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

Seventeenth meeting of the Plants Committee
Geneva (Switzerland), 15-19 April 2007

Review of Significant Trade in specimens of Appendix-II species

SPECIES SELECTED FOLLOWING COP13

1. This document has been prepared by the Secretariat.

Background

2. At its 15th meeting (PC15, Geneva, May 2005), the Plants Committee agreed that, under the terms of paragraph b) of Resolution Conf 12.8 (Rev. CoP13), a review should be undertaken of trade in *Aloe ferox, Christensonia vietnamica, Euphorbia candelabrum, Euphorbia stellata, Myrmecophila tibicinis, Nardostachys grandiflora, Pachypodium bispinosum, Pachypodium succulentum, Pterocarpus santalinus, Rauvolfia serpentina* and *Taxus wallichiana*.

3. The Secretariat notified the range States of the selected species, explained the reason for this selection and requested comments regarding possible problems with the implementation of Article IV of the Convention. At PC16 (Lima, July 2006), the Committee reviewed the available information according to paragraph f) of Resolution Conf. 12.8 (Rev. CoP13) and decided to eliminate *Aloe ferox, Euphorbia candelabrum, Euphorbia stellata* and *Nardostachys grandiflora* from the review (see PC16 WG1 Doc. 1).

4. IUCN - The World Conservation Union was engaged to compile information about the biology and management of and trade in *Christensonia vietnamica, Myrmecophila tibicinis, Pachypodium bispinosum, Pachypodium succulentum, Pterocarpus santalinus, Rauvolfia serpentina* and *Taxus wallichiana*, and to provide a preliminary categorization of these species in compliance with paragraphs h) and i) of Resolution Conf. 12.8 (Rev. CoP13).

5. The Secretariat transmitted the resulting reports to the range States, which had 60 days to submit comments, as set in Resolution Conf. 12.8 (Rev. CoP13), paragraph j). The reports are attached to this document as follows:

Annex 1: *Christensonia vietnamica*
Annex 2: *Myrmecophila tibicinis*
Annex 3: *Pachypodium bispinosum*
Annex 4: *Pachypodium succulentum*
Annex 5: *Pterocarpus santalinus*
Annex 6: *Rauvolfia serpentina*
Annex 7: *Taxus wallichiana*

6. The reports referred to above present conclusions about the effects of international trade on the selected species, the basis on which such conclusions are made, and problems with the implementation of Article IV of the Convention. They provide preliminary categorizations of the selected species into three categories as outlined in Resolution Conf. 12.8 (Rev. CoP13) as follows:

    i) 'species of urgent concern' shall include species for which the available information indicates that the provisions of Article IV, paragraph 2 (a), 3 or 6 (a) of the Convention are not being implemented;

    ii) 'species of possible concern' shall include species for which it is not clear whether or not these provisions are being implemented; and

    iii) 'species of least concern' shall include species for which the available information appears to indicate that these provisions are being met.

Actions required by the Plants Committee

7. In accordance with paragraphs k) and l) of Resolution Conf. 12.8 (Rev. CoP13), the Plants Committee is requested to review the reports and the responses received from range States and, if appropriate, to revise the preliminary categorizations proposed by the consultant.

8. Problems identified that are not related to the implementation of Article IV, paragraph 2 (a), 3 or 6 (a), should be referred to the Secretariat.

9. In accordance with paragraphs m) to o) of the same Resolution, the Plants Committee is also requested to formulate recommendations for species or urgent concern and of possible concern. Such recommendations should differentiate between short-term and long-term actions, and be directed to the range States concerned. Species of least concern shall be eliminated from the review.

Christensonia vietnamica Haager, 1993

FAMILY: Orchidaceae

COMMON NAMES: Lan tinh tay, Lan cu lao minh, Lan bach moi trung (Vietnamese).

GLOBAL CONSERVATION STATUS: Not assessed.

SIGNIFICANT TRADE REVIEW FOR: Viet Nam

SUMMARY

Christensonia vietnamica is an epiphytic orchid endemic to Viet Nam. It is the only member of its genus and was formally described in 1993 although is thought likely to have been traded within Viet Nam prior to this date. The only confirmed records are from a site in Khanh Hoa province in southern Viet Nam although there are indications that the species also occurs or occurred elsewhere. There is very little recent information on its status in the wild. It is listed as critically endangered in the most recent national orchid checklist and at least one authority believes the species may now be extinct in the wild.

Limited wild export (~ 6500 specimens) from Viet Nam has been reported, almost all in the years 1998-2000. No export at all has been reported since 2003. The species is currently (2007) relatively widely offered commercially outside Viet Nam as artificially propagated plants, and there has been a small amount of international trade in artificially propagated specimens in recent years. The species has also been used to create hybrids with related species, for example those in the genera *Renanthera* and *Vanda*. No recent illegal international trade has been documented.

No non-detriment findings have been conducted for *C. vietnamica*.

The absence of any recorded trade in wild plants in this species since 2003 and the lack of indication of any illegal trade mean that the species should be considered of **Least Concern.** However, it is possible that the cessation of export has been because plants are no longer available, and this could be because they have been almost or entirely collected out. Any increase in/ resumption of trade would be of concern, given the lack of information available upon which to base non-detriment findings. The species may merit inclusion in Appendix I of CITES.

SPECIES CHARACTERISTICS

The orchid *Christensonia vietnamica* is an epiphyte recorded from the wild in lowland deciduous gallery forest on silicate basement rock substrate (Averanov and Averyanova, 2003; Haager, 1993). The species is endemic to Viet Nam (Nguyen Tien Ban, 2005; Nguyen Tien Tich, 2001; Pham Hoang Ho, 2001), with confirmed records from Khanh Hoa province (Haager, 1993; Christenson, 1996; Christenson, 2001). Stems stand 7-30 cm with strap-shaped leaves to 6 cm long. Plants contain 1-3 branching inflorescences, each containing 3-5 (usually 4) flowers, with yellow-green petals and white lip midlobe. Flowering occurs from April to August. *C. vietnamica* is closely related to *Aerides*, *Vanda* and *Rhyncostylis* (Schuiteman and de Vogel, 2000; Christenson, 2001).

INTERNATIONAL TRADE

International trade of *Christensonia vietnamica* appears to be exclusively confined to ornamentals. CITES trade data suggests that until 2004, approximately 95% of the global trade of *C. vietnamica* was in wild specimens (see Table 1). The recorded trade in *C. vietnamica* since 2004 has only been with artificially propagated specimens exported from Malaysia and Thailand mainly to Japan, France, Guadeloupe and the US.

Table 1: Exports excluding re-exports of *Christensonia vietnamica 1996-2005**

Export Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
Viet Nam	0	7**	4547	780#	1060	4**	50	39	0	0	**6487**

(Source: CITES trade statistics derived from the *CITES Trade Database*, UNEP World Conservation Monitoring Centre, Cambridge, UK.)

* Consolidated exports for *Christensonia* spp. and *C. vietnamica*
** of which 5 specimens (1997) and 4 specimens (2001) are recorded as being artificially propagated
\# including 37 confiscated specimens

The attractive appearance of the species, with its unusually coloured flowers, and its taxonomic distinctness evidently made the species desirable amongst orchid collectors when it was first discovered in the early 1990s. This is likely to have fuelled over-collection of wild plants. The species is now advertised for sale by a number of specialist orchid nurseries (e.g. in Belgium, South Africa and the USA) apparently as artificially propagated plants. These do not command premium prices indicating that demand for the species is not now particularly high.

The species has been used to create intergeneric hybrids, for example with Renanthera (X Chrisanthera) and Vanda (X Chrisanda).

COUNTRY ACCOUNTS

Viet Nam

Status

Christensonia vietnamica is not listed in Viet Nam's *Red Data Book* (Anon, 1996; 2007). The species is confirmed in the wild from Khanh Hoa province only (Haager, 1993; Christenson, 1996; Christenson, 2001) with unconfirmed records from Ninh Thuan (Vu Anh Tai, 2007) and Gia Lai provinces (Anon, no date).

No data on population status or trends have been located, but the frequency of species occurrence has been listed as very rare with approximate conservation status given as critically endangered in the most recent national orchid checklist (Averyanov and Averyanova, 2003). Nguyen Tien Hiep (2007) considers that the species may already be extinct in the wild.

Management and trade

Recorded trade of *Christensonia vietnamica* from Viet Nam has been almost entirely in wild specimens, with only nine specimens recorded as being artificially propagated and 37 from legal confiscation since the species was first described in 1993. Trade in 1997 comprised just seven specimens, while in 1998 the trade peaked at 4547 recorded specimens. The vast majority (approx. 93%) were destined for the US market with most of the remainder imported by Japan. Trade in 1999 was dramatically reduced to 780 specimens, 62% of which were imported by Japan and 34% to the US. The year 2000 saw a slight increase in exported wild specimens to 1060, with 52% imported by Japan, 47% by Taiwan and 1% destined for Thailand. In 2001 no wild specimens were exported from Viet Nam, and only 92 more were exported to the end of 2003 and all of these to the US. Export of *C. vietnamica* of any source from Viet Nam has not been recorded by national authorities since 2003.

The species is not currently listed as a protected species under national Decree No. 32/2006/ND-CP which forbids, or restricts, commercial exploitation of listed taxa. National restrictions exist for 'special use forest' (SUF). According to Decision No. 186/2006/QD-TTg it is prohibited to extract natural resources from SUFs except in certain designated areas, such as administrative zones, and then with permission from the forest management board only. However, it is not known whether *C. vietnamica* is found in any SUFs.

There is no evidence of artificial propagation or cultivation of this species in Viet Nam.

No non-detriment findings have been conducted for *C. vietnamica* (CITES Management Authority of Viet Nam, 2007).

PROBLEMS IDENTIFIED THAT ARE NOT RELATED TO THE IMPLEMENTATION OF ARTICLE IV PARAGRAPHS 2A, 3 OR 6A

A small number of specimens (37) were reported in CITES trade data for 1999 as confiscations. No recent illegal trade has been detected.

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Myrmecophila tibicinis (Bateman ex Lindl.) Rolfe

FAMILY: Orchidaceae

SYNONYMS: *Schomburgkia tibicinis* (Bateman ex Lindley) Bateman.

COMMON NAMES: Fluteplayer's Schomburgkia or Fluteplayer's Orchid, Cow Horn Orchid (English); Caño (Spanish); Hom ikim, Ho hom bak (Maya).

GLOBAL CONSERVATION STATUS: Not assessed.

SIGNIFICANT TRADE REVIEW FOR: Belize

SUMMARY

Myrmecophila tibicinis, commonly known as the Fluteplayer's Schomburgkia, is a large, attractively-flowered epiphytic orchid from the central American region. It is one of eight or so members of the genus *Myrmecophila* of which three or four are reported to occur in Belize.

Reported trade in *Myrmecophila* in the CITES trade database is very largely in *M. tibicinis,* exported from Belize as wild-collected plants and intended for the horticultural trade. Just over 6000 have been reported in trade in the period 1996-2005, with annual numbers varying from just under 100 to over 1300. There is limited reported trade in artificially propagated specimens from some other range States and other countries.

Myrmecophila orchids are widely grown in gardens of houses and hotels in Belize, apparently very largely or perhaps entirely from wild-collected plants.

The status of *M. tibicinis* in Belize is unclear. It is generally reported to be widespread and at least locally common in coastal areas. However, one recent authority considers most records of *M. tibicinis* (including those of plants in cultivation and in international trade) in fact to refer to the newly described *M. christinae*, with the latter species being common in Belize but true *M. tibicinis* being rare.

Population data for Belize were not available for *M. tibicinis, M. christinae* or the other species of *Myrmecophila*, making it difficult to determine the impact of harvest on the wild populations. The relative importance of collection for export compared with that for the (evidently substantial) domestic market is also unclear. Belize has not conducted a non-detriment study on *Myrmecophila tibicinis* and no surveys or assessments of the wild status have been undertaken. However, the CITES Management Authority states that CITES export permits have been issued on the basis that specimens have been collected from areas cleared for agriculture or other development.

Pending clarification of the taxonomic status of the orchids currently being exported from Belize under the name *M. tibicinis* and further information on the impact of trade, export should be considered of **Possible Concern**.

SPECIES CHARACTERISTICS

Myrmecophila tibicinis is commonly known as the Fluteplayer's Schomburgkia or Fluteplayer's Orchid after the hollow cylindrical stems which are used as trumpets by children. It is a large, stout, epiphytic plant growing up to two metres tall with large showy flowers (8-9cm diameter) showing considerable colour variation from purple to red or yellow. Flowering seasons are March and from July to September. Flowers last several weeks (McLeish *et al*., 1995). It is self-compatible, pollinated by bees (Malo *et al*., 2001). Pseudobulbs are often inhabited by ants, the interaction of which with mealy-bugs has been shown to reduce the reproductive fitness of the species (Rico-Gray and Thein, 1989).

Carnevali *et al.*, (2003) in their review of the genus *Myrmecophila* listed Belize, Costa Rica, Guatemala, Honduras, Mexico (Gulf Coast only) and Nicaragua as range States for *M. tibicinis*. The World Checklist of Monocotyledons (2007) also includes Venezuela as a range State for *M. tibicinis*. Status and

population trends are poorly documented for most range States. A study in Yucatán, Mexico found densities in sampled populations ranging from 81 to 394 plants per hectare, with lower densities associated with increased human disturbance. Other areas had isolated individuals with densities of 1.2-13 plants per hectare (Malo *et al.*, 2001).

