**TIMBER - SHORT CASE STUDIES**

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| **Case Study 1 NDF Formulation for *Swietenia macrophylla* in Mexico**  In Mexico, the management of CITES timber species at the national level operates within the framework of the General Law of Sustainable Forestry Development. The process for formulating NDFs for *Swietenia macrophylla* is linked to the framework for sustainable forest management. The process has been developed since 2008, with the CITES SA working with forestry authorities from the outset. The State of Quintana Roo is the main area for export of mahogany wood. The State authorities request Technical Opinions (TOs) from the CITES SA on the Forest Management Programs (PMF) or Unified Technical Documents (DTU) prior to harvesting authorizations. In general, a TO can be considered a pre-NDF and is based on analysing information available in management plans and programs, technical studies and annual reports, on the property or place of origin, the methods of obtaining, analysis and results of the population sampling/monitoring in the field, the management measures of the species and its habitat, and the methods and estimation of the rate of exploitation. Management plans for timber species last for a specified period of time and NDF requirements can be modified when the management plan is revised.  Negative or partial NDFs are issued when the forest referrals come from properties whose PMF does not have a TO and/or when there is a lack of information to formulate the NDF. The steps necessary to develop technical considerations for a mahogany NDF or TO are set out in the Manual of Procedures with support sources included that contain reference values, literature or guides that can be used to determine if the data, methods and management of the species are adequate and therefore the estimates are reliable.  An analysis of the information required for NDF formulation for mahogany, indicating the relationship with national and international legislation has been undertaken. This includes elements such as: basic information of the species and the property, method of sampling, field data and calculation memory, volume of use and management of the species, including recommendations for information delivery. This was shared with CITES PC24 as PC Inf. 3. which provides a checklist of information requirements.  Source: CONABIO (2018) & CONABIO (2021) |

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| **Case Study 2 NDFs for *Dalbergia* spp. in Vietnam**  A process to develop NDFs for two native species, *Dalbergia cochinchinensis* and *Dalbergia oliveri*, was undertaken based on data collection and review workshops following methodology provided Rosser & Haywood, 2002. The guidance includes two steps of review. After the initial review relating to harvest of the species, it was found that there are negative opinions. Therefore, the assessors carried out a thorough review to see if the international trade could be detrimental to the survival of *D. cochinchinensis* and *D. oliveri*. The second review looked at parameters on biology, distribution, population size, population trend, main threats and management, harvest management, capacity for monitoring the harvest, benefits of harvest, and strict protection. These parameters were divided into seven categories of biological characteristics; national status; harvest management; control of harvest; monitoring of harvest; incentives and benefits from harvest and protection from harvest. 26 indicators were developed corresponding to multiple-choice questions. Data and information were collected to fill in these indicators. In each question, there are five answers ranked in order from 1 to 5. Score 1 reflected the lowest risk, whilst score 5 represents the highest risk. These values were then formed up a radar plot to indicate the level of each indicator to help understand an overview of NDF for *D. cochinchinensis* and *D. oliveri*. As the populations of both species are small and fragmented, facing major threats of illegal logging and trade and habitat loss, and no management plans are in place, the CITES Vietnam Scientific Authorities have seen that the harvest for export of *D. cochinchinensis* and *D. oliveri* timbers will be detrimental to the current vulnerable populations. Thus, the NDFs are negative and annual zero export quotas are being applied for 2022-2027.  Source: Center for Nature Conservation and Development (2021) |

