The elephant in the room: Madagascar’s rosewood stocks and stockpiles

Lucienne Wilmé1,2 | John L. Innes3 | Derek Schuurman4 | Bruno Ramamonjisoa5 | Marion Langrand6 | Charles V. Barber7 | Rhett A. Butler8 | George Wittemyer9 | Patrick O. Waeber10

1 Madagascar Program, World Resources Institute Africa, Antananarivo, Madagascar
2 Madagascar Research & Conservation Program, Missouri Botanical Garden, Antananarivo, Madagascar
3 Faculty of Forestry, University of British Columbia, Vancouver, British Columbia, Canada
4 Rainbow Tours, London, England
5 ESSA Forêts, University of Antananarivo, Antananarivo, Madagascar
6 Program on African Protected Areas & Conservation, IUCN, Pretoria, South Africa
7 World Resources Institute, Washington DC, USA
8 Mongabay.com, Menlo Park, California, USA
9 Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, Colorado, USA
10 ETH Zurich, Institute of Terrestrial Ecosystems, Forest Management and Development (ForDev) Group, Zurich, Switzerland

Abstract
To prevent the illegal trade in wild species, stock management is critical given stocks function as a buffer to supply chains during lean periods or as a mechanism for market speculation. The Madagascar government with backing by the World Bank recently promoted the sale of confiscated rosewood to reach a zero-stocks situation. To better assess options, we contrast the risks and rewards of four stock management options. Stock destruction broadcasts a potent conservation message, but provides little economic benefit. National trade can be beneficial to local socioeconomic development goals, but can lead to laundering of illegal products. International trade is fraught with risks related to illegal trade and is perceived to achieve the least related to forest and socioeconomic indicators. Lastly, banking stocks act to postpone decisions. No management option ensures a sustainable solution, but critical analyses allow better insight to the strengths and weaknesses of the available approaches.

Keywords
CITES, elephant ivory, endangered wildlife, international trade, precious timber, stocks management, traffic

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2020 The Authors. Conservation Letters published by Wiley Periodicals, Inc.
1 | INTRODUCTION

Management and regulation of stocks and stockpiles of Convention on International Trade in Endangered Species of wild flora and fauna (CITES)-listed species presents a complex, unresolved issue, globally (Frank & Wilcove, 2019; Supporting Information Appendix A). The foremost challenge involved is prevention of further illegal sourcing of—and trade in—threatened products. Stockpiles function as a buffer for lean periods and can also be used for speculation purposes (‘t Sas-Rolfes, Moyle, & Stiles, 2014; Mason, Bulte, & Horan, 2012). Operators and traffickers can leverage stockpiles to take advantage of legal loopholes favoring sourcing and trading of products (Vandergrift, 2013), which can manifest in adaptation to political changes and market conditions facilitating illegal trafficking (Challender & MacMillan, 2014; Hall, Milner-Gulland, & Courchamp, 2008; Wyatt, Johnson, Hunter, George, & Gunter, 2018). Market condition fluctuations can influence the flow of traded goods. Fluctuations may be driven by increased international demand for a product or an increase in its rarity (Wyatt, Brisman, 2017). Concerns with stockpile management are particularly salient for high traded, large volume commodities, of which illegally trafficked precious timber is among the highest of any plant-derived products traded (Wilmé et al., 2019, and references therein). CITES has been devoting attention to trade regulation of high-value hardwood species since the Brazilian Dalbergia nigra (Vell.) Allemão ex Benth. was listed in Appendix I at CoP8 in 1992.