Carnevali *et al.* (2003) recognised eight species and one naturally occurring hybrid in the genus *Myrmcophila*, occurring from Mexico south to Venezuela, with one species present on the Cayman Islands. Species can apparently be difficult to identify in the field when not in flower because of their variability in size and habit. Some individual may have 4-6 pseudobulbs each 7cm long while another nearby of the same species could have the same number of psuedobulbs each of 30 cm long (Adams, 2007). *Myrmecophila* is still quite frequently referred to as *Schomburgkia* in the orchid trade.

INTERNATIONAL TRADE

Myrmecophila tibicinis was listed in App II in 1975 with all Orchidacae species for which annotations have designated trade in all parts and derivatives, except: seeds and pollen (including pollinia); seedling or tissue cultures obtained in vitro, in solid or liquid media, transported in sterile containers; cut flowers of artificially propagated plants.

Table 1: Exports excluding re-exports of wild and artificially propagated *M. tibicinis* (1996-2005) from Belize

Exporting Country	Source	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total 1996-2005
Belize	W	250	460	300	1039	758	91	650	1358	1133	250	6289
Belize	R	4										4

(Source: CITES trade statistics derived from the *CITES Trade Database*, UNEP World Conservation Monitoring Centre, Cambridge, UK.)

Note: W includes wild sourced, Unknown and no stated source

Just over 6000 specimens have been recorded in CITES trade data as exported by Belize in the period 1996-2005, virtually all wild (Table 1). A small level of trade in artificially propagated specimens has been reported from other countries in the same period (380 exported by Taiwan POC and just over 100 exported by Mexico) and negligible export of wild specimens (four from Nicaragua in 1996-1997). However, see below for a discussion of the possible identity of *Myrmecophila* orchids exported from Belize.

Other species of *Myrmecophila* are reported traded in very small numbers, around 450 wild and 565 artificially propagated specimens between 1996-2005, making *M. tibicinis* apparently by far the most abundant *Myrmecophila* species in trade. Belize also reported the export of 315 specimens of wild *M. brysiana* between 1996 and 2005.

COUNTRY ACCOUNT

Belize

Status

The status of *M. tibicinis* in Belize is not clear. There are three or four species of *Myrmecophila* in the country, mainly restricted to coastal areas where they occur in trees primarily in seasonally flooded areas, along pine ridges and in mangrove swamps (Adams, 2007; McLeish *et. al.,* 1995), and in open wetland ecosystems or savannahs (CITES Management and Scientific Authority of Belize, 2007). Mcleish *et al.,* (1995) reported *M. tibicinis* to be found in all districts and some reports indicate that it is at least regionally common (e.g. in 'bajo' forests in the district of Corozal (Sayers, 2007). Meerman (2007) notes that *Myrmecophila* as a whole used to be common but are less easy to find now, in his opinion largely because of coastal development by the aquaculture industry and tourism sector. The CITES Management and Scientific Authority of Belize (2007) also report habitat loss as a threat to the species.

Carnevali (2007) considers that most records of *M. tibicinis*, including those in cultivation and trade, in fact refer to a newly described species, *Myrmecophila christinae* (Carnevali and Gómez-Juárez, 2001). He

considers this species and *M. brysiana* to be common in Belize and true *M. tibicinis* to be rare. Carnevali *et al.* (2003) give range States for *M. christinae* as Belize, Guatemala and Mexico (Gulf Coast only).

Management and trade

It is common practice for collectors to salvage orchids prior to and after development of coastal lands and CITES export permits have been issued on the basis that specimens have been collected from areas cleared for agriculture or other development. Permits are issued on the basis of actual specimens for export. Export is almost exclusively by one collector (CITES Management and Scientific Authority of Belize, 2007). There is reportedly quite high post-collection mortality, which creates a continuous demand for the species (CITES Management and Scientific Authority of Belize, 2007).

Sayers (2007) and Adams (2007) have observed the species cultivated in gardens and Adams (2007) claims that "nearly every house and hotel in the country" grows *Myrmecophila,* mostly of wild origin. However despite this significant local market demand, there is no information on the extent of harvest for domestic use as this is undertaken by local collectors with small scale operations (even though in general permits are required for orchid collection) (CITES Management and Scientific Authority of Belize, 2007). Sayers (2007) and Adams (2007) were unaware of any commercial cultivation. The CITES Management and Scientific Authority of Belize (2007) noted that there was no investment in artificial propagation as the species could readily be collected from the wild.

Bijleveld (1998) records the species from Shipstern Nature Reserve, although it is possible that, following Carnevali and Gómez-Juárez (2001) and Carnevali *et al,* (2003), this in fact refers to *M. christinae*.

Carnevali (2007) believes that most *Myrmecophila* exported from Belize are *Myrmecophila christinae* and *M. brysiana,* with *M. christinae* the most commonly collected species in the country. According to Meerman (2007) most people, including collectors, consider all myrmecophilas as "*tibicinis*". The Management Authority (2007) has stated that the inability to distinguish between species is a challenge, both for them and for collectors.

Belize has not conducted a non-detriment study on *Myrmecophila tibicinis* and no surveys or assessments of the wild status have been undertaken (CITES Management and Scientific Authority of Belize, 2007).

PROBLEMS IDENTIFIED THAT ARE NOT RELATED TO THE IMPLEMENTATION OF ARTICLE IV PARAGRAPHS 2A, 3 OR 6A

As noted above, the identity of the specimens currently exported by Belize is in question, with a recent revision of the genus indicating that the common species there, and the one that is primarily in trade, is in fact *M. christinae* Carnevali and Gómez-Juárez, 2001 and not *M. tibicinis* (Carnevali, 2007; Carnevali *et al*., 2003).

No indications of illegal trade in *Myremcophila* were found during the course of this review.

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Pachypodium bispinosum (L.f.) A. DC. 1844

FAMILY: Apocynaceae

COMMON NAMES: Bobbejaankos, Kafferkambroo, -Kamkoo, -Kamoo, Kambroo, Kamoa, Kragman, Sterk-, Porcupine Potato (Lüthy, 2006).

GLOBAL CONSERVATION STATUS: Not assessed.

SIGNIFICANT TRADE REVIEW FOR: South Africa

SUMMARY

Pachypodium bispinosum is a slow-growing succulent shrublet endemic to the Eastern and Western Cape Provinces of South Africa where it occurs at altitudes up to some 700 m in succulent scrub vegetation. The species is relatively widespread, with an estimated extent of occurrence approaching 60,000km^2 and is reported to be at least locally abundant.

Reported trade has been almost exclusively in live specimens for the horticultural industry. Trade in wild specimens between 1996 and 2005 has been in the order of 10,000 specimens, with the largest quantities being reported in trade in 2003, 2004 and 2005; no trade in wild specimens has been recorded as yet for 2006. In addition to wild trade, South Africa has also exported a limited number of artificially propagated specimens. Although Pachypodiums are used in landscaping here is no evidence of extensive domestic use of this species.

The widespread and at least locally abundant nature of the species and the relatively low level or reported exports (*ca* 1000 per year) mean that it is unlikely that collection of specimens for trade has a significant impact on wild populations. However, trade levels are higher than those seen in, for example, *P. succulentum* (also the subject of a Significant Trade review), and the species occurs over a somewhat smaller area. The CITES Scientific Authority reports that non-detriment findings have not been made. Given the lack of data on the species status or the impact of harvest on the population trade should be considered of **Possible Concern**.

SPECIES CHARACTERISTICS

Pachypodium bispinosum is a slow-growing *s*ucculent shrublet endemic to South Africa (Codd, 1963; Eggli, 2001, Hilton-Taylor, 2007). It has a large half to almost fully-submerged tuberous stem up to 18cm in diameter and bears several to numerous slender branches up to 45cm high. Pink to dull purple flowers with paler lobes are produced between July and December (Codd, 1963; Sajeva and Costanzo, 1994; Vorster and Vorster, 1973). *P. bispinosum* occurs in dry rocky habitat associated with succulent scrub vegetation at altitudes of 15-685 m (Codd, 1963; POSA, 2007). Like most other South African species of Pachypodium apart from *P. succulentum, P. bispinosum* is not resistant to frost (Vorster and Vorster, 1972).

P. bispinosum can be confused with the sympatric but wider spread *P. succulentum* when not flowering (Lüthy, 2006).

Many species of Apocynaceae have acrid stems and pith which may deter herbivores and result in relatively low levels of mortality (Midgley *et al*., 1997).

INTERNATIONAL TRADE

The genus Pachypodium was listed in CITES Appendix II in 1975. Some species have since been listed in Appendix I. Trade in Appendix II species has been subject to annotation #1 which until 13 September 2007 designated all parts and derivatives, except: seeds, spores and pollen (including pollinia); seedling or tissue cultures obtained *in vitro*, in solid or liquid media, transported in sterile containers; and cut flowers of artificially propagated plants. As of 13 September 2007 a slightly modified form of this annotation came into force; however this has no impact on the current trade in this species.

Reported trade has been almost exclusively in live specimens, evidently intended for the horticulture industry. According to Jenkins (1993), at the time of a survey of the European ornamental plant trade, *Pachypodium* species were popular plants in the general and specialist trade within Europe. Reported trade from South Africa in wild specimens has been in the order of 10,000 specimens in the period 1996-2005 (although importing countries reported significantly less than this) (Table 1). In addition, South Africa and, to a lesser extent the USA, have also exported artificially propagated specimens.

Table 1: Exports excluding re-exports of wild (W) and artificially propagated (A) *P. bispinosum* (1996-2005)

Exporting Country	Source	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total 1996-2005
South Africa	W		300	300	250	160	170	400	3757	3053	1640	10,030
South Africa (import reports)	W		200	300	220	160	150	400	1207	1130	120	3887
South Africa	A	20	40	35	56	102	150	111	45	535	341	1443

(Source: CITES trade statistics derived from the *CITES Trade Database*, UNEP World Conservation Monitoring Centre, Cambridge, UK.)

COUNTRY ACCOUNT

South Africa

Status

Although generally believed to occur in the Eastern Cape Province only (CITES Management Authority of South Africa, 2005), occurrence data supplied by the South African National Biodiversity Institute (SANBI) shows specimens collected from the eastern parts of the Western Cape. The Western Cape Province CITES Authority confirmed that exports from the Province do occur (Hignett, 2007).

Based on point data, the area of occurrence of the species has been calculated as in the region of 57,000 km^2. According to van Jaarsveld (2007), it is common and wide ranging within the Eastern Cape where it is present in thicket vegetation. Dold (2007) reports it to be very common in the Albany Region.

Management and trade

Early drafts of the Regulations to implement the National Environmental Management: Biodiversity Act No. 10 of 2004 designated all CITES listed species as 'Protected Species'. Due to the wording of the Act, however, this clause was eventually scrapped because of the unintended consequence of requiring owners of land with naturally occurring CITES species (including ubiquitous Appendix-II species such as aloes, succulent Euphorbias and orchids) to possess permits or face mandatory penalties. Although there are intentions to introduce national enforcement of CITES legislation at a national level using other Regulations, provincial legislation in the Western Cape (but not the Eastern Cape) currently provides the only legal protection for the species (Foden, 2007).

Management of exports in the species is carried out at the Provincial level. The Western Cape CITES Authority report issuing permits for 150 artificially propagated and 20 wild specimens in 2001, 322 wild specimens in 2002 and 5 artificially propagated specimens in 2003 (Hignett, 2007); no permits have been issued for this species since 2003 from the Western Cape Province. There have been no recent population surveys in the Western Cape and no non-detriment findings have been made (Hignett, 2007). No information was provided by the Eastern Cape Province but it would appear that specimens in trade post 2003 will have originated from this Province (see Table 1).

Pachypodiums are used for landscaping within South Africa, particularly *P. namaquanam* which has suffered local depletion from wild collection (Newton and Chan, 1998). Bruyns (2007) believes that excessive collection for the 'muti' (traditional medicine) trade and urban expansion are likely to be the two factors mainly affecting *P. bispinosum* However, the species is apparently not used by Xhosa people for traditional medicine and Dold (2007) had not observed it in herbal markets or muthi stores.

Bruyns (2007) notes that *P. bispinosum* is easily grown from seed. At least one nursery in South Africa is artificially propagating plants in this way (Dold, 2007). In general, the slow growth of Pachypodiums means production of mature specimens is slow (Vorster and Vorster, 1972). Newton and Chan (1998)

report that for a different species of *Pachypodium*, *P. namaquanum*, propagation systems have improved in recent years and that under ideal conditions plants can reach 30cm in height and 10cm diameter and produce flowers within 10 years (Retief, 1988). Under the Biodiversity Act nurseries artificially propagating species are required to be registered. However, no information was available on the number of nurseries artificially propagating the species.

According to SANBI no population studies have been carried out to determine impact of the harvest or to make non-detriment findings for this species (CITES Management Authority of South Africa, 2005).

PROBLEMS IDENTIFIED THAT ARE NOT RELATED TO THE IMPLEMENTATION OF ARTICLE IV PARAGRAPHS 2A, 3 OR 6A

None identified.

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Pachypodium succulentum (L.f.) Sweet 1830

FAMILY: Apocynaceae

COMMON NAMES: Bergkambroo, Bobbejaan-, -Kos, Bottelboom, Bottle tree, Dikvoet, Kafferkambroa, -Kambroo, Ystervark, -Kos (Lüthy, 2006).

GLOBAL CONSERVATION STATUS: Not assessed.

SIGNIFICANT TRADE REVIEW FOR: South Africa

SUMMARY

Pachypodium succulentum is a slow-growing succulent desert plant, endemic to South Africa. It is estimated to have an extensive range (over 300,000 km^2) and anecdotal information indicates that is it common or very common in at least parts of this, although no concrete population data are available.

