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Regulation, formalization, and smallholder timber production in northern Central Java, Indonesia

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Abstract Forest Law Enforcement, Governance, and Trade agreements between the EU and countries that grow tropical timber aim to complement, alter, or generate new regulatory mechanisms that ensure the legality of timber products. These regulatory changes affect pre-existing policies and practices within timber production networks. The Indonesian-EU Voluntary Partnership Agreement was signed in 2013, and legality verification is scheduled to become mandatory for all smallholders by the end of 2017. Using grower surveys conducted in the Jepara regency of Central Java (n = 204), we generate information on who Jepara smallholders are, what timber species they are growing, and how programs that provide free and discounted seedlings contribute to STP. We use these data to understand how STP operates and how *Sistem Verifikasi Legalitas Kayu* (*SVLK*), the Indonesian method for timber legality verification, will affect STP networks and producers. We find that resource provision and oversight of source documentation increase formalization within STP. Our discussion details four policy-relevant insights for promoting STP amid continued formalization.

Keywords Forest policy · FLEGT · Timber legality verification · Smallholder timber production · Formalization · Java

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Introduction

Forest legality verification represents the most recent in a line of initiatives to promote "good governance" of Indonesian production forests. In Indonesia, Reduced Impact Logging, the National Forest Programmes, and Integrated Conservation and Development Projects were implemented throughout the 1990s. Following these programs, often considered less than effective (Wells et al. 1999), non-state market driven (NSMD) certifications leveraged global markets and consumers to circumvent domestic institutions, implementing "good forest governance," as defined by third party certifiers (McDermott 2012). A longstanding complaint of many NSMD certifications is that comprehensive standards and implementation are not as widespread in the global south, restricting market access for tropical timber (Ebeling and Yasué 2009; Marx and Cuypers 2010). Forest Law Enforcement, Governance and Trade (FLEGT) policies incent

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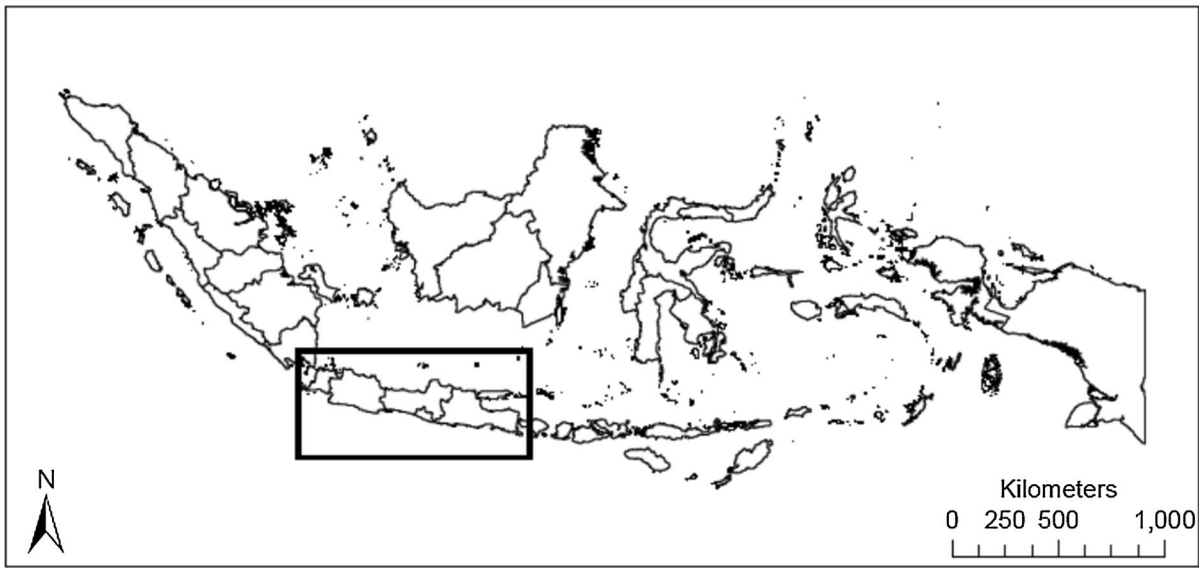

Fig. 1 Java's location in Indonesia (Source: Global Administration Areas 2012)

internationally approved timber legality regulation in tropical timber producing nations through continued access to European and American markets (European Union (EU) 2011). Advancing through Voluntary Partnership Agreements (VPAs) that specify regulatory mechanisms and institutional function in timber producing countries, FLEGT has garnered considerable international attention and approval (Cashore and Stone 2012).

Literature concerning FLEGT in Indonesia has focused on VPA negotiations, policy content, and the associated regulatory instrument. After years of bilateral discussions and multi-stakeholder input, the Indonesian VPA resulted in *Sistem Verifikasi Legalitas Kayu* (SVLK), a mandatory certification scheme. Literature on FLEGT in Indonesia considers the process by which the VPA developed (van Heeswijk and Turnhout 2012), perceptions of the VPA (Wiersum and Elands 2013), and general difficulties SVLK regulation will face (Lesniewska and McDermott 2014; Obidziski et al. 2014). While this literature is essential for understanding FLEGT in Indonesia, it often overlooks place specific growers, networks, and practices that bring timber to market. Considering how pre-existing policy and production networks is important for understanding how new regulation might promote change (McDermott et al. 2009), especially through increased formalization (Putzel et al. 2015). Formalization refers to the extent to which timber production networks and actors engage with official institutions of governance, and the predictability of these interactions (Guha-Khasnobis et al. 2006; Putzel et al. 2015). In this text, we examine the planting, growing, harvesting, and sale of timber, as well as official regulation of smallholder timber production (STP), in light of increasing formalization.

