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

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

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

The proponents propose deletion of *Dalbergia sissoo* DC., from CITES Appendix II as it does not meet the listing criteria set out in paragraphs 2(a) or 2(b) of Article II of the Convention text or the criteria laid down in Annex 2(a) and Annex 2(b) of Resolution Conf. 9.24 (Rev. CoP17). The species has a wide geographical range of distribution and in India it is found abundantly in the wild and in cultivation as well. The species has very fast growth rate and capacity to become naturalized outside of its native range, and is even invasive in some parts of the world. The regulation of trade in the species is not necessary to avoid it becoming eligible for inclusion in Appendix I in the near future and the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences.

B. Proponent

India and Nepal*

C. Supporting statement

1. Taxonomy

1.1 Class: Magnoliopsida

1.2 Order: Fabales

1.3 Family: Fabaceae

1.4 Genus, species or subspecies, including author and year: *Dalbergia* L. f. 1781 [1782]
Dalbergia sissoo DC. 1825

1.5 Scientific synonyms: *Amerimnon sissoo* (DC.) Kuntze

1.6 Common names: English: Indian rosewood, Himalaya raintree, Indian Dalbergia, Penny leaf tree, Sisso
French:
Spanish:

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

1.7 Code numbers: Not available

2. Overview

Dalbergia sissoo is a fast-growing perennial tree which is economically important for its value in forestry, agroforestry, and horticulture. The species is sustainably utilized for its timber, fuelwood, fodder, medicines, etc. The species is native to Afghanistan, Bangladesh, Bhutan, India, Islamic Republic of Iran, Iraq, Myanmar, Nepal, Pakistan, Philippines, and South Africa; and also widely introduced especially in Africa and Asia. It is even treated as invasive in Florida, USA and the Northern Territories, Australia, and has failed a risk assessment for the Pacific (https://www.cabi.org). In India, the wild subpopulations of *D. sissoo* are widely distributed in the sub-Himalayan tracts and outer Himalayan valleys of India and the species is also found naturalised outside its wild occurrence (extending up to southern India).

The wild population of *D. sissoo* does not fall under any Threatened categories (Bhattacharjee & al., 2018). Moreover, *D. sissoo* is one of the most widely utilised plantation tree species in the Indian subcontinent (Hossain & Martin, 2013), largely due to its fast growth and multiple economic uses, and in India, the species is found abundantly in cultivation / plantations. The abundance of *D. sissoo* both in the wild and in cultivated populations is also reported from other countries of the Indian subcontinent (Hossain & Martin, 2013; Groves & Rutherford, 2015). *Dalbergia sissoo* is the second most important cultivated timber tree in India. The species can be found in plantation/cultivation and/or the agroforestry system in almost every part of the country and it is very common in the northern, north-western, central, and eastern parts of country, mainly along highways, roads, riverbeds, water bodies, railway tracks, cultivated lands and is also found in villages, cities, and forest areas. In Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Odisha, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand, and West Bengal, *D. sissoo* is found almost in every village/town/city. The NDF study (Bhattacharjee & al., 2018) carried out for the species in India also revealed that the harvest of *D. sissoo* is conducted mostly from planted/cultivated trees outside the locations of its wild occurrence.

The major threat to *D. sissoo* both in the wild, and naturalised or planted/cultivated populations is not harvest and trade, but diseases. However, the high regeneration and growth rate of the species provides resilience to this threat. The impacts of both harvest and trade are low as harvest and trade do not pose threats to the existing wild population of *D. sissoo* in India. Due to its extensive availability in cultivation/plantations, the illegal trade of the species from its wild population is rarely reported at present. The existing management procedures (also supported by laws to regulate harvest of the natural population) are appropriate and effective to mitigate (i.e., reduce the severity of) the identified wild harvest impacts and trade impacts of *D. sissoo* (Bhattacharjee & al., 2018).

