Forest Policy and Economics 134 (2022) 102626

Contents lists available at ScienceDirect

Forest Policy and Economics

journal homepage: www.elsevier.com/locate/forpol

Inaccuracies in the reporting of volume and monetary value of large-scale rosewood seizures

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ARTICLE INFO

Keywords
China
CITES
Dalbergia
Forestry management
Hongmu
Illegal wildlife trade

ABSTRACT

It is increasingly realised that for a proper understanding of the illegal aspects of the international timber trade sound data on seizures is needed. Their value, however, may be greatly diminished in the absence of accurate reporting. International trade in rosewood is regulated through CITES, with large amounts trafficked illegally, and annually thousands of seizures are made. Unfamiliarity with the differences between ton and tonne as a unit of mass —the former equalling 907 kg and the latter 1000 kg and this is unrelated to US vs UK English spelling— has led to misreporting. Only the tonne is accepted by the Système international (and given the symbol t). Eighty-three independent reports of 19 large-scale rosewood seizures from nine countries (2013–2021) referred to mass in tonnes 48 times and in tons 35 times, without any conversion having taken place. The monetary value of rosewood in these seizures differed US$3246 t^{-1} depending on whether ton or tonnes were used. Accurate reporting and conversion of mass to the same unit there where needed is especially relevant when presenting aggregate analyses of the illegal timber trade.

1. Introduction

In terms of monetary value, the legal timber trade is the most important aspect of the global wildlife trade. In 2019 it was valued at ~US$244 billion year^{-1}, with fisheries coming second at ~US$151 year^{-1} (Nijman, 2021). When it comes to the illegal wildlife trade the monetary value is difficult to establish (t' Sas-Rolfes et al. (2019) gives a range of US$7–21 billion year^{-1}) but according to the United Nations Office of Drugs and Crime timber comprises 44.7% of the total value of seized wildlife, compared to for instance 5.5% for rhinos and rhino horn (UNODC, 2020). For proper management of forestry resources and in order to regulate legal international trade, it is important to have a sound understanding of the illegal aspects of this trade, especially in times of crisis. The illegal wildlife trade, the regulation of international legal trade in high-value timbers, corruption, and how this affects on-the-ground management has received increased attention in recent years (Chimeli et al., 2012; Lowe et al., 2016; Dumenu, 2019; Fukushima et al., 2020). Seizure data are a vital source of information to gain these insights. But their value may be greatly diminished in the absence of accurate reporting. Under-reporting or not reporting at all, double counting, using incorrect measurements, inappropriate grouping of unrelated items / species, and the use of unrealistic, often inflated, prices have been flagged up as issues that lessen the veracity of illegal trade and seizure reports (cf. Broad et al., 2002; Nijman, 2014; Phelps and Webb, 2015). It has also been noted that getting one's units right is vital, be it when reporting on wildlife trade, when sending rockets to Mars or when modelling sea surface temperatures (e.g., Chan et al., 2019; Shepherd and Nijman, 2021).

The rosewoods are a group of tree species that are affected by unregulated and illegal trade (Wenbin and Xiufang, 2013; Ratsimbazafy et al., 2016; Waeber et al., 2019; Wilmé et al., 2020). In the timber trade, rosewoods or hongmu (meaning 'red wood' in Mandarin) mostly refers to a list of 33 species from five genera (*Dalbergia*, *Pterocarpus*, *Diospyros*, *Cassia* and *Millitia*) with a global distribution. Hongmu is characterised by a unique, deep-red colouring, aromatic scent and excellent durability. Over the last decade, the demand for rosewood to be used in the production of luxurious furniture in China and Vietnam has led to an increase in global trade.

Recognising the threat that international trade pose to rosewoods, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has implemented a series of decisions concerning rosewood, including the listing of all *Dalbergia* species in its

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https://doi.org/10.1016/j.forpol.2021.102626
Received 6 August 2021; Received in revised form 12 October 2021; Accepted 15 October 2021
Available online 30 October 2021

Appendix II, thereby regulating international trade (Brazilian rosewood *D. nigra* is listed on Appendix I, precluding international trade). The rampant unregulated logging in 2000s, combined with domestic civil unrest shined a particular spotlight on the impact and lasting consequence of unregulated rosewood logging in Madagascar (Waeber et al., 2018; Waeber et al., 2019). At present, the issue surrounding the stockpile management of Malagasy rosewood still remains highly contested (Waeber et al., 2018; Wilmé and Waeber, 2019). Consequences of rosewood deforestation targeting developing nations have also spread elsewhere; in Ghana, despite comprehensive ban on rosewood logging implemented in March 2019, there have been persistent illegal extraction of rosewood with complex links to political and governance issues (Kansanga et al., 2021), while in Senegal, situation of illegal logging in the region of Casamance forests has led several international NGOs to lodge a criminal complaint before the Swiss War Crimes Unit (EIA, 2020; Martini and Sarlième, 2021).