The Javanese context

The island of Java (Fig. 1) is of great political and economic importance within Indonesia. It contains approximately 60% of the Indonesian population (Singer 2009), and the production forests of Java contribute to the livelihoods of millions of Indonesians.

Javanese forestry and the rise of smallholder timber production

Centralized control of Javanese forests began before Dutch colonization (Peluso 1992) and continues into the present (Kelly and Peluso 2015). The *Domeinverklaring* (Domain Declaration), within the Agrarian Law of 1870, began formal territorialization of Javanese forests through the legal claim that first disaggregated state-owned forests of Java from other land-use types (Peluso and Vandergeest 2001; Kelly and Peluso 2015). The state's claim to owning forest areas was reaffirmed by the 1945 Indonesian

Constitution [Article 33(3)]; the Basic Agrarian law (5/1960) which provided a single framework for dealing with land issues; Forestry Law 5/1967 as well as the Revised Forestry Law 41/1999, which set up a parallel and vertically integrated set of legal and institutional arrangements for lands classified as 'forest areas' (Affif et al. 2005; Nurrochmat et al. 2012). Law 41/1999 divides Indonesian forest areas into state-owned (*hutan negara*) and privately owned (*hutan hak*) forest (Ardiansyah et al. 2015). Two additional laws from 1999 decentralized rights to manage and use state-owned forests, primarily at the district level (Laws 22/1999 and 25/1999). A series of laws since 1999 have ceded district power to provinces (Laws 33/2004 and 23/2014) and villages (Law 6/2014), and a Constitutional Court decision (No.35/PUU-X/2012) excluded customary forests from state-owned forests outlined in Law 41/1999 (Nurrochmat et al. 2014). While these policy changes have changed how and by whom state-owned forests are managed (e.g. Barr et al. 2006; Nordholt 2012; Kelly and Peluso 2015; Obidzinski and Kusters 2015), the majority of Indonesian forestland remains owned and managed by the state.

A state forest company, *Perum Perhutani*, was established to manage the state-owned forests of Java (Ministry Regulation No. 15/1972). The Ministry of Forestry, now the Ministry of Environment and Forestry (Presidential Regulation No. 16/2015), claims control over Indonesian forests through the Basic Forestry Law (41/1999). *Perhutani*, in accordance with Presidential Regulation 72/2010, manages the production of state-owned, Javanese forests. Some of the most economically significant areas of Indonesian forest, an area approximately 19% (2.4 million hectares) of the land area on Java, is under *Perhutani* management. The state forest company claims to employ approximately 341,000 people throughout Java (Perum Perhutani 2011) and is surrounded by 6300 forest villages (Susilawati and Esariti 2007 in Peluso 2011). *Perhutani* manages forests through the control of trees, labor, and territory of its Javanese land holdings (Peluso 1992). The claim to state-owned forests, high volume and value of timber on the *Perhutani* estate, and fissures of state control over timber resources have led to repeated instances of theft and forest sabotage from state-owned forests (e.g. Peluso 1992; Colchester 2001; Barr et al. 2006; Singer 2008). This, coupled with a comparative increase in *Perhutani* timber harvest, has resulted in a decline in the availability of harvestable timber. The decline in *Perhutani* timber stock, especially *Tectona grandis* (teak), is related to forecasts of decreasing timber production and revenue (Affif et al. 2005; Astraatmaja 2008; Peluso et al. 2008; Purnomo et al. 2009; Soedomo 2010).

A future shortage may compound the current demand–supply gap for timber in Indonesia. To combat illegal logging, illegal timber trade, corruption, legal uncertainty, and poor law enforcement that is related to the demand–supply asymmetry, there has been a focus on "listing illegal logging as a predicate crime under anti-money laundering legislature and signing bilateral coordination agreements" as well as promoting smallholder and large-scale plantations throughout the archipelago (Obidzinski and Dermawan 2010). As a result of the growing demand–supply gap, STP on Java has become increasingly important.

In this text "smallholder" and "grower" refer to those individuals who plant, manage, and/or harvest trees for personal benefit from non-state lands. Smallholders typically plant timber species on plots ranging from less than one to two hectares (Kallio et al. 2011; Roshetko et al. 2013; Sabastian et al. 2014), as compared to the hundreds or thousands of hectares that comprise industrial forestry operations (Byron 2001). However, in Central Java, smallholder production generates more timber than *Perhutani* managed plantation forests. In 2011, STP accounted for 81.8% of the total timber supply of Central Java, while *Perhutani* accounted for 18.2% (Obidziski et al. 2014).