Highly prized internationally, rosewoods are sourced from tropical countries. During the last decade, rosewood sourcing and trade reached unprecedented levels in Madagascar (Waeb, Schuurman, & Wilmé, 2018). Simultaneously, corruption increased substantially, resulting in the country being placed within the worst corruption tier (Transparency International, 2018). The current rule of law rating slipped by eight places, with negative implications for the environment (Jones et al., 2019). Since the 1990s, Madagascar has experienced chronic political instability. For decades prior to 2013, forest regulations facilitated sourcing and exporting of rosewood (Waeb et al., 2019). Periodic attempts to halt the illegal logging—primarily through confiscation of logs and prosecution of illegal loggers—led to accumulation of substantial stockpiles of seized rosewood in locations scattered throughout the country (Wilmé et al., 2019).

At the time of the CoP16—March 2013—Malagasy rosewoods were listed under Appendix II of the CITES (CITES Decision 16.15). During the CoP18 in Geneva, Switzerland (August 17–28, 2019), the Malagasy government declared no more interest in selling the current stocks for international trade. CITES requested the full inventory of all stocks and stockpiles. Under the aegis of the CITES, the government started seizing, inventorying, and auditing stockpiles scattered throughout Madagascar in 2014. Stockpiles have been concentrated in the coastal north-eastern section of the main sourcing region, which encompasses several national parks and reserves. According to Malagasy law, any sourced timber coming from these protected areas is illegal. At the CoP18, it was agreed to maintain the zero-export quota until the next Standing Committee meeting in 2020. Madagascar announced that it was (a) not intending to export the stockpiles at this point, and that instead it would look to value added local processing, and (b) considering new scientific findings recommending a potential up-listing of rosewood (Dalbergia) and ebony (Diospyros) populations to CITES Appendix I. In addition, Madagascar has banned all timber trade within the country, not just in precious woods, to gain a better control of operating licenses.

Stocks of illegally sourced precious timber possess the typical characteristics of a “wicked problem”: all proposed management solutions risk creating new problems. This exacerbates the complexity of the rosewood trafficking process (Wilmé & Waeb, 2019). We present four management options to deal with the stocks and stockpiles and discuss the implications of each in terms of economic and conservation considerations. By doing so, we hope to lay the groundwork for wise policy making on the issue of trade in this high value timber product.

2 | METHODS

Rosewood stocks accumulated on a regular basis during the period 2009–2018 by means of seizures; confiscations (after declaration) and the exceptional permitting of exportation, ostensibly aimed at reducing stocks. With a scenario-based approach, we compare management options related to objectives and risks based on the logic framework approach (Calvanese, De Giacomo, Lenzerini, Nardi, & Rosati, 1998). It focuses on stock regulation as is reflected in forest legislation, in order to assess the potential management options, the objectives achieved, and the risks involved. We review necessary CITES documents under each CITES scenario and required changes of—or modifications to—current forest legislation. We also compare the stocks management options (Supporting Information Appendices B and C and Table S1) under the different CITES statuses (Appendices I–III). We review the different kinds of permits required under each option to conduct trading and we discuss the kind of forest legislation adaptations required under the respective management options. To this end, we researched the CITES database; used informal interviews with CITES experts and examined Malagasy forest legislation for decrees and orders in relation to stockpile management.
FIGURE 1  Rosewood range countries and their relative position based on timber trade, forest cover, and governance. Total trade value of UN Comtrade commodity # 4403 (“wood in the rough, whether or not stripped of bark or sapwood, or roughly squared”) over nine years (2009–2017) to China. Governance (a composite based on Rule of law, Corruption perception index, Governance effectiveness)—horizontal axe—and a function of the total commodity trade relative to respective forest cover in 2010—vertical axe. (Data and calculations in Tables S2–S4). ISO 3166-1 alpha-3 country codes: AGO, Angola; BOL, Bolivia (Plurinational State of); BRA, Brazil; CAF, Central African Republic; CIV, Côte d’Ivoire; CMR, Cameroon; COD, Democratic Republic of the Congo; COG, Republic of Congo; COL, Colombia; ECU, Ecuador; GAB, Gabon; GHA, Ghana; GIN, Guinea; GTM, Guatemala; GUY, Guyana; HND, Honduras; IDN, Indonesia; IND, India; KHM, Cambodia; LAO, Lao People’s Democratic Republic; LBR, Liberia; MDG, Madagascar; MEX, Mexico; MMR, Myanmar; MOZ, Mozambique; MYS, Malaysia; NGA, Nigeria; NIC, Nicaragua; PAN, Panama; PER, Peru; PHL, Philippines; PNG, Papua New Guinea; PRY, Paraguay; SLE, Sierra Leone; SUR, Suriname; THA, Thailand; TZA, United Republic of Tanzania; UGA, Uganda; VNM, Viet Nam; ZMB, Zambia