Unbeknownst to many, as a unit of mass, there are three types of tons, viz. the tonne, the short ton, and the long ton. The tonne, used in most of the world, equals 1000.0 kg; it is also referred to as a metric tonne or a metric ton. The short ton, frequently used in the USA, equals 2000 pounds or 907.2 kg. The long ton, used in the UK and other Commonwealth Nations that continue to use the Imperial system, equals 160 stone or 2240 pounds, and this equals 1016.0 kg. Note that these conversions are based the Imperial pound equalling 454 g, whereas countries where Germanic languages other than English are spoken, a 'Pfund', 'pond', 'pund', etc. equals 500 g. Only the tonne is accepted by the Système international and should be abbreviated as a t (the official SI unit is megagram, Mg). The long ton and the short ton are not accepted by the SI. A ton or a tonne is not related to US / American English and UK / British English spelling, and tonnes is not the plural of ton.

In addition to being a measure of mass, the ton is also a unit of volume, such as the freight ton used commonly in the USA for (container) shipments in large vehicles, trains or ships, or the cubic ton. The freight ton has a volume of 1.133 m^3 and for rosewood the cubic ton equates to 1.416 m^3 (EIA, 2014a).

In early 2021, Nijman and Shepherd (2021) brough to light that the confusion between a tonne and a ton may have led to errors in reporting quantities in the illegal wildlife trade. Nijman and Shepherd (2021) zoomed in on five large seizures of pangolins, small mammals which are traded for their meat and keratin scales and counted how many news items reported its quantities correctly. From this they concluded that about half of the news items underreported the trade by between 9 and 12% leading to a significant underestimate of the total number of animals being trafficked and being seized (in the order of 10,000 animals $year^{-1}$). Here we focus on rosewood seizures and how the confusion between measurements of mass may affect our understanding of the trade in these valuable timber species.

Nijman and Shepherd (2021) focussed mainly on Asia, where authorities report seizures firstly in tonnes, and subsequent errors in conversion and reporting mostly led to underestimating. They argued to for other wildlife commodities (ivory, shells, fish) in trade that are traded primarily in regions where the authorities firstly report seizures in tons, such as the USA, one would expect to see an overestimation of reported quantities. Inconsistencies in reporting volumes are not uncommon, especially when dealing with the complex nature of wildlife trade. The CITES Trade Database, even as one of the most comprehensive global databases regulating wildlife trade, often faces issues revolving around the inconsistencies of reporting between parties, reporting using multiple unstandardized measurement units, as well as identifications of different taxonomic levels (Foster et al., 2016; Robinson and Sinovas, 2018; Andersson et al., 2021).

The traded form of timber, in particular, also compounds the complexity in reporting (Liu et al., 2020. In an analysis of raw logs and lumber trade in China from 2002 to 2018, there were widespread trade discrepancies at the disaggregated levels (Liu et al., 2020). Furthermore, there were significant differences of trade discrepancies between tropical and non-tropical countries, and this was mainly attributable to intentional misclassification and misreporting (Liu et al., 2020).

Large quantities of rosewood are seized in Asia but also in Africa and South America (UNODC, 2016, 2020), and we expect a complex pattern (underestimating, overestimating and both under- and overestimating depending on the region the seizures are made) if indeed errors in reporting are frequent. The errors can have implications for our understanding of the magnitude and significance of the illegal rosewood trade. Rosewood seizure reports commonly include retail or wholesale prices for the seizure as a whole. Local legislation, and how it deals with fines or custodial sentences can, in part, be guided by the value of the timber that was seized. Inaccuracies in reports dealing with rosewood thus not only affects our understanding on the monetary values of this trade, but it also has broader legal and societal implications.

2. Methods

In June and July 2021 we conducted an Internet search for news reports of large-scale rosewood seizures or prosecutions related to large scale rosewood seizures in the last eight years (i.e., starting in July 2013). In July 2013 the listing of Siamese rosewood *Dalbergia cochinchinensis* on Appendix II of CITES came into effect, following the decision taken at the 16th meeting of the Conference of the Parties in Bangkok in March 2013, thus providing an appropriate starting point of our study. We used Google and Google Scholar, and in the first instance we used "rosewood" or "hongmu" in combination with "seiz*". "confiscate*" and "ton*". Large-scale here means at least 2 t (i.e., 2000 kg), with the reports indicating the mass in tonnes, t or tons (i.e., not in kg). We include only English language reports as the confusion is language specific. Reports that used the abbreviation tn were discarded as it was unclear if this referred to tonnes or tons. The unit MT is used for Megaton, i.e., 1000 t, but was occasionally used as an abbreviation for metric tonnes; when the latter was specified (or could be deducted) we included it in our analysis. A priori we excluded English language reports from Thailand, as in the Thai language, 'ton' refers to log-shaped items, often referring to raw logs (Siriwat and Nijman, 2018a, 2018b), and this may have caused errors unrelated to the argument we make here.