Unlike supply chains that provide timber from state-owned forests on Java, STP networks are flexible and variable in time and place (Irawati et al. 2009; Perdana et al. 2012). While STP and *Perhutani* timber production differ, they are connected in multiple ways. First, illegal timber within STP networks is harvested from state-owned forests (Ewasechko 2005; Obidzinski and Kusters 2015). Second, securing timber outside state-owned forests depends on continued and legal STP (Purnomo et al. 2009; Obidziski et al. 2014). And third, the proposed system of timber legality assurance from the Indonesian VPA uses a similar, third-party compliance verification for state-owned and smallholder timber legality verification (Wiersum and Elands 2013).

FLEGT, the Indonesian VPA, and looking ahead

The 2003 FLEGT Action Plan sought to foster global sustainability and good governance by stopping illegal timber products from entering the EU through measures of timber legality verification. Indonesia's verification system, the SVLK, was implemented through Ministry Regulation No. P38/MenHut-II/2009. The VPA was signed in March 2013, ending of a decade of bilateral and multi-stakeholder negotiations (European Commission (EC) 2013; European Union (EU) FLEGT 2013a, b). Conflicting regulation from the Ministries of Trade and further regulation from the Ministry of Environment and Forestry delayed the mandatory implementation of SVLK certification (Maryudi et al. 2015), but the first shipment of SVLK licensed timber is scheduled for November 2016 (Indonesia-European Union Joint Implementation Committee 2016).

The Indonesian VPA ensures timber legality by establishing a hierarchical auditing framework, overseen by the Ministry of Environment and Forestry. Accreditation bodies provide training and certification for Conformity Assessment Bodies, which in turn provide the required certification for source documentation under SVLK or a sustainable forest management certificate. This certification indicates that a business is SVLK compliant. The price for certification can range from IRP 30—114 million (USD $3000–$11,000[1]), depending on the type of business being certified, its size, and location (Reg. P.31/MenHut-II/2010). Certification and audit periods vary by forest and enterprise type.

The Indonesian VPA demonstrates a willingness to address legality within the timber sector and represents a hallmark of civil society participation in policy formation, but it favors industrial timber interests and presents barriers for STP (Lesniewska and McDermott 2014; Nurrochmat et al. 2013). First, even in areas with capacity building via test-projects for SVLK certification, producers and consumers of domestic timber products have little interest in pursuing SVLK certification (Nurrochmat et al. 2013), and smallholders reported that SVLK certification seems less legitimate than other forms of timber regulation (Nurrochmat et al. 2014). While SMEs (businesses with capital investments less than 500 million IRP) and private, community, or village forest owners (with yearly production less than 6000 m^3) can receive SVLK certification and pre-auditing funding as a group (Indonesia-European Union Joint Implementation Committee 2015), they must self-organize and finance their certification and audits; if any one member is found to be non-compliant, the entire group can lose certification (Kaye 2013). Second, while Ministry Regulation P.30/MenLHK/Setjen/PHPL.3/3/2016 grants groups of private forest owners and SMEs a free first period of certification and initial audit, the time and money compliance requires may remain too costly for smallholders (Maryudi et al. 2015). Finally, while multiple organization seek to establish more resources for smallholder certification, industrial timber plantations have received more attention and certification than SMEs (Lesniewska and McDermott 2014; Wiersum and Elands 2013; Obidziski et al. 2014). To continue addressing these difficulties, SMEs and timber smallholders were granted exemption from mandatory SVLK licensing until the end of 2017 (P.15/PHPL/PPHH/HPL.3/8/2016).

SVLK regulation represents a variety of benefits for the Indonesian state, but its impact on STP is unclear. Curbing illegal timber production, ensuring continued access to foreign markets, and securing resources beyond state-owned forest boundaries make SVLK certification nationally appealing (Cashore and Stone 2012; Maryudi 2016). However, the significance of STP to Indonesian timber production and the flexible, place-specific networks on which it depends underline the importance and difficulty of successful FLEGT implementation (Wiersum and Elands 2013; Obidziski et al. 2014; Nurrochmat et al. 2014; Maryudi et al 2015). To understand STP and regulation in tandem, we analyze smallholders and timber production policy in Jepara, Central Java.

Methods

We collect and analyze grower surveys, interviews, and forest policy that regulates STP on Java to understand the iterative relationship between policy and local practice in Jepara, Central Java. Through these methods, we provide information on how smallholder timber is produced and regulated.

[1] Exchange rate at the time of data collection was 9650 IRP/1 USD.

Surveying local practice in Jepara

The district (*kabupaten*) of Jepara is located in northern Central Java, on the western side of Mount Muria. It is the northernmost province of Central Java and is comprised of sixteen sub-districts (*kecamatan*). Jepara is home to approximately 1,124,203 people (Kabupaten Jepara 2011). Within the district, we surveyed growers from 18 villages (Fig. 2). We selected Jepara because of the importance and prevalence for timber production within the regency and throughout Central Java (Roda et al. 2007; Furniture Value Chains 2008; Purnomo et al. 2011). The furniture value chain in Jepara contributes over $110 million in annual exports (Purnomo et al. 2014).

