

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA



Nineteenth meeting of the Conference of the Parties
Panama City (Panama), 14 – 25 November 2022

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

To list African populations of the genus *Khaya* in CITES Appendix II, in accordance with Article II, Paragraph 2 (a) of the Convention and satisfying Criterion B of Annex 2 a of Resolution Conf. 9.24 (Rev. CoP17).

Annotation

#17 Designates logs, sawn wood, veneer sheets, plywood and transformed wood.

B. Proponent

Benin, Côte d'Ivoire, European Union, Liberia and Senegal*

C. Supporting statement

1. Taxonomy

1.1 Class: Magnoliopsida

1.2 Order: Sapindales

1.3 Family: Meliaceae

1.4 Genus, species or subspecies, including author and year:

The taxonomy of *Khaya* remains unresolved. This proposal follows the nomenclature outlined in Royal Botanic Gardens Kew's Plants of the World Online database (POWO, 2022), which recognises five species (*K. anthotheca* (Welw.) C. DC. (1878), *K. grandifoliola* C. DC. (1907), *K. ivorensis* A. Chev. (1907), *K. madagascariensis* Jum. & Perr. (1906) and *K. senegalensis* (Desr.) A. Juss. (1830)), with the addition of a sixth species, *K. comorensis*, as reported by the CITES MA of Comoros (*in litt.* to European Commission, 2021). However, a recent review of *K. anthotheca* by Bouka *et al.* (2022) identified two new undescribed species and supported the rehabilitation to the rank of species of three taxa previously considered to be synonyms of *K. anthotheca*: *K.*

* The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.

agboensis, *K. euryphylla* and *K. nyasica*. A full taxonomic revision of the genus is currently underway (Bouka *et al.* 2022).

1.5 Scientific synonyms:

Khaya anotheca: *Garretia anotheca* Welw. (1859); *Khaya agboensis* A. Chev. (1928); *Khaya euryphylla* Harms (1902); *Khaya mildbraedii* Harms (1917); *Khaya nyasica* Stapf ex Baker f. (1911); *Khaya wildemanii* Ghesq. (1926).

Khaya grandifoliola: *Khaya dawei* Stapf ex Broun & R. E. Massey (1929); *Khaya grandis* Stapf (1908); *Khaya kerstingii* Harms (1915); *Khaya kissiensis* A. Chev. (1920); *Khaya punchii* Stapf (1908).

Khaya ivorensis: *Khaya caudata* Stapf ex Hutch. & Dalziel (1928); *Khaya klainei* Pierre ex Pellegr. (1911).

Khaya madagascariensis: none

Khaya senegalensis: *Swietenia senegalensis* Desr. (1792).

1.6 Common names:

English: African mahogany

French: Acajou, Acajou d'Afrique

Spanish: Caoba africana, Caoba de Africa

1.7 Code numbers:

2. Overview

The genus *Khaya* comprises six species (*K. anotheca*, *K. comorensis*, *K. grandifoliola*, *K. ivorensis*, *K. madagascariensis* and *K. senegalensis*) of medium to large trees in the family Meliaceae, native to tropical and sub-tropical continental Africa, Madagascar and Comoros. *Khaya* spp. are valuable commercial timber trees that are part of the African mahogany species group, and are also used in traditional medicine. Ongoing wild harvest for the international timber market is the primary threat to the genus and is having a detrimental effect on natural populations, which are particularly vulnerable as a result of intrinsic poor regeneration rates and are in decline in several countries. The major *Khaya* spp. exporting range States are Gabon, Cameroon, Congo, Côte d'Ivoire and the Democratic Republic of Congo. During 2015-2019, China imported African mahogany products (which can include other species) equivalent to a total weight of > 23 million kg from *Khaya* spp. range States; the United States of America and the European Union are other key importers of African mahogany.

With the exception of *K. comorensis*, which has not been assessed, all *Khaya* spp. are categorised as globally Vulnerable in the IUCN Red List. The assessments (four of which require updating as they were compiled in 1998, with the exception of *K. madagascariensis* which was updated in 2020) were made on the basis of over-exploitation of the species for timber, loss of mature trees leading to poor natural regeneration, and genetic erosion of wild populations. Thus, five species (*K. anotheca*, *K. grandifoliola*, *K. ivorensis*, *K. madagascariensis* and *K. senegalensis*) appear to meet the criteria for inclusion in CITES Appendix II under Annex 2 a Criterion B of Resolution Conf. 9.24 (Rev. CoP17).

Khaya spp. are considered to be indistinguishable from one another based on macroscopic features of their wood (that is, using the naked eye or a hand lens up to 10x magnification) (Donkor, 1997), however, Koch (pers. comm. to UNEP-WCMC, 2021) also considered them to be indistinguishable based on microscopic wood characteristics. The wood of *Khaya* spp. is considered to be easily mistaken for that of CITES-listed *Swietenia* spp. (Holtken *et al.* 2012), particularly if the wood in question originated from a fast-growing plantation (Koch, pers. comm. to UNEP-WCMC, 2021). The criteria for inclusion of the entire genus in Appendix II under Annex 2 b A of the Convention thus also appear to be met.

3. Species characteristics

3.1 Distribution

The genus *Khaya* naturally occurs in tropical and sub-tropical Madagascar, the Comoros and continental Africa (Panshin, 1933; Donker, 1997; Nikiema and Pasternak, 2008; Pinheiro *et al.*, 2011). A distribution map based on representative sampling of all *Khaya* spp. (with the exception of ***K. comorensis***, and including the synonym *K. nyasica*) in their natural ranges has been produced by Pakull *et al.* (2019) (see Fig. 1); however, it should be noted that of the total 2222 individuals mapped, 124 were mapped based on herbarium specimens rather than field sampling (Pakull *et al.*, 2019).

Botanic Gardens Conservation International's "GlobalTreeSearch" database lists 31 range States where *Khaya* spp. are native (BGCI, 2020), as outlined below.

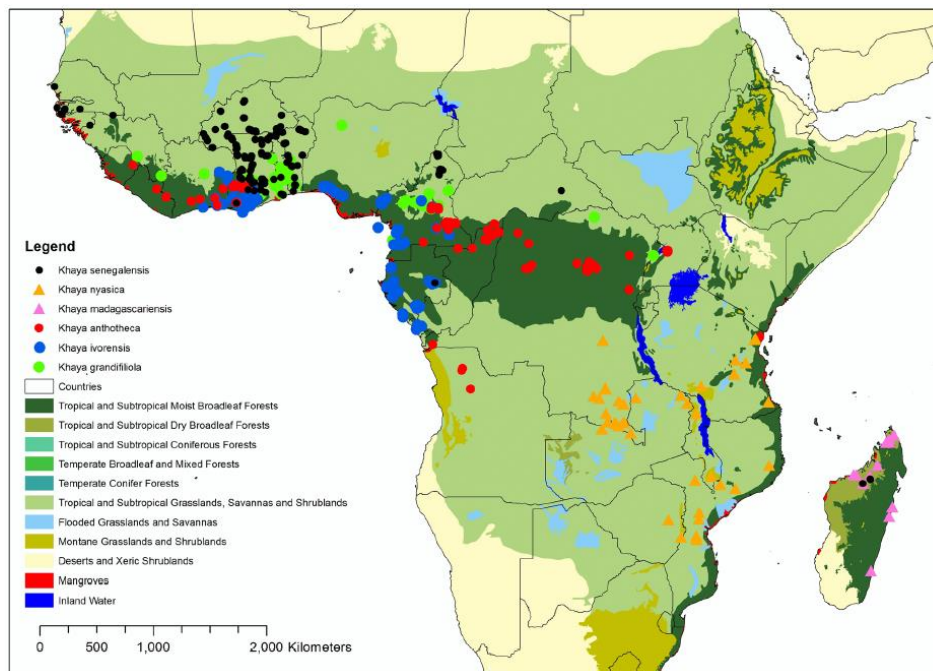


Figure 1. Geographic ranges of *Khaya* spp. based on representative sampling of >2000 *Khaya* individuals and including 124 herbarium accessions. Source: Pakull *et al.* (2019), reproduced with permission. Note that *K. nyasica* is considered here separately rather than as a synonym of *K. anthotheca*.

K. anthotheca occurs in Angola, Cameroon, Congo, Côte d'Ivoire, Democratic Republic of the Congo (hereafter DRC), Ghana, Liberia, Malawi, Mozambique, Nigeria, Sierra Leone, Uganda, United Republic of Tanzania (hereafter Tanzania), Zambia and Zimbabwe.

K. comorensis is endemic to the Comoros (CITES MA of Comoros *in litt.* to European Commission, 2021).

K. grandifoliola occurs in Benin, Burkina Faso, Congo, Côte d'Ivoire; DRC, Ghana, Guinea, Nigeria, South Sudan, Sudan, Togo and Uganda.

K. ivorensis occurs in Angola, Cameroon, Côte d'Ivoire, Gabon, Ghana, Liberia and Nigeria.

K. madagascariensis is endemic to Madagascar and the Comoros (islands of Grande Comore, Mohéli and Anjouan; see Fig. 2). It occurs naturally in the northern, central highland and eastern regions of Madagascar including Ambilobe, Analamerana protected area, Antanimihavotra and Bekolosy (Andriamanohera and Rakotoarisoa, 2020). As of 2020, the species had an estimated extent of occurrence of 262 803 km² but an estimated area of occupancy of only 56 km² (Andriamanohera and Rakotoarisoa, 2020). *K. madagascariensis* was historically more widespread with subpopulations previously recorded in the Madagascan provinces of Antsiranana, Fianarantsoa, Mahajanga, Toamasina and Toliara, and Nioumachoua Island in the Comoros (Andriamanohera and Rakotoarisoa, 2020); it is unclear whether the species has been completely extirpated from these locations. *K. madagascariensis* is also planted as an ornamental tree and for reforestation purposes elsewhere in Madagascar (Andriamanohera and Rakotoarisoa, 2020).

