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OF WILD FAUNA AND FLORA

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IMPLEMENTING CITES ROSEWOOD SPECIES LISTINGS: A DIAGNOSTIC GUIDE FOR ROSEWOOD RANGE STATES

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Implementing CITES Rosewood Species Listings

A Diagnostic Guide for Rosewood Range States

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INTRODUCTION

The 17th Meeting of the Conference of the Parties (COP-17) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), held in South Africa during September-October 2016, marked a turning point in CITES' treatment of timber species. While a number of tree species had been brought under CITES regulation over the previous decades[1], COP-17 saw a marked expansion of CITES timber species listings. The Parties at COP-17 listed the entire *Dalbergia* genus (some 250 species, including many of the most prized rosewoods), *Pterocarpus erinaceous* (kosso, a highly-exploited rosewood species from West Africa) and three *Guibourtia* species (bubinga, another African rosewood) to CITES Appendix II.[2] The new listings entered into force on January 2, 2017.

The COP-17 decisions on rosewood were provoked by escalation of scientific and media concern about the rapidly growing, unsustainable, and often illegal cutting and trade in rosewood species across the tropics. Rosewood is cut largely to supply booming demand for replica antique "*hongmu*" furniture in China and, to a much lesser extent, the global musical instruments industry (acoustic guitars in particular).[3]

The scale of the problem was documented in the 2016 *World Wildlife Crime Report* published by the UN Office on Drugs and Crime (UNODC). In the report, which was published shortly before COP-17, UNODC reported that rosewood constituted 35% of the value of total wildlife seizures between 2005-2014 – more than the value of elephant ivory, rhino horn, marine and freshwater turtles, big cats, and corals *combined*. Speaking at COP-17, the UNODC Representative read the following from the Report:

> Rosewood illustrates the limitations of a species-specific approach to wildlife protection. Timber traders evade CITES controls by finding substitute species, and the buying rush on these unprotected woods can devastate populations before controls can be put in place. Furthermore, it is very difficult for front line inspectors to distinguish different species of wood in the many forms it might appear, and misdeclaration of species has been detected. At present, there is generally no legal basis for most importing countries to respect the laws of exporters, and thus large volumes of illegally-sourced wood may be entering legal markets.[4]

Faced with this major threat, CITES Parties acted quite decisively, and without significant opposition, to apply Appendix II restrictions to a significant proportion of the rosewood species in international trade. Implementing these new rosewood listings is complex. Range States – which in this case are almost all tropical developing countries – in particular now must develop rules, procedures, and capacities to implement these new CITES listings, and others that may follow in coming years.[5] This has to be done in the face of significant information gaps on rosewood species, as well as policy, technical and governance weakness in Range States.

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[1] CITES tree species listings prior to Cop-17 are profiled in CITES and Timber: A Guide to CITES-Listed Tree Species, published by the Royal Botanic Gardens at Kew, UK (2015).

[2] Parties also tightened the existing Appendix II listing of Siamese rosewood (*Dalbergia cochinchinensis*) and extended the COP-16 suspension of all exports of species from the Madagascar populations of the Dalbergia and *Diospyros* (ebony) genera.

[3] For reporting on the rosewood crisis, see, for example: (UNODC, 2016; Winfield *et al*. (2016); EIA 2016; , Benin *et al*. 2016.)

[4] UNODC, 2016.

[5] Listings have already been proposed for consideration at the 18th Conference of the Parties (August 2019) for another highly-exploited *Pterocarpus* species from Africa, and for the entire *Cedrela* genus (Spanish cedar) in South America. Others are likely to follow at subsequent meetings.

This Guide is intended to provide rosewood Range States, their stakeholders and partners with a "diagnostic framework" for developing effective implementing measures for CITES rosewood listings, and other current or future timber species listings.

In large part, the Guide focuses on gathering the information and conducting the analyses necessary for Range States to conduct the required Non-Detriment Finding (NDF) which is the core element needed to implement any Appendix II listing. General information and specific technical guidance on the requirements for conducting an NDF can be found in many places, and we do not seek to "reinvent the wheel" in that respect. Rather, this Guide provides a series of questions that CITES authorities in any rosewood Range State will need to ask and answer as the basis for conducting a robust NDF on rosewood species and will suggest strategies and information resources they can use to answer those questions.

In many cases, Range States will determine that available information is incomplete, inconclusive, or outdated. The Guide therefore also outlines strategies that Range State authorities can pursue when faced with gaps in scientific knowledge of the species in question, incomplete or inapplicable legal, regulatory and management frameworks, or governance-related threats such as widespread illegal logging and trade.

Specifically, the Guide seeks to help Range State seek answers to the following five questions:

- Are you a Range State for one or more CITES-listed rosewood species?
- What is the species distribution, population and conservation status of the species?
- What is known about the biology and ecology of the species?
- What pressures and threats does the species face?
- What legal, regulatory and management measures applicable to the species are in place?

A final section then takes the reader through a generic NDF process for a CITES-listed rosewood species, to show how the information obtained in seeking answers to these five questions (including information about gaps in the pertinent science or legal and management frameworks) can be applied.

The hope is that by helping Range States to ask and answer these questions, the CITES rosewood listings can be implemented effectively by Range States and, in cases where information and capacity gaps are identified, measures can be taken to close those gaps.

I. ARE YOU A RANGE STATE FOR ONE OR MORE CITES-LISTED ROSEWOOD SPECIES?

This may seem like a quite straightforward question, but this is not always the case. Data on the distribution of many rosewood species is often scant, out-of-date, or incomplete. The timber from different rosewood species, even across genera, often looks alike, even to specialists. And even in the wild, trees of different species can be difficult to distinguish, especially when they are not flowering. The official Checklist of CITES Species, housed on the website of the CITES Secretariat, is a good place to start when answering this question. The CITES Checklist includes information organized by scientific genus and species names, common names, location, level of protection, and CITES Appendix in which they are listed. If you already know the answer, it is also a good time to ensure that the information in the official database is correct and up to date.

The official Checklist is by no means, however, a panacea. There are 292 *Dalbergia* species on the Checklist, and many of them have not been adequately described. Many are not even in international trade. Only 50 *Dalbergia* species are considered "accepted" by CITES, in that they are

included in the most recent CITES "Standard Nomenclature" Resolution.[6] Due to significant gaps in the taxonomic understanding of the *Dalbergia* genus, a taxonomic reference covering the entire genus was not adopted at COP-17, even though the entire genus was listed for Appendix II protection worldwide.

Another important information resource on *Dalbergia spp*. and *Pterocarpus spp*. in international trade is the *Global Status of Dalbergia and Pterocarpus Rosewood Producing Species*, a comprehensive review of available data as of 2016, which was introduced as a CITES Information Document at COP-17.[7] Additional information on select *Dalbergia* species as well as *Guibourtia demeusei* (bubinga) can be found in UNEP-WCMC (2017).[8]

The many scientific uncertainties and ambiguities about the taxonomy of *Dalbergia spp*. was, a key reason that the entire genus was listed instead of particular species. (Another reason was the "lookalike species" issues, which is particularly acute in a genus where even experts often disagree on the taxonomy, and have difficulty telling species apart.)

There are additional "lumping and splitting" problems with the *Dalbergia* genus when moving between the national and global level, and even between global sources. Some species may be recognized as distinct at the national level for both scientific and trade purposes but are treated as synonyms for the same species at the global level. Even global-level sources may differ on this point: *Dalbergia assamica* and *Dalbergia balansae,* for example, have been assessed by the IUCN Red List as separate species, while other sources consider them to be synonyms for the same species, and yet other sources consider one or another of them to be another species entirely.[9]

What is important for national CITES Scientific Authorities to remember is that at present ***there is no authorized taxonomic standard for the majority of Dalbergia species listed under CITES***. Therefore, since NDFs are carried out by Parties' national CITES Authority, the taxonomic designations considered valid at the national level are likely the best taxonomic basis for conducting an NDF. However, where such taxonomic discrepancies between national and global data sources exist, it is important to note and document the discrepancies in the text of the NDF. It is also important that this information is provided to the CITES Secretariat and Taxonomy Specialist in accordance with the applicable CITES Resolution.[10]

Range States also need to be aware of the import requirements of CITES Parties to which they may export CITES-listed rosewood species. General European Union guidance for import of CITES-listed species as of 2014 states that an NDF may not be considered valid if there is significant uncertainty surrounding identification to the species level.[11] At COP-17, however, the EU specifically supported the genus-level Dalbergia spp. listing, so it seems unlikely that the EU CITES authorities would stick to that previous guidance in a hard-and-fast manner when it comes to imports of Dalbergia spp. Range States exporting Dalbergia spp. to the EU would be prudent, nonetheless, to provide species-level information to the extent that is possible.

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[6] For a species name to be consider accepted by CITES, a scientific taxonomic reference is required to be reviewed by the taxonomic specialist and accepted by two-thirds of the Parties present and voting at a Conference of the Parties.

[7] Winfield *et al*. 2016.

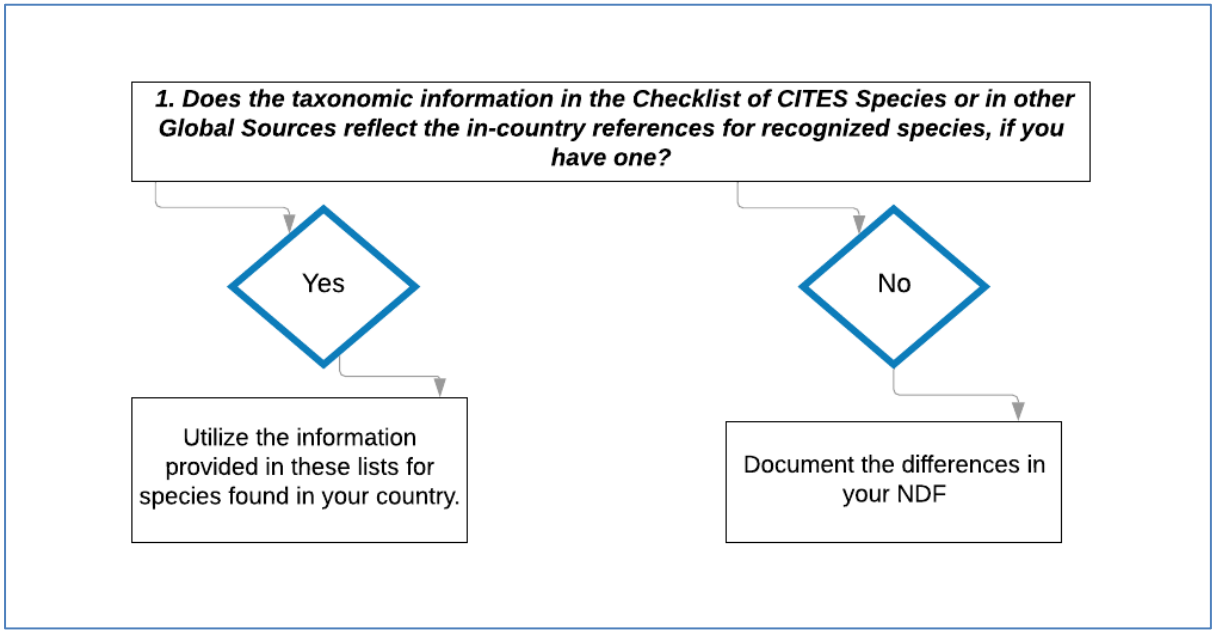
[8] UNEP-WCMC. 2017. *Review of selected Dalbergia species and Guibourtia demeusei*. SRG79/4/2/3. UNEP-WCMC, Cambridge, UK. Prepared for the European Commission.

[9] Winfield *et al.* 2016.

[10] Res Conf. 12.11 (Rev CoP17)

[11] Rose, 2014.

QUESTIONS TO ASK



II. WHAT IS THE SPECIES DISTRIBUTION, POPULATION AND CONSERVATION STATUS OF THE SPECIES?

Once it has been established for which CITES-listed rosewood species a Party is a Range State, and the taxonomic and nomenclature issues have been clarified to the extent possible, the next step is to answer questions which may be easy to ask but are often difficult to answer such as:

- Where in the country does the species grow?
- How much of it grows there?
- Is it in decline from overharvesting or other factors?
- Has its conservation status been assessed? If so, when?

Species Distribution

Understanding a species' distribution within a Range State is often difficult, since for many species no distribution survey has ever been conducted. In cases where surveys have been conducted, the information is now considered out of date as it may have occurred before heavy exploitation of the species commenced in the past few decades, and other pressures such as forest clearance for agriculture may have intensified.

Range State authorities will of course want to turn to local experts and sources, and should certainly consult Winfield *et al.* 2016 which compiled what species distribution information was available globally in 2016 for Dalbergia spp. and *Pterocarpus spp*. in trade. This publication also contains high-level species distribution assessments conducted by the IUCN Red List. These IUCN Red List assessments have recently been updated to reflect the current situation facing these species, as such, the assessments discussed in Winfield *et al.* 2016 can be used for historical comparison of species distributions.