We selected key informants using purposive sampling and timber smallholders using systematic random sampling. We identified key informants through local institutions, and with them conducted semi-structured interviews. We also accompanied smallholders and timber middlemen to observe STP, from felling to milling/production sites. Through these interviews and field observations, we obtained information on STP and regulation in Jepara while generating a sampling frame for household surveys. The sampling frame consists of lists of known timber producers from Village Heads (*kepala desa*) and local forestry and agro-forestry extension and NGO offices. From these lists, we systematically selected a random sample of growers.

We adapted grower questionnaires from the Poverty and Environment Network survey method (Poverty and Environment Network (PEN) 2007), eliciting socioeconomic, institutional affiliation, timber holdings, and market knowledge information from growers. We made language adjustments after a 2-day period of pilot testing. A team of two enumerators and the corresponding author conducted all surveys in either Bahasa Indonesia or Javanese over a course of 4 months, ending in January 2013.

To analyze survey data, we used SAS and R software to conduct descriptive and frequency statistics, as well as linear regression. Descriptive statistics summarize grower characteristics, timber network, and market knowledge data. To analyze the relationship between socioeconomic variables within groups of farmers growing specific timber species, we used Pearson correlation on complete pairwise

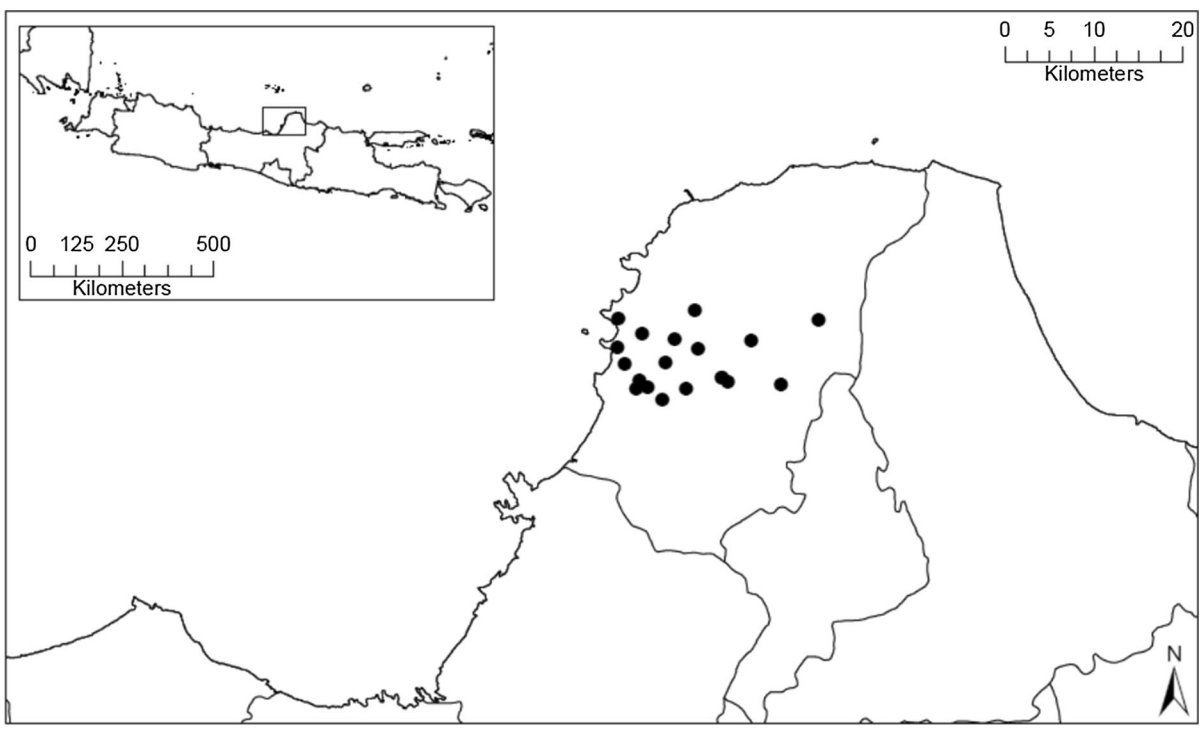

Fig. 2 Study sites in jepara with Java and provinces *Inset* map (Source: Global Administration Areas 2012)

observations. To examine the relationship between the impact of grower network and household socioeconomic variables on total smallholder timber holdings, we analyze grower data with multiple linear regression model (Eq. 1).

$$\begin{aligned} log\ (tree\ total) = {} & \alpha + \beta_1\ program\ index + \beta_2\ log\ (yearly\ income) + \beta_3\ log\ (land\ total) \\ & + \beta_4\ household\ size + \beta_5\ age + \beta_6\ years\ education + \beta_7\ known\ buyers \\ & + \beta_8\ furniture\ trade \end{aligned} \quad (1)$$

Equation 1: Grower Characteristics and STP Network Model

Previous studies that find grower characteristics significant for explaining timber production motivate our inclusion of yearly income, land total, household size, age, and years of education (Byron 2001; Irawati et al. 2009; Kallio et al. 2011; Perdana et al. 2012; Nurrochmat et al. 2013; Roshetko et al. 2013; Sabastian et al. 2014). We add STP network variables to the set of grower characteristics. To determine the significance of network variables in explaining timber holdings, we compare Eq. 1 to a model that doesn't include variables for the number of buyers a smallholder knows, furniture trade involvement beyond timber production, and participation in agro-forestry organizations. Table 1 presents variable definitions and treatment. To ensure model quality, we assessed collinearity through variance inflation factors (Freund and Littell 1986) and heteroscedacity with regression plot analysis.

