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Institutions and access to woodfuel commerce in the Democratic Republic of Congo

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Abstract

A new generation of woodfuel studies focuses on the political dynamics behind access to the woodfuel trade, providing better insights into patterns of inclusion and exclusion and options for resource management. Institutional mechanisms that govern access are difficult to untangle in the context of informal trade. This paper analyzes institutions and how they regulate access to commercialize woodfuel in two areas in the Democratic Republic of Congo (DRC). A review of empirical data (surveys and interviews) and secondary data on wood energy value chains in the DRC is used to examine the ways that woodfuel institutions affect access to resources and to markets. The main findings are that existing formal mechanisms regulating access to the woodfuel trade are hardly enforced. Informal, socially embedded institutions generally govern access, and the trade is open to less privileged and rural actors. People who benefit from these informal arrangements have many vested interests, and current production patterns are unsustainable and not sufficiently mitigated by these institutions. New strategies are required that promote the positive aspects of informality, while supporting initiatives that contribute to long-term resource sustainability and meet the high levels of urban demand, given the lack of alternative energy sources.

Keywords: charcoal; fuelwood; Africa; institutions; market access; value chain; Kinshasa

Research highlights

- DRC woodfuel institutions mainly informal; formal regulations weakly enforced
- Access to woodfuel trade is open to less privileged actors
- Many vested interests in upholding informal woodfuel institutions
- Producers get more of the retail price than producers in other African countries
- Current formal/informal institutions fail to mitigate pressure on woodfuel resources

1. INTRODUCTION

Besides being highly dependent on woodfuel¹ to meet household energy needs, many people in developing countries benefit from woodfuel markets to generate at least some cash income (Mwampamba *et al.*, 2013b; Schure *et al.*, 2013a; Vedeld *et al.*, 2007). This role of woodfuel as a revenue source is seen as deserving more attention (Arnold *et al.*, 2006; Openshaw, 2010; Sankhayan and Hofstad, 2000). Although many people are considered to have relatively easy access to woodfuel commercialization, it is often not clear who benefits, because institutional mechanisms defining access patterns to resources and markets are often location specific and difficult to untangle in the informal settings in which they are commonly found (Arnold *et al.*, 2003; Ribot, 1998; Wiersum *et al.*, 2014). Unequal access to benefits and the proportion of risk borne by different actors have resulted in skewed household income and the spatial variability of resources and markets (Drigo *et al.*, 2002; Gazull, 2008; Luckert and Campbell, 2002). Poor people are generally excluded from trade, because strong competition and costly entry barriers mean that they have weak or unequal access to both resources and product markets (Belcher *et al.*, 2005; Sunderlin *et al.*, 2005). The fragile market access and weak bargaining power of producers in remote areas make them dependent on traders who provide credit, trade contacts, and transport (Sunderlin *et al.*, 2005). Ribot's (1995a, 1995b, 1998) extensive study on the distribution of benefits of woodfuel commercialization in West-African countries revealed that, because of political ties and forest policies, the greatest benefits accrue to merchants. Furthermore, commercialization of forest products can lead to the degradation of forest resources in the absence of regeneration or resource management. This unsustainable harvesting threatens poor people's subsistence use of these products (Belcher *et al.*, 2005).

1.1 Institutions and access to woodfuel commercialization in the Democratic Republic of Congo: objective and research question

Addressing the full value chain, from production site through to the end consumer, helps to uncover the main challenges relating to access to a resource; how production, markets, and prices are regulated; and practices of corruption (Chidumayo and Gumbo, 2013; Owen *et al.*, 2013; Schure *et al.*, 2013b). To assess these aspects, refined empirical studies are needed to consider: (1) the specific context (environmental, socio-economic, and political) (Arnold and Persson, 2003; Soussan *et al.*, 1990); (2) access both to the resource and to the market (Bebbington, 1999; Tesfaye *et al.*, 2011; Wiersum *et al.*, 2014); and (3) the institutional mechanisms that shape livelihood outcomes for actors in the woodfuel trade (Arnold *et al.*, 2003; Leach *et al.*, 1999; Mearns, 1995; Mwampamba *et al.*, 2013a; Ribot *et al.*, 1998). This paper aims to contribute to this new generation of studies by examining institutions that