For each seizure we noted date, location, mass, and, if present, monetary value. We then used date, location, and other relevant information (e.g., names of the arresting agencies) to search for other reports of this seizure. This included ones that related to the prosecution of offenders that were reported months later. We then noted whether there were discrepancies in reporting of mass. For instance, a seizure of rosewood in Hong Kong in October 2015 could be reported as 1008 tonnes , rounded off to 1000 tonnes, or changed to 1000 tons. Reports include news items, technical reports and scientific articles, provided the information referred to a specific seizure, thus excluding aggregate reports. Seizures for which we only found one report were discarded as this did not allow for discrepancies in reporting of mass to occur.

Monetary values of the total seizures were mostly reported in local currencies, sometimes in combination of a US dollar value. We used the local currency value, corrected it for inflation to June 2021, and then converted this to US dollars, using the exchange rate of June 2021. We then divided this by the mass of the seizure (in tonnes) to derive at a monetary value for a tonne of rosewood. For those reports that gave mass in two measurement (tons and tonnes) we calculated two monetary values. Monetary values here refer to the value of the seized good at the time and the location of the seizure and we excluded those values where reporters clearly referred to what it would have been worth elsewhere (e.g., "on the Chinese market").

Given the global nature of the trade, with often multiple countries being involved in seizures (e.g., rosewood from Madagascar that was exported to China and that was intercepted in Tanzania), it was not always possible to find the 'first' or 'original' source who reported the seizure. If this was known, it would have been possible to check or deduct in what measurement (ton or tonnes) the amount was reported.

Table 1
Seizures of rosewood, with mass given in tons or tonnes in at least two independent reports; when quantities differ, all are given.

Date	Seizure location	Value US$ tonne^{-1}	Quantity	Number of reports in tonnes	Number of reports in ton
3 vi 2014	Singapore	17,607–20,933	3000 / 3235 / 3372	6	5
8 × 2015	Hong Kong, China		1000 / 1008	4	1
26 v 2014	Mombasa, Kenya	11,712–16,562	500 / 640 / 642	6	8
2 iv 2014	Colombo, Sri Lanka	15,976–17,612	420	7	2
? xi 2013	Fuzhuo, China	39,995–44,159	350	1	1
27 i 2014	Zanzibar, Tanzania		110	2	1
17 xii 2014	Hong Kong, China		92	2	1
? v 2014	Pemba, Mozambique		90	1	1
? x 2013	Quang Ninh, Vietnam		30	1	1
23 xxii 2017	Nam Phao, Laos		30	0	2
16 i 2018	Hong Kong, China	13,533–15,040	29 / 29.23	6	2
28 vi 2018	Hong Kong, China	5370-5968	29	1	2
5 ii 2019	Hong Kong, China	17,837–19,651	26	2	1
6 vi 2018	Hong Kong, China	39,638–47,713	23.8	2	2
4 ix 2013	Khnar Sandai, Cambodia		21	2	0
12 xii 2013	Boten, Laos		20	2	0
19 viii 2014	Samraong, Cambodia		14	0	3
28 v 2013	Ou Klakmom, Cambodia		10	1	2
24 × 2014	Oddar Meanchey, Cambodia		10	2	0
				48	35

Monetary values are calculated on the basis of reported values in local currencies that were corrected for inflation to June 2021, and then converted to US$.

As such, we were not in a position to decide which measurement was correct and in what direction any errors, if any, in reporting were (over- or underestimation). Here we simply quantify for any given seizure how many reported it in tonnes or t, and how many in ton.

3. Results

We found 19 rosewood seizures where the mass was given in tons/tonnes, for which we found a total of 83 independent reports of mass (mean 4.4 ± 3.5 reports seizure^{-1}). The range of independent reports for individual seizures was from 2 (our lower limit) to 14. The seizures were made in nine countries, i.e., seven in China (including Hong Kong), four in Cambodia, two in Lao PDR and one each in Kenya, Mozambique, Singapore, Sri Lanka, Tanzania and Vietnam.

Slightly more reports were given in tonnes or t (48) than in tons (35) (Table 1). For 14 of the seizures did we find the same (or very similar) quantities reported in both tons and tonnes, without any conversion having taken place. We found one case of a possible double conversion concerning a seizure in Singapore on 3 June 2014 of 29,000 rosewood logs from Madagascar. This was reported as 3000 t which may have been converted to 3235 tons using in conversion of 0.9272 rather than 0.9072, which was then also reported as 3235 t, in addition to 3000 and 3372 tons. The greatest difference (3235 t vs 3000 tons) is 503 t.

