

Illegality and inequity in Ghana's cocoa-forest landscape: how formalization can undermine farmers control and benefits from trees on their farms

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Abstract

Schemes to promote sustainable forest management have increasingly focused on addressing widespread informalities in timber production, based on the presumed links between formalisation, the maintenance of forest cover and local welfare. This trend is typified by the EU Forest Law Enforcement, Governance and Trade (FLEGT) initiative and associated Voluntary Partnership Agreements (VPA) aimed at eradicating the trade of illegal wood between partner countries and the EU. Yet there is concern that such initiatives might have detrimental impacts on the largely informal rights of local resource users. In order to inform the formalisation agenda, more detailed analysis of the operation of local rights, and how they might be affected by particular schemes is required.

This paper focuses on Ghana as a country with a largely informal wood sector that has signed a VPA with the EU for the express purpose of rapid formalisation. Our analysis is guided by a framework for assessing which types of rights might be transformed by particular approaches to formalisation and the subsequent effect this might have on forests and people in particular local contexts. We then apply this framework to an in-depth local case study of on-farm timber governance within a cocoa-forest landscape in Ghana's Central Region to examine how the operation of formal and informal and substantive and procedural rights shape who controls, and benefits from, on-farm timber production. We then analyse the content of the VPA in light of these local realities and assess its potential impacts.

Our findings highlight how the substantive rights the state grants to companies are presumed to be balanced with the granting of procedural rights to farmers via the mechanisms of right of refusal to harvest on-farm timber, compensation for damage to cocoa crops and the negotiation of community-level Social Responsibility Agreements with private companies. Yet a comparison of these formal rights with farmers' existing informal rights reveals that farmers' control and access to benefits from trees on their farms are notably higher in the 'illegal' chainsaw dominated informal sector than in the 'legal' state-based system. Farmers choose to maintain trees on farms both to shade cocoa and in anticipation of benefits from their informal sale. The VPA, however, aims to eradicate all informal on-farm timber production and thus threatens existing local rights and benefit capture while diminishing incentives to maintain trees on farm. Rather than further criminalising local systems of timber governance, the maintenance of tree cover and local benefit-sharing would be better served by 1) phasing out timber concessions on farmland, 2) abandoning the distinction between planted and native trees on farms and, 3) understanding, recognizing and respecting the existing informal rights of farmers, traditional authorities and chainsaw loggers to negotiate among themselves patterns of access and control of on-farm trees and timber. In general, the case study challenges the assertion that formalisation is requisite for sustainable forest management and

mandates a more nuanced and contextually informed assessment of the assumed costs and benefits associated with particular forms of legal and policy reform.

Keywords: Ghana, Cocoa, Forest, FLEGT VPA, Timber, Formalisation

1. Introduction

Widespread concern for global forest loss has fuelled international demand to formalize forest governance and tenure, based on a presumed link between legal formalisation and sustainability (McDermott, 2014). This equation of legality with sustainability is particularly evident in the European Union's Forest Law Enforcement Governance and Trade (FLEGT) Voluntary Partnership Agreement (VPA) programme, which calls for the prohibition of trade in illegally produced wood as a means to promote environmentally and socially responsible forest governance (Lesniewska and McDermott, 2014). Despite growing support for formalisation, however, the literature sends mixed messages as to its likely impacts. On the one hand, formalisation has been promoted as a means to support productive investments and sustainable land management practices, protect fragile rights, enable economic engagement and prevent over-exploitation of resources (De Soto, 2000; Hansen et al., 2015; Kishor and Lescuyer, 2012; Soule et al., 2000). On the other hand there are significant concerns regarding the increasingly intense pursuit of formalisation in a natural resources context, particularly regarding the ability of local users to control and benefit from those resources (McBarnet and Whelan, 1991; Putzel et al., 2015). For example, concerns have been raised about the criminalisation of legitimate but informal livelihood activities (Cerutti et al., 2013; Hauck, 2008; Marfo, 2010; Tschakert and Singha, 2007), the marginalisation of poor resource users who are unable to meet the financial and bureaucratic costs associated with formalised systems (Hilson and Potter, 2005; Lagos, 1995; Maldonado, 1995), and issues of elite capture at different levels (Meinzen-Dick and Mwangi, 2009; Platteau, 2004; Pritchard, 2013; Sjaastad and Cousins, 2009).

Given the diverse and conflicting evidence on formalisation, the assessment of its likely impacts calls for a more nuanced analysis that examines how existing governance arrangements shape patterns of control and access to benefits, and identifies precisely what types of rights are affected by formalisation, and how. For such purpose, this paper draws on three components of governance systems, which are often examined separately, to frame an analysis of the governance of on-farm timber in Ghana's central region. These are 1) formal versus informal¹ rights, 2) substantive versus procedural rights and 3) the contextual and multi-level nature of how different types of rights are translated into local patterns of control and benefit.

The impetus for legal reform of Ghana's forest sector is rooted in concerns about the impact of ongoing timber exploitation and the expansion of cocoa on the long-term benefits flowing from intact forests, including carbon storage and sequestration, provision of climatic conditions suitable for cocoa and biodiversity conservation (Benhin and Barbier, 2004; Ghana, 2005; Gockowski and Sonwa, 2011; Hansen et al., 2009; Obiri et al., 2007; Ruf, 2011; Wade et al., 2010). In addition to the management of forest reserves, considerable attention is focused on the informal timber harvest on cocoa farms, which hold a significant portion of the country's remaining tree cover, and also serve as important sources of wood supply for domestic and local markets (Hansen, 2011; Hansen et al., 2012; Marfo and Acheampong, 2011; Marfo and Schanz, 2009).

¹ In this paper the terms formal/statutory and informal/customary are used synonymously.

In light of these concerns, Ghana has signed a Voluntary Partnership Agreement (VPA) with the EU with the express aim of ensuring law enforcement both in forest reserves and on farms (Community, 2009). Given the strong international and national pressures to address informalities, it is critical to examine how efforts at formalisation interact with existing patterns of forest control and access. This paper therefore draws on a detailed case study of a Ghana cocoa-forest landscape to identify how actors currently control on-farm trees, and the associated distribution of benefits. We then critically reflect on the implications of the case study for efforts to formalize forest governance through international initiatives such as FLEGT.

The paper is organised as follows. The next section outlines the analytical framework employed in the paper and is followed by a description of the methods used in Section 3. Section 4 provides a national-level overview of tree and land tenure governance in Ghana. Section 5 focuses on our case study area, examining how the formal, informal, and substantive and procedural rights to timber influence the patterns of control and access to benefits of on-farm timber at a local level. Section 6 then briefly details Ghana's EU FLEGT-VPA and considers its implications for on-farm timber governance. The paper then summarizes the findings and identifies top priorities for action to deliver more effective and equitable governance reforms.

2. Assessing the impact of formalisation on access to on-farm trees - a framework

Historically, the term 'formalisation' has referred to the codification of informal or customary rules concerning natural resource rights, including ownership, access, use and trade, usually for recognition by the state. However, with the growth of illegal logging initiatives in the 2000s, the term has increasingly been used to refer more generically to the eradication of all activities not sanctioned by the state (Putzel et al., 2015; Weng, 2015). We argue that under both understandings, assessing the impacts of formalisation requires distinguishing between informal activities that are governed locally, from the complete absence of social order. This is particularly important in contexts where the imposition of state rules may override local norms, which may have evolved alongside formal policy agendas.

