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COMMENT

Tracking sequestered carbon in the timber trade

The most recent meeting discussing the Kyoto Protocol focused on market-based mechanisms to reduce greenhouse gases. This could pave the way for initiatives that allow polluters to offset their emissions if they buy carbon sequestered through reforestation (Sandalow & Bowles 2001). But rather than lose credit when the trees are harvested, investors must continue to track the sequestered carbon once trees become timber. I examined trade statistics for the best-tracked timber species, namely mahogany, *Swietenia macrophylla* King (Meliaceae). Although mahogany is regulated by one of the most restrictive trade agreements, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), I found discrepancies in USA trade statistics of *c.* 30%, representing *c.* US$ 100 million over the last 4 years. For comparison, I also calculated differences in trade data for all sawnwood, according to the United Nations Food and Agricultural Organization (FAO); discrepancies between USA and exporter reports were *c.* 38%. Large accounting problems must be solved before sequestered carbon should become a globally traded commodity.

Article 3.4 of the Kyoto Protocol recognizes the role of reforestation in creating 'carbon sinks'. Discussions have explored systems that maintain credit for carbon sequestered even once trees are harvested and the wood turned into lumber for construction and other permanent uses. Models suggest that *c.* 10% of the carbon sequestered by USA forests ends up in wood products (Pacala *et al.* 2001); this is equal to *c.* 4% of the carbon in USA emissions, or more than half of the reduction required under Kyoto.

Compared to measuring emissions or rates of sequestration, measuring the flow of carbon in wood products is considered 'relatively easy' (Pacala *et al.* 2001). However, trade analyses have found substantial discrepancies (Gerson 2000; Robbins 2000; Johnson 2002). When governments fail to report data accurately, this error is compounded in summary data compiled by the FAO for example, thus compromising the ability to determine if a country has met its commitment to reduce net emissions.

To evaluate the quality of trade data in the timber sector, I analysed USA imports of mahogany from countries where it naturally occurs, from Mexico south to Brazil. For 1997–2000, the only years for which data are available, I compared statistics from USA Customs and the USA CITES Authority.

Shipments of mahogany, the only commonly traded timber species listed by CITES, must be accompanied by CITES documents. Simultaneously, USA Customs independently reports all imports of mahogany in Harmonized Tariff Schedule Codes unique to *Swietenia* spp. (4407240030 and 4407240025; the other two *Swietenia* spp. are both listed on CITES Appendix II and are commercially extinct; Robbins 2000). Given these stringent twin-reporting requirements, USA trade data for mahogany should be of the highest quality of any internationally traded timber, tropical or otherwise.

USA Customs consistently reported a 17%–41% greater volume than the USA CITES Authority (Fig. 1). Even though CITES authorities in exporting countries are expected to report larger volumes of trade (because of permits granted, but unused), USA Customs reported at least twice the volume. Some exporting countries under-report, either due to errors or fraudulent export permits, and a few countries fail to report CITES trade data entirely. Alternatively, errors may occur from mistakes in data entry, coding, or converting between board feet and cubic metres.

The discrepancies imply more than just poor data collection. The excess reported by USA Customs represents trade that was, apparently, unaccompanied by CITES documentation, and is therefore, illegal according to Section 9(c)(1) of the USA's Endangered Species Act of 1973. However, after careful analysis (eliminating typographical errors that inflated the volume reported by USA Customs, for example), matches for all but *c.* 10% of the Customs reports were likely (Blundell & Rodan 2001).

Mahogany should be amongst the best-monitored timber species, yet the state of trade reporting raises considerable concern. Misidentification of species could lead to large errors in

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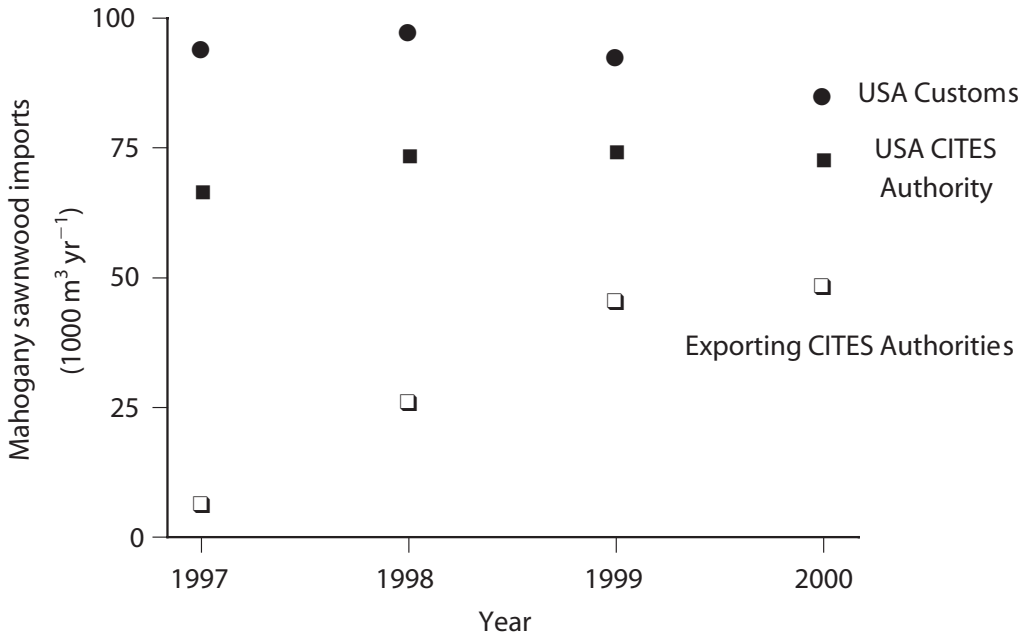