In reality there is very little geo-spatial data available on the distribution of rosewood species. In the case of Madagascar, where the entire genera *Dalbergia* and *Diospyros* (ebony) were listed on

CITES Appendix II in 2013, an otherwise comprehensive 2016 report by TRAFFIC published in 2016 (Ratsimbazafy *et al*. 2016) provides only fragmentary information on the distribution of *Dalbergia* species, and a study commissioned by the World Bank in the same year concluded that the distribution and population status of Dalbergia in the country is almost totally unknown (Mason *et al.* 2016). While globally range and distribution data may be somewhat more robust than in Madagascar, the reality is that in most countries, the only ones who seem to know where rosewood grows – or used to grow – are the people who have been cutting rosewood down and feeding into the largely illegal trade that drew the attention of CITES in the first place.

Given this lack of rosewood species distribution data, Winfield *et al.* (2016) conducted a modelling exercise for some of the most highly sought-after rosewood species in order to determine the most likely population distributions of species in today's remaining forested areas. This work utilized known biological preferences of target species from the scientific literature to indicate what areas of current forest cover constituted suitable habitat for different rosewood species. This was then overlaid with available satellite imagery of intact natural forest remaining.

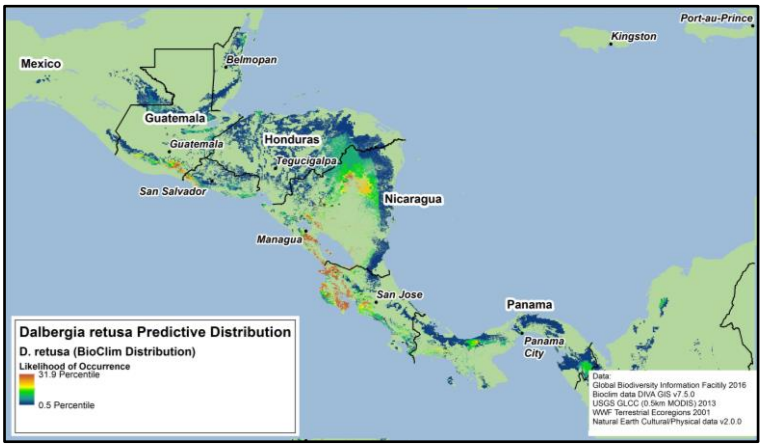
In 2016, when this exercise was a carried out reliable remote sensing imagery and analysis were not available for all rosewood Range States, particularly in West Africa. The availability of data for such modelling has recently improved, providing more powerful tools to extrapolate the current likely distribution of *Dalbergia spp*. within a country. Global Forest Watch (GFW) provides an interactive global map of primary tropical forests as of 2001, and annual tree cover loss data for all forests through 2018. One could therefore determine remaining primary forests for a range state (2001 primary forests minus cumulative 2002-2018 forest cover loss within those primary forest areas), screen for biological preferences of the target species as in Winfield *et al*. 2016 and derive a good first cut at where the target species are likely to remain. Access to GFW information is free, and GFW's "Map Builder" function allows users to access the underlying technology and data to build their own customized tools.[12]

In the absence of robust species distribution and population data, this kind of modelling can be an important and cost-effective tool for Range States. This technology reduces the costs and effort needed to produce an initial NDF, since it can be done without field studies. Once the initial NDF is created, it allows Parties to concentrate their research and field studies on forest areas that are most likely to contain rosewood species. This information needs to be carefully controlled however and thoughtfully published, as poachers are starting to utilize scientific papers that publish maps and GPS coordinates to increase the effectiveness of their poaching efforts.[13]

[12] While some remnant specimens of *Dalbergia spp*. may lie within secondary and degraded forest areas, most reporting from range states suggests that few commercially-trade rosewood trees persist in degraded and otherwise accessible forest areas.

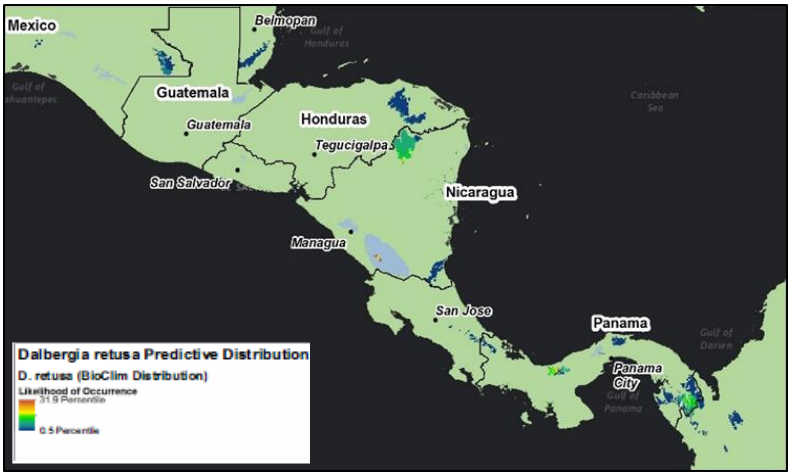
[13] See Lindenmayer & Scheele 2017.

Figure 1
Example of Modelling to Predict Likely Current *Dalbergia spp*. Range – Central America



(a) *Dalbergia retusa* predicted habitat from biological preferences (Winfield *et al*. 2016)

(b) Primary Forest 2001 (Global Forest Watch 2019)



(c) Overlay of (a) and (b) which isolates the predicted priority areas for CITES species implementation attention

Population Status

Population status refers in this context refers to the abundance and health of the populations of a species within the Range State. The most desirable population status for a CITES-listed rosewood species, given their scarcity compared to historic population status, would be "increasing."

However, forestry managers generally manage for a stable population, meaning that the number of trees lost to all sources of mortality (including harvesting) equals the number of trees recruited into the population and growing to maturity. Recruitment can be high, but if all of the recruited trees are cut as soon as they reach maturity, the population will not remain stable: Without large adult trees to flower and fruit to produce saplings, recruitment will begin to fail over time, and the population will start to decline. Sustainable management of CITES-listed rosewood species needs to balance harvest levels against the needs of the species and the forest to continue to flourish.

Information on population status can be obtained by field population surveys that take note of the number of trees in each subclass of Diameter at Breast Height (DBH). A proxy for this information is to simply know the density of trees of merchantable size, at a pre-determined DBH that is acceptable for a particular tree species to be harvested, or that are saplings or seedlings. This will also give you an indication of how good recruitment is across the forest sites surveyed. Other factors that will give you information about the health of the population are basal area and bio-volume, which gives further indications of the number of trees and total volume of wood (i.e. height and DBH of trees is utilized to determine total volume over the hectare surveyed).

Winfield *et al.* (2016) summarizes available global information on *Dalbergia spp*. population status as of 2016.

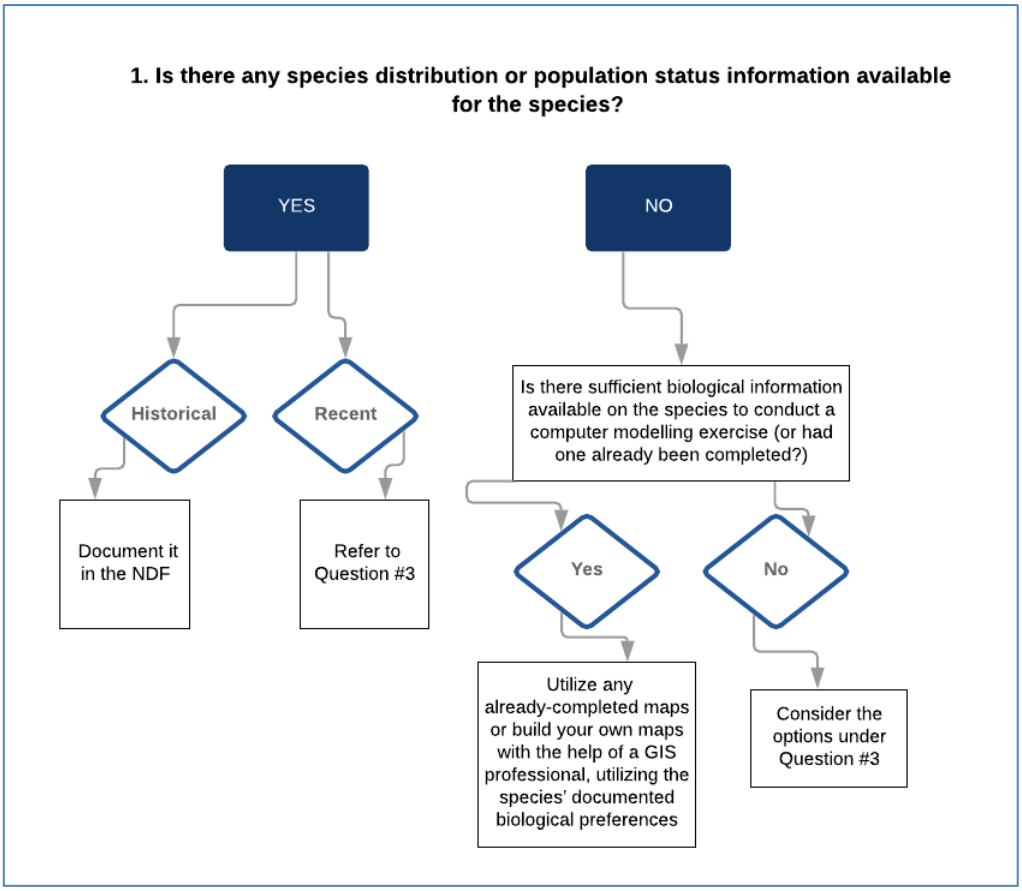
Conservation Status

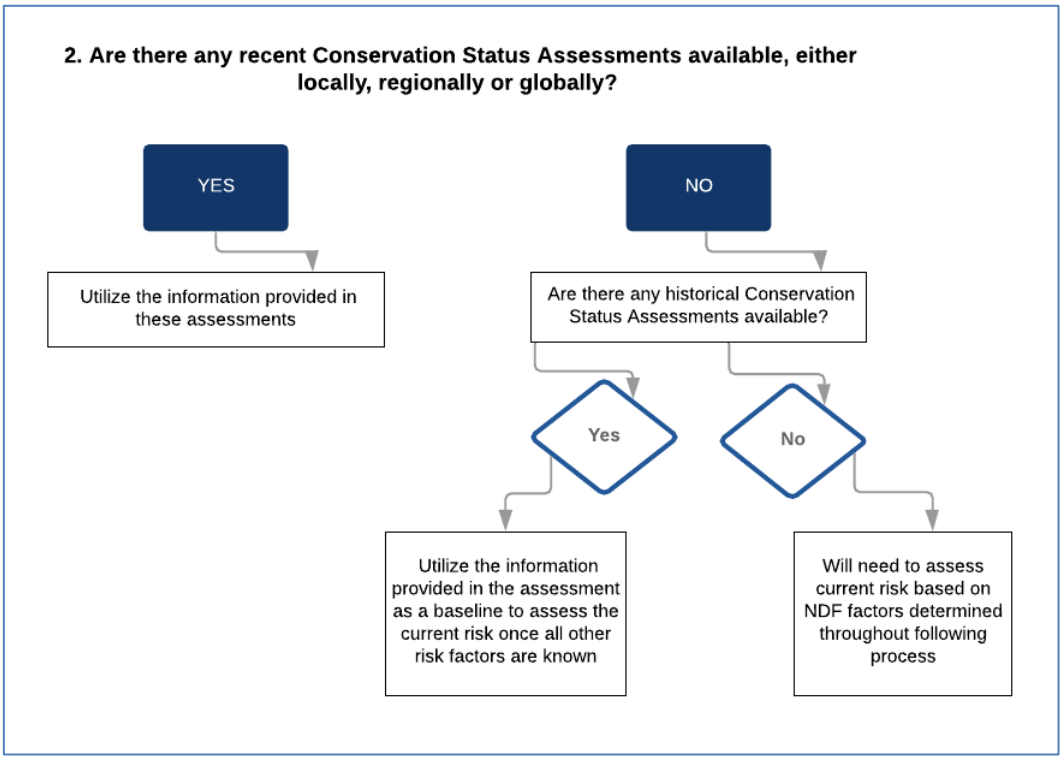
The IUCN Red List contains a number of global assessments for *Dalbergia* and *Pterocarpus* rosewood species. A number of rosewood species have recently been assessed or reassessed including *Pterocarpus erinaceus* and *Pterocarpus macrocarpus*[14] (Barstow, 2019) but the majority of *Dalbergia* species assessments are over 20 years old and therefore do not provide accurate information on which to base an assessment of current conservation status. In the absence of more recent conservation status assessments, the IUCN Red List assessments *can* be utilized to understand what the historical conservation status was for a species. Knowing this information can provide a baseline to understand what the likely current threat is for a species, once the other risk factors are considered through the NDF process (e.g. legal harvest and trade pressure, habitat loss, prevalence of illegal logging, etc.).

Thus, if the species in question was assessed as near-threatened 20 years ago, it would be prudent to assume that the species' threat status has worsened over the past two decades, given the boom in rosewood trafficking over the past two decades. If modeled or other assessment of population distribution indicate that almost all remaining rosewood in a Range State lies within protected areas where cutting is prohibited, this would be another factor indicating a high level of threat.