K. senegalensis occurs in Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone, South Sudan, Sudan, Togo and Uganda.

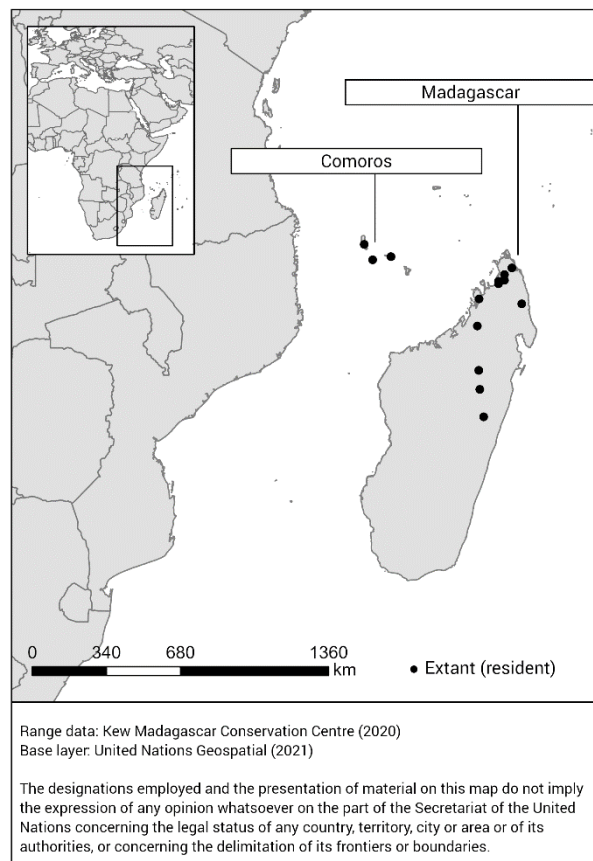


Figure 2. Distribution of *Khaya madagascariensis* in Madagascar and the Comoros. Source: Kew Madagascar Conservation Centre (2020).

3.2 Habitat

Khaya spp. occupy a variety of habitat types from closed forest to savanna (Donkor, 1997), and prefer a range of altitudes and soil types from lowland riparian zones and salt marshes (WCMC, 1998a) to well-drained soils in the foothills of mountains (Naidoo, 2007). The habitat preferences of individual *Khaya* spp. are outlined below.

K. anthotheca occurs in areas of low rainfall from Sierra Leone to Uganda (Donkor, 1997). The species inhabits low to medium altitude evergreen forests on well-drained soils, including mountain foothills in Tanzania (Naidoo, 2007). In Malawi, the species grows in riverine fringe forests with deep alluvial soils, and occurs typically at altitudes of 50-1400 m above sea level (CITES MA of Malawi *in litt.* to European Commission, 2021). In Angola, *K. anthotheca* is found in tropical rainforest (CITES MA of Angola *in litt.* to European Commission, 2022).

K. grandifoliola prefers drier, semi-deciduous forest and rocky areas of moist semi-deciduous forest at the border between savanna and closed forest zones, and is predominant in Côte d'Ivoire, Ghana and Nigeria (Donkor, 1997).

K. ivorensis occurs in moist evergreen and semi-deciduous forest types with high rainfall, from Côte d'Ivoire to Gabon (Donkor, 1997). In Angola, the species is found in tropical rainforest (CITES MA of Angola *in litt.* to European Commission, 2022).

K. madagascariensis is found in rainforest, along rivers and salt marshes (WCMC, 1998a), and in dry and humid forest at altitudes of 5-1000 m above sea level (Andriamanohera and Rakotoarisoa, 2020).

K. senegalensis is widely distributed across west and central African savanna, occurring from Senegal to Uganda (Donkor, 1997).

3.3 Biological characteristics

Khaya spp. are “non-pioneer light demanders”, able to germinate at low light levels but requiring higher light levels for further growth (Hall, 2011). The speed of growth for *Khaya* spp. has been reported to vary depending on forest type and plantation type (Lemmens, 2008; Nikiema and Pasternak, 2008). Plumptre (1995) reported that *Khaya* spp. produced fruit at sizes of 40 cm diameter at breast height (DBH) and larger (although age was not specified). All *Khaya* species have been noted to strongly resemble one another in flower and fruit morphology, but with inter-specific differences evident in their leaflets (Maroyi, 2008).

K. anthotheca individuals are monoecious, flowering from September to December and fruiting from March to September (Naidoo, 2007), with seed dispersal taking place from December to March (Makana and Thomas, 2004). Maroyi (2008) stated that ***K. anthotheca*** trees may begin producing fruit at 18 cm bole diameter (assumed to be DBH) but noted that “abundant fruiting” usually begins at a diameter of 70 cm. The age at which individuals attain the fruiting diameter reported by Maroyi (2008) is unclear. However, the species has been reported to take 60-80 years to reach full maturity (CITES MA of Malawi *in litt.* to European Commission, 2021).

K. ivorensis trees produce seed at 30 years of age and produce large seed crops at intervals of 3-4 years once at reproductive maturity (African Regional Workshop, 1998). The species reportedly produces hermaphroditic flowers from July to January, and fruits from February to May; seeds are wind-dispersed but spread only a short distance from the mother tree (Orwa *et al.*, 2009).

K. senegalensis trees reportedly produce seed after 20-25 years (Nikiema and Pasternak, 2008).

3.4 Morphological characteristics

Khaya individuals are medium to large trees (Panshin, 1933), attaining maximum heights of between 13-24 m (***K. madagascariensis***; Andriamanohera and Rakotoarisoa, 2020) and 60-65 m (***K. anthotheca***; Pinheiro *et al.*, 2011). A maximum DBH of 2 m has been reported for ***K. ivorensis*** (Orwa *et al.*, 2009). *Khaya* spp. were noted to be fast-growing, with an annual growth of 2.3 m in height and 2.5 cm in diameter observed in Ivoirian ***K. ivorensis*** (Orwa *et al.*, 2009), and an annual growth of <1.5 m in height for ***K. anthotheca*** (Naidoo, 2007). In the field, individual *Khaya* spp. can to an extent be differentiated from one another based on their leaflets, although it is noted that there is often considerable intra-specific variability and hard-to-classify “intermediate” individuals that may be hybrids (Bouka Dipelet, 2019).

Although a study by Donkor (1997) found that the wood of ***K. anthotheca***, ***K. grandifoliola***, ***K. ivorensis*** and ***K. senegalensis*** could be differentiated based on certain microscopic wood structures (the average fibre lumen/wall ratio, percentage multiseriate rays, and relative density) with 99% confidence, the authors highlighted that similarities in wood colour and anatomy make macroscopic identification (using the naked eye or a hand lens up to 10x magnification) of *Khaya* logs, lumber and finished products to species level “very difficult even for very experienced wood workers”. Koch (pers. comm. to UNEP-WCMC, 2021) stated that individual *Khaya* spp. could not be distinguished clearly or with certainty from one another at either the macroscopic or microscopic level. Molecular markers have recently been developed that can be used to differentiate between the wood of ***K. anthotheca***, ***K. grandifoliola***, ***K. ivorensis*** and ***K. senegalensis***, but this is an expert process that can only be carried out in a laboratory (Schröder, pers. comm. to UNEP-WCMC, 2021).

3.5 Role of the species in its ecosystem

Khaya spp. act as shade trees for other plant species and have been used in agroforestry for this purpose: specifically, ***K. ivorensis*** has been successfully retained as a shade tree in cocoa plantations in Nigeria (Lemmens, 2008). ***K. grandifoliola*** has been noted as an important species for stabilisation of riverbanks in Uganda (Opuni-Frimpong, 2008) and ***K. ivorensis*** is used in enrichment planting and is noted to act as a soil improver (Orwa *et al.*, 2009).

4. Status and trends

4.1 Habitat trends

Khaya spp. are considered to be threatened by habitat loss and “indiscriminate logging” across their native ranges (Fremlin, 2011 in Dickinson *et al.*, 2011). See Section 4.5 for detail.

4.2 Population size

Hall (2011) noted that overall density of Meliaceae is low across central Africa, with 0.5-2 mature individuals occurring per ha in unlogged forest.

K. anthotheca is described as being naturally scattered at low densities throughout forest (Maroyi, 2008). Preliminary results from Angola's 2015 National Forest Inventory estimated standing timber volumes of 0.005 m³/ha and 0.008 m³/ha for *K. anthotheca* trees in size classes 20-50 cm DBH and 50-100 cm DBH, respectively (CITES MA of Angola *in litt.* to European Commission, 2022). A relative frequency of 0.55%, a relative density of 0.05%, a relative dominance of 0.14%, and a basal area of 0.49 m² were also reported for *K. anthotheca* in Angola (CITES MA of Angola *in litt.* to European Commission, 2022). Large ***K. anthotheca*** individuals (>60 cm DBH) were reported to occur at average densities of 0.02 per ha in southern Cameroon and 0.3-0.9 per ha in Liberia (Maroyi, 2008). Smaller individuals (>10 cm DBH) were reported to occur at densities of 2-5 per ha in Côte d'Ivoire (Maroyi, 2008). The species was described as “common” throughout the humid forest region in northern and central DRC (Kiyulu and Rodrigues, 2014).

