

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



Fifteenth meeting of the Plants Committee
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Review of Significant Trade in specimens of Appendix-II species

Selection of species for trade reviews after CoP13

SEVEN ASIAN MEDICINAL SPECIES

1. This document has been submitted by the German Scientific Authority and prepared by TRAFFIC, in collaboration with the IUCN Species Programme.

Background

2. A variety of Asian medicinal plant species have been included in CITES Appendix II owing to concern, particularly from range States, that international trade might pose a threat to their long-term survival.
3. CITES implementation was previously reviewed for a number of these species, and recommendations made to address concerns regarding Article IV implementation, unregulated and illegal trade (Table 1).
4. In 2004, the German Federal Agency for Nature Conservation contracted TRAFFIC to undertake a review of the status, use, trade and trade controls for seven of these species. These were selected based on indications that implementation of CITES trade controls remains problematic, and that international trade continues to contribute to their decline in the wild despite CITES listings and earlier reviews.
5. The main CITES-relevant findings of this review are presented below. These indicate that action to address gaps in CITES implementation identified in previous studies has been limited. Suggestions are therefore made regarding the possible inclusion of several of these species within the next phase of the CITES Review of Significant Trade. The German Scientific Authority would be willing to provide the full results of the present assessments, which will be published later in 2005, as a contribution toward such reviews. Recommendations for consideration by individual range States and consumer countries are also provided. As well as noting these, the Plants Committee might also consider encouraging a regional response to unsustainable trade of those species with more than one range State.
6. International trade in several of these species provides an important source of rural income the range States, particularly within Nepal. It is therefore critical that approaches to encouraging more effective CITES implementation are designed taking into account the needs of rural harvesters.

Table 1. History of Review of Significant Trade for seven Asian medicinal species

Species	Listing date	Annotation	Previous reviews
<i>Cistanche deserticola</i>	19 July 2000	#3	
	13 February 2003	None	
	12 January 2005	#1	
<i>Dioscorea deltoidea</i>	01 July 1975	Roots only	
	01 August 1985	#1	1999: CITES Project S-109; Doc PC 9.9.1.3 (Rev); Schippman (2001)
<i>Nardostachys grandiflora</i>	18 September 1997	#3	2000: Doc. PC.10.10.2.3; Inf. PC 10.2; Mulliken (2000)
<i>Picrorhiza kurrooa</i>	18 September 1997	#3	2000: Doc. PC.10.10.2.3; Inf. PC 10.2; Mulliken (2000)
<i>Pterocarpus santalinus</i>	16 February 1995	#7	1999: CITES Project S-109; Doc PC 9.9.1.3; Schippman (2001)
<i>Rauvolfia serpentina</i>	18 January 1990	#2	1999: CITES Project S-109; Doc PC 9.9.1.3; Schippman (2001)
<i>Taxus wallichiana</i>	16 February 1995	#2	1999: CITES Project S-109; Doc PC 9.9.1.3; Schippman (2001)
	12 January 2005	#10	

Cistanche deserticola

7. Known only from China and Mongolia, the parasitic species *Cistanche deserticola* is in demand for medicinal use in China, and to a lesser but still significant extent, elsewhere in Asia. There is also evidence of ongoing demand within North America for both raw materials (stems) and finished products. It would appear to be the most popular of the *Cistanche* species, many of which are also used medicinally. *C. deserticola* and several other *Cistanche* species are traded as 'Herba Cistanches', the term applied to the dried stem, the primary plant part in trade. They may be included in packaged medicines either singly or mixed; such packages are frequently labeled as containing 'Cistanche' rather than indicating the species involved. Owing to the mixing of the species in trade, there do not appear to be any accurate data with regard to quantities of *C. deserticola* harvested and/or in domestic or international trade. International trade to Japan may involve primarily *C. salsa*. The vast majority of *C. deserticola* in trade is from wild sources, with commercial cultivation, although being promoted, apparently not producing significant quantities.
8. Although it appears that no thorough population studies have been done, there is general consensus that *C. deserticola* has declined significantly throughout much of its range as a result of harvest for medicinal use and trade (mainly domestic) and loss of the host species *Haloxylon ammodendron*. The latter is declining in part as a result of harvest for fuelwood and agriculture. There is also concern that other *Cistanche* species are declining as a result of harvest for medicinal use.
9. *Cistanche deserticola* was first included in Appendix II in 2000. Information regarding harvest and trade controls for *C. deserticola* within China remain unclear. Available information indicates that harvest from the wild is banned, at least at the national level, however this, and whether the ban has been taken up in the legislation of individual provinces and autonomous regions, requires confirmation. Domestic use in the manufacture of medicines has been banned at the national level, however uptake within local level legislation may not be universal, and use continues to be allowed in the manufacture of tonics and medicated wines. It appears that export of both raw materials and finished products of *C. deserticola* has been banned since early 2004, however, this requires confirmation. Whether or not export of other *Cistanche* species is similarly banned, and if not, how the Government is ensuring that trade does not involve *C. deserticola*, similarly requires further clarification. Implementation of the CITES listing, and through this, support for China's export ban, is