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| **Case Study 3 Information collection & NDF formulation for *Dalbergia* & *Diospyros* in Madagascar**  A workshop to evaluate scientific knowledge and identify priority research required for the issuing of an NDF was organized by TRAFFIC on 22-23 September 2014 in Antananarivo, in cooperation with the CITES Scientific and Management Authorities of Madagascar. The workshop was attended by government representatives from forestry, finance and police departments together with World Bank, EU, WWF, TRAFFIC, MBG, WCS, CI, MNP, the National Group of Forest Operators of Madagascar (GNEFM) and individuals from teaching and research institutions. The main objective was to allow stakeholders involved in the conservation and management of Madagascar’s resources to evaluate available information and to identify priority research required for *Dalbergia* and *Diospyros* species to guide the NDF process. The workshop used the IUCN NDF Guidelines, compiled by Rosser and Haywood (2002).  The workshop concluded that there was insufficient biological and ecological data available on precious timbers of Madagascar for the issuing of a NDF for the export of tree species. Gaps in essential information included species abundance, regeneration and population trends, particularly since data were only available from a few sites, thus making it difficult to extrapolate reliably. Few forest inventories existed for the species and these were hard to access. Accurate information on standing stocks, quantities felled and logging locations was not available. In addition experts were not able to estimate the regeneration capacity of key species hindering the development of sustainable action plans.  A comprehensive review of available information on *Dalbergia* and *Diospyros* of Madagascar was carried out by TRAFFIC to inform the NDF workshop and subsequently to prepare an overall assessment of the situation. Detailed recommendations were presented on research needs together with recommendations on management of forestry operations and controls on the trade in the species. Various of the recommendations have subsequently been carried out enabling Madagascar to make progress in identification of the main commercially valuable species in the genera; and in the development of NDFs for these species including implementation of appropriate monitoring mechanisms.  Source: Ratsimbazafy et al 2016. |

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| **Case Study 4 Forest management and NDF development for *Pericopsis elata* in Cameroon**  In Cameroon, *Pericopsis elata* is mainly found in the southeast of the country, notably in the departments of Boumba and Ngoko, Haut-Nyong and Kadey. In 2004 MINEF estimated the area of distribution as 4 071 857 ha, representing around 19% of the national forest estate. More recently the CITES SA has estimated a larger area of distribution.  There are four different categories of forest management within the country: forest concessions (Forest Management Units) managed by the private sector; communal forests – managed by municipalities; community forests, and standing timber sales.  The period of management for a FMU is 15 years, and is renewable once. With a maximum area of 200,000 ha, the FMU is divided into Annual Cutting Areas. A management plan is required by the Ministry of Forests & Fauna (MINFOF). Annual operating plans are required for each area to be harvested. The required elements of the management plan are specified in Arrêté 0222/A /MINEF/25 May 2021.  *Pericopsis elata* is categorised as a special species and is subject to management requirements which link to the NDF. The CITES MA allocates the volumes of *Pericopsis elata* to be exploited, monitoring and controlling the entire exploitation chain. The National Forestry Development Support Agency (ANAFOR) is the CITES SA responsible for issuing the NDF based on scientific studies.  Annual harvest quotas are set for *Pericopsis elata* in each management area. The harvest quota is adjusted each year based on the profile of the annual exploitation "block" and the exploitation/harvest history in the previous annual blocks of the same FMU.  The total annual harvest potential for *Pericopsis elata* is 75,715.08 m3 based on exploitation inventories of all valid sites.The national harvest quota allocated is 37,653.23 m3 representing49.73% of the harvest potential. It is considered precautionary and appropriate for sustainability of the species. The harvest quota equates to 14,989.72 m3 of processed timber - for export by 18 companies.  Source: Fouda Ndjodo et al, 2023 |

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| **Case Study 5 Forest Management Plans, Quotas and NDFs in Belize**  In Belize, tools to carry out NDFs for CITES listed timber species include a Sustainable Forest Management Plan, Annual Plan of Operation and General Yield Model to determine sustainability. These are peer reviewed with recommendation for export of not, made to the CITES SA. Recently a Management Plan Framework has been developed to guide Sustainable Forest Management Plans for Forest Reserves that comprise about 18% of the National Protected Area System. The focus has been on sustainable harvesting of economically valuable timber species but the ultimate goal is the protection of biodiversity and ecosystem services. Sustainable Forest Management Plans are prepared and submitted to the Forest Department every 5 years within the context of 40 year Long Term Licences and Annual Plan of Operations (APO). The APOs guide annual reduced impact logging and are based on the General Yield Model.  