This study recognises that ownership and related rights to natural resources are characterised by bundles of rights such as access, management, exclusion and alienation (Schlager and Ostrom, 1992). But rather than map out all of these rights in their full complexity, this paper focuses on two distinctions that we argue are critical for assessing the local impacts of formalisation. The first is between formal or statutory rights and informal or customary rights. Formal or statutory rights refer to those recognised in State laws, while customary rights refer to rights rooted in 'anteriority and alliance' (Cotula and Chauveau, 2007)². The latter are considered 'informal' because they operate separately from state institutions. These informalities may be legal, where they operate in unregulated spaces, or illegal. However, it is important to consider the legitimacy and equity of any given practice, since widespread regulatory biases against small-scale operators has meant many of

² This conceptualisation of informal rights is closely related to the concept of access (Ribot and Peluso, 2003), which refers more broadly to the ability of social actors to benefit from natural resources. The structural and relational mechanisms that determine access can include, but are not limited to, formal and informal rights. To retain conceptual clarity, this analysis focuses on how rights are commonly interpreted at the local level, but we highlight where relevant how the enactment of those rights are negotiated through relationships, for example, between landlords and tenant farmers.

them have found themselves operating illegally but according to arrangements that are widely held to be legitimate (IUFRO, 2016). These illegalities are qualitatively different from other illegalities such as the payment of bribes for concessions or forgery of documents. We refer to such rights as ‘informal’ or “customary”, to avoid conflating them with other types of illegality that lack local legitimacy, i.e. that are not well aligned with local perceptions of fairness or shared local objectives (Osei-Tutu et al., 2014).

This position aligns with the work on legal pluralism that addresses how multiple systems of rule-making may co-exist within the same territorial jurisdiction (Hamilton-Hart, 2017; Tamanaha, 2008). In light of this, interrogating the interactions between statutory and customary rights is central to understanding how formalisation and related natural resource governance reforms are likely to influence patterns of benefit and control. For example, as Tamanaha (2008) notes, formal legal systems may lack the resources necessary to accomplish the desired changes accompanying formalisation processes, in which case customary rights embedded in ‘lived norms will continue to govern social action’.

The second distinction in our framework, is between substantive and procedural rights. Following Ituarte-Lima and McDermott (*In Press*) we define substantive rights as those which refer to the allocation of rights, in this case to the ownership of, or access to, natural resources, while procedural rights refers to the processes and means by which those rights can be attained. In the context of Ghana’s timber sector, for example, the formal substantive rights to timber are vested in the state and are then granted to companies through a permitting system. Farmer’s formal legal right to access a share of the benefits from timber on their farm is attained communally through Social Responsibility Agreements (SRA). The formal procedural right to negotiate a SRA rests with the traditional authorities, who ostensibly negotiate with the concessionaire on behalf of community members (Agyei and Adjei, 2017; Ayine, 2008).

The concepts of substantive and procedural rights have largely originated within the context of formal legal systems but, we argue, can also be loosely applied to informal systems. That is, a farmer may be viewed as having locally recognized informal substantive rights when the local community considers it appropriate for the farmer to make choices about whether to retain or remove trees. The informal procedural rights of farmers refers to their locally recognized rights to make use of informal or traditional systems of negotiation and decision-making.

Formal and informal and substantive and procedural rights may be interlinked in dynamic and complex ways. Nevertheless, distinguishing between them in a case study context allows for more nuanced insights into how rights are translated into patterns of control and access to benefits from natural resources.

The operation of substantive and procedural rights are situated within the beliefs, practices and institutions of a particular culture. The distribution of the realisation of these rights in society is related to what McDermott et al. (2013) call ‘contextual equity’; ‘the pre-existing political, economic and social conditions under which people engage in and benefit from resource distributions – and which limit or enable their capacity to do both’. For example, the systemic disadvantages faced by people based on their gender, religion or ethnicity shape the realisation of rights. The consideration of ‘contextual equity’ facilitates a more holistic understanding of governance reforms.

Finally, it is important to recognise that the interactions between formal/informal and substantive/procedural rights operate on multiple scales and levels.³ As Mwangi and Wardell (2012:82) explain, accounting for the multi-level nature of governance requires devoting ‘attention to the links between humans and their environment, which may occur vertically (i.e. from local to global) or horizontally (at the same level), as well as to contestation and learning among parties with a stake in forests and other natural resources.’ For example, the definition of rights at a national level may establish ostensibly uniform legal rights and procedures, but as Sikor et al. (2010) note, local level actors play a key role in operationalizing the rights and duties associated with specific forest resources and shaping their distribution among stakeholders.

3. Methods

To explore in detail the local dynamics of on-farm timber governance a mixed-method multi-level case study was conducted in 6 communities in the Assin South District in Ghana’s Central Region between December 2013 and July 2016. The case study was purposively selected to represent mature cocoa-forest landscapes (where cocoa trees have been cultivated for more than 50 years). This is felt to be important because such landscapes represent a significant proportion of cocoa landscapes in Ghana and stands in contrast to popular descriptions of cocoa in Ghana as a frontier crop. The case was also selected as an area that had not been subject to any interventions from other research programs or NGO interventions to balance the bias in the literature towards field sites that examine interventions, for example efforts to encourage communities to support themselves using SRA process, that are not representative of the wider cocoa farming population.⁴

The analysis which follows is principally based on a series of in-depth interviews with farmers (n = 36, 10 of whom belonged to the indigenous ethnic group), chainsaw operators (6), and key informant interviews (n = 10) with the Forestry Commission, COCOBOD and in-country environmental NGOs. A series of focus groups (6 male groups, 6 female groups) were also conducted which were supplemented by 2 district level and 1 national level workshops with key state and non-state participants. The analysis also draws on interviews with UK and EU policy-makers and NGOs involved with forest law and policy (n = 12). The format of these interview-based methods were adapted to the respondent(s) but addressed questions concerning their perceptions regarding the governance of on-farm timber trees and relevant policy-processes. The data was analysed using standard qualitative techniques (Miles and Huberman, 1994).

These methods were supplemented with two household surveys conducted (in May 2015 and July 2016) with 108 randomly sampled (gender stratified) cocoa farmers to investigate, *inter alia*, factors that influence their decisions over retaining or removing trees from farms and their perceptions concerning their control over chainsaw operators and concessionaries. In addition to these discrete moments of data collection, the local field team who managed the continuous monitoring of plots established for ecological data collection (see below) also collected ethnographic observations for 2 years and recorded their interactions in the communities which enabled issues such as the operations of timber concessionaires in the area to be followed over time and in detail.

³ Following Gibson (2000) scale is understood as spatial, temporal, quantitative, or analytical dimensions used to measure and study phenomena. Within these scales there are a continuum of ‘levels’. For example, the jurisdictional scale includes the local, regional, national and international levels.