While this set of seven variables account for socioeconomic and grower network variation in the data, it does not account for biophysical or political variables that might affect smallholders and their assets. However, the close proximity of our sample and its location within the same district limits ecological, climactic, and political variation between growers. To complement growers survey analysis, we assess relevant policy regulation and informant interviews.

Regulation overview

The precedent for STP regulation enforces source documentation through transportation and/or timber origin documentation (P.30/MenHut-II/2012). We consider source documentation in light of information from key informant interviews and observations to understand how these regulations affect smallholder timber producers.

Results

Results on grower socioenomic status, market knowledge and values, as well as resource provision and timber production, come from 204 grower households across 18 villages. Survey response rates were over 98%, and so we did not investigate non-response bias. Results on current regulation for STP come from policy review, twelve key informant interviews, and three multiple day observations of timber felling, purchase, and transport. Key informants included academics (n = 3), NGO leaders (n = 3), local forestry agents (n = 2), village leaders (n = 3), and a *Perhutani* manager (n = 1).

Socio-economic information

Respondents included growers recognized, or able to answer questions about, the acknowledged head of household. They were predominantly male (88.2%), with an average age of 48.9 years, average household size of 4.40 members, and 6.90 years of education.

Head of household livelihood strategies varied widely. Major sources of primary income included private business or employment (32.8%), agriculture (28.4%), and a teaching or government position (16.7%). Sources of secondary income included agriculture (57.4%) or hired farm labor (7.4%). Additionally, 47.5% of all respondents listed involvement in the furniture value chain beyond producing or selling timber as part of their livelihood strategy. This includes making, selling, or transporting furniture in Jepara. Median yearly income for growers was $2709.33, well above the rural poverty line of $302.13/year for Jepara (BPS Jawa Tengah 2012).

Table 1 Variables and treatment

Variable name	Description	Treatment:reason
Tree total	Number of total trees a grower owns	Natural log transformation: to compensate for skewed distribution
Program index	An index of how many reforestation program affiliations a grower has	Summative index: to comprehensively analyze the impact of multiple reforestation programs on STP
Yearly income	The total amount of income a grower earns in a year, in \$1000 (does not include previously owned assets)	Conversion to USD from IRP: conversion rate at the time of data collection was 9650 IRP/1 USD
		Natural log transformation: To compensate for skewed distribution
Land total	The total amount of land a grower owns, in 1000 m^3	Natural log transformation: to compensate for skewed distribution
Household size	Number of persons in household	None
Age	Age of head of household	None
Years of education	Years of education head of household has completed	None
Known buyers	The number of timber buyers the head of household knows	None
Furniture trade	Whether or not the grower participates in the furniture trade beyond growing trees	Binary variable: to comprehensively analyze impact of furniture trade involvement on STP

Table 2 Characteristics of Jepara smallholders

	N	Mean	Median	SD
Yearly income (in \$1000)	204	4.86	2.78	7.86
Total land (1000 m^3)	204	3.73	2.30	6.66
Household size	197	4.42	4.00	1.60
Age (years)	202	48.86	50.00	10.32
Education (years)	204	6.91	5.00	3.30
Buyers known	202	2.88	1.00	0.96
Total teak	204	130.59	0	560.00
Total mahogany	204	91.50	0	493.20
Total sengon	204	521.63	100.00	2555.86
Total trees	204	754.88	150.00	2823.40

Further socioeconomic information is found in Table 2.

Market knowledge and grower values

The majority of growers (68.1%) reported selling to a timber middlemen (*makelar kayu*) from their village. 17.6% indicated they plan to sell to a middleman from another village, and 13.7% were unsure or unwilling to say to whom they would sell timber. Over half of all growers knew three or more middlemen. When dealing with middlemen, 99% of growers reported being paid in cash for their timber.

Most growers responded that the middlemen provided information on current timber prices (49.0%), while some responded they would sell for whatever they wanted or needed at the time, without checking prices (38.7%). Few smallholders reported discussing fair prices with other growers (8.30%) or using a phone to check or discuss current timber prices (2.00%).

The vast majority of growers indicated that they were growing trees for profit (98.5%) as opposed to growing them for ecological, aesthetic, or cultural reasons. The majority of growers (78.4%) expect to receive short-term (0–5 years) and long-term (over 5 years) financial gain from their timber crop.

Resource provision and timber production

The 204 growers from this sample owned a total of 153,996 trees and 761,037 m^3 of land, with a median plot size of 2300 m^3. Timber aged 1–5 years accounted for 76.0% of the total crop represented in the sample. 33.3% of respondents grew teak (*Tectona grandis*), 35.2% grew mahogany (*Swietenia macrophylla*) and 72.0% grew sengon (*Paraserianthes*

falcataria). These three species accounted for over 80% of all trees in the sample.