The mean reported monetary value of seized rosewood, corrected for inflation to June 2021, was US$20,209 ± SE US$4504 t^{-1} considering the higher quantities and mass being reported in tonnes and US$23,455 ± SE US$5169 t^{-1} considering the lower quantities and mass reported in tons.

4. Discussion and policy recommendations

The same rosewood seizure was frequently reported in both tons and tonnes without any conversions having taken place, using the two measurement terms interchangeably. This may lead to both under and overestimating the true nature of the volume of illegal trade. The seizures came from a wide range of countries underscoring the global nature of rosewood smuggling.

The wide range of monetary values for a tonne of rosewood reported here is probably due to a number of factors. The year-on-year increase in the value of rosewood exceeds inflation in most countries. While an inflation correction to June 2021, as done here, addresses some of this, calculated values from seizures made eight years ago tend to be lower than ones calculated from seizures made in 2020. The reported value of rosewood may refer to the wholesale value in the country where it was seized, the wholesale value in the importing country, which often was China, or it may refer to the value of processed rosewood in China. Finally, as with mass there were some clear discrepancies in the reported monetary values of specific seizures, with e.g., two near identical seizures of Honduran rosewood *D. stevensonii* in Hong Kong (both a single shipping container, with 29.2 t on 16 January 2018 and 29 t on 28 June 2018) were valued at HK$2.9 million and HK$1.15 million, respectively (Anonymous, 2018a, 2018b).

While it is unclear whether the discrepancies are due to genuine errors in reporting or are due to hitherto unknown reasons, there is a possibility that it could also be done deliberately to conceal true values. The issue surrounding management of stocks and stockpiles of CITES listed wildlife remain a complex issue (Wilmé et al., 2020). In Madagascar, for example, the lack of detailed information on the units of stocks or seizures in official government records that range from tonnes, cubic meters, number of logs or number of entire containers, could be an intentional in order to leave room for potential manipulation (Randriamalala, 2010). Even though since 2010 there has been further discussion on stock management, it is clear that each solution has its sensitivities and complexities, especially so long as there is a lack of transparency and accountability (Wilmé et al., 2020). This illustrates that the discrepancies in small issues concerning units and volumes, could lead to continual logging or persistent illegal trade in timber in places like Madagascar and other tropical countries. There are broad legal and societal implications not limited to biodiversity destruction, but also poaching and wildlife trafficking, illegal mining and damage to local villagers and communities (Patel, 2007; Wilmé et al., 2009).

Despite the intentions, when local reporting is unclear, this impacts wider reporting, where some overview reports on the rosewood trade show inconsistencies in reporting mass. In the methodological appendix to the 2016 Global Crime Report, the UNODC states that one m^3 of rosewood weighs slightly more than one metric ton, and later a m^3 of Madagascar rosewood *D. maritima* is equated to a ton. It is also indicated that for analysis tons were converted to kilograms, but it is not specified if this equals 907, 1000 or 1016 kg. In the chapter on rosewood in the report itself, ton(s) is used nine times and metric tons eight times (UNODC, 2016) suggesting the former represents a short ton. The Environmental Investigation Agency in a series of reports on rosewood seizures, use tonnes (EIA, 2014b), tons (EIA, 2019, 2020), and tons alongside cubic tons (EIA, 2014a). The mass of a cubic ton, and indeed a freight ton as measures of volume, depends on the density of wood and its moisture content. Thus, a cubic ton and a freight ton of dried Indian

rosewood *Dalbergia latifolia* have a mass of ~1274 kg and ~ 1020 kg, respectively. Other than the report by EIA (2014a) we did not come across any other uses of cubic or freight tons for rosewood seizures. However, given that rosewood is frequently seized in containers, where freight tons are a commonly used measure of volume, it may be prudent to ensure that the mass of seizures is indeed properly reported.

A sound understanding of both the volume and value of the illegal aspects of the rosewood trade is vital for proper management of forestry resources and to assess the effectiveness of domestic and international trade regulations (Broad et al., 2002; Phelps and Webb, 2015). While our searches give a good overview of the problem with reporting rosewood seizures, and draw attention to its existence, but they did not allow us to quantify the discrepancies or inconsistencies in reporting. We urge those that report on seizures of rosewood, including those in the media, press officers of universities and NGOs, government agencies and researchers, to be more specific in what unit of mass they report. We prefer the use of the SI approved tonne. However, given the evidently widespread use of both tons and tonnes we do not expect this confusion to go away anytime soon. We hope that bodies such as CITES and the UNODC will use only SI approved units. For now, we strongly recommend that even when the tonne is used it is defined (i.e., it equals 1000 kg). Likewise, when for whatever reason another unit is chosen (long ton, short ton, freight ton, cubic ton) this is also clearly defined, and a conversion into tonnes is included alongside in the same report.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We thank the editor and two anonymous reviewers for constructive comments and suggestions for improvement.

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