Each Sustainable Forest Management Plan should include inventory information to assess the structure and composition of the forest with the sampling intensity at least 0.2% of the Forest Reserve. There should be an inventory of all trees (over 25cm DBH) with further details for commercial timbers.  Plans for management of timber production should refer to the Code of Practice for Reduced Impact Logging and the General Yield Model. Information is required to justify the approach to harvesting of commercial species, (size and quantities) with calculation of cutting cycle and annual allowable cut, division of the forest into annual harvesting units and a schedule of timber production. Harvesting operations are based on minimum environmental standards specified in the legislation, licence and Code of Practice e.g., crown cover, maximum number of trees felled per hectare, restrictions against harvesting on slopes and watershed areas, minimum DBH for tree felling, a list of species to be protected, cutting techniques to optimize natural regeneration.  Monitoring of forest cover is required through, for example, pre- and post-harvest inventory. In addition, the use of remote-sensing tools including satellite imagery, fly-overs and drones should be explored. Use of standardised methodologies accepted by academia and the Forest Dept. is required. References must be provided. Monitoring of water supply and certain wildlife is also required.  Belize sets annual export quotas for *Swietenia macrophylla*, *Cedrela odorata* and *Dalbergia* spp. In accordance with the guidelines provided by CITES and in adherence to national Forestry laws, the national export quota is set according to the following basic steps:  A. A long-term forest license is approved for a given private land or forest reserve.  B. A Management Plan is developed by the license holder and reviewed by the Forest Department and forest experts including the Scientific Authority. The Management Plan is approved.  C. An Annual Plan of Operation for a given cutting block is prepared as per the established guidelines and framework and presented to the Forest Department for review and approval.  D. In a given cutting block in a sustainable logging concession, a full count and measurement of all standing trees is performed. The group of trees is taken as a single, independent population and a sustainable harvest yield is determined using scientific methods.  E. The previous step is repeated for all individual logging concessions in which a licensee proposes to harvest CITES listed species, and a national sustainable harvest yield is determined by summation.  F. The CITES SA then validates the proposed sustainable harvest yields and verifies the estimated volume of lumber to be produced – which forms the export quota.  G. Once validated, the CITES Management Authority confirms an export quota to each individual logging concession, which can then begin to cut and export the lumber.  H. Only licensees with approved export quotas can export CITES listed species, but only from areas to which the export quota applies. However, the licensee can sell such timber to third parties, who may then export the material under the export quota for the designated area from which the timber was cut.  I. The Forest Department undergoes a legal acquisition finding process, as per the Convention and its Resolutions to ensure that the timber is sourced from legal sources. The sale or transfer of timber from one buyer to the other must adhere to this process to verify quota integrity.  J. The Forest Department has established the volume of timber in log, flitch or sawn lumber form which may be exported based on conversion factors since the estimated standing export volume cannot be the same as the volume of sawn lumber.  Belize Forest Department, 2020 |

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| **Case Study 6 Inventory for *Pterocarpus erinaceus* in Burkina Faso, Niger and Togoas a basis for NDFs**  Forest inventories have been undertaken for *P. erinaceus* populations in Burkina Faso, Niger and Togo (Segla et al 2016). Sampling was based on two methods, the band transect method and the random method. The transect method was chosen as appropriate in areas with low density of the species in Sudanian and Sahelian zone vegetation in Burkina Faso and Niger, whereas the random method was adopted for the Guinean and Sudanian zones in Togo with a relatively high density of species.  