⁴ Although no data exists to accurately know how many of the 1 million cocoa farmers have been engaged by policy-pilots and related interventions schemes.

In order to contextualise the analysis of how rights shape the distribution of benefits, we estimated the monetary value of timber on cocoa farms in the study are by conducting a census of trees⁵ on 36 60x60m spatially sampled plots on cocoa farms as well as two 1 ha plots in Kakum National Park and one 1 ha plot in the adjacent Attandanso Forest Reserve to provide a 'baseline'. The cubic meters of timber for each tree were calculated using tree height, diameter at breast height (DBH) and a form function of 0.375 (this represents an average form between the two extremes, a neiloid with a form function of 0.25 and paraboloid, with a form function of 0.5 (Philip, 1994). Key informants (chainsaw operators and timber merchants) were consulted to translate this data into estimates the monetary value of timber trees to the farmer, in the domestic market and, for comparison, we also calculated the stumpage fee⁶.

4. Rights to land and timber resources in ghana: formal rights and informal realities

The Ghanaian constitution distinguishes between land and economic natural resources.⁷ Land is mostly (80-90%) held under customary ownership and, as a result, the state is not directly involved with questions of land governance, which are considered 'chiefly matters'. In this way, informal or traditional governance arrangements concerning land are recognised under statutory law. Approximately 65% of land under customary ownership is Stool⁸ land which is effectively under control of the paramount chief, the remaining 35% has been alienated and is, with varying degrees of documentation, privately owned by families or individuals (Amanor and Ubink, 2008; GoG, 2003; Zhang and Owiredi, 2007). In contrast to the customary ownership of land, since independence the state has been responsible for granting formal substantive rights to timber via the Forestry Commission, to private enterprises through a permit system (summarised in table 1)⁹. These permits are granted both to timber produced in reserved forests and timber that is grown on farmland, often referred to as 'on-farm' or 'off-reserve' timber. The distribution of these rights is governed by the 1998 Timber Resources Management Act (Act 547) and its amendment in act 617 in 2002 as well as the Timber Resources Management Regulations, 1998 (L.I 1649) and its amendment in 2002 (L.I 1721). Where these formal substantive rights are granted on farmland, agreement is required from the landowner (usually the paramount chief¹⁰) with disputes being resolved by committee (see Section 5 of act 547).

⁵ Using the Global Ecosystem Monitoring protocols (<http://gem.tropicalforests.ox.ac.uk>)

⁶ Stumpage fees are taxes paid by concession holders to the Forestry Commission and are based on the volume and value of trees

⁷ Although trees are not specifically addressed in the constitution, it vests responsibility for allocating or exploiting mineral, water and natural resources in parliament on behalf of, and in trust for, the people of Ghana (Article 268).

⁸ The term stool in Ghana refers to chiefly office (Berry, 2004).

⁹ This has been the case since 1962. The 1962 concessions act, (Act 124: Section 16 (4)) vests all rights to "economic trees" in the President in trust for the Stools. This replaced a system whereby chiefs, in partnership with European companies, had previously been in effective control of the forest estate (Grove 1997:172).

¹⁰ Traditional authorities in Ghana are characterised by a hierarchy headed by a paramount chief, who is supported by a series of sub-chiefs (divisional heads) and village chiefs (odikros).

Table 1. Summary of current timber permit types

Permit type	Description – key features
Timber Utilization Contract (TUC)	<ul style="list-style-type: none"> Competitively tendered and subject to parliamentary ratification Envisaged as the primary mode of distributing substantive rights to timber. Not permitted on farmland unless with the approval of the landowner (usually the paramount chief – see text). Concessionaries are required to share the benefits accruing from timber revenues by providing social amenities to forest communities through social responsibility agreements (SRAs). <ul style="list-style-type: none"> <i>Farmers have procedural rights under SRAs, substantive rights remain with concessionaire.</i>
Salvage Permit	<ul style="list-style-type: none"> Administered and signed by the Forestry Commission and granted to timber companies. Intended to be employed in areas undergoing development to salvage timber that might otherwise not be utilised, including in the cultivation of farms (see LI 1649 - Section 38). However, like other permits, they have been granted for native trees on farms that the farmers themselves have planted or nurtured. In such cases, farmers clearly have intended to utilize the trees for shade, fruit, medicine, timber or other purposes. Yet if the state awards a private company a salvage permit on their farms, farmers are given no compensation for the trees harvested. SRAs also required under salvage permits.
Timber Utilization Permits	<ul style="list-style-type: none"> Administered and signed by Forestry Commission on areas not covered by a TUC. A small-scale permit granted to the community for communal purposes (such as building a school) Felling undertaken by chainsaw operators with a registered chainsaw
Special permits	<ul style="list-style-type: none"> Permits approved by the minister on the recommendation of the forestry commission in areas not suitable for TUCs or Salvage Permits. There is ongoing debate about the role of such permits in the VPA.

Of particular relevance to on-farm timber, the timber regulations make the distinction between naturally occurring trees and those that are planted, with naturally occurring timber being vested in the state regardless of the land ownership arrangements, while timber planted privately is formally recognised as belonging to the person who planted it. Consequently, the state holds authority to grant timber rights to private enterprises to harvest native trees on farms and farmers have more control over exotic species, such as teak, than native species, since it is more difficult for farmers to prove that native trees were planted¹¹. Farmers usually nurture or transplant wildlings on their farm which are currently categorised as naturally occurring. Formally, farmers have no substantive rights to native trees, even though shade is a key component of cocoa management and the government recommends that farmers maintain 15-18 shade trees per hectare (CRIG, 2010).

While farmers and communities lack formal substantive rights to on-farm native trees, they are afforded some limited formal procedural rights. These are the right to refuse permission for concessionaires to fell timber on their farm, compensation for damaged cocoa (Richards and Asare, 1999) and communal benefits derived from social responsibility agreements (SRA). SRAs are made

¹¹ Efforts have begun to assist farmers to register trees that they plant (Fisher, 2012).

between the concessionaires and land owners, and require companies to provide specific social amenities for local communities that live in the proposed contract area. This compensation usually takes the form of infrastructure like roads, clinics or schools.

In order to compare and contrast these formal legal requirements with the informal governance of timber in Ghana, it is first necessary to understand their relative size and influence, as well as differentiate between wood sold domestically, overland via other West African countries, and exported overseas. Hansen et al. (2012) estimate that in 2009 the total amount of timber sold in Ghana, approximately 1.9 million m³ (equivalent to 6 million m³ raw wood equivalent), was six times the current annual allowable cut¹², and that approximately 75% of that production is used domestically or exported overland.¹³ Of the remaining 25% that is exported, only 11% was destined for Europe in 2016 (Ghana Forestry Commission, 2016). An estimated 84 % (Marfo, 2010) of domestic timber is illegal, and the majority of this illegal timber is produced by some 97,000 chainsaw operators who process the trees into lumber on the farm, rather than in mills (Marfo and Acheampong, 2011).

