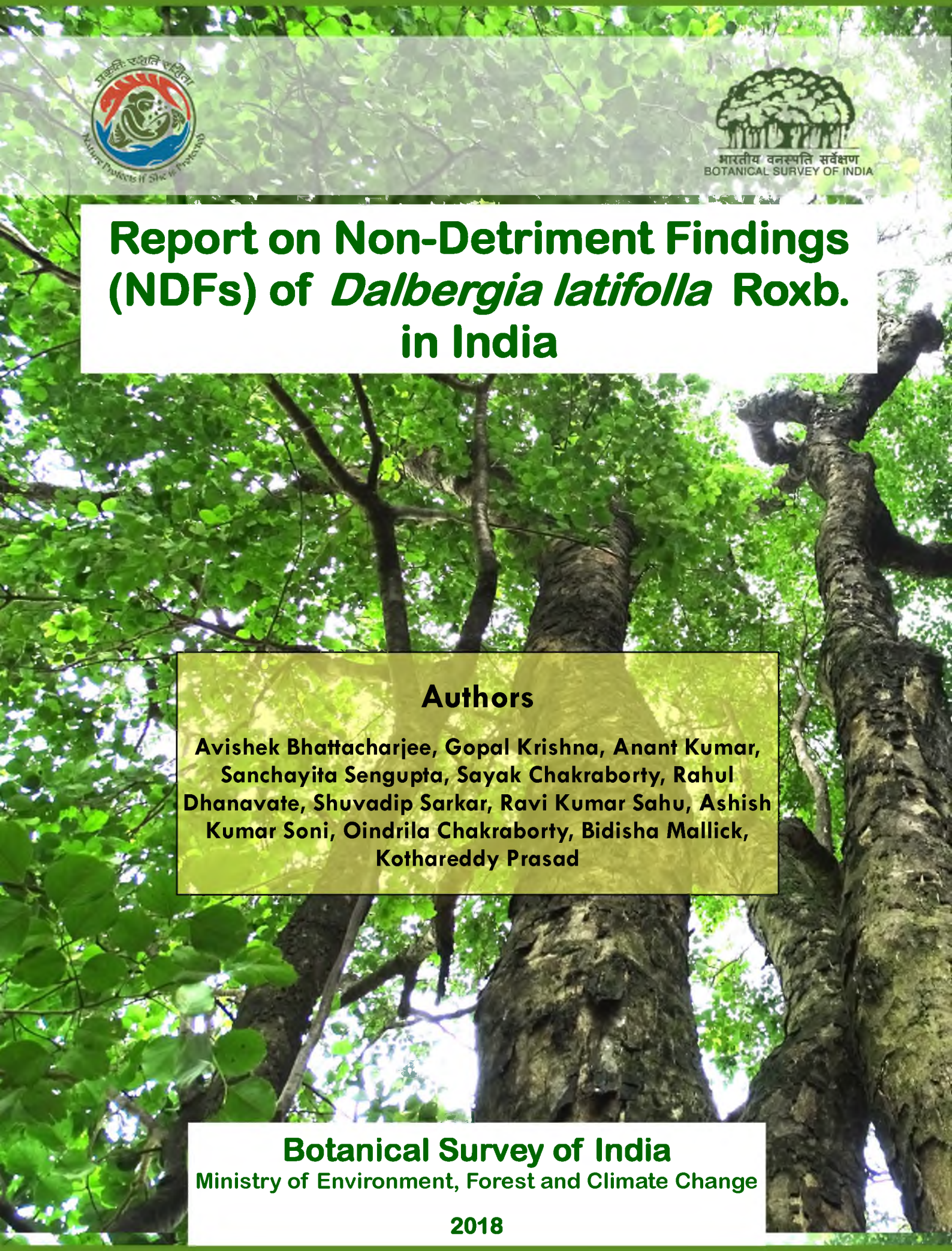
भारतीय वनस्पति सर्वेक्षण
BOTANICAL SURVEY OF INDIA

Report on Non-Detriment Findings (NDFs) of *Dalbergia latifolia* Roxb. in India

Botanical Survey of India
Ministry of Environment, Forest and Climate Change

2018



Report on Non-Detriment Findings (NDFs) of *Dalbergia latifolla* Roxb. in India

Authors

Avishek Bhattacharjee, Gopal Krishna, Anant Kumar, Sanchayita Sengupta, Sayak Chakraborty, Rahul Dhanavate, Shuvadip Sarkar, Ravi Kumar Sahu, Ashish Kumar Soni, Oindrila Chakraborty, Bidisha Mallick, Kothareddy Prasad

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CONTENTS

Introduction

The tropical genus *Dalbergia* L.f. belonging to the family Fabaceae comprises about 250 species in world (Mabberley, 2017). In India, the genus is represented by about 35 species (Thothathri, 1987), which includes various life-forms such as trees, shrubs and lianas. Several species of this genus are commonly known as "rosewood" or "palisander", which produce timbers of high economic value. The genus is native to the tropical regions of Central and South America, Africa, Madagascar and Southern Asia, with fragmented distribution. Many species are under threat due to non-sustainable harvest practices, natural and artificial fires and other anthropogenic activities.

Dalbergia nigra (Vell.) Benth. (Brazilian rosewood) has been listed in Appendix I of CITES since 1992 and all other species belonging to the genus have been listed in Appendix II of CITES since 2nd January 2017 as they face severe threat for survival due to uncontrolled trade.

The Ministry of Environment, Forest and Climate Change (MoEF & CC), Government of India commissioned a study through Botanical Survey of India (BSI), Kolkata for conducting the Non-Detriment Findings (NDFs) on two tree species namely *Dalbergia latifolia* Roxb. and *D. sissoo* DC., which was sanctioned (F. No. 4-6/2017/WL dated 7th March, 2018) in a project mode during March, 2018 and executed by a team of scientific staff/researchers of BSI.

Title of the project: "Non-Detriment Findings (NDFs) study on *Dalbergia latifolia* Roxb. and *D. sissoo* DC. in India". Separate reports are being submitted for each species, but with common (except some photographs) 'Acknowledgements', 'Introduction' and 'Methodology'.

Executing/Implementing Agency: Botanical Survey of India, CGO Complex, 3rd MSO Building, Block F(5th and 6th Floor), DF Block, Sector I, Salt lake City, Kolkata 700 064, West Bengal, India.

Duration: Six months (extended for one month due to severe flood in Kerala)

Starting date: Upon receiving funding for the project (28.03.2018)

Funded by: Ministry of Environment, Forest and Climate Change (Wildlife Division), Government of India, New Delhi under the scheme 'Wildlife Crime Control Bureau'

Budget: Rs. 25,00000/- (Rupees twenty five lakh only; fide F. No. 4-6/2017/WL dated 7th March, 2018; fund received on 28.03.18)

FACILITATORS

1. Director, Botanical Survey of India (BSI), Kolkata.
2. Scientist-in-Charge, Central National Herbarium (CNH), BSI, Howrah.

SCIENTIFIC TEAM/REPORT PREPARED BY

Scientific Staff

1. Dr. Avishek Bhattacharjee [Scientist 'B' and Project Investigator (PI), CNH]
2. Dr. Gopal Krishna (Botanical Assistant)
3. Dr. Anant Kumar (Botanical Assistant)

Project Fellows

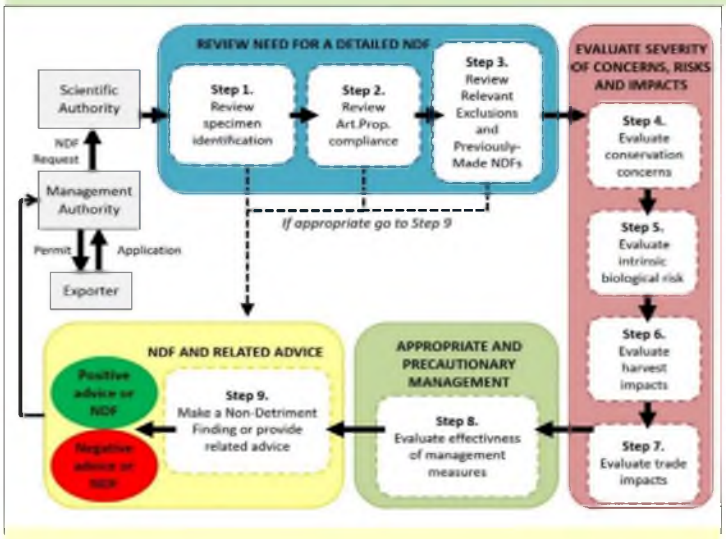
1. Ms. Sanchayita Sengupta (20.4.2018–31.7.2018)
2. Mr. Sayak Chakraborty (20.4.2018–31.7.2018)
3. Mr. Rahul Dhanavate (20.4.2018–1.8.2018)
4. Mr. Shuvadip Sarkar (20.4.2018–31.7.2018)
5. Mr. Ravi Kumar Sahu (20.4.2018–28.9.2018)
6. Mr. Ashish Kumar Soni (25.4.2018–11.9.2018)
7. Ms. Oindrila Chakraborty (1.8.2018–28.9.2018)
8. Ms. Bidisha Mallick (1.8.2018–28.9.2018)

Other Researcher

Dr. Kothareddy Prasad, Acharya Jagadish Chandra Bose Post-Doctoral Fellow

Methodology

The representative specimens of *Dalbergia latifolia* and *D. sissoo* housed at different herbaria (ASSAM, BSA, BSD, BSJO, BSI, BSIS, CAL, MH) of Botanical Survey of India have been consulted (before conducting field surveys) to observe and understand the phenotypic variations of the species, localities of occurrence, flowering and fruiting period and other pertinent information. Simultaneously, the relevant literature also referred. Based on the preliminary data retrieved from herbarium and literature consultation, the BSI team conducted forty two field surveys in different parts (including protected areas) of Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Dadra and Nagar Haveli, Daman and Diu, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh and West Bengal to assess the population status, harvest and management practices, threats, trade, etc., of the two species. The information from the remaining states and union territories (Andaman and Nicobar Islands, Lakshadweep, Manipur, Meghalaya, Mizoram, Nagaland and Sikkim) where these two species were either underrepresented or unreported have been obtained from the Forest Departments of these states/union territories and/or researchers working at the Regional Centres of BSI and also from other scientists/researchers/academicians working in different academic and research institutes of these states/union territories. The specimens deposited at other major Indian herbaria, viz., CALI, FRC, FRLH, KFRI, RHT and TBGT have also been consulted. The team members recorded geographical coordinates of the subpopulations/individuals (in wild and on cultivation, separately) by random sampling for mapping with ArcGIS software to estimate Extent of Occurrence (EOO) of these two species in India. The national conservation status of the two species was assessed by following the 'Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0' (IUCN, 2012). The population size, density (wherever possible), DBH (Diameter at Breast Height) of the boles, height, tentative ages of the plants were noted during field visits. The data on present stocks in cultivation/nurseries/depots of forest departments as well as in private nurseries/plantations were also recorded as much as possible during the field surveys. Information have also been collected from the scientists/scientific staff/ researchers of different units and regional centres of BSI and scientists/researchers/academicians of other academic and research institutes of India. The information received from some of the forest departments of Indian states and union territories were also considered. Semi-formal field interviews with villagers, traders, stakeholders were also conducted, whenever possible. The work has been carried out by following 'CITES Non-Detriment Findings Guidance for Perennial Plants' (Wolf & al., 2016).



Nine-Step Pathway for making Non-Detriment Findings for Perennial Plant Species listed in CITES Appendix II

Dalbergia latifolia

I. DALBERGIA LATIFOLIA ROXB.

A) BACKGROUND INFORMATION ON THE TAXON

i. Scientific, Vernacular/Common Names

Currently Accepted Scientific Name: Dalbergia latifolia Roxb.

Synonyms: *Dalbergia emarginata* Roxb., *Amerimnon latifolium* (Roxb.) Kuntze

Vernacular Names: *Satsor, Sitsal, Swetasal* (Bengali); *Kalaruk, Shisham* (Gujarati); *Bhotheula, Beete, Bide, Kala shisham, Pai, Sitsal* (Hindi); Agaru *Beete, Bete, Beete, Belbiti, Bide, Ibadi, Ibri, Kareevyaadhi, Karevyadi, Karimbeetti, Kariya ibbadi, Shushmaru, Thodagatti* (Kannada); *Cholavitti, Itti/Eetti, Kariveeti, Ulmalavitti, Veeti* (Malayalam); *Bhotheula, Kalarukh, Sisham, Sissu, Sisva* (Marathi); *Satisal* (Nepali); *Shishapa, Simsapa* (Sanskrit); *Eruvadi, Iridi, Irupottu, Itti/Eetti, Karundovira, Nukku, Palkonda, Tawadi, Thodagathi, Totakatti* (Tamil); *Chava, Chittegi, Iridi, Iruduchava, Jitegi, Viroogooduchawa, Virugudu, Zitregi* (Telugu); *Shisham, Sissua* (Urdu).

Common Names: Blackwood Tree, Black Rosewood, Blackwood, Bombay Blackwood, East Indian Rosewood, Indian Palisandre, Java Palisandre, Sonokeling, Roseta Rosewood.

ii. Etymology

The generic name, *Dalbergia*, is after the Swedish brothers Nils and Carl Dalberg, who lived in the 18th century. The former was a botanist and the latter explored Suriname. The specific epithet is derived from Latin 'lata' (broad) and 'folius' (leaved), referring to the size of leaflets of the species.

Dalbergia latifolia was first described by William Roxburgh in his second volume of the book entitled 'Plants of the Coast of Coromandel' (Roxburgh, 1798) wherein he mentioned 'Blackwood Tree' as its English name and 'Viroogooduchawa' as its vernacular name (Telugu).

iii. Botanical Description

Tree, 10–40 m high; trunk up to 260 cm in diam., with a crown of spreading branches; bark smooth. Leaves imparipinnate, alternate, 15–30 cm long; rachis straight, glabrous; leaflets 3–7, alternate to sub-opposite, orbicular to broadly obovate, 2.2–10.5 × 2–10.5 cm, shortly cuneate to rounded at base, entire, but often undulate at margins, obtuse to emarginate at apex, rarely acute, coriaceous, glabrous, glaucous beneath, distal ones always larger than others; lateral veins 6 or 7 pairs, ascending; petiolules 5–10 mm long, glabrous. Inflorescences corymbose paincles, fascicled on old wood below upper leaves or in axil of old leaves, axillary, 4–11.3 cm long; rachis glabrous; flowers white, 6–8 mm long, distinctly pedicellate; bracts present, bracteoles 2, oblong, caducous; pedicels slender, 2–5 mm long. Calyx campanulate, 4–5 mm long, 5-toothed, upper 2 sub-connate, lateral pair obtuse and lower most acute, all teeth veined, calyx and teeth glabrous. Petals 5; vexillum

ovate to broadly elliptic, rarely sub-orbicular, 5–5.5 mm long, clawed; wings and keels clawed, blade auricled, keels connate, all petals veined. Stamens 9, monadelphous, staminal sheath 5–7 mm long, split open dorsally, filaments free on their upper third, longer ones alternating with shorter ones. Ovary oblong, stipitate, 5–7 mm long, glabrous; style slender, curved; stigma minute; ovules 3–5. Pods oblong to oblong-lanceolate, flat, indehiscent, 4.5–10.2 × 1.5–2.6 cm, narrowed at base into a stalk, tips obtuse often with a minute apicule, coriaceous, sparingly veined especially over the seed, glabrous, green turns brown on dry; seeds oval to slightly reniform, 6–7 × 4.0–4.5 mm, smooth, compressed, brown to black.

***Dalbergia latifolia* from William Roxburgh's 'Flora Indica' drawings** (Roxburgh No.79)
[©Board of Trustees of the Royal Botanic Gardens, Kew]

iv. Distribution

Native: India, Indonesia, Malaysia, Nepal.

Exotic: Kenya, Mauritius, Myanmar, Nigeria, Pakistan, Philippines, Reunion (France), Sri Lanka, Sulawesi, Tanzania, Uganda, Vietnam.

India (wild): Andaman and Nicobar Islands*, Andhra Pradesh, Bihar, Chhattisgarh, Daman and Diu, Dadra and Nagar Haveli, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Sikkim*, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal.

India (introduced/cultivated): Jammu and Kashmir, Punjab, Tripura.

*Reported earlier (in literature) but presently not found.

B) NON DETRIMENT FINDINGS (NDFs) OF *DALBERGIA LATIFOLIA* IN INDIA

STEP 1: REVIEW OF SPECIMEN IDENTIFICATION

1.1 Has the plant/specimen been correctly identified, and, is the scientific name used compliant with the appropriate CITES standard?

Some of the plants/specimens are correctly identified, whereas some are not.

Dalbergia sissoides Wight & Arn., a species look-alike that of *D. latifolia* is also reported from Karnataka, Kerala, Tamil Nadu and it has been found that in many parts of these three states *D. sissoides* are misidentified as *D. latifolia* with the same vernacular names 'Itti'/'Eetti' or 'Veeti'/'Beeti' due to similarities in their morphological characters and uses. The heartwood of these two species are also very similar in appearance and both are highly valued and used for making furniture, musical instruments, cabinet works, etc. However, the wood of *D. sissoides* is stronger, harder, and lighter in colour with more streaks and it usually does not take high polish as the wood of *D. latifolia*.

Dalbergia latifolia and *D. sissoides* are indiscriminately harvested, traded, managed in many parts of the major harvesting states of *D. latifolia* (Karnataka, Kerala and Tamil Nadu). During the study it is also observed that in many of the Indian herbaria, considerable number of specimens of *D. sissoides* are misidentified as *D. latifolia.*

Due to similarities in morphological characters, several botanists treated *D. sissoides* as a variety of *D. latifolia* (Bentham,1860; Beddome, 1869; Baker, 1876), but several others (Gamble, 1902; Prain, 1904; Gamble, 1918; Thothathri, 1987; Sanjappa, 1992) treated as a distinct species. Further, Hiremath & Nagasampige (2004), based on RAPD markers treated *D. sissoides* as a distinct species, whereas based on pharmacognostical studies Muralidharan (2010, ined.) in his doctoral thesis treated *D. sissoides* as a distinct species. The flowering and fruiting period of these two species is also different.