The species has been exported as wild collected specimens in small numbers for the horticultural trade (just under 2000 reported in exports in the period 1996-2005) with a further 1300 artificially propagated specimens exported in the same period. There are no indications of any extensive domestic use of the species.

Although non-detriment findings have not been made by the relevant CITES Scientific Authority, the low level of exports and the widespread and at least locally abundant nature of the species indicate that collection for export is highly unlikely to be of concern for wild populations. Trade is therefore considered of **Least Concern**.

SPECIES CHARACTERISTICS

Pachypodium succulentum is a succulent desert plant, endemic to South Africa (Eggli, 2001). It has a large half-submerged tuberous stem measuring up to 15 cm in diameter, bearing several slender branches of between 15-60 cm (Codd, 1963). The species reaches heights of between 1.5 and 2.5 metres (Codd, 1963). Pink to crimson flowers are produced between August and December (Sajeva & Costanzo, 1994; Codd, 1963; Vorster and Vorster, 1973). It produces numerous seeds, although specialised pollinators are required to produce a good seed set (Codd, 1963). It is one of 13 or so species in the genus *Pachypodium* found in southern Africa and Madagascar.

The species is slow-growing and found in arid places, usually among rocks (Codd, 1963; Hilton-Taylor, 2007). Unlike other South African species of Pachypodium, *P. succulentum* is resistant to frost (Vorster and Vorster, 1972).

Many species of Apocynaceae have acrid stems and pith which may deter herbivores and result in relatively low levels of mortality from this cause (Midgley *et al.*, 1997).

INTERNATIONAL TRADE

The genus *Pachypodium* was listed in CITES Appendix II in 1975. Some species have since been listed in Appendix I. Trade in Appendix II species, of which *Pachypodium succulentum* is one, was subject to annotation #1 until 13 September 2007 which designated all parts and derivatives, except: seeds, spores and pollen (including pollinia); seedling or tissue cultures obtained *in vitro*, in solid or liquid media, transported in sterile containers; and cut flowers of artificially propagated plants. As of 13 September 2007 a slightly modified form of this came into force; however this has no impact on the current trade in this species.

Reported trade, which is for the horticulture industry, has been almost exclusively in live specimens. According to Jenkins (1993) at the time of a survey of the European ornamental plant trade Pachypodium species were popular plants in the general and specialist trade within Europe. Trade in wild specimens from South Africa has been in the order of 2000 between 1996 and 2005 (Table 1). None have been

reported in trade in 2006. In addition, the main exporter of artificially propagated specimens was South Africa (1285 specimens), with some imports from the USA (334 specimens) also reported mainly by Germany.

Table 1: Exports excluding re-exports of wild and artificially propagated *P. succulentum* (1996-2005)

Exporting Country	Source	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total 1996-2005
South Africa	Wild		60	100	30	100	120	500	558	362	40	1870
South Africa	Art. Prop.			64	127	123	380	55	163	123	250	1285

(Source: CITES trade statistics derived from the *CITES Trade Database*, UNEP World Conservation Monitoring Centre, Cambridge, UK.)

COUNTRY ACCOUNT

South Africa

Status

Pachypodium succulentum occurs in the Free State, Eastern Cape, Northern Cape and Western Cape (CITES Management Authority of South Africa, 2005) where it is found at altitudes of 288 to 1500m (POSA, 2007). The total estimated area of occurrence based on data supplied by the South African National Biodiversity Institute (SANBI) is in the region of 307,000 km^2.

Zietsmann (2007) reports that it occurs on dolerite outcrops (koppies) in the central part of the Free State and southwards into the Karroo. Van Jaarsveld (2007) considers it widespread and not threatened in the Free State and noted that its often subterranean caudices mean that it was easy to overlook. The species is estimated to occur within an area of 24,000 km^2 in the Free State.

In the Eastern Cape, where the area of occurrence is estimated to be in the region of 105,000 km^2, it is reportedly common and widespread in thicket vegetation (van Jaarsveld, 2007). Dold (2007) describes it as very common in the Albany Region of the Eastern Cape.

The area of occurrence in the Northern Cape is in the region of 125,000 km^2 and Western Cape 52,600 km^2. No information on population status was available.

The CITES Management Authority of South Africa (2005) reported it to be fairly widely distributed and abundant on dolerite koppies in rural areas, but believed it more threatened on dolerite koppies in urban areas.

Management and trade

Trade in wild specimens of this species has been in the order of 2000 specimens between 1996 and 2005, with the largest quantities being reported in trade in 2002 and 2003. In addition, trade in artificially propagated specimens has been report from South Africa with around 1300 specimens in trade in the same period.

Due to the wording of the Act, however, this clause was eventually scrapped because of the unintended consequence of requiring owners of land with naturally occurring CITES species (including ubiquitous Appendix-II species such as aloes, succulent Euphorbias and orchids) to possess permits or face mandatory penalties. Although there are intentions to introduce national enforcement of CITES legislation at a national level using other Regulations, in Provincial legislation species of the genus *Pachypodium* are listed as "Protected Species" in the current Conservation Acts of the Western Cape and Northern Cape, but not the Eastern Cape. Plants are protected under Free State Nature Conservation laws (Foden, 2007).

Management of exports of the species is carried out at the Provincial level. The Western Cape CITES Authority issued permits for 100 artificially propagated and 20 wild specimens in 2001 and 450 wild specimens in 2002 (Hignett, 2007) but have not issued permits for this species since then. No applications or permits for the export of any Pachypodium species have been requested from the Free State for the past five years (Boing, 2007). No population surveys have been carried out for the species in the Western Cape, however as there have been no exports since 2002 no non-detriment findings have

been made (Hignett, 2007). In the Free State permits are required to collect the species, but according to the National CITES Management Authority in 2005 there were no measures in place to monitor and regulate trade other than permit requirements. No information was available on trade or management of harvest for the Eastern Cape Province.

According to SANBI, no population studies have been carried out to determine impact of the harvest and or make non-detriment findings for this species (CITES Management Authority of South Africa, 2005).

Under the Biodiversity Act nurseries artificially propagating species are required to be registered. However, no information was available on the number of nurseries artificially propagating the species.

Pachypodiums are used for landscaping within South Africa, particularly *P. namaquanam* which has suffered local depletion from wild collection (Newton and Chan, 1998). Bruyns (2007) believes that excessive collection of *P. succulentum* for the 'muti' (traditional medicine) trade and urban expansion are likely to be the two factors mainly affecting the species. However, the species is apparently not used by Xhosa people for traditional medicine and Dold (2007) had not observed them in herbal markets or muthi stores.

The species is reportedly easily grown for seed (Bruyns, 2007) and at least one nursery in South Africa is propagating plants in this way (Dold, 2007), although the production of large plants from seed is a slow process (Vorster and Vorster, 1972). Newton and Chan (1998) report that for a different species of *Pachypodium*, *P. namaquanum*, propagation systems have improved in recent years and that under ideal conditions plants can reach 30cm in height and 10cm diameter and produce flower within 10 years (Retief, 1988).

PROBLEMS IDENTIFIED THAT ARE NOT RELATED TO THE IMPLEMENTATION OF ARTICLE IV PARAGRAPHS 2A, 3 OR 6A

None identified.

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Pterocarpus santalinus Linn. f.

FAMILY: Leguminosae

COMMON NAMES: Red Sandalwood, Red Sanders, Red Sanderswood (English); satelipuu (Finnish); Raktachandan (Indian); Santal rouge (French); Sándalo rojo (Spanish). A wide range of additional local and international trade names is provided in Mulliken and Crofton (2007).

GLOBAL CONSERVATION STATUS: Endangered EN B1 + 2de (Assessed 1998, Categories and Criteria version 2.3).

SIGNIFICANT TRADE REVIEW FOR: India

Note: This account draws heavily on research undertaken in the period 2004-2006 as part of a review of seven Asian CITES-listed medicinal and aromatic plant species, undertaken by TRAFFIC and IUCN and funded by the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN) (Mulliken and Crofton, 2007). The information in this was updated and additional research and analysis was undertaken in 2007 to produce the present account.

SUMMARY

Pterocarpus santalinus is a medium sized deciduous tree endemic to India with a very restricted range in the southern Eastern Ghats where it grows in dry, rocky ground at 150-900 m. Recent records in the wild are all from Andhra Pradesh state. It is currently classified by IUCN as Endangered. The species has a wide range of uses. The timber is valued both domestically and internationally and is used for carvings, furniture, agricultural implements, poles and house posts. A rare wavy grain variant of the timber is particularly highly valued, especially in Japan, where it is used to make a traditional musical instrument. A red pigment, santalin, is extracted from the timber and is also widely used domestically and internationally. It is now mainly used as a colorant in foods. In India it has multiple uses in traditional medicine.

Indian Customs data and information on seizures show that the wood and wood products of *P. santalinus* are in demand and traded internationally in large volumes with strong markets particularly in East Asian countries. Smuggling and illegal felling are of significant concern. Although commercial cultivation is being actively promoted as a means of producing timber for trade, the percentage of products currently in international trade coming from cultivated stocks is unknown.

P. santalinus was included in CITES Appendix II in 1995. The listing was annotated to cover only "logs, wood-chips and unprocessed broken material" (Annotation #7), modified at CITES CoP14 (effective 13 September 2007) to: "Designates logs, wood-chips, powder and extracts". No CITES trade data have been reported by India since 1999. The only CITES-reported trade in recent years appears to involve exports from non-range States (and therefore to be in question) and no trade at all has been reported since 2003.

The exclusion of extracts until September 2007 has meant that a significant proportion of the trade, including that in powder, has been outside of CITES trade controls. CITES trade data indicate the export of around 22 tonnes of extracts and 5 tonnes of sawn wood in the period 1996-2005. Indian customs data also indicate very substantial trade in wood-chips (nearly 600 t in the period April 1996 to March 2003). Wood chips have been covered by the CITES listing during this period and should therefore have been subject to CITES controls and reported in annual reports, but there is no record of this trade in CITES statistics.

Given the Endangered status of the species, the continuing existence of a substantial trade in products (including some that has gone unreported under CITES despite being covered by the Convention, and significant illegal trade), the lack of information on the extent of commercial cultivation and the absence of any evidence of non-detriment findings, trade in *Pterocarpus santalinus* from India is considered as of **Urgent Concern**.

SPECIES CHARACTERISTICS

Pterocarpus santalinus is a small to medium sized (11 m), deciduous tree. The heart wood is scarlet purple with streaks or purplish-black or almost black, dull, with a medium fine texture, very strong, extremely hard, very heavy and contains a red dye santalin. The wood of most trees has a normal grain; there is also a rare variant with a 'wavy' grain.

The natural range is restricted to typically dry, hilly, often rocky ground, at altitudes of 150-900 m (Government of India, 1994; Green, 1995), in areas receiving around 100 mm of rain in each of the two annual monsoons (Green, 1995). *P. santalinus* does not tolerate overhead shade or waterlogged conditions (Rao and Raju, 2002). The growth rate is slow (Anon., 2002a; Government of India, 1994). Seed production is high but natural regeneration is adversely affected by years of repeated fires (Anon., 2002b; Henry, 1994). Green (1995) in a general review of natural colorants and dyestuffs stated that *P. santalinus* regenerated well from coppicing, and reported that a 40-year coppice rotation was practised. However, no other reference to coppicing of the species has been located.

P. santalinus is generally agreed to be endemic to India (Molur *et al.,* 1995); Oldfield *et al.,* 1998; Vedavathy, 2004). Records from China and Taiwan POC, Pakistan and Sri Lanka (ILDIS, 2003, Richter and Dallwitz, 2002) are thought to represent introduced populations (Kumar and Sane, 2003 in UNEP-WCMC, 2003). A report of the species as native to Africa (Roubik, 1995 in Rao and Raju, 2002) is almost certainly in error.

Red Sandalwood has a wide range of uses. The heartwood is used to produce red pigments, specifically santalin as a dye for the furniture and crafts industry and as a colouring agent in cosmetics and food (Green, 1995; IUCN and TRAFFIC, 1994; Oldfield *et al.,* 1998). Its main use as a colorant in recent years has been in foods where it imparts orange-red shades and also a sweet-spicy flavour. In Europe it is classified as a "spice extract" rather than a food colorant (Green, 1995). It has therefore not been assigned an 'E number' and so its presence does not have to be declared on packaging. The colorant is extracted only from the heartwood, which is first reduced to chips or powder and the colorant then extracted with alcohol. Specific formulations (as liquids, dispersed solids or water-soluble forms) are prepared prior to sale to particular users at strengths appropriate for the food product (Green, 1995). The species is used as an incense base both for its fragrance (Star Child Aromatics, 2004) and also in Tibetan medicine (Tibetan Therapeutics, undated). In Myanmar, it is used in fragrances and scented (incense) sticks (Maung Lwin, 1995).

Timber with a 'wavy' grain is in high demand in Japan for the manufacture of 'shamisen' a traditional musical instrument, as the wood has very unusual acoustic properties (Venkatesh, 1976). The heartwood is also used to make 'hankos' (name seals), traditional dishes and carvings in Japan (Kiyono, 2005).

Santalins together with other related pigments are found in some other Pterocarpus and Baphia species (Green, 1995). Adenanthera pavonina is similarly used to produce santalin-based dyes while other products such as cochineal can serve as substitutes in foodstuffs (Anon., 2004a; Lange, 2005).

Three of the four Pterocarpus species occurring in India are harvested for santalin. All four species are valued for their wood, but only P. santalinus is highly valued for its "heavy, dark claret-red heartwood," especially that possessing a 'wavy' grain (Rao and Raju, 2002).

