 Brazil exported 97,000 m^3 of *Cedrela* spp. for an average price of US$260.00/$m^3$
Honduras exported *C.odorata* logs, sawnwood, plywood and veneer; Peru and Colombia both exported sawnwood in 1994 (ITTO, 1995).

Exports of *Cedrela* spp. from Brazil

Year	Sawnwood		Veneer	
	Tonnes	US$ FOB	Tonnes	US$ FOB
1993	37.197	21,609	1.098	807
1994	32.598	22,165	833	616
1995	22.125	16,510	416	655

Source: IBAMA, 1996

Conservation Status
In the WCMC Plants Database, this species is recorded as Not Threatened at a global level. It is recorded as nationally threatened in various countries including Colombia and the Dominican Republic. It has not yet been evaluated suing the new IUCN categoreis of threat.

Conservation Measures
In and *ex situ* growth trials have been set up by the Oxford Forestry Institute (FAO, 1986).

Brazil has both state and federal legislation protecting trees and forests. The federal law allows for the restriction or prohibition of the felling of threatened trees the state laws tend to be more specific and restrictive. The Brazilian legislation is fragile and state laws are sometimes reversed to allow deforestation. In reality almost any species can be cut if the proper licence is obtained (Varty & Guadagnin, 1996).

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Cephalotaxus oliveri
Olive Plum Yew

Distribution
This species is found in Guixhou, Hubei, Sichuan, Yannan, Guangdong, Guangxi, Hunan, Jiangxi, Vietnam and eastern India.

Habitat
This species is found in low altitude (300-1500m) subtropical closed forests. It is mainly found in evergreen broad-leaved forests or in evergreen and deciduous broad-leaved mixed forests in valleys and by streams.

Population Status and Trends
Populations of *C. oliveri* have been rapidly decreasing. This species is scattered in forests throughout its range (China Plant Red Data Book, 1992).

Regeneration
This is a shade tolerant species which has moderately slow growth. Seeds germinate after ripening for one year in the broad-leaf litter; once the seeds have germinated the seedlings require shade. (China Plant Red Data Book, 1992)

Role of Species in its Ecosystem
No information.

Threats
This species is threatened by over-exploitation and habitat loss (China Plant Red Data Book, 1992).

The dioecious nature of *C. oliveri* means that this species is further threatened by infrequent regeneration (China Plant Red Data Book, 1992).

Utilisation
Used for timber. *C. oliveri* contains the alkaloids cephalotaxine and harringtonine which can be extracted from the leaves, shoots and seeds which have medicinal value for treating leukaemia and lymphoma (China Plant Red Data Book, 1992), however, no widespread exploitation has yet taken place (Conifer SSC, 1996).

Trade
It is not known whether international trade in products from this species currently take place.

Conservation Status
IUCN Category and Criteria: VU (A1d) (Conifer SSC, 1996).

Conservation Measures
This species is found in several nature reserves (Emei Mountain in Sichuan, Shuanghuang Mountains and Zhangjiajie in Hunan (China Plant Red Data Book, 1992).

Note: *C. oliveri* is a relict species which is markedly different to other members of the same genus (China Plant Red Data Book, 1992).

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Chamaecyparis lawsoniana
Synonym: *Cupressus lawsoniana*
Port Orford Cedar

Distribution
This species occurs in Oregon and California, U.S.A.; covering an area of 18,000 km² (Draft CITES Proposal, 1994).

Habitat
Port Orford Cedar is restricted to areas that have year-round water seepage and a shallow water table. It can be found along riverbanks, bogs and coastal sand dunes. Port Orford Cedar can grow from sea-level to high altitudes and does not require any specific soil type. (Draft CITES Proposal, 1994)

In northern California this species occurs in the coastal redwood forest stands and is also present in mixed evergreen forest, montane forest and subalpine forests (Klamath Mountains only). This species is a minor component of the *Pseudotsuga-Sclerophyll* (mixed evergreen) vegetation type of the Siskiyou Mountains, the *Tsuga heterophylla* zone of coastal Oregon and *Picea sitchensis* zone of SW Oregon. (Draft CITES Proposal, 1994)

Population Status and Trends
The current range of *C. lawsoniana* is limited to approx. 64 km wide along the Pacific Coast extending from SW Oregon to northern California; there are a few smaller isolated stands inland in the valleys of the Trinity and Sacramento rivers. By 1990 the volume of Port Orford Cedar had been reduced to 1.1 million m^3 from 2.2 million m^3 in 1963 (Draft CITES Proposal, 1994).

Role of Species in its Ecosystem
C. lawsoniana is a crucial species in the aquatic/riparian ecosystems within its range; it is important for strambank and floodplain stability, shade, water temperature, and decay-resistant wood (Draft CITES Proposal, 1994). Loss of this species directly affects fish (i.e. Coho, Chum, Chinook Salmon) and amphibians.

Threats
The natural stands of Port Orford Cedar are being heavily logged to meet the export demand (Draft CITES Proposal, 1994). *C. lawsoniana* is also threatened by a fast spreading, untreatable fungal disease (*Phytophthora lateralis & cinnamomi*) (Conifer SSC, 1996). The transport of diseased wood on logging tracks is causing this disease to spread into healthy populations (Draft CITES Proposal, 1994). It is thought that the disease can also be dispersed by vehicles driving from infected areas into non-infected areas (Draft CITES Proposal, 1994).

Utilisation
Used for timber. It is also planted as an ornamental.

Trade
This species has a minor domestic market. Most of the timber is exported as unprocessed logs to Japan and other Asian countries. Between 1980 and 1988, 307,000 m^3 were exported making US$ 195 million, making Port Orford Cedar one of the more valuable species being traded (Draft CITES Proposal, 1994).

Conservation Status
IUCN Threat Category and Criteria: VU (A1d,e) (Farjon, 1996).

Conservation Measures
This species occurs in several National Parks and National Forests (Siskyou, Six Rivers, Klamath, Trinity). It also occurs in isolated groves in Sinslaw and Shasta National Forests. *C. lawsoniana* is found in Spotted Owl forest and most likely well protected (Conifer SSC, 1996).

This species is widely cultivated and is grown in plantations (Conifer SSC, 1996); however, *P. lateralis* threatens to destroy most of the commercial stands of this species (Draft CITES Proposal, 1994).

References

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Chamaecyparis obtusa var. formosana

Distribution
This taxon is endemic to Taiwan.

Habitat
This temperate species is found in moist coniferous montane forests with a seasonal climate. It is found at altitudes between 1800-2500m.

Population Status and Trends
C. obtusa var. *formosana* has been declining since 1960, although it is still abundant in its range (Conifer SSC, 1996).

Regeneration
Seeds of the species are wind dispersed.

Role of Species in its Ecosystem
This shade tolerant species is associated with *Chamaecyparis formosensis* and other conifers.

Threats
C. obtusa var. *formosana* is threatened by over-exploitation, habitat loss and changes in land use/management (Conifer SSC, 1996).

Utilisation
It is a timber species.

Trade
Currently no evidence of international trade in this species is known.

Conservation Status
IUCN Threat Category and Criteria: VU (A1c,d) (Conifer SSC, 1996)

Conservation Measures
There is an important population of *C. obtusa* var. *formosana* in Yuanyang Lake reserve.

References
Conifer SSC, 1996. Discussions held by the SSC Conifer Specialist Group as part of the WCMC/SSC Conservation and Sustainable Management of Trees Project. March, 1996.

Copaifera salikounda

Etimoe; Bubinga

Distribution

This species occurs in Côte d'Ivoire, Ghana, Guinea, Liberia and Sierra Leone.

Habitat

This species is most abundant in evergreen forests, although most large trees are found in wet, flat, disturbed areas. It is not limited to the above habitat types; it does, however, prefer moist to wet habitats (Hawthorne, 1995a).

Population Status and Trends

C. salikouna is common in Ghana although there is a low density of larger trees. There appears to be a lot of regeneration, especially around mother trees. It is a shade tolerant tree (Hawthorne, 1995a).

Role of Species in its Ecosystem

The seeds of this species are probably dispersed by birds, although many fall to the ground beneath the parent tree (Hawthorne, 1995a).

Threats

In Ghana this species is threatened by over-exploitation (Hawthorne, 1995a).

Utilisation

Trade

This species is available from specialist timber traders in the UK. It is also recorded in trade with German and the USA.

Conservation Status

IUCN Category and Criteria: VU (A1d) (African Regional Workshop, 1996)
Hawthorne (1995a) has given this species a red star, which means it is common in Ghana but under pressure from exploitation and conservation measures are necessary. This species is considered Vulnerable under the new (1994) IUCN threat categories (Hawthorne, 1995b).

Conservation Measures

No information.

References

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Cordia millenii
Omo

Distribution
Widespread in tropical Africa, this species occurs in Angola, Cameroon, Central African Republic, Côte d'Ivoire, Gabon, Ghana, Guinea, Kenya, Nigeria, Sudan, Tanzania, Uganda and Zaire.

Habitat
C. millenii grows in closed forests and old secondary formations.

Larger trees of this species (considering *C. millenii* and *C. platythyrsa* together) prefer undisturbed, well-drained areas while the smaller trees are more commonly found in disturbed forest (Hawthorne, 1995a).

Vegetation types according to White (1983)
1. Transitional rain forest of the Lake Victoria regional mosaic
The Kakamega forest in Kenya has several Guineo-Congolian lowland rain forest species including *Cordia millenii*.

Population Status and Trends
In Ghana, this species is common (Hawthorne, 1995a). It is only known from a few locations in Kenya and in these areas the populations are declining due to habitat loss (FAO, 1986).

Regeneration
This is a light-demanding species, as regeneration and large trees are doubled in density in forest where there has been disturbance (ie. logged or burnt) when compared to undisturbed forest (Hawthorne, 1995a)

Role of Species in its Ecosystem
In Uganda the fruits are probably dispersed by frugivorous primates (Plumptree *et al*, 1994 in Hawthorne, 1995a).

Threats
This species is threatened by habitat loss (FAO, 1986)

Utilisation
The wood is thought to be impenetrable to termites and is, therefore, used for furniture, joinery, roof shingles, canoes, household utensils and other decorative work. It is used for making musical instruments in Uganda (FAO, 1986). It is also used as firewood. Locally this species is used as a shade tree. A decoction of leaves are used to treat roundworm, ground up seeds mixed with palm oil are taken against ringworm, and the dried leaves are smoked in Nigeria for asthma, coughs and colds.

Trade
No information.

Conservation Status
IUCN Category and Criteria: LR (lc) (African Regional Workshop, 1996)
According to Hawthorne (1995a) this species is not of particular conservation concern in Ghana and has been awarded a green star in his star categorization system.

Conservation Measures
This species is considered a priority species for *in situ* conservation by FAO, 1984.

References

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Cordia platythyrsa
Mukumari

Distribution
This species occurs in Cameroon, Ghana, Côte D'Ivoire, Liberia and Sierra Leone.

Habitat
It is found in closed forests and in old secondary formations and is a common pioneer species.
Larger trees of these species (considering *C. millenii* and *C. platythyrsa* together) prefer undisturbed, well-drained areas while the smaller trees are more commonly found in disturbed forest.

Population Status and Trends

Regeneration
C. platythyrsa is a light demanding species, as regeneration and large trees are doubled in density in forest where there has been disturbance (ie. logged or burnt) when compared to undisturbed forest The species is regenerating well in Ghana, especially along new logging roads (Hawthorne, 1995a).

C. platythyrsa can reach a height of 23m or dbh of 23cm after four years of growth in open areas (Hawthorne, 1995a). In Sierra Leone, the mean annual increments vary between 3.3 and 6.3 cm for the first 18 years (Saville & Fox, 1967 in Hawthorne, 1995a).

Role of Species in its Ecosystem
The fruits (fleshy drupes) of this species are probably dispersed by animals, including elephants (Hawthorne, 1995a).

Threats
This species suffers from some exploitation (Hawthorne, 1995a&b).

Utilisation
The timber is used for furniture, joinery, and other decorative work.

Trade
No information.

Conservation Status
IUCN Category and Criteria: VU (A1d) (African Regional Workshop, 1996)
Under Hawthorne's (1995) star categorization system, *C. platythyrsa* scores a pink star which indicates that it is common and moderately exploited in Ghana. Hawthorne (1995b) considers this species Least Concern (or systematically Vulnerable) under the new (1994) IUCN threat categories.

Conservation Measures
This species is planted in a limited scale by the Forest Research Institute of Nigeria (FRIN) (African Regional Workshop, 1996).

References
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Cupressus dupreziana
Saharan Cypress

Distribution
This species is restricted to the Tassili N'Ajjer Massif in Algeria.