complicated by the lack of clarity regarding the species in trade, and the harvest and trade controls for those species.

10. Recommendations:

The Plants Committee might consider encouraging the CITES Authorities in China to:

- a) Clarify and confirm harvest and domestic trade controls for *C. deserticola* and other *Cistanche* species within China;
- b) Confirm how it discriminates between *C. deserticola* and other *Cistanche* species in controlling exports, and provide additional identification materials in this regard;
- c) Assess the level of threat to other *Cistanche* species posed by international trade relative to domestic trade; and
- d) Based on the above information, consider proposing the listing of the remaining *Cistanche* species in CITES Appendix II.

Dioscorea deltoidea

11. This widely distributed yam species occurs across the lower and middle Himalayan regions from Afghanistan to Bhutan, its range extending to parts of China and Viet Nam. Information on the status of the species throughout much of its range is scarce, however there are indications of significant population declines in India, where the species has been assessed as 'endangered' in several States. Overharvest was considered the primary threat, with earlier reviews indicating that habitat degradation had also led to declines. The species has similarly been assessed as 'endangered' in Nepal, however there have been no comprehensive assessments of the species' populations there. The species was listed in Appendix II in 1975.
12. The rhizomes of *D. deltoidea* are used in traditional medicine in Nepal and India, although apparently not in codified systems of medicine, e.g. Ayurveda. The rhizomes are used more widely as a source of diosgenin, which is widely used in the synthesis of steroids such as progesterone. It is also used to produce dehydroepiandrosterone (DHEA), a naturally occurring steroid that has gained popularity as a dietary supplement in the United States of America for its purported anti-aging properties. Both the rhizomes and stems are used medicinally in Pakistan, with the approximate annual yield of *D. deltoidea* estimated to be over 300 t. The rhizomes are also eaten as food, particularly by the rural poor, used for making soap, and to produce a poison used in catching fish.
13. There is evidence of international trade in this species, primarily of trade from Nepal to India, which may have exceeded 100 tons during the late 1990s. However, such trade appears to be declining in response to the increasing availability of other sources of diosgenin, e.g. from countries such as Mexico and China, and/or *Dioscorea* species, some of which, e.g. *D. floribunda*, are also being cultivated in India. Nepali traders have commented on declining demand for *D. deltoidea* from India, with harvest quantities in Nepal appearing to decline in recent years. *D. deltoidea* is cultivated commercially in India, and it appears that there are plans to increase production, which also seems likely to reduce demand for wild-collected product. Finally, the demand for diosgenin itself appears to be declining as other sources of steroid precursors are identified and produced.
14. CITES-reported international trade is limited to a single shipment of cultivated plants. Unreported trade seems likely to involve primarily dried rhizomes traded from Nepal to India. However, India does not regularly implement CITES controls for imports or re-exports, which are not covered by the country's CITES-implementing legislation. The Indo-Nepali trade treaty also appearing to allow for unregulated trade in medicinal plants from Nepal to India. Trade may also involve exports of extract (diosgenin) from India, which would also be covered under CITES in accordance with annotation #1. India bans export of specimens that have been wild-collected within India with the exception of 'formulations', processed products for which it is not possible to distinguish individual species. The latter would therefore be required to come from cultivated sources to be in accordance with India's export regulations.