¹ Woodfuel refers to all types of biofuels originating directly or indirectly from woody biomass and includes fuelwood and charcoal. Fuelwood refers to wood in its natural state and residues from wood-processing industries where the original composition of the wood is preserved. Charcoal is the solid residue derived from carbonization, distillation, pyrolysis, and wood torrefaction (FAO, 2004).

govern access to resources and to markets in woodfuel value chains in two urban centers in the Democratic Republic of Congo (DRC).

The DRC produced an estimated 77.7 million m³ of woodfuel in 2011, representing 94% of its total roundwood production (FAO, 2013). The use of woodfuel (fuelwood and charcoal) is growing in cities because of population growth, the lack of alternative energy sources, high unemployment, and the weak implementation of forest legislation, and has become associated with forest degradation and deforestation (Marien, 2009; Schure *et al.*, 2012). The Kinshasa and Kisangani woodfuel markets provide around 90% of their citizens' cooking energy needs. The volume of woodfuel for these two cities alone (5.0 million m³ in 2010) is 12 times greater than the official national timber production (400 thousand m³). An estimated 312,000 people are involved in woodfuel production and trade for the capital city Kinshasa, over 20 times greater than the workforce in the official forestry sector (15,000) (Schure *et al.*, 2013a). Notwithstanding the significance of woodfuel use in the country, there is still a lack of understanding of its precise nature and the main mechanisms involved in its production and trade – mainly because woodfuel production and trade are largely informal with few official data available and scant attention paid to the sector by national policies. The large volume of woodfuel trade in urban centers, the numerous people involved and largely informal systems interacting with production, and trade patterns raise questions such as: Who benefits from accessing woodfuel commercialization? And how do these access patterns work?

Comparing two woodfuel value chains with two contrasting resource and market conditions in the DRC, this paper aims to answer the research question: How do institutions shape access to woodfuel resources and to markets? It contributes to the theorizing of woodfuel as a livelihood resource, analyzing specifically how institutions shape access dynamics from the production to the consumption level. The research results elucidate whether producers are excluded from accessing markets and whether woodfuel institutions contribute to sustainable production.

1.2 Conceptual framework: institutions shaping access in woodfuel value chains

In woodfuel production and trade, numerous institutions and interacting factors influence whether and how actors in the value chain access resources and markets, and ultimately whether woodfuel production and trade contribute to their livelihoods.² This study focuses on the dynamic character of formal and informal institutions that shape value chain actors' access to resources and to markets. [Bebbington \(1999\)](#) argued that access should be central to livelihood studies and that importance should be given to the institutional spheres of state, market, and civil society that govern how people can renegotiate rules and relationships of resource access, use, and transformation. Informal and formal institutions at different scales,

² These factors encompass, for example, the vulnerability context, private sector, government arrangements, and control over assets, such as budget and technology (Ashley and Carney, 1999; North, 1990).

mediated by power relations, influence access to resources and the resulting livelihood strategies and ecological change (Leach *et al.*, 1999; Scoones, 1998). Markets are key institutions in the process of commoditization of resources (Leach *et al.*, 1999:240). Leach *et al.* (1999) use economic institutionalism (North, 1990,; 1993) combined with social studies to conceptualize institutions in their environmental entitlements framework. North's (1993:3) economic perspective on institutions as mediating entities that determine transaction and transformation costs makes a clear distinction between institutions and organizations: "If institutions are the rules of the game, organizations are the players ... Institutions consist of formal rules, informal constraints (norms of behavior, conventions, and self-imposed codes of conduct) and the enforcement characteristics of both" (North, 1993:2) (carried out by first, second, or third parties in the form of self-imposed codes, retribution, social or legal sanctions). Leach *et al.* (1999) use this distinction between institutions, organizations, and the role of enforcement, but, instead of looking only at rules of the game, they consider institutions as the formal and informal "regularized patterns of behavior that emerge from underlying structures or sets of 'rules in use'" (Leach *et al.*, 1999:237). This notion emphasizes the constructive and dynamic character of institutions in which rules are constantly being made and remade, shaping constraints or incentives to people's actions, and in which people's actions either strengthen or weaken institutions (Leach *et al.*, 1999; Woodhill, 2008).