3 | RESULTS

CITES-listed rosewoods occur in ca. 100 tropical range countries. Many sub-Saharan African countries experience poor governance indices, while simultaneously showing high timber trade volumes with China; there is significant under-reporting by many partner countries compared to China (Figure 1). Madagascar under-reports on “wood in the rough” (commodity 4403) compared to China, but it is reversed for commodity 4407 (Figure S1). Several shipments of precious wood from Madagascar were seized since 2011 indicating the volume of illegally sourced precious woods (Table 1).

Management options show similar risks, albeit to varying degrees. Banking and destruction of stocks have the lowest risk intensities. The destruction and banking options achieve the greatest number of objectives for the forests and both achieve some socioeconomic objectives. Opening stocks for export achieves the lowest number of objectives for both forests and socioeconomic indicators, despite the assumption that this option results in the highest tax revenues for the government (Figure 2). National trade—selling stocks

| Place of seizure      | Date     | Estimated weight (tons) |
|-----------------------|----------|-------------------------|
| Mauritius             | June 22, 2011 | 120                    |
| Comoros               | June 29, 2011 | 300                    |
| Zanzibar, Tanzania    | February 2014 | 110                    |
| Singapore             | March 17, 2014 | 3372                   |
| Sri Lanka             | April 2, 2014    | 420                    |
| Kenya                 | May 26, 2014    | 640                    |
| Hong Kong             | October 8, 2015  | >1000                  |
| **Total**             |           | **>5,962**              |

*According to Great Britain Parliament in 2013, only an estimated 10% of illegal wildlife and forest-derived product shipments are intercepted. This suggests that some 50,000 tons of Malagasy precious timber could have been exported illegally during the same period—noting that it is always problematic to estimate how much is being smuggled. (But see Tables S4 and S5 for Madagascar-related timber export to China and Mauritius.)
4 | DISCUSSION

Since the CITES Appendix II listing, the Malagasy government tried to combat the trafficking of illegal precious timber by introducing a new law in 2016 (Law N. 2015–056), with several amendments to forest legislations detailing the creation of committees to oversee the process of stocks management. Despite CITES requests for regular, transparent, and clear progress reports, the quantity of rosewood in stockpiles remains unknown. Also unknown is the proportion of stocks that have been inventoried. At the time of reporting, several stocks had been identified as “TBD” (to be determined) or classified by the number of containers rather than the number of logs (MEEF, 2018). In various official reports by the Malagasy government, there is no clarity in terms of units used: seizures or stocks are reported in tons; in cubic meters, in number of logs, or, alternatively, according to the number of containers involved. Wide variation and lack of consistency has left ample room for the manipulating of statistics, also reflected in the Comtrade data for the reporting (e.g., European Union, 2014).

4.1 | No exportation

4.1.1 | Destruction option

Destruction of stocks demonstrates intention of a government to curtail trafficking. However, the overriding concern with stock destruction is that in the context of extreme poverty, destroying so much potential revenue would be perceived as a cultural and social affront. The people most in need, that is, the impoverished rural residents, are those who have been, and still are being, used by traders to extract timber illegally. They would most likely not benefit from this option (Randriamalala, 2013). No revenue is earned from stockpile destruction and stockpile management, that is, storage, monitoring, transportation, and destruction are costly.