15. Recommendations:

The Plants Committee might consider:

- a) Requesting the CITES Secretariat to draw the attention of the CITES Management Authorities of India and Nepal to the apparent lack of CITES implementation for this and other CITES-listed medicinal plant species when traded from Nepal to India;
- b) Encouraging the CITES Authorities in India to:
 - i) Confirm the source of raw materials used for production of diosgenin and other medicinal products derived from *D. deltoidea*, as a means of ensuring that harvest for trade within India is not threatening the species in that country; and
 - ii) Ensure, when modifying its CITES implementing legislation, to introduce CITES trade controls for imports and re-exports of medicinal (and other plant) materials;
- c) Encouraging the CITES Authorities in Nepal to:
 - i) Promote harvest practices that allow for regeneration of the species and ensure that trade is maintained within sustainable levels; and
 - ii) Ensure that exports are accompanied by appropriate CITES permits;
- d) Encouraging the CITES Authorities in Pakistan to confirm whether harvests in that country are destined for use in domestic or foreign markets, and if the latter, implement CITES trade controls accordingly.

Nardostachys grandiflora

16. The aromatic rhizomes of the perennial Himalayan herb *Nardostachys grandiflora* are prized in traditional medicine within the species range States of Bhutan, China, India, Nepal and Pakistan. They are also used locally as a base for cosmetics, perfumes and incense, with a small, but increasing trade to Europe and North America for this purpose. The species was included in Appendix II in September 1997, annotated to include whole and sliced roots and parts of roots (annotation #3).
17. *N. grandiflora* is primarily traded in the form of dry, unprocessed rhizomes, i.e., strictly speaking, the trade primarily involves rhizomes rather than roots. Exports from Nepal to India dominate international trade, and are on the order of several hundred tonnes per year. Nepal's export of oil distilled from the rhizomes is increasing, and could now represent up to a third of international trade. Bhutan has also been identified as the source of smaller amounts of rhizomes exported to India. India's domestic markets rely primarily on imports, with much smaller quantities of rhizomes produced domestically. There is limited trade in finished products from India.
18. There has been a significant amount of research in Nepal regarding harvest and trade volumes, management regimes, etc., but no comprehensive surveys of the status of the species across the country. Research results point to the importance of harvests and trade to rural livelihoods, declines of wild populations in response to harvest and grazing in many if not most areas subject to harvest, and local management regimes to support sustainable use of the resource. Research in India points to significant population declines. The species has been categorized as 'threatened' in both countries. Relatively little information is available for Bhutan or Pakistan.
19. Research on the harvest, trade and CITES implementation for *Nardostachys grandiflora* undertaken in conjunction with a 1999 CITES Review of Significant Trade showed that large-scale international trade in the species from Nepal to India was being conducted outside of CITES trade controls: exports from Nepal are not accompanied by CITES permits, nor are such permits required upon import into India. This is reflected in CITES trade data, which is limited to trade records for specimens used in CITES training courses, and the reported export from China to Nepal of 12.5 tons of roots in 2001. Little appears to have changed with regard to trade controls since the time of that study. India bans export of specimens that have been wild-collected on its territory with the

exception of 'formulations', processed products for which it is not possible to distinguish individual species. India does not regularly implement CITES controls for imports or re-exports, which are not covered by the country's CITES-implementing legislation. As noted above, export of extracts from Nepal appears to be increasing, however these are not subject to CITES trade controls under the current annotation.

20. Recommendations:

The Plants Committee might consider:

- a) Including *Nardostachys grandiflora* in the next phase of the Review of Significant Trade;
- b) Requesting the CITES Secretariat to draw the attention of the CITES Management Authorities of India and Nepal to the apparent lack of CITES implementation for this and other CITES-listed medicinal plant species when traded from Nepal to India;
- c) Recommending to range State CITES Authorities that:
 - i) The annotation for this species be amended to include extracts; and
 - ii) A regional approach is developed with regard to ensuring sustainable management of this species;
- d) Encouraging the CITES Authorities in India to ensure, when modifying its CITES implementing legislation, to introduce CITES trade controls for imports and re-exports of medicinal (and other plant) materials; and
- e) Encouraging the CITES Authorities in Nepal to:
 - i) Promote harvest practices that allow for regeneration of the species and ensure that trade is maintained within sustainable levels; and
 - ii) Ensure that exports are accompanied by appropriate CITES permits.