[14] *Pterocarpus macrocarpus* is not CITES listed but was recently assessed for the first time and was classified as Endangered. This species is a look-alike species for *Dalbergia cochinchinensis*, as well as *Dalbergia oliveri.* Given its prominence in trade and ability to simply re-label shipments, it would be prudent for Range States to ensure any management arrangements applied to a CITES listed species are also applied to non-listed look-alike species.

QUESTIONS TO ASK





3. What can you do when you do not have sufficient information on population range, status and distribution to adequately inform an NDF?

- Utilize similar species, with similar habitat preferences and threat level, for which distribution or range is known as a proxy measure.

- Utilize known forest area and forest cover as a proxy to estimate potential stands of the species in question. (**NOTE:** This method bears a high level of inherent risk, and estimates should be made in a precautionary and conservative manner, followed by regular ground-truthing to ensure no detrimental impacts on the species.)

III. WHAT IS KNOWN ABOUT THE BIOLOGY AND ECOLOGY OF THE SPECIES?

The biological and ecological traits of timber species are often some of the easiest parameters to ascertain, as they have often been studied and reported on in literature at least somewhere in the world. While there may be area or region-specific differences in factors such as growth rates and regeneration potential, biological parameters such as maximum height, minimum diameter at breast height before harvest and reproductive systems are available across a wide range of references.

Winfield *et al*. (2016) provides the most comprehensive literature references available for species-specific information across each region, as of mid-2016, and relies on published scientific literature. Scientific studies since that time, anything in the "grey literature" produced by governments, intergovernmental agencies, or the private sector, has not been compiled as of 2019.

The level of biological information available for various rosewood species varies widely. Information for some species, such as *Dalbergia odorifera* and *Dalbergia tonkinensis* is limited, as shown in Annex II Table 1. While other species such as *Pterocarpus erinaceus* or *Dalbergia retusa* had much more information available, as shown in Annex II**Error! Reference source not found.**.

Biological information is required in order to assess the intrinsic risk to a species from harvesting pressure. In general, the longer a species takes to reach maturity, with low or disturbed recruitment potential and slow growth rates – the higher the intrinsic harvest pressure risk to the species. Other factors such as susceptibility to disease and browsing by herbivores are compounding risk factors that should also be considered during the NDF process.

Many Parties and commentators save said throughout CITES meetings that if there is limited information available about the biology of the species, especially since the taxonomy of these species can be in question, that it is not possible to do an NDF[15]. However, this is not necessarily the case. An NDF is essentially a risk assessment of whether a species can handle the harvest pressure being proposed given all the other sources of mortality expected including illegal harvesting. Therefore, if a species has limited information, allowing any sort of trade has a **high risk** of causing detriment to the species.

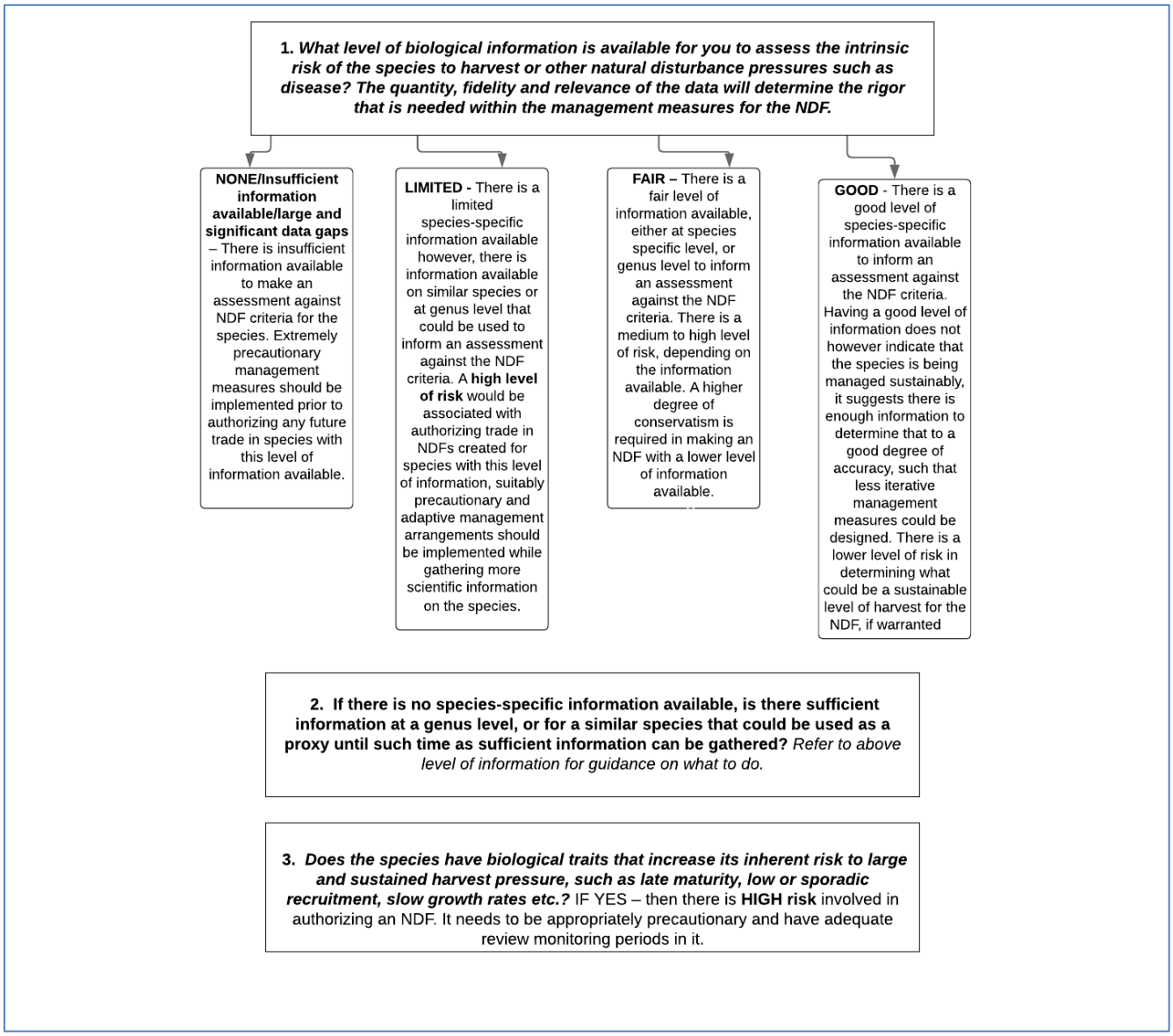
As such – at this step – one is not only determining the intrinsic risk of the species to harvest pressure but also the risk posed by conducting an NDF without full knowledge of the species' biology and how harvesting could impact the species in the long term. Under such conditions, one option might be to permit a lower harvest level over a short monitoring period, while endeavoring to collect the biological information to complete a more robust NDF. However, Range State authorities should

[15] Stated during Party interventions at Plants Committee and Conference of the Parties meetings but not captured in the Summary Records of meetings.

be aware that other CITES Parties, particularly those within the European Union, will scrutinize Range State management arrangements before they permit imports, and such a course of action may trigger either EU trade bans or full CITES trade sanctions.

Another strategy for conducting an NDF on a species for which little information exists is to utilize a similar species for which there are better data as a proxy. This approach involves a medium to high level of risk, however, since one is making an assumption that the two species are similar enough to be proxies for one another in determining the impacts of harvest and other pressures. If this method is utilized, it is very important that authorities put in place an adequate monitoring program to detect any detrimental impact to the CITES-listed species and endeavor to fill in gaps in biological information on the target species.

QUESTIONS TO ASK



IV. WHAT PRESSURES AND THREATS DOES THE SPECIES FACE?

The purpose of a CITES NDF is to determine what level of harvest – if any – of a listed species would not be detrimental to the species. To make that determination it is very important to take *all* sources of mortality into consideration, not just existing or proposed levels of legal harvest. In the case of rosewood species, if the NDF only takes existing or proposed legal harvest into account, it will almost certainly set a harvest level that will be detrimental to the species.

For a harvest level to be sustainable, the total species biomass removed annually by *all sources of mortality* must be replaced through recruitment into the population and annual growth rates of remaining trees. Authorities should therefore collect and analyze all available data on current levels of documented harvest and export, and cross-check export levels and destinations against internationally-available data on imports into major markets, China and Vietnam in particular.

Apart from legal harvest, other major sources of mortality for rosewood species include things common to many timber species such as pests, disease, natural disasters such as storms or forest fires, drought and domestic use for fuelwood and building materials in the informal economy.

For CITES-listed rosewood species, the greatest source of mortality is by far undocumented and illegal logging for international trade. Indeed, illegal logging of rosewood far outweighs sustainable harvesting. Indeed, many Range States have entirely prohibited logging of a number of highly exploited rosewood species through national legislation. It was the inefficacy of national bans, in the face of the booming international trade of rosewood to China, that caused many Range States to turn to CITES in the first place.

It is difficult to directly document levels of illegal harvest and export, but it is not impossible, using proxies. As noted above, reliable reporting on imports of various rosewood species, including reported country of origin, is produced by international non-governmental organizations, drawing on various government and private sector trade databases. If a country in Southeast Asia, for example, has a ban on the export of rosewood logs in place, but data on imports by a neighboring country show high levels of imports of rosewood logs from that source country, the source country likely has a major rosewood illegal logging problem and should not consider setting an export quota in its NDF at anything other than zero.

Authorities in countries experiencing high levels of illegal logging and associated trade will find it very difficult to complete a credible NDF for rosewood, unless they set zero-harvest quota. Range States who nonetheless allow for harvest under such conditions risk having CITES Parties impose a zero-harvest quota, as has happened with the Appendix II-listed Madagascar populations of *Dalbergia spp*. and *Diospyros spp*. In cases such as Madagascar, where illegal logging is acknowledged to be a significant problem, rosewood has become scarce due to over-exploitation, and remaining populations lie mostly within National Parks and other strictly protected forest areas, the most credible result of an NDF process will be to propose the rosewood species in question for uplisting to Appendix I (Waeber *et al*. 2019).

In carrying out an NDF for a CITES-listed species, or groups of species, authorities may wish to assess the extent to which depletion of CITES-listed species may in turn intensify threats to *other* rosewood species that are not yet listed. Based on their global survey, Winfield *et al*. (2016) noted that:

> There is clear evidence that trade in rosewood species rapidly shifts from one highly-valued species to another as stocks become depleted. Following the 1992 listing of *Dalbergia nigra* (Brazilian rosewood) on CITES Appendix I, Madagascan *Dalbergia* species began to appear in trade data at much higher levels than previously recorded. Similarly, following the 2013 listing of *Dalbergia cochinchinensis*

(Siamese rosewood), Malagasy *Dalbergia* species and several South American *Dalbergia* species, trade shifted to *Pterocarpus* species, particularly *Pterocarpus macrocarpus* (and its synonyms) in Asia and *Pterocarpus erinaceus* from West Africa.

The timber market has shown surprising adaptability to changes in law enforcement and regulation around the world. Since the listing of the entire *Dalbergia* genus at COP-17, for example, CITES Parties have noted during debates at 2017 and 2018 CITES Plants Committee meetings that they were already seeing a shift in the market to various "look-alike" rosewood species not yet listed by CITES. It is therefore advisable for countries that are Range States for such look-alike species to consider the current and potential impacts of harvest of the CITES-listed species on look-alike species in their NDF.[16]

Apart from the risk of rising pressure on non-listed look-alike rosewood species, there is an additional very likely risk that rosewood harvesters and traders will continue to harvest a CITES-listed species and simply export it under the name of a non-listed species. Myanmar and Thailand, for example, are Range States for CITES-listed *Dalbergia oliveri* (Burmese rosewood) but are also Range States for the non-listed species *Pterocarpus macrocarpus* (Burma padauk). It has been reported that restricted Dalbergia species such as *Dalbergia oliveri* and *Dalbergia cochinchinensis* are being harvested and exported as *Pterocarpus macrocarpus*, to get around CITES restrictions.[17] Therefore in order to ensure an effective management of the Dalbergia species, Forestry authorities may need to establish stricter management and export measures for *Pterocarpus macrocarpus*, in order to reduce pressure on both species and more effectively enforce CITES obligations.

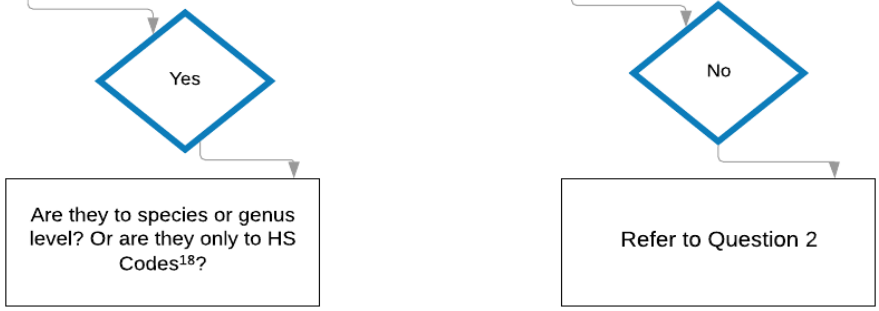
[16] Article II paragraph 2(b) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is known as the look-alike principle. It states "other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control" which means any species that is unable to be distinguished from the endangered/threatened listed species – should also be listed in the Convention in order to ensure effective implementation of the listing for the endangered/threatened species.