As suggested by ‘t Sas-Rolfes et al. (2014), the destruction of ivory stockpiles does not meet the precautionary principle (sensu Dickson, 1999), since the objectives achieved by this option are unknown. Burning of ivory stockpiles, as for example undertaken by the Kenya Wildlife Service in 1989 and 2011 was widely broadcasted in order to convey a message of zero tolerance toward trafficking (Braczkowski et al., 2018) and to instill global awareness of the issue in the hopes
of reducing demand (Bennett, 2015). However, confiscation and destruction of stocks can be viewed as having a negative impact, because poachers may want to compensate for their losses, which potentially instigates more slaughtering of elephants (Collins, Cox, & Pamment, 2017). Decreased supply likely leads to an increase of scarcity, and therefore, could drive an increase in the commodity’s price (‘t Sas-Rolfes et al., 2014). In the case of ivory, this did not appear to happen. Rather, recognition of the problems caused by the laundering of illegal ivory led the Chinese government to close domestic ivory trade, which led to a reduction in ivory prices in China (Zhou et al., 2018).

4.1.2 | Banking option

Destruction, together with banking of stocks, appears to be the stock management option that comes with the least risks. Storage of stocks has its drawbacks. In contrast to elephant ivory, timber loses some of its quality over time. Timber degradation can be slowed by storing in water—as is known from archaeological waterlogged wood (Walsh-Korb & Avérous, 2019). However even under water, timber is still subject to bacterial attack, which leads to an increase in its permeability. Logs can be stored in sealed containers under anaerobic conditions, which results in minimal deterioration. However, this expensive method is rarely utilized (Riguelle, Lesire, Hébert, & Jourez, 2017). Proper storage poses a significant challenge in terms of quality control, cost and safety. An unknown quantity of inventoried round logs in varied condition has been held in stocks for extended periods, some for more than 10 years.

4.1.3 | National trade option

Both trade options carry high risk of encouraging further illegal timber sourcing and laundering. One mechanism that has been proved to work—albeit with mixed results—is certification (e.g., Cashore & Stone, 2012). As proposed by Ballet, Lopez, and Rahaga (2010), the precious wood sector could engage in a certification scheme, which would facilitate monitoring and transparency.

The Malagasy artisan market workforce in the earlier 2000s lacked the capacity to process the quantities of rosewood held in known stocks. As of June 2019, at the Ministry of Industry, Trade, and Crafts, there are 129 entities registered, mainly in the capital city and its surroundings (108, 84%), and of these only 37 (29%) are registered as companies. Among them a majority are cabinetmakers or carpenters. Consequently, an industry would need to be created to “liquidate” the existing stocks and stockpiles. Opening the stocks to national trade would not prevent traffickers swiftly registering themselves in the craft industry to acquire the stocked logs and then funnel them back into the international trade. While this management option has the potential to create employment, there is a high risk that resident craftsmen would be left out. After liquidation, the remaining, living Malagasy Dalbergia trees would face a high level of threat because of demand for wood. Threat levels can be added to by creating arguments for the need to support local jobs. The new Annotation #15, covering Dalbergia species, exempts finished items up to 10 kg (e.g., musical instruments), so it may give Madagascar an exception in that locally made handicrafts can be exported by tourists with a proper license. This applies to Dalbergia worldwide, bar those already listed on Appendix I (Dalbergia nigra (Vell.) Allemão ex Benth., and Siamese rosewood Dalbergia cochinchinensis Pierre (covered by another annotation), and Mexican Dalbergia species.

4.1.4 | Global consequences of the exportation banning

If the exporting of precious timber from Madagascar stops, the demand from China will not simply dissipate: it can easily be substituted with a similar commodity from Africa or elsewhere, as is reflected in the volume of rosewood that has been imported by China in recent years (Zhu, 2019; Supporting Information Appendix D). In the current setting, banning the exporting of stocks will not reduce China’s high demand for raw precious timber. A ban cannot be regarded
as a measure able to guarantee cessation of further illegal logging but rather as conveying a strong message toward the donors for the funding of conservation programs.