Picrorhiza kurroa

21. This Himalayan perennial shrub was included in Appendix II in September 1997, annotated to include whole and sliced roots and parts of roots (annotation #3). It has previously been included by the Plants Committee within the Review of Significant Trade, the results of the earlier review having been considered at PC10 (Shepherdstown, December 2000). At that time it was noted that the majority of international trade in *Picrorhiza* spp. involved exports of rhizomes (not roots) from Nepal to India, and, to a lesser extent, from Nepal to China, for use in traditional medicine. Experts contended that the species in trade from Nepal and also occurring in China was not *Picrorhiza kurroa* (Royle), but rather *Neopicrorhiza scrophulariiflora* (Pennel) Hong (*Picrorhiza scrophulariiflora* Pennel), however some considered *P. scrophulariiflora* as a synonym of *P. kurroa*. The CITES Nomenclature Committee supported the view that *Neopicrorhiza scrophulariiflora* was a separate species, and recommended that a notation to this effect be included in the CITES Appendices. They also recommended that the effectiveness of the listing of *P. kurroa* be reviewed further given that the material in trade (rhizomes) of both species was referred to as 'kutki', with no differentiation as to the species involved (see document PC11 Doc. 14.2).
22. A recent review of the taxonomy and distribution of *Picrorhiza* indicates that the range of *Neopicrorhiza scrophulariiflora* extends both westwards and eastwards into India, the two species having overlapping ranges in Uttaranchal, and only *N. scrophulariiflora* being found in Sikkim. The range of *Picrorhiza kurroa* appears to extend into China, which is similarly therefore a range State for both species. *Neopicrorhiza scrophulariiflora* appears to be the only species found in Nepal, however.
23. The present study indicates that the main international trade in kutki continues to involve exports of air-dried rhizomes from Nepal, i.e. a non-CITES species, the trade having been estimated at several hundred tonnes per year. India is the primary export destination, with smaller quantities exported to

China. Bhutan is also believed to be a source of smaller quantities (on the order of tens of tonnes) of rhizomes in international trade.

24. International trade of the CITES-listed *Picrorhiza kurrooa* seems likely to be very small relative to consumption within India, the main range State for this species. CITES data show only limited trade, the only records of any significance being 400 kg of 'roots' reported as exported from China to Italy from 2001 to 2002. It may be that finished products are also in trade, and therefore would not be covered by the listing as it is presently annotated; such trade could equally if not more likely involve *Neopicrorhiza scrophulariiflora*, however.
25. India bans export of specimens that have been wild-collected on its territory with the exception of 'formulations', processed products for which it is not possible to distinguish individual species. India does not regularly implement CITES controls for imports or re-exports, which are not covered by the country's CITES-implementing legislation.
26. *P. kurrooa* has been assessed as 'threatened' in several Indian States, the threat status ranging from 'vulnerable' to 'critically endangered', with habitat degradation and loss and harvest for medicinal use and trade being cited as the main threats. There is also evidence that *Neopicrorhiza scrophulariiflora* populations are declining in Nepal, however no comprehensive population surveys have been undertaken.
27. Recommendations:

The Plants Committee might consider:

- a) Recommending to range States that:
 - i) They collaborate in assessing whether *Neopicrorhiza scrophulariiflora* meets the criteria for and would benefit from inclusion in CITES Appendix II;
 - ii) They consider proposing that the annotation for this species be changed to include extracts; and
 - iii) A regional approach be developed with regard to ensuring sustainable management of this species.
- b) Requesting the CITES Secretariat to draw the attention of the CITES Management Authorities of India and Nepal to the apparent lack of CITES implementation for this and other CITES-listed medicinal plant species when traded from Nepal to India; and
- c) Encouraging the CITES Authorities in India to ensure, when modifying its CITES implementing legislation, to introduce CITES trade controls for imports and re-exports of medicinal (and other plant) materials.