Since the Appendix II listing of *Dalbergia sissoo* came into place, exports of furniture and handicrafts made of *Dalbergia sissoo* from India have fallen by almost 50% from an estimated 1000 crore Indian Rupees (~129 million USD) per annum before the listing, to 500-600 crore Indian Rupees (~64 to 77 million USD) per annum after the listing. The decrease in exports of *Dalbergia sissoo* products has affected the livelihoods of around 50,000 artisans who work with the species. It has also had a knock-on effect on the livelihoods of other stakeholders who are directly or indirectly connected with the trade of the species, in particular farmers who have been growing the species as part of agroforestry activities to generate additional income (Export Promotion Council for Handicrafts, *pers. comm.* 30 April 2022).

Dalbergia sissoo is easy to identify in its living condition, and is unlikely to be confused with other species. Further, its wood can also be distinguished from other species of *Dalbergia* by its wood anatomical features, gene sequences and also by using technologies like DART TOFMS, Near-Infrared and Raman Spectroscopy.

Accordingly, the species does not meet the listing criteria set out in paragraphs 2(a) or 2(b) of Article II of the Convention text or the criteria laid down in Annex 2(a) and Annex 2(b) of Resolution Conf. 9.24 (Rev. CoP17) and should be deleted from Appendix II.

3. Species characteristics

3.1 Distribution

The species is native to Afghanistan, Bangladesh, Bhutan, India, Islamic Republic of Iran, Iraq, Myanmar, Nepal, Pakistan, Philippines, and South Africa, and exotic to Antigua and Barbuda, Australia, Cameroon, Chad, China, Cyprus, Dominican Republic, Ethiopia, French Polynesia, Ghana, Guinea-

Bissau, Indonesia, Israel, Kenya, Mauritius, Malaysia, Mozambique, New Caledonia, Niger, Nigeria, Oman Paraguay, Philippines, Puerto Rico, Senegal, Sierra Leone, Sri Lanka, Sudan, Thailand, Togo, Uganda, United Republic of Tanzania, United States of America, Virgin Islands of the USA, Zambia, and Zimbabwe.

In India, the species is found almost throughout the country. However, it is difficult to assess the wild localities of *D. sissoo* in the country due to its wide use in agroforestry, plantation, afforestation, and reforestation programmes and as a result, the species is now found naturalised in many places from where it was not found earlier. As per the best available information, the species is indigenous to gravelly river beds of the sub-Himalayan tracts and outer Himalayan valleys extending from Assam to Jammu and Kashmir. Further, it is found naturalised outside its wild occurrence, extending up to southern India.

3.2 Habitat

The species is adapted to a wide range of ecological habitats. It naturally grows in porous soils containing sand, pebbles and boulders and is found gregariously in river beds on alluvial soil, shingle boulders, along water channels occupying the 500–900 m elevation belt but exceptionally ascending to 1500 m with 4–45°C mean annual temperature, and 500–4500 mm mean annual rainfall. It is a gregarious colonizer of landslips, hillsides, roadsides, new embankments, grasslands and other places where mineral soil is exposed, and when stream and rivers alter their courses or add fresh deposits of sand, shingle and boulders (Troup, 1921; Parker, 1956; Streets, 1962). *Dalbergia sissoo* is a characteristic species of the 'Khair-sissoo' primary seral-type forest, and tropical dry mixed deciduous and dry deciduous scrub forest types, occurring in open and low forest formations composed entirely of deciduous trees and some trees of the thorn forest type, with a predominantly deciduous shrub layer, and are limited to Himalayan foothills and adjoining Siwaliks, and recent alluvial deposits (Champion & Seth, 1968). It regenerates naturally in soil with good drainage and sufficient aeration on fresh embankments, riverine slopes, exposed soil, laid down terraces, road cutting, etc. The species is considered as a pioneer species in riverine succession of sub-Himalayan tracts and outer Himalayan valleys. The species is fairly drought-resistant and frost-hardy (CSIR, 1952).