INTERNATIONAL TRADE

P. santalinus was included in CITES Appendix II in 1995 and is the only species of *Pterocarpus* in the CITES Appendices. The listing was annotated to cover only "logs, wood-chips and unprocessed broken material" (Annotation #7), modified at CITES CoP14 (effective 13 September 2007) to: "Designates logs, wood-chips, powder and extracts".

The species has clearly featured in international trade in considerable quantities, although this is not reflected in CITES data, in which no trade has been reported by India since 1999 and none by any country since 2003 (other than the return to India in 2004 of 56 tonnes seized in Singapore). Between 1995 (when the species was included in CITES Appendix II) and 1999, India's CITES annual reports recorded much lower trade volumes than their Customs data with a total reported export of approximately 22 t of 'extracts' and 5.1 t of sawn wood. India also reported the export of 1147 sets of carvings. It is interesting to note that India reported trade in extract, which was not covered at the time

by the CITES listing, but did not report the substantial trade in wood chips, which is covered by the listing. All products reported as exported were reported as coming from cultivated sources (Table 1).

Table 1: Exports of *Pterocarpus santalinus* from India as recorded in CITES trade database, 1995-2005

Product	1995	1996	1997	1998	1999	2000-2005	Total
Extracts (kg)	6720	4100		8824	2497	0	22141
Carvings (sets)				1147		0	1147
Sawn wood (kg)					5100	0	5100

Note: data includes exports declared as wild source and those declared as artificially propagated

China reported the import of 280 m^3 and 20 m of sawn wood and timber in 1999-2000, reported as originating in Cambodia, Brazil and Madagascar, none of which are range States for the species. Reported imports jumped to over 100 t in 2003, of which 96 t was reported as originating from the wild in Nepal, also not a range State, and 4.9 t as originating in India (as discussed under Illegal trade below, Red Sanders is believed to be smuggled from India to China via Nepal). An internet offer from China to buy "big quantities" of Red Sanders timber directly from India, either from plantations or from the wild, was posted in July 2007 (Wang, 2007).

Until recently, Indian Customs data documented the trade in three different *P. santalinus* product categories: chips, powder and timber, with the greatest share of the trade reported as involving chips. These data show an annual average of 85 t of "Sander Wood" chips exported in the period 1996/1997-2002/2003, with a peak of 271 t in 2000/2001 (Table 2). However since 1 April 2003 chips and timber have no longer been differentiated in India's Customs data. An average of 19 t of "Red Sandalwood Powder Used in Dyeing" was exported annually in the period 1997/1998-2005/2006 (Table 3).

Table 2: Exports of "Sander Wood" chips recorded in Indian Customs data per import destination (tonnes) (1996/1997-2002/2003)*

Year	96/97	97/98	98/99	99/00	00/01	01/02	02/03
Total	106.8	77	81.6	0	271.1	46.1	11.2

* Financial year runs from 1 April to 31 March.

Source: Export Import Data Bank, Department of Commerce, Government of India at http://dgft.delhi.nic.in/

Major importers were Singapore, Taiwan POC and Hong Kong SAR which together accounted for some 70% of declared exports. China, Saudi Arabia, United Arab Emirates, Oman and Japan accounted for the great majority of the rest.

Table 3: Exports of "Red Sandal Wood" powder recorded in Indian Customs data per import destination (tonnes) (1996/1997-2005/2006)*

Year	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06
Total	4.7	13.2	21.7	47.6	24.3	18.13	23.28	14.19	1.07

* Financial year runs from 1 April to 31 March.
** NB: From April-June 2004, one tonne was exported to Japan.

Source: Export Import Data Bank, Department of Commerce, Government of India at http://dgft.delhi.nic.in/

Japan is believed to be an important market for timber, with Green (1995) estimating annual demand at several hundred tonnes. The Andhra Pradesh Forest Development Corporation is said to have exported approximately 200 t of timber to Japan during the late 1990s and/or early 2000s (Anon., 2002a) although such trade, if it took place, is unreported in CITES or Customs data. The Japan External Trade Organization (JETO) offered 50 to 1000 tonnes of Red Sandalwood timber from Andhra Pradesh for sale in August 2007 (JETO, 2007), indicating that export to Japan may continue. This may represent seized timber disposed of by the Andhra Pradesh Forest Development Corporation (see below).

Singapore is a major destination for the reported export of "Sander Wood" chips. It is unknown whether Singapore is an end destination or an intermediary in the trade. Taiwan POC has also been identified in

Customs data as a major destination for the trade in both powder and wood chips (over 200 t reported as exported to Taiwan POC in the period 1997/1998–2005/2006).

P. santalinus has been imported into Germany in the form of powder or as an extract (oleoresin). According to two German traders, its use is declining, at least in part owing to difficulties in securing CITES documents for supplies from India and the wide availability of substitute colourings (Lange, 2005).

COUNTRY ACCOUNTS

India

Status

P. santalinus is endemic to India and has been recorded in the southern Eastern Ghats in the states of Andhra Pradesh, Karnataka and Tamil Nadu (Molur *et al.*, 1995; Oldfield *et al.,* 1998). It is also reported as occurring sporadically in other states (Government of India, 1994). However at a 1995 Conservation Assessment and Management Plan (CAMP) workshop it was recorded as having a very restricted range of less than 5,000 km^2 and an area of occupancy of less than 1,000 km^2 in Andhra Pradesh. No populations for Karnataka, Kerala or Tamil Nadu were reported at the workshop. The species overall was considered endangered (Molur *et al.*, 1995).

The primary reported threat to the species is illegal harvest and trade (Anon., 2004b; Molur *et al.*, 1995). The Government of India (1994) considered *P. santalinus* threatened by both legal and illegal trade at the time they proposed it for inclusion in CITES Appendix II, noting that the restricted distribution and slow regeneration rate of the species made in particularly vulnerable. Other threats are habitat destruction and habitat alteration (Anon., 2006a; Rao and Raju, 2002).

Management and trade

Domestic use

The primary use for *P. santalinus* is as a colorant, but the species has also played a traditional role in medicine within India as an astringent and for treatment of gastric and skin disorders (Green, 1995). It is also used to treat diabetes (Anon. 2005b), headache, burns, scalds, vomiting, diarrhoea, fever, blood disorders and to promote wound healing (Herbal Cure India, 2007), as well as to treat chronic dysentery, mental aberrations, ulcers, and leprosy (Social Forestry-Guntur, 2004). In Ayurvedic medicine it is also used as a base for incense (Shinjukoh, 2002). The timber, which can be of high quality, is widely used domestically to make furniture and carvings, agricultural implements, poles, carts and picture frames, and carved house posts (Anon., 2002c; Anon., 2005a; Green, 1995; Government of India, 1994). Inferior wood is sold as fuel and charcoal and the leaves are used for cattle fodder (Anon., 2002c; Green, 1995).

In a market survey carried out by TRAFFIC India in 1997, *P. santalinus* was found on sale in markets in Delhi, Kolkata, Mumbai and Haridwar. It was commonly used by India's herbal medicine industry and readily available (TRAFFIC India, 1998 in Schippmann, 2001). However a Government of India report (Anon., 2000a) noted that a Mumbai Ayurvedic medicine manufacturer considered *P. santalinus* to have been in short supply for approximately 18 years and that another manufacturer considered supplies to be limited. Estimates of domestic trade volumes in 1997 varied widely. Two traders estimated that sales in Delhi markets (presumably for all uses) were in the order of 100-400 t while the Dabur Research Foundation estimated the annual demand from the Ayurvedic industry to be 16 t (TRAFFIC India, 1998 in Schippmann, 2001).

A supply and demand study, commissioned by the Department of Indian System of Medicine & Homeopathy, Government of India and the World Health Organization predicted that demand from India's herbal medicine industry and practitioners for *P. santalinus* would be ca 170 t during 2001-2002 and 290 t during 2004-2005 (Anon., 2003 in Mulliken and Crofton, 2007).

Domestic controls

Harvest and transport of timber and other forest products in India is governed by The Indian Forest Act (1927) The Indian Forest Act (1927) has been adopted by most of the States and is directly applicable to the Union Territories of India. The remaining States have enacted State Forest Acts of their own,

which are largely based on the Indian Forest Act. Andhra Pradesh and Tamil Nadu, but not Karnataka have specific regulations for cultivation, harvesting and trade of *P. santalinus.*

Export controls

CITES is implemented in India through a combination of the Wildlife Protection Act, 1972/1991/2002 and the Export and Import Policy (EXIM), although the former does not cover this species. Policy on trade in wildlife and wildlife products is established via the EXIM policy, which is decided in consultation with the CITES Management Authority. The EXIM policy is put into effect via the provisions of the Foreign Trade (Development and Regulation) Act 1992 and enforced via the Customs Act (CITES Management Authority of India, 2004). The EXIM policy was embedded within a broader Foreign Trade Policy for the period 2004-2009, this change coming into effect on 1 September 2004 and includes a Special Agricultural Produce Scheme, promoting the export of, *inter alia*, minor forest produce such as medicinal plants and their value-added products. The policy outlines that all export and import shall be unrestricted, unless regulated under any legislation (Directorate General of Foreign Trade, 2004).

Of exports reported by India, all have been reported as of artificially propagated origin except for the export in 1999 of ca 2.5 tonnes of extract to Italy, which was reported as of wild origin. It is not known if non-detriment findings were made for this export (assuming it was not declared as of wild origin in error). The Director of the Botanical Survey of India is the CITES Scientific Authority responsible for making non-detriment findings. However no documents could be accessed to illustrate this process (TRAFFIC India, 2007).

A series of specific export rules for *P. santalinus* has been in place since at least the early 1990s, alongside more general provisions for CITES-listed species. A government ban on exports imposed in April 1992 was modified in October 1996 to relate only to unprocessed products (Anon., 2000b in Mulliken and Crofton, 2007). The species was included in India's *Negative List of Exports* of the Export and Import Policy in March 1996, banning virtually all exports of wild-harvested specimens. The listing for 1997-2002 and 2002-2007 was annotated such that "value added products" of the wood such as extracts, dyes and musical instruments and parts of musical instruments could be exported as long as the wood was procured from legal i.e. cultivated sources.

Exporters must obtain a licence, which requires that they provide certified copies of certificates of origin issued by the Principal Chief Conservator of Forests of the State from which the stocks were procured, giving details of the date of procurement and quantities. The stocks must be verified by a nominee of the Principal Chief Conservator and a certificate of their current position also provided with the application (Anon., 2005b). Export may also be subject to other conditions such as "quantity ceilings requirements under CITES" (Anon., 2005b), although it is unclear whether and what such restrictions might be in place.

The export of large quantities of wood chips recorded in Customs data seems to indicate that these were considered 'value added' products. Wood seized by the government (e.g. in Andhra Pradesh) becomes Government property and can also be legally exported (TRAFFIC India, 2007).

Assuming Customs data do in fact reflect trade in *P. santalinus*, then CITES would not appear to be being implemented for this species either in India or in countries of import. Over 500 t of wood chips have been exported from India since the CITES listing took effect according to India's Customs data. However, India's CITES annual reports do not show the export of any wood chips, with CITES-reported exports instead limited to extract and carvings, with these ceasing in 1999. Little trade has been reported by importing Parties with the exception of China, which reported significant imports from non-range States in 2002 and 2003.

All violations of the EXIM policy constitute an offence under the Customs Act and are dealt with by Customs officials, who alone have the responsibility to enforce compliance with CITES at border posts. Inspection of consignments by Wildlife Inspectors, co-operating with Customs staff, may also be carried out at border crossings, but such specialist investigations are few. Enforcement of any violations detected is the responsibility of the Customs authorities (Panda, 1998).

In Andhra Pradesh, the Andhra Pradesh Forest Development Corporation (FDC) has been appointed by the State Government as the main selling agent for seized timber of this species, which reportedly amounted to some 1800 t in the period 1992 to 2002. The FDC was said to sort the timber for sale onto

the global (and presumably domestic) market (Anon., 2002a). No exports that might have resulted from such a sale have been reported in CITES trade data.

Cultivation

The extent of commercial cultivation is unclear, although India's CITES annual reports have recorded all exports as being of cultivated origin (artificially propagated). An August 2004 offer for sale posted to the internet stated that 3,000 t of *P. santalinus* logs were available for sale from farmed trees 20 years old in Chennai, Tamil Nadu. The timber was said to be available with full government permissions for felling and shipping (Ragavan, 2004a). The following day another advert was posted on the internet with an increased offer of 12,000 tonnes of Red Sanders logs, also from trees 20 years old grown on the same farm (Ragavan, 2004b). Confirmation of the validity of these offers would indicate that cultivation timber is now produced in commercial quantities.

Cultivation trials were already made in the 1960s and later, primarily to try and meet the demand in wavy-grained timber (IUCN and TRAFFIC, 1994; Singh 1997 in Schippmann, 2001). Plantations were reportedly established in Kerala in 1983 (Babu, 1992). In 2001 seed production areas were listed for Andhra Pradesh (12.4 ha) and Karnataka (20 ha) by Forest Statistics India (2001). In 2002 it was reported that the Andhra Pradesh Forest Development Corporation planned to promote the establishment of further nurseries and plantations in the state, noting that the quality of plantation-produced wood was often low and more effort was needed to improve production (Anon., 2002a). The 2004-05 Annual Plan for Tamil Nadu's State Planning Commission includes a plan to raise plantations of Red Sanders (Anon., 2004c).

Recently best phenotypes for large-scale production of improved planting stock have reportedly been identified, apparently including forms that may have a high probability of yielding the highly valued wavy-grained wood (Andhra Pradesh Forestry Department, undated; Indian Council of Forestry Research and Education, undated). Vedavathy (2004) notes an estimate that if 500 trees were planted on one hectare, after a minimum of 25 years 500 kg heartwood per tree and 250,000 kg of wood per hectare could be expected.