Habitat
Cupressus dupreziana is found in dry sparsely vegetated areas between 1700 and 1900m.

Population Status and Trends
There are 153 individuals remaining within an area of 200km^2. There is no longer regeneration in the wild probably due to a water shortage as a result only the larger trees can reach the water table. The trees are producing viable seeds that can withstand climatic extremes (Conifer SSC, 1996).

Role of Species in its Ecosystem
This species is associated with *Rhus tripartitum*, *Pituranthos chloranthos*, *Olea laperrini*, *Lavendula pubescens*, *Myrtus rivellii*, *Nerium oleander* and *Tamarix articulata*.

Threats
Grazing has been reported to destroy any regeneration of this species (Lucas and Synge, 1978)

Utilisation
Previously a major source of timber for local use, *C. dupreziana* also used to be cut for firewood, but is now too rare to support any form of utilisation. It has been suggested that this species could be valuable for planting in arid areas (Lucas and Synge, 1978).

Trade
No current trade.

Conservation Status

Conservation Measures
The majority of this species is contained in the popular tourist site, the Tassili N'Agger National Park valley, which has been designated a World Heritage Site. The trees are guarded against cutting in this area (Conifer SSC, 1996). This species is cultivated on a small scale. It can be cultivated quite easily in Algiers and in Britain (Conifer SSC, 1996).

References
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Dalbergia cochinchinensis

Payung; Thailand Rosewood

Distribution

This species is found in Cambodia, Thailand, Laos and Viet Nam.

Habitat

It occurs in dry and moist evergreen forests mostly at 400-500 m. This species prefers deep, sandy, clay soil and calcareous soil, but it is not demanding as to the soil condition.

Population Status and Trends

In Vietnam, *D. cochinchinensis* is found south of Quang Nam-Da Nang, mainly in Gia Lai and Kon Tum; it in other provinces it is sparsely distributed in a few localities (Chính et al, 1996).

Regeneration

This species is shade tolerant as a sapling and becomes light demanding. *D. cochinchinensis* has quite a slow growth rate. It regenerates well by coppicing (Chính et al, 1996).

Role of Species in its Ecosystem

No information.

Threats

Deforestation and exploitation are threats to this species.

Utilisation

D. cochinchinensis is considered a 'first class prime timber', as it is hard, durable, easy to work and resistant to insects. The distinctive heartwood makes beautiful patterns when cut and the wood is used to make furniture, carvings, musical instruments and sewing machines (Chính et al, 1996).

Trade

No specific information on trade in this species is available.

Conservation Status

This species is considered Vulnerable in Vietnam (Chính et al, 1996).

D. cochinchinensis has not yet been evaluated using the new IUCN threat categories. However, the deforestation rates over the range of this species indicates that this species is likely to be Endangered (EN A1c) under the new IUCN categories. Confirmation of this categorisation by local experts is awaited.

Conservation Measures

A current IPGRI project is looking at the distribution of genetic resources of this species in its range countries.

References

Chính, N.N, Chung, C.T., Cân, V.V., Dung, N.X., Dung, N.K., Dào, N.K., Hop, T., Oanh, T.T., Quynh, N.B., Thìn, N.N., 1996. *Vietnam Forest Trees*. Forest Inventory and Planning Institute. Agricultural Publishing House: Hanoi. pp.788.

Dalbergia stevensonii
Honduras Rosewood

Distribution
This species is endemic to Belize. It is restricted to the southern part of the country between latitudes 16-17° N.

Habitat
This species has been reported to occur in fairly large patches along rivers but also on inter-riverain and drier areas; mostly between Sarstoon and Monkey Rivers (Chudnoff, 1984).

Population Status and Trends
No specific information is available.

Role of Species in its Ecosystem
No information.

Threats
No specific information is available.

Utilisation
This wood is used for speciality items including musical instruments, knife handles and veneers for fine furniture (Burton, *in litt.*, 1991).

Trade
The quantity available on the commercial market is very limited because of restricted growth areas (Flynn, 1994).

Conservation Status
No information is available on the conservation status of this species in the WCMC Plants Database. *D. stevensonii* has not yet been evaluated using the new IUCN categories of threat. However, considering that the recorded total area of forest cover in Belize was 16,864 km² in 1993 (Harcourt & Sayer, 1996), it is probable that this species will fall into at least the Vulnerable category (under criterion B, due to the restricted distribution). Confirmation of this categorisation by local experts is awaited.

Conservation Measures
No specific information.

References
Chudnoff, M., 1984. *Tropical timbers of the world.* USDA Forest Service Agriculture Handbook No. 607.
Flynn, J.H., 1994. *A guide to useful woods of the world.* King Philip Publishing Co: Portland, Maine, US
Harcourt C.S. and Sayer, J.A. (Eds), 1996. *The conservation atlas of tropical forests: the Americas.* Simon & Schuster:Singapore.

Diospyros celebica

Maccassar Ebony; Black Ebony

Distribution

This species is endemic to Sulawesi.

Habitat

This species is found in rain and monsoon forests; however, *D. celebica* can grow in both humid conditions and in seasonal climates. It can survive on a variety of soils (e.g. latosols, calcareous, and podzolic soils) (PROSEA, 1995). It occurs in undulating areas upto 600m above sea level (Sidiyasa, *in litt.*, 1994).

Population Status and Trends

Once a widespread species in Sulawesi, it is now comparatively rare, especially in the south (PROSEA, 1995). When present in a forest it tends to be scattered irregularly (PROSEA, 1995).

Regeneration

Flowering and fruiting occurs at the age of 5-7 years in *D. celebica* (PROSEA, 1995). The seeds remain viable for only a short time.

Role of Species in its Ecosystem

Seeds are dispersed by bats, birds and monkeys (PROSEA, 1995). It is often found with *Homalium celebicum* (PROSEA, 1995).

Threats

D. celebica is threatened by heavy exploitation since it is an important source of streaked ebony (PROSEA, 1995).

Utilisation

The timber is used for turnery, piano keys, carving, brush backs, inlaying, parts of stringed instruments and marquetry.

Trade

This species has been exported from Sulawesi since the 18th century. Export of this wood peaked in 1973 at 26,000 m^3, since then export has significantly decreased because few trees remain (PROSEA, 1995).

Japan is the primary market for this species, but it is also exported to Europe and the U.S..

Illegal logging and trade has been reported (Draft CITES Proposal, 1994).

Conservation Status

This species has an old IUCN global threat status of Rare in the WCMC Plants Database. The new IUCN threat categories have not yet been applied to this species.

Conservation Measures

In Sulawesi, *D. celebica* is protected and there is a quota system in place (CITES Proposal, 1994). The Indonesian Government has already started a planting programme of *D. celebica*; it has not, however, been planted on a large commercial scale (Sidiyasa, *in litt.*, 1994).

References

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Lemmens, R.H.M.J., Soerianegara, I. and W.C. Wong (Eds.), 1995. Plant Resources of South-East Asia (**PROSEA**) No. 5(2) *Timber Trees:Minor commercial timbers*. Backhuys Publishers, Leiden. 655 pp.

Sidiyasa, K., 1994. Letter to Sara Oldfield re: *Diospyros celebica, Intsia bijuga, Intsia palembanica*. Dated 28th April, 1994.

Diospyros crassiflora

African Ebony

Distribution

This species occurs in Cameroon, Central African Republic, Congo, Gabon, Nigeria, and Zaire.

Habitat

D. crassiflora is a lowland rainforest species.

Population Status and Trends

Virtually all big trees of the species have been marketed except in remote areas and the species is considered to be threatened in several countries such as Cameroon and Congo (WCMC, 1991a). Few large trees of the species remain in Nigeria (WCMC, 1991b).

Role of Species in its Ecosystem

No information.

Threats

According to White (*pers. comm.*, 1990 in WCMC, 1991b), this species is at risk as a commercial source of Ebony.

Utilisation

A speciality wood used for small parts of musical instruments, carvings and items of turnery.

Trade

Until recently, European demand for this species was limited as it is not considered a fashionable timber (WCMC, 1991), but this situation may now be changing. Zaire is the main exporter of this species. It is also of commercial importance in Congo, Cameroon, and Gabon. In the 1960s around 70 tonnes of wood were exported annually from Cameroon (WCMC, 1991). In 1994, Gabon exported 35 cu m (ITTO, 1995b).

Conservation Status

IUCN Category and Criteria: EN (A1d) (African Regional Workshop, 1996)

Conservation Measures

Special permission is required for utilization in Cameroon.
Regeneration measures are required (African Regional Workshop, 1996).

References

African Regional Workshop, 1996. *Conservation and Sustainable Management of Trees* project workshop held in Harare, Zimbabawe, July, 1996.

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Diospyros philippinensis

synonyms: Diospyros cunalon
Diospyros cumingii
Diospyros flavicans
Philippine Ebony; Kamagong

Distribution
This species is endemic to the Philippines and Northern Sulawesi.

Habitat
Philippine ebony grows in primary forest at altitudes up to 200 m (PROSEA, 1995).

Population Status and Trends
Very little lowland forest remains in the Philippines. Records of *D. philippinensis* are often from forest fragments or from habitats smaller than 50 km² (Madulid, *in litt.*, 1996)

Role of Species in its Ecosystem
No information.

Threats
According to Madulid (1996) this species is rarely exploited for timber.

Utilisation
The timber is used for turnery, piano keys, carving, brush backs, inlaying, parts of stringed instruments and marquetry.

Trade
D. philippinensis from the Philippines is not legally traded in the international market, therefore no official records exist (Madulid, 1996). Illegal trade in *D. philippinensis* is widespread, even though there has been a ban on log exports since 1989 (Blockus et al, 1992 in CITES Proposal). In 1991, a shipment of illegally cut *Diospyros sp.* (Kamagong) worth US$ 90,171 was seized in a Philippines port before it was illegally exported to Malaysia (Callister, 1992 in Madulid, 1996).

Conservation Status
The global threat status of *D. philippinensis* is unknown according to the WCMC Plants Database. The Philippines has had one of the highest deforestation rates for tropical rain forests (Collins, Sayer, and Whitmore 1991), making this species probably Endangered due to decline in habitat of more than 50 % in three generations, although more information is needed for Northern Sulawesi.

Conservation Measures
Philippine ebony is protected in the Philippines (PROSEA, 1995) and felling restrictions are in force.

D. philippinensis is found in many of the Philippine protected areas (i.e. Mount Arayat National Park, Mounts Palay Palay Mataas NA Gulod National Park, Initai National Park) (Dep't of Environment and Natural Resources, 1992 in CITES Proposal).
There are no known plantations of *D. philippinensis* in the Philippines (Madulid, *in litt.*, 1996)

References

CITES Proposal, 1992. Proposal to include *Diospyros philippinensis* in Appendix II of CITES.

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Madulid, D. A., 1996. Letter to Amy MacKinven dated 11th July 1996 re: *Diospyros pilosanthera* and *D. philippinensis*.

Collins, N.M., Sayer, J.A. and Whitmore, T.C. (Eds), 1991. *The conservation atlas of tropical forests: Asia and the Pacific*. Simon & Schuster:Singapore.

Diospyros pilosanthera

synonym: Diopspyros hiernii

Distribution

This widespread species is found in Myanmar, Thailand, Cambodia, Viet Nam, Peninsular Malaysia, Indonesia (Sumatra, Java, Borneo, and the Moluccas) and the Philippines.

Habitat

D. pilosanthera occurs in primary lowland and medium altitude forest (upto 900m) and is frequently found in peat swamp forest, swampy areas, and in river valley forests. This species can also be found in forests on rocky slopes, in old-growth secondary forests and in open forests near the coast (Madulid *in litt.*, 1996)

Population Status and Trends

Records of *D. pilosanthera* are often from forest fragments or from habitats smaller than 50 km^2 (Madulid, *in litt.*, 1996)

Role of Species in its Ecosystem

No information.

Threats

According to Madulid (1996) this species is rarely exploited for timber.
The forests containing *D. pilosanthera* have been degraded by legal and illegal logging and loss of habitat due to land conversion (i.e. agricultural land, grassland).

Utilisation

The wood is used for fancy woodwork, furniture, cabinet making and tool handles.

Trade

D. pilosanthera from the Philippines is not legally traded in the international market, therefore no official records exist.

In 1991, a shipment of illegally cut *Diospyros sp.* (Kamagong) worth US$ 90,171 was seized in the port before it was illegally exported to Malaysia (Callister, 1992 in Madulid, 1996).

Conservation Status

The global threat status of *D. pilosanthera* is unknown according to the WCMC Plants Database.
The new IUCN threat categories have not yet been applied to this species.