[17] See for example, EIA 2014 and Treanor 2016, and general information on *Pterocarpus macrocarpus* in Winfield *et al*. 2016.

QUESTIONS TO ASK

1. Are there any sources of data available to species level in your country for harvest or export?

Unlike NGOs and private sector firms, CITES authorities, as governmental entities, should be able to access detailed customs records relatively easily, without significant costs.



2. Are there any industry associations, representatives or companies you can ask for more detailed information?

N.B. If industry is asking to export species, they should be able to provide you with records of what they have exported in the past and in what levels – if they are unable to do this – how can they expect you to provide them with an export permit to attest that their trade is non-detrimental?

3. Do you have access to any pay for service customs record data such as www.Trademap.org or other open source data sources?

If industry isn't able to provide data, or you are dubious of the records they supply, pay for service such as trademap.org can provide additional clarity as to the level of harvest and trade from your country.

3. Do you have access to any pay for service customs record data such as www.Trademap.org or other open source data sources?

If industry isn't able to provide data, or you are dubious of the records they supply, pay for service such as trademap.org can provide additional clarity as to the level of harvest and trade from your country.

4. Is the harvest or trade level requested in dry weight or wet weight?

The weight of different wood species can change dramatically based on whether the reported weight is wet weight or dry weight – it is important that this distinction is clarified in any authorized to be authorized.

5. What is the level of wastage associated with an export level? I.e. what is the actual level of harvest (i.e. what is the reduction in standing volume) from the forest compared to reported export numbers?

This is basically asking what the reduction in standing volume within the forest is. The sustainability of an export quote should be based on the actual removal of biomass form the forest, including wastage, and not on the actual volume or weight exported.

[18] The Harmonized Commodity Description and Coding System, also known as the Harmonized System (HS) of tariff nomenclature is an internationally standardized system of names and numbers to classify traded products. Products are organized logically by economic activity or component material. Wood products are classified under Chapter 44, while furniture is classified under Chapter 94. Each separate product has its own code, with a corresponding description.

V. NDF IMPLEMENTATION CONSIDERATIONS: COUNTRY CONTEXT, LEGAL FRAMEWORK, AND MANAGEMENT MEASURES

Once the data and information discussed in Sections I-IV have been gathered and assessed for quality, a Range State can make its NDF. If the finding results in setting a zero-export quota, then the task of the Range State with respect to its CITES obligations becomes straightforward: ensure that the species is not exported, and that smugglers are deterred and sanctioned. If, however, the Range State determines in its NDF analysis that some level of export can be maintained without detriment to the species, another set of considerations comes into play: the Range State must then determine the extent to which it has in place legal and management measures and capacities to ensure that harvest and export is carried out in line with the findings of the NDF. And these considerations need to be assessed in the broader context of a country-specific conditions that can strongly influence the course of NDF implementation in the field.

Country Context

Forestry management around the world varies widely, and so do countries' legal and management regimes. There is no "one size fits all" approach. Each harvest regime proposed should be analyzed for merits and improvements, taking into account the unique characteristics of the country and species in question, and all associated risk factors revealed by the NDF process.

A significant challenge for developing NDFs for rosewood species is that the forestry sectors of many rosewood Range States are characterized by incomplete or outdated legal frameworks and procedures; weak forestry management regimes; meager forestry budgets; and low levels of technical and human resource capacity. Corruption is also a significant problem: The majority of Range States for CITES-listed rosewood score poorly on Transparency International's Corruption Perceptions Index for 2018, and corrupt practices connected to the rosewood trade have been extensively reported on in many Range States.[19]

A number of rosewood Range States face longstanding overall deforestation pressures as well. The Southeast Asian rosewood range stats of Cambodia, Myanmar and Laos have, for example, lost an average of 9 percent of their primary forest since 2002 (Global Forest Watch 2019).

A threshold condition for an NDF to allow for the export of CITES-listed rosewood species is, therefore, relative assurance of state capacity to limit illegal cutting and clearing of natural forests where the species occur or are thought to occur, and to effectively prevent and sanction illegal export of the species. An inability of Range States to stem the tide of illegal harvesting is likely to preclude the ability to export the species sustainably, because an NDF must consider *all* sources of mortality. Therefore, if you determine what a sustainable level of harvest is, but the illegal harvest is estimated to be far greater than this level, the Scientific Authority must not authorize any level of harvest above the sustainable limit. Therefore, Range State authorities who face ongoing and widespread illegal logging and forest clearing will be forced to decline to authorize exports of CITES-listed rosewood species, which are, by definition, already over-exploited and sought after by illegal loggers and traders.

In addition, Parties are required to make a Legal Acquisition Finding along with the Non-Detriment Finding. This determination, which is made by the Management Authority, states that they have full confidence that the species being presented for export was harvested in accordance with all relevant

[19] On links between the illicit rosewood trade and corruption, see, for example: Sharife & Maintikely (2018) on Madagascar; EIA (2018) on Nigeria; BBC, May 22, 2019 on Gabon; Global Witness (2015) on Cambodia, EIA (2014) on mainland Southeast Asia.

laws and regulations. In a state where there is rampant illegal logging and harvesting, and where timber tracking and traceability schemes have yet to be implemented, it would be difficult for Management Authorities to provide a legal acquisition finding

Indicative Core Legal and Management Measures

While it is beyond the scope of this Guide to provide guidance on best practices for overall forest legal frameworks and management regimes, effective implementation of the CITES rosewood listings – particularly completing a robust NDF and making a Legal Acquisition finding – does oblige Range States to consider the extent to which their system possesses the following basic elements:

- A ***basic forestry law*** or set of laws that defines what is forest land and what is not, and who owns, controls and manages it.

- A ***forest land use allocation system*** that determines where timber may or may not be harvested (e.g. protected areas versus forests allocated for timber production).

- A ***licensing or permitting system*** that regulates who may harvest the species in question, where, and under what restrictions and conditions (e.g. technical requirements on inventory, cutting volumes and methods; restrictions on cutting near watercourses or on steep slopes; community relations and social dimensions.)

- Provisions for development, and monitoring of ***management plans*** for specific forest areas (or for extraction of the CITES-listed species, e.g. on community-controlled forest lands);

- Rules and procedures governing the ***transport and traceability*** of harvested material from the forest to export, including maintenance of relevant chain-of-custody documents;

- Any rules and procedures relevant to ***royalties, fees and taxes*** on the listed species.

- Laws of general application prohibiting various forms of ***bribery and corruption***.

We do not mean to suggest that a Range State needs to have perfected all of these elements of their legal and management regime applicable to forests – few states have. Rather, we recommend that Range State authorities make a clear-eyed and honest assessment of where there may be gaps and weaknesses in these elements of their legal and management regime that may impact the ability to effectively implement an NDF (other than an NDF mandating a zero-harvest quota) and adjust their NDF accordingly.

VII How To do a Non-Detriment Finding – A Hypothetical Example

HYPOTHETICAL NDF EXAMPLE **Species: *Dalbergia exceptionalis*** **Range State: Faircoast**
The situation: The Faircoast CITES Scientific Authority (SA) has received a request from the Faircoast Forestry Department to authorize a future ongoing harvest and export of 2 million tonnes of newly discovered *Dalbergia exceptionalis* from the country. *Dalbergia exceptionalis* used to be widespread across the island nation, but rampant illegal logging 15-20 years ago effectively wiped out the known population of this species from the island. It was known to only to exist in small pockets in some National Parks. However, it was thought to exist within the interior of the island which until recently was inaccessible. As such, no surveys have ever been conducted. In the 20 years since logging on the island ceased, there has been minimal regrowth and recruitment of this species into National Parks and other forested areas where it once thrived. A mining company has discovered gold within the interior and has built roads into areas of the country previous inaccessible, which has led to the discovery of large tracts of forest that is thought to contain significant stands of *Dalbergia exceptionalis*. Despite having been heavily targeted in the past, there is only limited biological information available about the species. The mining company and forestry department have provided a dossier of what limited information exists.
NDF for *Dalbergia exceptionalis* for 2019-2020 from Faircoast
NDF INTRODUCTION – The CITES SA of Faircoast has received an application from Faircoast Forestry to authorise the export of their planned harvest of 2 million cubic tonnes of *Dalbergia exceptionalis* from the newly discovered forests of the interior. This area was never designated as a National Park because it was considered too harsh of terrain to ever be exploited but makes up over 80% of the remaining forests on the island. Many of our national park have little to no remaining stocks of this species due to illegal logging 15-20 years ago. The application received from the forestry department outlines that 5 different harvesters will be given quota and 10 different exporters will then be authorised to export this quota overseas.
TAXONOMY – *Dalbergia exceptionalis* is one of five species of *Dalbergia* found on the island. Until this latest discovery, it was considered to be one of rarest. When the tree is in the forest and flowering, it is relatively easy to distinguish from the other *Dalbergia*, as it has bright yellow flowers, whereas all others on the island have white flowers. However, it only flowers once a year, and at other times it is impossible to distinguish from two other species (*D. ordinarias* & *D. fantasticis)*. *D.fantasticis* is a protected species and its harvest is prohibited by Faircoast law. **RISKS:** It is possible that protected species will be harvested instead of the target species.

CONSERVATION STATUS – This species has never been listed on the protected species list because it was considered functionally extinct in all areas where it had been previously though to exist.

It is however listed as Vulnerable on the World Red List of Threatened Species. This assessment is considered to be out of date, though, as it relies on information from 15-20 years ago. The more accurate assessment would be that this species is ENDANGERED. A new Red List assessment is expected to be released shortly that revises the conservation status of this species.

One of the look-alike species is also endangered and protected (*D. fantasticis*). *D. ordinarias* is assessed as near-threatened. Assessments of both of these species are also out of date, however, and the threat category worldwide is likely to be higher than indicated.

On Faircoast – the Scientific Authority assesses that all three species are **Endangered.**

DISTRIBUTION – Until recently, this species was only known to exist in very small pockets in some of Faircoast's National Parks, but populations were not of commercially-exploitable size or volume.

The Forestry Department has reported that the newly discovered and accessible *Dalbergia* forest is over 5 million hectares, but the species composition is unknown. The Scientific Authority considers it **HIGHLY LIKELY** that there is more than one species of *Dalbergia* in this forest, and that those species found there are likely to be the last remaining healthy stocks in the country.

Information Available – Assessed as Limited for this criterion.

BIOLOGY – This species is known to grow to a height of 35m and a Diameter at Breast Height (DBH) of 200cm. The annual growth rate is unknown, but it is reportedly a slow-growing species. Trees harvested in the past that were 80cm DBH were aged to be over 250 years old.

This species grows around the world, when in dry, natural habitats this species is considered a deciduous tree while in moist conditions the trees can remain evergreen throughout the year. The Faircoast habitat in question is considered moist, so it is expected that the species will be evergreen year-round.

Flowers are bright yellow, with flowering seemingly changing every year (pers comm. field scientists, 2018), but occurring between February and June each year for a month to 6 weeks.

Information available – Assessed as Limited to Fair for this criterion. While more information would be advantageous, there is sufficient information available to conclude that the species is extremely slow growing and that it will take a very long time to regenerate, even if recruitment into the population is high.

RISKS – Given that this species, and others like it have been heavily targeted in the past, and we have seen little recovery in regions that haven't been logged for 15-20 years indicates this species has limited ability to recover from depletion events.

The Scientific Authority must therefore ensure that any harvest regime takes this into consideration and leaves sufficient "parental stock" in any harvested area, so that new recruits into the population can be achieved. Logged forests are going to take in excess of 100

years to regenerate back to pre-harvest levels (possibly even 200 years) due to the slow growth rate of this species.

POPULATION STATUS and TRENDS – There is no current information available on the population status and trends of this species, since this is a newly exploited forestry region. The population that exists within National Parks is considered remnant, as there are not very many trees left.

It is assumed due to the pristine nature of this area that the population is exhibiting the desirable reverse J curve which indicates a stable population. We therefore must ensure we maintain this through our approved harvest regime. There is also no density of trees per hectare provided.

Information available – **None** – Since we have limited information available, we will have to utilise the forest area and cover as a proxy to estimate the potentially viable biomass that can be harvested. This is inherently High Risk.

THREATS – The biggest threat facing *D. exceptionalis* is illegal logging. The species is targeted for its rich red hardwood core. Old trees of this species are large, sometimes reach a diameter of 200cm, which means they are highly prized for furniture and ceremonial carvings. Illegal logging was rampant 15-20 years ago, which effectively wiped out populations of the species known and accessible at the time.