Dalbergia latifolia and *D. sissoides* can be discriminated by combination of the following morphological characters.

Characters	*D. latifolia*	*D. sissoides*
Leaf/Leaflet	Leaflets 3–7, usually 5, orbicular to broadly obovate, 2.2–10.5 × 2–10.5 cm, shortly cuneate to rounded at base, mostly obtuse to emarginate at apex, rarely acute, often undulate at margins, with 6 or 7 pairs of lateral veins	Leaflets 5–7, rarely 3 or 9, ovate, ovate-elliptic to narrowly obovate, rarely sub-oblong, 2–7.5 × 1.5–5 cm, narrowed at base, mostly acute at apex with 4–6 pairs of lateral veins
Inflorescence	Clustered on previous years shoots	Terminal on new shoots
Pod	Oblong-lanceolate to oblong-elliptic, 3.5–9.2 × 1.1–2.6 cm, tip obtuse often with a minute apicule	Oblong to oblong-lanceolate, 3–8.5 × 0.7–1.5 cm, tapering at ends and often with long-apicule

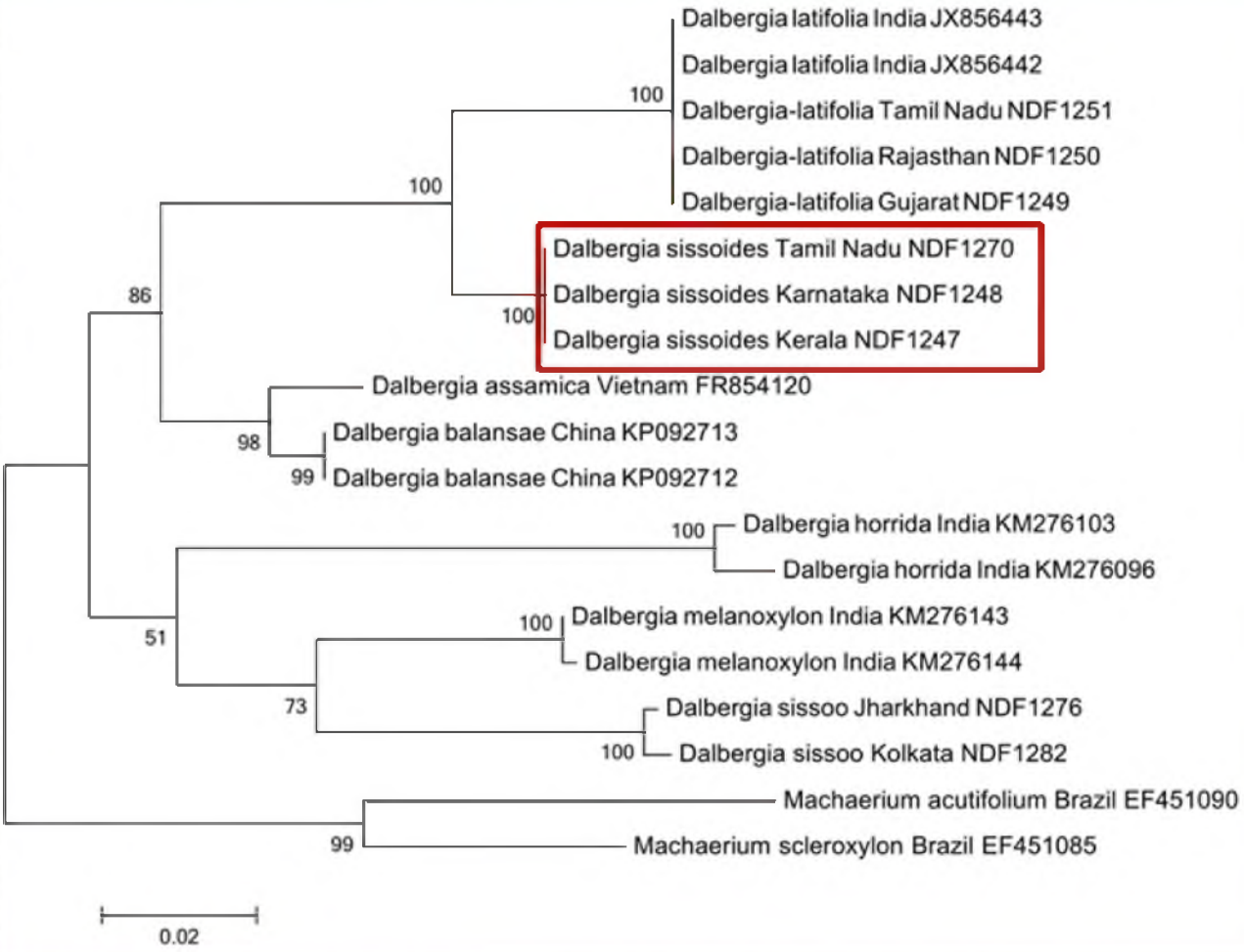
Dalbergia latifolia **Dalbergia sissoides**

(Difference in morphology of leaves/leaflets of *D. latifolia* and *D. sissoides*)

Dalbergia latifolia **Dalbergia sissoides**

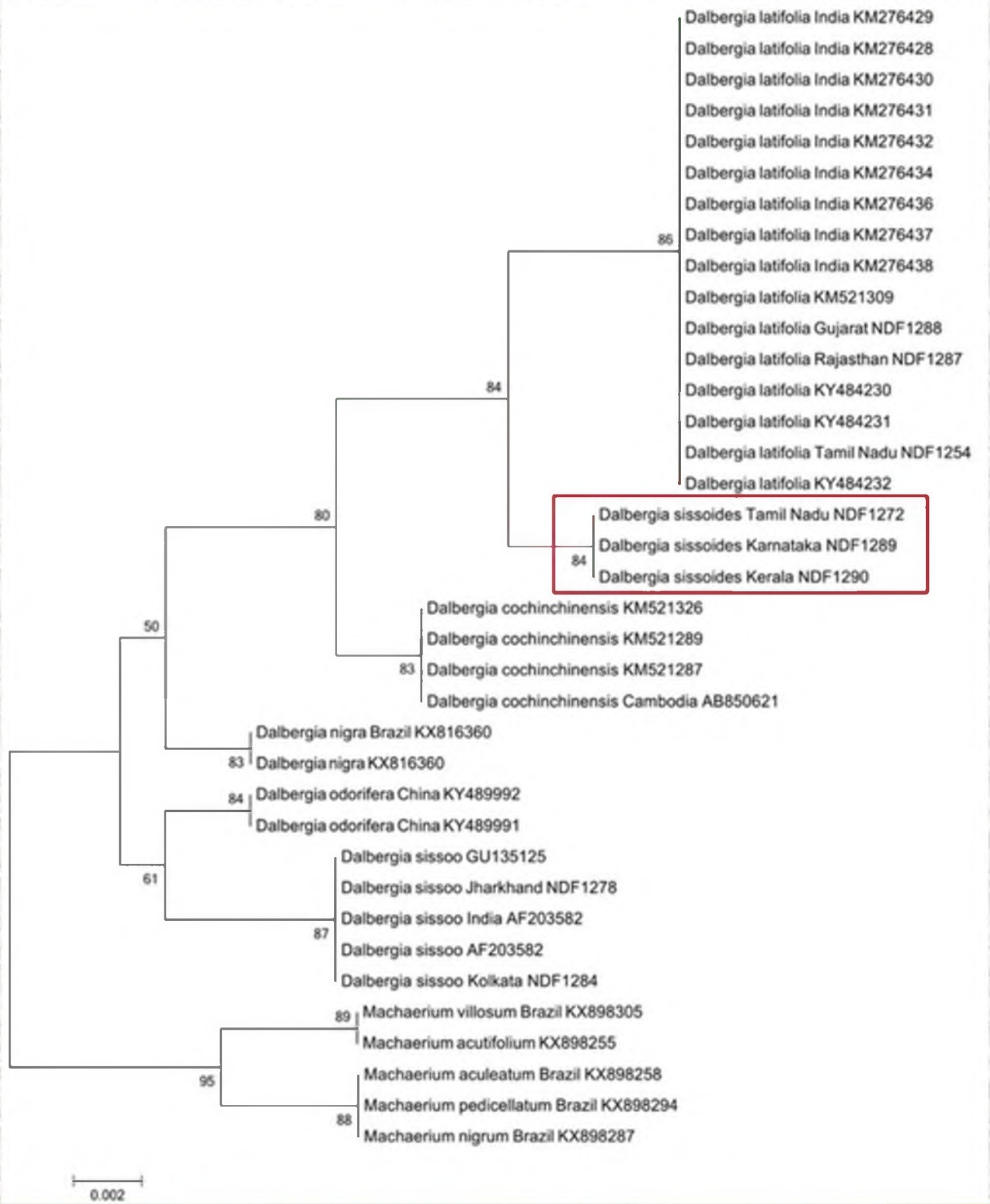
(Differences in the nature and morphology of pods of *D. latifolia* and *D. sissoides*)

During the present study, molecular analysis of some collected samples have been carried out using ITS and *matK* and the results show clear distinction between *D. latifolia* and *D. sissoides* at species level.



NJ trees based on ITS data constructed using MEGA 6.0 showing clear distinction between *D. latifolia* and *D. sissoides*

A minutely apiculate pod of *Dalbergia latifolia*



NJ trees based on *matK* data constructed using MEGA 6.0 showing clear distinction between *D. latifolia* and *D. sissoides*

Trees of *D. sissoides* misidentified as *D. latifolia* in a coffee plantation at Kodagu, Karnataka

Mixed population of *D. latifolia* and *D. sissoides* at Meppadi, Wayanad, Kerala

STEP 2: REVIEW OF COMPLIANCE WITH ARTIFICIAL PROPAGATION REQUIREMENTS

2.1 Is the permit application for Art. Prop. specimens?

No

STEP 3: REVIEW OF RELEVANT EXCLUSIONS AND PREVIOUSLY-MADE NDFs

3.1. Is the export of wild-harvested specimens of this species permitted?

Yes

There was no restriction on export of legally procured specimens of *D. latifolia* from India before inclusion of the entire genus *Dalbergia* under Appendix II of CITES in 2017. Presently the wild-harvested specimens in compliance with the CITES Comparable Certificate or Vriksh Shipment Certificate are only exported from India after verifying the legality and legal origin.

3.2. Is the specimen covered by CITES Appendix II?

Yes

3.3. Has a science-based NDF been made for this species that is still valid and sufficient to evaluate the current application?

No

STEP 4: EVALUATION OF CONSERVATION CONCERN

4.1. Has the conservation status of this species been assessed?

Yes

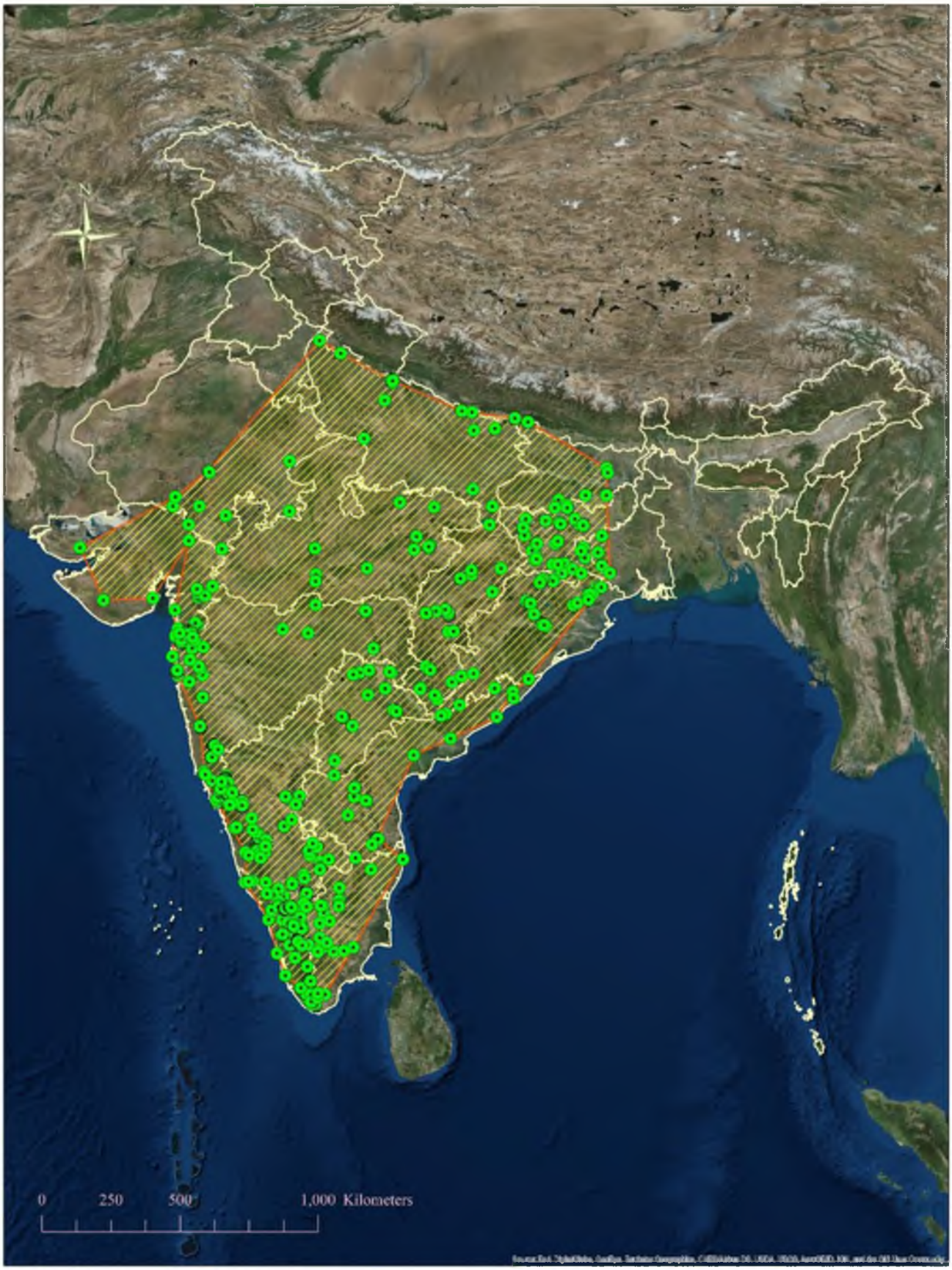
Assessed Vulnerable (as per ver. 2.3) in global context, but the assessment needs updating (Asian Regional Workshop, 1998); assessed **Near Threatened (NT)** in India by following 'IUCN Red List Categories and Criteria, Version 3.1, 2nd Edition' (IUCN, 2012) during the present study.

4.2. Considering existing conservation status assessments, what is the indicated severity of conservation concern?

Severity of Conservation Concern: Low

National conservation status for the case study country: Near Threatened (NT)

The estimated Extent of Occurrence (EOO; criterion B1) of *D. latifolia* in India is 19,36,393 km^2 and the number of mature individuals (criteria C, D) is > 100000 (based on surveyed locations only). However, the number of mature individuals is much more in reality as every location of its occurrence could not be covered/surveyed during project tenure due to certain limitations, but the observed number (> 100000) of mature individuals is much more than that of the threshold value (< 10000 for vulnerable) for treating the species under any threatened category. The suspected reduction in overall population (criterion A1) in India is < 50 % in last two decades and the causes of the reduction are clearly reversible, understood and have ceased.



Extent of Occurrence (EOO) of *D. latifolia* in India

Though the natural population of this species has been declined mainly in some parts of western, central and eastern India, it is moderately stable in Karnataka, Kerala and Tamil Nadu with good regeneration. However, the ultimate survival (from seedlings/saplings to mature individuals) even in some areas of these three states mainly is less due to forest fire, grazing, competition with invasive species and climatic factors. The population of this species in some parts of Gujarat, Andhra Pradesh and Telangana is fair but the regeneration is comparatively lower. The main threat to the mature individuals of this species throughout the country is harvesting for its valuable timber. However, a major part of the wild population of the species occurs within Protected Areas (PAs) of the country and therefore the population decline due to harvest is almost nil in PAs due to strict enforcement of laws [removal of any tree, even the dead/fallen tree, is prohibited from Protected Area as per the Wild Life (Protection) Act, 1972]. The harvest is permitted only from reserve forests, social forestry and private lands, i.e. outside the PAs. Further, the species is also listed as 'restricted species' in the states of Gujarat, Karnataka, Kerala, Tamil Nadu, and permission is required for harvesting (in private lands), transportation and marketing of this species; whereas it is listed as a 'reserved tree' under the Andhra Pradesh Preservation of Private Forest Rules 1978, which prohibits feeling of the species unless the tree exceeds 120 cm girth (DBH: c. 38 cm) at 1.3 m height from ground level. In Tamil Nadu, 'Rosewood' tree is given special status by a separate 'Rosewood Conservation Act'. A scheme "Tree Cultivation in Private Lands" was launched to encourage tree cultivation in uncultivable/abandoned/farm lands. 'The Kerala Preservation of Trees Act, 1986' prevents felling of 'Rosewood' trees. Felling of trees on private land within Maharashtra is regulated by the 'Maharashtra Felling of tree Act, 1964', 'Maharashtra Preservation of Trees Act 1975', 'The Maharashtra Land Revenue code 1966', and the transit regulation and permission for felling and transit of *D. latifolia* is required. In West Bengal, the 'WB Private Forest Act, 1948', 'WB Forest Produce Transit Rules, 1959' and 'WB Trees (Protection and Conservation in Non Forest Areas) Act, 2006' are in forces which regulate permission for felling and transit of trees grown on private lands. No tree can be felled in non-forest areas except with the procedure laid out for obtaining permission for felling of trees with obligation to plant trees in lieu of trees felled. As per the 'Jharkhand Timber and Other Forest Produce (Transit and Regulation) Rules, 2004' (with amendments proposed in 2010), 'Rosewood' tree can be removed only after obtaining permission from DFO or authorized ACF. According to 'Pondicherry Timber Transit Rules, 1983', 'Rosewood' tree is protected and such species cannot kept be in possession or transported by any individual/farm without special permit.