Conservation Measures

D. pilosanthera occurs in the protected forests of Palawan and Mt. Makiling, Philippines (Madulid, *in litt.*, 1996); the rest of the range in the Philippines (i.e. any public land) are under the jurisdiction of the Dep't of Environment and Natural Resources (DENR). There are no known plantations of *D. pilosanthera* in the Philippines (Madulid, 1996).

References

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Eribroma oblonga

synonym: *Sterculia oblonga*
Yellow Sterculia; Eyong

Distribution
This species occurs in Cameroon, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Liberia and Nigeria.

Habitat

Vegetation type according to White (1983)
1. Guineo-Congolian rain forest
Mixed moist semi-evergreen Guineo-Congolian rain forest
Drier peripheral semi-evergreen Guineo-Congolian rain forest and similar forest in the transition zones

It is a lowland rainforest species of transition forests between humid evergreen and semi-deciduous forest and it also occurs in secondary forests.

Population Status and Trends
This species is common in Ghana (Hawthorne, 1995a). It is also common in Nigeria and Cameroon (African Regional Workshop, 1996).

Regeneration
The seedlings are shade tolerant, but the larger trees are definite light demanders (Hawthorne, 1995a).

Role of Species in its Ecosystem
The seeds are probably dispersed by birds (Hawthorne, 1995a).

Threats
E. oblonga is exploited for its timber.

Utilisation
The timber is used for decorative veneers, furniture and construction work.

Trade
Côte d'Ivoire exported 246m^3 of *E. oblonga* plywood for an average price of US$3974.36/m^3 in 1994 (ITTO, 1995a). In 1987, Gabon exported 16m^3 from Owendo (IUCN, 1990). Gabon exported 987.165 m^3 of Eyong in 1994 and 1,893.308 m^3 in 1995 (DIAF, 1996).

Conservation Status
IUCN Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)
According to Hawthorne (1995a), this species is of no particular conservation concern and was awarded a green star for Ghana.

Conservation Measures
Regeneration work is necessary (African Regional Workshop, 1996).

References
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IUCN, 1990. *La Conservation des Ecosystèmes Forestiers du Gabon.* IUCN, Tropical Forest Programme Series. pp. 200.

White F., 1983. *The Vegetation of Africa.* A descriptive memoir to accompany the Unesco/AETFAT/UNSO vegetation map of Africa. Paris:Unesco. pp.356.

Fitzroya cupressoides
Alerce

Distribution
This species is found in Chile and in the provinces of Chubut, Neuquen and Rio Negro and the adjacent areas of Argentina.

Habitat
F. cupressoides is a lowland, closed forest species. It occurs in scattered stands from sea level to 1200m (Golte, 1996).

Population Status and Trends
F. cupressoides has been logged since the middle of the seventeenth century (Golte, 1996) and has been removed completely from parts of its range. It is estimated that by the early 1900's that 50,000 ha, approximately one third of the original *Fitzroya* stands had been cleared by the local people and that to date this species has been reduced to an estimated 15% (approx. 20,000 ha) of the original range (Golte, 1996). Clear-cutting and human-set fires have resulted in the replacement of *Fitzroya* forests in the Andes (Conifer SSC, 1996). There is poor regeneration (Conifer SSC, 1996).

Role of Species in its Ecosystem
F. cupressoides is an extremely slow growing species; it can take up to 200 years to reach maturity (Conifer SSC, 1996) and it can live as long as 3000 years (Golte, 1996). Regeneration of *F. cupressoides* is correlated with longevity and regeneration is stimulated by large scale natural disturbance such as a landslide or the deposition of volcanic ash. Unfortunately, regeneration does not take place after clear cutting (Golte, 1996).

Threats
This species is threatened by extensive logging; it is also threatened by loss of habitat due to expansion of human populations and human-set fires (Conifer SSC, 1996).

Utilisation
The exceptionally durable wood of this species is used mainly for house construction and roof shingles (Golte, 1996).

Trade
Illegal felling is occurring at alarming rates in Chile and they are illegally exporting this species by circumventing CITES restrictions (Conifer SSC, 1996). It is difficult to control the illegal exploitation of *F. cupressoides* in the more remote forests of the Andes and the coastal ranges (Golte, 1996).

In 1990, Chile exported 41876m³ of *Fitzroya cupressoides* the majority to East Germany and the United Kingdom. In 1991, 3164m³ of the timber was exported together with 2667727 timber pieces. An additional 772422 items of timber were reported to be imported by Japan in the same year. In 1992, Chile reported exporting 3148m³ of *Fitzroya cupressoides*. Except for the trade reported by Japan in 1991, and relatively small imports reported by the United States, 85m³ (1991) and 168m³ (1992), the majority of the exports of *Fitzroya cupressoides* recorded by Chile were not reported by the corresponding importers. Exports to CITES parties are recorded as pre-convention, that is from stocks acquired before 1 July 1975 (Oldfield and Collins, 1996).

Conservation Status
IUCN Category and Criteria: EN (A1c) (Conifer SSC, 1996).

Conservation Measures

This species is included in Appendix I of CITES but Chile entered a reservation in 1987 against this listing thus legally treating it as if included in Appendix II.

Chile declared *Fitzroya cupressoides* a National Monument in 1976 and both Chile and Argentina have prohibited logging of this species (Conifer SSC, 1996).

In 1991, a total of 2,309 ha of *F. cupressoides* were are protected in Chile as the 'Monumento Natural Alerce Costero' and it is also found in Chile's Alerce Andino National Park. In Argentina, Fitzroya stands are found in the Los Alerces National Park (Golte, 1996).

References

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Gossweilerodendron balsamiferum

Agba

Distribution

The genus *Gossweilerodendron* is endemic to the Guineo-Congolian region (White, 1983).
G. balsamiferum occurs in Angola, Cameroon, Congo, Equatorial Guinea, Gabon, Nigeria and Zaire.

Habitat

This shade-tolerant species usually grows in mature little-disturbed forest (evergreen or semi-deciduous) and occurs at elevations below 500m. This species flourishes on ferruginous soils derived from secondary sediments.

Population Status and Trends

It is absent or rare from part of its range within the main Nigeria\Zaire forest block (WCMC, 1991).

In the Congo, in the forest zone between Louessé and Niari of Makabana, stands of *G. balsamiferum* are found with 5 or 6 exploitable trees per hectare (N'Sosso *in litt*, 1995).

Role of Species in its Ecosystem

No information.

Threats

This species is declining because of heavy exploitation, habitat loss and a lack of a plantation programme (FAO, 1986).

Utilisation

The main uses of *G. balsamiferum* is in plywood manufacturing and for furniture, flooring, household fittings and light construction.

Trade

In 1994, 22m^3 of this species was exported as sawnwood from Congo (ITTO, 1995a). From the port of Owendo in Gabon, 6,002 m^3 were exported in 1987 (IUCN, 1990). Gabon exported 18,660.055 m^3 in 1994 and 27,307.858 m^3 in 1995 (DIAF, 1996).

Conservation Status

IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996)

Conservation Measures

FAO (1986) recommended that the genetic material of this species should be protected so that a future planting programme could be set up. A planting programme should be initiated (African Regional Workshop, 1996).

References

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Guarea cedrata

Guarea; light bossé

Distribution

This species occurs in Cameroon, Congo, Côte d'Ivoire, Gabon, Ghana, Liberia, Nigeria, Sierra Leone, Uganda and Zaire.

Habitat

G. cedrata trees are most common in moist semi-deciduous forest and in the dryer undisturbed areas of moist evergreen forest (Hawthorne, 1995a).

Vegetation type according to White (1983)

1. **Mixed moist semi-evergreen Guineo-Congolian rain forest**
2. **Guineo-Congolian short forest and shrub forest**
3. **Upland *Parinari excelsa* forest in West Africa**

Population Status and Trends

This species is common in Ghana (Hawthorne, 1995a).

Regeneration

Seedlings and saplings are often found in shady areas and tend to thrive in undisturbed areas rather than in disturbed areas; trees of all sizes are much more abundant in areas that have not been burnt (Hawthorne, 1995a).

Role of Species in its Ecosystem

The fruits are eaten and the seeds are most likely dispersed by birds and animals (Hawthorne, 1995a).

Threats

This species is moderately exploited (Hawthorne, 1995a&b).

Utilisation

Timber from this species is used for furniture, joinery, panelling, boat building, decorate veneers, turnery and flooring.

Trade

Ghana exported 2,450 m^3 of *G. cedrata* logs for an average price of US$ 221.00/m^3 in 1994 (ITTO, 1995a), 3,710 m^3 of air dried sawnwood for US$ 424.00 and kiln dried sawnwood for US$ 563.00/m^3 (ITTO, 1995a).

Gabon exported 1,669 m^3 from Owendo in 1987 (IUCN, 1990). The following amounts of Bossé (both *G. cedrata* and *G. thompsonii*) were exported from Gabon: 3,179.028 m^3 in 1994 and 3,572.884 in 1995 (DIAF, 1996).

Conservation Status

IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996)

Under Hawthorne's (1995a) star categorization system, *G. cedrata* scores a pink star which indicates that it is common and moderately exploited. Under the new IUCN threat categories (1994) this species is considered Vulnerable (Hawthorne, 1995b)

Conservation Measures

This species is protected by law in Côte d'Ivoire. Regeneration work required.

References

African Regional Workshop, 1996. *Conservation and Sustainable Management of Trees* project workshop held in Harare, Zimbabawe, July, 1996.

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Guarea thompsonii
Dark Guarea

Distribution
This species is found in Cameroon, Congo, Côte d'Ivoire, Gabon, Ghana, Liberia, Nigeria and Zaire.

Habitat
This shade tolerant species is found moist and evergreen forest hillsides.

Vegetation type according to White (1983)
1. Mixed moist semi-evergreen Guineo-Congolian rain forest

Population Status and Trends
This species is common in Ghana (Hawthorne, 1995a).
The seedlings are less commonly found in the shade when compared to *G. cedrata*, and some light exposure seems necessary for seedlings until a size of 15cm dbh is reached (Hawthorne, 1995a).

Regeneration
It takes almost 200 years to reach a 9 foot dbh, and is therefore relatively slow growing (Keay, 1961 in Hawthorne, 1995a)

Role of Species in its Ecosystem
No information

Threats
No specific information.

Utilisation
Timber from this species is used for furniture, joinery, panelling, boat building, decorate veneers, turnery and flooring.

Trade
G. thompsonii is not as commercially important as *G. cedrata*, although it is moderately exploited (Hawthorne, 1995a). The following amounts of Bossé (both *G. cedrata* and *G. thompsonii*) were exported from Gabon: 3,179.028 m^3 in 1994 and 3,572.884 in 1995 (DIAF, 1996).

Conservation Status
IUCN Category and Criteria: EN (A1c,d,) (African Regional Workshop, 1996)
Under Hawthorne's (1995a) star categorization system, *G. thompsonii* scores a pink star which indicates that it is common and moderately exploited in Ghana. Under the new IUCN threat categories (1994) this species is considered Vulnerable (Hawthorne, 1995b).

Conservation Measures
No information.

References
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Guibourtia ehie

Ovangkol;Amazone;Hyedua

Distribution

This species occurs in Cameroon, Côte d'Ivoire, Gabon, Ghana, Liberia and Nigeria.

Habitat

G. ehie is a forest species, preferring closed rainforests and transitional forests (WCMC, 1991). In Ghana, it is successful in the dryer areas of moist semi-deciduous forest (Hawthorne, 1995a).

Population Status and Trends

This species is common in Ghana, particularly in the north-west of the country. All sizes of tree do better in unburnt rather that burnt forest (Hawthorne, 1995a).

Regeneration

Seed dispersal is mainly by wind. Seedlings are found clustered around the parent tree and often remain gregarious in advanced stages of regeneration (Hawthorne, 1995a).

Role of Species in its Ecosystem

No information.

Threats

This species suffers from high rates of exploitation in Ghana (Hawthorne, 1995a&b).

Utilisation

The wood of this species is a popular substitute for Rosewood. It is used for fine furniture and cabinetwork, turnery, decorative veneers and flooring (WCMC, 1991).

Trade

This species is increasingly available in the U.S.. It is exported by Gabon; in 1987, 15,450m^3 were exported from Owendo (IUCN, 1990), in 1994, a total of 8,607.596 m^3 were exported (DIAF, 1996) and in 1995, 10,533.197 m^3 were exported (DIAF, 1996). The export of this species in log form is banned by Ghana.

Conservation Status

IUCN Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)
For Ghana, Hawthorne (1995a) has given this species a red star, which means it is common but under pressure from exploitation and conservation measures are necessary. Under the new IUCN threat categories (1994) this species is considered Vulnerable (Hawthorne, 1995b).

Conservation Measures

Regeneration measures are required (African Regional Workshop, 1996).