K. ivorensis individuals occur scattered or in small groups, typically at low densities (Lemmens, 2008). Large individuals (>60 cm DBH) were reported to occur at average densities of 0.02-0.08 per ha in southern Cameroon. In Côte d'Ivoire, “exploitable” individuals were recorded at an average density of <1 per 10 ha, though in some areas local densities reached 1 “exploitable” tree per 2 ha (Lemmens, 2008). ***K. ivorensis*** in Gabon was reported to occur at an average of 0.27 m³ of wood per ha (assumed to represent stem volume) (Lemmens, 2008). A 2017 study of ***K. ivorensis*** in Irele and Odigbo local government areas in the south of Ondo State, Nigeria recorded a total of 123 trees representing a total wood volume of 48.05 m³ and a low population density ranging from 0.02-0.03 trees/km² (Chaikaew *et al.*, 2020). The authors reported that DBH ranged from 5-48 cm, with an average of 18.9 cm, and a population structure appearing to show a reverse “J-shaped” curve (Chaikaew *et al.*, 2020).

K. madagascariensis has an estimated population size of 1400 individuals, in approximately 14 subpopulations (Andriamanohera and Rakotoarisoa, 2020). Subpopulations are shown in Fig.2 (above).

In a study of ***K. senegalensis*** populations in Benin, Gaoue and Ticktin (2007) reported average densities of adult trees (defined by the authors as trees with DBH >5 cm) as 43.16 ± 7.23 per ha and saplings and seedlings as 1255.83 ± 268.23 stems per ha.

4.3 Population structure

Hall (2011) reported that the population of Meliaceae across central Africa shows a greater abundance of individuals in smaller size classes (10 cm DBH) compared to larger trees (20-70 cm DBH). In the absence of more detailed information on abundance of individuals in intermediate size classes, as well as historical figures on the relative proportion of mature individuals that would be expected in healthy populations, it is difficult to determine whether this population structure (high numbers of small individuals and low numbers of large individuals) is indicative of a reverse “J-shaped” curve, which is typically seen for tree populations with good recruitment capacity (Hall and Bawa, 1993), or whether it is indicative of ongoing or past intense harvesting of individuals in larger size classes (Hall and Bawa, 1993). It should also be noted that this pattern was reported for Meliaceae collectively, and *Khaya* spp. have been reported to have poor natural regeneration (Oni and Igboanugo, 2007). However, a study of ***K. ivorensis*** conducted in the south of Ondo State, Nigeria in 2017 reported a population structure for the species resembling a reverse “J-shaped” curve (see Fig. 2 in Chaikaew *et al.*, 2020).

4.4 Population trends

The African mahogany species group (encompassing the four genera *Entandrophragma* spp., *Guarea* spp., *Lovoa* spp. and *Khaya* spp.) is considered to be in decline in west Africa as a result of over-

exploitation for timber, resulting in “serious genetic depletion” (Oni and Igboanugo, 2007). A study (year not provided) of the conservation status and regeneration of the native populations of *K. anthotheca* and *K. ivorensis* across three Nigerian lowland forest ecozones found high genetic depletion, a low density of mature trees (<1 tree per ha), and low natural regeneration for both species (Oni and Igboanugo, 2007). *K. ivorensis* was also stated to be rarely encountered in Côte d’Ivoire, and was not recorded in a census post-1990, with other species of *Khaya* only being found “once in a while” (CITES MA of Côte d’Ivoire *in litt.* to European Commission, 2020). Although *K. ivorensis* is classed as nationally widespread and common in Ghana, the species was also noted to be “potentially seriously threatened” by overharvest as a commercial timber (CITES MA of Ghana *in litt.* to European Commission, 2020). In Liberia, natural regeneration of *K. anthotheca* and *K. ivorensis* is impacted by destruction of naturally-regenerated seedlings “during the [timber] felling and skidding cycles”; this loss of seedlings also contributes to the species’ genetic erosion in the country (CITES MA of Liberia *in litt.* to European Commission, 2021). While *K. senegalensis* is considered “common” and “widespread” in Togo, *K. anthotheca* was reported to be nationally “very rare”, and *K. grandifoliola* was noted to be “highly endangered” and threatened by logging (CITES MA of Togo *in litt.* to European Commission, 2020). High densities of *K. grandifoliola* in Togo are restricted to agroforestry zones and protected areas and trees of exploitable age can only be found in the latter, although the protected areas themselves are considered to be “badly encroached upon” (CITES MA of Togo *in litt.* to European Commission, 2020). Surveys conducted by Lykke (1998) in the early 1990s in the savanna ecosystem of western Senegal found *K. senegalensis* to be rare, particularly in small size classes, and declining in the study region. More recently, large *K. senegalensis* trees were described as rare in the Sudanian savanna ecozone, particularly in Cameroon (Awé Djongmo *et al.*, 2020). Although *K. grandifoliola* was reported to occur over a wide area in northern DRC (with an estimated national extent of occurrence of 30 000 km²) the species was considered to be nationally rare and overexploited in the northeast of the country (Kiyulu and Rodrigues, 2014).

Both *K. senegalensis* and *K. grandifoliola* were reported to be under “immense logging pressure” in South Sudan, with large trees selectively targeted for harvest; the rate of *Khaya* spp. harvest in the country “exceeds their natural regeneration by several orders of magnitude”, and there is a risk of local extirpation (South Sudan Ministry of Wildlife Conservation and Tourism, *in litt.* to European Commission, 2021). *K. anthotheca* populations in Malawi have declined over the past 30 years, and are considered currently more threatened due to high demand for the species’ timber and timber products (CITES MA of Malawi *in litt.* to European Commission, 2021). Previously a “conspicuous” species along riverbanks, *K. anthotheca* can now “hardly be found” in Malawi and the national Department of Forestry considers populations to have rapidly declined (CITES MA of Malawi *in litt.* to European Commission, 2021). In Angola, *K. anthotheca* and *K. ivorensis* are considered “still in relative ecological balance, considering the volumes licensed annually [for harvest]” (CITES MA of Angola *in litt.* to European Commission, 2022).

In Madagascar and the Comoros, the population trend for *K. madagascariensis* was considered “stable” in the 2020 IUCN Red List assessment (Andriamanohera and Rakotoarisoa, 2020). However, the assessors noted that the species had suffered population declines of over 30% over three generations as a result of harvest for timber, with many subpopulations having disappeared in Madagascar, mainly in the north western province of Mahajanga (Andriamanohera and Rakotoarisoa, 2020). *K. madagascariensis* was previously reported to be “under high pressure” from habitat loss and selective logging (Maroyi, 2008).

4.5 Geographic trends

High rates of deforestation were found to be severely impacting *Khaya* spp. in southwest Nigeria (Alamu and Agbeja, 2011), and habitat degradation was noted to threaten remaining *K. madagascariensis* populations in Madagascar and the Comoros (Andriamanohera and Rakotoarisoa, 2020). In Côte d’Ivoire, forest loss due to uncontrolled encroachment of agricultural land and rural development has caused a recent decline in *Khaya* spp. production in natural forests (CITES MA of Côte d’Ivoire, *in litt.* to European Commission, 2020). Similarly, *K. anthotheca* in DRC was considered at risk from expansion of agriculture and urbanisation into forested areas (Kiyulu and Rodrigues, 2014).

Several *Khaya* range States have experienced high rates of deforestation in recent years (FAO, 2020a; Vancutsem *et al.*, 2021). In the Global Forest Resources Assessment (FRA) for 2020, the ten countries with highest average annual net loss of forest area over the period 2010-2020 included Angola (annual net forest change of -0.8%), DRC (-0.83%), Mozambique (-0.56%) and Tanzania (-0.88%) (FAO, 2020a). The FRA also reported that DRC and Nigeria each contributed 2% of total global wood

removals (that is, removal of roundwood and fuelwood from forests, other wooded land and areas of trees outside forests) in 2018 (FAO, 2020a). A long-term assessment of tropical moist forest cover change 1990-2019 noted that the African countries showing the greatest reduction in area of undisturbed moist forest (that is, forest unaffected by deforestation or degradation) over this time period were Côte d'Ivoire (reduction of 81.5%), Ghana (70.8%), Angola (67%), Madagascar (67%), Nigeria (46.7%) and Liberia (36%) (Vancutsem *et al.*, 2021). Although in comparison Cameroon (12.7%) and Gabon (2.9%) showed much lower levels of reduction in undisturbed moist forest, the authors noted that these two countries, alongside DRC, contain the largest areas of forest converted into tree plantations within Africa, at 0.07 million ha, 0.04 million ha, and 0.08 million ha respectively (Vancutsem *et al.*, 2021).

5. Threats

All *Khaya* spp. with the exception of ***K. comorensis*** were considered to be globally threatened in the IUCN Red List in 1998 as a result of heavy exploitation for timber (African Regional Workshop, 1998; Hawthorne, 1998a; Hawthorne, 1998b; WCMC, 1998a; WCMC, 1998b); the four continental African species were categorised as Vulnerable, although these assessments are currently annotated as needing updating (African Regional Workshop, 1998; Hawthorne, 1998a; Hawthorne, 1998b; WCMC, 1998b). Re-assessment of the four continental species is currently ongoing (Bouka Dipelet pers. comm. to UNEP-WCMC, 2021), although no further information was available at the time of submission (June 2022). ***K. madagascariensis*** was categorised as Endangered in 1998 (WCMC, 1998a), but re-assessed as Vulnerable in 2020 on the basis that the species has undergone a significant population decline (30%) as a result of timber harvest (Andriamanohera and Rakotoarisoa, 2020).

Poor regeneration after the extraction of mature trees was highlighted in the Red List assessments for ***K. anthotheca***, ***K. grandifoliola***, ***K. ivorensis*** and ***K. senegalensis*** (African Regional Workshop, 1998; Hawthorne, 1998a; Hawthorne, 1998b; WCMC, 1998b), and ***K. anthotheca*** and ***K. senegalensis*** were additionally noted to be suffering from genetic erosion (Hawthorne, 1998a; WCMC, 1998b).