The actual species of tree does not matter to the Chinese market: what counts is the desired properties and color, for furniture. Kosso (*Pterocarpus erinaceus* Poir.) from mainland Africa, long ago replaced *Dalbergia* spp. as the dominant tree species utilized for hongmu furniture. Now that kosso is listed on Appendix II, traders are redirecting attention to other, non-CITES species like Burmese padauk *Pterocarpus macrocarpus* Kurz (Wilmé et al., 2019).

### 4.2 Exportation option

Selling stocks on the international markets was the preferred alternative prior to the CoP18. It is the least costly and fastest option to reach a zero-stocks situation. It brings the highest economic benefits, making it attractive to those that will benefit from the sales. Allowing international trade under the current CITES Appendix II status would only be granted under specific circumstances. Every Malagasy species in the genus *Dalbergia* has had Appendix II status since 2013. The Standing Committee has set and maintained the zero-export quota because of failure to resolve various scientific and management issues, including the stockpiles, as spelled out in the Action Plan (MEEF, 2018), agreed by CITES and reaffirmed at CoP18. If the zero-quota were to be lifted, it would still be obligatory for the Malagasy CITES Scientific Authority to carry out a non-detriment finding (NDF), which would be used to set an export quota by the Management Authority.

Exporting stocks is linked with the highest risk of instigating further illegal timber sourcing. Historically in Madagascar, this alternative has not born fruit. For example, on September 21, 2009 (Ministerial Decision N. 38244/2009) and October 5, 2009 (Ministerial Decision N. 38409/2009), the Transitional Government agreed to “exceptionally export,” twice, hundreds of containers loaded with Malagasy rosewood and ebony in order to reach the “zero-stocks” scenario by end 2009. However, as soon as existing stocks were exported, further logging ensued, creating new stocks (Ballet et al., 2010).

The speculative nature of stocks and stockpiles gives rise to seemingly insurmountable challenges surrounding their management. The situation with elephant ivory serves to illustrate the risks involved. Following the global financial crisis in 2008, investments increased in products with high value such as gold and ivory. As durable products with high value, rosewood and ivory make for attractive, high-benefit investments. In the case of ivory, statistics point to the theory that increased poaching feeds illegal stockpiles that are being gathered and used for speculative purposes. For example, the demand in Asia does not correspond with the influx of Ivory (Wilmé et al., 2019). There is a gap between the estimated quantity of ivory being imported and amount being processed (‘t Sas-Rolfes et al., 2014): demand for carvings is thought to account for vastly less ivory than that available in the market (Stiles, Martin, & Moyle, 2015). The ivory carving capacity within China is believed to be insufficient to process the ivory that has been imported. This imbalance suggests that raw ivory is being stockpiled for speculative reasons rather than going directly to the markets where it would be sold in carved form. Adding to the argument that China’s demand for ivory is lower than the quantities that have been imported is the fact that demand for luxury goods in the country has recently showed a decreasing trend (Wendlandt, 2014). In recent times, ivory has been advertised as a worthwhile investment, along with art. Consequently, there was growing investment in ivory and art in China (Gao & Clark, 2014), which subsequently waned following intervention by the government of China (Zhou et al., 2018). Unfortunately, the role of stocks and stockpiles in illegal international trade varies by the valuation of the commodity, biology of the species, and the degree and ease to which it can be stored. The rosewood volume needed to match the same values of high-end products such as gold or ivory is much higher. In addition, its propensity to deteriorate and lose value over time makes rosewood logs a less attractive long-term investment and speculation commodity. As such, the framework we apply here can be used for other products, but the considerations impacting the cost-benefit of each management option will differ relative to the considerations listed above.