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Hallea ledermanni

synonyms: *Mitragyna ciliata*; *Mitragyna ledermannii*
Abura

Distribution
Abura occurs in the coastal regions of the following West Africa countries: Angola, Benin, Cameroon, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Guinea, Liberia, Nigeria and Zaire.

Habitat

Vegetation type according to White (1983)
1. Guineo-Congolian swamp forest and riparian forest
Hallea ledermanni is widespread in this forest type.

H. ledermannii is gregarious in freshwater swamps. This light-demanding species forms a narrow border along rivers and lagoons in high forest areas, grass plains, savanna and in swampy areas of deciduous and evergreen rain forests (FAO, 1986b) and occurs in areas that are periodically inundated. In Ghana it is often found outside forest reserves along rivers and in village swampland; it tends to have a patchy distribution around swamps, although it does not inhabit all swampy areas. It is found in the coastal regions of Nigeria (Keay, 1989 in Hawthorne, 1995a).

Population Status and Trends
As noted above, *H. ledermannii* is widespread within swamp and riparian forest. Although information on population status and trends is not directly available this could be inferred from information on the extent and decline of its wetland habitats.

Regeneration
Regeneration requires fresh water conditions and this species thrives best in humid conditions where rainfall is over 1250mm/year and the temperature is between 25 °C and 35 °C. When in its preferred habitat regeneration is plentiful and successful and growth is rapid (FAO, 1986b).

Role of Species in its Ecosystem
H. ledermanni releases lots of small winged seeds that can produce patches of regeneration on exposed mud (annon. 1958 in Hawthorne, 1995a). It can also reproduce vegetatively (FAO, 1986b). Commonly Abura is found in pure communities associating with species such as *Gilbertiodendron*, *Randia lane-poolei*, *Symphonia globulifera*, and *Raphia vinifera* (FAO, 1986b).

Threats
This species is suffering from over-exploitation in Ghana (Hawthorne, 1995a).

Utilisation
This is a general-purpose timber used in furniture production, joinery, domestic flooring, plywood, veneer, carving and transmission poles. *H. ledermannii* has some important medicinal properties, e.g. it is poisonous to paramecia and has analgesic properties, and many local medicinal uses (FAO, 1986b)

Trade
In 1994, 22,133 m^3 of Abura logs (*Hallea ciliata*) were exported from the Congo, 9,109 m^3 (@ US$ 450.57/m^3) were exported from Côte d'Ivoire and an unknown amount of Abura (*Mitragyana ciliata*) was exported from Gabon at an average price of US$ 27.27/m^3 (ITTO, 1995a). In the same year, 945 m^3 of

Abura {*Hallea ciliata*} sawnwood was exported from Congo and 463 m^3 of veneer Abura (*Hallea ciliata*) was exported from Côte d'Ivoire for an average price of US$ 1680.61/m^3 (ITTO, 1995a).

Conservation Status

IUCN Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)

Hawthorne (1995a) has given this species a red star, which means it is common but under pressure from exploitation and conservation measures are necessary. This species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b).

Conservation Measures

It is considered a priority for *in situ* conservation by FAO, 1984. *Ex-situ* conservation work should be commenced and intensified (African Regional Workshop, 1996).

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Haplormosia monophylla
Akoriko

Distribution
This species occurs in Cameroon, Côte d'Ivoire, Liberia, Nigeria and Sierra Leone.

Habitat
H. monophylla is found in swamp forest in lowland areas.

Population Status and Trends
This species is potentially declining (African Regional Workshop, 1996).

Role of Species in its Ecosystem
No information.

Threats
Exploited as a timber species (African Regional Workshop, 1996).

Utilisation
This species is used for its timber.

Trade
No information.
Conservation Status
IUCN Category and Criteria: VU (A1d) (African Regional Workshop, 1996)

Conservation Measures
Regeneration work is required (African Regional Workshop, 1996).

References
African Regional Workshop, 1996. *Conservation and Sustainable Management of Trees* project workshop held in Harare, Zimbabawe, July, 1996.

Khaya ivorensis

Acajou; African Mahogany

Distribution

This species occurs in Angola, Cameroon, Congo, Côte d'Ivoire, Gabon, Ghana, Liberia, Sierra Leone, Nigeria and Zaire.

Habitat

In Ghana, this species occurs in many habitat types but seems to thrive best in moist and wet undisturbed evergreen forest (Hawthorne, 1995a).

Population Status and Trends

It is found scattered across almost the whole of Congo and is occasionally quite abundant (N'sosso, *in litt.* 1995). African mahogany is common in Ghana (Hawthorne, 1995a).

Regeneration

Trees of *Khaya ivorensis* can have good seed production at the age of 30; it seems that abundant seed production only occurs every 3-4 years, although some seed is produced every year. The seeds are wind dispersed (Hawthorne, 1995a). The species does not respond well to disturbance (burning or logging), as there is very little regeneration in disturbed areas. However, it does require small to medium light gaps for subsequent growth (Hawthorne, 1995a).

Role of Species in its Ecosystem

No information.

Threats

It is over-exploited for its popular timber (WCMC, 1991).

Utilisation

The timber is used for panelling, furniture, interior fittings and high quality joinery.

Trade

In 1989 Ghana exported 10,463m^3 of lumber of this species. In a questionnaire survey of UK traders carried out for the ITTO, source countries for this species were given as Cameroon, Ghana, Liberia and Zaire. Gabon also exports this species; in 1987, from Port Owendo 9,667m^3 were exported (IUCN, 1990), in 1994, 5,303.158 m^3 were exported and in 1995, 7,510.019 m^3 were exported (DIAF, 1996). In 1994, Cameroon exported 12,000 cu m and Ghana exported 11,130 cu m (ITTO, 1995b). At the end of the 1980s, with the price increases for Brazilian Mahogany and Utile, *Khaya* has become popular again in the UK market (WCMC, 1991).

Conservation Status

IUCN Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)
For Ghana, Hawthorne (1995a) has classified this a scarlet star species, which means it is common but under serious threat from heavy exploitation. Reduced exploitation and full protection are required. Under the new IUCN threat categories (1994) this species is considered Vulnerable (Hawthorne, 1995b).

Conservation Measures

K. ivorensis is protected by law in Côte d'Ivoire and log export has been banned from Ghana and Liberia. It has been considered a priority species for *in situ* conservation by the FAO (1984).
Pest control for *Hypsilla* is required (African Regional Workshop, 1996).

References

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Lophira alata
Ekki; Azobé

Distribution
Azobé is found in Cameroon, the Congo Basin, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Liberia, Nigeria, Sierra Leone, and Zaire.

Habitat
It grows in evergreen and moist deciduous forests, in freshwater swamp forests and close to river banks (WCMC, 1991). Although this species has a definite preference for wet evergreen areas, it is assumed to be sensitive to non-evergreen forest soils and is unsuccessful on rocky soils. *L. alata* is a pioneer species and is representative of a disturbed forest (Hawthorne, 1995a). It is also sensitive to drought (Swaine & Veenendaal, 1994 in Hawthorne, 1995a).

Vegetation type according to White (1983)
1. Hygrophilous coastal evergreen Guineo-Congolian rain forest
Lophira alata is one of the most abundant species in this forest type and is indicative of earlier cultivation.
2. Mixed moist semi-evergreen Guineo-Congolian rain forest

Population Status and Trends
Azobé is a common species in Cameroon and regenerates well (WCMC, 1991). It has been suggested that Cameroon forests with an abundance of this species were once disturbed by humans (Letouzey, 1960 in Hawthorne, 1995a). It is also common in Ghana (Hawthorne, 1995a).

Role of Species in its Ecosystem
The seeds of this species are wind dispersed. Light gaps are necessary for successful regeneration, as seed germination does not occur in shady understorey (Hawthorne, 1995a).
It is estimated that is takes 220 years for a tree to reach a girth of 2.7m in Nigeria Leone) (Keay, 1961 in Hawthorne, 1995a).

Threats
This species is threatened by over-exploitation (Hawthorne, 1995a&b)

Utilisation
Azobé is used for heavy durable construction work, harbour work, flooring and in railway construction. The fruits can be used to make an edible oil.

Trade
L. alata logs were exported from Cameroon, Côte d'Ivoire, Gabon, Ghana in 1994 (ITTO, 1995a).
Cameroon exported 49 000m^3 at an average price of US$200.00/m^3, Côte d'Ivoire exported 8 351m^3 at an average price of US$219.43/m^3, Ghana exported 1 970m^3 at an average price of US$131.00/m^3 and Gabon exported an unknown volume at an average price of US$11.46/m^3 (ITTO, 1995a).
Gabon exported a total of 12,416.85 m^3 in 1994 and 8,518.17 m^3 in 1995 (DIAF, 1996).

Conservation Status
IUCN Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)
This species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b). Hawthorne (1995a) has given this species a red star for Ghana, which means it is common but under pressure from exploitation and conservation measures are necessary.

Conservation Measures

This species has been selected by FAO for conservation action because of heavy utilisation pressure (Palmberg, 1987). It is protected by law in Côte d'Ivoire.

In Cameroon 277 ha have been planted. Regeneration work should be intensified (African Regional Workshop, 1996).

References

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Lovoa swynnertonii
Mukonguru

Distribution
This species occurs in Kenya, Mozambique, Tanzania, Uganda, Zaire and Zimbabwe.

Habitat
It grows within wet evergreen forest. In Kenya, this species prefers sandy or loamy soils (FAO, 1986). In the Kwale district of Kenya this species is found in lowland forests dominated by *Newtonia paucijuga*, *Milicia excelsa* and *Antiaris toxicaria* and in the Meru district of Kenya it occurs in upland forest dominated by *Newtonia buchananii* and *Ocotea usambarensis* (FAO, 1986). In Mozambique, this species is only known from the Garuso forests and in Zimbabwe is only known from the Chirinda forest where it is found on well-drained slopes of river banks (Flora Zambesiaca).

Vegetation type according to White (1983)
1. Zanzibar-Inhambane lowland rain forest
2. Zanzibar-Inhambane undifferentiated forest

Population Status and Trends
L. swynnertonii is very sparsely distributed over its range and is only found in a few locations. It is not regenerating well (FAO, 1986). This species is at the edge of its range in Zimbabwe and is found in low densities in the Chirinda Forest (6km^2) where there are over 1000 individuals but no saplings (African Regional Workshop, 1996).

Regeneration
Seed is wind dispersed. Natural regeneration is reported to be poor (FAO, 1986).

Role of Species in its Ecosystem
No information.

Threats
This species is suffering from habitat loss. Excessive exploitation of the large seed-producing trees occurs and natural regeneration is poor. Plantations tend to be unsuccessful because of infestation by *Hypsipyla* (FAO, 1986). In Uganda the species is suffering from genetic erosion (Styles, *in litt*, 1991).

Utilisation
The timber is used for furniture production and has been used in Kenya for bridge construction.

Trade
No information.

Conservation Status
IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996)
This species' distribution has been greatly reduced, only a few trees remain in Zimbabwe and Mozambique (Styles, *in litt*, 1991). Bandeira (1996) considers this species to be Data Deficient (DD) under the new IUCN (1994) threat categories, due to lack of biological surveys in north Mozambique. *L. swynnertonii* is also rare in Tanzania and Uganda as it is at the fringe of its range (Styles, *in litt.*, 1991). Styles (1991) felt that this species deserves endangered status.

Conservation Measures

This species is found in a few protected forest reserves such as the Rau Forest, Tanzania, the Chirinda Forest, Zimbabwe, and the Meru Forest, Kenya (FAO, 1986). In Mozambique, there are no conservation measures being taken (Bandeira, *in litt.*, 1996). Regeneration work is urgently required (African Regional Workshop, 1996).

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Lovoa trichilioides

African Walnut; Dibetou

Distribution

This species occurs in Angola, Cameroon, Congo, Gabon, Ghana, Côte d'Ivoire, Liberia, Nigeria, Sierra Leone, Tanzania, Uganda and Zaire.

Habitat

African walnut occurs in evergreen and deciduous forests, preferring moist sites and tends to be gregarious (WCMC, 1991). It shows a strong preference for acidic, base poor soil (Hawthorne, 1995a).

Vegetation type according to White (1983)

1. Mixed moist semi-evergreen Guineo-Congolian rain forest

2. Drier peripheral semi-evergreen Guineo-Congolian rain forest in the Guinea-Congolian/Zambezia regional transition zone.

Population Status and Trends

Dibetou is found all over Congo, however it is generally quite rare (N'sosso, *in litt.* 1995). It is common in Ghana (Hawthorne, 1995).

