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Market Signals of Unsustainable and Inequitable Forest Extraction: Assessing the Value of Illegal Timber Trade in the Eastern Arc Mountains of Tanzania

MARIJE SCHAAFSMA [a,e], NEIL D. BURGESS [b,c,d,e], RUTH D. SWETNAM [e,f], YONIKA M. NGAGA [g], R. KERRY TURNER [a] and THORSTEN TREUE [d,*]

[a] *University of East Anglia, Norwich, UK*
[b] *UNEP-World Conservation Monitoring Centre, Cambridge, UK*
[c] *World Wildlife Fund, Washington, DC, USA*
[d] *University of Copenhagen, Denmark*
[e] *Cambridge University, Cambridge, UK*
[f] *Staffordshire University, Stoke-on-Trent, UK*
[g] *Sokoine University of Agriculture, Morogoro, Tanzania*

Summary. — Natural forests and woodlands of the Eastern Arc Mountains (EAM) in Tanzania are under threat from deforestation and degradation. The estimated annual revenues from EAM hardwood for domestic use are USD 10 million in terms of planks, and twice as much when processed into furniture. Timber profits are largely captured by people whose livelihoods do not directly depend on other EAM ecosystem services. Market data, such as declining plank sizes and shifts to low-quality timber species, contain possible early warning signals of unsustainable hardwood harvesting. Policy recommendations include simplifying regulations for legal trade, developing sustainable financing, and increasing softwood supply.
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Key words — timber, forest ecosystem services, value-chain analysis, sustainable harvesting, Tanzania, Africa

1. INTRODUCTION

Wherever the lack of or weak enforcement of rules makes illegal trade more profitable than legal trade, illegal resource use and markets are likely to arise (Brack & Hayman, 2002). Many illegal activities in forestry sectors around the world take place in countries with high levels of corruption (FAO, 2001), which either allows logging to occur illegally, or results in no action against transport, trade, and manufacturing of the (illegally) harvested logs or planks. An estimated 15–30% of international wood trade, and 50–90% of timber harvest in tropical countries, is thought to be illegal (Nellemann, 2012). Illegal logging has, therefore, become a policy issue of international importance, and was made a priority area of the British presidency of the G8 in 2005. The IMF–World Bank meeting in 2006 initiated the *G8 Illegal Logging Dialogue* in order to address corruption and promote good governance as well as poverty reduction. The EU has adopted the FLEGT Action Plan under which voluntary partnership agreements can be set up with timber exporting countries to ensure legal trade; and the US Lacey Act (a conservation law) adopted a special amendment to prevent illegal logging in 2008.

Illegal logging generates high private rents for extractors because it avoids the costs of licenses, royalties, and less-intensive harvesting levels, although some bribery is also generally necessary. This opportunity to generate high private rents may lead to higher extraction rates than is optimal for social welfare maximization (Palmer, 2001). Other forest stakeholders are not compensated for the negative impacts of illegal logging. The negative externalities of unsustainable timber harvesting include effects on (non-marketed) ecosystem services of global importance such as biodiversity conservation, carbon storage and emissions, and eco-tourism. Local and regional externalities relate to direct forest uses such as lower harvesting of non-timber forest products, soil degradation, reduced water-regulating capacity of catchment areas, and reduction of pollination and cultural values. However, the timber trade creates jobs and cash income which may be vital to people in rural communities where many live near the poverty line, and provides important material resources to urban people. Enforced regulation of the timber industry thus comes at a cost to some, but provides benefits to other interests, both locally and to the global society at large.

A decline in forest resources represents a major policy problem and urgent action, based on interdisciplinary research, is needed to achieve more sustainable forest management in many parts of Africa, including Tanzania. The largely illegal nature of the forest sector means that there is little market-based evidence to inform decision-making and to estimate the severity of the problem, let alone to assess the distributional effects of possible policy interventions. In addition, biophysical stock assessments, based on large-scale forest

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surveys are costly and often remain unachievable for developing countries, where many of the remaining hardwood resources are located. Moreover, sustainable harvesting or species growth rates are unavailable for many tropical timber species. Alternative, faster and cheaper pragmatic assessment methods may provide a way forward.

This paper addresses hardwood extraction from the natural forests and woodlands of the Eastern Arc Mountains in Tanzania, a global biodiversity hot-spot under increasing pressure from deforestation and forest degradation (see Section 2). The main goal of the paper is to inform policy development and decision-making by assessing (a) the economic value of timber extraction from the Eastern Arc Mountains forests and woodlands, (b) the distribution of the associated benefits throughout the timber commodity chain, and (c) markets signals of the sustainability of hardwood extraction. While under (a) we aim to provide insight into the magnitude and significance of the forest policy issue, under (b) we show how the interests of different actors are served, thereby informing how future forest policies could be developed to ensure a more equitable use of forest resources. By analyzing various market variables (c), which are relatively easy and cheap to collect compared with large-scale physical stock and extraction assessments, we aim to provide policy-relevant information giving us clues about the sustainability of extraction levels. We link our findings to forest policies in Tanzania and suggest changes to simplify legal timber production, to invest in plantation programs and to encourage new organizational and sustainable financing mechanisms.