The newly-opened forest area is still very remote, but there are now roads that do provide easier access for people who may wish to illegally fell these trees. The roads in and out of the area are currently only accessible to the mining company, their employees and forestry officials – who will provide authorization to utilize the roads to the 5 harvesting companies. These companies have suggested they will build additional roads to further utilize the forest under the concessions expected to be provided by the forestry department.

The long-term plan is to allow the public to use these roads as well, which will further increase the risk of illegal logging in this region. The distance to the island's ports from the interior is significant, however, making transport expensive, which may offset the illegal logging risk to some degree.
Planned mining activities also pose a threat to this species, as some 50-100 hectares of forest will be cleared for the mine and associated road infrastructure, both directly and indirectly affecting the species in question. There is also a risk that the mining activities themselves could have detrimental impacts on the forest from heavy metal contamination of the water supply or chemical contamination from the mining process. These risks have been assessed by the Environment Department, with management plans in place to mitigate the impacts. There is, however, a risk that these measures will not be effectively implemented or adequately monitored over time.

We do not know of any other risks to this species, as we have no information on diseases or pests that could post a threat. There is little to no threat of fire in this region due to the high level of rainfall.

Harvest level – As previously noted, there is currently no harvest of this species and it has not been harvested for 15-20 years. There are not, therefore, any previous data with which to determine what a sustainable harvest level would be. Clearly the previous harvests 15-20 years ago were not sustainable.

The proposed level of export of 2 million tons per year is extremely high given the level of uncertainty in the data available. While 5 million hectares may seem like a large tract of

forest from the perspective of Forestry Department officials, the forest area where the species was previously harvested covered more than 12 million hectares and the species was nonetheless harvested to commercial extinction in less than 20 years.

The figure provided by forestry is also an export quota, rather than a harvest quota. Presumably this means that the trees have been cut into logs, and potentially dried (which makes them lighter), so the actual level of harvest from the forest is likely to be much higher. No information has been provided on the actual expected level of harvest from the forest. It is also impossible at this time to determine the potential level of waste as planned harvests move along the supply chain from forest to port.

Management Measures –The forestry department has provided a very brief management plan for this proposed harvest and export of 2 million tons per year. They plan to allocate this harvest level across five logging companies, but there are no other management arrangements that have been agreed at this time. How this quota will be allocated and managed to ensure that logging companies do not exceed their harvest quotas is also unknown.

NDF Finding – The following options for an NDF finding are provided as examples of how a Scientific Authority could choose to deal with this circumstance. There is no "right" answer – but there is a wrong answer – if the harvest regime implemented turns out to be detrimental – it was a wrong decision. Hence, ensuring that any detrimental impact from the harvest authorised is monitored and reported and then acted on, should ensure that it can be corrected before lasting impact.

OPTION 1 – Scientific Authority finds that there is insufficient evidence to support a positive Non-Detriment Finding at this time. The Forestry Department, logging companies and exporters are requested to conduct research and provide the following information (at a minimum) before an NDF can be made:

1. A population survey of a representative sample of the forest to provide an estimate of the following:
    a. Species composition;
    b. Density per hectare of each *Dalbergia* species; and
    c. Size/class distributions of the *Dalbergia* species populations.

2. More extensive management plans on how the Forestry Department plans to ensure there is no illegal logging, how a sustainable level of harvest was/is determined, and measures to be put in place to detect and mitigate any detrimental impacts.

Therefore, a zero harvest and export quota is implemented for a period of two years or until this data is collected and provided to the SA (if collected sooner than two years).

OPTION 2 – The Scientific Authority finds that the proposed harvest and export of 2 million tonnes of *Dalbergia exceptionalis* is likely to be **DETRIMENTAL**.

However, we recommend the following strict harvest limit will be non-detrimental for the following two years, while sufficient information is gathered such that a longer term NDF and forestry management plan could be implemented.

We authorize that all *Dalbergia spp.* trees may be exported from the 50-100 hectares of land that will be cleared for the establishment of the gold mine. These trees will be harvested anyway and should be put to good use. At least part of the revenue from the sale and export

of these trees *must* be utilized to gather additional information to inform a longer term NDF post 2020 (details as above and below on what types of measures are necessary).

It is also suggested that this clearing be utilized as an additional survey point to understand the density per hectare of each of the *Dalbergia* species in the region. Once harvested, samples should be collected for DNA or wood anatomy testing to determine what species they are.

No trees are to be harvested outside of the gold mine area.

The forestry department must ensure that no harvest occurs outside this area.

If any harvest is detected outside this region over the coming two years – all future NDFs are likely to be negative findings due to the risk of over harvesting or illegal harvesting, so all stakeholders have an interest in ensuring that illegal logging does not occur.

It is also recommended that the Forestry Department consider collecting seeds and saplings that could be transplanted and utilised to revegetate national parks in the rest of the country to help the wider recovery of this species.

OPTION 3 – The Scientific Authority finds that the proposed harvest and export of 2 million tonnes of *Dalbergia exceptionalis* is likely to be **DETRIMENTAL**.

However, in addition to the 50-100 hectares of forest that will be cleared for the gold mine (details above), we recommend the following harvest limit will be non-detrimental for the following ONE YEAR, while sufficient information is gathered such that a longer term NDF and forestry management plan could be implemented.

A total of 50 *Dalbergia* trees per hectare for 20 additional hectares (a total of 1000 trees) **TOTAL** may be harvested and exported for the following year. This assumes that there is at least 100 *Dalbergia* trees per hectare – which is what we expect from other field surveys of *Dalbergia* forests that have a stable population.

NO CLEAR CUTTING is authorized outside of the gold mine area. This quota is NOT LIMITED to *Dalbergia exceptionalis* and includes ALL *Dalbergia* species due to the difficulty in telling them apart.

Once harvested, samples should be collected for DNA or wood anatomy testing to determine what species they are.

At the end of this year – the Forestry Department must have determined the following:

- Species composition and how it varies across the region (i.e. harvest the 20 trees from varying areas across the now accessible forest);
- Species density per hectare for each *Dalbergia* species harvested;

In addition, the Forestry Department should, by the end of the year:

- Have robust measures in place to ensure no illegal logging is taking place
- Have a monitoring program in place to detect any detrimental impacts, in the short and long term

Should this data be collected, the Scientific Authority will re-assess the harvest limits for the following year, if no additional information is gathered, no further harvest or export will be authorized.

It is also recommended that the Forestry Department consider collecting seeds and saplings that could be transplanted and utilized to revegetate national parks in the rest of the country to help the wider recovery of this species.

EXAMPLE NDF EXAMPLE with REAL WORLD SPECIES AND DATA

Species: *Dalbergia sissoo*

Range States: Afghanistan, Bangladesh, Bhutan, India, Islamic Republic of Iran, Iraq, Myanmar, Nepal, South Africa, Philippines and Pakistan[20]

The situation: India harvest a considerable amount of Dalbergia sissoo, reportedly from plantations across the country. As such, they have requested for Dalbergia sissoo to be removed from CITES Appendix II, because "it doesn't meet the biological criteria" for listing on Appendix II.

This species was not listed on CITES under the biological criteria, it was listed under the look-alike provisions of paragraph b of the CITES listing criteria.

Using the information provided in the CITES proposal to remove *Dalbergia sissoo*, a sample NDF has been developed, which would meet the same objective as de-listing the species, without creating loopholes for illegal traders to mislabel shipments as *Dalbergia sissoo* when they are really a much more endangered species or rosewood.

SAMPLE NDF

NDF INTRODUCTION – Dalbergia sissoo, colloquially called Indian Rosewood, is a fast-growing species that has a widespread distribution. According to the CoP 19 Prop 51 this species range includes Afghanistan, Bangladesh, Bhutan, India, Islamic Republic of Iran, Iraq, Myanmar, Nepal, South Africa, Philippines and Pakistan[20]. However, according to the Global Invasive Species Database[21], this species is only native to Bhutan, India, Myanmar, Nepal, Oman and Pakistan, and is invasive to over 30 other countries, with many populations becoming naturalized. It is economically important throughout its range for forestry, agroforestry and horticulture. It is utilized for its timber, fuel wood, fodder, medicines etc.[20].

This non-detriment finding will discuss all matters that are relevant to determining what a sustainable level of harvest is for this species such as whether there is any ambiguity in the taxonomy of the species, how its biology could make it susceptible to overharvesting or not, and whether the management measures in place are adequate. It is imperative for this non-detriment finding that management plans and practices are not just simply words on a page, but they are implemented accordingly and continually monitored for required adjustments if/when detrimental impacts are reported

TAXONOMY – *Dalbergia sissoo* is considered in some literature to be a synonym *of Dalbergia latifolia* (Winfield et al, 2016). "*The Invasive Species Compendium (2013) states that D. latifolia and Amerimnon sissoo are considered synonyms[22], while a genetic study undertaken by Rout et al. (2003) suggested that D. latifolia and D. sissoo shared a minor cluster relationship with a 50% similarity. The Plant List (2013) also supports Amerimnon sissoo as a synonym. According to the Wood Database (2015), the status of D. sissoo as an official rosewood is disputed because its density, hardness, and color intensity is lower than other rosewoods."*[9]

[20] CITES, 2019. CoP18 Prop. 51 - Proposal to remove Dalbergia sissoo from CITES Appendix II, India, CITES.
[21] Global Invasive Species Database , 2016. Species profile: Dalbergia sissoo. [Online], Available at: http://www.iucngisd.org/gisd/species.php?sc=1186, [Accessed 10 June 2016].
[22] Invasive Species Compendium, 2013. Datasheet report for *Dalbergia sisso*. [Online], Available at: http://www.cabi.org/isc/datasheet/17808 [Accessed 20 June 2016]

RISKS: It is possible that protected species will be harvested instead of the target species.

CONSERVATION STATUS AND LEGAL INSTRUMENTS OF PROTECTION

Dalbergia sissoo has not been assessed by the IUCN Red List for conservation status. In India, *D. sissoo* is not in any threatened category. The Wild Life (Protection) Act, 1972 prevents removal of any tree from any Protected Areas and this species is found in the following Protected Areas (CITES, 2019):

- Nandini Wildlife Sanctuary of Jammu and Kashmir,
- Corbett National Park,
- Rajaji National Park of Uttarakhand,
- Sher Jung National Park of Himachal Pradesh,
- Pilibhit Tiger Reserve,
- Dudhwa National Park of Uttar Pradesh,
- Valmiki National Park,
- Kanwar Lake Bird Sanctuary of Bihar,
- Daying Ering Wildlife Sanctuary of Arunachal Pradesh,
- Bura Chapori Wildlife Sanctuary of Assam.

Throughout India, the harvest of *D. sissoo* is regulated differently in each territory. CITES (2019) provides the following details:

Region	**Status**	**Rules and Regulations**
Jharkhand, West Bengal	Restricted Species	Jharkhand Timber and Other Forest Produce (Transit and Regulation) Rules, 2004 (with amendments proposed in 2010) - tree of *D. sissoo* can only be removed after obtaining permission from DFO or authorized ACF
West Bengal		West Bengal Private Forest Act, 1948', 'West Bengal Forest Produce Transit Rules, 1959' and 'West Bengal Trees (Protection and Conservation in Non-Forest Areas) Act, 2006' These regulate permission for felling and transit of trees grown on private lands and permission is mandatory for11 species, including D. sissoo
Assam	Reserve Tree	Assam (Control of felling and removal of Trees from Non-Forest land) Rules, 2002 vide Notification No. FRM-88/2001/77 dated 7th May, 2002 regulates felling permission and transit of timber derived from non-forest areas of Assam
Haryana		Only dead, diseased and drying trees of *D. sissoo* are being harvested. Working plans of the state do not prescribe for green felling of D. sissoo. However, green trees are harvested only in case of emergency felling when forest area is diverted for non-forestry activities.

Punjab		*D. sissoo* is the state tree of Punjab and no green tree of this species has been marked for felling as per the Working Plan of the state

DISTRIBUTION – According to CITES (2019) in India, the wild subpopulations of *D. sissoo* are widely distributed in the sub-Himalayan tracts and outer Himalayan valleys of India and the species is also found naturalized outside its wild occurrence (extending up to southern India). The wild subpopulations of *D. sissoo* are found in the following regions:

• Jammu and Kashmir,	• Punjab,
• Haryana,	• Uttarakhand,
• Himachal Pradesh,	• Uttar Pradesh
• Bihar,	• West Bengal
• Assam,	• Arunachal Pradesh

This species is also found in wild condition in the following Protected Areas within the regions above[20]:

- Ramnagar Wildlife Sanctuary, Jasrota Wildlife Sanctuary and Nandini Wildlife Sanctuary in Jammu and Kashmir,
- Saraswati Plantation Wildlife Sanctuary in Haryana,
- Nangal Wildlife Sanctuary in Punjab,
- Sher Jung National Park in Himachal Pradesh,
- Corbett National Park, Rajaji National Park in Uttarakhand,
- Pilibhit Tiger Reserve and Dudhwa National Park in Uttar Pradesh,
- Valmiki Tiger Reserve, Kanwar Lake Bird Sanctuary in Bihar,
- Daying Ering Wildlife Sanctuary in Arunachal Pradesh
- Bura Chapori Wildlife Sanctuary in Assam.