3.3 Biological characteristics

The species is naturally propagated by seeds, root suckers and it also coppices vigorously. In wild conditions, the regeneration from seeds and root suckers is very common. *Dalbergia sissoo* is fast growing and can start producing flowers in nine months. Seed germination takes place the during monsoon. Availability of adequate amount of overhead light and protection against grazing and fire are vital factors determining the success or failure of natural regeneration obtained through seeds. The rate of regeneration (RR) is moderate to high in different parts of country, ranging from 136 % to 1218 % (Bhattacharjee & al., 2018). The species usually flowers between February to June (rarely in September in some parts of South India) in India and the fruiting period of the species is usually between the end of March to December (– February). The species is open-pollinated and the seed raised plants show wide genetic variability. The tree sheds pods during December–April and seeds germinate at the commencement of rains. Pods are disseminated by wind. Due to growth near streams/rivers, the pods are also dispersed by water along streams/rivers.

3.4 Morphological characteristics

Dalbergia sissoo is 10–30 m high deciduous tree, with a trunk of 2–4 m in girth at base. The bark is grey to pale brown, flaking in narrow longitudinal strips. Leaves are imparipinnately compound, usually with 5 leaflets (sometimes 3, rarely 4); leaflets are alternately arranged, sub-orbicular, obcordate, broadly ovate to obliquely ovate in shape and are 3.9–9 cm long and 3–7 cm broad with conspicuously and abruptly cuspidate apices. Flowers are yellowish white, 7–9 mm long; the calyx is campanulate with 5 segments, the two upper ones are rounded and three lower are acute, with the middle one the longest; petals are 5 in number, the vexillum is sub-orbicular, emarginate at the apex and narrowed at the base into a long claw; wings and keels are oblong, distinctly clawed; stamens are 9 and monadelphous. Pods are linear-oblong, strap-shaped, 4.8–9.7 cm long and 0.7–1.3 cm broad, acute at the apex (sometimes rounded), mucronulate with a narrow base with usually 1–3 seeds (rarely 4), and glabrous.

3.5 Role of the species in its ecosystem

The species is largely used in agroforestry, plantation, afforestation, and reforestation programmes. It is a nitrogen fixer and also improves soil fertility with its leaf litter which decomposes slowly and releases nutrients gradually. The honey is dark amber and strong-flavoured and serves as an important food source for honeybees, beetles, wasps, bumble bees, butterflies and other insects. The leaves are used as a source of food for mammals. The tree serves as host of other plants such as epiphytic orchids, ferns, and fungi, lichens, etc. and also for birds and other insects. Based on available records there are no dependent species for *D. sissoo.*

4. Status and trends

4.1 Habitat trends

India's total growing stock of *Dalbergia sissoo* in 2019 was estimated at 5,915.76 million m^3, of which 4,273.47 million m^3 was in forests while the remaining 1,642.29 million m^3 is in Trees Outside Forests (TOF). The average growing stock in forests was about 55.69 m^3/ha in 2019 (Kant & Nautiyal, 2021). According to the 'India State of Forest Report 2021', the total forest cover of the country is 7,13,789 km^2, which is 21.71 % of the geographic area of the country (FSI, 2021). As per the report (FSI, 2021), during the two assessments periods of 2019 and 2021, increase of 1540 km^2 forest cover at the national level was recorded, whereas from 2017 to 2021 the increase in forest cover is 5516 km^2. Hence, the habitat trend of *D. sissoo* in India is positive.

4.2 Population size

The species is abundantly found in the wild mostly along riverine tracts of Jammu and Kashmir, Punjab, Haryana, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar, West Bengal, Assam and Arunachal Pradesh; whereas the species is found in cultivation / plantations almost throughout the country. As per the NDF study (Bhattacharjee & al, 2018) conducted for *D. sissoo* in India, 8 to 38 mature individuals are found per hectare for the wild population in different parts of country, whereas it is 3 to 39 per hectare for cultivated stocks and up to 1600 per hectare for pure and monospecific plantations. The Extent of Occurrence (EOO) of *D. sissoo* in India is at least 1,98,974 km^2 considering only the sub-Himalayan tracts from where wild subpopulations of the species are reported. According to 'State Forest Report 2021' (FSI, 2021), the total estimated number of trees of *D. sissoo* outside the forests in India is 7,57,62,000.