The ongoing conundrum over rosewood stocks and stockpile in Madagascar indicates how seemingly insurmountable a challenge it poses for the Malagasy government. Within this crisis, a core issue lies in the network of the various actors involved. According to Naylor (2005), the illegal and the legal operations in any wildlife and forest product-related trade are conducted by the same actors. In Madagascar, powerful operators are linked with the political elite (Randriamalala, 2013; Randriamalala & Liu, 2010). It is widely hoped that after the CoP18, the Malagasy government is willing to tackle these challenges of corruption and in-transparency. Breaking this deadlock is essential in order to avoid further illegal sourcing and depletion of the last standing populations of the target tree species.

There is no single, sustainable solution that can resolve the issues surrounding the precious timber stocks. In the context of high levels of uncertainty and elevated risks, the best option seemingly points to the destruction of all existing stocks and stockpiles, as that could finally end the illegal traffic and immobilize what Nordstrom (2004) refers to as shadow states and networks. However, if Madagascar can overcome these barriers and establish a transparent and accountable precious timber sector, then using the existing stocks—and only those—might be a partial solution, with added value benefiting Malagasy artisans. It is widely recognized that
replacement of rosewood and ebony resources takes from 80 to 300 years or more, depending on the species. Therefore, sustainable exploitation of these tree species is challenging and their extraction from the forests is like that of mineral resources: the “life expectancy” of these resources is considerably higher than that of any political mandate or the duration of forest legislations and decision-making. Long-term wood production—over 200 years—is achievable as shown by the example of oak, Quercus petraea (Matt.) Liebl. (Lebourgeois, Cousseau, & Ducos, 2004), under the condition that serious law enforcement and regulatory capacity are in place. Madagascar’s rosewoods should therefore be treated as a non-renewable, extractive resource. International efforts should support Madagascar in what they labeled during the last CoP18 as making a “paradigm shift” to halt any kind of illegal logging. Curtailing future exporting of any precious woods would conserve these species, which are part of our global forest legacy.

ACKNOWLEDGMENTS

We thank representatives of the Delegation of the European Union, the World Bank, US-AID, FAO, GIZ, UNICEF, as well as participants to the ATBC 2019 conference in Antananarivo for lively discussions on stocks management. We further acknowledge the participants of the CITES CoP18 meeting, August 17–28, 2019, for fruitful discussions. We also acknowledge the GEF funded project Global Forest Watch in Madagascar (ID: 5356).

ORCID

Lucienne Wilmé https://orcid.org/0000-0002-8344-1957
Patrick O. Waebber https://orcid.org/0000-0002-3229-0124

REFERENCES

Ballet, J., Lopez, P., & Rahaga, N. (2010). L’exportation de bois précieux (Dalbergia et Diospyros) « illégaux » de Madagascar: 2009 et après? Madagascar Conservation & Development, 5, 110–116. https://doi.org/10.4314/mcd.v5i2.63141

Bennett, E. L. (2015). Legal ivory trade in a corrupt world and its impact on African elephant populations. Conservation Biology, 29(1), 54–60. https://doi.org/10.1111/cobi.12377

Braczkowski, A., Holden, M. H., O’Bryan, C., Choi, C. Y., Gan, X., Beesley, N., … Brehony, P. (2018). Reach and messages of the world’s largest ivory burn. Conservation Biology, 32, 765–773. https://doi.org/10.1111/cobi.13097

Calvenase, D., De Giacomo, G., Lenzneri, M., Nardi, D., & Rosati, R. (1998). Description logic framework for information integration. In Cohn, A. G., Schubert, L. K., Shapiro, S. C. (Eds.), Proceedings of the Sixth International Conference on Principles of Knowledge Representation and Reasoning (KR) (pp. 2–13). San Francisco, CA: Morgan Kaufmann.