Dalbergia sissoo is the second most important cultivated timber tree in India. The species can be found in plantation/cultivation and/or agroforestry system in almost every parts of the country and it is very common in the northern, north western, central, eastern parts of country mainly along highways, roads, riverbeds, water bodies, railway tracks, lands for cultivation and also found in villages, cities, forest area. In Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Odisha, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand, West Bengal, D. sissoo is found almost in every villages/town/cities.

Information Available – Assessed as **Good** for India.

BIOLOGY – In India, "*the species is considered as pioneer species in riverine succession of sub-Himalayan tracts and outer Himalayan valleys. The species is fairly drought-resistant and frost-hardy (CSIR, 1952)". The rate of regeneration (RR) is moderate to high in different parts of country, ranging from 136% to 1218% (Bhattacharjee & al., 2018).The species usually flowers between February to June (rarely in September in some parts of South India) in India and the fruiting period of the species is usually between end of March to December (- February).*[20]

Role in the Eco-system in India

CITES (2019) states *"The species is largely used in agroforestry, plantation, afforestation, reforestation programmes. It is a nitrogen fixer and also improves the soil fertility with its leaf litter which decomposes slowly and releasing nutrients gradually. The honey is dark amber and strong-flavoured and 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 such as epiphytic orchids, ferns, and fungi, lichens, etc. and also for birds and other insects. Based on available records there are no dependent species for D. sissoo."*

All available species biology in literature was summarised in Winfield et al (2016) – CoP17 Information Document 48 as follows:

DALBERGIA SISSOO			
Height (m)	**Diameter (cm)**	**Flowering Season**	**Fruiting Season**
10-15 (dry areas) [116] Up to 30 (wet areas) [116] Up to 30 [87] (favourable conditions)	80 [87] (favourable conditions).	India March to April [117]	March to April [117]

Habitat Type/natural density	**Reproduction/survival strategy and germination/regeneration potential**	**Growth rates and heartwood development information**
This is a deciduous tree species located in tropical to subtropical climates in natural and planted forests, mainly along forest margins near streams and rivers, hammocks, canopy gaps, agricultural areas, disturbed sites and roadsides [117, 116]. Rainfall range: [87, 116]. - 500-4570 mm. - Often associated with seasonal monsoon and periods of drought up to six months. Altitude range: 0-1500 m [87]. Mean annual temperature: -4 to 45 °C [87]. Soil preference: [87] - Wide range of soil types, from pure sand and gravel to rich alluvial soil of riverbanks. Growth is slow in poorly aerated sites, like heavy clay soils. - pH tolerated = 5-7.7.	Reproduction - Reproduces via seed and vegatively through suckers arising from their root system [116] and it is useful for stabilizing eroding sites [87]. In South Asia, it is found in a variety of wastelands where it is known as a colonizing species [87]. - Mature pods remain attached to tree for 7-8 months [87]. Seeds disbursed via wind and water [116, 87]. - Ability to coppice vigorously up to around 20 years of age [87]. Germination rates - High germination rate [117]. - Up to 83.6% in fresh seeds [117]. - 73.68% in naturally pollinated individuals [117]. - 73.99% in self-pollinated individuals [117]. Regeneration - Successful regeneration requires plenty of moisture [86, 116, 87]. - Rarely regenerates under shade [116, 85]. Strong light demander from the seedling stage onwards [116]. - Weed growth poorly affects regeneration [116].	Second most widely cultivated species in South Asia due to its fast growth [15]. Growth rates - 3.7 meters in one year, 5 meters in three years, 11 meters in in five years and 15 meters in ten years [87]. Wood density (oven dry mass/fresh volume) - 0.669 (South-east Asia) - 0.760 g/cm3 (India) [102, 103].

[85] - Lusweti, A., Wabuyele, E., Ssegawa, P. & Mauremootoo, J., 2011. Dalbergia sissoo (Indian Rosewood): Fact Sheet. [Online] Available at: http://keys.lucidcentral.org/keys/v3/eafrinet/weeds/key/weeds/Media/Html/Dalbergia_sissoo_(Indian_Rosewood).htm, [Accessed 1 July 2016].
[86] - Global Invasive Species Database[21]
[87] - Orwa, C. et al., 2009. Agroforestry Database: A Tree Reference and Selection Guide 4.0. [Online].Available at: http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp [Accessed 11 May 2016].
[102] - Chave J, J. et al., 2009. Towards a worldwide wood economics spectrum. Ecology Letters, 12(4), pp. 351-366.
[103] - Zanne, A. E. et al., 2009. Towards a worldwide wood economics spectrum. Dryad Digital Repository. Available at: http://dx.doi.org/10.5061/dryad.234, [Accessed 10 May 2016].
[116] – Invasive Species Compendium[22]
[117] - Sharma, R., Chauhan, S. K. & Khajuria, H. N., 2009. Reproductive Biology and Variability Studies in Dalbergia sissoo. Journal of Tree Sciences, Volume 28, pp. 23-38.

POPULATION STATUS AND TRENDS

Habitat and Population Trends

According to the *'India State of Forest Report 2017'*, the total forest cover of the country is 708 273 km2 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 km2 forest cover at the national level was recorded. Three states, namely Andhra Pradesh, Karnataka and Kerala had contributed to an increase of 2141 km2, 1101 km2 and 1043 km2, 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 km2), Assam (567 km2), Telangana (565 km2), Rajasthan (466 km2), Himachal Pradesh (393 km2), Uttar Pradesh (278 km2), Jammu and Kashmir (253 km2) and Manipur (263 km2). The states which showed reduction in forest cover primarily include Mizoram (531 km2), Nagaland (450 km2) and Arunachal Pradesh (190 km2).[20]

Despite this, CITES (2019) states that the population trend for *D. sissoo* is slightly decreasing in some parts of the country due to diseases. In addition, it states that the population density of the species has also declined in the past, specifically in the areas of Bihar, Odisha, Punjab, Haryana, Uttarakhand, Uttar Pradesh – where the decline has been in planted/cultivated populations, rather than the wild. However, due to its high capacity for regeneration and naturalisation, it has spread into new areas of India such that its overall geographic range has increased[20].

Population size

CITES (2019) states "*As per the NDF study (Bhattacharjee & al, 2018) of D. sissoo in India, 8 to 38 mature individuals are found per hectare (Annexure 1) for wild population in different parts of country, whereas it is 3 to 39 per hectare (Annexure 2) for cultivated stocks and up to 1600 per hectare for pure and mono specific plantations. The Extent of Occurrence (EOO) of D. sissoo in India is at least 1, 98,974 km^2 considering only the sub-Himalayan tracts from where wild subpopulations of the species are reported."*

As mentioned above, CITES (2019) provides two annexes with the results of survey work carried out throughout India in both Protected Areas and cultivated plots. The annexes give average density of trees with a diameter at breast height greater than 8cm, seedling/sapling density and regeneration rates for several sites within each location. For ease of reference for this NDF, the information provided in those lengthy annexes has been simplified in Table 1.

Table 1 - Average Tree and Sapling/Seedling Density and Regeneration Rates of Wild *D. sissoo* in India

Wild Population area	Trees Density (DBH > 8cm) (N/ha)[23]	Seedlings/Sapling Density (N/ha)[23]	Regeneration Rate[24]
Arunachal Pradesh	28.55	231.75	777.75
Assam	31.6	90	284
Bihar	14.5	47	303
Himachal Pradesh	23.32	78.88	348
Jammu and Kashmir	26.15	82.33	315
Sikkim	16	45	281

[23] average based on minimum 3 plots of 100 x 100 m

[24] Regeneration rate (RR) = No. of individuals reproduced or regenerated (Nr)/ No. of individuals at the age of reproduction (Ns) x 100

Uttar Pradesh	20.05	53.16	324.66
Uttarakhand	20.75	147	525.25
West Bengal	15	68	453

Table 2 - Average Tree Density of cultivated *D. sissoo* in India (N/ha)

Cultivated Region	Average of No. of trees (DBH ≥ 8 cm)[23]	Cultivated Region	Average of No. of trees (DBH ≥ 8 cm)[23]
Andhra Pradesh	23.5	Madhya Pradesh	20.91
Arunachal Pradesh	17.4	Maharashtra	17.44
Assam	18.84	Odisha	24.23
Bihar	25	Punjab	20.54
Chhattisgarh	18.9	Rajasthan	14.15
Dadra and Nagar Haveli	15.66	Tamil Nadu	15.18
Haryana	27.36	Telangana	28.6
Himachal Pradesh	19	Tripura	10
Jammu and Kashmir	18.96	Uttar Pradesh	22.55
Jharkhand	19.33	West Bengal	15.18
Karnataka	13.79	**Average**	**19.35**

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

CITES (2019) defines the densities as follows: Trees ≤ 5 = Rare; 6–10 = Scarce; 11–20 = Common; >20 = Abundant. The average across the country is 19.35 trees per hectare. While CITES (2019) defines this as common, in many scientific papers on density of *Dalbergia* species, less than 20 trees per hectare was considered rare (Winfield et al, 2016). It is not overly clear whether this is a scientifically determined threshold, or an arbitrary one created by a management authority responsible for management of a dwindling resource. There are a lot of scientific papers in Winfield et al (2016) that have densities of over 100 trees per hectare, which defined low density as 20 trees per hectare or less. This threshold therefore appears to be subjective to the resource being assessed at the time.

Population structure

CITES (2019) states that the "w*ild subpopulations of the national population of D. sissoo are mostly medium-sized, sometimes large, unevenly distributed. As per the survey report (Bhattacharjee & al., 2018) in different parts of India, 43% mature individuals are with 8–20 cm DBH, 37% are with 21–40 cm DBH, 15% are with 41–60 % DBH, whereas 5% are with 61–90 cm DBH. Apart from that plants in seedling/ saplings stage are found in all locations of its wild occurrence and the rate of regeneration (RR) is moderate to high in different parts of country, ranging from 136% to 1218% (Bhattacharjee & al, 2018)."*

Information available – There is a **GOOD** (even excellent) level of information available on the population status of this species. There is a good baseline with which to assess the sustainability of forestry management plans against. If density of trees in size classes necessary to maintain the species drops below 20; then management action can be taken quickly to ensure that population status is not negatively affected by the management action put in place.

DISTURBANCE AND THREATS – The major threat to *D. sissoo* is reported in CITES (2019) to be disease, rather than harvest. However, for an NDF, we must consider ALL sources of mortality, therefore, if disease is seriously affecting the species, such that both the population size and density have both had noticeable decreases, then in order to ensure the species can recover, the harvest regime for those planted/cultivated stands may need to be altered.

India also reports limited illegal harvest due to the high availability of this species in cultivated stands.

Diseases

CITES (2019) states "*the main threats to the wild, naturalised as well as cultivated/ planted populations of D. sissoo are fungal and bacterial diseases and from insects…. The frequency of mortality due to diseases is lower in wild/ naturalised subpopulations than that of in cultivation/ plantation. Several insects, especially two defoliators, PlecoptrareflexaGuenée and Dichomeriseridantis Meyrick have been reported to damage D. sissoo. Plecoptrareflexa is a serious defoliator in nurseries and young plantations (Sharma & al., 2000).*"

"There are two major diseases severely damaging D. sissoo, wilt and dieback, caused by three fungi i.e., Fusarium solani (Mart.) Sacc., Ganoderma lucidum (Curtis) P. Karst and Phellinus gilvus (Schwein.) Pat. The Fusarium wilt disease has been reported from Uttar Pradesh, Bihar and Punjab in plantations, raised on unsuitable sites i.e., stiff, clayey soils and water logged conditions. Trees of advanced age are usually susceptible to the disease. The affected trees die within a few months (Bakshi, 1954)."

CITES (2019) provides details of a number of different fungus that can affect *D. sissoo*, however, the most important aspect is to know that there are a quite a few different diseases that are fairly common both in the wild and in the plantations. The information provided also states that the wild stands tend to fair better than plantations where the diseases can spread a lot easier. This is a type of mortality that must be considered when the final NDF decision is made. It is also noted in CITES (2019) that "*the forest departments of different states (like Haryana) are following a protocol (Bhattacharjee & al., 2018) to combat against the diseases of D. sissoo which is found effective.*"

Information available: Assessed as Good. Low risk harvest regime implemented will not adequately take into account known threats

USES AND HARVEST – DOMESTIC AND INTERNATIONAL

DALBERGIA SISSOO
Commercial Value Assessments • Priced similarly to Teak (India).
Uses High quality furniture, cabinets, decorative veneer, carvings, marine and aircraft grade plywood, tone wood and musical instruments, carving, engraving, tool handles, sporting goods (mallet heads, croquet balls, tennis racket frames), boat building, tool handles, gun cartridges and fuelwood, foliage used as a fodder, traditional medicines, handicrafts, heartwood used as a lubricant oil root wood used to make tobacco pipe [80, 86, 117, 77,84]

[80] - Orwa, Mutua, Kindt, Jamnadass, & Anthony, 2009[25] [86] - Global Invasive Species Database , 2016[21]
[117] - Sharma, Chauhan, & Khajuria, 2009[26] [77] - Jenkins, Bridgland, Hembery, Malessa, & Hewitt, 2012[27]
[84] - The Wood Database, 2015[28]

In India, the wood of this species is highly valued in the wood carving industry, as well as in agroforestry. The Indian CITES Management Authority states in CITES (2019) that "*the legal restrictions on export of D. sissoo products have caused severe financial loss to the wood carving industry during 2017 -18 and livelihoods of around 50 000 artisans is affected*".