4.3 Population structure

Wild subpopulations of the Indian population of *D. sissoo* are mostly medium-sized, sometimes large, and unevenly distributed. As per the survey report (Bhattacharjee & al., 2018) in different parts of India, 43% mature individuals are with 8–20 cm DBH, 37% are with 21–40 cm DBH, 15 % are with 41–60 % DBH, whereas 5 % are with 61–90 cm DBH. Apart from that, plants in seedling / saplings stage are found in all locations of its wild occurrence and the rate of regeneration (RR) is moderate to high in different parts of country, ranging from 136 % to 1218 % (Bhattacharjee & al, 2018). According to the 'State Forest Report 2021' (FSI, 2021), *D. sissoo* also occurs abundantly outside forests (Total estimated trees: 7,57,62,000) in India and 6,11,90,000 of trees of *D. sissoo* growing outside the forests are of 10–30 cm diam., 1,40,34,000 are of 30–60 cm diam. and 5,38,000 of 60 cm + diam.

4.4 Population trends

Though the population trend of *D. sissoo* is slightly decreasing in some parts of the country during the last few decades due to some diseases, the wild population of *D. sissoo* in India is not affected by harvest and trade as the harvest / trade of *D. sissoo* is being done mostly from planted/cultivated trees. The impacts of both harvest and trade are low as harvest and trade do not pose to threats to the existing wild population of *D. sissoo* in India. The existing management procedures (also supported by laws to regulate harvest of the natural population) with high initiatives for cultivation / plantation of the species by farmers, villagers, and forest departments throughout the country are effective to maintain the overall population of *D. sissoo* in India. The population trend of *D. sissoo* in India is increasing which is evidenced by the increase in the estimated number of trees of *D. sissoo* outside forest areas in India from 7,40,25,000 to 7,57,62,000 during 2017–2021 (FSI, 2017; FSI, 2021).

4.5 Geographic trends

Though the population density of this species had declined in the past in some parts of Bihar, Odisha, Punjab, Haryana, Uttarakhand, Uttar Pradesh, the majority of this decline was from planted / cultivated populations. However, due to its high capacity to be naturalised in new areas, the overall geographic range of the naturalised population has expanded, even up to South India. The species is also reported to be introduced in different parts of World and the trend of geographic distribution is increasing at the Global level.

5. Threats

Diseases

The main threats to the wild, naturalised, as well as cultivated / planted populations of *D. sissoo* are fungal and bacterial diseases and from insects. However, due to its very high regeneration and growth rate, the overall population is not affected much. The frequency of mortality due to diseases is lower in wild / naturalised subpopulations than that of cultivations / plantations. A large number of insect pests have been recorded on *D. sissoo* including wood borers, leaf defoliators, leaf miners, leaf rollers and sap suckers (Mathur & Singh, 1959). Several insects, especially two defoliators, *Plecoptra reflexa* Guenee and *Dichomeris eridantis* Meyrick have been reported to damage *D. sissoo. Plecoptra reflexa* is a serious defoliator in nurseries and young plantations (Sharma & al., 2000). There are two major diseases severely damaging *D. sissoo,* wilt and dieback, caused by three fungi i.e., *Fusarium solani* (Mart.) Sacc., *Ganoderma lucidum* (Curtis) P. Karst and *Phellinus gilvus* (Schwein.) Pat. The Fusarium wilt disease has been reported from Uttar Pradesh, Bihar and Punjab in plantations, raised on unsuitable sites i.e., stiff, clayey soils and water-logged conditions. Trees of advanced age are usually susceptible to the disease. The affected trees die within a few months (Bakshi, 1954).

Root rot of *D. sissoo* due to *Ganoderma lucidum* is common both in natural forests and in plantations. It causes white spongy rot in the sapwood. The affected trees exhibit a stag-headed appearance and are eventually killed. Lateral spread of the disease in plantations is through root contact, which results in gaps in pure plantations. Another fungus causing root rot is *Phellinus gilvus* which is a wound parasite and is known to infect plantation trees (Sharma & al., 2000). According to Gill & al. (2001) the primary cause of dieback in *D. sissoo* is *Phytophthora cinamomi* Rands. Powdery mildew disease is caused by another fungus, *Phyllactinia corylea* (Pers.) P. Karst. (Singh, 2011). Stem canker in trees of advanced age is caused by *Polyporus gilvus* (Schwein.) Fr. and can be seen in naturally growing trees of the terai region, the outskirts of villages and canal banks in Punjab and Uttar Pradesh. Collar rot of seedlings is caused by *Rhizoctonia solani* J.G. Kuhn (CSIR, 1952). The root-knot nematode *Meloidogyne javanica* (Treub) Chitwood has been recorded to form galls on roots of *D. sissoo* from Lachhiwala range nursery, Dehra Dun (Mehrotra & Sharma, 1992). Heavy infestations of the nematode affect plant growth adversely.