For the transect method, two perpendicular transects with widths of 200 m each were used, use of north–south and east– west transects taking account the heterogeneity of the plant formations. Sufficient inventories of *P. erinaceus* individuals to estimate the density could subsequently be made. In each observation band an azimuth method was carried out using a GPS. Gradually moving along the transects, all *P. erinaceus* individuals were observed and diameters at breast height (DBHs) ≥ 10 cm were measured.  The random method was based on 1000 m2 (40 m × 25 m) sampling units at regular intervals of 200 m, randomly defined in populations dominated by *P. erinaceus*. A total of 60 plots were studied in Togo (20 in Abdoulaye wildlife reserve, 25 in Oti-Keran National Park and 15 in Togodo wildlife reserve).  In all cases the DBH ≥ 10 cm measurements were performed using a tree caliper for large diameters or a tape measure for medium and small stems. Measurements of total and merchantable heights were made using a graduated pole (for trees lower than 5 m) or a Relascope of Bitterlich (for trees higher than 5 m).  Forest characteristics were assessed by calculating the average diameter, the total average height and the average merchantable height of the species. An analysis of variance was performed to compare the dendrometric parameters (diameter and height) according to the climate zones. A general linear model was applied using R software (https://cran.rproject.org/bin/windows/base/) and Minitab 16 (http://en.softonic. com/s/free-download-minitab-16).  The average density (average number of standing individuals estimated per ha), the basal area (the sum of the cross sections of all *P. erinaceus* individuals per m2 /ha) and Lorey's mean height (average height of individuals weighted by their basal area) of individuals in each climate zone were calculated.  To determine the size class distribution, Minitab 16 software (http://en.softonic.com/s/free-downloadminitab-16) was also used to estimate the parameters of the Weibull distribution from diameter and height data. To ensure adequate adjustment of the observed Weibull distribution, SAS software (SAS Inc., 1999) was used for an adjustment test based on a log-linear analysis.  The minimum felling diameter (MD) and the rotation cycle for *P. erinaceus* is based on the formula of Durrieu de Madron and Forni (1997) which calculates the recovery rate (the ratio between the stock of harvestable trees at the beginning of the forestry operation and the predicted remaining stock after one felling cycle) and adapted to the distribution per diameter class of the species basal area by Sokpon and Biaou (2002) and Sokpon et al.(2006). This rotation calculation method is based on the principle that the duration of rotation is related to the passage of trees with a diameter lower than the MD to the group of exploitable tree diameter (plant diameter higher than the MD). The rotation cycle, therefore, takes into account the growth rate and the diametric structure of the species.  To determine the rotation cycle, the restoration percentage of the original exploitable basal area for the species needs to be calculated, the restoration percentage is based on the exploitation losses, the diameter growth and the natural mortality of individuals. The MD is determined iteratively by testing the various diameter classes, including the classes 25 cm, 35 cm, 45 cm and 55 cm. When the restoration percentage is low (below 50%) the MD increases and a new restoration percentage is calculated until an MD favouring restoration of the species (N50%) is obtained. The restoration percentage is calculated based on the transition time, or rotation, which is the time required to move all individuals in one diameter class to a diameter higher than the MDE. The restoration percentage does not indicate the actual restoration, but gives a renewed idea of the restoration of populations of a species. The formulae used to determine the transition time and the restoration percentage are from Durrieu de Madron and Forni (1997).  In Togo an NDF has been developed for *P. erinaceus* for the period 2022-2023. Comprehensive data collection took place as a basis for the NDF. “Principles for Non-Detriment Findings (NDF) for Trees” methodology developed in Cancun in 2008 were followed considering five points: biology and distribution area of the species; information on the population; management measures and harvesting regime; control and follow-up; conservation and precautionary principle. Workshops were held to review the information and draft NDF. Based on species density per hectare, population structure, MD and recovery rate, the study set the operating quota at 80% of the potential to be exploited within a defined area. In order to ensure a rapid recovery of degraded stands of *P. erinaceus*, 20% of the standing resource in the form of seed trees is preserved. The exploitation of the species in protected areas and in ecologically sensitive areas is forbidden. At the same time there is a national moratorium on the cutting, marketing, import or re-export of *P. erinaceus* timber for a period of 10 years (2016-2026) in order to limit overexploitation and allow natural stands to be able to regenerate.  Source: Segla et al. 2016 and Laboratoire de Recherche Forestiere, 2022. |