2. TIMBER TRADE IN THE EASTERN ARC MOUNTAINS OF TANZANIA

As a result of drivers such as population growth, development of infrastructure and competition over resources and agricultural land, forest and woodland cover in Tanzania is being lost at an increasingly rapid rate (Hosonuma *et al.*, 2012). The Eastern Arc Mountains (hereafter EAM) region of Tanzania (Figure 1) harbor some of the most biodiversity rich forests in the world (Burgess *et al.*, 2007), yet they are under severe pressure from conversion for agriculture and degradation due to extraction of firewood, poles, charcoal, and timber (Ahrends *et al.*, 2010; Hall, Burgess, Lovett, Mbilinyi, & Gereau, 2009). The EAM have lost around 70% of their natural forests (Burgess, Doggart, & Lovett, 2002; Green *et al.*, 2013), which poses a threat to many species (Burgess *et al.*, 2007; Hall *et al.*, 2009).

Tanzania has a well-developed forest policy framework and a long history of forest management. In colonial times, forests were considered a valuable resource and logging took place on industrial scales. Forest reserves were established primarily for the purpose of production. This practice continued in the EAM through the colonial and early post-colonial periods, with industrial logging in the EAM area of the East Usambaras, Ulugurus, and the Kilombero valley in the 1970s and early 1980s during and after the construction of the main railway line connecting Dar es Salaam with West-Tanzania (Hamilton & Bensted-Smith, 1989). Extraction shifted westward to Tabora and Rukwa in the early 1990s, but within a decade commercial stocks were largely depleted, and extraction moved on into the coastal forests (Wells & Wall, 2005).

In 1985, the Tanzanian government acknowledged the threat from logging to remaining forests and biodiversity, and implemented a ban on logging in the central government (catchment) Forest Reserves of the EAM and some other mountain areas. This was maintained in the 2002 Forest Act. Forest policies are currently being updated to incorporate concepts of biodiversity, catchment forests and nature reserves, and to recognize the potential of REDD and PES [1] financing of conservation. In total, 75% of the c. 4,000 km^2 forested area in the EAM has been gazetted, i.e., are formally protected (Platts *et al.*, 2011; UNEP-WCMC, 2009). In comparison, only 21% of the surrounding undisturbed woodlands are formally protected (Platts *et al.*, 2011), [2] which cover a larger area and are an importance source of ecosystem services (Green *et al.*, 2013).

Despite the clear policy and legal frameworks, with formal bans on logging in central government protection forest reserves and systems of timber licensing and royalties to regulate harvesting levels outside protection reserves, there is a clear lack of adequate policy enforcement. Estimates for the southern coastal regions in Tanzania suggest that less than 23% of the volume of actual trade is covered by official documents (Milledge, Gelvas, & Ahrends, 2007), although this percentage may be lower with only 4% of potential revenues being collected by the government (Milledge & Elibariki, 2005). Timber and charcoal demand from the city of Dar es Salaam has largely depleted coastal forests from Dar es Salaam to the Rufiji river (Ahrends *et al.*, 2010; Millegde & Kaale, 2005), with the impact spreading south into Rufiji and Kilwa districts in recent years (Sulle, 2013).

The decline in coastal forest resources combined with recent robust economic growth and urbanization (World Bank, 2013) has increased pressure on inland forests, including the EAM which still contain some highly valuable timber species. Indeed, timber harvesting is known to happen on a daily basis across the EAM in protected and unprotected areas alike (Burgess *et al.*, 2002; Makero & Malimbwi, 2012). Pitsawyers operating in small teams of two or more men (Wells & Wall, 2005) without official licenses account for most of the hardwood harvesting and input into the supply chain, mostly in the form of planks rather than logs (see Section 4). The developments raise questions about the sustainability of current harvesting rates in terms of forest ecology, welfare maximization, and distribution across stakeholders and in time.

To our knowledge, no peer-reviewed study exists in the academic literature that combines market and value chain analysis with consumption based volume estimates to assess the sustainability of timber extraction from natural forests. In the gray literature, Wall and Wells (2000) provide an overview of the various supply chain systems from West-Tanzania to Dar es Salaam. Shayo (2006) provides a more detailed supply chain analysis of the hardwood market in Dar es Salaam and supply areas in West-Tanzania, as well as some locations in between and along the main railway line, while Milledge *et al.* (2007) study the hardwood trade in the coastal zone of southern Tanzania. A peer-reviewed study by Wells and Wall (2005) has looked into the sawn timber market and the demand in Dar es Salaam and Mwanza. None of these studies focus on supply and consumption of hardwood from natural forests in the EAM or review the usefulness of a set of market signals related to extraction sustainability.

3. METHODS AND DATA COLLECTION

In many countries, research on hardwood extraction from natural habitats is complicated by the illegality of the sector. A major methodological challenge lies in data collection (Gavin, Solomon, & Blank, 2009). The absence of reliable

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