K. anthotheca, ***K. grandifoliola*** and ***K. senegalensis*** were categorised as nationally endangered in Uganda's 2016 list of threatened species (WCS, 2016). The CITES Management Authority (MA) of Ghana (*in litt.* to European Commission, 2020) reported that ***K. ivorensis*** was rated as a "scarlet star" species nationally, meaning that the species is common, widespread and commercial, but "potentially seriously threatened by overexploitation". ***K. anthotheca*** and ***K. grandifoliola*** were both categorised as nationally vulnerable in DRC's 2014 red list of exploitable timber species (Kiyulu and Rodrigues, 2014). In Togo, ***K. grandifoliola*** was considered to be threatened with extinction according to the country's National Forest Action Plan 2011-2019 (MERF, 2011a).

K. senegalensis was noted to be threatened in Sudan by illegal exploitation, and expansion of urban areas, agriculture and desertification (CITES MA of Sudan *in litt.* to European Commission, 2021). Harvest for traditional medicine was also noted to pose a "serious threat" to natural ***K. senegalensis*** populations across the species' global range (Pinheiro *et al.*, 2011). An assessment of the impact of bark harvest for traditional medicine on ***K. senegalensis*** populations in Benin found that harvesters preferentially targeted larger trees (>35 cm DBH), with a greater proportion of harvested trees with increasing size class (Gaoue and Ticktin, 2007). The authors observed the same harvest preferences for ***K. senegalensis*** trees where branches had been pruned for livestock fodder in Benin and reported that trees in the largest size classes were no longer present in intensely harvested populations (Gaoue and Ticktin, 2007). Debarking typically constituted removal of <25 % of stem bark and "in most cases, less than half" of each debarking wound recovered through regrowth (Gaoue and Ticktin, 2007). Ringbarking¹, though rare, resulted in tree death (Gaoue and Ticktin, 2007). Pruning for fodder typically resulted in total crown removal and, although re-sprouting was observed after pruning, trees subjected to intensive and frequent pruning sometimes failed to develop new branches and died (Gaoue and Ticktin, 2007). The authors noted that in Benin's Sudano-Guinean ecoregion, intensive bark and foliage harvest resulted in "significant decreases" in density of ***K. senegalensis*** seedlings and saplings due to reduced fruiting of harvested trees (Gaoue and Ticktin, 2007).

High rates of deforestation threaten natural *Khaya* spp. populations in Nigeria (Alamu and Agbeja, 2011), and the wild population of ***K. madagascariensis*** in Madagascar and Comoros remains threatened by habitat degradation from uncontrolled fires and encroaching agriculture, despite conservation measures including protection by local communities (Andriamanohera and Rakotoarisoa, 2020). In DRC, ***K. anthotheca*** is at risk from habitat loss due to encroaching farmland and urbanisation (Kiyulu and

¹ Ringbarking involves removing bark in a continuous strip around the entire circumference of the tree (Gaoue and Ticktin, 2007)

Rodrigues, 2014). In Côte d'Ivoire, *Khaya* spp. timber production was noted to have declined in recent years as a result of large-scale replacement of woodlands by uncontrolled agricultural and rural development, rather than as a result of reduced demand or improved species protection (CITES MA of Côte d'Ivoire, *in litt.* to European Commission, 2020).

In addition to anthropogenic pressures, *Khaya* spp. have been noted to be affected by natural barriers to regeneration including short-term seed viability (Oni and Igboanugo, 2007; Orwa *et al.*, 2009) and high seedling mortality (Hall, 2011; CITES MA of Côte d'Ivoire *in litt.* to European Commission, 2020). The poor natural regeneration of *K. anthotheca* and *K. ivorensis* has been suggested by Oni and Igboanugo (2007) to result from the height of mother trees meaning that seeds often fall onto understory vegetation where they lose viability before they can reach the forest floor. *K. anthotheca* seeds are also commonly predated by rodents and beetles (Makana and Thomas, 2004), and young *K. anthotheca* trees are considered susceptible to the shoot borer *Tragocephala variagata* (Naidoo, 2007). The poor seed dispersal capacity of *Khaya* spp. has also been noted to negatively affect natural regeneration (Pinheiro *et al.*, 2011). Furthermore, logging has been reported to act synergistically with these intrinsic pressures on natural regeneration by reducing the number of large fruiting trees within populations (Pinheiro *et al.*, 2011).

6. Utilization and trade

6.1 National utilization

Benin: *K. senegalensis* is an important multipurpose non-timber forest product tree, with the stem bark harvested for traditional medicine to treat diseases in both humans and livestock, and the branches pruned for livestock fodder in the dry season (Gaoue and Ticktin, 2007). Although establishment of *K. senegalensis* plantations in the south of the country appeared to reduce debarking pressure on wild populations, the same was not true for pruning pressure (Gaoue and Ticktin, 2007).

Burkina Faso: *K. senegalensis* is reportedly used as an intercrop species in groundnut agriculture (Nikiema and Pasternak, 2008).

Central African Republic: *Khaya* spp. bark is harvested for the fermentation of palm wine (Le Ministre des Eaux Forêts Chasses et Pêches du République Centrafricaine, 2009).

Côte d'Ivoire: *Khaya* spp. are used in-country for woodworking, carpentry and medicinal purposes (CITES MA of Côte d'Ivoire *in litt.* to European Commission, 2020).

DRC: *K. anthotheca* and *K. grandifoliola* are used for furniture and joinery, and parts are used in traditional medicine and handicrafts (Kiyulu and Rodrigues, 2014). *K. anthotheca* is additionally used in the manufacture of musical instruments and traditional canoes, and for charcoal and firewood (Kiyulu and Rodrigues, 2014). *K. grandifoliola* trees are planted along roads and in cities for shade (Kiyulu and Rodrigues, 2014).

Madagascar: *K. madagascariensis* timber is used in joinery, carvings and traditional canoes (Maroyi, 2008), with the bark being used for traditional medicine (Andriamanohera and Rakotoarisoa, 2020). *K. madagascariensis* seeds are reportedly sold nationally for ornamental planting, for which it is widely used across Madagascar, and for reforestation purposes (Andriamanohera and Rakotoarisoa, 2020).

Malawi: *K. anthotheca* wood is used for boat building, construction, carpentry and interior fittings such as panelling and flooring, as well as for furniture, veneer and plywood (CITES MA of Malawi *in litt.* to European Commission, 2021). The species' bark and oil are used in traditional medicine, and the seeds are used in dye production (CITES MA of Malawi *in litt.* to European Commission, 2021). *K. anthotheca* trees are also planted as ornamentals and for water conservation (CITES MA of Malawi *in litt.* to European Commission, 2021).

Sudan: *K. senegalensis* is used for timber, firewood, carvings, medicinal purposes, and to source honey (CITES MA of Sudan *in litt.* to European Commission, 2021).

Togo: *K. senegalensis* was considered one of the most frequently used commercial medicinal plant species nationally (MERF, 2011a).

Zimbabwe: Although *K. anthotheca* occurs at ‘localised sites’ nationally, it is not commercially harvested (CITES Management Authority of Zimbabwe *in litt.* to European Commission, 2021).

6.2 Legal trade

Commercial exploitation of *Khaya* and *Entandrophragma* spp. has “sustained much of the timber industry in Central Africa for several decades”, with Meliaceae (including *Khaya* spp.) being the focus of “low levels of high-grade logging” in the region (Hall, 2011). *K. anthotheca* is also reported to be one of several timber species that “dominate the domestic markets” in east and southern Africa (Lukumbuzya and Sianga, 2017).

The United States of America (USA), the European Union, and China are three key international importers of the genus. Imports of *Khaya* spp. into the USA were noted to have increased as the species became a substitute for declining American mahogany, *Swietenia* spp. (Lemmens, 2008), which had become more expensive (Robbins, 2000). Imports of *Khaya* spp. from Cameroon and Ghana have also been reported to enter the USA via Europe (Robbins, 2000). According to figures recorded by value in USD from the International Trade Centre’s “Trade Map” tool², over the period 2010-2019 the USA imported African mahogany products (under Harmonised System (HS) code 4407290106³) equivalent to a total value of USD 214 359, of which USD 210 193 was imported from *Khaya* spp. range States (see Table 1), USD 2654 was imported from the European Union, and USD 1511 was imported from other countries (Trade Map, 2021). It should be noted that the trade names “African mahogany” and “Acajou d’Afrique” are also used to refer to other taxa, for example, “African mahogany” is also used to refer to *Azelia* spp. (Balima *et al.*, 2018); therefore, it cannot be assumed that all of this trade is in *Khaya* spp.

Table 1 Imports of African mahogany (HS code 4407290106) by value in USD from range States to the United States of America over the period 2010-2019. Blank cells in the table indicate that trade was not reported for that exporter/year combination. Source: Trade Map, 2021.

Exporter	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Ghana	9395	7221	9034	9031	8954	8966	4915	5767	8081	6067	77 431
Cameroon	4141	7570	8165	7695	6775	10 584	6569	6286	4155	5267	67 207
Côte d'Ivoire	5476	5596	4759	5602	3202	3128	926	750	490	139	30 068
Congo	1746	1853	2650	3365	2675	3813	2505	2128	1153	1901	23 789
DRC	404	294	212	293	740	604	1492	1583	303	26	5951
Gabon	31	163	471	1255	1327	854	364	124	164	344	5097
Guinea	230	28	16		155	77					506
Central African Republic	24		33			3		68			128
Gambia			9	7							16

A “high percentage of the wood sold in Europe as ‘mahogany’” was reported to be *K. ivorensis* (Orwa *et al.*, 2009). A report on timber trade in the DRC noted a timber concession near Beni that produced *K. anthotheca* parquet flooring for the European market (WWF, 2012). In ITTO’s 2017-2018 biennial review of the world timber situation, European consumer countries reporting imports of *Khaya* spp. included Cyprus, Czech Republic, Estonia, France, Latvia and Malta (ITTO, 2019).