Cashore, B., & Stone, M. W. (2012). Can legality verification rescue global forest governance? Analyzing the potential of public and private policy intersection to ameliorate forest challenges in Southeast Asia. Forest Policy and Economics, 18, 13–22. https://doi.org/10.1016/j.forpol.2011.12.005

Challender, D. W., & MacMillan, D. C. (2014). Poaching is more than an enforcement problem. Conservation Letters, 7, 484–494. https://doi.org/10.1111/conl.12082

Collins, A., Cox, C., & Pamment, N. (2017). Culture, conservation and crime: Regulating ivory markets for antiques and crafts. Ecological Economics, 135, 186–194. https://doi.org/10.1016/j.ecolecon.2017.01.018

Dickson, B. (1999). The precautionary principle in CITES: A critical assessment. Natural Resources Journal, 39, 211–228.

Union, European (2014). Forest governance and timber trade flows within, to and from Eastern and Southern African countries. Madagascar study. Retrieved from https://europa.eu/capacity4dev/public-flegt/document/madagascar-study

Frank, E. G., & Wilcove, D. S. (2019). Long delays in banning trade in threatened species. Science, 363, 686–688. https://doi.org/10.1126/science.aao413

Gao, Y., & Clark, S. G. (2014). Elephant ivory trade in China: Trends and drivers. Biological Conservation, 180, 23–30. https://doi.org/10.1016/j.biocon.2014.09.020

Great Britain Parliament. House of Commons: Environmental Audit Committee. (2013). Wildlife crime: Third report of session 2012-2-13 (vol. 1). London, UK: Author.

Hall, R. J., Milner-Gulland, E. J., & Couchamp, F. (2008). Endangering the endangered: The effects of perceived rarity on species exploitation. Conservation Letters, 1, 75–81. https://doi.org/10.1111/j.1755-263X.2008.00013.x

Jones, J. P. G., Ratsimbazafy, J., Ratsifandrianimanana, A. N., Watson, J. E. M., Andrianandrasana, H. T., Cabeza, M., … Wright, P. C. (2019). Madagascar: Crime threatens biodiversity. Science, 363, 825. https://doi.org/10.1126/science.aaw6402

Lebourgeois, F., Cousseau, G., & Ducos, Y. (2004). Climate-tree-growth relationships of Quercus petraea Mill. stand in the Forest of Bercé (“Futaie des Clos”, Sarthe, France). Annals of Forest Science, 61(4), 361–372. https://doi.org/10.1051/foret:2004029

Mason, C. F., Bulte, E. H., & Horan, R. D. (2012). Banking on extinction: Endangered species and speculation. Oxford Review of Economic Policy, 28, 180–192. https://doi.org/10.1093/oregon/ro2006

MEEF (Ministry of Environment, Ecology and Forests). (2018). Stockpile verification mechanism and business plan. Operational framework: Phase 1 and Phase 2. Unpublished report June 2018. Retrieved from https://cites.org/sites/default/files/eng/conl/sc70/EC-SC70-27-05-01-A3.pdf

Naylor, R. T. (2005). The underworld of ivory. Crime, Law and Social Change, 42, 261–295. https://doi.org/10.1007/s10611-005-2143-7

Nordstrom, C. (2004). Shadows of war: Violence, power, and international poaching in the twenty-first century (Vol. 10). Berkeley, CA: University of California Press.

Randriamalala, H. F. (2013). Étude de la sociologie des exploitants de bois de rose malgaches. Madagascar Conservation & Development, 8(1), 39–44. https://doi.org/10.4314/ecd.v8i1.6

Randriamalala, H., & Liu, Z. (2010). Rosewood of Madagascar: Between democracy and conservation. Madagascar Conservation & Development, 5(1), 11–22. https://doi.org/10.4314/ecd.v5i1.57336