Using these constructs, this study defines woodfuel institutions as the formal and informal rules and regularized patterns of behavior between different actors in society and associated enforcement mechanisms that shape access to woodfuel production and trade.³ Informal or socially embedded institutions are upheld by socially shared, usually unwritten, conventions, created by, and enforced among, the actors involved. Formal or bureaucratic institutions can be considered as the rules enforced by an outside third party (often government agency or development organization), such as the rule of law and contracts (Cleaver, 2002; Leach *et al.*, 1999; North, 1993).

The value chain is a concept used to link resources and market dynamics. "The value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use" (Kaplinsky and Morris, 2001:4). It represents the arena where key actors (producers, traders, transporters, and vendors) move back and forth, possibly switching roles and locations, while employing their various tangible and intangible assets (capitals) to execute their activities. In Central Africa, urban citizens often depend on peri-urban products such as crops and woodfuel, and peri-urban or rural citizens trade these products in urban markets. Trade patterns in peri-urban areas reflect dynamic urban–rural interfaces with the mix of factors and actors exacerbating rivalry and conflict over space and resources, such that

³ Drawing on Leach *et al.*'s (1999) definition of institutions.

competing claims are constantly being structured and renegotiated. This occurs in a context of plural governance arrangements, with the degree of political and legal control in Central Africa tending to decrease as distance from the capital city increases (Trefon, 2011).

Access to natural resources and to markets reflects the ability of actors to participate and benefit from woodfuel commercialization. “Access to natural resources” is conceptualized as “natural capital” that people can acquire, influenced by both the vulnerability context and the “transforming structures and processes” that shape access (Ashley and Carney, 1999). Market access is “the ability of individuals or groups to gain, control, or maintain entry into exchange relations” (Ribot and Peluso, 2003:160). The ability to access markets, together with credit arrangements and relations with market actors (social capital) that help secure this access, represents a resource that people can use to support their livelihoods (Bebbington, 1999; Leach *et al.*, 1999; Scoones, 2009).

The ultimate desirable outcome of access to woodfuel production and trade is poverty reduction for those involved and the more sustainable use of the natural resource base, to enable the continuance of woodfuel-based livelihood strategies. Figure 1 depicts the framework that links the value chain concept with woodfuel institutions, access to resources and markets, and livelihood outcomes.

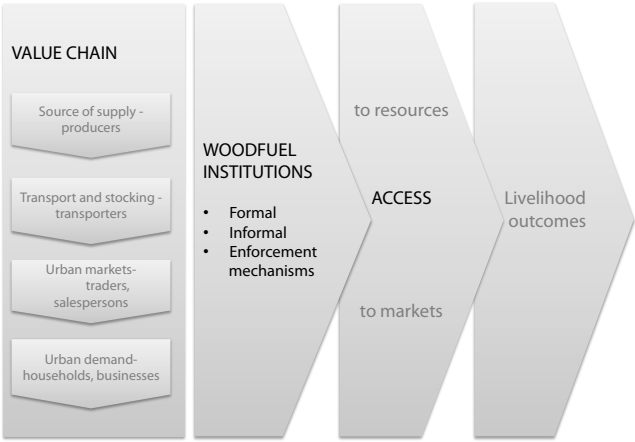


Figure 1: Conceptual framework: value chains woodfuel institutions, and access to resources and markets

2. METHODOLOGY

2.1 Study area

The study area covers the woodfuel supply and consumption zones of the DRC's capital, Kinshasa, and Kisangani, capital of Orientale Province (Figure 2, Table 1). These cities were selected because of their high woodfuel demand (Table 2) and the possibility of comparing the savannahs and degraded forest around Kinshasa with the abundant lowland humid forests around Kisangani.