Some other threats include natural calamities, habitat loss/degradation, and diseases (non-lethal). Several insects, including defoliators, bark feeders and sap suckers, are known to be associated with living trees of *D. latifolia*. The damage caused by them is insignificant and there is no threat from any of them in the establishment of nurseries or plantations.

Therefore, based on population size, reduction in population, geographic range in the form of EOO along with its associated threats, *D. latifolia* is assessed as Near Threatened (NT) in India.

STEP 5: EVALUATION OF POTENTIAL INTRINSIC BIOLOGICAL RISK OF WILD HARVEST

5. What is the severity of intrinsic biological risk factors?

1. Plant part harvested versus life form of species

Risk severity: High

Primarily harvest of whole plants for timber; leaves and bark are also harvested for fodder and ethno-medicines but in less extent.

Stump after the harvest of whole tree

2. Resilience of the species

Risk severity: Low

During the study, it has been observed that several insects, including defoliators, bark feeders and sap suckers infesting the living trees of *D. latifolia*. However, the damage caused by them is insignificant and there is no threat from any of them in the establishment of nurseries or plantations. The rust fungi *Uredo sissoo* Syd., *Maravalia achroa* (P. Syd. & Syd.) Arthur & Cummins and *M pterocarpi* (Thirum.) Thirum. have been reported to cause foliage infections in nursery seedlings. A *Meliola* sp. causes a sooty mould of seedlings. Root rot of *D. latifolia* caused by *Phellinus gilvus* (Schwein.) Pat. and *Coriolopsis sanguinaria* (Klotzsch) Teng are the other minor diseases of the tree, reported from India. Seedling die-back disease of *D. latifolia* was observed at Jabalpur in Central India (Verma & al., 2016). The causal organism was identified as *Colletotrichum capsici* (Syd. & P. Syd.) E.J. Butler & Bisby. In nursery the disease

ranges from 16.7 to 33.3% with an average of 25.2%. *Dalbergia latifolia* seedlings and saplings are readily browsed by cattle, goats, deer etc. Leaf spot diseases by *Cercospora dalbergiae-latifoliae* Chidd. (from Pune, Maharashtra; Chiddarwar, 1959), *Phyllachora dalbergiae* Niessl (from Coimbatore, Tamil Nadu; Hosagoudar, 1985b), *Uromyces achorus* Std. (from Idukki, Kerala; Hosagoudar, 1985a) are also reported in the species.

Leaves damaged by Acridid grasshopper

Stump damaged by termites

Tree trunk damaged by termites

Tree damaged by beetles (*Acanthophorus* sp.)

3. Geographic distribution

Risk severity: Low

This species is native to India, Indonesia, Malaysia, Nepal and introduced in Kenya, Mauritius, Myanmar, Nigeria, Pakistan, Philippines, Reunion (France), Sri Lanka, Sulawesi, Tanzania, Uganda, Vietnam.

In India, it is found Andhra Pradesh, Bihar, Chhattisgarh, Daman and Diu, Dadra and Nagar Haveli, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh and West Bengal in wild and in Jammu and Kashmir, Punjab and Tripura found only on cultivation/plantation. Though the species is reported earlier from Andaman and Nicobar Islands and Sikkim, but presently not found in these states in wild.

4. National population size and abundance

Risk severity: Medium

Subpopulations of the national population of *D. latifolia* are mostly medium-sized, sometimes large, and mostly unevenly distributed. The species is abundantly found in some parts of Western Ghats of Karnataka, Kerala and Tamil Nadu, and also well-represented in some parts of Gujarat, Telangana and Andhra Pradesh. The subpopulation sizes are small and fragmented in Bihar, Chhattisgarh, Daman and Diu, Dadra and Nagar Haveli, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Uttar Pradesh and West Bengal.

In **Karnataka**, the species is abundantly found in Uttar Kannada, Belgaum and Shivamogga districts in large, unevenly distributed subpopulations; in Chikkmagaluru, Chitradurga, Bellary, Udupi districts in relatively smaller and unevenly distributed subpopulations; in Tumakuru, Chamraj-nagar, Bengaluru and Mysuru districts in small, scattered subpopulations with low density. It is interesting to state here that *D. sissoides* found in most of the coffee estates of Kodagu and Hassan districts have been harvested, traded and managed as *D. latifolia* due to misidentification.

***Dalbergia latifolia* at Kadekel Forest Range**

Dalbergia latifolia in Kali Tiger Reserve

Dalbergia latifolia at Arbail Ghat

Dalbergia latifolia at Syntheri Rocks

Dalbergia latifolia in Bannerghata National Park

Regeneration of *D. latifolia* at Kargal Range

In **Tamil Nadu**, this species is found growing abundantly in some parts of the districts of Coimbatore, Tiruppur, Nilgiris, Dharmapuri in large and unevenly distributed subpopulations, whereas in Kanyakumari and Salem districts it is less common with scattered subpopulations. The species is also reported from the forests of Namakkal, Theni, Tiruchchirappalli, Tiruvannamalai, Tirunelveli, Vellore, Viluppuram, Virudhunagar districts. However, trees of *D. sissoides* are also identified and managed as *D. latifolia* in Tamil Nadu.

***Dalbergia latifolia* in Anamalai Tiger Reserve, Coimbatore**

An iconic tree of *D. latifolia* near Elephant Camp in Anamalai Tiger Reserve, Coimbatore

Forest patch of *D. latifolia* at Ovally Range, Mudumalai Tiger Reserve

Measuring DBH of *D. latifolia* at Bhavani Sagar Range
of Sathyamangalam Tiger Reserve, Erode district

Dalbergia latifolia in Kadayanallur Range of Nellai Wildlife Sanctuary, Erode district

In **Kerala**, the species is abundantly found in Thiruvananthapuram, Wayanad (South), Palakkad and Thrissur districts in large, unevenly distributed subpopulations; in Kannur, Wayanad (North), Idukki, Kozhikode, Malappuram and Thrissur districts in relatively smaller, unevenly distributed subpopulations; in Ernakulam, Kottayam, Alappuzha, Pathanamthitta and Kollam districts in small, scattered populations. Interestingly, in Wayanad, Idukki, Palakkad, Kollam, Malappuram, Kannur and Thrissur districts there are several intermixed subpopulations of *D. latifolia* and *D. sissoides*, but *D. sissoides* is misidentified and managed as *D. latifolia* in most of the forest offices/depots of these regions.

Population of *D. latifolia* at Neyyar Wildlife Sanctuary

Measuring DBH of *D. latifolia* at Palode Range

A large tree of *D. latifolia* at Kulathupuzha Range

Seedling of *D. latifolia* at Kulathupuzha Range

Population of *D. latifolia* in Reserve Forest of Thrissur district

Population of *D. latifolia* in a private land at Machad Range, Wayanad

A mixed population of *D. latifolia* and *Tectona grandis* at Machad Range

A large tree of *D. latifolia* at Machad Range, Wayanad

Canopy of a gigantic *D. latifolia* at Pulpally Range, Wayanad

In **Gujarat**, the species is found in Narmada and Dang districts in unevenly distributed subpopulations. In Dharampur district, relatively smaller and unevenly distributed subpopulations were found. The species is also reported from the forests of Ahwa, Panch Mahal and Sabarkantha districts with small, scattered subpopulations.

***Dalbergia latifolia* in Shoolpaneshwar Wildlife Sanctuary, Gujarat**

***Dalbergia latifolia* in mixed dry deciduous forest of Dang district, Gujarat**

***Dalbergia latifolia* in Wagai Reserve Forest, Gujarat**

In **Telangana**, this species is commonly found in Medak, Warangal and Bhadradri Kothagudem districts in unevenly distributed subpopulations; in Khammam, Nirmal, Mancherial, and Koaram Bheem-Asifabad districts in relatively smaller, unevenly distributed subpopulations; in Adilabad, Nizamabad, Wanaparthy and Jayashankar-Bhupalpalli districts in small, scattered subpopulations with low density.

***Dalbergia latifolia* in Narsapur Reserve Forest**

***Dalbergia latifolia* in Pakhal Reserve Foorest**

***Dalbergia latifolia* in Pakhal Reserve Forest**

***Dalbergia latifolia* in Wanaparthy Reserved Forest**

In **Andhra Pradesh**, the species is abundantly found in Chittoor and Kurnool districts in small to medium and unevenly distributed subpopulations; commonly found in Kadapa and Prakasam districts in relatively smaller and unevenly distributed subpopulations; found rarely to scarcely in Nellore, Ananthapuramu and Srikakulam districts in small and scattered subpopulations with low density.

***Dalbergia latifolia* at Balapalli Forest Range**

Gigantic growth of *D. latifolia* at Mamandur

In **Maharashtra**, this species is found scarcely or commonly in some parts of Satara and Ratnagiri districts in small, unevenly distributed subpopulations, whereas in Kolhapur and Nagpur districts in relatively smaller and unevenly distributed subpopulations.

Dalbergia latifolia at Kumbhrali Ghat

Dalbergia latifolia at Panhala

Dalbergia latifolia at Radhanagari Wildlife Sanctuary

Dalbergia latifolia at Sinhagad Hill

In **Madhya Pradesh**, the species is found in Umaria district in small, unevenly distributed subpopulations; whereas in Anuppur, Dindori, Jabalpur, Khargone, Panna, Rewa, Sahdol and Seoni districts it is found in smaller, scattered subpopulations with low density.


***Dalbergia latifolia* in Bada Tumbi, Umaria**


***Dalbergia latifolia* in Reserve Forest of Chandia Range, Umaria**


***Dalbergia latifolia* at Sunder Dadar, Umaria**

In **Uttar Pradesh**, this species is found in Pilibhit and Sonbhadra districts in small, unevenly distributed subpopulations; whereas in Gorakhpur, Lakhimpur Kheri and Bahraich districts it is found in scattered subpopulations with very low density.

***Dalbergia latifolia* at Vijaygarh, Sonbhadra**

***Dalbergia latifolia* at Tinkonia Range, Gorakhpur**

In **Chhattisgarh**, the species is found in Dhamtari and Koriya districts in unevenly distributed small subpopulations.

Dalbergia latifolia **at Dugli Range**

Dalbergia latifolia **at Gatta Silli of Birgudi Forest Range**

In **Bihar**, this species is found in Valmiki Tiger Reserve and adjoining Reserve Forests of West Champaran district in small and unevenly distributed subpopulations.

D. latifolia **in Valmiki Tiger Reserve, West Champaran district**

Standing population of *D. latifolia* in Reserve Forests of West Champaran district

Collection of data at Valmiki Tiger Reserve, West Champaran

Population of *Dalbergia latifolia* in Valmiki Tiger Reserve, West Champaran

In **Odisha**, this species is found in Mayurbhanj, Sundargarh and Sambalpur districts in unevenly distributed, small subpopulations and in the districts of Phulbani and Angul, it is more rare.

***Dalbergia latifolia* in Simlipal Tiger Reserve**

Dalbergia latifolia **in the premises of Maa Ambika Temple, Devkund in Simlipal Biosphere Reserve**

In **Jharkhand**, this species is found in Latehar district in small, unevenly distributed subpopulations. In West Singhbhum, Hazaribagh and Giridih districts it is found in smaller, scattered subpopulations with low density.

Collecting field data from resource person

Dalbergia latifolia **in Garu Pahar, Latehar**

Dalbergia latifolia **in Garu Pahar, Latehar**

In **Rajasthan**, *D. latifolia* is found in the districts of Alwar, Ajmer, Banswara, Chittorgarh, Pali, Pratapgarh, Rajsamand, Sirohi and Udaipur in small and fragmented subpopulations.

***Dalbergia latifolia* in Mount Abu Wildlife Sanctuary**

***Dalbergia latifolia* in Todgarh-Raoli Wildlife Sanctuary**

In **West Bengal**, this species is found in the districts of Purulia and Jhargram districts in a few small, scattered populations.

Dalbergia latifolia **in Garh Panchokat**

Dalbergia latifolia **in Ajodhya Hills**

Dalbergia latifolia **in Ajodhya Hills, Purulia**

Dalbergia latifolia **in Ajodhya Hills, Purulia**

Dalbergia latifolia in Ajodhya Hills

Dalbergia latifolia in Matha Hills

In **Dadra and Nagar Haveli**, the species is found in Dudhani, Athal and Morkhal areas in small, scattered subpopulations.

An immature individual of *D. latifolia* growing on hillslopes on way to Dudhani

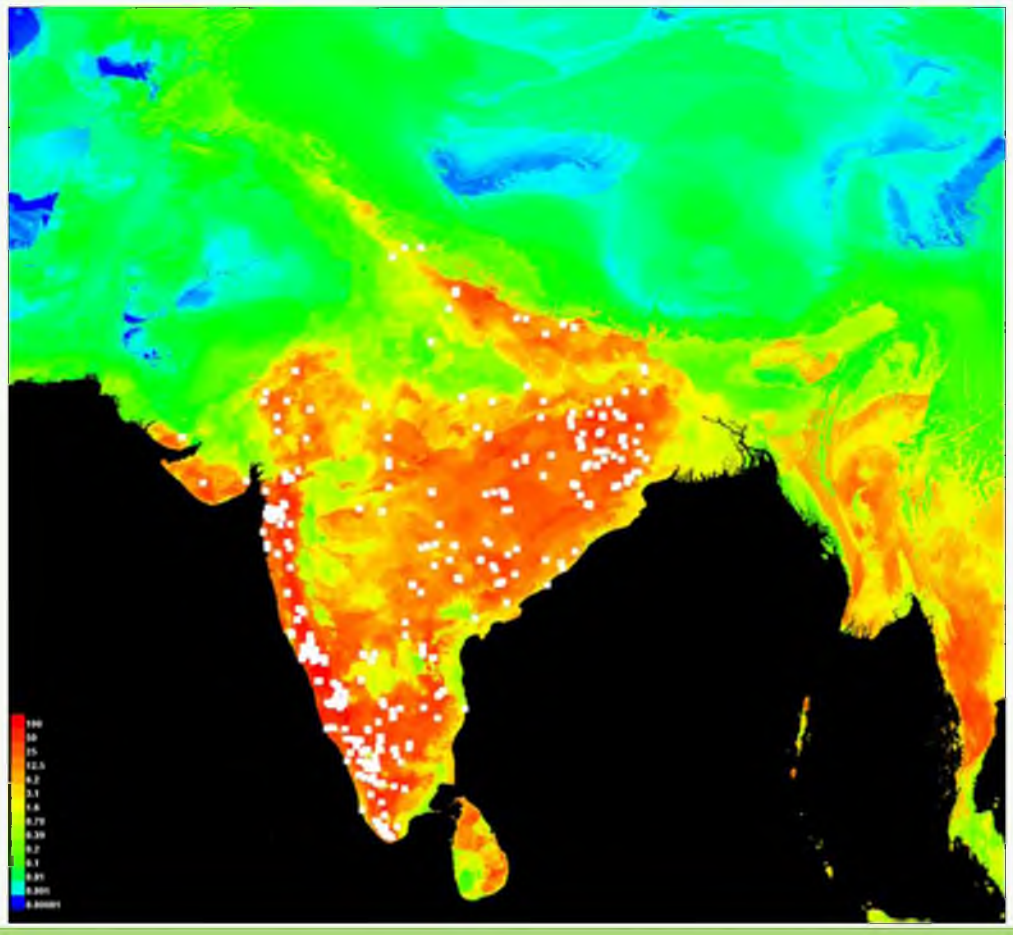
A mature individual of *D. latifolia* growing on hillslopes along the river on way to Dudhani