These high levels of illegality have been created by a policy environment focused on timber production for export to the relative neglect of the domestic market and the customary norms governing on-farm timber that have evolved over the preceding decades, most notably the blanket ban on chainsaw production in 1998.¹⁴ While formally rights to land and trees are separate, customary arrangements make no such distinction and have continued to evolve in spite of the criminalisation of arrangements between farmers, landowners and chainsaw operators concerning the management of trees on farms¹⁵. Evidently, a significant proportion of Ghana's timber sector is governed by informal arrangements that are critical to understanding the likely impacts of policies such as the VPA.

The subsequent section draws on our case study in the Assin South region to examine, in practice, the intersection of formal rights with local informal rights and resulting on-the-ground outcomes. In particular, we compare farmers' degree of control over, and benefit from, trees on farms under formal and informal timber governance systems.

5. Control over and benefits from trees on cocoa farms: the case of assin south

5.1 Rights and patterns of control

During the course of our field studies, we observed formal, on-farm logging in our case study area, which the Forestry Commission had authorized by means of a 'salvage permit' granted to a timber company¹⁶. Our comparison of formal and informal timber production thus begins with interviews

¹² Which was increased from 1 million to 2 million m³ (raw wood equivalent) in 2004, compromising 1.5 million m³ from off-reserve areas and 0.5 million from forest reserves. (Oduro et al. 2014)

¹³ Unpublished estimates from a Ghana-based NGO suggest 63% of domestic timber is exported overland.

¹⁴ Through the Timber Resources Management Regulations, 1998 (L.I 1649 – Part VI)

¹⁵ For a historical review of Ghana's timber sector see Hansen and Lund (2017).

¹⁶ Illegalities surrounding the granting of concessions has been the focus of some work (e.g. by Civic Response), but this issue is not the focus of this paper.

and participant observation associated with these state-sanctioned logging activities, and follows with analysis of the more general data collected through interviews and surveys.

Our observation of the salvage permit corroborated previous studies, which found that while concessionaries are not allowed to harvest trees on farms without permission from the person with the right to use the land (the farmer), in practice they often do (Hajjar, 2015; Hansen, 2011). During and after the salvage logging had taken place, we revisited the village authorities and local farmers in these villages, and spoke with them about their ability to control the timber company's activities on their farms. According to an *Odikro*¹⁷ whose village lay within the active salvage permit, many farmers were reluctant to give permission to the concessionaire to harvest trees on their farms, but felt forced by circumstances to acquiesce:

*'Initially, we were reluctant about the timber operations [concessionaire]. But the team from the paramountcy and the company said the trees are state property and so our hands were tied, we had to agree. Initially most people were opposed, but cocoa has its seasons, during the lean season it is difficult so when they [the farmers] are broke they go to the [timber] company to get a little extra money and now most are selling their trees [to the concessionaire]'*¹⁸.

This quote illustrates how the formal system of permitting gives leverage to concessionaires to pressure farmers to 'sell' their trees (i.e. to allow the trees to be harvested in exchange for compensation for damage done to cocoa trees). It also highlights a range of relevant contextual factors. Most notably, the role of the social hierarchy associated with the paramount chiefs, as landowners, in facilitating the operation of timber concessions on farms.

The extent to which paramount chiefs play a more proactive role in the distribution of formal rights, by inviting companies to seek concessions on their land for example, is not clear. However, paramount chiefs also influence control over trees informally. For example, the paramount chief in one of the study field sites died during the course of fieldwork, and the palace employed chainsaw operators to fell trees across the Stool's land, ostensibly in order to fund the funeral and palace rehabilitation.

As illustrated by these cases, the operation of formal and informal rights at supra-local (state and paramountcy) level undermines farmers' ability to control the trees on their land (both removal and retention). Many farmers therefore resort to collaborating informally with chainsaw operators. These chainsaw operators are frequently maligned by non-local actors as wreckers of 'havoc' (Sarfo-Mensah, 2005), or people who 'operate at night and non-working hours in virtually every forest area they could find... are armed and ready to attack any person including forestry officials who dare to confront them' (Boakye, 2015). Yet, as explained below, in our case study area, these relationships were widely held to be legitimate locally despite their informality and current illegality.

Findings across all of our study sites (both within and outside of the above-mentioned salvage permit area) showed that chainsaw operators are often settled, integrated and valued members of communities. Every village in the study area had 3-5 permanently settled people who operated a chainsaw, mostly alongside farming. The reciprocal relationship between farmers and chainsaw operators are reflected in farmer's attitudes towards them. Of the 36 farmers who were monitored closely during the course of the study none were worried about chainsaw operators removing trees without their permission, and all except one, who was a caretaker farmer and would need

¹⁷ The term *Odikro* means village or local chief.

¹⁸ Interview: #15103_1. Although formally payments to farmers are compensation for damage to cocoa trees community members referred to, and understood, the transaction as a sale.

permission from his landlord, agreed that removing trees on their farms would be ‘very easy’, just requiring the payment of a chainsaw operator. This provides empirical support to the argument of this paper, that farmers have customary rights, as in locally recognized informal rights, to trees on farms.

In regards to local understanding of access rights, most farmers choosing to sell their trees to chainsaw operators do not require permission from their landowner and landowners can equally choose to sell trees on their land without permission from the tenant farmer. In other words, the farmer and/or the landowner hold informal substantive rights to the trees. At the same time, the informal procedural rights concerning trees on farm are highly flexible and depend on contextual factors such as land tenure¹⁹ arrangements and inter-personal relationships that are shaped by, *inter alia*, individuals’ relationships of trust and reciprocity. Nonetheless, this bundle of informal substantive and procedural rights usually delivers greater control to farmers than they enjoy under the formal concession system. Further evidence of greater local control over trees under local versus state-based governance is seen in the observation that farmers control over chainsaw operators actually increased after the government ban on chainsaw logging.²⁰ As one cocoa farmer explained, ‘When they used to give chainsaw operators permits, they would fell 3 or 4 trees for each permit,’ now ‘I don’t fear losing my trees to chainsaw operators because they cannot fell any trees without my permission’.

Despite farmers holding these *de facto* informal procedural ‘rights’ to sell their on-farm trees to chainsaw operators, our study found that farmers were actively maintaining significant tree cover on their farms. The census of trees on farmers’ plots revealed that on average farmers had 16 shade trees²¹ per hectare, including timber species (see supplementary material 1 for table of most preferred and least preferred species and reasons for preferences). This is in line with the Cocoa Research Institute of Ghana (CRIG) recommendation of 15-18 trees.

This evidence of voluntary, on-farm tree stewardship informs ongoing debates about the role of land and tree tenure security in driving deforestation (e.g. (Belcher et al., 2005; Damnyag et al., 2012). Proponents of the argument that granting farmers substantive rights to the native trees on their farms would precipitate rapid deforestation appear not to recognize that farmers 1) choose to raise native trees from wildlings/saplings on their cocoa farms even though they lack formal rights ensuring they would benefit from the timber they provide and 2) already hold locally recognized and actionable procedural rights to harvest trees on their farms and yet chose to leave many trees standing. These findings are an important counter to narratives that portray chainsaw operators as uncontrollable criminals and farmers as powerless victims. Although this narrative may be closer to lived experience in some communities it is inaccurate to generalise this situation and important to attend to the differences among different types of chainsaw operators. This is particularly important given how influential simplified or partial narratives can be on policy development.