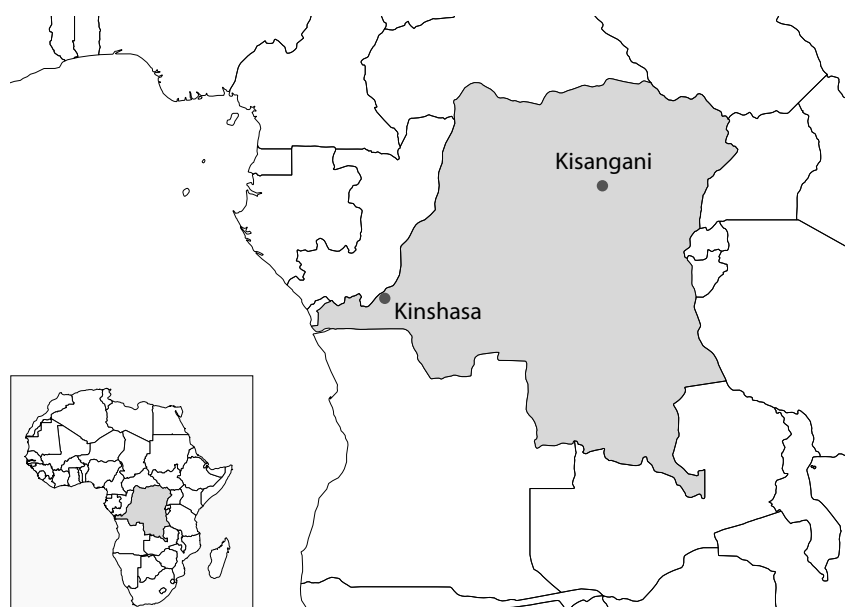


Figure 2. Study sites (Kinshasa and Kisangani) in the Democratic Republic of Congo

Kinshasa is the second most populated city in Sub-Saharan Africa after Lagos. Woodfuel is supplied largely from Kinshasa and Bas-Congo provinces (43% and 34%, respectively). The supply zone stretches to the southwest and northeast over an average distance of 102 km for fuelwood and 135 km for charcoal. The remainder (23%) arrives via the Congo River from Bandundu, Equateur, and Orientale provinces up to 1,000 km away (Schure *et al.*, 2013a).

Kisangani is supplied via six main river and road routes. The supply zone is on average 25 km for fuelwood and 37 km for charcoal (Schure *et al.*, 2013a). The population in Orientale is poorer than that in Kinshasa and Bas-Congo provinces (Table 1).

Table 1. Socio-economic status of research locations

	Kinshasa Province ^a	Bas Congo Province	Orientale Province	DRC
Surface (thousands km ²)	9.9	55.9	503.2	2,344.8
Population (millions)	5.8	3.2	6.6	64.3
Poverty rate (%)	41.6	69.8	75.5	71.3
Average household size	6.0	4.8	4.7	5.3
Primary school education rate (%)	74.8	71.1	76.6	76.3
Under-employment ^b (%)	53.1	73.4	71.9	72.7
Origin of household income (%):				
- Informal sector	89.5	93.6	95.9	94.6
- Public sector	6.1	4.0	2.9	3.6
- Private sector	4.4	2.4	1.3	1.8
Average monthly household income (USD)	84.0	37.0	25.0	42.0

Source: UNDP (2009a, b, c)

^a Some of the variations in the data are explained by the fact that Kinshasa province is characterized by a large urban population (in the capital Kinshasa) compared to the two other provinces.