Pterocarpus santalinus

28. Endemic to India's Eastern Ghats, this slow-growing deciduous tree is highly valued for its heavily pigmented heartwood. The wood, with a deep red to purple colour, is used as a high value timber, as a source of santalins and other pigments, which are used as a dye, and, to a lesser extent, as an ingredient in traditional medicine and incense. The species is classified as 'Endangered' in the IUCN Red List, with threats involving a combination of overharvest and habitat alteration.
29. Demand for the timber is said to be particularly strong in Japan (particularly for timber with a 'wavy' grain used in making musical instruments) and possibly China, with references made of significant shipments made to the former country. Singapore has emerged as a major destination for illegal timber exports, with seizures of timber en route to or arriving in Singapore reported by CITES Authorities in both Singapore and India. It is not known if such timber was intended for use within Singapore or for onward shipment. Export of unworked timber from wild stands has been banned since at least 1992, and hundreds of tonnes have been seized within India. It is unclear whether the export ban extends to timber from plantations, however.

30. Legal exports primarily involve wood chips and powder, which are used as a source of dyes for colouring food, natural fibres and other items. Indian Customs' data show the export of 153 tons of powder and a further 426 tons of wood-chips from 1997/98 to 2003/2004, with East Asia and, increasingly, Singapore and the Middle East, being the primary export destinations. The trade in powder is excluded from CITES trade controls under annotation #7; the trade in wood-chips is subject to such controls. However, based on a review of India's CITES annual reports and CITES annual report data compiled by UNEP-WCMC, CITES export permits are not being issued for trade in wood-chips or other products. There similarly seems to be a general lack of enforcement of CITES trade controls at the time of import, seizures of timber in Singapore providing a notable exception. China's annual reports show the import of over 100 tons of *P. santalinus* timber in 2003, indicating some level of control, however 96 tons of this is said to have come from Nepal, which is not a range State for this species.

31. Cultivation of *Pterocarpus santalinus* appears to be increasing within India. The proportion of trade involving wood from plantations is unknown, as is the proportion that might involve other santalin-rich species, e.g. *P. indicus* and *Adenanthera pavonina*. It is therefore not possible to assess whether current trade levels are sustainable.

32. Recommendations:

The Plants Committee might consider:

- a) Including *Pterocarpus santalinus* within the next phase of the Significant Trade Review Process.
- b) Encouraging the CITES Authorities in India to:
 - i) Clarify national level export controls for the species, including as these relate to specimens from wild, cultivated and seized stocks;
 - ii) Encourage greater dialogue amongst CITES Management Authority, Customs, and state level Department of Forestry staff with regard to implementing national export controls and CITES implementation for the species;
 - iii) Consider submitting a proposal to CITES CoP14 to modify the annotation applied to *P. santalinus* so that only finished pharmaceutical products are excluded from the listing; and
 - iv) Call on the Governments of importing Parties to assist in the implementation of the listing by requiring presentation of CITES permits at the time of import;
- c) Encouraging the CITES Authorities of Parties identified as importers of *P. santalinus* timber, particularly Japan and China, to:
 - i) Review domestic markets for *P. santalinus* timber in order to assess the likely level of trade; and
 - ii) Be more vigilant in checking for and confirming the validity of CITES permits upon presentation of shipments for import, and to seize shipments lacking such documentation; and
- d) Encouraging the CITES Authorities of Parties identified as importers of *P. santalinus* wood-chips, particularly Singapore and the United Arab Emirates, to be more vigilant with regard to shipments presented for import.

Rauvolfia serpentina

33. The roots of *Rauvolfia serpentina*, a perennial, evergreen forest shrub distributed widely from Pakistan to Indonesia, have been used for centuries in traditional medicine across Asia, and, since the 1950s, as a source of reserpine, valued in western pharmaceutical preparations. Significant declines in wild populations have been noted as a result of harvest for trade, particularly in India, where the species is considered to be threatened through much of its range, and Nepal, where it is

similarly considered at risk. Information regarding its status in Myanmar and Thailand, which, along with India and Nepal, appear to be the main countries engaged in international trade, is mixed.