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| **Case Study 7 Information collection & NDF recommendations for *Cedrela* spp. in Colombia**  In Colombia there are four species of *Cedrela: C. fissilis*, *C. montana*, *C. nebulosa* and *C. odorata* distributed in diﬀerent ecosystems at altitudes from 0 to almost 3000 m above sea level. Many of the forest habitats are undergoing transformation. To support the development of NDFs for these species, information collection and review has been carried out following the 9-step guidance for timbers.  Information on distribution of *Cedrela* spp. used data from Global Biodiversity Information Facility- GBIF(<https://www.gbif.org/>) together with data from Colombia Biodiversity Information System -SIB (https://sibcolombia.net/), the National Herbarium, University herbaria and theTropicos database (https://www.tropicos.org/home). Complementary data on *Cedrela odorata* was included from the Instituto Amazónico de Investigaciones Científicas-SINCHI.  Information on the threat status of *Cedrela* spp. nationally and globally was based on the IUCN Red List (https://www.iucnredlist.org/es/), the red book of threatened timber plants in Colombia (Cárdenas & Salinas 2007) and resolution 1912 of 2017 of the Ministry of Environment and Sustainable Development (MADS) by which the list of threatened wild species found in the national territory is established.  Information on spatial distribution and population density of *Cedrela* spp. was collected from documents available online and from SINCHI. For population size structure, information was collected on the diameter and height of individuals of the species by department. Information on diametric growth of *Cedrela* spp. was based on Cárdenas et al. (2015) for the Colombian Amazon and information on growth and mortality was obtained from a 25 ha permanent plot in Amacayacu- Amazonas established by SINCHI, the National University of Colombia, Sede Medellin and National Parks.  The population density of *Cedrela* spp. (number of individuals/ha) varies depending on the species and the area of distribution. In the review, population density could only be established for *C. odorata* and varies between 0.051 and 4.8 individuals with DBH > 10 cm per ha, similar to population density in Bolivian forests. Information to determine the density population of the species including individuals < 10 cm DBH is uncommon and further research is needed to integrate the information into NDF development for C. *odorata* populations. Furthermore information is needed in the departments of Antioquia, Choco, Nariño and Santander where harvesting is thought to be greater but volumes were not available. Generally, there is insuﬃcient information to establish the size structure of the populations of *Cedrela* spp. In the case of *C. montana*, for example, an approximation of the population structure could only be made for the department of Cundinamarca. The average diameter for isolated trees is 30.6 cm, for primary forest it is 45.23 cm and for fragmented forest it is approximately 38 cm. The species shows good regeneration but for the seedlings to reach the adequate DBH for use it will require a long period of time. Likewise, the number of individuals with harvestable diameters (>40 cm) was few and their harvesting can aﬀect the reproduction of the species mainly due to the elimination of seed trees.  Minimum felling diameters have only been established for *C. odorata*. In Amazonia a MD of 80 cm was proposed (Castaño et al., 2007), while in the department of Chocó a MCD of 45 cm was established (Cárdenas et al., 2015). However, Regulations specify that in the Chocó harvesting of threatened species including *C. odorata* is included, must guarantee the permanence of at least 30% of each diameter class and the harvestable diameter will be at least 50 cm.  Information was requested from 16 Regional Autonomous Corporations where *Cedrela* spp. are harvested relating to administrative arrangements, forest management plans and harvesting plans for *Cedrela* spp. between 2018 and 2020. Several responded, with for example, the Corporación Autónoma Regional de Santander (CAS), providing the characterization, methodology, deﬁnition of forest management administrative units, guidelines for updating the Forest Management Plan of its jurisdiction and a database with information on harvesting permits granted between 2018 and 2019 (also in the database provided by the MADS).  Harvesting information between 2013-2020 including species, product type and quantity was obtained from a database maintained by MADS of harvesting permits issued at national level. A database of transport permits granted for these species recorded by volume also maintained by MADS was also utilized. MADS also provided data on registered plantations of *Cedrela* species shared by the Colombian Agricultural Institute - ICA.  