The species is reported in cultivation in China (Hau, 1997 in Schippmann, 2001; Maung Lwin, 1995), and in the Philippines (List and Hörhammer, 1977 in Mulliken and Crofton, 2007).

PROBLEMS IDENTIFIED THAT ARE NOT RELATED TO THE IMPLEMENTATION OF ARTICLE IV PARAGRAPHS 2A, 3 OR 6A

As discussed at length above, it seems that a large proportion of international trade in *P. santlinus* has been taking place outside CITES controls, including that in parts and derivatives that have been covered by the Convention for the period under review. Until implementation of CITES and reporting under the Convention improves for this species, it will be difficult to assess the impact of collection for international trade on wild populations strictly under the terms of the Review of Significant Trade.

The smuggling of *P. santalinus* from India to South-East and East Asia is a significant area of concern. Increasing amounts were seized in India between 2003 and 2006: 151 MT during 2003-2004, 347 MT during 2004-2005 and 449.375 MT during 2005-06; these seizures included cut to size pieces of timber and semi-finished musical instruments, the presence of the latter being a recent trend. Seizures have been made at several ports in India such as Cochin, Pune, Chennai, Tuticorin, Kolkata and Ahmedabad. In most cases the cargo was destined for Singapore (Directorate of Revenue Intelligence, 2006). Mulliken and Crofton (2007) list 20 seizures of more than one tonne made between 1999 and May 2005. There were also numerous smaller seizures of *Pterocarpus santalinus* at various sea ports and airports, destined for the EU, the USA (mainly powder) and some other parts of the world. These items were seized as a result of violations of either India's EXIM policy and/or CITES trade controls (Mulliken and Crofton, 2007).

A new route for the illegal trade of *P. santalinus* has recently been discovered to E. India through Nepal, on its way to China. Over 200 t have been confiscated in Nepal in recent months and several seizures have also taken place in India along the Indo-Nepal border (Chapagain, 2007; Nepalnews, 2007; TRAFFIC India, 2007; The Times of India, 2007).

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Rauvolfia serpentina Benth. ex Kurz

FAMILY: Apocynaceae

COMMON NAMES: Rauwolfia root, Serpentine root, Serpentine wood, Snakewood (English); Rauvolfia (Italian); Sarpagandha (India); Bon-ma-ya-zar (Myanmar); Ra Yom (Thai); ba gac hoa do (Vietnam).

GLOBAL CONSERVATION STATUS: Not assessed.

SIGNIFICANT TRADE REVIEW FOR: India, Myanmar and Thailand

Note: This account draws heavily on research undertaken in the period 2004-2006 as part of a review of seven Asian CITES-listed medicinal and aromatic plant species, undertaken by TRAFFIC and IUCN and funded by the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN) (Mulliken and Crofton, 2007). The information in this was updated and additional research and analysis was undertaken in 2007 to produce the present account.

SUMMARY

Rauvolfia serpentina is a small, evergreen shrub with a wide-ranging distribution in Asia, occurring throughout most of India and east through Myanmar to Viet Nam. It grows in the tropical and subtropical belt with rainfall 250-500 cm, and up to 1000 m altitude. It is one of around 60 species in the genus *Rauvolfia*, which is distributed widely in the tropics.

The roots are rich in alkaloids, including reserpine, an important medicinal drug. In traditional Asian medicine *R. serpentina* roots have been used for centuries for a range of complaints including nervous disorders, hypertension, schizophrenia, epilepsy, fever, cholera, high blood pressure, and dysentery. In Western medicine, reserpine-based pharmaceuticals have been used since the early 1950s and have become important in the treatment of hypertension and mental illnesses.

The increased demand for reserpine has evidently resulted in declines in wild populations of *R. serpentina* in India and other countries in its range. Habitat loss and fire are additional threats. Conservation Assessment and Management Planning workshops in India (in 1995, 1998 and 2003) concluded that the species was endangered or critically endangered in a number of states and vulnerable in most other states in its Indian range. The species is reported to be widespread and locally abundant in Myanmar, although no inventories or surveys have been carried out. It is widespread in Thailand and not considered threatened there.

R. serpentina is reported to be commercially cultivated on a small scale in India, although not in sufficient amounts to meet domestic demand. It is not known to be cultivated commercially in Myanmar or Thailand. The species is apparently used domestically on only a small scale in Thailand. In Myanmar licence fees indicate that harvest (reportedly intended only for domestic use but see below) amounted to around 52 tonnes in the year April 2005 to March 2006. Demand in India is apparently increasing and was estimated at nearly 600 t for 2004-2005. Available information indicates that use of reserpine in Western pharmaceutical products in the USA and western Europe is declining, with many of India's exports of reserpine having shifted to the Russian Federation and Eastern Europe.

R. serpentina was listed in CITES Appendix II in 1990 with Annotation #2, which designates "all parts and derivatives, except a) seeds and pollen; b) seedlings or tissue cultures obtained *in vitro*, in solid or liquid media, transported in sterile containers; c) cut flowers of artificially propagated plants; and d) chemical derivatives and finished pharmaceuticals". The annotation was modified at CITES CoP14 (2007) to: "Designates all parts and derivatives except: a) seeds and pollen; and b) finished products packaged and ready for retail trade". This modification took effect 13 September 2007.

India is believed to be the major producer of reserpine globally. Most export is in the form of extracts and formulations which until 13 September 2007 were exempt from CITES controls. CITES-reported exports of *R. serpentina* for the period 1996-2005 amounted to around one tonne of roots and very small amounts (a few kilogrammes or tens of kilogrammes) of powder, derivatives and extract. Production of

reserpine in India evidently uses both *R. serpentina* and the African species *R. vomitoria* which is not subject to CITES controls. According to Customs data India imports "serpentina roots" for processing into reserpine (around 275 tonnes in the period April 1999 to March 2006), but also exports significant amounts of such roots (around 32 tonnes in the same period). Over two-thirds of the reported imports (184.6 t) came from Myanmar. This trade seems very likely to have involved *R. serpentina*, as there is no information to suggest that *R. vomitoria* (the other commercial source of reserpine) is cultivated in or exported from Myanmar. If imports from Myanmar into India are confirmed to involve *R. serpentina*, then they are taking place outside of CITES trade controls as the very large proportion of these imports have not been reported in CITES data.

India is a major producer and exporter of reserpine from this species and (non-CITES-listed) *R. vomitoria*. Production is apparently based on imported material but the species is said to be overharvested in much of India and likely also to be used in production for export. Pending further clarification of the source of all material used for production of resperpine for export, trade in *R. serpentina* from India is considered of **Possible Concern**.

Substantial exports from Myanmar have been reported in Indian customs data that have not been reported in the CITES trade database (around 185 tonnes, 1999-2006) and Myanmar says that export permits have not been issued. The species is reported to be widespread. No detail of non-detriment findings was available, which indeed would not be necessary if, as stated by the CITES Management Authority of Myanmar, no export permits have been issued. Due to the uncertainties of trade in this species from Myanmar, it should be considered of **Possible Concern**.

In Thailand the species is reported to be widespread and not threatened; trade in the species from Thailand is therefore considered of **Least Concern**. (Although the quantity reported as exported from Thailand in 1996-2005 is higher than that reported from Myanmar under CITES, other trade data indicate that the reverse is the case.)

SPECIES CHARACTERISTICS

Rauvolfia serpentina is an erect, small evergreen perennial subshrub, usually 15-45 cm high, sometimes up to 1 m. It has a tuberous taproot system up to 40-60 cm long.

The species is widespread in Asia; reported range States are Bangladesh, Bhutan, China, Indonesia, India, Lao PDR, Malaysia, Myanmar, Nepal, Sri Lanka, Thailand and Viet Nam. It occurs in tropical or subtropical regions up to 1000 m altitude and prefers areas with annual rainfall in the range 250-500 cm and slightly acidic, deep, fertile soils rich in organic matter (Anon., 2002a; National Institute of Industrial Research, 2006; Ved *et al.* 2003a).

The roots are rich in alkaloids, including reserpine, an important drug and they, and to a lesser extent the leaves, are used medicinally (National Institute of Industrial Research, 2006). In traditional East Asian medicine *R. serpentina* roots are used to reduce heat, reduce liver wind, promote subsidence of swelling and lower blood pressure (Hau, 1997 in Schippmann, 2001). In South Asia the plant is widely used to treat various central nervous disorders, including anxiety states, maniacal behaviour associated with psychosis, schizophrenia, insanity, insomnia, and epilepsy, as well as intestinal disorders, cholera and fever (Ayensu, 1996; Balasubramanian, 2004; Government of India, 1989; Manandhar, 2002; Siddique *et al.*, 2004). The species is also used by traditional healers to treat snake and dog bites and is also planted to ward off snakes in rural India (Oudhia, 2001-2003). In Western medicine, the alkaloid reserpine, first isolated from *Rauvolfia* roots in the early 1950s, has been of importance in the treatment of hypertension and mental illnesses through its effect as a tranquillizer (National Institute of Industrial Research, 2006).

R. vomitoria, which is from Africa, is also a commercially important source of reserpine; its trade is outside CITES controls (National Institute of Industrial Research, 2006). Other species of *Rauvolfia* are known to contain reserpine, but none is known to be commercially exploited. *R. serpentina* is the only species of the genus listing in the CITES appendices. According to the US National Toxicology Program 11th Report on Carcinogens (Anon., 2004), there was no known commercial production of synthetic reserpine.

INTERNATIONAL TRADE

R. serpentina was listed in CITES Appendix II in 1990 with Annotation #2, which designates "all parts and derivatives, except a) seeds and pollen; b) seedlings or tissue cultures obtained *in vitro*, in solid or liquid media, transported in sterile containers; c) cut flowers of artificially propagated plants; and d) chemical derivatives and finished pharmaceuticals". The annotation was modified at CITES CoP14 (2007) to: "Designates all parts and derivatives except: a) seeds and pollen; and b) finished products packaged and ready for retail trade". This modification took effect in mid-September 2007.

The current global demand for *R. serpentina* is unknown; it was estimated to be 100-150 t (presumably of dried roots) annually in the early 1980s (Mulliken and Crofton, 2007). However domestic demand in 2004/2005 in India alone was estimated at just under 600 t (Anon., 2001-2002 in Mulliken and Crofton, 2007). In recent years the use of reserpine in western Europe and the USA has decreased considerably owing to side effects (Anon., 2006; Frohne, 1994 in Schippmann, 2001). However, trade data indicate that use is still extensive in the Russian Federation and eastern Europe, notably Ukraine.

Table 1: Export of *Rauvolfia serpentina* by range States 1996-2005 as recorded in CITES trade data

Exporter	Unit (kg)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
India	Powder		50								
India	Derivatives		14.2								
India	Extract			2.5	8.5	2.2					
India	Roots					100		125		680	200
Myanmar	Roots				14340						
Thailand	Roots				3300	9500	4020	1740	2370	6050	3030

NB: All export from India since 1999 reported as of artificially propagated origin

In addition 2 million 'derivatives' (no units specified) were recorded by India as exported to Russia in 1997.

CITES annual report data (Table 1) show trade in powder, derivatives, extracts and roots (despite derivatives and extracts being exempt from the listing prior to September 2007). Reported exports of *R. serpentina* roots by range States were just over 42 t in the period 1999-2005, dominated by exports from Myanmar (14 t) and Thailand (27 t). Importing Parties showed trade in around 32 t over this period. India features as both importer and exporter. The 1999 exports from Myanmar were recorded as going to India. India reported almost exactly half of this as imports.

Additional information on international trade is available from Indian Customs statistics which indicate a large amount of trade in 'Serpentina roots' not recorded in CITES data (Tables 2 and 3).

Table 2: Export of 'Serpentina roots' recorded in India's Customs data (1999/2000-2005/2006)* (tonnes)

99-00	00-01	01-02	02-03	03-04	04-05	05-06	Total
9.0		6.0		14.2	1.4	0.9	31.5

Table 3: Imports of 'Serpentina roots' into India, recorded in India's Customs data (1999/2000-2005/2006)* (tonnes)

Origin	99-00	00-01	01-02	02-03	03-04	04-05	05-06	Total
Belgium					1.0		15.0	16.0
Congo DR					35.3	16.0		51.3
Kenya					12.1			12.1
Myanmar	**19.8**	**6.0**	**19.3**	**36.1**	**70.4**	**12.0**	**21.0**	**184.6**
Nepal			6.0					6.0
Singapore	6.0							6.0

* Note years run from 1 April to 31 March

Source: Export Import Data Bank, Department of Commerce, Government of India at http://dgft.delhi.nic.in

According to these data, India exported 31.5 t of "Serpentina roots," between 1 April 1999 and 31 March 2006, only ca 0.8 t of which is reported by India in CITES data and 0.4 t by importing parties. The quantity of 6 t in 2001-02 is recorded both as an export from India to Nepal and an import from Nepal to India, presumably in error.

During the same period, India reported the import of some 276 t of "Serpentina roots". Myanmar was the reported source of around two thirds of this (185 t). Customs data for 1999-2000 correspond very roughly to CITES annual report data from Myanmar for 1999; however, none of the other imports is reflected in CITES data, despite the fact that the only *Rauvolfia* species occurring in Myanmar known to be used for reserpine production is *R. serpentina*. Virtually all the remaining quantity of "Serpentina roots" imported according to customs data was recorded as coming from either Africa (Congo DR and Kenya) or Belgium, a country with strong trading links in central Africa. *Rauvolfia serpentina* does not occur in Africa; however, *Rauvolfia vomitoria,* which is also used on a commercial scale for reserpine production, does (Mulliken and Crofton, 2007). In 2007, TRAFFIC India reported that while no data could be found to ascertain this fact, a personal communication with the CITES Management Authority of India indicated that *R. vomitoria* was being imported from South Africa.