According to figures recorded by weight in kilograms (kg) from the International Trade Centre’s “Trade Map” tool, over the period 2015-2019 China imported Acajou products (HS code 44072920⁴) equivalent to a total weight of 25 435 347 kg, of which 23 646 533 kg was imported from *Khaya* spp. range States (see Table 2), 47 968 kg was imported from the European Union (EU28), and 1 740 846 kg was imported from other countries (Trade Map, 2021).

² Trade Map is available at: <https://www.trademap.org/Index.aspx>

³ Harmonised System (HS) code 4407290106: Acajou d’Afrique aka African Mahogany, sawn or chipped lengthwise, sliced or peeled, of a thickness exceeding 6 mm.

⁴ HS code 44072920: Acajou wood, sawn lengthwise, of a thickness exceeding 6 mm.

Table 2 Imports of Acajou (HS code 44072920) by weight in kg from range States to China over the period 2015-2019. Blank cells in the table indicate that trade was not reported for that exporter/year combination. Source: Trade Map, 2021.

Exporter	2015	2016	2017	2018	2019	Total
Gabon	4 207 240	3 243 592	3 907 526	2 278 681	3 390 703	17 027 742
Cameroon	1 448 232	191 076	240 791	787 813	875 878	3 543 790
Congo			20 412	921 189	817 759	1 759 360
Côte d'Ivoire	108 058	70 798	124 561	7395	94 153	404 965
DRC	4280	14 026	83 149	149 290	92 110	342 855
Angola		140 050				140 050
Gambia			107 676			107 676
Benin	46 000	58 000				104 000
Central African Republic				74 145	25 065	99 210
Nigeria		24 000	23 000			47 000
Tanzania	35 570					35 570
Ghana	34 315					34 315

Angola: Forest licensing volumes for *Khaya* spp. are established annually (CITES MA of Angola *in litt.* to European Commission, 2022). Licensed harvest volumes for *K. anthotheca* were 8950 m³ in 2019, 8775 m³ in 2020, and 16 075 m³ in 2021; and 50 m³ of *K. ivorensis* was licensed for harvest in 2019 (harvest volume for *K. ivorensis* was set to zero in 2020 and 2021) (CITES MA of Angola *in litt.* to European Commission, 2022).

Cameroon: According to figures recorded by weight in kg from the International Trade Centre's Trade Map tool, over the period 2007-2014 Cameroon exported approximately 130 million kg of African mahogany to other *Khaya* range States, the European Union, and other countries (Trade Map, 2021; see Annex 2).

Congo: According to figures recorded by weight in kg from the International Trade Centre's Trade Map tool, over the period 2008-2017 Congo exported 7 897 262 kg of rough *Khaya* wood and 6 060 570 kg of Acajou wood to other *Khaya* range States, the European Union, and other countries (Trade Map, 2021; see Annex 2).

Côte d'Ivoire: The CITES MA of Côte d'Ivoire (*in litt.* to European Commission, 2020) reported that *Khaya* (species unspecified) was regularly exported from the country but noted that the volumes of timber exported over the past decade showed a regular decrease in line with a dwindling of wood resources in the country (see Annex 2).

Ghana: The CITES MA of Ghana (*in litt.* to European Commission, 2020) provided trade levels for "mahogany" (assumed to refer to either *Khaya* spp. or specifically *K. ivorensis*) over the period 2017-2019, with products including lumber, veneer, plywood and mouldings. The total volume of mahogany produced was ~6131 m³ in 2017, ~7617 m³ in 2018, and ~7552 m³ in 2019, valued at ~6.5 million USD, ~9.3 million USD, and ~8.9 million USD, respectively (CITES MA of Ghana *in litt.* to European Commission, 2020)⁵. In March of 2000, the international retail price per cubic metre of Ghanaian *Khaya* spp. sawn wood was reported to be 750 USD (Robbins, 2000).

Tanzania: *K. anthotheca* was reported to be "heavily used" for furniture in Tanzania, and to have been exported "in large quantities" from east Africa (Naidoo, 2007).

6.3 Parts and derivatives in trade

Khaya spp. are valuable commercial timber trees, harvested for the manufacture of a range of wood products including furniture, boats, musical instruments, panelling and joinery, flooring, veneer, and carvings (Donkor, 1997; Orwa *et al.*, 2009; Pinheiro *et al.*, 2011). Naidoo (2007) stated that *K. anthotheca* timber was durable and resistant to termites and borers, as well as moderately resistant to fungi. *K. ivorensis* has been characterised as "the most important *Khaya* spp. for providing African mahogany" (African Regional Workshop, 1998). The wood, bark, and roots of *Khaya* spp. are also used

⁵ Values converted from EUR to USD using <https://www.xe.com/currency-converter> [accessed 18th January 2021].

in traditional medicine (Maroyi, 2008; Pinheiro *et al.*, 2011). ***K. anthotheca*** (Naidoo, 2007) and ***K. senegalensis*** are used as shade trees and ornamentals (Danthu *et al.*, 2003).

Although sawn wood appears to be the dominant *Khaya* spp. product type in international trade (Trade Map, 2021), the genus enters the international market in the form of numerous products including lumber, sawn wood, veneer, plywood, machined wood and mouldings (CITES MA of Côte d'Ivoire *in litt.* to European Commission, 2020; CITES MA of Ghana *in litt.* to European Commission, 2020; Trade Map, 2021) (see Section 6.2). For this reason, it is proposed that *Khaya* spp. be included in Appendix II with Annotation #17 designating logs, sawn wood, veneer sheets, plywood and transformed wood.

6.4 Illegal trade

Illegal exploitation of *Khaya* spp. has been documented in several countries, both for domestic use (CITES MA of Côte d'Ivoire, *in litt.* to European Commission, 2020) and for export (Global Witness, 2019).

Cameroon: An independent forest monitoring mission conducted by the environmental organisation Forêts et Développement Rurale (FODER) in January 2018 documented illegal logging carried out by companies operating beyond their demarcated harvest boundaries in Mbam-et-Kim Division, Cameroon Central Region (FODER, 2018). In total, 162.8 m³ of illegally harvested timber was recorded from nine species including ***K. ivorensis*** (FODER, 2018).

Côte d'Ivoire: Illegal logging was noted to occur in Côte d'Ivoire, primarily for domestic needs (CITES MA of Côte d'Ivoire, *in litt.* to European Commission, 2020).

DRC: A company operating in the DRC was found to have illegally logged trees from several species, including 358 m³ of *Khaya* spp. logs exported to the European Union during June-October 2018 (Global Witness, 2019). Previously, a report on the timber trade in DRC noted that although national *Khaya* stocks were harvested mainly by artisanal loggers, the national forest code lacked "clear procedures" for such artisanal and small-scale operations, meaning that loggers were unable to obtain local harvesting rights using official government channels and instead relied on "informal procedures" (WWF, 2012). DRC's artisanal logging sector was previously described by Brown and Makana (2010) as largely illegal and unsustainable, as well as lacking in clear forestry regulations and "reliable statistics" on the level of exploitation taking place. According to Lukumbuzya and Sianga (2017), artisanal logging of *Khaya* and *Entandophragma* spp. comprised ~70% of DRC's timber trade.

Nigeria: Oni and Igboanugo (2007) stated that relative abundance of ***K. anthotheca*** and ***K. ivorensis*** across Nigerian lowland forest ecozones was negatively impacted by illegal and uncontrolled logging, noting that both species were observed at greater frequency in the forest reserves, national parks and strict nature reserves where logging was somewhat regulated. In addition, the authors noted that anthropogenic forest disturbance and illegal logging contributed to the poor regeneration rates of both species (Oni and Igboanugo, 2007).

Sudan: Illegal harvest of ***K. senegalensis*** for wood and firewood has resulted in rapid population decline (CITES MA of Sudan *in litt.* to European Commission, 2021).

6.5 Actual or potential trade impacts

Commercial exploitation of wild populations of *Khaya* spp. for the international timber market is considered an ongoing, primary threat to the genus. All *Khaya* spp. with the exception of ***K. comorensis*** were assessed as globally threatened in the IUCN Red List in 1998 on the basis of unsustainable harvest for timber (African Regional Workshop, 1998; Hawthorne, 1998a; Hawthorne, 1998b; WCMC, 1998a; WCMC, 1998b), and a recent reassessment of ***K. madagascariensis*** categorised the species as Vulnerable based on past population declines of over 30% in three generations as a result of exploitation for timber (Andriamanohera and Rakotoarisoa, 2020) (see Section 5).

7. Legal instruments

7.1 National

Legislative measures to protect national populations of *Khaya* spp. are in place in a number of range States – these are outlined in Annex 3. No relevant national legal instruments could be located for Angola, DRC, Madagascar, Niger, Sudan, Uganda or Zimbabwe.

7.2 International

Cameroon, Central African Republic, Congo, Côte d'Ivoire, DRC, Gabon, Ghana and Liberia have signed FLEGT Voluntary Partnership Agreements with the EU, which are legally binding agreements to ensure that timber and timber products exported to the EU are legally-sourced (European Forest Institute, 2020).

8. Species management

8.1 Management measures

Note that, unless otherwise stated, management measures in this section refer to harvest of timber rather than to non-timber forest products (NTFPs).

Onana *et al.* (2011) reported that *K. ivorensis*, among other key African timber species, is the focus of cultivation and planting in forest reserves by government forestry departments “in most countries” within its native range. The authors concluded that for this reason the species is unlikely to become extinct, despite exploitation for timber driving large trees to become “increasingly rare” (Onana *et al.*, 2011). Research on the effects of selective logging of *K. anthotheca* in Uganda found that removal of large individuals (defined as 45-50 cm DBH) led to reduced fruit production, as fruiting in *Khaya* spp. required a DBH of ≥40 cm (Plumptre, 1995). For *Khaya* spp. in natural forest, longer harvest rotations have been recommended by several authors (Lemmens, 2008; Maroyi, 2008; Nikiema and Pasternak, 2008), with 60-80 years considered “realistic” for *K. anthotheca* (Maroyi, 2008) and *K. ivorensis* (Lemmens, 2008), and 80-100 years recommended for *K. senegalensis* (Nikiema and Pasternak, 2008). Conversely, a shorter cutting rotation of ~30 years and a density of 80 trees per ha before harvest has been recommended for *K. ivorensis* grown in mixed plantations (Orwa *et al.*, 2009). It is not known whether these recommended cutting rotation timescales are applied in practice in any range States.