***Dalbergia latifolia* at Athal**

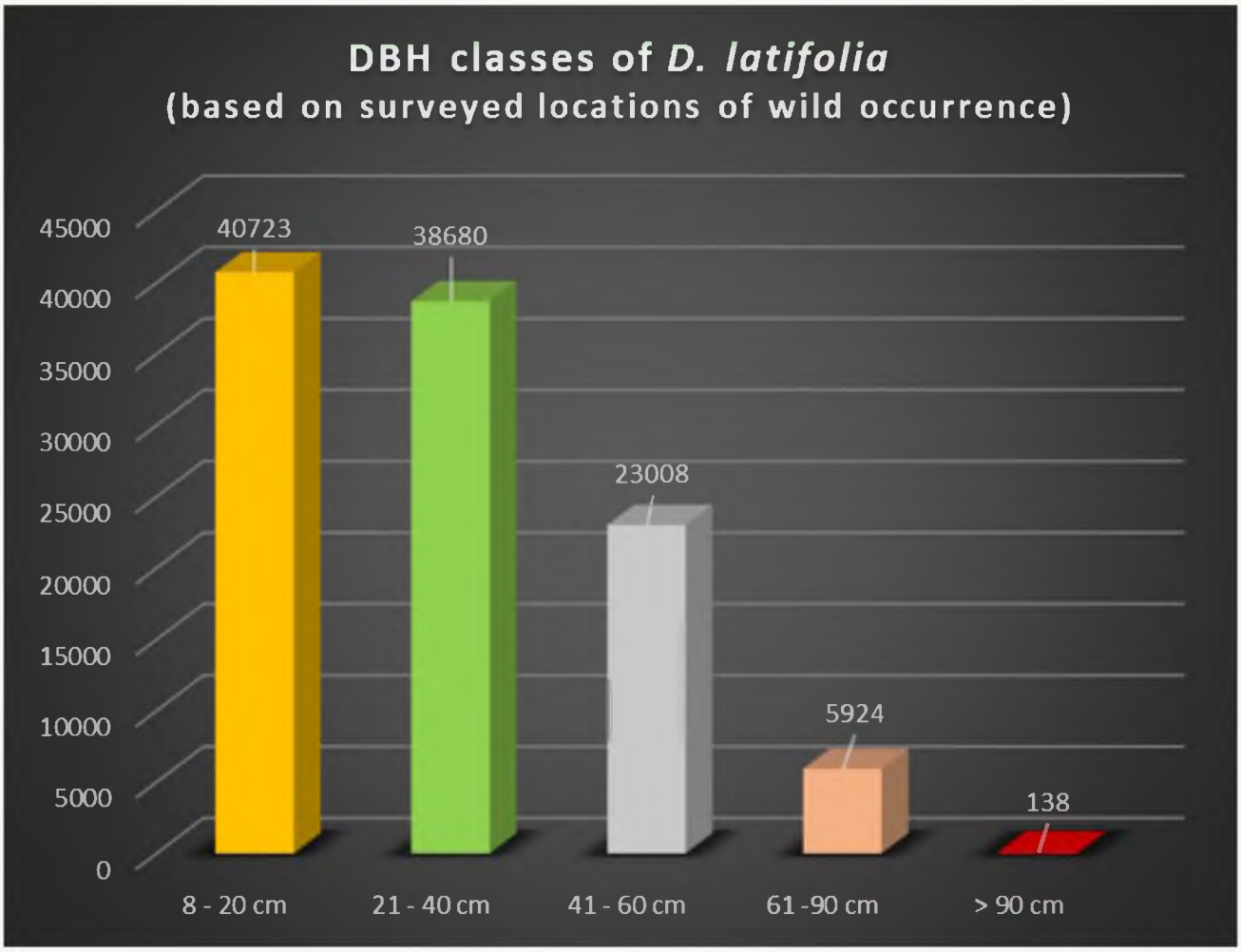
A seedling of *D. latifolia* at Athal

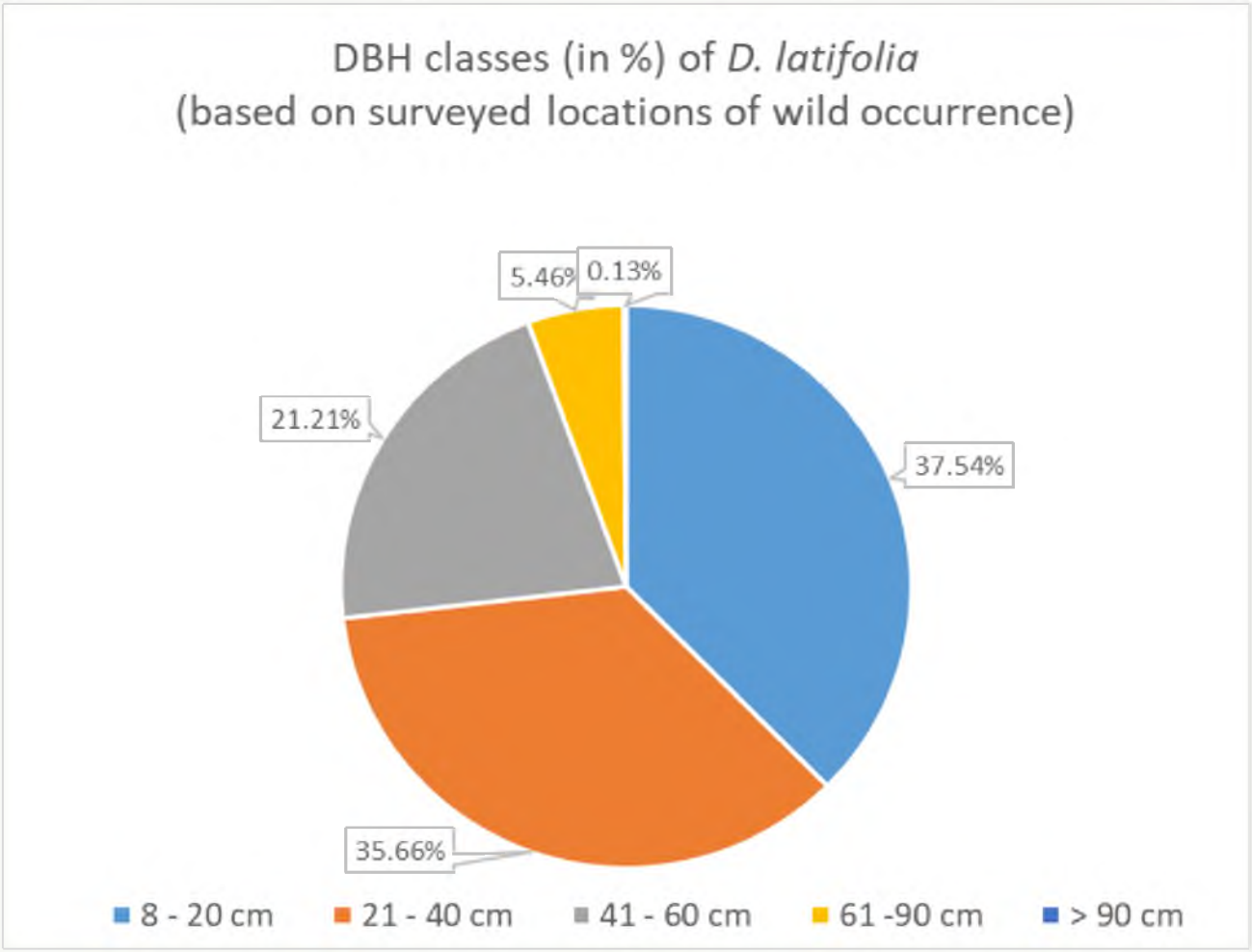
In Goa, *D. latifolia* is reported to occur in small, scattered subpopulations in Bhagwam Mahavir Wildlife Sanctuary and Mollem National Park, Netravali Wildlife Sanctuary, Cotigao Wildlife Sanctuary, Kulem, Canacona and adjacent area.

The species is also found as shade tree in several private coffee and tea plantations in Karnataka, Kerala and Tamil Nadu. Most of the large, mature trees in these private lands are actually wild and kept for long period as shade trees and also for harvesting the timber on maturity. Data on the population density of trees and seedlings of *D. latifolia* along with rate of regeneration at some randomly surveyed areas are provided in **Annexure 1**.



Representation of the Maxent model (Maximum Entropy) for *Dalbergia latifolia*. Warmer colours show areas with better predicted conditions (potential distribution of species) and white dots show the presence locations.


DBH classes of D. latifolia
(based on surveyed locations of wild occurrence)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
40723
38680
23008
5924
138
8 - 20 cm
21 - 40 cm
41 - 60 cm
61 -90 cm
> 90 cm


DBH classes (in %) of D. latifolia
(based on surveyed locations of wild occurrence)
5.46%
0.13%
21.21%
37.54%
35.66%
8 - 20 cm
21 - 40 cm
41 - 60 cm
61 -90 cm
> 90 cm

5. Habitat specificity and vulnerability

Risk severity: Medium

Dalbergia latifolia is reported to be scattered in the dry and moist mixed deciduous and semi-evergreen forests, mostly in hilly forests up to 1500 m elevation in the areas with 750–5000 mm mean annual rainfall and 8–44°C mean annual temperature. At seedling stage, *D. latifolia* is shade tolerant but sensitive to drought and fire. In maturity, it is tolerant of drought and ground fire, but susceptible to crown fire. The mature tree can thrive in area with up to six dry months with mean monthly rainfall < 40 mm. The species grows on a variety of soil formations including gneiss, trap, laterite, alluvial, and bolder deposits. It grows best on well-drained, deep, moist soils (http://db.worldagroforestry.org). *Dalbergia latifolia* is common in areas with deep loams or clays containing lime. It also grows well on black cotton soils. Areas with shallow dry soils and poor drainage exhibit trees with stunted growth. The important associates of *D. latifolia* are *Bombax ceiba* L., *Xylia xylocarpa* (Roxb.) Taub., *Tectona grandis* L.f., *Terminalia* spp., *Pterocarpus marsupium* Roxb., *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr., *Holoptelea integrifolia* Planch., *Lagerstroemia lanceolata* Wall., *Wrightia tinctoria* R. Br., *Grewia tiliifolia* Vahl, *Cassia fistula* L., *Macaranga peltata* (Roxb.) Müll. Arg. and Bamboos.

6. Regeneration

Risk severity: Medium

Under natural conditions, *D. latifolia* reproduces by seed, root sucker and it is also capable of coppicing. The growth rate of *D. latifolia* in India is slow with long rotations. In India, the average age of reaching a diameter of 60 cm is usually not less than 240 years. The germination percentage of the seed is 65%, germination period is from 7 to 21 days, seedling survival is 45% (http://forests.telangana.gov.in). 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 tree also coppices well, the production of shoots being influenced by the season of cutting. Experimental trials in Madhya Pradesh show that the percentage of stools yielding coppices shoots is 100% in April–July, 80% in August and 25% in September (CSIR, 1952). The initial natural regeneration is good in forests of the Western Ghats of Karnataka, Kerala and Tamil Nadu, however, the ultimate survival is affected due to forest fire, grazing, competition with invasive species and climatic factors.

Regeneration of *Dalbergia latifolia*

The rate of regeneration (RR) is low to high in different parts of country, ranging from 0% to 650% (Annexure 1). Artificial propagation is possible both by direct sowing and by planting seedlings, root suckers and sections of lateral roots. Stump planting is the best method for raising the species, though direct sowing and planting out entire seedlings are also successful.

***Dalbergia latifolia* regenerated by coppicing**

The species exhibits typical slow growth and can be enhanced through fertilization, soil moisture conservation and weed control. The trees were found to reach 58 cm diam. in 80 years in Mysuru and 110 years in Kurnool; a diameter of c. 34 cm in 80 years was recorded in Surat (CSIR, 1952). In the mixed deciduous forests of Wayanad (Kerala), the trees were estimated to reach 60 cm diam. in 148 years. A maximum diameter growth of 3 m has been reported from Karnataka (Prasad & al., 1993). The growth of *D. latifolia* in the Southern Tropical Semi-evergreen and Moist Deciduous Forests of North Canara is found to be slow and in this locality, this species is found to take 238 years to reach a diameter of 60 cm (Tewari, 1995). The annual girth increment recorded in some of the plantations in Tamil Nadu is c. 3 cm, between the ages of 10 and 18 years. A DBH of c. 55 cm for a 22-year old nursery tree growing in Mirzapur, Uttar Pradesh was recorded (CSIR, 1952). *Dalbergia latifolia* grows considerably faster than teak in middle age, but the growth is slower than teak during earlier and later stages (CSIR, 1952). Though the growth rate of *D. latifolia* is slow, due to capacity of re-sprouting after harvest its risk severity is assessed as medium.

7. Reproduction

Risk severity: Medium

Dalbergia latifolia is naturally reproduced by seeds and root suckers or coppiced. Root suckers, produced from long, horizontal, superficial root branches are plentiful in exposed situations and causing prolific vegetative reproduction in some areas. In natural condition, seeds remain viable for a period of about 6 months and germination of seed takes place during the monsoon. Factors which favour development of seedlings are full light, a highly porous soil, freedom from weeds and, as a rule, sufficient moisture in the soil to tide over the dry season. The roots can produce suckers and many of which develop into trees. Hence it is not unusual to see old trees surrounded by large numbers of younger trees developed from suckers.

Pods of *Dalbergia latifolia*

Seedling of *Dalbergia latifolia*

Regeneration of *Dalbergia latifolia* from root suckers

The fruit-setting through open pollinator was 5.24% and through cross pollination (Xenogamy) experiments the fruiting obtained was 4 %. Even though 2% fruit setting through self-pollination (autogamy) was observed, the produced fruits fell off prematurely (Sasidharan & al., 2015).

Breeding behaviour of *D. latifolia* (Sasidharan & al., 2015)

Treatments	No. of flowers pollinated/observed	No. of flowers set fruits	% of fruit set
Autogamy	50	1	2
Geitonogamy	50	0	0
Xenogamy	50	2	4
Apomixis	50	0	0
Open pollination	916	48	5.24

Pollination mode is mainly entomophily, through bees (melittophily) and butterflies (psycophily), though a few nectar feeding birds also visit the flowers. The seeds dispersed by wind (Sasidharan & al., 2015).

8. Role of the species in its ecosystem

Risk severity: Low

Dalbergia latifolia is a nitrogen fixer and also improve the soil fertility with its leaf litter which decomposes slowly and releasing nutrients gradually. The honey is dark amber and strong flavoured which serves as important food source for honeybees, beetles, wasps, bumble bees, butterflies and other insects. Leaves are used as a source food for mammals. The tree serves as host of other plants like epiphytic orchids, fungi, lichens, ferns, etc. and also for birds and other insects. Based on research there are no dependent species or key functions.

STEP 6: EVALUATION OF IMPACTS OF WILD HARVEST

6. What is the severity of harvest impact on individual plants, target populations, the national population, and on other species?

1. Impact of harvest on individual plants for the exports requested

Harvest impact severity: High

The species is primarily harvested for timber and thus the harvest is lethal.

Harvest of *Dalbergia latifolia* for timber

Intentionally damaged heartwood of *Dalbergia latifolia* at Narmada, Gujarat

2. Impact of harvest on target populations for the exports requested

Harvest impact severity: Medium

The majority of exports of *D. latifolia* wood and wood products are sourced from the dead/fallen trees of the forests (excluding the Protected Areas) and trees growing in private lands, especially in private coffee and tea estates of Karnataka, Kerala, Tamil Nadu. Sometimes trees are also harvested by the state forest department in non-forest areas which are legally converted for settlement or other non-forestry activities. The species is well represented in several Protected Areas of these three states [Anshi National Park, Bannerghata National Park, Kudremukh National Park, Biligiri Rangaswamy Temple National Park, Sharavati Valley Wildlife Sanctuary, Bhadra Wildlife Sanctuary, Kali Tiger Reserve of Karnataka; Anamalai Tiger Reserve, Mudumalai Tiger Reserve, Kanyakumari Wildlife Sanctuary, Sathyamangalam Tiger Reserve, Nellai Wildlife Sanctuary, Kalakkad Mundanthurai Tiger Reserve of Tamil Nadu; Eravikulam National Park, Periyar National Park, Silent Valley National Park, Mathikettan Shola National Park, Anamudi Shola National Park, Pambadum Shola National Park, Karimpuzha National Park, Chinnar Wildlife SanctuaryParambikulam Wildlife Sanctuary, Peechi-Vazhani Wildlife Sanctuary, Peppara Wildlife Sanctuary, Neyyar Wildlife Sanctuary, Wayanad Wildlife Sanctuary of Kerala] and the harvest is completely prohibited within the Protected Areas. As *D. latifolia* is listed as 'restricted species' in Karnataka, Kerala, Tamil Nadu and Gujarat, permission from state forest department is required for harvesting, transportation and marketing of this species.

The plants are mainly harvested for timber and the harvest spreads over a moderate range of age/ size-classes. In Karnataka, the following are the girth classes for timber of *D. latifolia* being sold from the depots.

In Kerala, the outturn of Rosewood timber during 2016–17 was 123 m^3 and in Karnataka it was 17021.16 m^3 during 2017–18.

Girth	Grade Class
2 m and above	'a'
Over 1.5 - 2 m	'b'
Over 1 - 1.5 m	'c'
1 m and below down to 60 cm	'd'

The impact of harvest is more in the states where the species is not legally protected by rules/Acts of state forest department and therefore, highly exploited by domestic trade. Earlier, the species was well-represented in some forest ranges of Uttar Pradesh (Kamperganj, Fareda), but now it can be hardly found in these areas. The population of *D. latifolia* near Birsinghpur, Umaria district of Uttar Pradesh is indirectly affected by the Sanjay Gandhi Coal Power Station, Birsinghpur. Prior to the establishment of this power station the population of *D. latifolia* was quite good, but the employment generated due to the power station created high demand for making good quality furniture. The local people cut down the trees and as a result this species is now very rare in Pali

Range. The population found in Anuppur district of Madhya Pradesh has also been highly declined during the last three decades. Though the population in Chandaia range of Umaria district, Madhya Pradesh is good in comparison to other parts of the state, felling is quite frequent in the Forest Corporation area and the plants are under threat. In Valmiki Tiger Reserve (West Champaran district, Bihar) and its surrounding areas most of the large plants (DBH > 30 cm) were cut off during the last 10–30 years by the 'wood mafias'. The local people of Valmiki Nagar Forest area still use small plants (DBH: 8–20 cm) of *D. latifolia* as firewood. In Ajodhya and Mathaburu hills of Purulia district of West Bengal, the local people are still cutting the small trees of *D. latifolia* for firewood.

In the South Wayanad division of Kerala, felling of 14,763 rosewood trees were started under the Wayanad Colonization Scheme in six villages (Kuppady, Cheeral, Nenmeni, Ambalavayal, Thomattumchal and Krishnagiri) and 10,005 trees were already felled and transported to different Government sales depots of Kuppady and Chaliyam for auction. The hydel projects (about five dams were built across river Kali alone) in the Uttara Kanada district of Karnataka resulted in the harvesting of thousands of 'rosewood' trees. Mining in Joida and Yellapur taluks also contributed to the harvesting of several 'rosewood' trees.

However, the quantity of harvest of *D. latifolia* timber can not be ascertained with surety as both *D. latifolia* and *D. sissoides* are harvested as well as managed indiscriminately in Karnataka, Kerala, Tamil Nadu due to identity crisis. Therefore, timbers available at depots of these three states are mixture of *D. latifolia* and *D. sissoides* and difficult to identify for their very similar macromorphological characteristics and uses. Therefore, though the severity of impact of wild harvest on target populations for the exports is predicted as medium, it can not be ascertained confidently at this stage due to identity crisis of the harvested stock.