Three different agro-forestry programs provided free or discounted seedlings to 78.4% of smallholders in the sample, and 72.5% of growers self-financed at least some of their timber crop. Of these self-financing growers, 70.2% also had an affiliation with an agro-forestry program, many with multiple affiliations. The three organizations that promote agro-forestry by providing seedlings in Jepara include the local forestry office (*Dinas Kehutanan*), which provides training and seedlings for the village nursery program *Kebun Binit Rakyat* (KBR). The NGO Trees 4 Trees (T4T), which provided growers with seedlings, monitored grower timber holdings, and worked to connect growers with certification bodies and purchasers offering current market price for timber. *Perum Perhutani* also offered free and discounted seedlings but did not monitor or record their activities. 62.3% of growers reported receiving seedlings from the KBR program, 33.3% from T4T, and 36.8% from *Perhutani*.

We use pairwise Pearson correlations to measure associations between grower characteristics as well as network variables and the total number of trees planted in four groups: teak, mahogany, sengon, and total tree holdings (Table 3). Total land owned demonstrated a moderate positive correlation within all groups of tree holdings. Total yearly income similarly demonstrated moderate positive correlation within all groups except for total sengon. Only total teak holdings demonstrated a moderate positive correlation with head of household age and the program affiliation index. Total sengon holdings demonstrated moderate negative correlation with the program affiliation index. Total years of education were moderately and positively correlated with all tree groups except teak. Only total tree holdings were significantly correlated with involvement in the furniture trade, and the correlation was moderate and negative.

Including grower network variables increased adjusted R^2 by 0.074 (Table 4). The Grower Characteristics and STP Network Model and the Grower Characteristics Model both indicate that total land holdings, yearly income, and years of education are significant predictors for total tree holdings for sampled growers. The Grower Characteristics and STP Network Model further demonstrates that involvement in the furniture trade and the number of agro-forestry programs affiliations are significant predictors of total tree holdings. Grower participation in the furniture trade is the only significant covariate negatively related to total trees planted, and smallholders who worked in the furniture trade beyond growing trees are predicted to have approximately 61.5% fewer trees. Each additional agro-forestry program affiliation (min = 0, max = 3) predicted a 20% increase in the number of total tree holdings, with all other variables held constant.

Current regulation of smallholder timber production

Networks for STP are governed largely at the village level. Village or community officials approve timber sales from their villages, verifying the legality of the transaction and the source of the felled trees. At the time of surveying, Ministry Regulation P.30/MenHut–II/2012 determined the required forms and appropriate

Table 3 Pearson correlation of tree species with socioeconomic variables

	Teak total (n = 70)	Mahogany total (n = 72)	Sengon total (n = 149)	Log tree total (n = 197)
Log yearly income ($1000)	0.332**	0.454**	0.123	0.343**
Log total land (1000 m^3)	0.310**	0.304**	0.382**	0.531**
Household size	−0.207*	−0.109	−0.117	−0.0658
Age	0.314**	0.171	−0.141	0.0924
Years education	0.182	0.370**	0.243**	0.194**
Program affiliation Index	0.259**	0.138	−0.231**	0.0699
Purchasers known	−0.0735	−0.0251	−0.0336	−0.00565
Furniture trade	−0.0117	0.0216	−0.136	−0.175**

* Significant at 0.05

** Significant at 0.01

Table 4 Regression model of jepara STP (n = 204)

	Coefficient	SE	t-value
Grower characteristic and STP network model adjusted $R^2 = 0.395$			
Intercept	−5.07	1.56	−3.25**
Log yearly income ($1000)	0.375	0.0914	4.11**
Log total land (1000 m^3)	0.546	0.0666	8.21**
Household size	−0.0745	0.0469	−1.59
Age	−0.00266	0.00858	−0.310
Years education	0.0503	0.0248	2.03*
Program affiliation index	0.200	0.0847	2.36*
Known buyers	−0.0689	0.0510	−1.35
Furniture trade	−0.615	0.163	−3.76**
Grower characteristic model adjusted $R^2 = 0.331$			
Intercept	−4.53	1.64	−2.76**
Log yearly income ($1000)	0.297	0.0934	3.18**
Log total land (1000 m^3)	0.519	0.0695	7.46**
Household size	−0.0470	0.0488	−0.963
Age	0.0121	0.00833	1.46
Years education	0.0522	0.0253	2.06*

* Significant at 0.05

** Significant at 0.01

transactions for selling from private forests. Key informants indicated that this system is often interpreted and enforced differently, by different local actors, within the regency.

Regulation P.30/MenHut–II/2012 required different documentation depending on timber product and its origin. It required a distribution note (*Nota Angkotan*), self-usage distribution note (*Nota Angkutan Penggunaan Sendiri*), or timber origin certificate (*Surat Keterangan Asal Usul Kayu*—SKAU) accompany timber produced outside *Perhutani* land. Distribution notes are used for specific species of lower-value tropical timber, self-usage distribution notes for community rights forests or public facilities outside *Perhutani* territory, and timber origin certificates for the distribution of timber (e.g. teak, mahogany, and sengon) not defined within distribution of self-usage distribution notes (Table 5). Each note is subject to approval by the elected Village Head or a local forestry official.