Angola: Presidential Decree No. 171/18 of 23rd July 2018, which approves the Forestry Regulation, lists *K. anthotheca* and *K. ivorensis* as wood-producing species with minimum exploitable diameters (MED) of 90 cm (Órgão oficial da República de Angola, 2018).

Cameroon: MEDs at breast height of 80 cm have been reported for *K. ivorensis* (Lemmens, 2008) and *K. grandifoliola* (Opuni-Frimpong, 2008).

Central African Republic: A MED of 80 cm has been reported for harvest of *K. grandifoliola* timber (Opuni-Frimpong, 2008). Article 49 of Order No. 09.021 of 2009 defines the bark of *Khaya* spp. (for the fermentation of palm wine) as a NTFP; Article 42 states that companies exploiting NTFPs require an exploitation permit from the Ministry of Forests and an operator’s card from the Ministry of Commerce (Le Ministre des Eaux Forêts Chasses et Pêches du République Centrafricaine, 2009).

Côte d'Ivoire: *Khaya* spp. are subject to the provisions of the national forestry code, with all principal species having a MED of 60-80 cm (CITES MA of Côte d'Ivoire, *in litt.* to European Commission, 2020). It was noted that consultations are underway with the private forestry sector with the aim of ensuring a sustainable domestic market and reduction in fraudulent exploitation of wood (CITES MA of Côte d'Ivoire, *in litt.* to European Commission, 2020). Nationally, *Khaya* plantations cover approximately 3000 ha in pure stands, and 3400 ha in mixed stands with other species (CITES MA of Côte d'Ivoire, *in litt.* to European Commission, 2020).

DRC: A MED of 80 cm has been reported for *K. grandifoliola* (Opuni-Frimpong, 2008).

Gabon: Order No. 000117/PR/MEFEPEPN of 1st March 2004 set a MED of 80 cm for *K. anthotheca* and *K. ivorensis* (Republique gabonaise, 2004).

Gambia: In 2017, a project proposal to develop non-detriment findings for *K. senegalensis*, *Cordyla pinnata* and *Pterocarpus erinaceus* was submitted to the CITES Tree Species Programme by the University of The Gambia and the National Agriculture Research Institute; however, the proposal was not selected for support (CITES Secretariat pers. comm. to UNEP-WCMC, 2020).

Ghana: In the 1970s, *K. ivorensis* was used for enrichment planting in three forest reserves, with the aim of augmenting Ghana's standing stock of valuable commercial timber (CITES MA of Ghana *in litt.* to European Commission, 2020). More recently, Ghana reported planting almost three million *K. ivorensis* seedlings in plantations and enrichment planting areas, 2016-2019 (CITES MA of Ghana *in litt.* to European Commission, 2020). A MED of 110 cm was reported for *K. ivorensis* (Lemmens, 2008) and *K. grandifoliola* (Opuni-Frimpong, 2008). The Forest Research Institute of Ghana has conducted studies into shoot borer resistance and vegetative propagation of *K. ivorensis*, as well as establishing gene banks of the species for *ex situ* conservation (CITES MA of Ghana *in litt.* to European Commission, 2020).

Mozambique: Ministerial Order No. 52-C/2003 of the 20th May 2003 classed *K. anthotheca*, under the synonym *K. nyasica*, as a Class 1 timber species with a MED of 50 cm (Government of Mozambique, 2003).

Sierra Leone: Article 9 of the Forestry Regulation of 1989 defines non-species-specific "minimum girth limits" for harvest as 1.83 m in selective felling areas and 1.22 m in clear-felling areas, unless otherwise specified in a management plan, concession agreement or timber license (Government of Sierra Leone, 1990).

Tanzania: A minimum harvest DBH of 55 cm (minimum girth of 165 cm) was set for *K. anthotheca* under the Forest Regulations of the 1st January 2004 (Government of Tanzania, 2004).

8.2 Population monitoring

No information on specific population monitoring schemes was found, however, several plantations of *K. ivorensis* established in Ghana are used as research plots to explore the effects of different silvicultural systems on success of the species in plantation, investigate outcomes of different rooting media on vegetative propagation, and explore methods of increasing *K. ivorensis* resistance to shoot borers (CITES MA of Ghana *in litt.* to European Commission, 2020). Similarly, the ongoing FORESTINOV project "Promoting mixed plantations to secure the production of timber wood and to maintain ecosystem services" in Côte d'Ivoire aims to identify the most effective strategies for growth of *K. ivorensis* in national reforestation and plantation schemes (CITES MA of Côte d'Ivoire *in litt.* to European Commission, 2020).

8.3 Control measures

8.3.1 International

Lukumbuzya and Sianga (2017) examined timber trade within east and southern Africa, in which *K. anthotheca* was highlighted as a key timber species in trade. The authors noted that the regional timber industry was not well-monitored, with harvest and processing "largely unregulated" and records of companies, target species, harvest volumes and import and export volumes "largely unavailable" (Lukumbuzya and Sianga, 2017).

8.3.2 Domestic

No control measures were identified.

8.4 Captive breeding and artificial propagation

Although *Khaya* spp. are considered to be "largely undomesticated throughout their natural range", and exploitation of African mahoganies has largely focussed on natural populations rather than plantations (Oni and Igboanugo, 2007), some plantations have been reported from Benin (Gaoue and Tickin, 2007), Burkina Faso (Nikiema and Pasternak, 2008), Côte d'Ivoire (Nikiema and Pasternak, 2008; CITES MA of Côte d'Ivoire *in litt.* to European Commission, 2020), Ghana (CITES MA of Ghana *in litt.* to European Commission, 2020), Mali (Nikiema and Pasternak, 2008), Nigeria (Lemmens, 2008) and Togo (Nikiema and Pasternak, 2008; FAO, 2020b). *K. ivorensis* in particular has been reported to grow

rapidly in plantation and to produce high quality timber (Lemmens, 2008), and *K. madagascariensis* reportedly grows fairly rapidly in plantation and has been reported to be “progressively planted” (Maroyi, 2008). The CITES MA of Côte d’Ivoire (*in litt.* to European Commission, 2020) reported that in plantation trials *K. anthotheca* showed faster growth than *K. ivorensis*, and specimens planted in shade showed slower growth in comparison to those in open areas.

It has been noted that *Khaya* spp. grown in mixed plantations rather than monoculture are more resilient to pests (CITES MA of Ghana *in litt.* to European Commission, 2020). *K. anthotheca* and *K. ivorensis* seedlings in plantations were reported to be highly susceptible to attack from the shoot borer *Hypsipyla robusta* (Oni and Igboanugo, 2007), resulting in mortality or growth defects that affect their timber market value (Atuahene, 1997 in Oni and Igboanugo, 2007). Enrichment planting trials conducted 2009-2014 in a logging concession in south-eastern Cameroon found that growing *K. anthotheca* in slightly shaded conditions rather than in open areas improved growth and reduced *H. robusta*-induced mortality (Doucet *et al.*, 2016). In Malawi, the caterpillar *Heteromygmia dissimilis* was also noted to attack the leaves of *K. anthotheca* (CITES MA of Malawi *in litt.* to European Commission, 2021). Germination success of *K. anthotheca* in plantation was reported to be “high but sporadic”, with 90% of seeds germinating within three weeks of being sown (CITES MA of Malawi *in litt.* to European Commission, 2021). Plantation trials of *K. anthotheca* and *K. ivorensis* in Côte d’Ivoire found that the germination potential of harvested seeds rapidly declined with storage time, with germination success decreasing by approximately 50% for both species 1-2 months post-harvest; this was suggested to result from the seeds’ high oil content (CITES MA of Côte d’Ivoire *in litt.* to European Commission, 2020).

Khaya plantations have also been established in parts of Australia (Dickinson *et al.*, 2011), Sri Lanka (Nikiema and Pasternak, 2008), Southeast Asia (Orwa *et al.*, 2009) and South and Central America (Naidoo, 2007; Lemmens, 2008; Ferraz Filho *et al.*, 2021). *K. senegalensis* has been described as the “most widely planted high value timber species in northern Australia” (Dickinson *et al.*, 2011) and “a priority species for timber plantation establishment in Sri Lanka” (Nikiema and Pasternak, 2008). In Brazil, plantations of *K. grandifoliola* and *K. senegalensis* were reported to constitute ~50 000 ha as of 2020 (Ferraz Filho *et al.*, 2021), resulting in small amounts of Brazilian plantation *Khaya* wood entering the international market (Ribeiro *et al.*, 2019). Research carried out in 2016 by Santos *et al.* (2021) in south-eastern Bahia, Brazil found that both *K. grandifoliola* and *K. ivorensis* were most successful in mixed plantations with herbicide application to control competitive understory vegetation. The study also found that, under the same plantation conditions, *K. grandifoliola* trees grew more rapidly than *K. ivorensis* trees, although as a result the former were more prone to developing bends in their trunks that made them less commercially useable for producing sawn timber; moderation in fertiliser use was recommended to minimise growth spurts and thus control trunk stability (Santos *et al.*, 2021). Trial plantations of *K. grandifoliola* have additionally been established in Indonesia (Opuni-Frimpong, 2008). *K. anthotheca* is grown in plantations in Cuba, Puerto Rico and South Africa (Naidoo, 2007), and *K. ivorensis* is grown in plantations in Fiji, Indonesia and Malaysia (Orwa *et al.*, 2009) and has been used in reforestation in Brazil (Lemmens, 2008).