Riguelle, S., Lecize, C., Hébert, J., & Jouriez, B. (2017). Influence of a long-term storage in anaerobic conditions on Norway spruce (Picea
abies, L. Karst.) physical and mechanical wood properties. Wood Material Science & Engineering, 12, 288–294. https://doi.org/10.1080/17480272.2016.1178668

Stiles, D., Martin, R., & Moyle, B. (2015). Analysis of ivory demand drivers. Beijing: Wildlife Conservation Society. Retrieved from http://danstiles.org/publications/ivory/43.Analysis%20of%20Demand.pdf

’t Sas-Rolfes, M., Moyle, B., & Stiles, D. (2014). The complex policy issue of elephant ivory stockpile management. Pachyderm, 55, 62–78. Retrieved from http://www.pachydermjournal.org/index.php/pachy/article/view/3470

Transparency International. (2018). Corruption Perceptions Index 2018. Retrieved from http://www.transparency.org/cpi2018.

Vandergrift, J. (2013). Elephant poaching: CITES failure to combat the growth in Chinese demand for ivory. Virginia Environmental Law Journal, 31, 102–135.

Waeber, P. O., Schuurman, D., & Wilmé, L. (2018). Madagascar’s rosewood (Dalbergia spp.) stocks as a political challenge. PeerJ Preprints, #27062. https://doi.org/10.7287/peerj.preprints.27062v1

Waeber, P. O., Schuurman, D., Ramamonjisoa, B., Langrand, M., Barber, C. V., Innes, J. L., … Wilmé, L. (2019). Uplisting of Malagasy precious woods critical for their survival. Biological Conservation, 235, 89–92. https://doi.org/10.1016/j.biocon.2019.04.007

Walsh-Korb, Z., & Avérous, L. (2019). Recent developments in the conservation of materials properties of historical wood. Progress in Materials Science, 102, 167–221. https://doi.org/10.1016/j.pmatsci.2018.12.001

Wendlandt, A. (2014). Chinese demand for luxury goods hits a major slump. Business Insider, 25 July. Retrieved from http://www.businessinsider.com/r-lvmhresults-send-chill-across-luxury-goods-sector-2014-25#ixzz3Aup2ALdY

Wilmé, L., & Waeber, P. O. (2019). Madagascar: Guard last of the forests. Nature, 565, 567. https://doi.org/10.1038/d41586-019-00323-6

Wilmé, L., Innes, J. L., Schuurman, D., Ramamonjisoa, B., Langrand, M., Barber, C. V., … Waeber, P. O. (2019). Management options for addressing the persistent and unresolved CITES issue of Madagascar’s rosewood stocks and stockpiles. PeerJ Preprints, #27889. https://doi.org/10.7287/peerj.preprints.27889v1

Wyatt, T., & Brisman, A. (2017). The role of denial in the ‘Theft of Nature’: Comparing biopiracy and climate change. Critical Criminology, 25(3), 325–341. https://doi.org/10.1007/s10612-016-9344-5

Wyatt, T., Johnson, K., Hunter, L., George, R., & Gunter, R. (2018). Corruption and wildlife trafficking: Three case studies involving Asia. Asian Journal of Criminology, 13, 35–55. https://doi.org/10.1007/s11417-017-9255-8

Zhou, X., Wang, Q., Zhang, W., Jin, Y., Wang, Z., Chai, Z., … MacMillan, D. C. (2018). Elephant poaching and the ivory trade: The impact of demand reduction and enforcement efforts by China from 2005 – 2017. Global Ecology and Conservation, 16, e00486. https://doi.org/10.1016/j.gecco.2018.e00486

Zhu, A. L. (2019). China’s rosewood boom: A cultural fix to capital over-accumulation. Annals of the American Association of Geographers, https://doi.org/10.1080/24694452.2019.1613955

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Wilmé L, Innes JL, Schuurman D, et al. The elephant in the room: Madagascar’s rosewood stocks and stockpiles. Conservation Letters. 2020;13:e12714. https://doi.org/10.1111/conl.12714