Who Sells Illegal Fuelwood?

Evidence from local market sales in northeastern Bangladesh

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1. Introduction

In tropical countries, governments have implemented regulations to control logging in specific forest areas to safeguard natural resources. However, illegal logging remains a pervasive problem in developing countries. The production of fuelwood, which is essential for household and commercial cooking and heating, drives illegal logging. Due to the lack of gas and electricity facilities, developing countries rely more heavily on fuelwood; for instance, 68% of households in Bangladesh still depend on fuelwood for cooking.

Existing literature on illegal logging mainly addresses timber extraction (Vasco et al., 2017), the high transaction costs of legal operations (Mejia et al., 2015), and low perceived punishment risks (Amacher et al., 2009). However, the significant demand for fuelwood in developing countries remains underexplored as a driver of illegal logging. We investigate the dynamics of illegal fuelwood sales in local markets and the potential role of monitoring systems in preventing illegal supply by using tree species information to identify illegal fuelwood at the vendor level.

2. Data and method

We analyzed the primary data obtained from face-to-face interviews with the owners/managers of fuelwood vendors using a semi-structured questionnaire. The survey was conducted from December 2018 to January 2019 in markets within a 30-km radius of the borders of two forest protected areas: Khadimnagar National Park (KNP subregion) and Lawachara National Park (LNP subregion) in northeastern Bangladesh. Two subregions are located approximately 100 km apart and have contrasting environmental conditions. We surveyed 206 fuelwood vendors, including wholesale and sawmill vendors, who procured, collected, and sold fuelwood in 112 markets (74 in the KNP subregion and 38 in the LNP subregion) sampled from all 535 markets in the regions. [1]

We conduct OLS regression analysis to investigate the factors associated with the sales of illegally harvested fuelwood at the vendor level. Our data allowed us to identify the sources of fuelwood sold by vendors. Illegal fuelwood sources included (a) reserved and protected forests managed by the government and (b) tea estates managed by the government or private companies. Legal fuelwood sources included (a) private homestead forests or home gardens and (b) roadside

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[1] The remaining 423 markets, 250 markets in the KNP subregion and 173 markets in the LNP subregion, were not surveyed because of difficult access in wetland areas by road or a lack of fuelwood vendors.

plantations under social forestry schemes. The dependent variable, $Illegal\ Source_i$, is a dummy variable equal to 1 if the sales of vendor *i* include fuelwood from illegal sources. Independent variables include vendor characteristics and market characteristics.[2]

3. Results

In the LNP subregion, 78% of vendors sell illegal fuelwood, while in the KNP subregion, this figure is 58%. There is a positive correlation between the amount of annual sales and illegal fuelwood sales. Sawmills and proximity to national highways are negatively correlated with illegal fuelwood sales. Sawmill vendors, who produce fuelwood as a by-product of processing and require a license from the Bangladesh Forest Department, are less likely to sell illegal fuelwood. Additionally, vendors in markets near and along the national highways are less likely to sell illegal fuelwood, indicating that highway checkpoints effectively monitor the transport of illegally logged products.

Table. OLS Estimates

	(1)	(2)
Annual sales (100t/year)	0.050*	0.054*
	(0.026)	(0.026)
Sawmill vendor	-0.254**	-0.209*
	(0.094)	(0.102)
National highway		-0.422***
		(0.132)
Vendor control	Yes	Yes
Market control	No	Yes
Sub-region control	Yes	Yes
Observations	206	206
Adjusted R-squared	0.089	0.177

Notes: Standard errors are clustered at subdistrict level.*** p<0.01, ** p<0.05, * p<0.1.

4. Conclusion

This study examines illegal fuelwood sales and discusses how to prevent and monitor them. Our findings indicate that the fuelwood business certification system and the government supervision have successfully reduced illegal fuelwood sales in local markets.

Reference

Amacher, G. S., Merry, F. D., & Bowman, M. S. (2009) "Smallholder timber sale decisions on the Amazon frontier," Ecological Economics, 68(6), 1787-1796.

Mejía, E., Pacheco, P., Muzo, A., & Torres, B. (2015) "Smallholders and timber extraction in the Ecuadorian Amazon: amidst market opportunities and regulatory constraints," International Forestry Review, 17(1), 38-50.

Vasco, C., Torres, B., Pacheco, P., & Griess, V. (2017) "The socioeconomic determinants of legal and illegal smallholder logging: Evidence from the Ecuadorian Amazon," Forest Policy and Economics, 78, 133-140.

[2] Vendor characteristics include annual sales, ownership dummy, year in business, seasonal sales fluctuation, sawmill dummy. Market characteristics include distance to forest, the Normalized Difference Vegetation Index (NDVI), population density, urban markets dummy, and national highway dummy. The quantity of fuelwood sold was recorded in local units, "maund" ≈ 37.32 kg, and converted to metric tonnes (t) for summarization. NDVI values, generated from Sentinel-2 imagery (10m × 10 m resolution), were calculated per 3km grid centered around each market. Population density data (per 100 m × 100 m grid cell) were derived from the WorldPop dataset and estimated for each 3 km × 3 km grid using ArcGIS through focal statistics.