Reserpine is also exported from India in the form of formulations. Customs data indicate export of some 266 t of "Formulation of reserpine and other Rauvolfia alkaloids in tablets etc" in the period 1999/2000 – 2003/2004, 95% of which went to the Russian Federation and Ukraine. Even if these products were derived from *R. serpentina* until mid-September 2007 they were exempt from CITES provisions under Annotation #2; no CITES permits are issued and no records maintained (Jain, 2005). This trade would not need to and does not therefore appear in CITES trade data. From September 2007 formulations are no longer exempt from controls unless they are in the form of finished products packaged and ready for the retail trade.

R. serpentina is also reportedly cultivated in four provinces in China (Hau, 1997 in Schippmann, 2001); on a small scale in Bangladesh (National Institute of Industrial Research, 2006), and in Java (Indonesia) and Sri Lanka (Oudhia, 2002a). Commercial cultivation is reported from Malaysia (Wichtl, 1997 in Schippmann, 2001). Experiments on cultivation are reported in progress in the US (Oudhia, 2002a).

COUNTRY ACCOUNTS

India

Status

R. serpentina is widespread in India in the sub-Himalayan tract from Punjab eastwards to Sikkim, Assam, in the lower hills of the Gangetic plains, Eastern and Western Ghats, parts of central India and also in the Andaman Islands (Anon., 2002a). States where it is recorded include: Andamans, Andhra Pradesh, Assam, Bihar, Chattisgarh, Gujarat, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharastra, Meghalaya, Orissa, Sikkim, Tamil Nadu, Uttarakhand, and West Bengal (Anon., 2002a; Ved *et al.*, 2003b).

Two Conservation Assessment and Management Planning (CAMP) workshops carried out in the mid-1990s concluded that the species was endangered in southern and central India. Identified threats were over-exploitation for the medicine trade, habitat loss and fire, and the species was believed to have declined by more than 50% between 1985 and 1995 (Molur *et al.,* 1995; Molur and Walker, 1998). At a later CAMP workshop the species was assessed as critically endangered in Madhya Pradesh, with decline there known believed or inferred to have been more than 80% during 1988-1998 (Patnaik, 1999 in Schippmann, 2001). Two CAMP workshops held in 2003 assessed the species as critically endangered in Himachal Pradesh, Chhattisgarh, Andhra Pradesh and Maharashtra and vulnerable in Jammu & Kashmir, Madhya Pradesh, Uttarakhand, Assam and Meghalaya. Major identified threats were harvest for medicinal use and trade (Ved *et al.*, 2003b in Mulliken and Crofton, 2007; Ved *et al.*, 2003a). The species was reported by Rath (2005) as apparently endangered or critically endangered in several localities in Orissa. According to Ansari (1993) in Schippmann (2001) genetic erosion has affected the species greatly and populations left in India have very poor alkaloid content.

Management and trade

Domestic use

During a TRAFFIC India market survey in 1997 (TRAFFIC India, 1998), the species was found to be readily available and among the most significantly traded medicinal plants. At least twelve different herbal formulations using *R. serpentina* were known. At the Delhi market, the species was said to come mainly from Uttarakhand, but with substantial quantities also reportedly imported from Pakistan (not a range State), Bhutan and Nepal. As Nepal imports some *R. serpentina* to meet its own needs (Tiwari *et al.*, 2004), it seems unlikely that significant quantities are imported from there today.

Rath (2005) noted that the average sale of roots in the Kolkata market was about 50 t. Until a few years previously, all of this had apparently come from Orissa but by that time Orissa supplied only around 10-20 t, with wild roots coming from north-eastern and cultivated roots starting to appear on the market. Ramachandran (2005) indicates widespread use of the species in India by phyto-pharmaceutical companies.

A recent study of harvesting techniques in Madhya Pradesh indicated these were deteriorating because of the high price of the product in the market. Immature roots were being harvested and plants were not being left for regeneration (Mishra, 2003). According to Chatterjee (2004, in Jain, 2005) up to 30-40% of the harvest is eventually lost due to accumulation of toxins. Oudhia (2003) reports that *R. serpentina* is illegally harvested and traded in Chhattisgarh and other states, sometimes falsely labelled as turmeric, the trade of which is not controlled, and is also passed off as cultivated specimens.

A medicinal plant supply and demand study commissioned by the Department of Indian Systems of Medicine & Homeopathy, the Indian Government and the World Health Organization (WHO) estimated demand for the species to be ca 420 t in 2001-2002 and ca 590 t in 2004-2005, much higher than earlier estimates (Anon., 2001-2002 in Mulliken and Crofton, 2007). According to Gupta (2005), the main markets where the species is sold are Amritsar, Delhi, Kolkata and Mumbai.

Domestic regulation

The main laws governing harvesting of medicinal plants are the Indian Forest Act (1927), and, to a lesser extent, the Wildlife (Protection) Act (1927/1991/2002). The Indian Forest Act (1927) consolidates the law relating to forest produce, the transit thereof and duty thereon, and empowers State Governments to regulate the transit of forest produce, e.g. medicinal plants. The Act deals specifically with reserved, protected, and village forests and has been adopted by most of the States and is directly applicable to the Union Territories of India. The remaining States have enacted State Forest Acts of their own, which are largely based on the Indian Forest Act (Jain, 2000). Almost all the States and Union Territories in India have regulations regarding harvest, transit and trade in medicinal plants. Harvest and trade of *R. serpentina* is banned in Chhattisgarh (Oudhia, 2001-2003).

Export controls

There is conflicting information regarding India's export controls for this species prior to the mid-1990s (see, e.g. IUCN and TRAFFIC, 1989; Government of India, 1989). As of March 1994, the export of wild-harvested *R. serpentina* was prohibited through the species' inclusion in the *Negative List of Exports* in March 1994. However, this ban does not appear to have extended to exports of formulations or cultivated products. The relatively small amount of export of *R. serpentina* reported in the CITES trade database as exported from India since 1999 (see table 1 in International Trade above) has all been reported as of artificially propagated origin.

CITES is implemented in India through a combination of the Wildlife Protection Act, 1972/1991/2002 and the Export and Import Policy (EXIM), although the former does not cover this species. Policy on trade in wildlife and wildlife products is established via the EXIM policy, which is decided in consultation with the CITES Management Authority. The EXIM policy was embedded within a broader Foreign Trade Policy for the period 2004-2009, this change coming into effect on 1 September 2004 and includes a Special Agricultural Produce Scheme, promoting the export of, *inter alia,* minor forest produce such as medicinal plants and their value-added products. The policy outlines that all export and import shall be unrestricted, unless regulated under any legislation (Directorate General of Foreign Trade, 2004).

Import and export restrictions for specific products are established via India's ITC (HS) classifications in accordance with the broader policy. Several categories relevant to CITES-listed species have been identified as goods allowed to be imported without restriction (i.e. free of import duties or quotas), e.g. "medicinal plants, fresh or dried, whether or not cut, crushed or powdered" (Schedule 1 Chapter 12) and pharmaceutical products (Schedule 1, Chapter 30). Although instructions under the EXIM policy for 1997-2002 stipulated that imports of plants, products and derivatives were subject to CITES provisions (TRAFFIC India, 1998 in Schippmann, 2001), the low levels of trade data for imports of CITES-listed species into India indicate that these provisions were not implemented effectively.

As stipulated in Chapter 12 of the ITC (HS) classifications, the export of plants, plant portions, their derivatives and extracts of species included in CITES Appendix I and II and obtained from the wild (regardless of their country of origin) is prohibited. These species are included in an "Export Licensing Note" appended to Chapter 12 which specifies 29 plant taxa including this species.

Exports of plants produced via cultivation are allowed subject to obtaining a transit pass from the relevant Divisional Forest Officer if the plants were cultivated in sites within forests, or a Certificate of Cultivation from a District Agriculture, Horticulture or Forest Officer if cultivated at sites outside forests.

According to a CITES Management Authority staff member in India, the only permitted export of *Rauvolfia* products is in the form of reserpine, produced from imported *R. vomitoria*, with an affidavit to this effect obtained from exporters prior to permitting export. Quantities are checked to ensure that exports do not exceed those that could have been produced from imported *R. vomitoria*, and the exporter is provided with a No Objection Certificate. As the trade is considered not to involve the CITES-listed *R. serpentina*, it is not recorded in CITES annual reports. However, as noted above (Table 3 under International Trade), Indian customs data indicate the import of very substantial quantities of "serpentina roots" from Myanmar (comprising over two-thirds of recorded serpentina root import for the period April 1990 to March 2006). As the only *Rauvolfia* species known to be commercially harvested in Myanmar is *R. serpentina* it seems extremely likely that this is the species concerned.

Treaty of Trade between Nepal and India

The Governments of India and Nepal entered into a bilateral trade agreement in 1991. The treaty provides for exemption from Customs duty and quantitative restrictions of trade of certain "primary products", which include Ayurvedic and herbal medicines (Anon., 2002b). A certificate of origin issued by the Government of Nepal is the only document required for presentation to India's Customs authorities at the time of import. During the late 1990s, border officials were unaware that CITES documentation might also be required for export (Mulliken and Crofton, 2007). The treaty was extended for a further five years in 2002 until 5 March 2007 (Anon., 2002c). Although some amendments were made, these did not reflect the concerns raised regarding CITES implementation (Amatya, 2005). In February 2007 another treaty extension was announced (Indian Embassy, 2007). It is not known whether amendments reflect the concerns raised. However, Nepal has stated that export of raw or unprocessed forms of *R. serpentina* has been banned under the Forest Regulation 1995 (CITES Management Authority of Nepal, 2005).

Cultivation

R. serpentina is apparently commercially cultivated on a small scale. The Planning Commission, Government of India (2007) reported a total of 1000 ha cultivated in Bihar, Madhya Pradesh, Orissa, Uttarakhand and West Bengal. Kumar (1997) reported a larger area of 2500 ha under cultivation in Madhya Pradesh. Rath (2005) cites an instance in northern Orissa where around 8 acres (ca 3 ha) were planted by an entrepreneur and were apparently so profitable that he received orders for 200,000 plantlets to sell to other farmers. Traditional rice growers in Chhattisgarh were stated in 2002 as shifting to alternative crops including *R. serpentina* (Oudhia, 2002b).

Reported average yields are 2700-3300 kg dried roots/ha and 8-10 kg seed/ha (Oudhia 2002a). Comparatively high rates of profitability per hectare (Rs 40,000-55,000 or ca USD 850-1200) have been quoted (National Institute of Industrial Research, 2006; Planning Commission, Government of India, 2000). However Oudhia (2003) stated that growers in Chhattisgarh were not receiving good enough prices to justify the long duration of the crop, which is 28 months for best results. It was not possible to verify the current extent of cultivation within the country.

Myanmar

Status

According to Zaw (2005), *Rauvolfia serpentina* is sometimes abundant in moist deciduous forests, although it could be declining in areas where habitat is degraded. It is reported in six of Myanmar's 14 regions: the states of Kayah, Kayin and Shan and the divisions of Sagaing, Bago and Mandalay. Aung Din (2005) considers the major threat to be habitat degradation and change of land use. The CITES Management Authority of Myanmar (2007) reports that the species is cosmopolitan in Myanmar, growing in many types of forest as an understorey plant and with abundant natural regeneration.

Management and trade

R. serpentina is used in indigenous medicines, to treat hypertension, as a sedative, and for treatment of intestinal disorders (Aung Din, 2005). Local people collect the species and sell it to small traders in the nearest towns, who distribute the plants to major traders in big cities such as Yangon and Mandalay (Zaw, 2005). Wholesalers also have agents who collect the species in local areas, possibly buying from village collectors (Aung Din, 2005). Some local collectors sell directly to cottage medicine industries. Only a small number of individuals and households are thought to be involved in the collection of *R. serpentina,* although the number is hard to estimate as the species is collected opportunistically, while people harvest other forest products for local use (Zaw, 2005). The roots are usually dried, although indigenous healers often prefer to use fresh roots (Aung Din, 2005).

The species is not protected within national legislation (Zaw, 2005), however harvests are controlled via the Forest Law and The Protection of Wildlife and Conservation of Natural Areas Law (Aung Din, 2005). The Forest Department allows collection as a non-timber forest product and issues bills upon payment of a fixed royalty (CITES Management Authority of Myanmar, 2007). On the basis of revenue collected, the CITES Management Authority (2007) report that just over 52,000 kg of *R. serpentina* was recorded as harvested in the financial year 2006-2007 and just over 16,000 kg between 1 April 2007 and September 2007. From 2001 to 2004 the Forest Department allowed around 70 t (fresh weight) to be harvested for domestic use. No scientific surveys have been undertaken of this species (Zaw, 2005). However, the CITES Management Authority of Myanmar (2007) noted that they did not believe that the current level of harvest as reflected in revenue receipts adversely affected populations of the species in Myanmar.

Indian customs data show the import of substantial quantities of "serpentina roots" from Myanmar (185 tonnes in the period April to 1999 to March 2006 – see Table 3 in International Trade above). No *Rauvolfia* species other than *R. serpentina* is known to be harvested in Myanmar for commercial use. However the CITES Management Authority (2007) state that harvest of the latter species is intended entirely for domestic use and confirm that they have never issued export permits for this species to India or any other country despite having reported the export of 14,340kg of roots to India in 1999.