Harvest

Dalbergia sissoo is primarily harvested for its timber which is used in the making of handicraft items, furniture, boats, carts, carriages, gun handles, rail-sleepers, cabinets, decorative veneer, ornamental turnery, plywood, musical instruments, skis, carvings, boats, tool-handles, floorings, etc.

6. Utilization and trade

6.1 National utilization

Dalbergia sissoo is one of the most useful timber species of India and is primarily used in the making of handicraft items, furniture, veneer, plywood, and several other tools and artifacts. The leaves of *D. sissoo* are used as medicine and fodder, and the wood is also used as fuelwood, especially in the villages of India. The total monetary gains estimated for *D. sissoo* was Rs. 13.4 million per hectare (Jalota & Sangha, 2000). The price of the *D. sissoo* wood in the domestic market was Rs. 400/- to Rs. 750/- per CFT (cubic feet), depending on the quality and distance to source (Sinha & Pasha, s.d.). According to 'Indiamart' (https://www.indiamart.com/proddetail/sissoo-wood-19045644162.html; accessed on May 1, 2022), the price of per CFT of wood-log of *D. sissoo* varies from Rs. 800/- to Rs. 4500/- depending on the quality, length, breadth, shape, moisture content, etc.

6.2 Legal trade

Since the Appendix II listing of *Dalbergia sissoo* came into place, exports of furniture and handicrafts made of *Dalbergia sissoo* from India have fallen by almost 50% from an estimated 1000 crore Indian Rupees (~129 million USD) per annum before the listing, to 500-600 crore Indian Rupees (~64 to 77 million USD) per annum after (Export Promotion Council for Handicrafts, *pers. comm.* 30 April 2022). Exports from India were mainly to the Netherlands, Sweden, United Arab Emirates, China, Australia, Switzerland, Italy, France, Qatar, SAR Hong Kong, Romania, Uruguay, Columbia, Argentina, Peru, Austria, and Poland.

According to the CITES Trade database, a total 26021813.1 kg of carvings / derivatives / sawn wood / timber / wood products, 2514.45 g of wood product / carvings, 68.91 m3 of logs, and 1722818 number of specimens of *D. sissoo* were exported during 2017 to 2021 globally. The countries / territories involved in export of carvings / derivatives / sawn wood / timber / logs / wood products of *D. sissoo* are India, Germany, Pakistan, Ireland, Australia, Japan, South Korea, United States of America, Czech Republic, Denmark, Egypt, Netherlands, South Africa, Canada, Switzerland, China, France, United Kingdom, Lebanon, SAR Hong Kong, Indonesia, British Indian Ocean Territory, New Zealand, and Singapore (UNEP-WCMC).

6.3 Parts and derivatives in trade

Primarily harvest of whole plants for timber, but also harvested for firewood and fodder. Leaves, bark and seeds are also harvested for ethnomedicines in some parts of India but to a very small extent.

6.4 Illegal trade

Dalbergia sissoo is the second most important cultivated timber tree in India. Due to its extensive availability in cultivation/ plantation, the illegal trade of the species from its wild population is very rarely reported at present.

6.5 Actual or potential trade impacts

The wild population is insignificantly affected by trade at present as the harvest/trade is infrequent from the wild mainly due to enormous availability of harvestable trees in plantation / cultivation. Therefore, the actual or potential trade impact is low.