Key informant interviews indicated a variety of smallholder timber production occurs within the sub-district and district levels and is often unaccompanied by mandatory documentation. Field observations support key informant findings, as no permits accompanied timber sold to local craftsmen, sawyers, or timber middlemen. Further, 83% of key informants indicated that, when complied with, document verification is often accompanied by rent seeking, through monetary or goods-based "gifts."

Discussion

STP in northern Central Java is formalizing through resource providing organizations, and it will continue to formalize through SVLK regulation. Formalization is the extension of official and regulated practices and technologies into new realms of ownership, access, or production (Putzel et al. 2015). It is a process that increases the engagement of production with state institutions, actors, and processes (Kelly and Peluso 2015). An economic activity can be characterized along two dimensions of formalization:

(1) The extent that it interacts with, or comes into the net of, the structures of official governance at the national or local levels.
(2) The extent to which an activity and the interactions among its constituent individuals are structured according to a predictable, though not necessarily a codified, framework (Guha-Khasnobis et al. 2006, pp 6, 16).

Table 5 STP verification requirements from regulation P.30/MenHut-II/2012

Name of verification	Species based	Territory based	Used for	Administrative oversight
Distribution note	Yes	No	Timber from twenty-two tree species of lower-value timber (Article 5 Regulation P.21/MenHut-II/2012)	Report to village head Self-completed transportation document Six copies for: timber transport, district/city head, forest product archives, province head, council head, and archive publishers
Self-usage distribution note	No	No	Timber from Public Facilities not including: Primary business license for forest products (IUIPHHK), Community timber processing units (IPKR), Portable timber processing unit (IPKT), or Registered processing units (TPT)	Self-completed transport document One copy to accompany sold timber
Timber origin certificate	Yes	Yes	All timber not found within the distribution note and not found on public facilities noted in self-usage distribution note	Report to closest village head/forest official who has been certified for SKAU approval Must report total timber, pass physical examination of timber, and complete Location Verification form SKAU requires serial number upon publication Six copies for: timber transport, district/city Head, forest product archives, province head, council head, and archive publishers

Our results indicate that resource provision and regulation increase the extent and predictability of STP with official governance structures. We advance four policy suggestions through three general strategies to promote STP amid increasing formalization.

Provide strategic resources

Growers had little incentive to comply with timber regulations and engage with government officials when selling domestically (Perdana et al. 2012; Nurrochmat et al. 2014; Obidziski et al. 2014). Our research does, however, indicate that affiliation with an agro-forestry program increased the extent to which smallholders interact with official governance, the ability to predict future interactions with official governance, and total tree holdings. Thus, we suggest:

1. Using resource providing institutions to assist in determining legal timber verification.
2. Providing positive incentives for adhering to timber regulation standards, especially in the form of faster growing strains of luxury tropical hardwoods.

Smallholder timber investments were largely self-financed, but 78.4% of the growers were affiliated with one or more program, and our model predicted a 20% increase of total tree holdings from each additional program affiliation. When providing seedling resources, agro-forestry programs increase smallholder engagement with official governance structures. T4T and KBR programs generated records to predict output and future interactions with governance structures. Using these records can help verify timber origin. Providing licenses to smallholders or auditing when dispensing seedlings can provide a positive incentive for smallholder timber legality verification. By focusing on resource provision and licensing at the moment of planting, timber legality verification might be implemented more effectively.

Management for mature, luxury hardwood timber is secondary to short-term (1–5 years) demands, for growers in this study. 98.5% of respondents grow timber for economic benefit, and 76% of their standing stock is between 1 and 5 years. The shorter management timeframe is reiterated by the majority of growers who grew sengon (73%) and reported harvesting it within 5 years. Ministry Regulation P.7/

MenHut-II/2009 requires that only when "local needs" are fulfilled may smallholder timber be sold to other regions. In Jepara, the demand–supply gap for timber, combined with the possibility of limited timber flowing in from other regions, will generate a greater need for local production of luxury hardwood timber (Purnomo et al. 2009; Nurrochmat et al. 2015).

Providing access to fast-growing varieties of luxury hardwoods can maintain shorter rotation periods and ameliorate the demand for luxury tropical hardwood. As Sabastian et al. note, to promote agro-forestry among smallholders, it is important to provide resources that maximize each unit of smallholder labor and require minimum input costs (2014). Given the importance and projected dearth of luxury tropical hardwoods in Jepara, providing strategic seedling resources while certifying smallholders can benefit timber producers and product companies.