¹⁹ Land tenure on cocoa farms is characterised in simplified terms as occurring under two systems. The system of *Abunu*, refers to situations where land is given to someone to establish a cocoa farm and, once the farm is mature and productive, half the land returns to the original owner. Under the *Abusa* system, the farm is managed by a caretaker and the crop is divided into thirds, with one-third usually going to the land owner. This study found that land tenure arrangements, or whether farmers were local or migrant, did not have a significant impact on the informal rights farmers held over trees (described in the text), although these arrangements may be more significant in other areas of Ghana.

²⁰ Before 1998.

²¹ Defined as non-cocoa trees >10cm diameter at breast height and >12m height.

5.2 Rights and the distribution of benefits

Formally, benefits from state timber concessions are shared through the distribution of stumpage fees. These are distributed between the District Assemblies (55%), Administrator of Stool Lands (10%), Traditional Councils (20%) and Stools (25%), after the Forestry Commission has taken 40-60% for management fees. These fees are a small fraction of the final value of the timber, partly because they are not updated regularly (Birikorang, 2015). The percentage of these fees which indirectly reach the farmers depends on the Stool and District Assembly, but are generally considered to be low, effectively zero (Hansen, 2011; Hansen and Treue, 2008). In fact, none of the farmers interviewed were aware of any benefits related to the distribution of stumpage fees.

Communities are also formally entitled to benefit from timber operations on their land through the above-mentioned Social Responsibility Agreements (SRAs). The SRAs, which are limited in value to no more than 5% of the stumpage fees on the concession, are designed to deliver social amenities and compensation to forest communities (Ayine, 2008). These agreements, again, are made with the landowner (usually the paramount chief) and not the farmer. Farmers do not have any explicit claim to compensation through the SRA process, although some of our case study respondents reported receiving informal payments from the company comparable to that paid by chainsaw operators (20-50 cedis²²). The *Odikro* of one village, where the salvage permit was granted and therefore an SRA process, claims that the payment reflects the customary right of the farmer to sell or maintain trees, but is only paid if the farmer ‘*makes a lot noise*’, and then it is informal, just ‘*something out of their pockets*’. However, in cases of disagreement, for example, where the concessionaire does not pay compensation or when they fell more trees than the farmer permitted, he said:

‘The company tells them, if you have a problem then you have to go to your chief and to the government because they have given them the right to take the timber. But they can’t just go to the paramount chief. There is a hierarchy. You cannot just go there for some small 30 cedi dispute and since they [the paramountcy] have already agreed, then there’s no point’²³.

The costs of enforcing the laws on compensation are disproportionate to the value of the compensation itself, meaning more powerful actors can benefit from timber on farms, literally at the expense of the farmers. Furthermore, in the case of the salvage permit which was granted in our case study area, it came to light after the logging was done that the SRA had been forged. To the surprise of the *Odikro* and District Assembly man, their respective sections on the SRA forms had been signed and thumb printed with different signatures indicating that they had received all the items listed. In fact they were unaware of any agreement. Furthermore, the detailed investigations conducted by the local field team revealed that the original agreement had stated that the parties (*Odikro* and District Assembly) would receive 10 bags of cement, 2 packs of iron (roofing) sheets and 1,500 cedis cash. The new agreement included the construction of 5km of trunk road, construction of 2 new bridges, 50 bags of cement, 2 packets of roofing sheets and 2000 cedis cash. However, to date (June 2017), none of the items have been delivered and felling of trees on the concession has been completed. This case highlights the importance of distinguishing between different kinds of illegality. A farmer who employs a chainsaw operator to fell a tree they nurtured on their farm to roof their house after a storm is operating illegally. However, that illegality is qualitatively different, and holds greater local legitimacy, than forging documents and refusing to pay the necessary

²² Approximately US\$5-12.

²³ Interview: #15103_1

compensations. Although using the term informal introduces some ambiguity to discussions, it is essential to avoid conflating operations with vastly different degrees of legitimacy.

As well as having greater control under informal systems, farmers access greater benefits from the trees on their farm through informal channels. One chainsaw operator summarised the widely noted reasons farmers prefer to work with chainsaw operators rather than contractors (concession holders):

‘There are a lot of reasons; the timber contractors can spoil a lot of cocoa²⁴, the compensation is lower [than selling to a chainsaw operator] because the contractor says they have already paid the government, the farmers get fertilizer from the saw dust, there is no or only a little damage to the cocoa trees and the farmer can keep or have removed as many trees as he likes’²⁵.

Whether the logging is done by concessionaires or chainsaw loggers, farmers receive relatively small sums of money from logging on their farms. Table 2 shows the estimated mean, minimum and maximum value of timber on farms (cedis per hectare) at different points on the value chain. This shows that farmers selling their trees to chainsaw operators receive approximately 4% of the value of the timber at point of sale in the domestic market. This is broadly comparable with the stumpage fee rates²⁶, although these are low due the near absence of high value hardwood timber species on sampled cocoa farms. Furthermore, none of the value of the stumpage fees is paid to farmers. Rather, and as discussed above, farmers are sometimes paid 20-50 cedis per tree as compensation for associated damage to cocoa trees.

Table 2. The estimated value of timber on cocoa farms and forest land, based on sample plot data, at different points in the value chain

	Cocoa farms			Forest plots		
	Mean (n = 36)	Min	Max	Mean (n =3)	Min	Max
Value of stumpage fee (cedis²⁷/ha)	526 (±118)	0	2740	1496 (± 198)	1155	1843
Value of timber to farmer if sold to chainsaw operators (cedis/ha)	657 (±119)	0	4042	1855 (± 280)	1310	2241
Value in local timber market (cedis/ha)	14976 (±2795)	0	91417	36623 (±5976)	25080	45080

*Figures in parenthesis show standard errors of the mean. See methods section for more details on how these figures were calculated.

Notably, one farm has twice the valuable timber per hectare compared to forest plots. This farm has been managed for timber and the farmer, a retired lecturer, has been able to protect his formal substantive rights to the trees on the basis that he claims to have planted the trees (and therefore owns them), and has been able to prevent concessionaries from taking them. This unusual case highlights an important point relating to contextual equity. The formal rights farmers have are most

²⁴ Chainsaw operators ‘slice’ the timber into lumber on the farm which is then carried out by teams of carriers. This is a lot less damaging to cocoa than large-scale companies who fell the tree with chainsaws and then drag the whole tree out of the farm using a heavy machinery. Respondents in the household survey estimated that, on average, contractors damaged 31 cocoa trees per timber tree while chainsaw operators damaged 12.

²⁵ Interview: #15514_1

²⁶ N.B. Stumpage fees are paid to the forestry commission by timber concessionaries and not to the farmer.

²⁷ There are approximately 4.5 cedis to a dollar.

easily harnessed by more powerful and educated farmers. Less powerful and educated individuals struggle to realise their formal rights resulting in them being framed as criminals for selling their trees to chainsaw operators. This can further distance them from accessing benefits through formal channels and result in costs associated with court cases or paying bribes to officials. This case also emphasises the scale of potential value of timber on farms *if* the appropriate arrangements of rights is developed in a context where they can be supported.