3. Impact of harvest on national population for the exports requested

Harvest impact severity: Low

Though the major harvest of *D. latifolia* is from Karnataka, Kerala and Tamil Nadu where the species is abundantly and commonly found in wild. The species is also found in wild in Andhra Pradesh, Bihar, Chhattisgarh, Daman and Diu, Dadra and Nagar Haveli, Goa, Gujarat, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Telangana, Uttarakhand, Uttar Pradesh, and West Bengal. The harvest frequency of the species is higher in southern part of the country and the majority of exported wood and wood products of *D. latifolia* is sourced from Karnataka, followed by Kerala and Tamil Nadu. The species is found in several Protected Areas of the country such as Anshi National Park, Bannerghata National Park, Kudremukh National Park, Biligiri Rangaswamy Temple National Park, Sharavati Valley Wildlife Sanctuary, Bhadra Wildlife Sanctuary and Kali Tiger Reserve of Karnataka, Anamalai Tiger Reserve, Mudumalai Tiger Reserve, Kanyakumari Wildlife Sanctuary, Sathyamangalam Tiger Reserve, Nellai Wildlife Sanctuary and Kalakkad Mundanthurai Tiger Reserve of Tamil Nadu, Eravikulam National Park, Periyar National Park, Silent Valley National Park, Mathikettan Shola National Park, Anamudi Shola National Park, Pambadum Shola National Park, Karimpuzha National Park, Chinnar

Wildlife Sanctuary, Parambikulam Wildlife Sanctuary, Peechi-Vazhani Wildlife Sanctuary, Peppara Wildlife Sanctuary, Neyyar Wildlife Sanctuary and Wayanad Wildlife Sanctuary of Kerala, Shoolpaneshwar Wildlife Sanctuary, Purna Wildlife Sanctuary and Vansda National Park of Gujarat, Kawal Tiger Reserve, Pranahita Wildlife Sanctuary of Telangana and Seshachalam Biosphere Reserve of Andhra Pradesh, Radhanagari Wildlife Sanctuary and Sanjay Gandhi National Park of Maharashtra, Bhagwam Mahavir Wildlife Sanctuary, Mollem National Park, Netravali Wildlife Sanctuary and Cotigao Wildlife Sanctuary of Goa, Betla National Park and Palamau Wildlife Sanctuary of Jharkhand, Simlipal National Park of Odisha, Mahananda Wildlife Sanctuary of West Bengal, Valmiki National Park, Gautam Buddha Wildlife Sanctuary and Bhimbandh Wildlife Sanctuary of Bihar, Phulwari Ki Nal Wildlife Sanctuary, Sita Mata Wildlife Sanctuary, Mount Abu Wildlife Sanctuary, Jaisamand Wildlife Sanctuary and Todgarh-Raoli Wildlife Sanctuary of Rajasthan and Pilibhit Tiger Reserve of Uttar Pradesh. Small proportion of the national population is affected by the harvest as the harvest is permitted outside the Protected Areas. Considering its wide distribution and national population size, stability in sub-population numbers the severity of impact of wild harvest on national population for the exports is low.

4. Impact of harvest on other species for the exports requested

Harvest impact severity: High

Dalbergia latifolia is often confused with *D. sissoides* in many parts of Karnataka, Kerala, Tamil Nadu and thus *D. sissoides* is indiscriminately harvested as well as managed in place of the target species at the major harvesting states (Karnataka, Kerala and Tamil Nadu) of the country. As a result, no record of export of *D. sissoides* from India is available at the CITES Trade Database due to its export under the name *D. latifolia*. As *D. sissoides* is a more or less equally valuable timber species in India with more restricted distribution, harvest practices of *D. latifolia* in some parts of the major harvesting states have a substantially negative effect on *D. sissoides*.

STEP 7: EVALUATION OF IMPACTS OF TRADE

7. What is the impact of legal and illegal trade on national population of the species concerned?

1. Magnitude and trend of legal trade

Trade impact severity: Medium

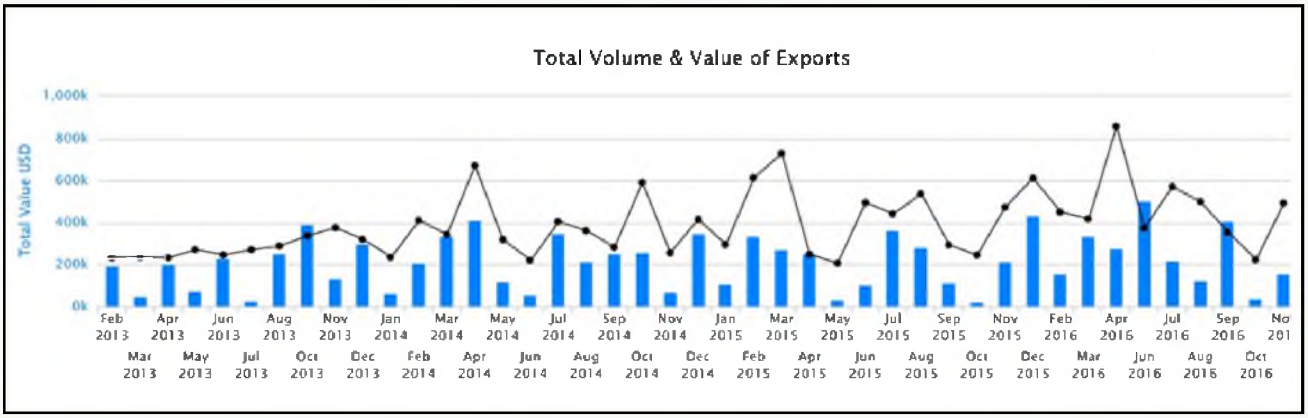
Dalbergia latifolia is one of the most valuable timber-yielding tree of India. The plant, being one of the most important timber species, yields the famous Indian rosewood or black wood of commerce. Wood is highly valued for timber with an average price higher than that of teak (*Tectona grandis*) (Praciak, 2013). It is used for making furniture and cabinet, decorative carving, wheels of gun carriages, ammunition boxes and temple cars (Thothathri, 1987). In India, the wood has high demand for making musical instruments primarily for its acoustical and mechanical properties and secondarily for its visual appearance. It is a popular wood for the guitar industry and has been used extensively in acoustic guitars for many years (Wood Database, 2017).

Dalbergia latifolia ranks one among the finest woods for furniture, carving, ornamental plyboards and veneers. The heartwood is rated as very durable, and is generally highly resistant to attack by termites and decay fungi. Besides, the wood is used for the manufacture of pulleys, knife handles, shelves, decorative carriage parts, calico-printing blocks, mathematical instruments, boat knees, well construction, agricultural implements, combs, razor handles and brush backs, etc. The timber is also used for posts, rafters, floor boards, panelling, interior and exterior joinery, door, window frames, etc. The market demand is increasing in response to limited resource availability and also due to shortages of material in trade due to several restrictions imposed on its harvest, trade and export.

During February 2013–November 2016, total 2026235 units made up of *D. latifolia* worth $9301526 (https://www.zauba.com) with $4.59 average price per unit and $9,491 average value per shipment were exported from India. The export was from six ports (port of loading), viz., Jawaharlal Nehru Port/Nhava Sheva Port (INNSA1), Cochin Seaport (INCOK1), Cochin (INCOK6), Bangalore Air Cargo (INBLR4), Kolkata Air Cargo (INCCU4), Bombay Air Cargo (INBOM4) to United States, China, Hong Kong, Spain, South Korea, United Kingdom, Japan, Philippines, United Arab Emirates, Vietnam, Australia, Canada, Ireland, Taiwan, Germany, Uganda and France.

In India, the wood is highly preferred for making musical instruments and at least nine major companies (along with a few more smaller companies) are the legal active exporters of rosewood from India, viz., Overseas Traders (Karnataka), Gemwood (Kerala), Atheena Exports (Kerala), Tony Wood Industries (Kerala), Hi-Tech Wood Industries (Kerala), Overseas Timbers (Kerala), Malabar Timber Company (Kerala), Associated Timber Traders (Kerala), C. Jacob and Company (Kerala).

Various artifices displayed for sale at M.G. Kaveri Silks and Handicraft Emporium at Kushalnagar, Coorg, Karnataka



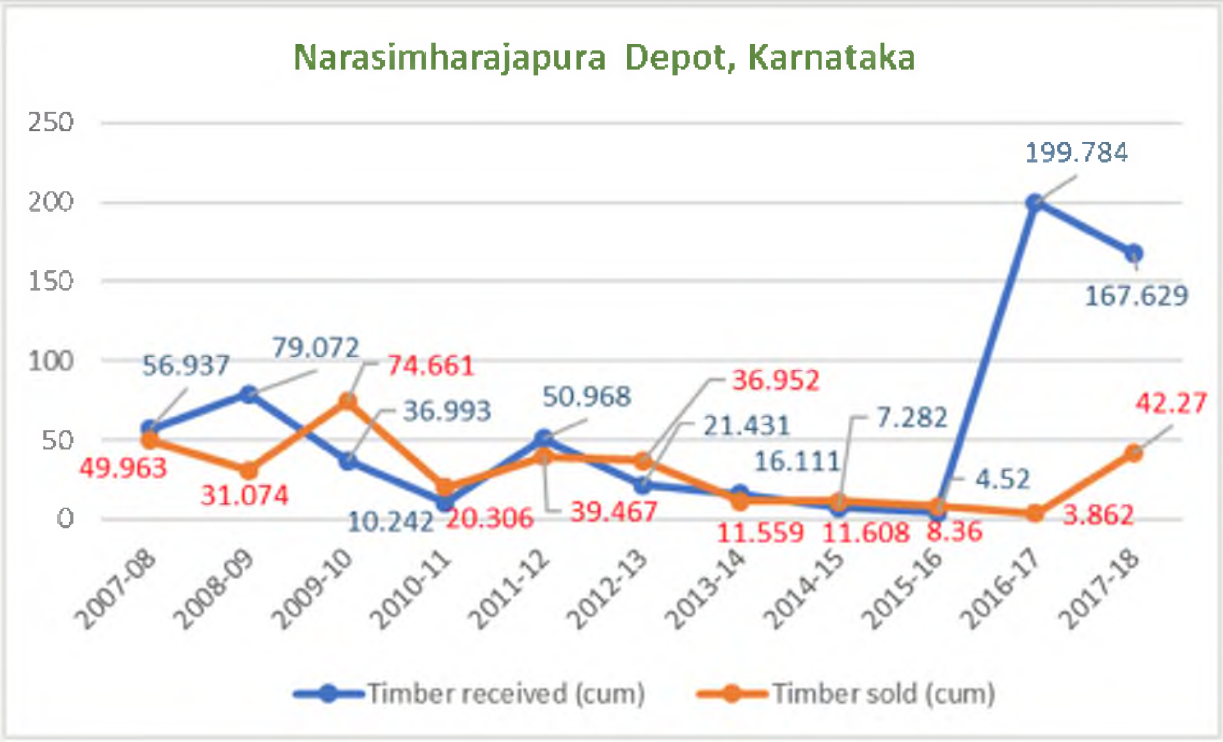
The export data of *D. latifolia* from India available at the CITES Trade Database during the year 2017 is as follows.

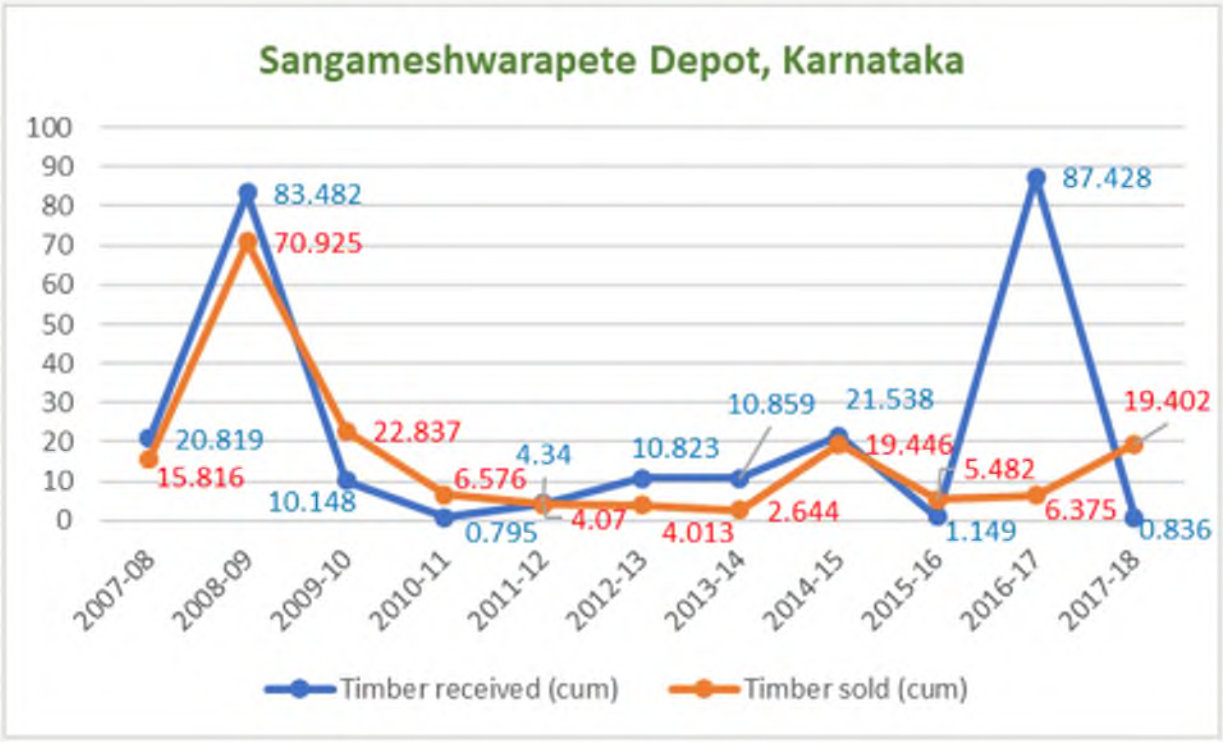
Term	Importer	Importer reported quantity	Unit
Wood product	AT	37	Not specified
Wood product	BG	4	Not specified
Wood product	BG	33610	Not specified
Carvings	CZ	326	Not specified
Carvings	CZ	1429	Not specified
Veneer	CZ	2400	Not specified
Carvings	DE	149.21	kg
Sawn wood	ES	2.698	m^3
Sawn wood	ES	4.065	m^3
Veneer	ES	5.96	m^3
Veneer	ES	146.084	m^2
Veneer	IT	13597.34	m^2
Veneer	IT	154300	Not specified
Wood product	NL	2000	Not specified
Wood product	PL	3530.5	kg
Wood product	PL	11.51	Not specified
Sawn wood	PT	9.559	m^3

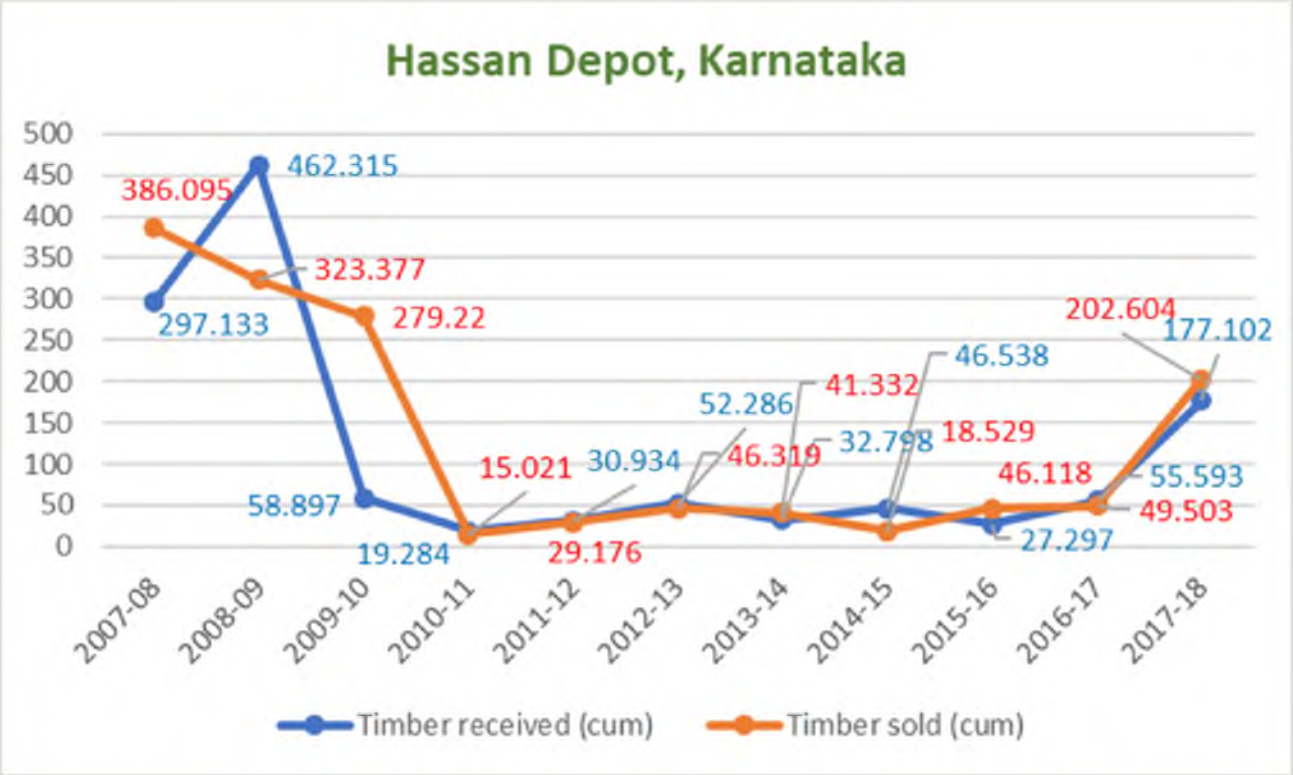
In Karnataka, the total 'Rosewood' timber produce in 2017–18 was 17021.16 m^3. In Kerala, outturn of rosewood timber during 2015–16 was 148.42 m^3 and during 2016–17 was 123 m^3. The scheduled rates of 'Rose wood' of 'Export B' and 'Export C' categories for selling by Kerala forest department during the year 2013–15 were Rs. 3,83,600/- per m^3 and Rs. 3,48,730/- per m^3 respectively; whereas the rate of other categories of 'Rose wood' timber varied from Rs. 28,000/- per m^3 to Rs. 3,63,750/- per m^3 depending on quality of wood. The 'Rose wood firewood' and 'Rose wood billets' were sold @ Rs. 10490/- per m^3 and Rs. 33,190/- per m^3 to Rs. 59,250/- per m^3 by the Forest department of Kerala during 2013–15.