Strengthen existing regulation

Existing networks that require source documentation need to be strengthened, and incentives need to be aligned, for the successful inclusion of STP within timber legality verification. In relation to strengthening existing networks and aligning incentives, we suggest:

3. Addressing the legitimacy of SKAU certification rather than relying on compliance verification.

Though Ministry Regulation P.30/MenLHK/Setjen/PHPL.3/3/2016 currently permits self-documented compliance in lieu of formal certification, SVLK seeks to bolster the legitimacy of timber documented through SKAU using third-party audits. However, third-party audits that only check compliance assume legal documents are produced by appropriate administrative procedures. Resistance to SKAU documentation and procedural verification is not only possible through non-compliance, but it is also possible by issuing false permits and lax enforcement or oversight.

Recent Ministry Regulations (P.21/MenLHK-II/2015 and P.30/MenLHK/Setjen/PHPL.3/3/2016) alter the system of STP regulation in effect at the time of sampling (Table 5). Most notably, SKAU certification, which requires formal checks of timber origin by village heads or local forestry officials, is now only required for timber transport outside of Java, Bali and Lombok, for timber species not including teak, mahogany, sengon, and a variety of lower value fruit trees (Article 4 Regulation P.21/MenLHK-II/2015). While this streamlines the overall process of documenting timber transport and origin as suggested by Rohadi et al. (2012), overall procedural compliance remains the domain of locally elected officials or forestry employees. Clienteleism, patronage democracy, or state pluralism, where semi-autonomous actors work outside national logics of governance and political favors can be traded for support (McCarthy 2004; Nordholt 2012) will remain a hurdle for SVLK certification. The non-compliance with timber origin and transportation documents observed in this study, coupled with the patronage, clientelism, and lack of administrative transparency noted in other research (Obidziski et al. 2014; Maryudi et al. 2015; Obidzinski and Kusters 2015), indicates that unless SVLK certification audits the process and procedure of STP regulation, it risks permitting lax or corrupted legality verification.

Further reduce certification costs

Making it more difficult and expensive to sell timber disincentivizes STP as a supplemental income activity. While many steps toward easing the burden of licensing and auditing STP have been taken, we suggest:

4. Further reducing the cost of SVLK licensing and auditing through financial incentives or reduced certification and auditing requirements.

Key informants, observations, and grower surveys indicated smallholders do not want to invest additional time and energy into timber production. Other studies of STP in Central Java reinforce the supplemental nature of timber production and a general lack of market knowledge among (Kallio et al. 2011; Perdana et al. 2012; Roshetko et al. 2013; Obidziski et al. 2014). Dharmawan et al. estimate 17–23% of smallholder income is derived from timber (2012 in Obidziski et al. 2014). Median income for smallholders in this study was over seven times the rural poverty line. However, nearly half received market information exclusively from purchasers, and an additional 38.7% indicated they sell for whatever price they need. Given the supplemental nature of timber production, and smallholders' unwillingness to spend extra time or

money on market information, it is unlikely the smallholders in this sample will willingly pursue and pay for SVLK auditing and licensing.

Multiple policies seek to ease the burden of certification on smallholders, but this study suggests that further measures of cost reduction or financial incentives are necessary. SMEs and timber smallholders are permitted to band together for certification, they can receive pre-auditing and initial certification from outside funding, and they have until the end of 2017 to comply with mandatory SVLK certification (P.30/MenLHK/Setjen/PHPL.3/3/2016). However, estimated costs for SVLK compliance over the first ten year period, assuming the initial certification and pre-audit is free, remains approximately 100 million IRP (Maryudi et al. 2015). Despite concessions to smallholders, the growers in our study are unlikely to comply or continue producing timber, given the time and money certification will require.

To promote Jepara STP in light of SVLK, we support Obidzinski et al.'s suggestion to reduce the financial burden on smallholders through decreasing the cost of certification and auditing and/or providing financial incentives for compliance (2014). Growers in our sample can use their land for other income generating activities. Mandating costly STP certification might make them more likely to pursue other supplemental income activities.

Conclusion

Our sample suggests that growers prefer short rotation cycles and fast growing timber species. The analyses indicates that land, income, and education are positive predictors of total tree holdings. Further, understanding smallholders as part of a network of timber production that includes agro-forestry program affiliations, down-stream furniture production activities, and number known of timber buyers helps to explain variation in total timber holdings. However, STP functions as a supplemental income activity, and growers spend little additional time and money on obtaining market information or complying with loosely enforced regulation. Given these findings, we suggest:

1. Using resource providing institutions to assist in determining legal timber verification.
2. Providing positive incentives for adhering to timber regulation standards, especially in the form of faster growing strains of luxury tropical hardwoods.
3. Addressing the legitimacy of SKAU certification rather than relying on compliance verification.
4. Further reducing the cost of SVLK licensing and auditing through financial incentives or reduced certification and auditing requirements.

STP provides essential timber resources and directly supplements rural income across Central Java. While FLEGT collaboration provides an opportunity for the Indonesian state to increase its legitimacy within global timber product markets, burdening smallholders with timber regulations without providing proper incentives, addressing legitimacy issues in pre-existing regulation, and reducing costs may result in non-compliance or public resistance. Though regulation may be mandated nationally, it is implemented and practiced locally. As SVLK certification becomes mandatory for smallholders in the near future, it will become increasingly important to study the impacts of regulation and increased formalization on STP and the domestic timber trade in Indonesia.

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