However, an article published in the Millennium Post on 31st of October 2018 (http://www.millenniumpost.in/business/wooden-handicrafts-grow-despite-curbs-on-sheesham-325283) states "*EPCH [Export Promotion Council for Handicrafts] with its proactive strategy has been able to ensure that the exports of wooden products of these two species are being made without any hindrance." The exports of wooden handicrafts have registered a* ***growth of 8.97 per cent during the year 2017-18*** *with Rs. 4267.37 crores*". This information is also repeated on the Export Promotion Council for Handicrafts (EPCH) website (https://www.epch.in/index.php?option=com_content&view=article&id=53&Itemid=177) which states that in the period 2017 – 2018 exports increased in dollar terms by 10.52%. This organization is currently the organization given authority to provide "CITES like" documents for any exports.

The total monetary gains estimated for D. sissoo was Rs. 13.4 million per hectare (Jalota& Sangha, 2000). The price of the D. sissoo wood in domestic market is Rs. 400/- to Rs. 750/- per CFT (cubic feet), depending on the quality and distance to source (Sinha & Pasha, s.d.).[20]

CITES (2019) provides the following information about exports from India – "*During February 2013 to November 2016, total 4739 shipments (Quantity: 260347) of D. sissoo worth $ 1,079,870 (https://www.zauba.com) with $4.15 average price per unit and $228 value per shipment were exported from India. The export was from nineteen ports (port of loading) viz., …However, the volume of specimens in trade from wild subpopulations is very small in relation to abundance of the species, and the major part of the traded material is sourced from planted/ cultivated subpopulations (Bhattacharjee & al., 2018).*"

[25] Orwa, C. et al., 2009. Agroforestry Database: A Tree Reference and Selection Guide 4.0. [Online], Available at: http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp, [Accessed 11 May 2016].
[26] Sharma, R., Chauhan, S. K. & Khajuria, H. N., 2009. Reproductive Biology and Variability Studies in Dalbergia sissoo. Journal of Tree Sciences, Volume 28, pp. 23-38.
[27] Jenkins, A. et al., 2012. Tackling the Trade in Illegal Precious Woods, TRAFFIC.
[28] The Wood Database, 2015. Available at: http://www.wood-database.com/, [Accessed 20 May 2016].

However, thus far, I have been unable to determine what the actual harvest regime is for agroforestry in India, which makes determining whether the harvest regime is non-detrimental to the species survival in the wild or not difficult.

Limitation: Actual harvest regime proposed across the country has not been disclosed. There is also no historical harvest data with which to assess the sustainability of and impacts of the harvest regime to date.

Management Measures – The management of this species is reported to vary across the regions in India, but in general, harvest from the wild doesn't occur often. Harvest outside of Protected Areas is regulated by rules/Acts of the different States/ Union Territories (CITES, 2019). *Dalbergia sissoo* is a restricted or reserved tree in Jharkhand, West Bengal, Assam, where the harvest from the wild is restricted by requiring permission or completely banned. From Bihar to "other states", due to rapid deforestation and reduced availability of plantations, harvest of *Dalbergia sissoo* has also been banned[29]

Winfield *et al* (2016) stated that "*there is a potential management opportunity to create a sustainable timber industry through eco-labelling or certification processes, similar to the forest certification (FSC) program, particularly for D. sissoo plantations [15]. In India, various Government Institutes have identified D. sissoo and P. santalinus as a focus species requiring long term tree development and improvement [16].*"[30] At this stage, this does not seem to have been capitalized on or is not reported on in the public domain and cannot therefore be assessed for sustainability.

"The species is enormously available in several Government and private nurseries (Bhattacharjee & al., 2018)) of almost all states and union territories of India for ex-situ conservation, plantation, afforestation, reforestation and also for distribution/sale"[20]. CITES (2019) also stated that the management measures and legal instruments in India are "*appropriate and effective to mitigate (=reduce the severity of) the identified wild harvest impacts and trade impacts*" but does not actually provide further details of what those management measures are.

Because harvest from the wild is in general not permitted in India, the major aspect that requires management effort is to do with traceability of product to ensure that timber product presented for export is in fact *Dalbergia sissoo*, and not another more endangered species of *Dalbergia* that is being claimed to be *Dalbergia sissoo*. This is a common operating model of illegal traffickers, and it is imperative that adequate control measures are in place to ensure that India does not become a key node in the illegal wood supply chain.

This is achieved through not only the CITES Management Authority but also the Export Promotion Council for Handicrafts (EPCH) who are authorised to verify legal origin of wood and wood products. They are the developers of the "*Vriksh standard Timber Legality Assessment and Verification Scheme*". This is a due diligence system of certification for companies dealing in timber. Companies receive certification for a 5-year period which is subject to an annual surveillance audit. They are required to verify the following documentation:

- Forest auction note/
- sales invoice of forest department
- invoice of sawmills
- License and sawmill record (register) attested by the forest department

[29] Sinha, S. & Pasha, M. K. S., n.d. Wood Based Handicraft Industry. In: Report on Survey of Wood Based Handicraft Industry., Jodhpur: TRAFFIC-India and GFTN-India.

[30] Where [15] - Cunningham, et al., 2005 and [16] - Jalonen, et al., 2009

- 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
- Gate Pass
- transit permit
- weighment bridge slip
- sales invoice of immediate supplier,
- Vat or Sales Tax document

The system is designed to prove that companies are able to trace their product from the forest all the way to individual consignments through a series of checks and balances and mountains of paperwork – however, I was unable to determine whether anyone can actually verify that the wood in a particular shipment actually CAME from where the paperwork says it comes from. Companies are notorious for gaining permission to harvest from one area, but instead going to a national park to harvest because the wood is better and not affected by fungus or disease that is commonly found in plantations. It is unclear how this scenario is detected in this certification program which can pose some risk – but this risk is mostly related to other species of *Dalbergia*, and not the *Dalbergia sissoo*.

Information available: Assessed as GOOD. India appear to have a relatively robust system in place for managing timber harvest. There is a LOW risk that the management measures are insufficient to ensure non detriment to the species.

NDF Finding – The following NDF is provided as an example of how a Scientific Authority could choose to deal with this circumstance. There is no "right" answer – but there is a wrong answer – if the harvest regime implemented turns out to be detrimental – it was a wrong decision. Hence, ensuring that any detrimental impact from the harvest authorized is monitored and reported and then acted on, should ensure that it can be corrected before lasting detrimental impact is realized.

This non-detriment finding **[example only]** is made on the basis that harvest from the wild is not permitted in India. The only permitted harvest is from agroforestry plantations of *Dalbergia sissoo*. Each company responsible for these agroforestry areas are required to be authorised for export through a third-party certification process, which is valid for 5 years, subject to a yearly audit. This certification process appears to be thorough, although there is still a small risk that shipments presented with correct paperwork have come from different areas than, or that the shipment of wood has been replaced with a more precious timber of *Dalbergia* that is not allowed to be exported. Exactly how this risk is dealt with is a big limitation of this NDF.

The density per hectare of *Dalbergia sissoo* as shown in Table 1 for wild populations indicates that the species is still relatively rare in the wild. Although the paper that these values comes from considered an average of 20 trees per hectare as common, in reality, this is still quite a low density per hectare. There is a very high regeneration potential for these trees, with a high density of seedlings and saplings. This, however, doesn't necessarily translate into a high recruitment into the population, as shown in Winfield et al (2016). *Dalbergia* trees are highly desirable by browsing animals and they are often stripped of their leaves before they have the chance to mature.

In reality, the density per hectare of the cultivated agroforestry *Dalbergia sissoo* shown in Table 2 is not much different from the density of the wild *Dalbergia sissoo*, which is surprising for a

cultivated plot. With an average of 19.35 trees per hectare, it is assumed that the harvest rate of these trees is approximately 1 tree per hectare in order to be sustainable. However, this is unable to be confirmed at this time. The aspect that works in this species favour is its rapid growth rate and ease of regeneration, this does allow any forested areas that show detrimental harvest patterns can actually recover in a decent amount of time, if appropriate management arrangements are implemented to arrest the decline that has been reported. This appears to have occurred already in a number of regions in India where harvest from the wild has been banned.

None the less, the harvest regime in India is not from the wild, and there is an apparently robust certification and verification process in place to ensure that wood shipments from India of *Dalbergia sissoo*, are in fact *Dalbergia sissoo*. Therefore, it is considered low risk that this harvest regime would be detrimental to the species survival in the wild.

This is therefore considered to be a positive Non-Detriment Finding.

NB: It is however recommended that the certification and verification program is maintained and if possible increased to ensure that all shipments leaving India are in fact *Dalbergia sissoo*. The risk of this positive NDF is that the legal harvest and export allowance will encourage illegal traders to substitute other timbers into the shipment in order to get them to their destination in Asia. This could encourage traders to use India as a trans-shipment destination for the illegally harvested wood, in order to launder the timber into the legal exporting system. This must be avoided at all costs but is not an actual risk to *Dalberia sissoo's* survival in the wild*,* which is the subject this NDF.

ANNEX I

CITES-Listed Rosewood Species in International Trade, Known Range States and IUCN Red List Status

SCIENTIFIC NAME	KNOWN RANGE STATES	IUCN RED LIST (YEAR CONDUCTED)
ASIA		
Dalbergia annamensis	Vietnam	Endangered (1998)
Dalbergia assamica	Vietnam, China, Lao PDR, Cambodia, Thailand, Myanmar, Bhutan, Bangladesh and India, and has been introduced into tropical Africa	Least concern (2010)
Dalbergia balansae	China, Vietnam	Vulnerable (1998)
Dalbergia bariensis	Cambodia, Lao PDR, Thailand, Vietnam, Myanmar	Endangered (1998)
Dalbergia cambodiana	Cambodia, Vietnam	Endangered (1998)
Dalbergia cochinchinensis	Cambodia, Lao PDR, Thailand, Vietnam, Myanmar	Vulnerable (1998)
Dalbergia cultrata	Myanmar, China, Indonesia, Thailand, Lao PDR, Vietnam, India	Near Threatened (2010)
Dalbergia fusca	Myanmar, Thailand, China	Vulnerable (2010)
Dalbergia latifolia	India, Indonesia, Nepal, Kenya, Malaysia, Myanmar, Philippines, Sri Lanka, Vietnam	Vulnerable (1998)
Dalbergia mammosa	Vietnam	Endangered (1998)
Dalbergia oliveri	Myanmar, Thailand, Vietnam	Endangered (1998)
Dalbergia odorifera	China	Vulnerable (1998)
Dalbergia sissoo	North India, Nepal, and Pakistan, Western Asia	Not listed
Dalbergia tonkinensis	Vietnam and China	Vulnerable (1998)
AFRICA (Excluding Madagascar)Excluding Madagascar)		
Dalbergia melanoxylon	Angola, Botswana, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of Congo, Eritrea, Ethiopia, Kenya, Malawi, Mali, Mozambique, Namibia, Nigeria, Senegal, South Africa, South Sudan, Sudan, Tanzania, Uganda, Zambia, Zimbabwe	Near Threatened (1998)
Pterocarpus erinaceus	Benin; Burkina Faso; Cameroon; Central African Republic; Côte d'Ivoire; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Mali; Niger; Nigeria; Senegal; Sierra Leone; Togo Uncertain: Chad; Liberia	Endangered (2018)
Guibourtia demeusei	Cameroon, Central African Republic (CAR), Congo, Equatorial Guinea, Gabon, Liberia, Nigeria, South Africa, Uganda, Democratic Republic of Congo (DRC) (ITTO, 2012)	Not Assessed by IUCN but see ITTO (2012). [31]
Guibourtia pellegriniana	Cameroon, Congo, Gabon, Nigeria	Not Assessed
Guibourtia tessmannii	Cameroon, Equatorial Guinea, Gabon	Not Assessed
MADAGASCAR		
Dalbergia abrahamii	Madagascar	Endangered (1998)
Dalbergia baronii	Madagascar	Vulnerable (1998)
Dalbergia bathiei	Madagascar	Endangered (1998)
Dalbergia chapelieri	Madagascar	Near Threatened (2010)
Dalbergia chlorocarpa	Madagascar	Vulnerable (1998)
Dalbergia davidii	Madagascar	Endangered (1998)
Dalbergia delphinensis	Madagascar	Endangered (1998)
Dalbergia greveana	Madagascar	Near Threatened (1998)
Dalbergia hildebrandtii	Madagascar	Vulnerable (1998)

[31] ITTO, 2012 – *Background Information on the Conservation Status of Bubinga and Wengé Tree Species in African Countries*. Report prepared for the International Tropical Timber Organization (ITTO) by Dr Jean Lagarde Betti, ITTO - CITES Project Africa Regional Coordinator, University of Douala, Cameroon.