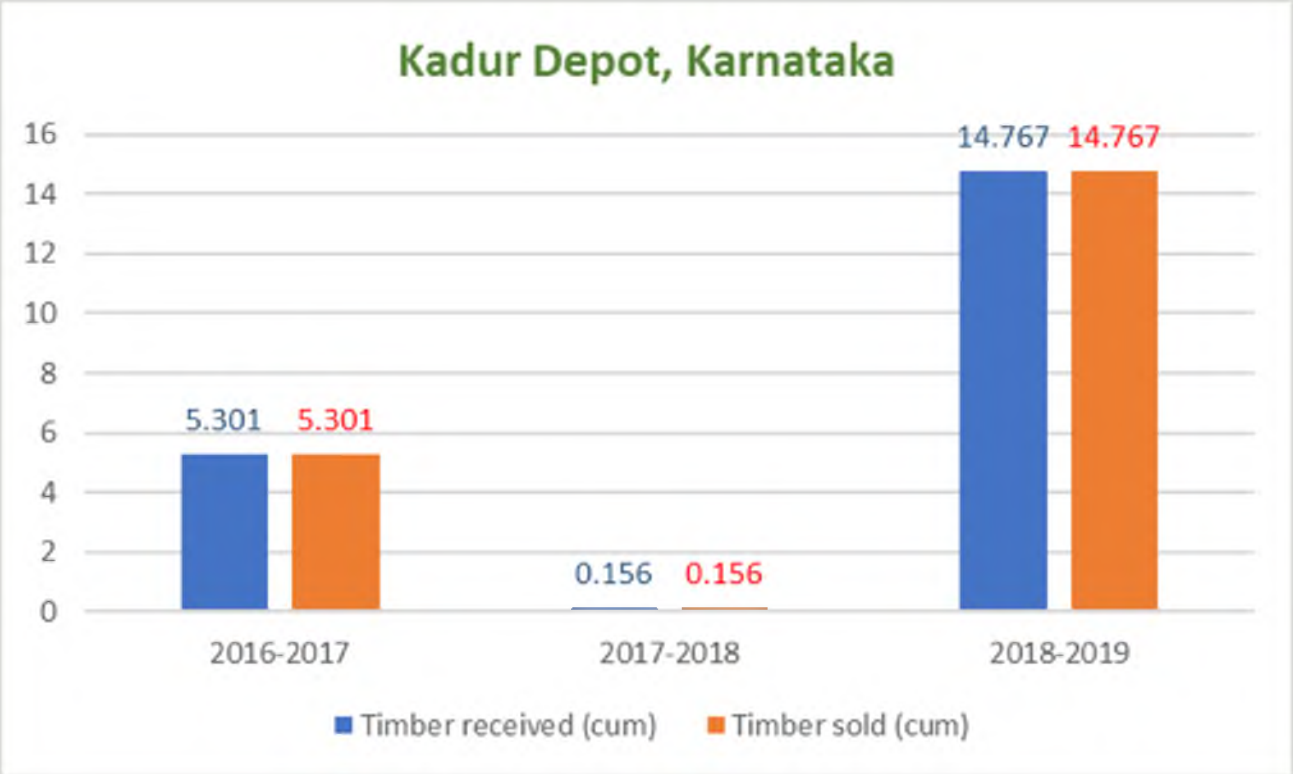
Karnataka, Kerala and Tamil Nadu are the major states from where legal harvesting of *D. latifolia* is mainly carried out. As the species is 'restricted species' in these states, the major source of the harvest is dead/fallen trees, which are being sold by auction, retail sale or through allotment from the depots which are under control forest departments of respective states. Pathanapuram depot for Kollam circle, Mudikkal depot for Thrissur circle and Kallai depot for Kozhikkode circle are the central depots for receiving rosewood from all over Kerala and for marketing the same. Some of the major depots in Karnataka are, Dandeli, Hassan, Narasimharajapura, Thithimathi, etc.

The year wise data on timber received and timber sold of 'rosewood' at Narasimharajapura, Sangameshwarapete, Hassan, Kadur depots are providing below.









The volume of specimens in trade is not moderate in relation to abundance of the species and the trade volume/market demand of the species is slowly increasing. Therefore, the trade impact severity is medium for the species. However, the actual magnitude and trend of legal trade of *D. latifolia* could not be ascertained with surety as both *D. latifolia* and *D. sissoides* are being managed and traded under same vernacular and scientific names.

Logs of harvested rosewood for auction at Kushalnagar Depot, Coorg, Karnataka

Logs of harvested rosewood for auction at Thithimathi Depot, Coorg, Karnataka

A stock of seized logs *Dalbergia latifolia* at Thithimathi Depot, Coorg, Karnataka

Logs of harvested rosewood for auction at Narasimharajapura Depot, Coorg, Karnataka

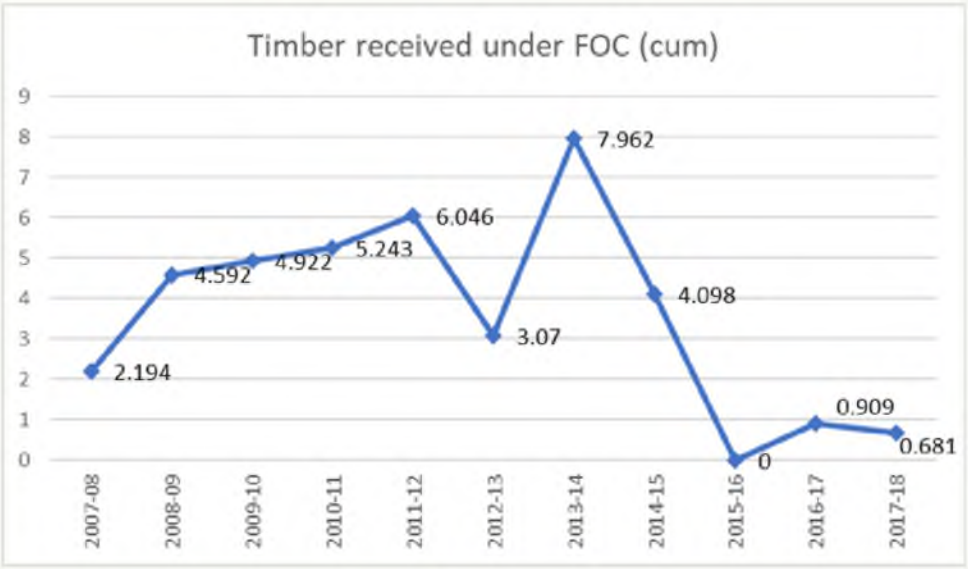
2. Magnitude of illegal trade

Trade impact severity: Medium

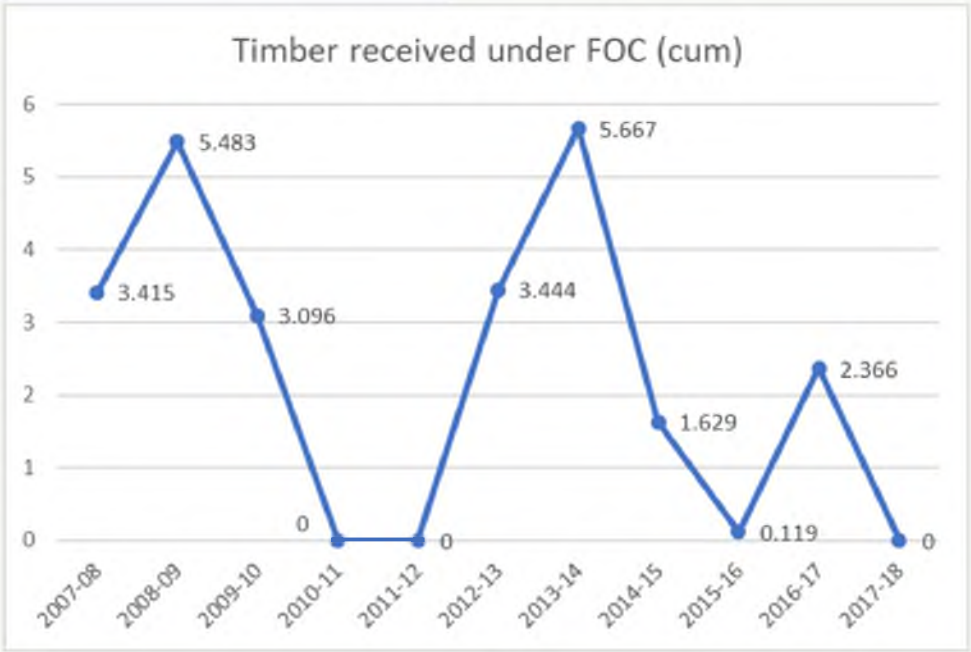
Illegal trade is documented for the species in India. In Karnataka, as on 31.3.2018, a total of 44 Forest Offence Cases (FOCs) for 'Rosewood' are under the Vigilance Wing, out of which 5 FOCs are detected during the period from 1.4.2017 to 31.3.2018. As per the data received during survey of different timber depots under Karnataka forest department it has been noted that in Narasimharajapura (N.R. Pura), Hassan, Kadur and Thithimathi depots of Karnataka, the quantities of 'Rosewood' received against Forest Offence Cases (FOCs) during 2017–2018 are 6.746 m^3, 0.681 m^3, 0.156 m^3, 60 m^3, respectively.

The year-wise seized/FOCs 'rosewood' timber availability in Narasimharajapura (N.R. Pura), Sangameshwarapete, Hassan depots indicates decreasing trend of illegal trade in certain part of Karnataka.

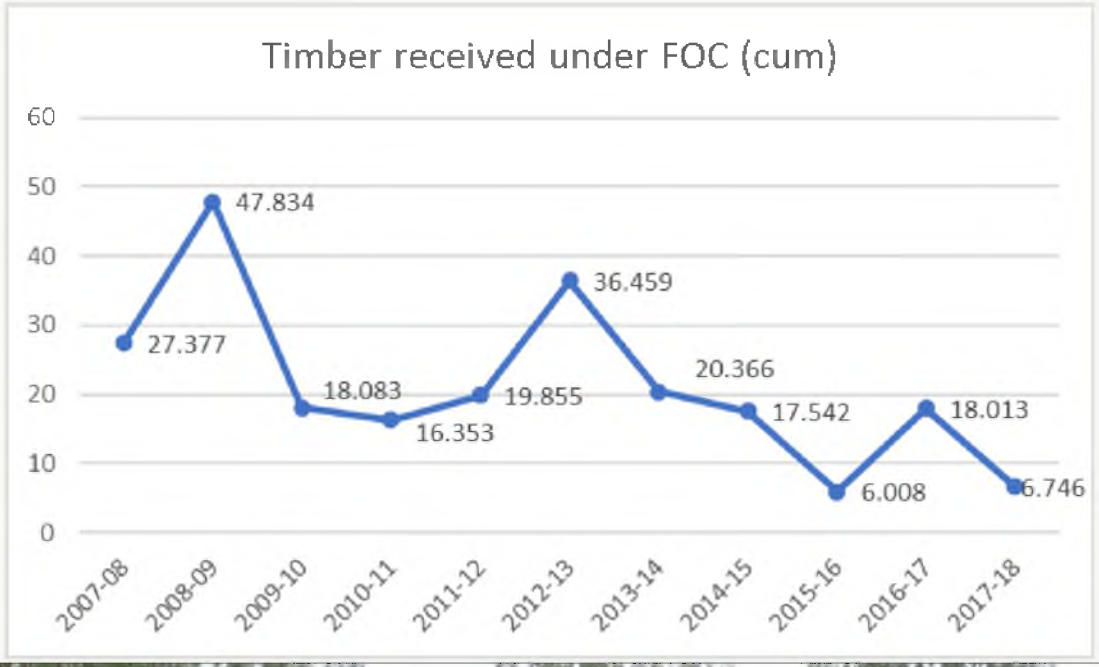
Narasimharajapura depot, Karnataka



Sangameshwarapete depot, Karnataka



Hassan depot, Karnataka



An official of Karnataka State Forest Department explaining the Rosewood collection at Hassan Depot, Karnataka

However, it should be noted that the timber seized under the name *D. latifolia* or 'rosewood' may or may not be of *D. latifolia* due to its indiscriminately uses with that of *D. sissoides* and hence the trade impact severity can not be ascertained with confidence.

STEP 8: EVALUATION OF EFFECTIVENESS OF MANAGEMENT MEASURES

8.1. What management measures are in place for the target species?

1. Management of wild harvest impacts: Moderate

According to the 'India State of Forest Report 2017', the total forest cover of the country is 7,08,273 km^2, which is 21.54% of the geographic area of the country (FSI, 2017). As per the report, during the two assessments periods of 2015 and 2017, increase of 6778 km^2 forest cover at the national level was recorded. Three states, namely Andhra Pradesh, Karnataka and Kerala had contributed to an increase of 2141 km^2, 1101 km^2 and 1043 km^2 respectively, much of which could be attributed to plantation and conservation activities both within and outside the Recorded Forest areas as well as improvement in interpretation due to better radiometric resolution of the recent satellite data. Other states contributing significant increase were Odisha (885 km^2), Assam (567 km^2), Telangana (565 km^2), Rajasthan (466 km^2), Himachal Pradesh (393 km^2), Uttar Pradesh (278 km^2), Jammu and Kashmir (253 km^2) and Manipur (263 km^2). The states which showed reduction in forest cover primarily include Mizoram (531 km^2), Nagaland (450 km^2) and Arunachal Pradesh (190 km^2).

Dalbergia latifolia is found in several Protected Areas of the country and thus protected under Wild Life (Protection) Act, 1972. The harvest is allowed only from the dead/fallen trees of reserve forests, social forestry areas or trees growing in private lands, i.e. outside the Protected Areas. Further, the Indian Forest (Amendment) Act, 2012 prohibits fresh clearances of reserved forests. However, there is no uniformity in harvest control and management policies of the different forest departments of Indian States/Union Territories from where the species is reported. The species is listed as 'restricted species' in the states of Gujarat, Karnataka, Kerala, Tamil Nadu, and permission is required for harvesting (in private lands), transportation and marketing of this species; whereas it is listed as a 'reserved tree' under the Andhra Pradesh Preservation of Private Forest Rules 1978, which prohibits feeling of the species unless the tree exceeds 120 cm girth (DBH: c. 38 cm) at 1.3 m height from ground level. Felling of trees on private land within Maharashtra is regulated by the Maharashtra Felling of Tree (Act 1964), Maharashtra Preservation of Trees Act 1975, The Maharashtra Land Revenue Code, 1966 and the Transit Regulation, and permission for felling and transit of *D. latifolia* is required.

2. Management of trade impacts: Basic

As the genus *Dalbergia* is listed under Appendix II of CITES since 2nd January 2017, CITES permit is now required to export/import for any material of *D. latifolia.* The national authority responsible for implementing CITES is called the CITES Management Authority. The Additional Director General (Wildlife), Ministry of Environment, Forest and Climate Change, Government of India, is designated CITES Management Authority of India and the Regional Deputy Directors of Wildlife Crime Control Bureau (WCCB) are designated as CITES Assistant Management Authorities. To obtain CITES export permit/comparable certificate, copy of the valid export order/ irrevocable letter of Credit from the foreign buyer, Legal Procurement Certificate (LPC), copy of

Certificate of Physical Verification from the Regional Deputy Director (Wildlife) or from the DCF/ DFO of the concerned division etc. are to be submitted to CITES Assistant Management Authority along with CITES permit application. At the time of import, the CITES Import Certificate is to be surrendered to CITES Assistant Management Authority. However, if a species or specimen has to be re-exported, the CITES Re-export Permit application should be accompanied by a copy of CITES Import Permit/Certificate (for imports outside Customs notified area), in addition to LPC from State Wildlife Authority.

The Export Promotion Council for Handicrafts (EPCH) is also authorised for verification of legality and legal origin of wood and wood products in India and EPCH has developed the 'Vriksh standard Timber Legality Assessment and Verification Scheme'. The EPCH is entitled to issue 'Vriksh Shipment Certificate' for exporting goods containing *D. latifolia* (and *D. sissoo*) by verifying Forest auction note/sales invoice of forest department, social forestry sales invoice, cutting permit 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, Sawmill's invoice, 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.