7. Legal instruments

7.1 National

The wild subpopulations of *D. sissoo* are found in several Protected Areas of the country, viz. Nandini Wildlife Sanctuary of Jammu and Kashmir, Corbett National Park, Rajaji National Park of Uttarakhand, Sher Jung National Park of Himachal Pradesh, Pilibhit Tiger Reserve, Dudhwa National Park of Uttar Pradesh, Valmiki National Park, Kanwar Lake Bird Sanctuary of Bihar, Daying Ering Wildlife Sanctuary of Arunachal Pradesh, Bura Chapori Wildlife Sanctuary of Assam, etc., and the Wild Life (Protection) Act, 1972, prevents removal of any tree from such Protected Areas. The harvest of *D. sissoo* outside the Protected Areas is also regulated by rules/Acts of different States / Union Territories. The species is listed as a 'restricted species' in Jharkhand and West Bengal and permission is required for harvesting (in private lands), transportation and marketing of this species. As per the 'Jharkhand Timber and Other Forest Produce (Transit and Regulation) Rules, 2004' (amended in 2010), *D. sissoo* trees can be removed only after obtaining permission from the forest department.

In West Bengal, the 'West Bengal Private Forest Act, 1948', 'West Bengal Forest Produce Transit Rules, 1959' and 'West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006' are in force which regulate permission for felling and transit of trees grown on private lands and permission is mandatory for 11 species, including *D. sissoo*. The Assam (Control of felling and removal of Trees from Non-Forest land) Rules, 2002 vide Notification No. FRM- 88/2001/77 dated 7th May, 2002 regulates felling permission and transit of timber derived from non-forest areas of Assam and 48 tree species have been declared as 'Reserve trees' in Assam including *D. sissoo.* In Haryana, only dead, diseased and drying trees of *D. sissoo* are being harvested. Working plans of the state do not prescribe for green felling of *D. sissoo.* Green trees are harvested only in case of emergency felling when forest

areas are diverted for non-forestry activities. *Dalbergia sissoo* is the state tree of Punjab and no green tree of this species has been marked for felling as per the Working Plan of the state.

7.2 International

As the genus *Dalbergia* is listed under Appendix II of CITES since 2nd January 2017, a CITES permit (for Parties) / comparable documentation (for non-Parties) is required to export/import *D. sissoo* specimens subject to Annotation #15.

8. Species management

8.1 Management measures

The wild subpopulations of *D. sissoo* are found in Jammu and Kashmir, Punjab, Haryana, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar, West Bengal, Assam, and Arunachal Pradesh, whereas the cultivated trees of *D. sissoo* are found almost throughout the country. The wild population is insignificantly affected by harvest as the harvest is infrequent from the wild mainly due to enormous availability of harvestable trees in plantations / cultivation. Moreover, the legal instruments enforced in different states / union territories also protect the wild population and even the cultivated population of *D. sissoo* in India. *Dalbergia sissoo* is the second most important cultivated timber tree in India. The species can be found in plantation/cultivation and/or the agroforestry system in almost every part of the country and it is very common in the northern, north western, central, eastern parts of country mainly along highways, roads, riverbeds, water bodies, railway tracks, lands for cultivation and is also found in villages, cities, and forest areas.

In Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Odisha, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand, and West Bengal, *D. sissoo* can be found almost in every village/town/city. This abundance is mainly due to its fast growth rate and the utility of its timber in making handicraft, furniture, tools and artifices etc. for which it is mostly preferred by the forest departments, NGOs, other agencies in afforestation / restoration programmes and also by the farmers for commercial use. The species is widely available in several Government and private nurseries (Bhattacharjee & al., 2018) of almost all states and union territories of India for *ex-situ* conservation, plantation, afforestation, reforestation and also for distribution/sale. The forest departments of different states (like Haryana) are following a protocol (Bhattacharjee & al., 2018) to combat against the diseases of *D. sissoo* which is found effective.

8.2 Population monitoring

Being a very common species on cultivation, the market demand is easily fulfilled from cultivated plants. The wild population of *D. sissoo* is also not affected by harvest and trade and therefore, the programmes related to monitoring the status of wild populations and the sustainability of off-take from the wild have not been taken up. In Haryana, only dead, diseased and drying trees of *D. sissoo* are being harvested and the working plans do not prescribe for green felling of *D. sissoo.* However, sometimes green trees are harvested in case of emergency felling when a forest area is diverted for non-forestry activities.