34. *R. serpentina* is an important component of traditional medicine in India, where domestic demand was predicted by the Department of Indian Systems of Medicine and Homeopathy to be 424 tons for 2001/2002, climbing to 589 tons for 2004/2005. India is also a significant producer and exporter of reserpine and possibly other *Rauvolfia* alkaloids used in pharmaceutical preparations. Indian Customs' data show that a total of 20 tons of alkaloids in tablet and other forms was exported in 2002/2003 alone. According to one government source, reserpine exported from India is now produced from *Rauvolfia* imported from other countries, e.g. *R. vomitoria* from Africa. India also exports smaller quantities of 'Serpentina roots' according to India's Customs' data, with 14 tons reported as exported to Kuwait and the United Arab Emirates in 2003/2004. CITES data show much lower levels of trade from India, limited to extracts, reflecting at least in part that country's ban on exports of wild-sourced raw materials and extract other than as formulations.
35. India's Customs' data show that India is also a significant importer of 'Serpentina roots' from Myanmar. A total of 153 tons was reported as imported from 1999/2000 to 2003/2004, of which 70 tons were imported in the latter year alone. Further research is required to determine whether this trade involves *R. serpentina* and/or other *Rauvolfia* species. Myanmar's CITES Management Authority reports that 68 tons of *R. serpentina* was permitted to be harvested from 2001 to 2004, the species being used locally for medicinal purposes. They have not received any requests for CITES export permits. CITES data show much lower levels of trade than the reported export to India of 14 tons of *R. serpentina* roots by Myanmar in 1999, corresponding imports reported by India being only 7 tons. Imports of this and other CITES-listed medicinal species are generally not controlled or reported by India.
36. Thailand appears in CITES data as a relatively small but consistent exporter of *R. serpentina* roots. A total of 4 tons were exported from Thailand, where the species is also used for traditional medicine, to Germany from 1999 to 2004 according to Thailand's CITES data, with 3 tons exported in the most recent year. Imports of this species into Germany are believed to have declined in recent years, mirroring a decline in the sales of reserpine-based pharmaceuticals in that country, and also, it appears, in the United States of America. Smaller amounts of *R. serpentina* continue to be used in phytopharmaceutical preparations in Germany.
37. India bans export of specimens that have been wild-collected in India with the exception of 'formulations', processed products for which it is not possible to distinguish individual species. India does not regularly implement CITES controls for imports or re-exports, which are not covered by the country's CITES-implementing legislation. Nepal only allows exports in processed form. Harvest and export of raw products is permitted from Thailand and Myanmar, although in the case of the latter country, there have been no recent requests for CITES export permits. Cultivation has been promoted for this species within India, however it is not clear how successful this has been; the species requires a minimum of two years to bear products of marketable size, as well as a steady source of moisture, e.g. irrigation, which may be limiting investment in cultivation by small farmers.
38. Recommendations:

The Plants Committee might consider:
 - a) Including this species in the next phase of the Review of Significant Trade;
 - b) Whether range States for other *Rauvolfia* species should be encouraged to examine harvest and exports with a view to ensuring that they are within sustainable levels;
 - c) Encouraging the CITES Authorities in *R. serpentina* range States to consider proposing a revision to the existing annotation so that the trade in chemical derivatives would be subject to CITES trade controls;
 - d) Requesting the CITES Authorities in India to:
 - i) Confirm the species and origin of *Rauvolfia* imports, particularly with respect to imports from other *R. serpentina* range States, e.g. Myanmar; and

- ii) Ensure that imports and re-exports of *R. serpentina* are accompanied by appropriate CITES documentation; and
- e) Requesting the CITES Authorities in Myanmar to confirm the species of *Rauvolfia* exported to India from that country.