Other management measures

Cultivation/plantation

The cultivation/plantation of this species was not very popular mainly due to its very slow growth rate. However, presently there is encouraging trend in introducing the species under cultivation/ plantation. The species is found in cultivation in Sreevarimettu of Andhra Pradesh (c. 1000 seedlings were planted in year 2006-07 and presently only c. 200 plants are found survived), Chettikonda (c. 200 plants were planted in year 1998 and presently only c. 50 plants are found survived], Diwancheruvu (c. 1000 plants were planted in year 2006 and presently c. 800 plants are found survived). In Mamandur of Andhra Pradesh, c. 2000 saplings were planted in 1994, but now there is not any surviving individual at that plantation due to improper site selection. In Telangana, two plantations of *D. latifolia* were done in Ashoknagar, where 100 plants were planted in year 1998 (now 90 plants are survived with DBH: 7–13 cm) in one spot and c. 200 plants were planted in year 2004 (now c. 170 plants are survived with DBH: 3–10 cm). The species is found in small patches in Jamui, Madhepura, Banka, Bhagalpur, Purnea districts of Bihar under plantation/ cultivation. In Madhepura district of Bihar, the state forest department planted *D. latifolia* at Arar Nahar, near Udakishunganj subdivision c. 30 years back, but now only c. 30–40 matured individuals of 18–22 cm DBH are present. In the year 1999, at Chausa Canal area, c. 600–700 planted individuals were damaged due to flood. The forest department of Valmiki Tiger Reserve, Bihar use to distributes saplings of *D. latifolia* to the local farmers. Plantation of this species is also reported from Pollachi in Tamil Nadu. Clonal evaluation trial of *D. latiflolia* is being carried out by Vilamundi Research Centre, Tamil Nadu in c. 1 ha area where 400 plants are planted with 5 × 5 m spacing, whereas introduction trial of the species is being conducted by Perumalmalai Research

Centre, Tamil Nadu in c. 1 ha area where 400 plants are planted with 5 × 5 m spacing. In Tinkonia Forest Range, Gorakhpur district of Uttar Pradesh 50–60 mature plants (60–100 years old trees, DBH: 31–62 cm) are found under plantation, whereas in a plot of Forest Research Institute, Etawa, Madhya Pradesh 10 mature plants of 38–44 cm DBH are located. In 2017, in Forest division Katghora Tiwarta, Korba of Chhattisgarh c. 555 saplings were planted in 30 acres of forest land. In an area near Candy canal, Hoshiarpur district of Punjab, c. 1000 saplings in a patch of along the canal have been found which were planted by the forest department c. 4 years back. In Maharashtra, under Dhule Forest Division the plantation area of *D. latifolia* is 158.48 ha (0.64–2.954 tress/ha); in Malegaon Forest Sub-Division the plantation area is 397.44 (0.12 trees/ha); in Sawantwadi Forest Division the plantation area is 432.36 (0.547–0.549 trees/ha); in Aurangabad Forest Division the plantation area is 634.32 (0.005–0.039 trees/ha); in Bramhapuri Forest Division the plantation area is 1416.6 (0.014–1.704 trees/ha); in Thane Forest Division the plantation area is 19.08 (2.201 trees/ ha); in Satara Forest Division the plantation area is 228.33 (0.01– 0.12 trees/ha); in Chandrapur Forest Division the plantation area is 813.24 (3.125– 4.66 trees/ha); in Central Chandha Forest Division the plantation area is 688.32 (0.355–1.88 trees/ha); in Amravati Forest Division the plantation area is 874.84 (0.007– 0.084 trees/ha). The species is found in the campus of Birsa Agricultural University campus (4 trees, DBH: 20–30 cm) of Ranchi district, Jharkhand. In Anandanagar of Tripura, c. 250 saplings were planted by the forest department in 0.25 hectare, whereas in Teliamura Range (under Mixed High Yielding Forest Plantation) 150–200 seedlings were planted in a plot of 0.25 hectare by the state forest department. *In situ* conservation for *D. latifolia* is also reported (Jalonen & al., 2009) in Madhya Pradesh (5 ha). In Kerala, the 'rosewood' plantation area during 2015–16 was reported to be 45.130 ha, whereas it increased to 54.51 m^3 as on 31.03.2017. Plantation was done in Lodhashuli beat (180 saplings) of Lodhasuli range and Balvasa (850 saplings), Kushumghati (250 + 260 saplings), Ramrama (320 saplings) beats of Manikpara range of West Bengal in 2016–17, whereas 100 saplings and 101 saplings have been planted in during 2017–18 in Chandri and Lodhashuli beat of Lodhasuli range. At Amlachoti, West Bengal 7 trees of *D. latifolia* have been found which were planted by the forest department more than 20 years back. In Jammu and Kashmir, the species is now being cultivated in two nurseries of State Forest Research Institute at Sidhara, Jammu and Hariachak, Kathua for first time plantation in the state. The seeds were obtained from the Forest Research Institute, Dehradun.

The total plantation area under the forest department of Kerala as on 31.03.2016 was 154950.325 ha, which came to 13.7 % of the total forest area. Among this, the 'rosewood' plantation (Ranni: 3 ha, Kothamangalam: 8.1 ha, Thrissur: 18.41 ha, Nilambur (N): 5.62 ha, Wayanad WL: 10 ha) was in 45.13 ha, i.e. in 0.029 % of total plantation area.

Dalbergia latifolia is not found in Andaman and Nicobar Islands in wild. During 1965 to 1970, a trial to introduce the species (along with *D. sissoo*) was done in 3 experimental plots in Long Island (total 1.2 ha) under Silviculture division, but it was not successful. The growth of these planted trees are below average and most of these are either dead or dying. The monoculture plantation of *D. latifolia* was taken up in Mayabunder Forest Division in North Andaman and the detail of the same is provided here.

Location	Year	Area (hectare)	No. of trees
Tugapur	1958	1.2	40 (DBH: c. 41 cm)
	1958	12.1	20 (DBH: c. 44.5 cm)
	1959	12.1	110 (DBH: c. 39.7 cm)
	1965	3.2	25 (DBH: c. 47.7 cm)
Austin	1953	3.2	9 (average DBH: c. 3–22 cm)

Further trial of introduction has not been done recently as there is a ban (following Supreme Court order in 2002) on introduction of species which are not native to Andaman and Nicobar Islands.

Plantation at Chettikonda, Andhra Pradesh

Plantation at Ashoknagar, Telangana

Plantation near Candy canal, Punjab

Plantation at Children's Park, Jamui, Bihar

Plantation at Amlachoti, West Bengal

Plantation at Teliamura Range, Tripura

As pure stands, *D. latifolia* is usually spaced at 1.2 m² or 1.8 m² in India. Plantation with wide spacing may produce crooked stems. After planting or direct sowing, regular weeding is necessary until trees can withstand weed competition. Loosening soil around seedlings also improves growth. Weeding and soil loosening should be done before weeds become dense (http://db.worldagroforestry.org). De-oiled seed cakes along with soil, sand can be used as a potential, effective, cheaper and non-polluting organic source of nitrogen and other growth promoting substances (Kumar & al., 2014).

Under the 'Scheme for Incentivisation of Private Forestry', the Kerala forest department providing cash incentives to farmers with an objective of encouraging them to grow more trees and produce timber in private lands which includes plantation of *D. latiflolia* along with other tree species. Those who are planting a minimum of 50 seedlings in their land are eligible for incentives.

Nursery Stock: The species is found growing in several Government and private nurseries for ex-situ conservation, plantation, re-introduction and also for distribution/sale. Information on stocks of some nurseries are given below which have been recorded either by visiting the nurseries or from the record/inventory of these nurseries. There are several other nurseries present in different parts of the country where *D. latifolia* are being grown, but information on their stock could not be retrieved during the present study.

Nursery	Number of seedlings/saplings/ stumps/plants	State
Nursery of State Forest Department at Diwancheruvu, East Godavari	c. 100 seedlings	Andhra Pradesh
Nursery of State Forest Department at Chetti Konda, Guntur	c. 200 saplings	Andhra Pradesh
Nursery of State Forest Department at Bathnaha (Horticulture nursery), Araria	c. 1000 seedlings	Bihar
Nursery of State Forest Department at Bathnaha (Permanent nursery), Araria	c. 1000 seedlings, c. 10000 stumps	Bihar
Nursery of State Forest Department at Narpatganj, Araria	c. 1000 seedlings	Bihar
Nursery of State Forest Department at Raniganj, Araria	c. 2000 seedlings	Bihar
Nursery of State Forest Department at Kariat, Araria	c. 3000 seedlings, c. 10,000 stumps	Bihar
Nursery of State Forest Department, Kishanganj	c. 2000 seedlings	Bihar
Nursery of State Forest Department at Pothia, Kishanganj	c. 100 seedlings, c. 10,000 stumps	Bihar
Nursery of State Forest Department at (Simaraha Permanent Nursery), Araria	c. 1100 seedlings, c. 8000 stumps	Bihar
Nursery of State Forest Department at Uda-Kishangunj, Madhepura	c. 2000 seedlings	Bihar
Nursery of State Forest Department at Chausa, Madhepura	c. 2000 seedlings	Bihar
Nursery of State Forest Department at Supaha, Banka	c. 3000 seedlings	Bihar
Nursery of State Forest Department, Jamui	c. 1800 seedlings	Bihar
Nursery of State Forest Department, Purnea	c. 2000 seedlings	Bihar
Udyan Nursery of State Forest Department at Amarpur, Banka	c. 30 seedlings	Bihar
Nursery of State Forest Department at Katoria, Banka	c. 4920 seedlings	Bihar
Nursery of State Forest Department at Bhagwanpur Block Campus, Begusarai	c. 1355 seedlings	Bihar
Chainpur Permanent Nursery of State Forest Department, Kaimur	c. 200 seedlings	Bihar

Nursery	Number of seedlings/ saplings/stumps/plants	State
Nursery of State Forest Department at Naugachia, Bhagalpur	c. 1000 seedlings	Bihar
Nursery of State Forest Department at Baghaut (near Dharhara), Bhojpur	c. 2306 seedlings	Bihar
Nursery of State Forest Department at Arti, Gaya	c. 1440 seedlings	Bihar
Nursery of State Forest Department at Belaganj, Gaya	c. 960 seedlings	Bihar
Nursery of State Forest Department at Maranpur (Khatachak), Gaya	c. 2925 seedlings	Bihar
Nursery of State Forest Department at Gurua, Gaya	c. 500 seedlings	Bihar
Paraya Permanent Nursery of State Forest Department, Gaya	c.1625 seedlings	Bihar
Piparghatti (Dobhi) Permanent Nursery of State Forest Department, Gaya	c. 4383 seedlings	Bihar
Darauli Permanent Nursery of State Forest Department, Siwan	c. 2667 seedlings	Bihar
Udyan Nursery of State Forest Department, Sono, Jamui	8770 seedlings	Bihar
Permanent Nursery of State Forest Department at Sono, Jamui	c. 14,774 seedlings	Bihar
Nursery of State Forest Department at Raxaul, East Champaran	c. 1300 stumps	Bihar
Nursery of State Forest Department at Chauradano (Chawrodano), East Champaran	c. 870 seedlings	Bihar
Nursery of State Forest Department at Piprakothi, East Champaran	c. 4000 stumps	Bihar
Nursery of State Forest Department at Hisua, Makhweh, Nawada	c. 2000 seedlings	Bihar
Nursery of State Forest Department at Nawada (ITI), Nawada	c. 2000 seedlings	Bihar
Nursery of State Forest Department at Dhanarua, Patna	c. 3972 seedlings	Bihar
Nursery (Temporary) of State Forest Department at Dhanarua, Patna	c. 4060 seedlings	Bihar
Nursery of State Forest Department at Punpun, Patna	c. 3185 seedlings	Bihar
Nursery (Temporary) of State Forest Department at Fatuha, Patna	c. 4000 seedlings	Bihar
Nursery (Permanent) of State Forest Department at Fatuha, Patna	c. 3035 seedlings	Bihar
Nursery of State Forest Department at Amour, Purnia	c. 4000 seedlings	Bihar
Nursery of State Forest Department at Sheosagar, Rohtas	c. 2834 seedlings	Bihar
Nursery of State Forest Department at Bhagwanpur, Samastipur	c. 2460 seedlings	Bihar
Nursery of State Forest Department at Sharkhauli Paudhshala village, Sitamarhi	c. 3400 seedlings	Bihar
Nursery of State Forest Department, Dumara Paudhshala Collectorate Campus	c. 500 seedlings	Bihar
Nursery of State Forest Department at Raghopur, Supaul	c. 1530 seedlings	Bihar

Nursery	Number of seedlings/ saplings/stumps/plants	State
Nursery of State Forest Department at Bhimnagar, Supaul	c. 2000 seedlings	Bihar
S.K. Medical Nursery, Muzaffarpur	c. 500 seedlings	Bihar
Bansa Jhal Forest Nursery of State Forest Department, Bilaspur	c. 3,00,000 saplings	Chhattisgarh
Nursery of State Forest Department at Sutara, Korba	c. 1500 saplings	Chhattisgarh
Nursery of State Forest Department at Rajpipla Research Range, Narmada	c. 10,000 saplings	Gujarat
Central Nursery of State Forest Department at Dediapada, Narmada	c. 5000 saplings	Gujarat
Central Nursery of State Forest Department at Waghai, Dang	c. 5000 saplings	Gujarat
Ambika Nursery at Sakarpatal, Dang	c. 2000 saplings	Gujarat
Sidhara Model Nursery of State Forest Research Institute, Jammu	c. 10,000	Jammu and Kashmir
Hariachak Government Nursery of State Forest Research Institute, Kathua	c. 6000	Jammu and Kashmir
Nursery of State Forest Department at Simariya Range, Chatra	c. 20,000 saplings	Jharkhand
Nursery of State Forest Department at Tangli Forest, Kadur	c. 1000 saplings	Karnataka
Nursery of State Forest Department, Londha	c. 3000 saplings	Karnataka
Nursery of State Forest Department, Nagargali	c. 1880 saplings	Karnataka
Nursery of State Forest Department, Yellapur	c. 50 saplings	Karnataka
Nursery of State Forest Department at Rajgarh, Bhopal	c. 25,685	Madhya Pradesh
Nursery of State Forest Department at Vidisha, Bhopal	c. 2,65,423 saplings	Madhya Pradesh
Nursery of State Forest Department, Bhopal	c. 2,49,742 saplings	Madhya Pradesh
Nursery of State Forest Department at Sehore, Bhopal	c. 1,75,954 saplings	Madhya Pradesh
Nursery of State Forest Department at Raisen, Bhopal	c. 2,67,827 saplings	Madhya Pradesh
Nursery of State Forest Department, Jabalpur	c. 30,233 saplings	Madhya Pradesh
Nursery of State Forest Department at Mandla, Jabalpur	c. 99,292 saplings	Madhya Pradesh
Nursery of State Forest Department at Dindori, Jabalpur	c. 31,188 saplings	Madhya Pradesh
Nursery of State Forest Department at Narsimpur, Shivni	c. 110 saplings	Madhya Pradesh
Nursery of State Forest Department at Chhindwara, Shivni	c. 1,87,733 saplings	Madhya Pradesh
Nursery of State Forest Department at Seoni, Shivni	c. 86,128 saplings	Madhya Pradesh
Nursery of State Forest Department at Balaghat, Shivni	c. 30,058 saplings	Madhya Pradesh

Nursery	Number of seedlings/ saplings/stumps/plants	State
Nursery of State Forest Department at Dhar, Shivni	c. 2,59,900	Madhya Pradesh
Nursery of State Forest Department, Jhabua	c. 1,58,293 saplings	Madhya Pradesh
Nursery of State Forest Department at Alirajpur, Jhabua	c. 34,786 saplings	Madhya Pradesh
Nursery of State Forest Department at Ujjain, Ratlum	c. 78,770 saplings	Madhya Pradesh
Nursery of State Forest Department at Neemuch, Ratlum	c. 1,08,387 saplings	Madhya Pradesh
Nursery of State Forest Department at Agar, Ratlum	c. 53,515 saplings	Madhya Pradesh
Nursery of State Forest Department at Datia, Gowalior	c. 51,000	Madhya Pradesh
Nursery of State Forest Department at Bhind, Gowalior	c. 1,43,286 saplings	Madhya Pradesh
Nursery of State Forest Department at Shivpuri, Gowalior	c. 9,80,304 saplings	Madhya Pradesh
Nursery of State Forest Department at Sheopur, Gowalior	c. 1,49,247 saplings	Madhya Pradesh
Nursery of State Forest Department, Betul	c. 23,500 saplings	Madhya Pradesh
Bori Nursery at Harda, Betul	c. 8000 saplings	Madhya Pradesh
Nursery of State Forest Department at Debas, Indore	c. 49,344 saplings	Madhya Pradesh
Nursery of State Forest Department, Indore	c. 5972 saplings	Madhya Pradesh
Nursery of State Forest Department at Khandwa, Khandwa	c. 71,712 saplings	Madhya Pradesh
Nursery of State Forest Department at Barwani, Khandwa	c. 20,995 saplings	Madhya Pradesh
Nursery of State Forest Department at Burhanpur, Khandwa	c. 14,970 saplings	Madhya Pradesh
Nursery of State Forest Department at Satna, Riva	c. 28,921 saplings	Madhya Pradesh
Nursery of State Forest Department, Riva	2300 saplings	Madhya Pradesh
Nursery of State Forest Department at Sidhi, Riva	c. 65,152 saplings	Madhya Pradesh
Nursery of State Forest Department at Umaria, Riva	c. 1335 saplings	Madhya Pradesh
Nursery of State Forest Department at Singrauli, Riva	c. 85,766 saplings	Madhya Pradesh
Nursery of State Forest Department at Tikamgarh, Sagar	c. 2,14,020 saplings	Madhya Pradesh
Nursery of State Forest Department at Chattarpur, Sagar	c. 72,449 saplings	Madhya Pradesh
Nursery of State Forest Department at Panna, Sagar	c. 1,43,485 saplings	Madhya Pradesh
Nursery of State Forest Department, Sagar	c. 5,00,779 saplings	Madhya Pradesh
Nursery of State Forest Department at Damoh, Sagar	c. 65,903 saplings	Madhya Pradesh

Nursery	Number of seedlings/ saplings/stumps/plants	State
Nursery of State Forest Department, Dimbha	c. 5000 saplings	Maharashtra
Hitech Nursery of State Forest Department, Seminary Hills Social Forestry, Nagpur	c. 3500	Maharashtra
Nursery of State Forest Department at Kuarmunda, Sundargarh	c. 50 saplings	Odisha
All Nurseries of State Forest Department of Ropar district	c. 2961 seedling/saplings	Punjab
All Nurseries of State Forest Department of Garhshankar district	c. 994 seedling/saplings	Punjab
All Nurseries of State Forest Department of Hoshiarpur district	c. 1077 seedling/saplings	Punjab
Nursery of Institute of Forest Genetics, Coimbatore	c. 100 saplings	Tamil Nadu
Shree Balaji Roja Nursery, Coimbatore	c. 1000 saplings	Tamil Nadu
Nursery of Mettupalayam Research Centre, Coimbatore	c. 150 saplings	Tamil Nadu
Nursery of State Forest Department at Ashoknagar, Narsampet, Warangal	c. 1000 seedling c. 2000 saplings	Telangana
Nursery of Van Gaveshana Kendra, Hatipara	22 saplings	Tripura
Nursery of State Forest Department at Bhabani Range, Robertsganj	c. 50 saplings and 8 mature plants	Uttar Pradesh
Nursery of State Forest Department at Ajodhya, Purulia	c. 5500 saplings	West Bengal

Raising and management of seedlings of *D. latifolia* seedlings at Bansa Jhal Forest Nursery, Bilaspur

Raising of seedlings of *D. latifolia* at Ashoknagar Nursery, Telangana

Raising of seedlings of *D. latifolia* at Nursery of State Forest Department, Bhopal, M.P.