Regeneration

Seeds of this species are wind-dispersed. Copious seed production of this species seems to occur every 3-4 years in Nigeria (Sanders, 1953 in Hawthorne, 1995a). The viability of seeds is shortlived and they are heavily predated (Sanders, 1953 in Hawthorne, 1995a). The seedlings are shade tolerant, however, they will only develop when there is a light gap in the canopy and seem to require more light once the tree reaches larger sizes (Hawthorne, 1995a). *Lovoa* initially has a slower growth rate than *Khaya ivorensis*, but the growth rate does not slow down as it does in *K. ivorensis*. It is predicted to take 106 years to reach a girth of 9 ft (Keay, 1961 in Hawthorne, 1995).

Role of Species in its Ecosystem

No information.

Threats

Exploitation for international trade.

Utilisation

The timber is used for furniture and cabinetwork, decorative veneers, panelling, joinery and shop fittings.

Trade

The timber is exported by Gabon and Zaire. It is one of the two main species exploited in the Congo (WCMC, 1991).

Cameroon exported 15,000 m^3 of Dibetou logs at an average price of US$390.00/$m^3$ in 1994 (ITTO, 1995). Ghana exported sawnwood at an average price of US$467.00/$m^3$ for air dried wood and US$567.00/$m^3$ for kiln dried wood (ITTO, 1995). In 1987, Gabon exported 4,653 m^3 from Owendo (IUCN, 1990).Gabon exported only 1m^3 of sawnwood at a price of US$108.00/$m^3$ in 1994 (ITTO, 1995) but according to the Direction des Inventaires et Aménagements des Forêts a total of 8,427.548 m3 was exported from Gabon in 1994. In 1995, Gabon exported 8,923.279 m3 of Dibetou (DIAF, 1996). In 1994, Côte d'Ivoire exported 146m^3 of Dibetou as a veneer at an average price of US$2007.74/$m^3$ (ITTO, 1995).

Conservation Status

IUCN Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)

This species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b). Hawthorne (1995a) has given this species a red star, which means it is common but under pressure from exploitation and conservation measures are necessary.

Conservation Measures

It is protected by law in Côte d'Ivoire and is subject to Ghanaian and Liberian log export bans.

6380 ha have been planted in Cameroon (African Regional Workshop, 1996).

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Mansonia altissima
Mansonia

Distribution
This species occurs in Benin, Cameroon, Congo, Côte d'Ivoire, Ghana, and Nigeria.

Habitat
M. altissima prefers dry fertile forest soil over wet forest and tend to be drought tolerant (Hawthorne, 1995a).

Vegetation type according to White (1983)
1. Guineo-Congolian rain forest
Drier peripheral semi-evergreen Guineo-Congolian rain forest and similar forest in the transition zones. *Mansonia altissima* is frequent in the peripheral semi-evergreen lowland rain forest but is absent from wetter types.

Population Status and Trends
Mansonia is common in Ghana (Hawthorne, 1995a).

Regeneration
The fruits are wind dispersed; seed germination does not occur in large light gaps (Kyereh, 1994 in Hawthorne, 1995a) and seedlings prefer shade for the first two years (Taylor in Hawthorne, 1995a), but after that period the species is a definite light demander (Hawthorne, 1995a). Smaller adult trees (< 60cm dbh) are more common in disturbed forest (i.e. logged or burnt) (Hawthorne, 1995a). More seedlings are found in disturbed areas (Hawthorne, 1995a).

Role of Species in its Ecosystem
No information.

Threats
In Ghana this species is moderately exploited for its timber (Hawthorne, 1995a&b).

Utilisation

Trade
Imports: Austria, Portugal and the USA are listed by the ITTO (1995a) as importing Mansonia logs in 1994. Portugal, Sweden and the USA imported Mansonia sawnwood in 1994 (ITTO, 1995a).

Exports: Côte d'Ivoire exported 314 m^3 of Mansonia veneer in 1994 for an average price of US$ 2,706.22/m^3 (ITTO, 1995a).

Conservation Status
IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996)
This species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b). For Ghana this species has been awarded a pink star in Hawthorne's (1995a) star system, which means that it is common and moderately exploited.

Conservation Measures
This species is protected by law in Côte d'Ivoire. It is considered a priority for *in situ* conservation by FAO, 1984. The export of this species in log form is banned by Ghana. In Cameroon 420 ha have been planted (African Regional Workshop, 1996).

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Microberlinia bisulcata

Zebrano

Distribution

This species is endemic to Cameroon.

Habitat

Vegetation type according to White (1983)

1. Guineo-Congolian rain forest

Hygrophilous coastal evergreen Guineo-Congolian rain forest

Microberlinia bisulcata is gregarious in this region, forming almost pure stands with good regeneration

Population Status and Trends

Information is not available but could be inferred from the extent and rate of decline of the coastal evergreen rainforests in Cameroon. The species has a very limited distribution within Cameroon (Gartlan, *in litt.* 1991).

Role of Species in its Ecosystem

This is an ectomycorrhizal species and is efficient in phosphorus recycling. Ecophysiological work is currently being carried out on this species and related Leguminous species within Korup.

Threats

Cutting for the inernational market.

Utilisation

A speciality timber with white and black streaks used in turnery.

Trade

This timber fetches a high price (African Regional Workshop, 1996).

Conservation Status

IUCN Category and Criteria: CR (A1c) (African Regional Workshop, 1996)

Conservation Measures

In-situ conservation provided by Korup National Park and ex-situ conservation presently being undertaken by the Forest Research Station, Kumbu, Cameroon should be intensified (African Regional Workshop, 1996)

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Microberlinia brazzavillensis

Zebrano; Zebra Wood

Distribution

This species is restricted to two coastal areas in Congo and Gabon (Fernan Vaz region).

Habitat

It is a forest species.

Population Status and Trends

The distribution is sparse in Gabon, with less than one individual per square kilometre (Wilks *in litt.*, 1992).

Role of Species in its Ecosystem

The seeds of the this species are large and heavy and are, therefore, not dispersed far from the parent tree (Wilks *in litt.*, 1990).

Threats

M. brazzavillensis is lightly logged (Wilks *in litt.*, 1992).

Utilisation

This speciality timber is used for decorative veneers and turnery. It is also used in ski manufacture. (WCMC, 1991).

Trade

M. brazzavillensis is exported by both Gabon and the Congo (WCMC, 1991).

Conservation Status

IUCN Category and Criteria: CR (A1c) (African Regional Workshop, 1996)

Conservation Measures

No information.

References

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Milicia excelsa

synonym: *Chlorophora excelsa*
Iroko; Tule

Distribution

This species is widely distributed across Africa; it occurs in Angola, Benin, Burundi, Burkina Faso, Central African Republic, Cameroon, Congo, Côte d'Ivoire, Ethiopia, Gabon, Equatorial Guinea, Sao Tomé & Principe, Ghana, Kenya, Malawi, Mozambique, Nigeria, Sierra Leone, Sudan, Tanzania, Togo, Uganda, Zaire and Zimbabwe.

Habitat

Vegetation type according to White (1983)
1. Guineo-Congolian rain forest
Drier peripheral semi-evergreen Guineo-Congolian rain forest and similar forest in the transition zones
Milicia excelsa is also commonly found in wetter secondary forest types.
Old secondary forest
2. Drier peripheral semi-evergreen Guineo-Congolian rain forest in the Guinea-Congolia/Zambezia regional transition zone
3. Drier peripheral semi-evergreen Guineo-Congolian rain forest in the Lake Victoria regional mosaic
4. Zanzibar-Inhambane lowland rain forest
5. Zanzibar-Inhambane undifferentiated forest
6. Zanzibar-Inhambane secondary grassland and wooded grassland
In this habitat type, *M. excelsa* from the original forest have been left standing.
7. Príncipe

M. excelsa is found in transitional vegetation between closed forests and savanna. It is often found in gallery forest and can be found in deciduous, semi-deciduous or evergreen forest. Occasionally it is found in isolated relict forests from sea level to about 1300m. It is fairly abundant in the drier areas of semi-deciduous *Antiaris-Chlorophora* forest (FAO, 1986b).

Both *M. excelsa* and *M. regia* show a preference for dry, flat, light areas (Hawthorne, 1995a). Most effective seed germination occurs in half-shade, the seedlings are most commonly found in medium sized light gaps and then become light dependant (Hawthorne, 1995a). *M. excelsa* is considered to be a pioneer species which regenerates in disturbed, open areas and in logged forest (Hawthorne, 1995a).

In Kenya, this species is found in relict moist forest and wooded grassland (Beentje, 1994) along the coast and in the central Meru district and Nyanza province (Marshall & Jenkins, 1994). It has been found at an altitude of 4500 m on Mount Kilimanjaro in Tanzania; although, it is usually found between sea level and 1200 m (FAO, 1986a). In West Africa this species is found in areas where rainfall is between 1150mm and 1900mm and the temperature is between 25 °C and 35 °C.

Population Status and Trends

Iroko is commonly found growing around villages and old farms as it is left to grow there because of its commercial value (FAO, 1986b).
This species is abundant, especially in Côte d'Ivoire, Cameroon, Congo, Gabon and Zaire (N'Sosso *in litt*, 1995). It is also commonly found in Ghana (Hawthorne, 1995a)
In Mozambique, *M. excelsa* is very scarce and dispersed (Moreno Saiz, 1996). This is also the case in Kenya where this species is now sparsely distributed due to heavy exploitation (Marshall & Jenkins, 1994).

Regeneration
There is very little regeneration of this species in Zimbabwe (African Regional Workshop, 1996). In Mozambique, where an area was cleared but large trees of *M. excelsa* left standing, there seems to be regeneration in the open areas (African Regional Workshop, 1996).

Role of Species in its Ecosystem
The fruit of this species contains many small seeds which are dispersed by bats and birds (Osmaston, 1965 in Hawthorne, 1995a). Duikers and animals eat the newly emergent shoots (FAO, 1986b).

Threats
This species is heavily exploited in Ghana (Hawthorne, 1995a&b) and plantations of this species tend to be unsuccessful (FAO, 1986b). In Zimbabwe, *M. excelsa* is threatened by habitat degradation; it is found only in an area which is suffering from alluvial erosion. It is not, however, exploited in Zimbabwe (African Regional Workshop, 1996).

Utilisation
The high quality timber is used as a Teak substitute. It is widely used for all kinds of construction work and carpentry including domestic flooring, veneer and cabinetwork (WCMC, 1991). The timber is used for building ships and barrels. It is used externally because it has great resistance to bad weather (Moreno Saiz, 1996). Locally, this species has many medicinal uses; the bark is also used as a dye (FAO, 1986b). The wood is also exploited by the local people (African Regional Workshop, 1996).

Trade
This species is not distinguished from *Milicia regia* by commercial logging companies (Hawthorne, 1995a).

Iroko is a major commercial species in international trade. Tanzania and Uganda were in the past major sources of the timber and some Iroko is still exported from E. Africa. In Kenya users of this species claimed that supplies were variable and unpredictable (Marshall & Jenkins, 1994).

West African countries are now the main exporters, especially Ghana (traded together with *M. regia*) and Côte d'Ivoire (WCMC, 1991). The UK imported 22 648m^3 in 1989. Côte d'Ivoire supplies 60% of the Iroko imported to the UK (WCMC, 1991).

In 1987, 11,988m^3 were exported from Owendo, Gabon (IUCN, 1990). In 1994, Gabon exported 8,236.664m^3 of Iroko and in 1995 exported 12,823.169m^3 (DIAF, 1996).
According to the ITTO (1995a) in 1994 Iroko logs were exported by: Cameroon (65 000m^3 at an average price of US$245.00/$m^3$), Congo (10 206$m^3$), and Gabon (US$39.75/m^3). In addition Cameroon exported 12 000m^3 of sawnwood at an average price of US$640.00/$m^3$ and Ghana exported 47 340m^3 of air dried sawnwood (@ US$520.00/$m^3$) and an unknown volume of kiln dried sawnwood at an average price of US$653.00/$m^3$ (ITTO, 1995). Congo and Togo both export Iroko sawnwood (ITTO, 1995a). It is estimated that the formal commercial trade in Kenya uses between 800m^3 and 1100m^3/year of this species (Marshall & Jenkins, 1994).

There is illegal trade in *M. excelsa* from Kenya and Uganda and suspected illegal trade from Tanzania (Marshall & Jenkins, 1994). Most of *M. excelsa* used in Kenya is imported (Marshall & Jenkins, 1994).

Conservation Status
IUCN Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)
This timber species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b). It has been awarded a scarlet star in Hawthorne's (1995a) own system, which means that it is common but it is under profound pressure from heavy exploitation in Ghana. This species requires protection and exploitation has to be limited if it is to be sustainable (Hawthorne, 1995a).