Taxus wallichiana

- 39. Himalayan yew *Taxus wallichiana* was included in Appendix II in 1995 owing to concern that harvest for international trade, driven by growing demand for the anti-cancer compound paclitaxel, was threatening this species, which is found from Afghanistan South and East as far as Viet Nam and Indonesia. With much of the international trade involving extract rather than raw materials (needles and bark), the listing was amended at CITES CoP13 to exclude only finished pharmaceutical products, seeds and pollen (annotation #10). Whole artificially propagated plants are also excluded with appropriate documentation.
- 40. Evidence that other Asian *Taxus* species were also being harvested unsustainably for trade, and a lack of clarity regarding species taxonomy, prompted the listing of four additional *Taxus* species in Appendix II at CITES CoP13: *T. chinensis*, *T. cuspidata*, *T. fuana* and *T. sumatrana*. These were similarly annotated with annotation #10. Although the present assessment refers primarily to *T. wallichiana*, the findings are equally relevant to these other species.
- 41. Concerns remain with regard to the status of *T. wallichiana* in India, where it has been assessed as 'endangered' or 'critically endangered' in many of the States where it occurs. Key threats in India include harvest for medicinal (presumably pharmaceutical) trade, habitat loss, selective logging and fires. Hundreds of tonnes of leaves were harvested annually in India during the mid-1990s; current harvest levels are unknown. The species has similarly been assessed as 'endangered' in Nepal, where threats include harvest for wood shingles, the species being resistant to rot. In Pakistan, harvest for use as fuelwood, timber, fodder and paclitaxel production have all been cited as contributing to the decline of the species, along with habitat degradation. Annual illegal extraction of leaves was estimated at 6,000 tons per year from 1996 to 2001, however enforcement of a ban on harvest is believed to have reduced illegal extraction to such an extent that it is no longer significant. All *Taxus* species in China are considered to have declined as a result of and to be threatened by harvest for domestic use and processing.
- 42. The United States is believed to be the main market for paclitaxel, with markets in Europe believed to be expanding. A growing number of countries are producing and selling paclitaxel for pharmaceutical production. The United States market is supplied in part, perhaps predominantly, by plant cell fermentation (PCF) technology, to which a single company has sole worldwide licensing agreements. Available information indicates that other companies both within and outside of the United States remain reliant on the bark and needles of *Taxus* species for paclitaxel production. The main manufacturing centres are the United States and China, with companies also found in Canada, Australia, the European Union, India and Nepal. Reported harvest in the latter country exceeded 500 tons in the years 2001/2002, but fell to 78 tons in 2003/2004.
- 43. North American paclitaxel production from *Taxus* species appears to come from a combination of plantation and wild material from the United States and Canada, and possibly imports from other countries. The United States is also believed to be a significant (probably the main) importer of paclitaxel produced in other countries, e.g. China. Paclitaxel production in China has increased with the construction of new factories. Raw materials are apparently supplied largely by *Taxus* imported from other countries, reflecting a ban on harvest and trade within China. This is said to include imports of *Taxus* materials from North America and Germany. A website for at least one manufacturer in China lists Asian *Taxus* species as a source of paclitaxel produced, and imports have been reported from Myanmar (see below). Manufacture in Europe is said to be based primarily on *T. baccata* cuttings from European countries. Cultivation efforts for *Taxus* species are increasing in several range States for the CITES-listed species, e.g. China, India and Nepal.
- 44. CITES annual report data show only limited trade in *T. wallichiana*, reflecting in part the exclusion until recently of extract from the CITES listing. A notable exception is China's reported import in 2003 of 500 tons of bark from Myanmar, reported as being artificially propagated, and a further 50 tons of extract from the same country, reported as coming from the wild. The CITES Management

Authority of Myanmar has commented that they were not aware of this trade and that the species is not cultivated in Myanmar.

45. Recommendations:

The Plants Committee might consider:

- a) Including CITES-listed *Taxus* species in the next phase of the Review of Significant Trade;
- b) Encouraging the CITES Authorities in China and Myanmar to confirm the origins of the plant materials imported into China and reported as originating in Myanmar;
- c) Encouraging the CITES Authorities in China to examine more closely the source of other *Taxus* materials imported into that country and to ensure that they are accompanied by appropriate CITES documentation;
- d) Encouraging all range State CITES Authorities to confirm that harvest for domestic production of paclitaxel and export of raw materials is maintained within sustainable levels; and
- e) Encouraging all range State and consumer country CITES Authorities to ensure that Customs and other personnel charged with enforcing CITES and other border controls are aware of CITES trade controls for parts and derivatives.

Acknowledgements

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