Khaya spp. timber resembles that of CITES-listed *Swietenia* spp. (see Section 9 for detail) that are native to Brazil and Cuba, where, as noted previously, some *Khaya* spp. plantations have been established (Naidoo, 2007; Lemmens, 2008; Ferraz Filho *et al.*, 2021). However, given the relatively small scale of these plantations at present, as well as the broad distribution of *Khaya* plantations around the world, it is considered that any modest conservation gains of a global CITES listing for the genus would currently not match the administrative burden of enforcement. Plantations established outside of *Khaya* spp. African range States are thus excluded from this proposal.

8.5 Habitat conservation

K. ivorensis, *K. madagascariensis*, and *K. senegalensis* have been reported to be the focus of forest restoration and reforestation efforts in Ghana (CITES MA of Ghana *in litt.* to European Commission, 2020), Madagascar (Andriamanohera and Rakotoarisoa, 2020), and Togo (CITES MA of Togo *in litt.* to European Commission, 2020) respectively. The CITES MA of Ghana (*in litt.* to European Commission, 2020) noted that over 1 million *K. ivorensis* seedlings had been planted in total from 2016 to 2019 as part of the country’s Forest Investment Program to enhance natural forest and combat deforestation and forest degradation. In Burkina Faso, “conservation stands” of *K. senegalensis* are reportedly managed for seed production by local communities in partnership with Centre National de Semences Forestières (Nikiema and Pasternak, 2008). In Yapo-Abbé, Côte d’Ivoire, reforestation schemes in 2014 and 2019 included the planting of 714 ha and 605 ha of *Khaya* spp. respectively (CITES MA of Côte d’Ivoire *in litt.* to European Commission, 2020).

8.6 Safeguards

Protected species status has been mandated for *K. anthotheca* in Malawi, *K. grandifoliola* in Benin and Togo, *K. madagascariensis* in Comoros, and *K. senegalensis* in Benin, Burkina Faso, Gambia and Togo. National legislation is in place to restrict harvest of all *Khaya* spp. in Tanzania, *K. ivorensis* in Ghana, and *K. senegalensis* in Mali and Senegal. Additionally, log export bans are in place for *K. anthotheca* and *K. ivorensis* in Liberia and for Acajou (*Khaya* spp.) in Cameroon, and in Zambia the import and export of *K. anthotheca* logs is controlled by ministerial order (see section 7.1).

9. Information on similar species

Khaya, *Entandrophragma* and *Swietenia* all yield very similar reddish-brown wood (Gasson, 2011). In particular, *Khaya ivorensis* and *Entandrophragma angolense*, as well as *Carapa guianensis*, are described as being easily mistaken for CITES-listed *Swietenia* spp. (Holtken *et al.* 2012). Koch (pers. comm. to UNEP-WCMC, 2021) noted that “there is a risk” of mistaking *Khaya* for *Swietenia*, especially if the timber originates from fast-growing plantations. However, *Khaya* was considered “clearly” distinguishable from *Entandrophragma* based on macroscopic and microscopic wood characteristics (Koch pers. comm. to UNEP-WCMC, 2021). *Khaya* is also reportedly “occasionally” mistaken for *Aucoumea klaineana* at the macroscopic level, though the taxa can be clearly distinguished from one another with microscopic analysis (Koch pers. comm. to UNEP-WCMC, 2021). In a study of wood identification of Meliaceae timbers using mass spectrometry analysis, Deklerck *et al.* (2019) noted that the chemical fingerprint of *Khaya anthotheca* was difficult to differentiate from that of *Entandrophragma angolense*, *E. candollei* and “several *Swietenia* species”. Holtken *et al.* (2012) reported that species identification via DNA sequence analysis of wood samples was often challenging due to the difficulty in extracting sufficient DNA from processed and/or dried heartwood. However, the authors noted that a genetic marker system had been developed to successfully differentiate *Swietenia* wood samples from *Carapa*, *Entandrophragma* and *Khaya* (Holtken *et al.* 2012).

Although there appears less difficulty in identification between the two genera *Khaya* spp. and *Azelia* spp., both are referred to in trade as “African mahogany” (Oni and Igboanugo, 2007; Balima *et al.*, 2018).

10. Consultations

A consultation was distributed by the European Union to all range States in April 2021 and in October 2021 (see Annex 1).

11. Additional remarks

12. References

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Summary of range State reponses

Range State	Response
Angola	Unclear, noting that <i>Khaya</i> spp. in Angola are in “relative ecological balance”, and that a forest inventory would be beneficial.
Benin	Supports listing in Appendix II
Burkina Faso	
Cameroon	
Central African Republic	
Chad	Supports listing in Appendix II
Comoros	Supports listing in Appendix II
Congo	
Côte d’Ivoire	Supports listing of the genus in Appendix II, but with the exclusion of reforested populations
Democratic Republic of the Congo	
Gabon	
Gambia	Supports listing in Appendix II
Ghana	Under consideration
Guinea	
Guinea Bissau	
Liberia	Supports listing in Appendix II
Madagascar	
Malawi	Supports listing in Appendix II
Mali	
Mozambique	
Niger	
Nigeria	
Senegal	Supports listing in Appendix II
Sierra Leone	
South Sudan (non-Party)	Supports listing in Appendix II
Sudan	Supports listing in Appendix II (specifically referred to <i>K. senegalensis</i>).
Togo	Supports listing of <i>K. grandifoliola</i> in Appendix II
Uganda	Supports listing in Appendix II
United Republic of Tanzania	
Zambia	Supports listing in Appendix II
Zimbabwe	Status in Zimbabwe does not warrant CITES listing.

Exports of African Mahogany, Acajou and *Khaya* spp. from *Khaya* spp. range States

Cameroon: According to figures recorded by weight in kg from the International Trade Centre's Trade Map tool, over the period 2007-2014 Cameroon exported *Khaya* spp. to other *Khaya* range States, the European Union, and other countries (Trade Map, 2021). The products were traded under three HS codes: 4407290000⁶, 4407290200⁷ and 4408390200⁸, comprising totals of 115 511 702 kg, 15 138 730 kg, and 69 793 kg respectively (see Table 3) (Trade Map, 2021).

Table 3 Exports of *Khaya* spp. (HS codes 4407290000, 4407290200 and 4408390200) by weight in kg from Cameroon over the period 2007-2014. No exports were reported for the year 2013. Source: Trade Map, 2021.

HS code	Importer	2007	2008	2009	2010	2011	2012	2014	Total
4407290000	Range States	1 940 734	10 288	5609		30 000			1 986 631
	European Union	89 220 466	49 042	189 293	105 030	244 907	109 752		89 918 490
	Rest of World	21 315 140	652 584	150 114	188 305	932 396	368 042		23 606 581
4407290200	Range States				229 049	108 247	57 530	39 851	434 677
	European Union				756 400	280 741	687 128	651 003	2 375 272
	Rest of World				1 503 651	2 643 849	1 901 662	6 279 619	12 328 781
4408390200	Range States		4899						4899
	European Union						31 457		31 457
	Rest of World					2563	30 874		33 437

Congo: According to figures recorded by weight in kg from the International Trade Centre's Trade Map tool, over the period 2008-2017 Congo exported *Khaya* spp. under HS codes 4403490200⁹ and 4407290200¹⁰ comprising totals of 7 897 262 kg and 6 060 570 kg respectively (see Table 4) (Trade Map, 2021).

Table 4 Exports of *Khaya* spp. (HS codes 4403490200 and 4407290200) by weight in kg from Congo over the period 2008-2017. No exports were reported for 2015-2016. Source: Trade Map, 2021.

HS code	Importer	2008	2009	2010	2011	2012	2013	2014	2017	Total
4403490200	Range States	9574							253 756	263 330
	European Union	1 321 147	93 060	185 696	108 551	26 772	275 829	606 576	19 992	2 637 623
	Rest of World	1 455 066	35 398	70 634	465 686	215 779	765 365	1 547 396	440 985	4 996 309
4407290200	Range States						237 214			237 214
	European Union	94 238					176 966			271 204
	Rest of World	3 553 493	62 729	69 312			1 866 618			5 552 152

Côte d'Ivoire: The CITES MA of Côte d'Ivoire (*in litt.* to European Commission, 2020) reported that *Khaya* [species unspecified] was regularly exported from the country but noted that the volumes of timber exported over the past decade showed a regular decrease in line with a dwindling of wood resources in the country (see Table 5).

⁶ HS code 4407290000: African mahogany wood, sawn (*Khaya*).

⁷ HS code 4407290200 (Cameroon): African mahogany or Ngollon or Ndola or Deke timber, sawn.

⁸ HS code 4408390200: African mahogany wood in sheets of veneer, of plywood, not exceeding 6 mm in thickness.

⁹ HS code 4403490200: Rough *Khaya* (mahogany) wood, unsquared.

¹⁰ HS code 4407290200 (Congo): Acajou wood, sawn, with a thickness exceeding 6mm.

Table 5 Volumes of *Khaya* spp. legally exploited and exported from Côte d'Ivoire, 2009-2019. Source: CITES MA of Côte d'Ivoire (*in litt.* to European Commission, 2020).