Conservation Measures

M. excelsa is protected by legislation in Côte d'Ivoire and Mozambique and is subject to a log export ban in Ghana. In Cabo Delgado, Mozambique, no Iroko has been cut since 1987 because it took a dramatic decline (Moreno Saiz, 1996). In Nigeria, Oyo State has a 10 year moratorium on exploitation.

Uganda banned export of unworked timber in 1987, although there is still licensed trade with Kenya and, more recently, with Europe. In 1993, Tanzania also banned the export of unworked timber. Kenya has imposed a "Presidential Ban on Logging of Indigenous Timber" (1986), however, little is known about this ban except that it prohibits logging of indigenous timbers. (Marshall & Jenkins, 1994).

M. excelsa is found in the Shimba Hills National Reserve, although there are reports that this species is still being extracted (Marshall & Jenkins, 1994).

M. excelsa is found in Reserves and National Parks in Zimbabwe but it is not well protected (African Regional Workshop, 1996).

Additional Information

Plantations in Ghana have been unsuccessful because of gall attacks (FAO, 1986b). *M. excelsa* is often found with galled leaves caused by the insect *Phytolyma lata*, it is thought that these outbreaks limit high densities of this species due to increased mortality (Hawthorne, 1995a).

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Milicia regia

Synonym: *Chlorophora regia*
Iroko

Distribution
This widespread species occurs in Benin, Cameroon, Côte d'Ivoire, Gambia, Ghana, Guinea-Bissau, Guinea, Liberia, Sierra Leone and Senegal. Introduced into Nigeria.

Habitat

Vegetation type according to White (1983)
1. The Coastal Plain of Basse Casamance
Milicia regia is found in the well-drained drier forest.

Both *M. excelsa* and *M. regia* show a preference for dry, flat, light areas (Hawthorne, 1995a). *M. regia* is found in the same forest types as *M. excelsa*, with a slight preference for moister forest (Hawthorne, 1995a).

Population Status and Trends
This species is common in Ghana (Hawthorne, 1995a)

Role of Species in its Ecosystem
No information.

Threats
This species is severely threatened by over-exploitation in Ghana (Hawthorne, 1995a).

Utilisation
The high quality timber is used as a Teak substitute. It is widely used for all kinds of construction work and carpentry including domestic flooring, veneer and cabinetwork.

Trade
This species is not distinguished from *Milicia excelsa* by commercial logging companies (Hawthorne, 1995a).

Iroko is a major commercial species in international trade. Tanzania and Uganda were in the past major sources of the timber and some Iroko is still exported from E. Africa (WCMC, 1991). West African countries are now the main exporters, especially Ghana (traded together with *M. regia*) and Côte d'Ivoire (WCMC, 1991).

The UK imported 22 648m^3 in 1989. Côte d'Ivoire supplies 60% of the Iroko imported to the UK.

Conservation Status
IUCN Category and Criteria: VU (A1d) (African Regional Workshop, 1996)
This species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b). It has been awarded a scarlet star in Hawthorne's (1995a) own system, which means that it is common but it is under profound pressure from heavy exploitation. This species requires protection and exploitation has to be limited if it is to be sustainable (Hawthorne, 1995a).

Conservation Measures
This species is considered a priority for *in situ* conservation by FAO, 1984. It is legally protected in the Gambia and is subject to a log export ban in Ghana. Known to be resistant to Phytolema attack and deserves trials in plantation throughout its range (African Regional Workshop, 1996).

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Millettia laurentii
Wenge

Distribution
This species occurs in Cameroon, Congo, Gabon, Equatorial Guinea and Zaire.

Habitat
It is a species of semi-deciduous, dense forest and it is sometimes found in inundated swampy forests.

Population Status and Trends
No information also this could be inferred from forest extent and rate of decline.

Role of Species in its Ecosystem
No information.

Threats
This species is threatened by over-exploitation for timber (African Regional Workshop, 1996).

Utilisation
A decorative species used in furniture production, decorative veneers and speciality items (WCMC, 1991).

Trade
Zaire is the main source of Wenge for the European market. It is also exported by Congo and Gabon (WCMC, 1991). Gabon exported 589 m^3 of *M. laurentii* from Owendo in 1987 (IUCN, 1990), a total of 390.580 m^3 in 1994, and a total of 400.584 m^3 in 1995 (DIAF, 1996)

Conservation Status
IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996)

Conservation Measures
Special permission is required for exploitation of this species in Cameroon.
Regeneration work is urgently required (African Regional Workshop, 1996).

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Monopetalanthus heitzii

Andoung

Distribution

Monopetalanthus heitzii is restricted to northern parts of Gabon.

Habitat

This species prefers moist soils along rivers and swampy or occasionally inundated areas.

Population Status and Trends

No specific information.

Role of Species in its Ecosystem

No information.

Threats

No specific information.

Utilisation

The timber is used in furniture production, boxes and crates, light construction and plywood manufacture (WCMC, 1991).

Trade

Gabon exported a total of 18,481.058 m^3 of Andoung in 1994 and a total of 3,542.281 m^3 in 1995 (DIAF, 1996).

Conservation Status

IUCN Category and Criteria: DD (African Regional Workshop, 1996)

Conservation Measures

No information.

References

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Nauclea diderrichii

Opepe; Bilinga

Distribution

This species is widely distributed: Angola, Cameroon, Central African Republic, Congo, Côte d'Ivoire, Gabon, Ghana, Liberia, Mozambique, Nigeria, Sierra Leone, Uganda and Zaire.

Habitat

Vegetation type according to White (1983)
1. Guineo-Congolian rain forest
Mixed moist semi-evergreen Guineo-Congolian rain forest

Population Status and Trends

In Ghana, this species is found at constant, low densities and is never very abundant (Hawthorne, 1995a).

Regeneration

This species is light-demanding. It is a pioneer species that requires large light gaps to regenerate.Young trees are often found in secondary bushy growth in humid areas (N'Sosso, *in litt.* 1995). In Nigeria, this species was found to regenerate well in large canopy gaps, but in a clear-felling *N. diderrichii* is out competed by *Musanga* (Lancaster, 1961 in Hawthorne, 1995a). This species is commonly used in plantations (specifically taungya) (Neil, 1983 in Hawthorne, 1995a).

Role of Species in its Ecosystem

Elephants and other animals disperse the seeds of this species. Many small seeds are found in the fruit. The seeds can remain dormant in the forest soil (Hall & Swaine, 1980 in Hawthorne, 1995a). The seeds are stimulated into germination by increased light exposure. The effect on germination of the seed passing through an animal's gut has yet to be examined; seedlings, however, are commonly found along elephant tracks (Hawthorne, 1995a).

Threats

This species suffers from heavy exploitation (Hawthorne, 1995a)

Utilisation

The timber is used in general construction, flooring, furniture production, dock and marine work, and railway crossings (WCMC, 1991).
Locally it has medicinal uses.

Trade

Côte d'Ivoire exported 13,723 m^3 of *Nauclea* spp. logs for an average price of US$ 232.18/m^3 in 1994. Ghana exported 4,960 m^3 of *N. diderrichii* logs for an average price of US$ 135.00/m^3 in 1994. In addition Ghana exported 1,430 m^3 of *N. diderrichhi* air-dried sawnwood for an average price of US$ 337.00/m^3 and an unknown amount of kiln-dried sawnwood (ITTO, 1995a). Gabon exported 1,356m^3 from Owendo in 1987 (IUCN, 1990), a total of 3,570.907 m^3 in 1994, and a total of 3,010.279 m^3 in 1995 (DIAF, 1996).

In the first half of 1994, Liberia exported 8 m^3 of Bilinga logs for an average price of US$ 80.00/m^3 and from June to December they exported 22 m^3 for an average price of US$ 50.00/m^3 (ITTO, 1995).

Conservation Status

IUCN Category and Criteria: VU A1c,d (African Regional Workshop, 1996)
This species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b). It has been awarded a scarlet star for Ghana by Hawthorne (1995a), which means that it is common but it is under profound pressure from heavy exploitation. This species requires protection and exploitation has to be limited if it is to be sustainable (Hawthorne, 1995a).

Conservation Measures

Opepe is subject to a Liberian export ban.

References

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Nesogordonia papaverifera

Danta; Kotibé

Distribution

This species occurs in Benin, Cameroon, Central African Republic, Congo, Côte d'Ivoire, Gabon, Ghana, Liberia, Nigeria and Sierra Leone.

Habitat

Vegetation type according to White (1983)

1. Guineo-Congolian rain forest

Drier peripheral semi-evergreen Guineo-Congolian rain forest and similar forest in the transition zones *Nesogordonia papaverifera* is frequent in the peripheral semi-evergreen lowland rain forest but is absent from wetter forest types.

2. The Coastal Plain of Ghana

West African dry coastal forest

N. papaverifera occurs in the western type of this habitat.

This species appears to be confined to areas where savannas have in the past replaced forest. *N. papaverifera* prefers base-rich soils. In Ghana, it occurs in moist semi-deciduous forest (Hawthorne, 1995a). This species can occur at altitudes up to 1000 m but it rarely occurs over 500 m (FAO, 1986). In logged areas of Ghana, *N. papaverifera* seems to fare well as large trees of this species still remain (Hawthorne, 1995a).

Population Status and Trends

According to FAO (1986) this species is endangered in parts of its range and subject to genetic impoverishment in outlying populations in Gabon, Central African Republic, Cameroon, Liberia and Sierra Leone. *N. papaverifera* can be found at high densities e.g. in the *Nesogordonia papaverifera/Khaya ivorensis* zone of the *Celtis* spp./*Triplochiton sclerocylon* forest type in Côte d'Ivoire (FAO, 1986). In Ghana, this species is common (Hawthorne, 1995a).

Regeneration

This species produces small, wind dispersed seeds, that require moderate shade to germinate and seedlings are common in fairly large light gaps. In Ghana, regeneration is twice as common in disturbed (logged) forest as in similar undisturbed forest (Hawthorne, 1995a).

Role of Species in its Ecosystem

No information.

Threats

In Ghana this species is moderately exploited (Hawthorne, 1995a).
There are no plantations of this species due to its shade demanding nature (FAO, 1986).

Utilisation

The high quality timber is used in flooring, boat and vehicle building, for tool handles and for furniture. It is locally used for shutters, door/window frames and rafters (FAO, 1986).

Trade

Côte d'Ivoire exported 9,869 m^3 of *N. papaverifera* logs in 1994 at an average price of US$333.23/$m^3$ and 251 m^3 of veneer at an average price of US$1186.33/$m^3$ (ITTO, 1995a).
Gabon exported 6,210.734 m^3 of Kotibe in 1994 and 7,366.573 m^3 in 1995 (DIAF, 1996).

Conservation Status

IUCN Category and Criteria: VU A1c,d (African Regional Workshop, 1996)

This species is considered Vulnerable (1994 IUCN threat category) due to exploitation (Hawthorne, 1995b). For Ghana this species has been awarded a pink star by Hawthorne (1995a), which means that it is common and moderately exploited.

Conservation Measures

N. papaverifera is protected by law in Côte d'Ivoire. Ghana has banned export of this species in log form.

The FAO (1986) claim that this species is fairly secure because of the frequent high density stands, its affinity for growing in groups, and its location on hillsides (which are unsuitable for plantation establishment). It still requires *in-situ* conservation of certain populations (FAO, 1986).

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Pouteria altissima
synonym: *Aningeria altissima*
Mukali; Anegre

Distribution
This widespread species occurs in Burundi, Cameroon, Central African Republic, Congo, Côte d'Ivoire, Ethiopia, Gabon, Ghana, Guinea, Kenya, Nigeria, Rwanda, Sierra Leone, Sudan, Tanzania, Uganda and Zaire.

Habitat
This species tends to be found in the drier areas of semi-deciduous forests.

Vegetation types according to White (1983)
1. Guineo-Congolian rain forest
Drier peripheral semi-evergreen Guineo-Congolian rain forest and similar forest in the transition zones. *P. altissima* is frequent in the peripheral semi-evergreen lowland rain forest but is absent from wetter forest types.
2. Zambezian dry evergreen forest
This is a characteristic species of the semi-evergreen forest of marked Guineo-Congolian affinity; small patches are found in the Mbala district in Zambia.
3. Drier peripheral semi-evergreen Guineo-Congolian rain forest in the Lake Victoria regional mosaic.
4. Transitional rain forest in the Lake Victoria mosaic.
P. altissima is at its eastern most limit in the Kakamega forest of Kenya.

Population Status and Trends
It is relatively common in Ghana (Hawthorne, 1995a).

Regeneration
It is thought that development past the seedling stage requires at least small light gaps (Hawthorne, 1995a).