The Colombian Ministry of Environment (MADS) has issued logging permits for a total of 29,357.85 m3 of *Cedrela* spp timber. The years 2018 and 2019 were the years with the highest logging volumes during the period under review. Logging permits for timber in natural forest were mainly for the departments of Nariño (36%), Santander (30%) Antioquia (14%) and Boyacá. The main places where those products were commercialized were Valle del Cauca (26%), Bogotá (15%) and Santander (8%).  Exports for the period 2018-2020 were sourced from CITES (htps://cites.org/) together with a review of secondary information provided by the MADS. There have been some exports of *Cedrela* timber to Spain (from natural forests) and also to Cuba (from plantation stock) and some discrepancies in the quantities recorded.  Utilisation of timber products in Colombia is mainly for household consumption (61%), followed by Logs (27%) and sawnwood (6%). (MADS 2022).  From the information review, relevant aspects were identiﬁed for conducting the NDF for Cedrela spp. together with knowledge gaps. It was observed that there are issues in species identification which hinders knowledge of populations and control of wood exploitation. Data on population dynamics (growth, reproduction, mortality and recruitment ), is scarce – as has also been noted in Bolivia. The lack of knowledge on usable stocks of *Cedrela* spp. together with high levels of illegality make it difficult to establish utilization and export quotas. More information may exist that has not been made available for this study. Additional information on the distribution of *Cedrela* spp. needs to be sourced from national forest inventory and research initiatives.  Source: Vasquez Valderrama, M. (2021)  A supplementary study of *C. odorata* in Amazonas, Chocó and inter-andean valleys has been undertaken confirming the need for an NDF for the species (Gutierrez, E. et al. undated) |

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| **Case Study 8 Potential for NDF development for timbers of Mozambique**  In Mozambique, the Forest and Wildlife Policy and Strategy and the Forest and Wildlife Law (LFFB) - Law No 10/1999 divides forests into ‘conservation’, ‘productive’, and ‘multiple use’. An exploitation licence is required to fell trees, with associated fees, except in cases of personal consumption. There are two main types of licence: simple licence and forest concession agreement. The legislation allows for enforcement by forest and wildlife inspectors and community agents. Concession authorisations are at three levels: up to 20,000 hectares (ha) authorised by the provincial governor, 20,000 to 100,000ha by the Minister for Agriculture, and over 100,000ha by the Council of Ministers. Concession holders are required to carry out sustainable exploitation of forest resources in accordance with the approved management plan,harvest and process the timber and guarantee inspection of the concession, in accordance with the legal provisions.  Two timber species recently listed in CITES Appendix II, *Afzelia quanzensis* and *Pterocarpus angolensis* are of great significance in Mozambique as together with *Millettia stuhlmannii* they account for 78% of the country’s total timber production.The current available commercial volume for *Afzelia quanzensis* in Mozambique is about 2,514,000 m3. The regulation size for harvesting is a DBH ≥ 50 cm. The estimated available volume of *Pterocarpus angolensis* in Mozambique is about 5,620,000 m3 and the regulation DBH for harvesting is ≥40 cm. Studies of the growth rate of *P. angolensis* indicate that it takes 29 years for a tree to reach a DBH of 10 cm, and around 100 years to reach a DBH of 30 cm–40 cm; but ages up to 300 years are possible and growth rates vary depending on environmental factors at specific sites.  Another timber species of Mozambique already listed on CITES Appendix II is *Dalbergia melanoxylon*. Mozambique is currently the major exporter of timber of this species as recorded in CITES Wildlife TradeView. A quota was developed for exploitation of this species in Mozambique laid out in Ministerial Decision (1 April 2016) by province from 10t to 400t. It is not known whether NDFs have been formulated for the species which is currently categorised as Near Threatened by IUCN as it almost qualifies for Vulnerable under Criterion A (population decline due to levels of exploitation in Mozambique and Tanzania).  Macqueen, D (ed.) (2018) China in Mozambique’s forests: a review of issues and progress for livelihoods and sustainability. Research report. IIED, London.  *Mate, R., Johansson, T.& Sitoe, A.(2014) Biomass Equations for Tropical Forest Tree Species in Mozambique. Forests 2014, 5, 535-556; doi:10.3390/f5030535* |