Although farmers receive greater benefits, and lower costs (in the form of uncompensated damage to cocoa) in the informal sector compared to the formal sector the payments remain a very small proportion of the value of the timber on their farms. Evidently, how the formal and informal, substantive and procedural rights are interwoven and shape the patterns of control and benefit distribution are complex and heavily shaped by the local context. It also illustrates how the uniformity and coherency of procedural and substantive rights defined at the national level are in fact transformed and blended with customary norms at a local level. The paper continues by reflecting on the implications of these findings for ongoing discussion on formalisation in the timber sector under the FLEGT VPA and then concludes.

6. THE GHANA EU-FLEGT VPA AND ITS IMPLICATIONS FOR CONTROL OVER, AND BENEFIT FROM, ON-FARM TIMBER

In 2009 Ghana signed a Voluntary Partnership Agreement (VPA) with the European Union, to develop a legality licensing system as a means to eradicate illegal timber production. The VPA includes a definition of legal timber which covers, *inter alia*, only the types of timber concessions and permits allocated by the Forestry Commission and therefore only timber produced by companies in possession of a concession is recognized as legal (e.g. see Table 1). This includes on-farm timber concessions and, as explained above, excludes chainsaw logging. A brief overview of how the VPA is to be operationalized reveals its potential impacts on farmer access to, and control over, on-farm timber.

A core provision of the VPA is a Timber Legality Assurance System (TLAS), including a wood tracking system (WTS). The TLAS is intended to provide an auditable chain of custody for timber that covers imports, pre-felling procedures, felling, processing through to point of sale. Once the TLAS is operational, and receives approval from the EU, timber that conforms to its requirements will bear a FLEGT license. Only FLEGT licensed timber will then be allowed into EU markets. Given the EU's anticipated requirements for legality licensing (Council Regulation (EC) No 2173/2005) much of the effort in operationalizing the VPA to date has been channelled into developing appropriate technologies to track and audit timber production destined for export to the EU.²⁸

While the initial design and testing of the TLAS has focused on timber destined for the EU, stakeholders in both Ghana and the EU have raised concerns about the large quantities of illegal timber traded in domestic markets and overland (Hansen et al., 2012; Hansen and Treue, 2008).²⁹ Ghana has therefore decided to include all wood production, including for domestic markets, within the VPA and TLAS. In other words, the goal in future is to eradicate informal on-farm timber production and chainsaw logging altogether, by ensuring that only licensed timber is sold both internationally and domestically.

²⁸ Interview: #15511_1

²⁹ Interviews: #15610_1 and #17316_1

Given that, as mentioned above, some 84% of Ghana's domestic timber production is currently informal, i.e. 'illegal', this is an ambitious goal indeed. Our interviews with the Forestry Commission and review of grey and academic literature suggest that as yet no estimates have been made of the costs of incorporating all of Ghanaian timber production under the TLAS, nor how such costs would be financed. Nor have we uncovered assessments of the political or technical feasibility of rapid and effective enforcement of legality within the domestic market. However, what is clear from the previous sections' analyses of on-farm and domestic timber production, is that if the VPA continues on its current trajectory and proves effective in enforcing its current legal framework, and prosecuting illegal production, this could have severe negative effects on farmers' rights and benefits from the trees on their farm, as well as on domestic access to timber resources.

Previous studies of the FLEGT VPA's social impacts have focused simply on farmer incomes over a one-year study period (e.g. (Hansen et al., 2015)). This research has shown that the existing bundles of rights and their contextual mediation already marginalise farmers. Hence they conclude the impact of any policy on farmer income from trees is inevitably small because the 'baseline' is already extremely low. They therefore argue that policy reforms focused on strengthening farmers' rights to trees will have much greater impact than programmes focused on providing farmers with alternative, non-timber sources of income.

Our findings are certainly in line with arguments for policy reform. In a counter-factual context where benefits flowed to farmers in a way that was commensurate to their current informal substantive and procedural rights to their trees, then the impact of curtailing those benefits through full implementation of the VPA would be quite significant. In fact, the granting of government concessions for trees nurtured by farmers from this perspective looks more like theft than good governance. But even beyond this, we argue that a focus solely on annual farmer incomes from timber is inadequate to capture the potential negative impacts of full VPA enforcement on business as usual. Timber is a long-rotation crop that may be used by rural households as a source of insurance to draw upon during times of crisis or special needs, e.g. during times of crop failure, or for weddings, funerals. Furthermore, farmers – like the majority of Ghanaian consumers – also rely on 'illegal' timber for their wood supply, and poor farmers in particular can ill afford to travel long distances for replacement products. But perhaps most importantly for the farmers themselves, our evidence suggests that existing informal systems of tree governance have granted many farmers a sense of power and control over their farmlands and the trees they nurture within them that would be largely lost if the current legal framework was effectively enforced. In sum, efforts to capture all of Ghana's timber production under the VPA risks deepening existing marginalisation and criminality of resource users, many of whom are poor.

7. Conclusions

Calls for formalisation, including the overriding of customary rules and norms with statutory law and the prosecution of illegal activities, are becoming increasingly hegemonic as the favoured means to deliver control to higher level actors, often in pursuit of sustainability. However, there is concern that formalisation, by ignoring local dynamics of resource governance, might fail to deliver the desired levels of control to regional, national and international bodies. Furthermore, as the blanket chainsaw ban in Ghana demonstrates, formalisation can serve to criminalise and marginalise already poor resource users. Using a unique framework which recognises the importance of distinguishing between formal-informal and substantive-procedural rights and how contextual factors shape their realisation across scales and levels, this study sheds light on the governance of on-farm timber in

Ghana's cocoa landscape, with major implications for how it might interact with international initiatives focused on legal formalisation.

The analysis demonstrates how informal rights to trees, wrapped up with customary land tenure arrangements, deliver greater levels of control to farmers than the formal procedural rights embodied in the SRAs. The case study material highlights how contextual factors such as land tenure arrangements and societal position of individuals, particularly paramount chiefs, in governance arrangements, mediates the operation of rights at a local level. In general, farmers access the vast majority of benefits from trees on their farms through informal channels. However, quantifying the value of timber at various levels of the timber value chain demonstrates how weak and variable farmers' bundles of rights are in practice.

The intended trajectory of the VPA, which is to include the entire wood production sector under the timber legality assurance system, implies the eradication of informal on-farm timber production. This, if implemented, would further undermine the already tenuous levels of control farmers have over their trees and the benefits associated with them. The issues facing the pursuit of sustainable forest management reach beyond legal non-compliance and raise critical questions of equity when the power of different groups to define what constitutes formal rights and laws, and then harness them, is deeply asymmetrical. Focussing efforts in the timber sector on enforcement of existing laws such as the payment of compensation, while well intentioned, actually obfuscates the inequalities enshrined in the existing legal framework.

Is there an effective way forward that escapes the hegemonic logic of formalisation? Differentiating between diverse wood production systems would allow for a more nuanced assessment of the appropriate arrangements of formal-informal and substantive-procedural rights to be pursued in combination with an understanding of how local contexts shape the actual realisation of rights at a local level. The most appropriate strategies for governing on-farm timber to addressing concerns about livelihoods and illegality are surely different from strategies in uninhabited forest production reserves. A differentiated approach would permit a degree of flexibility that is currently lacking.