Year	Volume acajou (<i>Khaya</i> spp). exploited within logging perimeter (m ³)	Volume acajou (<i>Khaya</i> spp). machined and exported (m ³)
2009	24 015 588	14 352 041
2010	27 386 300	18 800 340
2011	23 206 463	6 765 011
2012	42 419 864	13 629 934
2013	34 877 369	10 359 414
2014	22 759 825	8 139 377
2015	20 180 322	6 706 061
2016	15 952 835	4 753 947
2017	9 061 650	3 358 881
2018	7 977 822	2 373 276
2019	3 433 286	2 544 984

National legal instruments

Range State	Legal protection
Angola	In January 2018, the Ministry of Agriculture reportedly banned the exploitation of forest resources, including felling, movement and transportation of logs (Macauhub, 2018). However, it is unclear if this legislation is still in place, as the CITES MA of Angola reported harvest of <i>Khaya</i> spp. in 2019, 2020 and 2021 (CITES MA of Angola <i>in litt.</i> to the European Commission, 2022).
Benin	<i>K. grandifolia</i> and <i>K. senegalensis</i> were both listed as protected species by Decree No. 96-271 of 2 nd July 1996, Article 25, which implements Benin's Forest Code (Republic of Benin, 1996). Article 36 of the Forest Code states that the cutting, felling, delimiting and uprooting of such protected species is prohibited, except when authorised by the Forest Administration (Republic of Benin, 1993). In addition, Articles 3 and 5 of Inter-ministerial Decree 2007/0053/MEPN/MIC/DC/SGM/DGFRN/DGCE, lay out provisions for importing and exporting timber products and prohibit export of raw timber, and Article 8 prohibits both the national transit and re-export of raw and unprocessed timber (Republic of Benin, 2007). In March 2017, the government issued a decree authorising the export of wood products from 2015 and 2016 until 31 st December 2017 (General Directorate of Water, Forests and Hunting Benin, 2019). Since January 2018, national authorities were reported to have taken steps to prohibit exploitation of <i>K. senegalensis</i> including for local use (CITES MA of Benin <i>in litt.</i> to the European Commission, 2021).
Burkina Faso	Order No. 2004-019/MECV of 7th July 2004 listed <i>K. senegalensis</i> as a protected species that cannot be cut, felled, uprooted or burnt unless authorised by the competent forest authority (Government of Burkina Faso, 2004). However, it is unclear whether this protection remains in place as the Order was associated with implementation of the country's 1997 Forest Code (Law No. 006/97/ADP), which was repealed in 2011 by a new Forest Code (Government of Burkina Faso, 2011). As of 2016, it appeared that no implementing decree concerning species protection under the new Forest Code had been published (CoP17 Prop. 57). National-level exploitation and trade in timber was suspended by Decree No. 2005 – 003/MECV/MCPEA of 9th March 2005 (Government of Burkina Faso, 2005); the suspension was reported to be ongoing as of 2018 (Environmental Investigation Agency, 2018). However, two sawmills in Banfora were temporarily exempt from the suspension, and as of 2016 it was unclear whether they were still in operation (Portail du Service d'Information du Gouvernement burkinabe, 2016).
Cameroon	Acajou logs [<i>Khaya</i> spp.] were listed in Annex I-B of Cameroon's Forest Law Enforcement, Governance and Trade (FLEGT) Voluntary Partnership Agreement with the European Union as products prohibited from export (The European Union and The Republic of Cameroon, 2011). Note that this does not apply to sawn timber and processed logs.
Central African Republic	<i>Khaya</i> spp. are not included in the list of protected timber species under Forest Code implementing decree Order No. 09.021 of 2009 (Le Ministre des Eaux Forêts Chasses et Pêches du République Centrafricaine, 2009). However, a 2003 Decision from the Minister of Water, Forestry, Hunting and Fishing suspended all timber logging and export until specific authorisation was granted to resume these activities on a case-by-case basis (Le Ministre des Eaux Forêts Chasses et Pêches du République Centrafricaine, 2003); it is unclear whether this Decision is still in operation.
Chad	The export of wood and charcoal, and their use by companies within Chad, was reportedly prohibited by Order No. 025/MEERH/SECHVP/SG/DFLCD/2008 of 6 th August 2008 (OFAC, 2013); however, this legislation could not be accessed for verification.
Comoros	<i>K. comorensis</i> was classed as a fully protected species by Order No. 01/031/MPE/CAB of the 14th May 2001 (Republique Federale Islamique des Comoros, 2001). Articles 4 and 7 of the Order state that the cutting, uprooting, destruction, transport, purchase, sale and export or re-export of such species, including their derivatives, is strictly prohibited unless authorised on a case-by-case basis by the Minister of the Environment for scientific research purposes only (Republique Federale Islamique des Comoros, 2001).

Congo	Article 48 of the Forest Code (Law No. 16-2000 of 20th November 2000) prohibited export of raw logs and mandated that wood products could only be exported in finished or semi-finished form (Government of Congo, 2000). As of 2018, this legislation was reportedly still in place (EIA, 2018).
Côte d'Ivoire	Decree 2013-816 of 26th November 2013 banned the exploitation, transport, processing and export of timber and woodworking species from forests located above the 8th parallel of latitude (CITES MA of Côte d'Ivoire <i>in litt.</i> to European Commission, 2020).
Democratic Republic of Congo	
Gabon	A ban on export of unprocessed logs was reportedly put in place in May 2010 (Mongabay, 2010). The ban was reportedly still in place in 2018 (EIA, 2018).
Gambia	<i>K. senegalensis</i> was listed as a protected species under the Second Schedule of The Forest Regulations of 1998, implementing the 1998 Forest Act (Government of Gambia, 1998). However, it is unclear if this protection is still in place as a new Forest Act was reportedly adopted in 2018 (EIA, 2020); the 2018 Forest Act could not be accessed for verification. The import, transport and export of logs was reportedly suspended by the Ministry of Environment in 2017, although the suspension was temporarily lifted on several occasions to allow some re-exports (EIA, 2020).
Ghana	<i>K. ivorensis</i> is classed as a restricted species, excluding it from normal yield allocation and requiring a permit from the Ministry of Lands and Natural Resources for its logging or other harvesting (CITES MA of Ghana <i>in litt.</i> to European Commission, 2020).
Guinea	Order No. A12006/6634/MAEF/CAB/SG of the 21 st November 2006 prohibited the export of rough sawn timber and teak logs (Le Ministre des Eaux et Forêts de la République de Guinée, 2006).
Guinea-Bissau	In 2015, a moratorium on logging and log exports was reportedly put in place (Reuters, 2015). However, in January 2021 it was reported that a decree had been drafted to lift the moratorium (Mongabay, 2021).
Liberia	Export of <i>K. anthotheca</i> and <i>K. ivorensis</i> logs is prohibited under Forestry Development Authority Regulation No. 18 of 1 st October 1990 (FDA, 1990).
Madagascar	
Malawi	<i>K. anthotheca</i> , under the synonym <i>K. nyasica</i> , was classed as a protected species by Government Notice No. 89 of 30 th March 1994 (Government of Malawi, 1994).
Mali	<i>K. senegalensis</i> was classed as a partially protected species by Decree No. 10-387/P-RM of 26 th July 2010 (Republic of Mali, 2010a). Under Article 22 of Law No. 10/028 of 12 th July 2010, an exploitation title is needed in order to cut partially protected species; titles are only granted after payment of a royalty per tree, and minimum harvest diameters are set by law (Republic of Mali, 2010b). Additionally, Interministerial Decree No. 2015-1536/CI/MEF-SG of 5 th June 2015 banned the export of unprocessed wood products and charcoal (Republic of Mali, 2015), and Decision No. 0016/MEADD-SG DU of 27 th May 2020 suspended all exploitation of timber and sawn timber in Mali until further notice (Republic of Mali, 2020).
Mozambique	An export ban on raw logs was put in place in 2007 (CIFOR, 2014) and was reported to still in place as of 2018 (EIA, 2018).
Niger	
Nigeria	The export of rough or sawn timber is prohibited (Nigeria Customs Service, 2021).
Senegal	<i>K. senegalensis</i> was classed as a partially protected species by Decree No. 2019-110 of 16 th January 2019, which implements the 2018 Forest Code (Republic of Senegal, 2019). Under Articles 50-51 of the Decree, felling, cutting and uprooting of partially protected species is prohibited unless authorised by the Directorate of Water, Forestry, Hunting and Soil Conservation (Republic of Senegal, 2019).

Sierra Leone	A log export ban was reportedly put in place in 2007 (Munro and Hiemstra-van der Horst, 2012) and although the ban has been temporarily lifted on several occasions to allow exports of stockpiled logs, it was reportedly reinstated in April 2018 (Sewa News Stream, 2018).
South Sudan	A wood and charcoal export ban was reportedly put in place in July 2018 (Sudan Tribune, 2018).
Sudan	
Togo	<i>K. grandifoliola</i> and <i>K. senegalensis</i> were both reportedly listed as protected species by Decision No. 233/AE of the 18 th April 1947, which implemented the 1938 Forest Code, according to Togo's National Forest Action Plan 2011-2019 (MERF, 2011a). The felling, uprooting and mutilation of such species is reportedly prohibited (MERF, 2011b). However, the 1938 Forest Code was repealed and replaced with a new Forest Code on 19 th June 2008 (Government of Togo, 2008). Although the 2008 Forest Code designates certain species as fully protected from harvest unless for scientific purposes, no implementing decree for plant species had been adopted as of 2016 (CoP17 Inf. Doc. 79) and it appears that this is still the case.
Uganda	
United Republic of Tanzania	All <i>Khaya</i> spp. of any size were classed as reserved trees by Government Notice No. 506 of the 3 rd August 1995 (Government of Tanzania, 1995). Under the 2002 Forest Act, the unlicensed felling, cutting, damage, removal of or sale of produce from a reserved tree on general land is prohibited (Government of Tanzania, 2002). Furthermore, a log export ban was reportedly put in place in 2004 (Lukumbuzya and Sianga, 2017).
Zambia	<i>K. anthotheca</i> logs were classed as controlled goods under Statutory Instrument No. 27 of the 24 th March 2017; such goods may be subject to import and export restrictions or bans by ministerial order (Government of Zambia, 2017).
Zimbabwe	