8.3 Control measures

8.3.1 International

Apart from the CITES Management Authority of India, the Export Promotion Council for Handicrafts (EPCH) is also authorised to issue CITES comparable documentation for export of *D. sissoo* specimens from India. EPCH has developed the "Vriksh standard Timber Legality Assessment and Verification Scheme". EPCH issues ‘Vriksh Shipment Certificates’ for exporting goods containing *D. sissoo* by verifying forest auction note / sales invoice of forest departments, social forestry sales invoice, cutting permits issued by the forest department, attested Khasra/field details indicating the location from where the tree was removed, Mandi Samiti (Agricultural Produce Marketing Committee) receipt and Gate Pass, invoice of sawmills, license and sawmill record (register) attested by the forest department, transit permit, weighment bridge slip, sales invoice of immediate supplier, Vat or Sales Tax document, etc.

8.3.2 Domestic

The Wild Life (Protection) Act, 1972 prevents removal of any tree from Protected Areas. The harvest of *D. sissoo* outside Protected Areas is also regulated by rules / legislations of different States / Union Territories. However, there are variations in the rules and regulations related to felling of trees, transportation of felled timber across various States / Union Territories and their management. *Dalbergia sissoo* is listed as a 'restricted species' in Jharkhand and West Bengal and permission is required for harvesting (in private lands), transportation and marketing of this species. In Assam, *D. sissoo* is a 'reserved tree' and therefore, felling and transit of the species is regulated. The sourcing of timber of *D. Sissoo* from Bihar has been banned. *Dalbergia sissoo* is the state tree of Punjab and green trees of this species are not marked for felling as per the Working Plan of the state.

8.4 Captive breeding and artificial propagation

In India, *D. sissoo* is very common in cultivation and found growing in farmers' land, gardens, plantations etc. (i.e. under controlled conditions). These trees are grown from seeds, cuttings, stumps, and propagules derived from cultivated parental stock and are therefore 'artificially propagated'. Artificial regeneration is possible through almost all common practices such as direct sowings, entire transplanting, planting stumps and root sections and stem cuttings, cloning, etc. Stump planting (planting c. 5 cm of stem and 20 cm of root) is known to be the best method of artificial regeneration (Lodhiyal & al., 2001). Artificial propagation of *D. sissoo* is frequently done by the Forest departments of almost all states and union territories of India resulting in wide availability of seedlings / saplings / stumps at nurseries.

8.5 Habitat conservation

Dalbergia sissoo is found in wild conditions in several Protected Areas (PAs) of the country namely Ramnagar Wildlife Sanctuary, Jasrota Wildlife Sanctuary and Nandini Wildlife Sanctuary in Jammu and Kashmir, Saraswati Plantation Wildlife Sanctuary in Haryana, Nangal Wildlife Sanctuary in Punjab, Sher Jung National Park in Himachal Pradesh, Corbett National Park, Rajaji National Park in Uttarakhand, Pilibhit Tiger Reserve and Dudhwa National Park in Uttar Pradesh, Valmiki Tiger Reserve, Kanwar Lake Bird Sanctuary in Bihar, Daying Ering Wildlife Sanctuary in Arunachal Pradesh, Bura Chapori Wildlife Sanctuary in Assam etc. Apart from PAs, the species is also found in Reserve Forests which are also protected and regulated by the forest department of the concerned state / union territory.

8.6 Safeguards

Not applicable.

9. Information on similar species

Dalbergia sissoo is easy to identify in its living condition and is unlikely to be confused with other species.

10. Consultations

A consultation letter along a draft of the present proposal was sent to 43 range and consumer States of *Dalbergia sissoo* on 14 May 2022. Email responses were received from China on 17 May 2022 and Sudan on 5 June 2022 indicating support for the proposal. By an email dated 30 May 2022, Nepal indicated it wished to be a co-proponent of the proposal.

11. Additional remarks

In its living condition, *Dalbergia sissoo* is easy to identify, and is unlikely to be confused with other species.