Long-standing debates about tree tenure in Ghana have, thus far, focused on reforming formal substantive rights at a national level. Formalising farmers' substantive rights to the trees on their farms, as suggested in the VPA, would have positive impacts for some farmers who are successful in staking their claims, especially in cases where contestations over customary rights prevent the flow of benefits over trees they nurture. However, the analysis offered in this paper suggests that regardless of whether or not success is achieved at a national level, it would be possible to complement these efforts by devolving procedural control over trees on farms to local communities (i.e. farmers and traditional authorities), allowing them to govern tree harvests through their existing informal governance systems. This would effectively reflect the current situation of land rights in Ghana where customary rights to land are formally recognised. Three primary steps that could be taken to achieve this are, the phasing out of on-farm timber concessions, formal recognition of farmers' existing yet informal rights over trees and de-criminalising chainsaw milling on farms. Given the current *de facto* rights farmers have over their trees, there is no reason to suggest that adopting these measures would increase deforestation on cocoa farms. In general, this case challenges the assertion that formalisation is requisite for sustainable forest management and mandates a more nuanced and contextually informed assessment of the assumed costs and benefits associated with particular forms of legal and policy reform.

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References

- Agyei, F.K., Adjei, P.O.-W. (2017) Representation without accountability in forestry: experiences from the Social Responsibility Agreement in Ghana. *Forest Policy and Economics* 80, 34-43.
- Amanor, K.S., Ubink, J.M. (2008) *Contesting Land and Custom in Ghana. State, Chief and the Citizen*. Leiden University Press.
- Ayine, D.M. (2008) Social responsibility agreements in Ghana's forestry sector. *Unpublished*.
- Belcher, B., Michon, G., Angelsen, A., Ruiz Pérez, M., Asbjornsen, H. (2005) The socioeconomic conditions determining the development, persistence, and decline of forest garden systems. *Economic Botany* 59, 245-253.
- Benhin, J.K., Barbier, E.B. (2004) Structural adjustment programme, deforestation and biodiversity loss in Ghana. *Environmental and Resource Economics* 27, 337-366.
- Birikorang, G., (2015) Why don't we make the loggers pay? Stumpage value and policy failure in Ghana's forest sector. *International Institute for Environment and Development (IIED)*, London.
- Boakye, J. (2015) Estimation of illegal logging by the formal timber sector in Ghana: implications for forest law compliance, enforcement and EU-Ghana voluntary partnership agreement. *International Forestry Review* 17, 117-127.
- Cerutti, P.O., Tacconi, L., Lescuyer, G., Nasi, R. (2013) Cameroon's hidden harvest: commercial chainsaw logging, corruption, and livelihoods. *Society & Natural Resources* 26, 539-553.
- Community, G.-E., (2009) VOLUNTARY PARTNERSHIP AGREEMENT BETWEEN THE EUROPEAN COMMUNITY AND THE REPUBLIC OF GHANA ON FOREST LAW ENFORCEMENT, GOVERNANCE AND TRADE IN TIMBER PRODUCTS INTO THE COMMUNITY.
- Cotula, L., Chauveau, J.-P. (2007) Changes in customary land tenure systems in Africa. *Unpublished*.
- CRIG, (2010) *A Source Book for Sustainable Cocoa Production*, in: Ghana, C.R.I.o. (Ed.). CRIG, Accra.
- Damnyag, L., Saastamoinen, O., Appiah, M., Pappinen, A. (2012) Role of tenure insecurity in deforestation in Ghana's high forest zone. *Forest Policy and Economics* 14, 90-98.
- De Soto, H. (2000) *The mystery of capital: Why capitalism triumphs in the West and fails everywhere else*. Basic books.
- Fisher, R., Barrow, E., Silva, J.d., Ingles, A., Shepherd, G. (2012) Improving access to forest resources. Experiences in informal tenure reform from IUCN's Livelihoods and Landscapes Strategy. *International Union for Conservation of Nature and Natural Resources (IUCN)*, Gland, Switzerland.
- Ghana Forestry Commission, (2016) *Report on Export of Wood Products*, December 2016, in: (TIDD), T.I.D.D. (Ed.), Accra, Ghana.
- Ghana, G.o. (2005) *Growth and Poverty Reduction Strategy (2006–2009)*. Republic of Ghana, Accra.
- Gockowski, J., Sonwa, D. (2011) Cocoa intensification scenarios and their predicted impact on CO₂ emissions, biodiversity conservation, and rural livelihoods in the Guinea rain forest of West Africa. *Environmental Management* 48, 307-321.
- GoG, (2003) Emerging land tenure issues, in: *Forestry*, M.o.L.a. (Ed.). Government of Ghana, Accra, p. 33.
- Hajjar, R. (2015) Advancing small-scale forestry under FLEGT and REDD in Ghana. *Forest Policy and Economics* 58, 12-20.
- Hamilton-Hart, N. (2017) The Legal Environment and Incentives for Change in Property Rights Institutions. *World Development* 92, 167-176.
- Hansen, C., Lund, J., Treue, T. (2009) Neither fast, nor easy: the prospect of Reduced Emissions from Deforestation and Degradation (REDD) in Ghana. *International Forestry Review* 11, 439-455.
- Hansen, C.P. (2011) Forest law compliance and enforcement: the case of on-farm timber extraction in Ghana. *Journal of Environmental Management* 92, 575-586.
- Hansen, C.P., Damnyag, L., Obiri, B., Carlsen, K. (2012) Revisiting illegal logging and the size of the domestic timber market: the case of Ghana. *International Forestry Review* 14, 39-49.
- Hansen, C.P., Pouliot, M., Marfo, E., Obiri, B.D., Treue, T. (2015) *Forests, Timber and Rural Livelihoods: Implications for Social Safeguards in the Ghana-EU Voluntary Partnership Agreement*. *Small-scale Forestry* 14, 401-422.

Hansen, C.P., Treue, T. (2008) Assessing illegal logging in Ghana. *International Forestry Review* 10, 573-590.

Hauck, M. (2008) Rethinking small-scale fisheries compliance. *Marine Policy* 32, 635-642.

Hilson, G., Potter, C. (2005) Structural adjustment and subsistence industry: artisanal gold mining in Ghana. *Development and change* 36, 103-131.

Ituarte-Lima, C., McDermott, C. (*In Press*) Are more prescriptive laws better? Transforming REDD+ safeguards into national legislation. . *Journal of Environmental Law*.

IUFRO, (2016) Illegal Logging and Related Timber Trade – Dimensions, Drivers, Impacts and Responses, in: Daniela Kleinschmit, S.M., Christoph Wildburger, Andre Purret (Ed.), IUFRO World Series. International Union of Forest Research Organizations (IUFRO), p. 148.

Kishor, N., Lescuyer, G. (2012) Controlling illegal logging in domestic and international markets by harnessing multi-level governance opportunities. *International Journal of the Commons* 6.

Lagos, R.A. (1995) Formalizing the informal sector: barriers and costs. *Development and change* 26, 111-131.