Zaw (2005) notes that some small-scale trial plantations for local medicinal supply have been established.

Thailand

Status

R. serpentina is widely distributed in Thailand and is reported from evergreen forest or open areas up to 800 m altitude in the north (Chiang Mai, Lampang, Lamphun, Nan, Phitsanulok, Phrae, Tak), northeast (Loei, Nong Khai, Phetchabun), southwest (Kanchanaburi, Prachuap Khiri Khan), centre (Bangkok, Saraburi) and southeast (Chanthburi, Chon Buri, Surat Thani). *R. serpentina* is found in many protected areas throughout Thailand and is also widespread on private lands (CITES Management Authority of Thailand, 2005; Sankasubuan, 2005).

Management and trade

The species is used in traditional medicine to treat various nervous system disorders. Domestic trade is small scale and amongst local communities (CITES Management Authority of Thailand, 2005, 2007). Harvest is said to mainly involve villagers who collect the species as an opportunistic activity, with companies involved in internal trade and export. It does not appear that other species with similar properties are mixed with or substituted for *R. serpentina* (Sankasubuan, 2005). Collection takes place

during the rainy season, in May-June, with collectors drying the roots prior to sale. Exporters only buy the root once a year, from middlemen, during the rainy season (CITES Management Authority of Thailand, 2005; 2007).

The CITES Management Authority (2005, 2007) notes that conversion of land for agricultural use and settlement can be primary threats for all *Rauvolfia* spp. but believes that over-collection for international trade does not occur. He does not consider *R. serpentina* threatened in Thailand. However, no details of how non-detriment findings have been made were available.

Harvesting in protected areas is prohibited under the Forest Act and National Park Act. Export, import and re-export are restricted under the Plants Act B.E. 2518 (1975) (CITES Management Authority of Thailand, 2005, 2007; Sankasubuan, 2005).

According to Sankasubuan (2005), cultivation is currently under study. The CITES Management Authority of Thailand (2007) determined through interview a likely yield of 750 kg of dried roots/ha.

PROBLEMS IDENTIFIED THAT ARE NOT RELATED TO THE IMPLEMENTATION OF ARTICLE IV PARAGRAPHS 2(a), 3 OR 6 (a)

As discussed at length above, it seems that a very large proportion of international trade in *R. serpentina* has been taking place outside CITES controls, including that in specimens, parts and derivatives that have been covered by the Convention for the period under review. Until implementation of CITES and reporting under the Convention improves for this species, it will be difficult to assess the impact of collection for international trade on wild populations strictly under the terms of the Review of Significant Trade.

India

Rath (2005) reports that sometimes *R. serpentina* is exported in the name of *R. tetraphylla* (native to Mexico, Central and South America) as customs staff are not able to distinguish between the two. At the time of *R. serpentina's* inclusion in Appendix II, illegal exports from India were believed to be substantial (Government of India, 1989). However, seizures reported in India generally concern very small quantities (Mulliken and Crofton, 2007). One relatively large consignment of approximately 7 t of *R. serpentina* roots was seized at Kolkata in 1999 (Anon., 2001 in Mulliken and Crofton, 2007).

Myanmar

Noting high demand from pharmaceutical industries, particularly from traditional Chinese medicine, and Myanmar's long common borders with China, Thailand and India, the Director of Myanmar's CITES Scientific Authority believes that illegal trade may occur. However, there have been no reports of large seizures by Customs staff in border areas. He reports that no applications for CITES export permits have been received (Zaw, 2005). Details of large-scale exports from Myanmar documented in India's Customs data were received with surprise, and further enquiries were being made by the Forest Department as a result of receiving this information (Aung Din*,* 2005). However the CITES Management Authority (2007) reported that they were not in a position to clarify the status of these apparent exports.

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Taxus wallichiana Zucc.

FAMILY: Taxaceae

COMMON NAMES: Ximalaya hongdoushan (Chinese); Himalayan yew (English); If de l'Himalaya (French); Tejo del Himalaya (Spanish).

SYNONYMS: *T. baccata* subsp. *wallichiana* (Zucc) Pilger, *T. nucifera* Wall, *T. contorta* Griff., *T. orientalis* Bertol, *T. yunnanensis* W.C. Cheng & L.K. Fu.

Note: The taxonomy of the genus *Taxus,* and particularly the Asian *Taxus* populations, including those within India currently considered as *T. wallichiana*, is uncertain. Differences between named species are not always consistent. *T. wallichiana* is said to differ from European *T. baccata* by having longer leaves, which are generally not abruptly cuspidate, and may only merit sub-specific rank (Farjon, 2001). Populations that under CITES taxonomy are considered *T. wallichiana* are sometimes referred to in domestic regulations and reports (e.g. in Nepal and Sikkim) as *T. baccata* (see below).

GLOBAL CONSERVATION STATUS: Data Deficient (Assessed 2000, Categories and Criteria version 2.3). Considered Lower Risk in the *World List of Threatened Trees* (Oldfield *et al.,* 1998).

SIGNIFICANT TRADE REVIEW FOR: India

Note: This account draws heavily on research undertaken in the period 2004-2006 as part of a review of seven Asian CITES-listed medicinal and aromatic plant species, undertaken by TRAFFIC and IUCN and funded by the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN) (Mulliken and Crofton, 2007). The information in this was updated and additional research and analysis was undertaken in 2007 to produce the present account.

SUMMARY

Taxus wallichiana is a small, evergreen tree that grows in temperate mixed forests between 1500 m and 3000 m. The species as generally recognised has a wide-range in Asia, occurring from Afghanistan through the Himalaya to the Philippines. It is one of a number of very similar species in the genus *Taxus* which is widespread in North America and Eurasia and is a multipurpose plant valued through much of its range as a source of timber, fuelwood, fodder, traditional medicine and, since the early 1990s, paclitaxel and other taxanes used in anti-cancer medications. These taxanes are extracted from a range of yew species in addition to *T. wallichiana*.

In India *T. wallichiana* is widely agreed to have been affected by over-harvesting for domestic use, and habitat degradation and loss, exacerbated by slow growth and poor regeneration, even before harvest for taxanes began. High demand for bark and leaves for paclitaxel production reportedly resulted in a significant increase in the rate of exploitation evidently leading to sharp population declines, at least in India. Conservation Assessment and Management Plan (CAMP) workshops in India in 1997, 2003 and 2005 assessed *T. wallichiana* as critically endangered or endangered in most Indian states within its range.

International trade in *T. wallichiana* and other yews involves a combination of leaves, bark and extracts in various stages of processing. Much of the preliminary processing appears to take place within India (and other range States), while the final pharmaceutical products are more likely to be produced and consumed in the USA, and, increasingly, in Europe. India is believed to be one of the world's main producers of paclitaxel and production appears to be increasing.

In India, the export of wild specimens of *T. wallichiana* sourced from within the country has been prohibited since at least 1996. However, this prohibition would not appear to apply to cultivated specimens, nor to formulations in which product of the species concerned is present in unrecognisable and physically inseparable form, or to finished products. Wild harvest of *T. wallichiana* continues to be legal in some states.

Although the species has been listed in CITES Appendix II since 1995, there is very little information available regarding current rates of harvest of and trade in *Taxus wallichiana*. The only export from India reported in CITES trade data is of 100 kg of leaves exported in 2001. Commercial production of paclitaxel in India is currently stated to be based on imported *T. baccata* rather than on native or imported *T. wallichiana*. Exports of paclitaxel are therefore considered essentially to involve re-export of *T. baccata,* and not to require CITES export certificates as this species is not listed in the Appendices. However at least some yew for processing has been reported as coming from Nepal where, under CITES taxonomy, the only native *Taxus* species is *T. wallichiana* (sometimes considered a subspecies of *T. baccata* and apparently reported as such). If this is the case, then paclitaxel exported from India may in fact be based on *T. wallichiana* and should therefore since 2005 have been reported under CITES. The range of *T. wallichiana* in India is largely contiguous with the range of the species in Nepal and it is unclear therefore how material from India could be distinguished from that originating in Nepal at processing and later stages (including export).

Large-scale commercial cultivation of *Taxus wallichiana* has not yet been achieved in India although it is being promoted currently by most State governments where the species is native.

In view of the substantial quantities of paclitaxel currently exported by India, the fact that production is apparently based at least in part and possibly mainly on *T. wallichiana* (imported from Nepal as *T. baccata* but *T. wallichiana* under CITES taxonomy) and continuing reports of illegal harvest of *T. wallichiana* in India, at least some if which is likely to be used for paclitaxel production, export of *T. wallichiana* from India is believed to be of **Possible Concern**.

SPECIES CHARACTERISTICS

T. wallichiana is a small evergreen tree or shrub, around 6 m tall with reddish-brown, thin and scaly bark. It flowers in March-May and fruits in September-October (Anon., 2005a) and can live for as long as 2,000 years (Anon., 2002a). Under CITES taxonomy, its range comprises Afghanistan, Bhutan, China, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, the Philippines and Viet Nam.

The species occurs in temperate mixed forests with *Rhododendron* spp. and *Betula* spp. between 1500 m and 3000 m (Molur and Walker, 1998). It grows particularly in deeply-shaded, moist and sheltered areas, such as gorges and is primarily an understorey species that occurs in patches, and does not form extensive cover (Rikhari *et al.*, 1998). It is very slow growing with generally poor regeneration and is adversely affected by livestock grazing, bark stripping by deer, opening up the forest canopy and fire (Purohit *et al.,* 2001, Rikhari *et al*, 1998).

The species has multiple uses. For several centuries the young shoots, leaves and bark have been used for their medicinal properties (Anon., 2000a). Young shoots are used to prepare homeopathic remedies to treat cystitis, headaches, heart and kidney problems and rheumatism (Ahmad, 2005).

Along with other *Taxus* species, *T. wallichiana* is the source of taxanes, of which one, paclitaxel, has proved effective in the treatment of certain cancers, particularly ovarian and breast cancers, and AIDS-related Kaposi's sarcoma. Paclitaxel was discovered in the bark of Pacific Yew *T. brevifolia* and demonstrated to have cancer-fighting properties. Concern regarding the sustainability of *T. brevifolia* harvests and the availability of supplies needed to produce paclitaxel spurred the synthesising of paclitaxel from another taxane (10-DAB) found in other *Taxus* species, including *T. wallichiana*. This new development also expanded the extraction of taxanes to leaves, a more sustainable source of taxanes than bark. Although leaves are needed in large quantities, methods of extraction have become increasingly efficient (Schippman, 2001). One kg of paclitaxel has been estimated to require around 3 tonnes of leaves (McCoy, 2004) or between 7000 and 10000 kg of bark, the latter equivalent to or some 3000 medium-sized trees (IUCN/TRAFFIC, 2004).

According to a Chinese manufacturer of paclitaxel, *T. baccata, T. brevifolia* and *T. yunnanensis* supply most of the trade, and market research suggests *T. canadensis* and *T. media* are also important species (TRAFFIC North America, 2004 in Mulliken and Crofton, 2007). Other genera than *Taxus*, such as *Cephalotaxus,* yield similar compounds with medicinal qualities (Farjon and Page, 1999) although the extent to which they are used commercially is unclear.

Ongoing research and developments in the technology for extracting and synthesising paclitaxel and other taxanes has widened the range of *Taxus* species from which these compounds can be made and

extracted. Paclitaxel is also now being produced via plant cell fermentation technology (Anon., 2002b). These developments suggest that demand for wild-harvested *T. wallichiana* will decrease at some stage in the future (Mulliken and Crofton, 2007).

T. wallichiana wood is valued for its strength, durability, decay resistance and decorative characteristics. It is used locally for cabinet making, furniture, veneers, parquet floors, gates, and roofs (IUCN SSC and TRAFFIC, 1994; Oldfield *et al.*, 1998). In Nepal the species is used for thatching material and to make furniture (Kunwar and Adhikari, 2005). In Pakistan it is used for fodder and fuelwood (Aumeeruddy-Thomas *et al.*, 2004).

INTERNATIONAL TRADE

T. wallichiana was included in CITES Appendix II in 1995. The listing was annotated with what was at that time Annotation #8 and covered extracts as well as raw materials in international trade. However, this annotation was changed at CoP11 (2000) to exclude extracts. It subsequently became clear that chemical derivatives (extracts) formed a significant share, if not the vast majority, of international trade in this species and the annotation was amended at CITES CoP13 (2004) to Annotation #10: "Designates all parts and derivatives except: a) seeds and pollen; and b) finished pharmaceutical products", which entered into effect on 12 January 2005. This annotation was modified at CITES CoP14 to: "Designates all parts and derivatives except: a) seeds and pollen; and b) finished products packaged and ready for retail trade", and took effect 13 September 2007. At CoP13 the other Asian *Taxus* species (*T. chinensis, T. cuspidata, T. fauna* and *T. sumatrana*) were also included in Appendix II.

The centre of demand for finished products made from paclitaxel and related compounds continues to be within the USA and, to an increasing extent, in Europe (McCoy, 2004). The US Scientific Authority believes that the bulk of *Taxus* trade consists of Asian rather than North American species (TRAFFIC North America, 2004 in Mulliken and Crofton, 2007). It therefore seems likely that at least some *T. wallichiana* is in trade to North America, either as raw materials or, more likely, as chemical derivatives following processing in India (Mulliken and Crofton, 2007).

Global demand for paclitaxel in 2004 was estimated at 400 kg. Growth in the global market and especially in Europe, for paclitaxel is expected. According to a Canadian paclitaxel producer it will climb to over 1000 kg per year by 2008 (McCoy, 2004).