The wood of *Dalbergia sissoo* can be distinguished from the wood of other Dalbergia species that are threatened, namely, D. *nigra*, D. *melanoxylon*, D. *madagascariensis* and D. *cochinchinensis* through the following means:

(i) Wood density:

Dalbergia sissoo can be easily distinguished from most of the other Dalbergia species by its Average Dry Weight (48 lbs/ft3 or 770 kg/m3). It is the species with second lowest Average Dry Weight (at 12% moisture content) among the internationally traded woods and being considerable different from:

D. *nigra* (Vell.) Allemão ex Benth (52 lbs/ft or 835 kg/m3),

D. *cochinchinensis* Pierre ex Laness (65 lbs/ft or 1035 kg/m3),

D. *madagascariensis* Vatke (58 lbs/ft or 935 kg/m3),

D. *melanoxylon* (79 lbs/ft or 1270 kg/m3),

[source: CITES Wood Database; accessed on May 1, 2022].

(ii) Gene Sequencing

Dalbergia sissoo can be discriminated from all other species of Dalbergia by its gene sequences (https://www.ncbi.nlm.nih.gov/gene/?term=Dalbergia+sissoo). The species can be identified by DNA Barcoding technique with minimal amount of leaf, wood or other parts. The gene sequences available at GenBank for D. *sissoo* include PsbA-like (psbA), psbA-trnH intergenic spacer, ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit (rbcL), maturase K (matK), tRNA-Leu (trnL), internal transcribed spacer 1 (ITS1), ribosomal protein L23 (rpl23), NADH-plastoquinone oxidoreductase subunit 4L (ndhE), cytochrome b6/f complex subunit VIII (petN), clp protease proteolytic subunit (clpP), acetyl-CoA carboxylase carboxyltransferase beta subunit (aacD), etc.

(iii) Spectrometry

The traded products of *Dalbergia sissoo* can be distinguished from the other species of Dalbergia by DART TOFMS (Direct Analysis in Real Time, Time of Flight Mass Spectrometry). This system works by combusting a small sample of wood, which enables its chemical profile to be analysed. Analytical tools like Near-Infrared and Raman Spectroscopy have found potential to clearly differentiate the wood samples of different species. Handy instruments using these techniques are also available in market. The Indian Institute of Science, Bengaluru uses Raman Spectroscopy and Institute of Wood Science and Technology, Bengaluru uses Near Infrared Techniques to differentiate various wood samples.

Other wood-anatomical characters, like features of rays, endgrains, arrangement of vessels etc. can also be used to differentiate the wood samples of *Dalbergia* spp.

Since the Appendix II listing of *Dalbergia sissoo* came into place, exports of furniture and handicrafts made of *Dalbergia sissoo* from India have fallen by almost 50% from an estimated 1000 crore Indian Rupees (~129 million USD) per annum before the listing, to 500-600 crore Indian Rupees (~64 to 77 million USD) per annum after. Whereas the percentage share of wood products made of *Dalbergia sissoo* of total woodware exports from India was around 25% before the listing, it has fallen to 7.29% for the financial year 2021-2022 (Export Promotion Council for Handicrafts, *pers. comm.* 30 April 2022).

The decrease in exports of *Dalbergia sissoo* products has affected the livelihoods of around 50,000 artisans who work with the species. It has also had a knock-on effect on the livelihoods of other stakeholders who are directly or indirectly connected with the trade of the species, in particular farmers who have been growing the species as part of agroforestry activities promoted by the government to generate additional income (Export Promotion Council for Handicrafts, *pers. comm.* 30 April 2022).

Further negative effects as a result of the CITES listing are foreseeable. The reduction in value of *Dalbergia sissoo* may dissuade farmers from growing the tree, thereby reducing the overall abundance of the species. Given its fast growth rate, adaptability and suitability for artificially propagation, the species is ideal for agroforestry and sustainable utilization for trade. The regulations imposed on trade of the species may result in a switch to utilization of other tree species which are less abundant and less suitable for commercial exploitation, thereby contributing to their decline.

12. References

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