Role of Species in its Ecosystem
Fruits of this species are eaten and dispersed by birds and perhaps other animals (Hawthorne, 1995a). Generally, trees can fruit once they reach a size of 50 cm dbh (Plumptree *et al*, 1994 in Hawthorne, 1995a).

Threats
P. altissima is threatened by over-exploitation in Ghana (Hawthorne, 1995a). In logged areas of Uganda, regeneration of this species is further affected by elephant damage to seedlings and saplings (Struhsaker *et al*, 1996).

Utilisation
Timber from the genus *Pouteria* is used for general carpentry, joinery, veneer and plywood, and furniture components. Locally this species has medicinal uses.

Trade
Note: *P. altissima* and *Aningera robusta* are often confused and it is thought that no distinction is made by the timber industry (Hawthorne, 1995a).

P. altissima has been exported from Ghana as a veneer; in 1994, 12 080m^3 of sliced veneer was exported at an average price of US$984.00/m^3 and jointed veneer fetched an average price of US$1375.00/m^3 (ITTO, 1995a).

Conservation Status

IUCN Category and Criteria: LR (cd) (African Regional Workshop, 1996)

Hawthorne (1995a) has given this species a red star, which means it is common but under pressure from exploitation and conservation measures are necessary. *Aningeria robusta* has been assigned a pink star by Hawthorne, indicating it is of slightly less conservation concern, although the wood of this species is also heavily exploited for timber.

Conservation Measures

No information.

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Prunus africana

synonym *Pygeum africanum*
Red Stinkwood; African Cherry

Distribution

This widespread species is found in Angola, Burundi, Cameroon, Ethiopia, Equatorial Guinea - Bioko, Sao Tome & Príncipe, Kenya, Madagascar, Mozambique, Rwanda, South Africa (Cape Province, Natal, Transvaal), Sudan, Swaziland, Tanzania, Uganda, Zaire and Zambia.

Habitat

Habitat type according to White (1983)
1. Guineo-Congolian rain forest
Drier peripheral semi-evergreen Guineo-Congolian rain forest and similar forest in the transition zones
2. Marsabit District, Kenya in the Somalia-Masai regional centre of endemism
Afromontane evergreen forest, scrub forest, and related types.
3. Afromontane Forest
Afromontane rain forest
Prunus africana is a characteristic species of the Afromontane rain forest.
Undifferentiated Afromontane forest
4. Afromontane Bamboo
P. africana is frequently found scattered in *Arundinaria alpina* bamboo.
5. Transitional rain forest of the Lake Victoria regional mosaic.
6. Sao Tomé
Mist forest region
7. The Comoro Islands

This species occurs at altitudes above 1500m in Kenya (Marshall & Jenkins, 1994). In Madagascar this species occurs above 1000m. In Zimbabwe *P. africana* is restricted to montane rainforest (CITES proposal, 1994)

Population Status and Trends

In Cameroon, where *P. africana* is restricted to the montane forests of the western highlands, the high level of trade has greatly depleted this species (Dawson & Rabevohitra, 1996). This species is relatively rare in Zimbabwe (CITES proposal, 1994). In South Africa, *P. africana* colonises open sites and the species is regenerating well, with younger trees growing along the roads (African Regional Workshop comm., 1996).

Regeneration

This is a fast growing species and the seeds germinate easily, however the seeds are recalcitrant (African Regional Workshop, 1996).

Role of Species in its Ecosystem

P. africana trees are an important part of the montane ecosystem; tree deaths from bark stripping affects the integrity of the forest and reduces food resources for rare birds (Cunningham & Mbenkum, 1993 in CITES proposal, 1994).

Threats

High demand for *P. africana* has led to over-exploitation of this species for its medicinal properties and to a lesser degree its timber (Dawson & Rabevohitra, 1996). Bark removal is most extensive in Cameroon and Madagascar (Dawson & Rabevohitra, 1996). In Madagascar, trees are being felled for the bark in protected areas (100-200 trees along the western boundary of the National Park of Mantadia) (Dawson & Rabevohitra, 1996).

Regeneration from cut young trees appears to be low in Cameroon (Dawson & Rabevohitra, 1996)
Tree bark can regenerate if care is taken not to damage the cambium. The forestry procedures for bark removal in Cameroon are as follows, the bark is to be stripped from the two opposite quarters of the trunk and the tree is then left to regenerate its bark for four years, after this time the remaining quarters are then stripped (Parrott & Parrott, 1989).

This species is not under threat in South Africa, as there is regeneration and limited exploitation in rural areas where ring barked trees are dying (African Regional Workshop, 1996).

Utilisation
This species has excellent timber for construction, furniture and household utensils. It is used especially in the informal sector, although it is also used commercially (Marshall & Jenkins, 1994). The bark of *P. africana* is highly valued for its medicinal properties; it is used as a purgative and as a medicine for benign prostatic hyperplasia and prostate gland hypertrophy, diseases that commonly affect older men in Europe and N. America (Dawson & Rabevohitra, 1996). Bark extracts were patented about 30 years ago (CITES proposal, 1994).

Trade
P. africana is exported from Africa to Europe where the active compounds in the bark are used for drug production (Walter & Rakotonirina, 1995). Between 1988 and 1993 in Madagascar, the amount of bark harvested doubled from 300 tonnes/year to 600 tonnes/year; in 1995, the estimated figure doubled again to 1200 tonnes (Dawson & Rabevohitra, 1996). Between 1986 and 1991 Cameroon exported an average of 1923 tonnes/year to France, Zaire exported 300 tonnes/year (of *P.africana* and *P.crassifolia*) to Belgium and France, Kenya exported 193 tonnes {in 1993?} to France and Uganda exported 96 tonnes {in 1993?} (various sources in Walter & Rakotonirina, 1995).

There have been reports of illegal harvesting in Uganda (Anon, 1993 in CITES proposal, 1994). There is evidence of complete stripping of trees or felling in Cameroon and Madagascar (Dawson & Rabevohitra, 1996). Trade bans in Cameroon have led to massive illegal trade (Cunningham & Mbenkum, 1993 in CITES proposal, 1994). *P. africana* is being removed from the Kakamega Forest Reserve, Kenya (Marshall & Jenkins, 1994)

Conservation Status
IUCN Category and Criteria: Cr (A1c,d) - This category was applied at the Regional Workshop for the *Conservation and Sustainable Management of Trees* project. It may, however, apply to populations of the species in parts of its range rather than to the entire population.

In many areas, *P. africana* is severely threatened (Dawson & Rabevohitra, 1996). In Madagascar, trees are cut down and completely stripped of bark; this heavy exploitation is causing the species to be severely threatened (Dawson & Rabevohitra, 1996). This species has been listed as Endangered to Extinction by the department of forestry in Cameroon (CITES proposal, 1994).

Conservation Measures
This species is listed on Appendix II of the CITES convention.
There are 153 ha of this species in plantations in Kenya (Marshall & Jenkins, 1994). Seed has been collected and substantial planting of *P. africana* is underway in Cameroon (Dawson & Rabevohitra, 1996). There are no conservation measures in practice in Madagascar (Dawson & Rabevohitra, 1996). *P. africana* is no longer harvested in Zimbabwe, it is only used locally in South Africa and it has not entered international trade in Malawi (CITES proposal, 1994).

Intensive regeneration is required (African Regional Workshop comm., 1996).

Additional Information

P. africana is an important source of income for the villagers employed by licence holders to collect the bark (Walter & Rakotonirina, 1995).

P. africana is a fast growing species that can be cultivated on steep slopes, however, farmers are reluctant to plant unless they can be assured that there is a market (CITES proposal, 1994).

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Pterocarpus angolensis
Bloodwood

Distribution
This species occurs in Angola, Botswana, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zaire, Zambia and Zimbabwe.

Habitat

Vegetation type according to White (1983)
1. Zambezian woodland
Zambezian miombo woodland
Pterocarpus angolensis is a canopy associate, rather that a dominant canopy species.
North Zambezian undifferentiated woodland and wooded grassland
South Zambezian undifferentiated woodland and scrub woodland
Zambezian 'chipya' woodland and wooded grassland
Zambezian Kalahari woodland
2. Zambezian thicket
When found in this habitat type *P. angolensis* tends to be rare and quite small. It is thought that large mammals and fire allow for the occurrence of the species in the Zambezian thicket as it does not regenerate well in the shade.
3. Grassland and wooded grassland of the Guinea-Congolia/Zambezia regional transition zone.

In Mozambique, this species is found in all types of woodland and wooded savanna, however its occurrence and density is not uniform (Moreno Saiz, 1996). In Zimbabwe, *P. angolensis* is found on the fringe of pan grassland of the Lupane and Nkayi districts and in the woodland thicket on the hills of the Binga district (Timberlake *et al*, 1991). Populations of *P. angolensis* are denser on Kalahari sand (African Regional Workshop, 1996).

Population Status and Trends
This species is very widespread although it is never common. In areas where the local people use the trees there are fewer older stands.

In Mozambique, the abundance of this species has decreased dramatically in the last decades; it is rarest in the southern province (Moreno Saiz, 1996).

A large proportion of mature trees have been lost to a fungal disease. Approximately forty percent of the trees in Zambia have died from the fungal disease (African Regional Workshop, 1996).

Regeneration
There is evidence of natural regeneration occuring for this species; however regeneration tends to be episodic and is stimulated by high rainfall or fire (African Regional Workshop, 1996). *P. angolensis* is often a secondary coloniser. Reproduction starts when the tree is 15-20 years old. It does not coppice well, if at all, and therefore *P. angolensis* needs to reproduce by seed.

Role of Species in its Ecosystem
No information.

Threats
P. angolensis is exploited for its timber. Larger trees are dying from a fungal disease that blocks up the xylem (African Regional Workshop, 1996).

Utilisation
The wood is used for carpentry and construction, especially in the construction of boats.
The sap is used as a long-lasting dye. It also has medicinal properties.

Trade
There is a huge demand for this species both within Mozambique for furniture making and for export. Almost all of the trees cut in Cabo Delgado, Mozambique are sent to South Africa for export to the Far East (i.e. Thailand, Hong Kong, etc.). In 1993, 1,690m^3 of *P. angolensis* were exported from Cabo Delgardo and in 1994, the volume exported was 5,497m^3 (Moreno Saiz, 1996). This is currently a key species for exploitation in Zimbabwe (African Regional Workshop, 1996).

This species is imported into Kenya from Tanzania (Marshall & Jenkins, 1994).

Conservation Status
IUCN Category and Criteria: LR (lc) (category assigned by the South African group of the Workshop, due to observations of sufficient regeneration. VU (A1c,d) was assigned by the West African group.)

Conservation Measures
Bloodwood is found in the Derre forest reserve in Mozambique. There are 2 ha planted with this species in Kenya (Marshall & Jenkins, 1994). Growth of *P. angolensis* is slow and variable for at least the first seven years, making it less suitable for plantation (African Regional Workshop, 1996).

In Zimbabwe this species is found in Forest Commissioned land where it is rarely exploited. The minimum cutting diameter is 25 cm, however this is not enforced (African Regional Workshop, 1996).

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Santalum album
Sandalwood

Distribution
This species is widely scattered in China, India, Indonesia (Timor, Sumba and Flores and planted in Java and Bali), the Lesser Sunda Islands, the Philippines and Australia.

Habitat
It grows on dry, stony but fertile soil (WCMC, 1991). In India, *S. album* occurs between the elevations of 0-700m and in rainfall zones of 300-3000mm. It is found mainly in dry deciduous forests (USDA, 1990).

Population Status and Trends
In India, Sandalwood is regenerating when in favourable conditions and it's distribution is extending (USDA, 1990).

Northern Australia has only a small patch of *S. album* in basalt region in the Hughendon-Cloncurry area (Statham, 1990).

Regeneration
S. album regenerates vegetatively with root suckers and by coppicing when the plant is juvenile (USDA, 1990). It begins to flower at 3 years of age and starts producing viable seeds at about 5 years.

Role of Species in its Ecosystem
Sandalwood is a hemi root parasitic tree and requires a host plant (can parasitise over 300 species including itself) for nitrogen, phosphorous and potassium (USDA, 1990). Birds are necessary for efficient seed dispersal (USDA, 1990).

Threats
Fire and grazing are threats because they have a detrimental affect on regeneration (USDA, 1990). There is much concern regarding over-exploitation due to smuggling for trade.

Utilisation
The timber is used for fine furniture, carving and turnery. Oil is extracted from the heartwood and is in high demand for incense, perfumery and medicines.

Trade
The price of Sandalwood in India increased from RS 20,000 per tonne in 1980 to RS 200,000 per tonne in 1990. "Smuggling has assumed alarming proportions." The total annual production in India is about 1800 tonnes (Chadha, 1989 in WCMC, 1991).