Maldonado, C. (1995) Informal Sector: Legalization or Laissez-Faire, *The. Int'l Lab. Rev.* 134, 705.

Marfo, E. (2010) Chainsaw milling in Ghana: context, drivers and impacts. *CiteSeer*.

Marfo, E., Acheampong, E. (2011) Estimating the number of jobs created by chainsaw activities in Ghana. *Ghana Journal of Forestry* 27, 1-11.

Marfo, E., Schanz, H. (2009) Managing logging compensation payment conflicts in Ghana: Understanding actor-empowerment and implications for policy intervention. *Land Use Policy* 26, 619-629.

McBarnet, D., Whelan, C. (1991) The elusive spirit of the law: Formalism and the struggle for legal control. *The Modern Law Review* 54, 848-873.

McDermott, C.L. (2014) REDDuced: From sustainability to legality to units of carbon—The search for common interests in international forest governance. *Environmental Science & Policy* 35, 12-19.

McDermott, M., Mahanty, S., Schreckenberger, K. (2013) Examining equity: a multidimensional framework for assessing equity in payments for ecosystem services. *Environmental Science & Policy* 33, 416-427.

Meinzen-Dick, R., Mwangi, E. (2009) Cutting the web of interests: Pitfalls of formalizing property rights. *Land Use Policy* 26, 36-43.

Miles, M.B., Huberman, A.M. (1994) *Qualitative data analysis: An expanded sourcebook*. Sage.

Mwangi, E., Wardell, A. (2012) Multi-level governance of forest resources (Editorial to the special feature). *International Journal of the Commons* 6.

Obiri, B.D., Bright, G.A., McDonald, M.A., Anglaaere, L.C., Cobbina, J. (2007) Financial analysis of shaded cocoa in Ghana. *Agroforestry systems* 71, 139-149.

Osei-Tutu, P., Pregernig, M., Pokorny, B. (2014) Legitimacy of informal institutions in contemporary local forest management: insights from Ghana. *Biodiversity and Conservation* 23, 3587-3605.

Philip, M.S. (1994) *Measuring trees and forests*. CAB international.

Platteau, J.-P. (2004) Monitoring Elite Capture in Community-Driven Development. *Development and change* 35, 223-246.

Pritchard, M.F. (2013) Land, power and peace: Tenure formalization, agricultural reform, and livelihood insecurity in rural Rwanda. *Land Use Policy* 30, 186-196.

Putzel, L., Kelly, A.B., Cerutti, P.O., Artati, Y. (2015) Formalization as development in land and natural resource policy. *Society & Natural Resources* 28, 453-472.

Richards, M., Asare, A. (1999) Economic incentives for cocoa farmers to tend timber trees in Southern Ghana. *Overseas Development Inst.*

Ruf, F.O. (2011) The myth of complex cocoa agroforests: the case of Ghana. *Human Ecology* 39, 373-388.

Sarfo-Mensah, P. (2005) Exportation of Timber in Ghana: The menace of illegal logging operations.

Schlager, E., Ostrom, E. (1992) Property-rights regimes and natural resources: a conceptual analysis. *Land economics*, 249-262.

- Sikor, T., Stahl, J., Enters, T., Ribot, J.C., Singh, N., Sunderlin, W.D., Wollenberg, L. (2010) REDD-plus, forest people's rights and nested climate governance. *Global Environmental Change* 20, 423-425.
- Sjaastad, E., Cousins, B. (2009) Formalisation of land rights in the South: An overview. *Land Use Policy* 26, 1-9.
- Soule, M.J., Tegene, A., Wiebe, K.D. (2000) Land tenure and the adoption of conservation practices. *American Journal of Agricultural Economics* 82, 993-1005.
- Tamanaha, B.Z. (2008) Understanding legal pluralism: past to present, local to global. *Sydney L. Rev.* 30, 375.
- Tschakert, P., Singha, K. (2007) Contaminated identities: Mercury and marginalization in Ghana's artisanal mining sector. *Geoforum* 38, 1304-1321.
- Wade, A.S.I., Asase, A., Hadley, P., Mason, J., Ofori-Frimpong, K., Preece, D., Spring, N., Norris, K. (2010) Management strategies for maximizing carbon storage and tree species diversity in cocoa-growing landscapes. *Agriculture, Ecosystems & Environment* 138, 324-334.
- Weng, X. (2015) The rural informal economy. *Natural resource management*.
- Zhang, D., Owiredo, E.A. (2007) Land tenure, market, and the establishment of forest plantations in Ghana. *Forest Policy and Economics* 9, 602-610.

Supplementary material 1.

Farmers' preferences for retaining and removing particular tree species. From household survey data.

<i>Species</i> (local name in Twi)	% stating preference to keep species:	Top reasons for keeping (% of respondents who mentioned species mentioning reason)		<i>Species</i> (local name in Twi)	% stating preference to remove species:	Top reasons for removing (% of respondents who mentioned species giving the reason)
<i>Terminalia ivorensis</i> (Emire)	53%	Timber (60%) Shade (51%) Soil fertility (26%) Good for water on the farm (25%)		<i>Cola nitida</i> (Bese)	25%	Competes with cocoa (59%) Too much shade (45%) Reduces soil fertility (45%) Reduces water availability on the farm (30%) Increases incidence of pests (30%)
<i>Terminalia superba</i> (Ofram)	46%	Shade (61%) Timber (59%) Soil fertility (24%) Good for water on the farm (22%)		<i>Triplochiton scleroxylon</i> (Wawa)	21%	Reduces water availability on the farm (41%) Increases incidence of pests (36%) Competes with cocoa (31%) Too much shade (27%) Reduces soil fertility (27%)
<i>Milicia regia</i> (Odum)	31%	Timber (94%) Shade (58%) Soil fertility (31%) Provides cash income (15%) Good for water on the farm (12%)		<i>Ceiba pentandra</i> (Onyina)	20%	Too much shade (71%) Fear felling will damage cocoa crops (33%) Competes with cocoa (29%) Increases incidence of pests (24%) Reduces availability of water on the farm (14%)
<i>Triplochiton scleroxylon</i> (Wawa)	18%	Timber (79%) Shade (53%) Good for water on the farm (26%) Soil fertility (11%)		<i>Alstonia boonei</i> (Nyame dua)	11%	Too much shade (75%) Reduces soil fertility (33%) Increases incidence of pests (17%) Poor timber species (17%)
<i>Ceiba pentandra</i> (Onyina)	15%	Shade (96%) Good for water on the farm (69%) Soil fertility (50%) Timber (31%) Biodiversity (13%)		<i>Rauvolfia vomitoria</i> (Kakapenpen)	10%	Too much shade (64%) Increases incidence of pests (36%) Fear felling will damage cocoa (27%)
<i>Nesogordonia papaverifera</i> (Danta)	15%	Timber (74%) Shade (67%) Soil fertility (33%) Soil erosion (33%) Good for water on the farm (20%)		<i>Milicia regia</i> (Odum)	10%	Don't know/No answer (41%); Competes with cocoa (19%); Reduces soil fertility (15%); Too much shade (11%)