Raising of seedlings of *D. latifolia* at Bori Nursery, Madhya Pradesh

Raising of seedlings of *D. latifolia* at Uda Kishanganj Nursery, Madhepura, Bihar

Raising of seedlings of *D. latifolia* in polybags at Londa Nursery, Maharashtra

Raising of seedlings of *D. latifolia* at Rajpipla Forest nursery, Narmada, Gujarat

Raising of seedlings of *D. latifolia* in nursery of Forest Genetics Research Centre, Coimbatore

Raising of seedlings of *D. latifolia* in Shree Balaji Roja nursery, Coimbatore, Tamil Nadu

An officer of State Forest Department showing seedlings of *D. latifolia* at Ajodhya, West Bengal

Pods of *D. latifolia* collected for raising seedlings at Forest nursery Ajodhya, West Bengal

STEP 9: NON-DETRIMENT FINDING AND RELATED ADVICE

FROM STEP 1

9.1. Specimen identification is not clear for all materials/specimens under export

Dalbergia sissoides, a species that look-alike of *D. latifolia*, is also reported from Karnataka, Kerala and Tamil Nadu (also the major harvesting states for *D. latifolia*). In many parts of these three states, *D. sissoides* are often misidentified as *D. latifolia* with the same common names 'Itti'/'Eetti' or 'Veeti'/'Beeti' due to remarkably similar morphological characters and uses. Therefore, these two species are indiscriminately harvested, traded, managed in many parts of the major harvesting states of *D. latifolia*. Further, no record of export of *D. sissoides* from India is available at the CITES Trade Database due to its export under the name *D. latifolia*. As *D. sissoides* is a more or less equally valuable timber species in India with more restricted distribution, the present harvest and management practices under the name of *D. latifolia* should have adverse effect on the wild population of *D. sissoides*.

- **Negative NDF for wild population of natural and semi-natural forests**

FROM STEP 8

9.8. The existing management measures does not adequately mitigate harvest and trade impacts of wild population of *D. latifolia*

This is mainly due to indiscriminate harvest, trade and management practices of *D. latifolia* without differentiating it from *D. sissoides* in the major harvesting states. It is not possible for the scientific authority to assess the actual quantity of harvest, trade and export (and their impact) of specimens of the 'true' *D. latifolia* due to the identity crisis and indiscriminate management practices.

- **Negative NDF for wild population of natural and semi-natural forests**

However, in India the timber of *D. latifolia* is sold (in major harvesting states) through auction by the forest administrations and the harvest as well as trade of timber (governed by forest department) sourced from the trees growing in private lands (such as gardens, tea and coffee plantations), which are grown through 'assisted production' will not be detrimental to the survival of wild population of *D. latifolia* in the forests.

Therefore, the specimens sourced from trees growing in private lands (gardens, tea and coffee plantations) or available under source code 'A' or 'proposed' source code 'Y' can be harvested (after proper identification before harvesting) and traded with proof of their origin through LPCs or similar legal documents.

OTHER ADVICE

- The management of *D. latifolia* and *D. sissoides* in Karnataka, Kerala and Tamil Nadu should be done by recognizing the plants with their correct identity and recording the data on harvest, trade, export, timber stock at depots, living stock at nurseries/plantations, separately.
- Capacity Building Trainings should be given to the staff of forest department (especially in the states of Karnataka, Kerala and Tamil Nadu, i.e., where both *D. latifolia* and *D. sissoides* are found) in identifying these two species. Correct identification is essential before harvest/ removal of the tree from the site and the harvested timber should be kept separately at depots. An easy and effective identification/detection manual for wood/timber of *D. latifolia* is warranted, which should be available with foresters, wildlife managers, timber depots to discriminate the species from *D. sissoides*.
- Preparing inventories of standing stocks (wild and cultivated separately) of *D. latifolia* for every state/union territory is essential for better management and establishing national export quota of the species (when necessary).
- *Dalbergia latifolia* is listed as 'restricted species' in the states of Gujarat, Karnataka, Kerala and Tamil Nadu, and permission is required for harvesting (even in private land), transportation and marketing of this species. Similar law should be enforced in other Indian states and union territories where the species is found in the wild.
- *Dalbergia latifolia* is listed as a 'reserved tree' under the Andhra Pradesh Preservation of Private Forest Rules 1978, which prohibits felling of the species unless the tree exceeds 120 cm girth (DBH: c. 38 cm) at 1.3 m height from ground level. Similar law should be enforced in other states and union territories of India, where the species is found in the wild.
- Trial of introduction of *D. latifolia* is not carried out in Andaman and Nicobar Islands at present as there is a ban (following the Supreme Court order in 2002) on introduction of species which are not native to the islands. However, *D. emarginata* Roxb., a synonym of *D. latifolia*, was described by William Roxburgh based on specimens collected from Andaman and Nicobar Islands. Therefore, the species is not an exotic to Andaman and Nicobar Islands and the forest department should take initiative for plantation of this species in the islands.
- Non-Detriment Findings of *D. sissoides* is needed, because this narrowly distributed species (in India found only in Karnataka, Kerala and Tamil Nadu) is highly traded/commercially utilized as *D. latifolia* or under the same common/vernacular names as that of *D. latifolia*.

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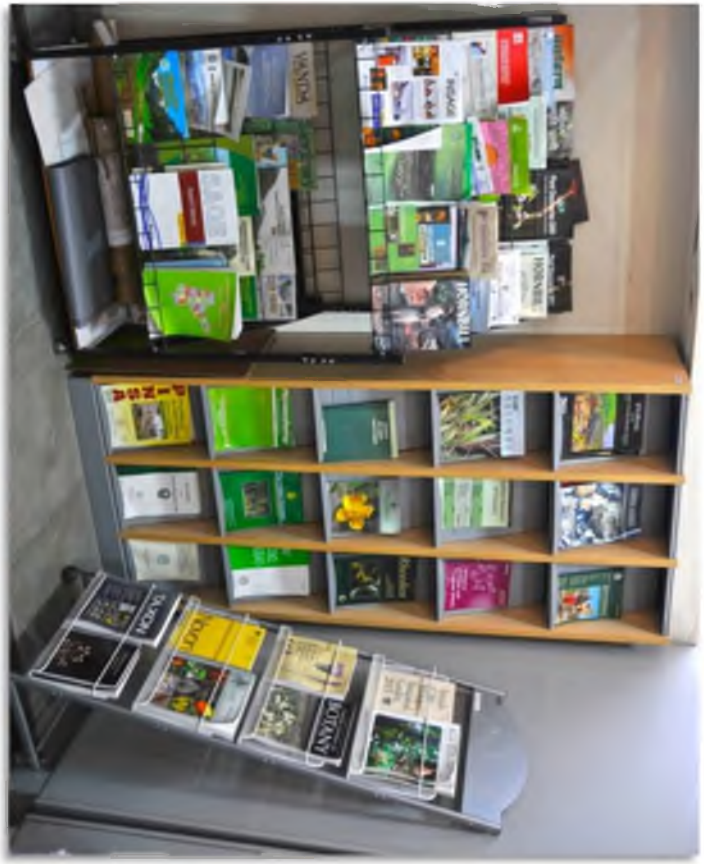

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Annexure 1

Wild population data of *Dalbergia latifolia* Roxb. based on hectare wise randomly surveyed locations

State	Location	No. of trees (DBH ≥ 8 cm) per hectare (average based on minimum 3 plots of 100 x 100 m)	No. of seedlings/ saplings/ plantlets per hectare (average based on minimum 3 plots of 100 x 100 m)	#Regeneration Rate (RR) = No. of individuals reproduced or regenerated (Nr)/No. of individuals at the age of reproduction (Ns) x 100
Andhra Pradesh	Tirupati Range (Seshachalam Biosphere Reserve)	33.3	29	107
Andhra Pradesh	Balapalli Range	3.6	14	466
Andhra Pradesh	Nandyal Forest Range (Nallamala Reserve Forest)	2.6	10	384
Andhra Pradesh	Chalama Forest Range	20	48	282
Andhra Pradesh	Rudravaram Forest Range	10	29	362
Andhra Pradesh	Veligonda Hills	1.6	5	500
Bihar	Valmiki Tiger Reserve (Govardhana)	5	16	320
Bihar	Valmiki Tiger Reserve (Valmiki Nagar)	1.3	6	461
Bihar	Valmiki Tiger Reserve (Someshwar Hill)	6	11	220
Bihar	Jhurang Hill (Gaya)	1.3	0.6	37.5
Chhattisgarh	Keregaon, Dhamatari	5	6	150
Chhattisgarh	Khariibera Compartment No. 413	8	10	142
Chhattisgarh	Jabra Kachh Sivpur Compartment No. 305	2.6	5	250
Chhattisgarh	Dugli Forest Range	3.3	0	0
Chhattisgarh	Gatta Silli of Birgudi Forest Range	8	16	200
Dadra and Nagar Haveli	Morkhal Areas	10	20	222
Dadra and Nagar Haveli	Dudhani	6	15	375
Dadra and Nagar Haveli	Athal	9	14	175
Gujarat	Phulsar Range (Shoolpaneshwar Wildlife Sanctuary)	16.6	25	166
Gujarat	Sagai Forest Range (Shoolpaneshwar Wildlife Sanctuary)	16	29	223
Gujarat	Piplodh Forest Range (Shoolpaneshwar Wildlife Sanctuary)	22	30	136
Gujarat	Waghai Forest Range	7.6	26	433

Trees ≤ 5 = Rare; 6–10 = Scarce; 11–20 = Common; >20 = Abundant

State	Location	No. of trees (DBH ≥ 8 cm) per hectare (average based on minimum 3 plots of 100 x 100 m)	No. of seedlings/ saplings/ plantlets per hectare (average based on minimum 3 plots of 100 x 100 m)	#Regeneration Rate (RR) = No. of individuals reproduced or regenerated (Nr)/No. of individuals at the age of reproduction (Ns) x 100
Gujarat	Sakarpatal Forest Range	4.6	22	550
Gujarat	Dharampur Forest Range	2.6	15	576
Jharkhand	Chaibasa of West Singhbhum	4	0	0
Jharkhand	Baghin Jhopari (Latehar)	3.3	5	166
Jharkhand	Garu Hills (Latehar)	10	12	133
Jharkhand	Saranda (West Singhbhum)	4	12	400
Jharkhand	Canary Hill of Hazaribagh District	5	16	533
Jharkhand	Parashnath Hills of Giridih District	3.3	10	333
Karnataka	Anshi Range	5*	Data not available	Data not available
Karnataka	Phansoli Range	2.4*	Data not available	Data not available
Karnataka	Kulgi Range	27*	Data not available	Data not available
Karnataka	Castle Rock and nearby area	9	20	222
Karnataka	Bannerghata National Park (Bannerghata Forest Range)	12	40	363
Karnataka	Jagalpet Range	14.3	32	228
Karnataka	Dandeli and adjoining areas	30	36	138
Karnataka	Arbail Ghat (Yellapur)	20.6	51	283
Karnataka	Kumta-Hubli Reserve Forest	17.6	34	212
Karnataka	Hubli	15.6	45	346
Karnataka	Kadekal Range	12.3	41	341
Karnataka	Umrabel Range	12.3	55	545
Karnataka	Kargal Range (Sharavati Valley Wildlife Sanctuary)	7.3	30	575
Karnataka	Tiger-Lion Safari, Thyavarekoppa	4.6	10	333
Karnataka	Ramanmalai Forest Block	8	4	57
Karnataka	Sandur	9	5	62
Karnataka	Kanhati Range, Chikkamagaluru	7	3	75

Trees ≤ 5 = Rare; 6–10 = Scarce; 11–20 = Common; >20 = Abundant

State	Location	No. of trees (DBH ≥ 8 cm) per hectare (average based on minimum 3 plots of 100 x 100 m)	No. of seedlings/ saplings/ plantlets per hectare (average based on minimum 3 plots of 100 x 100 m)	#Regeneration Rate (RR) = No. of individuals reproduced or regenerated (Nr)/No. of individuals at the age of reproduction (Ns) x 100
Karnataka	Jogimatti Wildlife Sanctuary, Chitradurga	22.6	45	270
Karnataka	Koppa Forest Division	10	24	295
Karnataka	Kudremukh National Park	12	14	117
Karnataka	Devarayana Durg State Reserve Forest	33	40	129
Karnataka	Biligirirangana Temple Tiger Reserve	21	46	255
Karnataka	Nandi Hills	5.3	12	293
Karnataka	Bhadra Wildlife Sanctuary	33*	Data not available	Data not available
Karnataka	Belgaum-Khanapur-Londha-Nagargali	28	35	159
Kerala	Neyyar Wildlife Sanctuary (Neyyar Range)	2.6	12	600
Kerala	Peppara Wildlife Sanctuary	1.6	0	0
Kerala	Ettikunnu Forest Beat (Kulathupuzha Range)	5	15	375
Kerala	Kannankunna Forest Beat (Palode Range)	41	153	413
Kerala	Eetimoode Forest Beat	2.8	11	550
Kerala	Machad Range	20	29	161
Kerala	Chedleth Range	1.5	0	0
Kerala	Meepady Range	12	0	0
Madhya Pradesh	Bada Tumbi (Anuppur)	6.6	0	0
Madhya Pradesh	Pali (Umaria)	3	5	166
Madhya Pradesh	Chandia (Umaria)	20	11	61
Madhya Pradesh	Ghunghuti (Umaria)	3	0	0
Madhya Pradesh	Kola Road	5	13	325
Madhya Pradesh	Sunder Dadar (Panna Tiger Reserve)	4	1	25
Madhya Pradesh	Pallighat	4.6	0	0
Maharashtra	Sinhagad Hill Forest	5	21	525
Maharashtra	Kumbharli Ghat	8.3	45	562

Trees ≤ 5 = Rare; 6–10 = Scarce; 11–20 = Common; >20 = Abundant

State	Location	No. of trees (DBH ≥ 8 cm) per hectare (average based on minimum 3 plots of 100 x 100 m)	No. of seedlings/ saplings/ plantlets per hectare (average based on minimum 3 plots of 100 x 100 m)	#Regeneration Rate (RR) = No. of individuals reproduced or regenerated (Nr)/No. of individuals at the age of reproduction (Ns) x 100
Maharashtra	Panhala-Masai Pathar	4.5	21	525
Maharashtra	Radhanagari Wildlife Sanctuary	14.3	42	323
Maharashtra	Seminary Hills	15	40	287
Maharashtra	Bal Udhayan, Seminary Hills	10	25	277
Odisha	Simlipal Tiger Reserve of Mayurbhanj (Pithabata Forest Range)	6	15	250
Odisha	Udala Forest Range	4	0	0
Odisha	Kaptipada Range	5	15	375
Odisha	Jenabil Range	6	11	222
Odisha	National Park Range	8	10	142
Odisha	Kuarmunda Range of Sundargarh District	5	9	225
Rajasthan	Mount Abu Wildlife Sanctuary	3	5	250
Rajasthan	Phulwari Ki Nal Wildlife Sanctuary	5	8	200
Rajasthan	Sita Mata Wildlife Sanctuary	4	2	66
Rajasthan	Jaisamand Wildlife Sanctuary	4.3	3	75
Rajasthan	Todgarh-Raoli Wildlife Sanctuary	3	3	150
Tamil Nadu	Anamalai Tiger Reserve (Pollachi Range)	39.3	54	154
Tamil Nadu	Bolumpatty Range	36.6	69	209
Tamil Nadu	Mudumalai Tiger Reserve (Gudalur Range)	38.6	76	107
Tamil Nadu	Ovally Range	48	155	322
Tamil Nadu	Pandalur Range	38.6	77	202
Tamil Nadu	Kanyakumari Wildlife Sanctuary (Azhakiapandyapuram Range)	33.3	70	212
Tamil Nadu	Bhavani Sagar Forest Range (Sathyamangalam Tiger Reserve)	15	39	650
Tamil Nadu	Thalamalai Forest Range	2.6	9	450

Trees ≤ 5 = Rare; 6–10 = Scarce; 11–20 = Common; >20 = Abundant

State	Location	No. of trees (DBH ≥ 8 cm) per hectare (average based on minimum 3 plots of 100 x 100 m)	No. of seedlings/ saplings/ plantlets per hectare (average based on minimum 3 plots of 100 x 100 m)	#Regeneration Rate (RR) = No. of individuals reproduced or regenerated (Nr)/No. of individuals at the age of reproduction (Ns) x 100
Tamil Nadu	Mundanthurai Range (Kalakadu-Mundanthurai Tiger Reserve)	5.3	29	483
Tamil Nadu	Kadayanallur Range (Nellai Wildlife Sanctuary)	19.3	88	455
Telangana	Narsapur Reserve Forest	20	59	347
Telangana	Pakhal Reserve Forest	20	27	105
Telangana	Wanaparthy Reserved Forest	6	39	650
Telangana	Bejjur Reserved Forest	10	0	0
Telangana	Asifabad Reserved Forest	9	25	625
Telangana	Penchakalpet Range	10	15	187
Telangana	Kondampalli	12	25	250
Telangana	Narlapur	7.5	0	0
Telangana	Indanpally Forest Range (Kawal Tiger Reserve)	40	72	184
Telangana	Khanapur Forest Range (Nirmal Reserve Forest)	20	42	221
Telangana	Khanchuleru	10	36	450
Telangana	Pothampalli	5	9	225
Telangana	Marriguda	15.3	28	215
Telangana	Gondigudem	9	16	228
Telangana	Lakkavaram Forest Range (Bhadrachalam Forest Division)	19	18	94
Uttar Pradesh	Pilibhit Tiger Reserve	8	30	428
Uttar Pradesh	Vijaygarh Fort	7.6	10	142
Uttar Pradesh	Renukoot	5	20	500
West Bengal	Garh Panchokot Hills	7	5	83
West Bengal	Ajodhya Hills	11	12	120
West Bengal	Mathaburu Hills	8	11	183

*No. of trees per hectare as per secondary resources (Dr. S.S. Kulkarni, Bangurnagar Degree College, Dandeli)

RR: 0–100 = low; 100–1000 = Average; > 1000 = High (Anon. 2013. *Evaluation écologique des bois précieux, provision de données taxonomiques, validation et mise au point de méthodes de quantification pour la gestion durable des bois précieux de Madagascar*. Department of Biology and Plant Ecology of the Faculty of Science of the University of Antananarivo, Final report ITTO–CITES)

Trees ≤ 5 = Rare; 6–10 = Scarce; 11–20 = Common; >20 = Abundant