^b Underemployment: people involuntarily working less than 35 hours a week or earning less than the national minimum salary.

Table 2. Woodfuel trade in Kinshasa and Kisangani (2010)

	Kinshasa	Kisangani
Total charcoal market (tons)	490,000	16,000
Total fuelwood market (tons)	60,000	32,000
Total volume woodfuel market (m ³)	4,800,000	200,000
Total value woodfuel market (USD)	143,000,000	2,500,000
Number of actors involved:		
Producers ^a	290,000	10,000
Transporters	900	1,600
Traders and vendors	21,000	12,100
Total chain actors	311,900	23,700

Source: Schure *et al.* (2013a)

^a Producers are often involved part-time in the commercial production of fuelwood and/or charcoal, mostly combined with agriculture.

2.2 Study design and methods

Case studies of these two urban woodfuel value chains were compared. Similar results were expected in the sense that in both urban centers woodfuel is the main source of household energy. Theoretical replication predicted contrasting results relating to the differences in commercial demand (higher in Kinshasa), pressure on the natural resource base (higher in Kinshasa), and distance to public administration (shorter in Kinshasa). A sample survey was conducted of the key actors involved in the woodfuel value chain at the two case study sites. Explanation building around the cases and analysis of the survey in terms of the research question constituted the main analytic strategy.

A combination of methods was used to measure, value, and compare aspects of woodfuel institutions. Between September 2009 and April 2011, interviews with administrations and analysis of legal documents provided insights into formal or bureaucratic institutions that

regulate access to woodfuel commercialization. Informal or socially embedded institutions were also studied, through a total of 4,266 surveys with producers, transporters, traders, and consumers. Twenty-seven focus group meetings with producers, transporters, traders, and consumers (households and businesses) in the Kinshasa and Kisangani supply and consumption zones elucidated how different actors access resources and markets and which institutions shape these access mechanisms. Observations at road control points and markets were made to investigate (illicit) tax collection and the use of trade permits. Literature and document review was used to crosscheck findings.

3. RESULTS: WOODFUEL INSTITUTIONS AND ACCESS

This section presents the study's results on institutions that shape access to woodfuel commercialization. The production process and actors involved in the woodfuel value chain are introduced, followed by analysis of the formal and informal institutions that define who benefits from access to resources and to markets.

3.1 Woodfuel production and trade: setting the scene

The differences between Kinshasa and Kisangani in ease of accessing the resource and the market reflect contextual differences and higher pressure and demand in the Kinshasa region. For most urban households in both cities, tree resources are too far away for them to collect fuelwood. Charcoal making, although it uses rudimentary techniques, requires expertise and experience. Consequently, it is primarily fuelwood collectors and charcoal producers who access woodfuel resources. Producers in the Kinshasa and Kisangani supply zones are mostly farmers who live and work in their village of origin. Woodfuel is sourced mainly from forest cleared for fallows as part of shifting cultivation, either by the producer or the landowner. Two-thirds of the woodfuel produced for Kinshasa and Kisangani originates from this type of agricultural activity, and around one-third comes from forests: generally degraded gallery forests around Kinshasa and primary forests around Kisangani.

Whereas in Kisangani most woodfuel is transported by bicycle or boat to urban markets, woodfuel is transported to Kinshasa over longer distances by large trucks, and this entails higher costs. Distances to the resource are increasing, and associated problems, such as conflicts over access to trees, are common in both regions. Unlike around Kinshasa, where every available tree is used, around Kisangani resource use is more selective, with preferred species exploited. Woodfuel depots, often located at strategic entrance points to town, constitute the transit points for charcoal and fuelwood arriving in Kinshasa before roadside retailers resell it to industrial buyers or via smaller markets to household consumers. These depots are recognized and licensed by the State services. In Kisangani, woodfuel is sold mainly in markets, although some is sold directly to consumers or small businesses as it enters the city.