In 2004 it was reported that the majority of paclitaxel manufacturing facilities were located in China (a *T. wallichiana* range State) and the USA, with much smaller numbers in Canada and several European countries (TRAFFIC North America, 2004 in Mulliken and Crofton, 2007). More recently India has evidently become one of the world's main producers of paclitaxel, as indicated by customs data.

Despite the listing of *T. wallichiana* in CITES Appendix II in 1995, little of this trade has been recorded in CITES data. This is likely to be largely a result of the exclusion of chemical derivatives from the CITES listing between 2000 and 2005 (see below under 'Regulation of international trade') but also undoubtedly also reflects the generally low level of CITES implementation for medicinal plants (Mulliken and Crofton, 2007).

The only recorded export of *Taxus wallichiana* from India reported in CITES trade data in the period 1996 to 2005 is of 100 kg of leaves in 2001. Reported trade in this species is in general at a relatively low level (of other range States, China reported export of 4000 kg of derivatives in 1999 and of around 140 kg of extract in the period 2000-2005 and Mynamar reported extract of 500,000 kg of bark and 50000 kg of extract in 2003).

India's Customs data show the export of both paclitaxel and docetaxel beginning in 1999/2000 (Table 1). Although exports are reported in units of 'thousands of kilogrammes', it seems more likely that the units are in fact kilogrammes, i.e. 21.58 kg in 2003/04 (Mulliken and Crofton, 2007). There has been a general increase in exports over the period with a maximum of 41.28 kg in 2004/05. According to CITES Management Authority staff in India, exports involve extracts from imported *T. baccata* rather than from native or imported *T. wallichiana*, and are permitted in trade based on corresponding evidence of previous *T. baccata* imports; *T. wallichiana* is not believed to be exported in any form. Other sources have also stated that *Taxus* is imported in large quantities for processing (Jain, 2005). TRAFFIC India (2007) report that India is importing *Taxus* primarily from Nepal for producing paclitaxel. The imports are reported as *T. baccata* although wild *Taxus* populations in Nepal are under CITES taxonomy regarded as

T. wallichiana. The latter is sometimes considered a subspecies of *T. baccata* so that is it is possible that these reports simply reflect the use of different classification systems (Anon., 2001 in Mulliken and Crofton, 2007). The CITES Management Authority of Nepal (2005) reports that "export of raw or unprocessed *Taxus wallichiana* (syn. *T. baccata*) (sic) is banned". This implies that any such imports to India are illegal.

Table 1: Exports of paclitaxel and docetaxel recorded in India's Customs data (1999/2000-2005/2006; tonnes*)

	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2003/2004	2005/2006
Total	4.37	27.6	3.9	5.68	21.58	41.28	32.71

NB Although the data source indicates the above figures are in thousands of kilogrammes, it seems more likely that they represent kilogrammes.

Source: India Department of Commerce Export Import Databank, Categories 30049044 PACLITAXEL and DOCETAXEL. http://dgft.delhi.nic.in/

Note that between 2000 and January 2005, extracts of *Taxus wallichiana* were excluded from the provisions of CITES and would therefore not expect to be reported in CITES trade data.

COUNTRY ACCOUNTS

India

Status

Wild *Taxus* populations occur in the northern states of Jammu & Kashmir, Himachal Pradesh, Uttarakhand (=Uttaranchal), Sikkim, Arunachal Pradesh, Assam, Manipur and Meghalaya (Mill, 1994 in Schippmann, 2001), and also in West Bengal (Chhetri *et al.*, 2005), and Nagaland (Department of Forests, Ecology, Environment and Wildlife, Nagaland, undated). It occurs in temperate mixed forests with *Rhododendron* spp. and *Betula* spp. between 1500 m and 3000 m. Its range in India is $<2{,}000$ km^2 and the area occupied is <500 km^2 (Molur and Walker, 1998). Preferred habitats for *T. wallichiana* in Uttarakhand are deeply-shaded, moist and sheltered areas, such as. gorges. It is primarily an understorey species that occurs in patches under other species, and does not form extensive cover (Rikhari *et al.*, 1998).

A Conservation Assessment and Management Plan (CAMP) workshop in Lucknow, India assessed the northeastern Indian populations of *T. wallichiana* to be critically endangered as they had undergone a decline of more than 90% from 1988-1998 due to harvest for medicinal trade purposes (Molur and Walker, 1998). In 2003, the CAMP workshops in Guwahati and Shimla assessed populations as endangered in Arunachal Pradesh, Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttarakhand and as critically endangered in Megahalaya; these declines were due to habitat degradation and loss, and trade (Ved *et al.*, 2003a, 2003b, 2005). Rawat (2005) confirms that populations have declined drastically in many places; selective logging, harvest for small-scale subsistence and fires are the main threats followed by harvesting for domestic use, and human induced habitat loss and degradation. The species is considered to be critically endangered in the Darjeeling Himalaya, West Bengal due to over-collecting by villagers paid by Ayurvedic medicine traders (Chhetri *et al.*, 2005). Large-scale dying of *T. wallichiana* trees reportedly took place recently in Himachal Pradesh due to reckless lopping for its needles (Anon., 2005b).

Management and trade

Harvest and use

In Ayurvedic medicine the shoots are used to treat headache, giddiness, falling pulse, coldness of the limbs, diarrhoea, and serious biliousness. The needles are used for hysteria, epilepsy and nervousness (Anon., 2005a). The species is also used in Unani medicine as a sedative, for the treatment of bronchitis, asthma, epilepsy, snake bites and scorpion stings, and as an aphrodisiac (Rikhari *et al.,* 1998). In some rural Himalayan areas the bark and leaves are collected mainly for traditional teas and for curing colds and coughs (Maikhuri *et al.*, 1998). Some indigenous people in the Himalayas use the wood for carving and construction of beehives and houses and the leaves for thatching (Purohit *et al.*, 2001).

Harvesting for local use and, at one time at least, for the production of paclitaxel reportedly takes place all year around, preferably when the tree is tall and mature (15-20 years old). The main harvesting areas in India are the cool temperate zones between 2200-3000 m, mainly in Uttarakhand and Himachal Pradesh (Rawat, 2005). Harvest is generally carried out by local people who supply traders (Chhetri *et al.*, 2005; Handique *et al.*; 2000, Misra, 2003a). No evidence was found of the development of sustainable harvest rotations for bark and leaves. Illegal harvest of *T. wallichiana* is said to take place in several protected areas in Uttarakhand: the Wildlife Sanctuaries of Askot and Kedarnath, and Nanda Devi and Govind Pashu Vihar national parks (Rawat, 2005). There is also believed to be extensive illegal harvest and domestic trade of the species in Arunachal Pradesh and Himachal Pradesh (Anon. 2002c; Anon., 2005b; Chatterjee and Dey, 1997).

Taxus is processed on an industrial scale within India for the production of Ayurvedic medicines as well as taxanes such as paclitaxel for export or re-export. Paclitaxel production was reported as taking place during the 1990s, for instance by Indo-Italian companies, for export to the USA (Chauhan, 1999 in Mulliken and Crofton, 2007; TRAFFIC East Asia, 2007), and appears to be expanding. As noted above, India is believed to be one of the world's main producers of paclitaxel. Processing is now said to involve primarily, if not entirely, imported *T. baccata* (Jain, 2005).

A 1997 market survey by TRAFFIC India showed that *T. wallichiana* was commonly traded at the national level at that time. Rough estimates of the annual turnover at the Delhi market ranged from 300-700 t, with demand said to exceed supply. Himachal Pradesh and Jammu & Kashmir were reported to be the main source of *T. wallichiana* sold on the Delhi market (TRAFFIC India, 1998 in Schippmann, 2001). Delhi, Kolkata and Amritsar are now said to be the main market centres of the trade, from which the material is distributed to smaller markets (Jain, 2005). Total demand for the species within India was estimated at 500 t by an Indian trade organization. The Dabur Research Foundation estimated the demand by the Ayurvedic industry to be significantly less than this, only 23.6 t annually (TRAFFIC India, 1998 in Schippmann, 2001).

Domestic regulation

The main laws governing harvesting of medicinal plants are the Indian Forest Act (1927), and, to a lesser extent, the Wildlife (Protection) Act (1927/1991/2002). The Indian Forest Act (1927) consolidates the law relating to forest produce, the transit thereof and duty thereon, and empowers State Governments to regulate the transit of forest produce, e.g. medicinal plants. The Act deals specifically with reserved, protected, and village forests and has been adopted by most of the States and is directly applicable to the Union Territories of India. The remaining States have enacted State Forest Acts of their own, which are largely based on the Indian Forest Act (Jain, 2000). Wild collection of *T. wallichiana* is now banned in Arunachal Pradesh (Misra, 2003a) and *T. baccata* is designated a protected species in Sikkim (where wild populations of *Taxus* under CITES taxonomy are considered *T. wallichiana*) (Jain, 2000). Other states have established local controls and fee structures on domestic trade in native medicinal species.

Regulation of international trade

In India, the export of wild specimens of *T. wallichiana* sourced from within the country has been prohibited through the species' listing on the *Negative List of Exports* since March 1996 (TRAFFIC India, 1998 in Schippmann, 2001), and possibly as early as March 1994 (Lange and Wächter, 1996 in Schippmann, 2001). This prohibition would not appear to have extended to cultivated specimens, nor to finished products, or possibly to chemical derivatives, e.g. paclitaxel (see below).

CITES is implemented in India through a combination of the Wildlife Protection Act, 1972/1991/2002 and the Export and Import Policy (EXIM), although the former does not cover this species. Policy on trade in wildlife and wildlife products is established via the EXIM policy, which is decided in consultation with the CITES Management Authority (CITES Management Authority of India, 2004). The EXIM policy was embedded within a broader Foreign Trade Policy for the period 2004-2009, this change coming into effect on 1 September 2004 and includes a Special Agricultural Produce Scheme, promoting the export of, *inter alia*, minor forest produce such as medicinal plants and their value-added products. The policy outlines that all export and import shall be unrestricted, unless regulated under any legislation (Directorate General of Foreign Trade, 2004).

Import and export restrictions for specific products are established via India's ITC (HS) classifications in accordance with the broader policy. As stipulated in Chapter 12 of the ITC (HS) classifications, the export of plants, plant portions, their derivatives and extracts of species included in CITES Appendix I and II and obtained from the wild, regardless of their country of origin is prohibited. These species are included in an "Export Licensing Note" appended to Chapter 12 that specifies 29 plant taxa including this species. An exception for both CITES species and those listed in the Licensing Note is made for the export of "formulations", defined as including "products which may contain portions/extracts of plants on the prohibited list but only in unrecognisable and physically inseparable form" and "value added formulations as well as herbal Ayurvedic" (Chapter 12, Export Licensing Note 3). TRAFFIC India (2007) has confirmed that the term "unrecognisable" is defined following the CITES interpretation of "readily recognisable". This exemption would appear to be designed to apply to mixed formulations and particularly finished pharmaceutical products and not to pure extracts such as paclitaxel. CITES Management Authority staff have further advised that, if Customs staff refer a shipment of "formulations" containing CITES-listed species to the Management Authority for clearance, then issuance of a CITES export permit will be required (Aarti *pers. comm.*, 2005).

According to India's CITES Management Authority staff, the export of paclitaxel and 10 DAB manufactured from imported *T. baccata* is permitted with issuance of a "No Objection Certificate" by the CITES Management Authority after scrutinising import documents and taking an affidavit from the exporter that the exported derivatives have in fact been manufactured from imported *T. baccata*. Such exports are not being recorded in India's CITES annual reports as they are not considered to involve CITES-listed species (Jain *in litt.*, 2005).

Treaty of Trade between Nepal and India

The Governments of India and Nepal entered into a bilateral trade agreement in 1991. The treaty provides for exemption from Customs duty and quantitative restrictions of trade of certain "primary products", which include Ayurvedic and herbal medicines (Anon., 2002d). A certificate of origin issued by the Government of Nepal is the only document required for presentation to India's Customs authorities at the time of import. During the late 1990s, border officials were unaware that CITES documentation might also be required for export. The treaty was extended for a further five years in 2002 until 5 March 2007 (Anon., 2002d). Although some amendments were made, these do not reflect the concerns raised regarding CITES implementation (Amatya, 2005). In February 2007 another treaty extension was announced (Indian Embassy, 2007). It is not known whether amendments reflect the concerns raised. However, Nepal has stated that export of raw or unprocessed forms of *T. wallichiana* (synonym *T. baccata*) has been banned under the Forest Regulation 1995 (CITES Management Authority of Nepal, 2005).

Cultivation

At the present time, large-scale commercial cultivation of *T. wallichiana* has not been achieved in India. However cultivation of the species is being promoted currently by most State governments where the species is native, including Arunachal Pradesh, Himachal Pradesh, Manipur, Meghalaya, Sikkim, West Bengal and Uttarakhand (Anon., 2000b, 2004, 2005b, 2005c, Chhetri *et al.*, 2005, Lohumi, 1999, Misra, 2003a, 2003b, Singh, 2003, State Forest Research Institute, 2003).

PROBLEMS IDENTIFIED THAT ARE NOT RELATED TO THE IMPLEMENTATION OF ARTICLE IV PARAGRAPHS 2A, 3 OR 6A

As noted above, it is reported that India's paclitaxel production is based on imported yew, a substantial proportion of which is said to originate in Nepal, where the only wild species present is *T. wallichiana*. If this is true, then this trade has gone unreported under CITES.

Two shipments of *T. wallichiana* destined for Singapore (2 kg) and Malaysia (75 kg) were confiscated in 2001; the commodities in trade were not specified (CITES Management Authority of India, 2004 in Mulliken and Crofton, 2007).

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