Figure 1 Volume of mahogany sawnwood imports to the USA from countries with native mahogany populations (Mexico south to Brazil). Data are from USA Customs (●) and the USA CITES Authority (■) and, for exporting countries, from CITES reports to the World Conservation Monitoring Centre (❑). In 1997, for one shipment from Mexico, USA CITES had no record of volume and, therefore, the mean size for Mexican shipments was used; one shipment from Brazil in 1998 and one from Belize in 1999 also had no record of volume and were treated similarly.

tracking carbon because timber species vary in wood density by almost an order of magnitude (Forest Products Laboratory 1999). Sawnwood and other finished products are not readily identifiable at the species level. Even experts have difficulty distinguishing between the timber of some species, let alone customs officials, who often rely solely on the information in the shipping documents.

To determine if mahogany is representative of most timber trade, I also examined FAO data (FAOSTAT) for all USA imports of sawnwood. In 1999, the most recent year available, FAO reported 87 countries exporting sawnwood to the USA. However, only 52 of these countries reported directly to FAO (for a total of *c.* 45 million m^3). In contrast, the US reported receiving sawnwood from 76 countries (*c.* 50 million m^3), or a 10.4% greater volume of sawnwood than exporters reported. As an extremely crude approximation, this difference represents 2 million tonnes of carbon. Of the 43 countries that both the USA and the exporting country reported, there was a median discrepancy of 38%; for the 16 major exporting countries (i.e. those that reported at least 20 000 m^3 in trade), the median discrepancy was still 25% (or 10.7% of total volume; Fig. 2).

In November 2001, in Marrakesh, parties to the Kyoto Protocol reached consensus that forest carbon sinks can compensate for emissions. However, those hoping to use such a mechanism face a difficult challenge. If a global approach to climate change includes sequestration through forestry then we must be able to monitor emissions and predict forest growth. Measuring the third link, the flow of carbon in forest products, may be relatively easy; nonetheless, our current ability appears inadequate. Although some models, such as CO_2FIX (Nabuurs 2001), do not track trade, but assume that a constant proportion of wood, and therefore carbon, remains permanently sequestered, even these models require empirical data on which to base their estimate. Without tracking the movement of one of the largest sources of sequestered carbon, any attempt to offset emissions with sequestration in a meaningful way is likely to fail.

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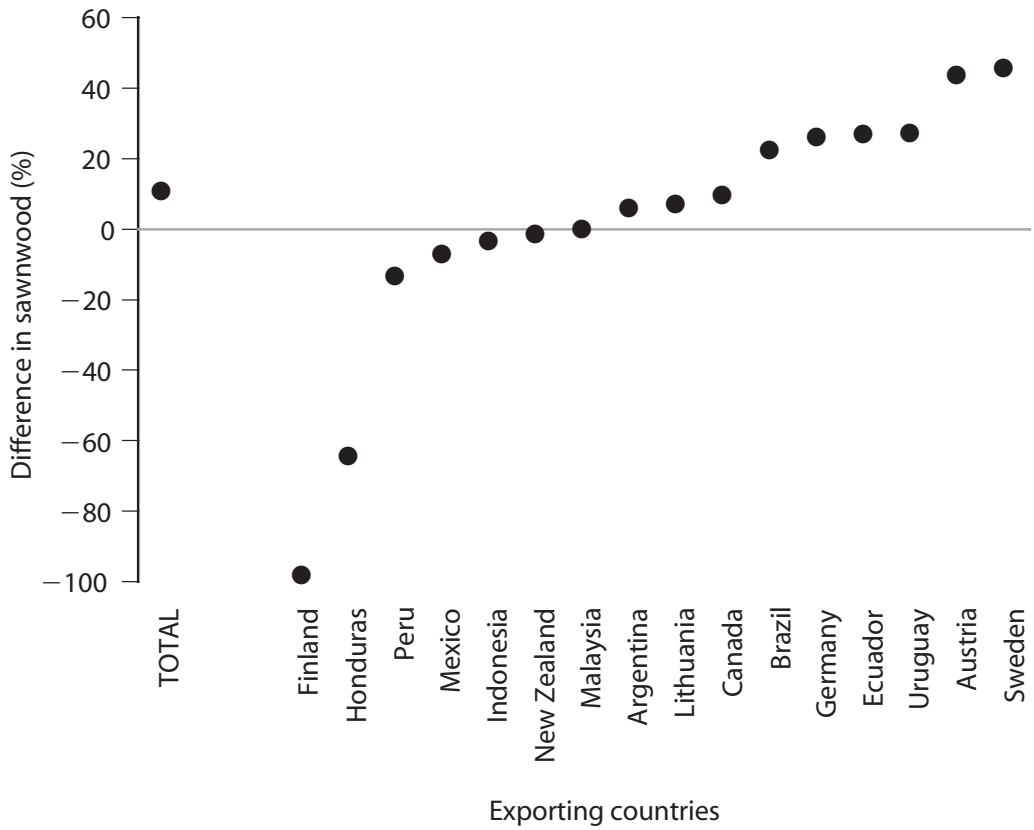

Figure 2 Difference (%) in reported trade in sawnwood between the USA and exporting countries in 1999, according to FAOSTAT.

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