3.2 Formal institutions shaping access

3.2.1 Access to resources

The forest sector is formally controlled by the Ministry of Environment (*Ministère de l'Environnement, Conservation de la Nature et Tourisme*: MECNT), with authority for woodfuel shared by the Directorate of Forest Management (*Direction de la Gestion Forestière*: DGF), responsible for streamlining the processing and use of wood as an energy source, and the Directorate of Horticulture and Reforestation (*Direction de l'Horticulture et du Reboisement*: DHR). Regulatory frameworks for the woodfuel sector are embodied in the 2002 Forestry Code and the 1973 Land Law (currently under revision), and some related principles regarding energy and sustainable production are embedded in the 2011 Agriculture and Environment Codes (Pougoue and Bachelet, 1982; RDC, 2002; 2011a; 2011b; Zaïre, 1973). Under the Forestry Code, all trees are owned by the State, with the exception of trees on private land, in villages, or on agriculture plots. User rights for subsistence use of trees are enshrined in the law. Official concessions for commercial purposes should be obtained through the official land cadastre. In the forest domain, all deforestation, except to clear land of less than 2 ha for agriculture, requires a felling permit. A ministerial decree of October 2002 specifies permits for felling fuelwood and carbonization, which can be issued to Congolese living in rural zones. All transported forest products need to be accompanied by a circulation permit, issued by the forest administration at the place of exploitation. There are five legal options for managing woodfuel production: (1) public plantations; (2) private plantations; (3) reforestation of agricultural parcels; (4) woodfuel exploitation with a permit for fuelwood cutting and carbonization; and (5) rural community forests (Schure *et al.*, 2013a).

Enforcement of official woodfuel access rules is weak. Official concessions are relatively rare in both regions (Table 3). The few existing woodfuel plantations include the Mampu Project on the Bateke Plateau, which produces charcoal from 8,000 ha of acacia trees (*Acacia auriculiformis*), the neighboring reforestation project at Ibi village, which produces charcoal under the Clean Development Mechanism, and the EcoMakala Project in North Kivu. Reforestation to date is insignificant; despite the targets set by the National Forest Fund (500 ha per year from 1986 to 2006, recently increased to a target of 1,000 ha per year per province), only 4,787 ha were planted between 1986 and 2006.⁴ The permit system for woodfuel does not capture the nature of production far from Kinshasa. Over half the producers (53% from the Bateke Plateau supply zone and 60% from the Lukaya supply zone) know that a permit system exists, but none of those interviewed possessed a permit. Data from the Ministry of Environment at Tshiangu in Kinshasa confirms this lack of implementation of permits: from 2009 to 2011, only 318 permits were issued, for a total of

⁴ Directorate of Horticulture and Reforestation of the Ministry of Environment, personal communication, Kinshasa, August 2009.

43,386 tons of charcoal,⁵ representing less than 3% of Kinshasa's charcoal. Most producers (77% in the Bateke Plateau zone and 87% in the Lukaya zone) expressed interest in obtaining a permit, but only if this reduced their current payments of bribes, fees to village chiefs, and if the State participated in reforestation and provided storage depots in town. Although most producers work in groups, most (95%) are not members of a woodfuel-related organization, with only one formal producers'/traders' association known: the 200-member *Association des Diamants Noirs* in Maluku, operating since 2005.

Table 3. Types of access to the resource per woodfuel product per supply region (%)

Type of access to resource	Kinshasa		Kisangani	
	Charcoal	Fuelwood	Charcoal	Fuelwood
Traditional landowner	59.5%	53.6%	54.1%	73.6%
Renting land	33.2%	37.5%	26.0%	19.4%
Buying trees	2.7%	5.4%	14.7%	1.4%
Official concession holder	3.5%	3.6%	3.7%	1.4%
Other	1.1%	.0%	1.6%	4.2%