Dalbergia louvelii	Madagascar	Endangered (1998)
Dalbergia madagascariensis	Madagascar	Vulnerable (1998)
Dalbergia maritima	Madagascar	Endangered (1998)
Dalbergia mollis	Madagascar	Near Threatened (1998)
Dalbergia monticola	Madagascar	Vulnerable (1998)
Dalbergia normandii	Madagascar	Endangered (1998)
Dalbergia purpurascens	Madagascar	Vulnerable (1998)
Dalbergia trichocarpa	Madagascar	Least Concern (1998)
Dalbergia tsiandalana	Madagascar	Endangered (1998)
Dalbergia viguieri	Madagascar	Vulnerable (1998)
Dalbergia xerophila	Madagascar	Endangered (1998)
AMERICAS		
Dalbergia brasiliensis	Brazil	Not assessed
Dalbergia calderonii	Belize, El Salvador, Guatemala, Honduras, Mexico and Nicaragua	Not assessed
Dalbergia calycina	Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua	Least concern (2010)
Dalbergia cearensis	Brazil	Not assessed
Dalbergia congestiflora	El Salvador, Mexico	Not assessed
Dalbergia cubilquitzensis	Belize, Guatemala, Mexico	Not assessed
Dalbergia cuscatlanica	Costa Rica, El Salvador, Guatemala, Mexico, Panama	Not assessed
Dalbergia darienensis	Colombia, Panama	Not assessed
Dalbergia decipularis	Brazil	Not assessed
Dalbergia foliolosa	Bolivia, Brazil	Not assessed
Dalbergia frutescens	Argentina, Bolivia, Brazil, Colombia, Costa Rica, Guyana, Ecuador, Paraguay, Peru and Venezuela	Not assessed
Dalbergia funera	Guatemala, El Salvador	Data deficient (1998)
Dalbergia glomerata	Costa Rica, Guatemala, Honduras and Mexico	Vulnerable (1998)
Dalbergia granadillo	El Salvador and Mexico	Not assessed
Dalbergia hortensis	Brazil	Not assessed
Dalbergia longepedunculata	Honduras and Mexico	Not assessed
Dalbergia luteola	Guatemala and Mexico	Not assessed
Dalbergia melanocardium	Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico and Nicaragua	Not assessed
Dalbergia miscolobium	Brazil	Not assessed
Dalbergia modesta	Mexico	Not assessed
Dalbergia nigra	Brazil	Vulnerable (1998)
Dalbergia palo-escrito	Mexico	Not assessed
Dalbergia retusa	Belize, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Mexico*, Nicaragua, and Panama	Vulnerable (1998)
Dalbergia rhachiflexa	Mexico	Not assessed
Dalbergia ruddiae	Costa Rica and Mexico	Not assessed
Dalbergia spruceana	Bolivia, Brazil, Honduras and Venezuela	Not assessed
Dalbergia stevensonii	Belize, Guatemala, Honduras and Mexico	Not assessed
Dalbergia tucurensis	Belize, Costa Rica, Guatemala, El Salvador, Mexico and Nicaragua	Not assessed
Dalbergia villosa	Bolivia, Brazil	Not assessed

***** This species is not considered to be native to Mexico by the Mexican CITES Scientific Authority. It is often said to be misreported in trade. It is considered most likely to be *D. granadillo*.

Source: Winfield *et al*. 2016

ANNEX II

Risk Assessment of Level of Biological Data Available

One of the most important aspects of conducting an NDF is understanding the levels of risk involved. The less information that is available on biology and population status, the higher the risk that the harvest regime authorized will be detrimental to the long-term survivability of the species. Therefore, this annex provides two examples of the different ends of the spectrum with regards to the amount of biological data available for rosewood species. Table 1 below (replicated from Winfield et al (2016)) provides one example from each region of the low level of data available, while Table 2 provides two examples of species that have a lot of biological data available on them. While having more data on biology means you can make a more informed decision on whether a harvest regime will be detrimental or not, you must still ensure you have adequate monitoring mechanisms in place to detect any deleterious impacts and act accordingly.

Table 1 - Biological Data Available for Species of Rosewood – Low Information Level

ROSEWOOD SPECIES FROM ASIA				
Species	**Species Description**	**Habitat Type**	**Reproduction, Growth, Development etc.**	**Wood Properties**
Dalbergia tonkinensis	Tree height = 25m [7] Tree diameter = 80m [7]	According to Chính *et al.* (1996) 32 and Ban (1998), this species prefers deep, fertile soils in primary and secondary forests below 500 m in altitude and is found in reserves if Lang Son province and Ha Noi and Phong Nha-Ke Bang National Parks.		
ROSEWOOD SPECIES FROM MADAGASCAR				
Dalbergia baronii	Deciduous, medium sized tree. Height 25-30m Bole length = 6-20m Diameter = 100-140cm [10, 8]	Found in lowland evergreen humid rainforests, often in marshy areas and near mangroves. Altitude: 0-150m (rarely up to 600m) Soils – sandy, sometimes salty [11]	- it is very similar to *D. monticola* and often not able to be distinguished - Flowers are bisexual [10] - 1-3 seeds in fruit - roots are nitrogen fixing	12% moisture: [10] Wood density = 620-950 kg/m^3 Modulus of rupture = 132-221 N/mm^2 Compression (parallel to grain) = 58-86 N/mm^2 Cleavage = 14-20 N/mm Chalais-Meudon hardness = 2.9-7.8
ROSEWOOD SPECIES FROM THE AMERICAS				
Dalbergia granadillo	Tree of up to 20m [14].	Deciduous forests, pine, oak and mixed pine-oak forests, wet forests with pronounced seasonality [15]. Altitude Range: 750-1200m [15]. Soils - well-drained soils [14]. Rainfall range: less than 700m annually [15].	*D. granadillo* blooms in May [14]. Fruiting is generally unknown but possibly in May to June prior to the rainy season [14]. Species also has a symbiotic relationship with nitrogen-fixing bacteria [16].	Heartwood yellow to orange with dark brown with dark streaks. Odour believed to be fragrant. Density of 0.90-1.35 g/cm^3 [15].

[32] As referenced by UNEP-WCMC (2014).

Table 2 - Biological Data Available for Species of Rosewood – High Information Level

PTEROCARPUS ERINACEUS – this species comes in two forms; 1. Low branching spreading form, associated with drier climate 2. Large tree specimens with straight trunks, associated with more favourable and wet conditions [17]

Maturity Age	Height (m)	Diameter (cm)	Rotational Length	Life Expectancy	Flowering Season	Fruiting Season
	12-15m [18, 19, 17]	1.2–1.8 m [17]			December–February [20]	

Habitat Type

This species is found across semi-arid and sub-humid Africa, mainly in open forest and wood savannahs that have moderate to long dry seasons up to 9 months. It can tolerate a range of climatic and soil conditions [20, 18, 19]

Soil Requirements
- Can thrive even on shallow soils [20]
- Main soils in Burkina Faso - Luvisols, lixisols and leptosols [21]

Altitude Range: 0-600m [20]

Rainfall Range: 600-1200 mm [17]
Burkina Faso Study – 750-900mm [21]

Temperature Range: 15-32°C, can tolerate up to 40°C [17]

Survival Strategy

This species appeared to suffer during early development due to fire and drought, however, survivability and consequently growth rates appear to recover after the first 10 years when the tap root system can cope with drought and fire better [22].However, drought was found to have a low relative importance on actual seedling mortality for planted seedlings, of 20% and 30% for 3 month and 9 month olds respectively [23]. This same study found that herbivore browsing was the main cause of seedling mortality for watered seedlings that didn't lose their leaves as quickly [23]

Seedlings survival rates are higher when they are protected from livestock or wild ungulates [18]

Reproduction/survival strategy and germination/regeneration potential

Seed Production
Average 1000 seed weight (g): 135.56 (Duvall 2008)

Seed Germination Rate
Duvall (2008) states that germination rates of untreated seeds is approximately 50% (although no direct reference is provided). Different treatment methods including soaking in water or sulphuric acid, raising and lowering the temperature and exposing to different light levels increases germination rates, which ranged from 70-100% [18]. However, how these rates compare to wild populations is unknown.

Regeneration potential
The regeneration potential has been stated as being "often abundant" in the CoP17 proposal, based on Duvall (2008). Studies in Burkina Faso confirmed the assumption of high regeneration potential, as they found a high density of seedlings in the protected area of W National Park. However, this potential was not realized, as there was no correspondingly high density of saplings, indicating that recruitment was still low [21].

This appears to be common throughout areas where population status assessments have been conducted, refer to Population Structure and Status Section. Most populations showed little to no recruitment occurring, even in protected areas where it is usually expected that recruitment and therefore regeneration potential would be high due to the presence of larger reproductive trees. In fact, recruitment was often worse in protected areas, than non-protected areas, which has been attributed to over-browsing or trampling by the abundant ungulate populations in protected areas.

Growth rates and heartwood development information

Growth Rates

A study conducted across 5 protected areas in South Senegal from 2002 – 2004 estimated the growth rates, as shown in **Error! Reference source not found.**. The growth rings showed alternating bands, that got slightly smaller towards the end of the growing season, they also showed increasing biomass production as the tree aged, refer to **Error! Reference source not found.**.

Table 3 - Growth Rates of *P. erinaceus* in South Senegal (n=3) [Adapted from Table 3 and 4 of [22]**]**

Tree Age	mean annual D increment	mean annual biomass increment
0-10 years	0.40cm	0.51kg
0-20 years	0.58cm	2.75kg
0-end of life*	0.60cm	3.71kg

***mean end age = 22

Duvall (2008) states the following (but does not explicitly state which references the information comes from):

- **Mali:** After 1 year – seedlings only 15cm; 2 years up to 42cm, however, up to 100cm after 2 years has been reported under better conditions
- **Côte d'Ivoire:** planted seedlings H_{ave} = 9cm (3 months); 50cm (18 months); 2.8m (2.5 years). H = 10m (5.5 years) for fastest growing

Ecological Role/Significance

As for all *Pterocarpus* species, bar a few, this species develops nitrogen fixing bacteria nodules in their root systems. The nitrogen fixing potential of this species is much lower than other species in this genus, such as *P. lucens* [18]

DALBERGIA RETUSA			
Height (m)	**Diameter (cm)**	**Flowering Season**	**Fruiting Season**
15-30 [24, 16]	50-91 DBH [24, 16]	*General* January to May (first flowering) August to September (second flowering)	March to May Dry season with irregular fruit drop [25]

Habitat Type/natural density	**Reproduction strategy and germination potential**	**Growth rates and heartwood development information**
Found on flatlands or moderate slopes in tropical dry forests with an annual rainfall less than 2000mm and a temperature range of between 24 to 30 °C [81]. Soil Requirements: Requires deep sandy or rocky soil [26]. Altitude Range: 350-500 [27]. Rainfall range: Less than 2000mm [28]. Temperature range: 24 to 30°C [28].	Pollination Bees and other insects, seeds dispersed by both wind and water [26]. *D. retusa* has been known to come into partial bloom out of season attracting large numbers of bees, even recorded as attracting bees away from other flowering species in the same area [29]. Mass flowering followed by low fruit set has been observed for this species [16]. Flowering occurs after 4 or 5 years [30]. Seed dispersal: September to February [28]. Vegetative growth: January to November [28]. Defoliation: November to March [28]. Demonstrated to exhibit self-rejection [31]. Seeds can remain viable for up to 5 years although reportedly have a high rate of unviability [26]. Reported as an evergreen species with soft wood, it uses soil water as a reservoir. Flowers can appear rapidly as old leaves are shed [32]. Biennial fruiting has been observed in this species. *D. retusa* is believed to drop its leaves in January to March, flush in April, flower in March or April and have mature fruit at some point in the dry season [25]. Reported to respond well to fire with regeneration of young trees observed in areas that have been periodically exposed to fire [16]. Germination rate Germination rates of up to 80% observed in a nursery setting [16].	As with many *Dalbergia* species a slow growth rate is recorded for this species [16]. Trees may reach heights of 8m and 13m DBH when grown in controlled situations [26]. Heartwood shows remarkable resistance to termites, even when buried for 13 years in the jungle with part exposure to the elements [33]. Natural regeneration is scarce although young trees up to 4m have been observed in areas that have been periodically exposed to fire [16], despite being reported as abundant in the CoP16 CITES proposal [34]. Heartwood color is yellow to orange or dark brown with dark streaks. Density is between 0.90-1.35 g/cm [15]. **Ecological Significance** Provides suitable habitat for a range of epiphytes including orchids, ferns, bromeliads, fungi and lichens which can be found living on both the trunk and branches [28]. Also exhibits symbiosis of root nodules with nitrogen-fixing rhizobia, which is beneficial to soil fertility and forest biodiversity in general [28].