India uses all *S. album* domestically and export is prohibited (USDA, 1990). Major exporters of top quality logs are Hawai'i, Fiji, Indonesia and Western Australia. The main world supplier of sandalwood chips and powder for incense is Australia, limited quantities are exported from India (USDA, 1990). Good quality logs in India sold domestically went for an average price of US$4,590/tonne in 1987 and US$9,410/tonne in 1990 (USDA, 1990).

Conservation Status
This species is considered globally Not Threatened under the old IUCN threat categories according to the WCMC Plants Database. It has not yet been evaluated using the new IUCN categories of threat.

Conservation Measures
Export of timber from India is totally banned except for handicraft pieces of sandalwood up to 50g weight. FAO, 1984 notes that it is a priority species for in situ conservation.

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Swartzia fistuloides

Dina; Pau Rosa

Distribution

This species occurs in Angola (Cabinda), Congo, Côte d'Ivoire, Cameroon, Gabon, Ghana, Equatorial Guinea, Nigeria and Zaire.

Habitat

S. fistuloides is found in dense rainforest.

Population Status and Trends

This species is rare in Ghana (Hawthorne, 1995a). This species has been classified as a blue star by Hawthorne (1995a), meaning it is widespread internationally but rare in Ghana, and it is Ghana's interests to look after this species.

Role of Species in its Ecosystem

Elephants are seed dispersers (1% of elephant dung piles in the Bia South game park reserve contained seeds (Martin, 1991 in Hawthorne 1995a)).

Threats

"This species may be suffering from a shortage of elephants" Hawthorne, 1995a.

Utilisation

The decorative timber is used for veneer, turnery, carvings and tool handles.

Trade

In 1987, Gabon exported 1,250 m^3 of Pau Rosa from Owendo (IUCN, 1990); in 1994, Gabon exported 1,387.583 m^3 of Pau Rosa and in 1995 they exported 1,921.841 m^3 (DIAF, 1996).

Conservation Status

IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1995)

Conservation Measures

Regeneration work is urgently required (African Regional Workshop, 1996).

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Testulea gabonensis
Izombé

Distribution
This species occurs in Cameroon, Congo, Equatorial Guinea, and Gabon.

Habitat
It is found in dense primary forests and transitional formations (WCMC, 1991).

Population Status and Trends
It has a scattered distribution. It has a very limited range in Southern Congo near Conkouati (WCMC, 1991).

Izombé also has a very limited geographic distribution within Cameroon (Gartlan, *in litt.* 1991)

Role of Species in its Ecosystem
No information.

Threats
Exploitation for international trade.

Utilisation
Izombé is used for door and window frames, furniture, flooring, turnery and carving (WCMC, 1991).

Trade
In 1987, Gabon exported 935 m^3 of Izombé from Owendo (IUCN, 1990). Gabon exported *T. gabonensis* logs for an average price of US$33.50 in 1994 (ITTO, 1995a). In 1994, 5,176.546 m^3 of Izombé were exported from Gabon and 4,942.090 m^3 were exported in 1995 (DIAF, 1996).

Conservation Status
IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996)
The species has been considered to be Endangered in Cameroon (Palmberg, 1987).

Conservation Measures
Regeneration work is required (African Regional Workshop, 1996).

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Tieghemella africana

Douka; Makoré

Distribution

This species occurs from Sierra Leone to Cameroon, Congo, Equatorial Guinea, Gabon and south to Cabinda.

Habitat

T. africana is a high rain forest species.

Vegetation type according to White (1983)

1. Guineo-Congolian rain forest

Hygrophilous coastal evergreen Guineo-Congolian rain forest

Tieghemella africana is found in the western centre of endemism but is replaced by the closely related *T. heckelii* in the east.

Population Status and Trends

No direct information although this could be inferred from information on forest extent and rate of decline.

Role of Species in its Ecosystem

No information.

Threats

In Cameroon it is under pressure because of changes in land use (WCMC, 1991).

Utilisation

This species is used for timber.

Trade

Gabon exported 15,278 m^3 of *T. africana* in 1987 from Owendo (IUCN, 1990). In 1994, Gabon exported 201m^3 of Douka sawnwood at an average price of US92.71m^3$ (ITTO, 1995a). Total Douka export from Gabon in 1994 was 20,115.323 m^3 and total export in 1995 was 20,515.665 m^3 (DIAF, 1996). Côte d'Ivoire exported 196m^3 of *T. africana* veneer for an average price of US$1801.07/$m^3$ (ITTO, 1995a).

Conservation Status

IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996)

Conservation Measures

Regeneration work is required (African Regional Workshop, 1996).

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Tieghemella heckelii
Makoré

Distribution
This species occurs in Cameroon, Côte d'Ivoire, Gabon, Ghana, Liberia, Nigeria and Sierra Leone.

Habitat
It is a high rainforest species, preferring wet, evergreen forest.

Vegetation type according to White (1983)
1. Guineo-Congolian rain forest
Hygrophilous coastal evergreen Guineo-Congolian rain forest
Tieghemella heckelii is found in the eastern centre of endemism but is replaced by the closely related *T. africana* in the west.

Population Status and Trends
This species might become extinct in Liberia unless re-planted by the Forest Service (Voorhoeve, 1979 in WCMC, 1991). *T. heckelii* is common in Ghana (Hawthorne, 1995a).

Regeneration
Both the seedlings and the saplings are shade tolerant and shoot up in height when exposed to light (Hawthorne, 1995a).

Role of Species in its Ecosystem
The large seeds and fruit are eaten by small animals and elephants (in 12% of piles of elephant dung, seeds were found in the Bia South game park reserve (Martin, 1991 in Hawthorne, 1995a)). Seedlings are rare because of predation by rodents who eat the large oily cotyledons.

Threats
This species is severely threatened by over-exploitation in Ghana (Hawthorne, 1995a).
The reduction of elephant numbers in high forest areas has limited the natural regeneration of Makoré (WCMC, 1991).

Utilisation
Locally the oil from the seed is eaten and the fruit is used to make soap.

Trade
Ghana exported 2,090 m^3 of *T. heckelii* air dried sawnwood for an average price of US$510.00/$m^3$ and kiln dried sawnwood was sold for US$659.00/$m^3$. Ghana also exported 3,240 m^3 of sliced veneer at an average price of US$778.00/$m^3$, rotary peeled veneer for US$446.00/$m^3$, and jointed veneer for US$1734.00/$m^3$ (ITTO, 1995a).

Portugal imported 227 m^3 of *T. heckelii* logs at an average price of US$215.00/$m^3$.
Italy imported 2,336 m^3 of sawnwood. The USA imported both logs and sawnwood. Portugal and Sweden both imported Makoré sawnwood. (ITTO, 1995a).

Conservation Status
IUCN Category and Criteria: EN (A1c,d) (African Regional Workshop, 1996)

This species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b). For Ghana this species has been awarded a scarlet star by Hawthorne (1995a), which means that it is common but it is under profound pressure from heavy exploitation. This species requires protection and exploitation has to be limited if it is to be sustainable (Hawthorne, 1995a).

Conservation Measures

T. heckelii is protected by law in Côte d'Ivoire. The export of Makoré in log form is banned by Ghana and Liberia.

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Triplochiton scleroxylon
Obeche; Wawa

Distribution
This species occurs in Benin, Cameroon, Congo, Côte d'Ivoire, Equatorial Guinea, Ghana, Guinea, Liberia, Nigeria, Sierra Leone and Zaire.

Habitat

Vegetation type according to White (1983)
1. Guineo-Congolian rain forest
Drier peripheral semi-evergreen Guineo-Congolian rain forest and similar forest in the transition zones. *Triplochiton scleroxylon* is often gregarious and can regenerates well on abandoned farmland.
Old secondary forest

T. scleroxylon occurs mainly in forests transitional between humid evergreen and semi-deciduous forests. It prefers base rich, high ph soils and is associated with a two-peak rainfall pattern (Hall & Bada, 1979 in Hawthorne, 1995a). The species has extended its range due to deforestation for agricultural purposes (White, 1983).

Population Status and Trends
It is very common in Ghana, especially outside the wet evergreen forest type (Hawthorne, 1995a). Increasingly smaller trees are being logged in Nigeria for match production which is putting pressure on the species (WCMC, 1991). Populations of this species only occur in north Congo especially in the Sangha region.

Regeneration
This species regenerates well in logged forest (Hawthorne, 1995a) and in abandonned farmland. It is fast growing and light demanding. Seed production is very irregular for this species; good seed years occur every 4-5 years. It is thought that the dry spell between the two rainy peaks is a stimulus for flowering (Hall & Bada, 1979 in Hawthorne, 1995a).

Role of Species in its Ecosystem
No information.

Threats
This species is severely threatened by over-exploitation in Ghana (Hawthorne, 1995a)

Utilisation
Used locally and internationally as a timber species.

Trade
T. scleroxylon accounts for more of the timber volume extracted annually from west African forests that any other single species. It is Ghana's major timber species for the export trade; in 1989, it accounted for 56.6% of the country's log exports and 22.9% of lumber exports.

In 1994, 310,000 m^3 of Obeche were exported in log form from Cameroon at an average price of US$220.00/$m^3$. Ghana exported Obeche logs and 131,360 m^3 of sawnwood, air dried sold for an average of US$274.00/$m^3$ and kiln dried sold for US$330.00/$m^3$.
Togo exported *Triplochiton* spp. as sawnwood. As a veneer, Obeche was exported in 1995 from Cameroon, and Ghana (sliced veneer: 660 m^3 @ ave. US$1214.00/$m^3$; rotary peeled @ ave. US$357.00/$m^3$; jointed

veneer @ ave. US$1951.00/m^3). Plywood *T. scleroxylon* was exported from Cameroon (10,000 m^3 @ ave. US$695.00/m^3) and Ghana in 1994 (ITTO, 1995a).

In 1994, *T. scleroxylon* logs were imported into the Netherlands (2,000 m^3), Portugal (408m^3 @ ave. US$18.00/m^3), Switzerland (3,000 m^3) and the USA (ITTO, 1995a). Italy imported 46,144 m^3 and Switzerland imported 1,900 m^3 of Obeche sawnwood. Portugal, Sweden, and the USA also imported Obeche sawnwood. In addition, Portugal and the United States imported Obeche veneer and plywood. (ITTO, 1995).

Conservation Status

IUCN Category and Criteria: LR (lc) (African Regional Workshop, 1996)
This species is considered Vulnerable (1994 IUCN threat category) due to excessive exploitation (Hawthorne, 1995b). It has been awarded a scarlet star in Hawthorne's (1995a) star system for Ghana, which means that it is common but it is under profound pressure from heavy exploitation. This species requires protection and exploitation has to be limited if it is to be sustainable (Hawthorne, 1995a).

Conservation Measures

It is protected by law in Côte d'Ivoire. Export of this species has been banned by Liberia. (WCMC, 1991).

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Turraeanthus africanus
Avodiré

Distribution
The genus *Turraeanthus* is endemic to the Guineo-Congolian regional centre of endemism (White, 1983). This species is distributed in Angola, Benin, Cameroon, Congo, Equatorial Guinea, Ghana, Nigeria, Sierra Leone, Uganda and Zaire.

Habitat
T. africanus is found commonly in moist semi-deciduous forest and tends not to occur in the wettest and the driest forest (Hawthorne, 1995a).

Population Status and Trends
This species is common in Ghana and regeneration is sufficient (Hawthorne, 1995a).

Regeneration
Only the smaller trees produce fruit and this occurs irregularly (Hawthorne, 1995a). There is high viability of seeds that germinate in the shade and seedlings are shade tolerant, however, a small light gap is best for growth and survival (Alexandre, 1977 in Hawthorne, 1995a). Large trees are usually found in the shade as well (Hawthorne, 1995a).

Role of Species in its Ecosystem
Seeds of this species are dispersed by animals (Alexandre, 1977 in Hawthorne, 1995a).

Threats
This species is threatened by moderate exploitation in Ghana (Hawthorne, 1995a).

Utilisation
T. africanus is used for furniture, joinery, decorative veneer, cabinetwork and panelling (WCMC, 1991).

Trade
The export of Avodiré in log form has been banned by Ghana (WCMC, 1991).

Conservation Status
IUCN Category and Criteria: VU (A1c,d) (African Regional Workshop, 1996)
This species is considered Vulnerable (1994 IUCN threat category) due to exploitation (Hawthorne, 1995b). It has been awarded a pink star in Hawthorne's (1995a) star system for Ghana, which means that it is common and moderately exploited.

Conservation Measures
This species is protected by law in Côte d'Ivoire. It is considered a priority for *in situ* conservation by FAO, 1984. Urgent regeneration work is required (African Regional Workshop, 1996).

References
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