3.2.2 Access to markets

The Ministry of Environment issues sales permits for fuelwood and charcoal. At the Ministry of Energy, woodfuel falls under the auspices of the Directorate of New and Renewable Energy (*Direction de l'Energie Nouvelle et Renouvelable*). In Kinshasa province until 2005, permits for woodfuel sales were granted by the Ministry of Environment and could be obtained by producers at the divisional office. Initially, inspections were conducted at production sites, but due to a lack of resources these shifted to controls at markets, although these are seldom implemented. Instead, an institutionalized system of illicit roadside tax collection operates, said taxes negotiated on the spot with transporters. Since 2005, the Kinshasa Urban Division of Energy under the Directorate General of Revenues (*Division Urbaine de l'Energie via la Direction Générale des Recettes de Kinshasa*) levies woodfuel sales taxes in markets, with market managers and State agents collecting taxes. Producers and vendors therefore are required to pay two taxes to the two authorities on the same product. They also reported a multitude of other State services collecting taxes. Trefon *et al.* (2010) counted 10 other State services imposing taxes on woodfuel transporters and sellers. Taxes paid by transporters at various official control posts are generally not declared in official documents and do not reach the public treasury. Transport to Kinshasa often takes place at night to avoid such illegal levies. In Kisangani, the Ministry of Environment levies taxes. The provincial Ministry of Energy has no role. At markets and river harbors, a myriad of at least seven State authorities collect taxes under incoherent and often illicit tax regimes.

⁵ Urban Division of the Ministry of Environment in Tshiangu (Kinshasa), personal communication, Kinshasa, 2012.

In summary, current formal mechanisms regulating access to woodfuel resources and markets exist, but are characterized by non-implementation and non-enforcement, and overshadowed by corruption. Policies are fragmented in their approach, neither covering the entire value chain nor addressing the various actors involved. Formal recognition and channels that allow the concerns of producers to be voiced are lacking. There is a wide gap between the intention of formal regulations regarding woodfuel, their enforcement by State officers and local practices (see Table 4).

3.3 Informal institutions shaping access

3.3.1 Access to resources

Fuelwood production, from cutting the wood to packing bundles for sale, is often done by family members, and sometimes villagers are hired for a daily fee or in-kind compensation. Temporary urban-to-rural producer migration was observed to some extent, especially to deal with large-scale requests for fuelwood for bakeries. The production cycle for charcoal, from cutting the wood to packing bags, involves mainly local men paid a daily fee (or sometimes a percentage of the total production) by the landowner or the head producer. In both regions, reciprocal labor exchange groups are common. These involve around 10 producers working in turns to build a member's charcoal kiln. The host producer provides food and drinks and reciprocates by working on other members' kilns. There are also permanent groups of professional producers who access trees on private or communal lands. In remote areas, a camp is sometimes built at the site. Some urban citizens also specialize in charcoal production. They mainly function as intermediaries, hiring villagers to produce charcoal. Most charcoal production in the Kinshasa and Kisangani zones is artisanal, using traditional charcoal kilns with a low energy efficiency of 10% to 20% (Dikhulu Kianda and Lelo N'Kambu, 2000; Makala Project, 2012). There is no formal education for woodfuel production, but 6% of charcoal producers mentioned that they had received some type of training from experienced producers. The main factors influencing access to resources according to producers are the distance to the production site and the caterpillar-harvesting season. In the latter season, it is prohibited to cut trees that are home to caterpillars, a common and popular food. Producers also mention restricted zones, especially around Kinshasa (49% vs. 9% in Kisangani). These are mainly sacred sites, private forests, concessions, or plantations. Accessing these areas can lead to conflicts, as indicated by 13% of Kinshasa producers and 6% of Kisangani producers. Increased scarcity was one of the main causes of conflicts mentioned by Kinshasa producers. Other reasons include disagreements over land rights, access, prices, and corruption.

The weak implementation of woodfuel sector regulations contrasts with the strong customary rules that largely govern access to resources. Access depends on whether the trees grow on village lands, private lands, or plantations. Around Kisangani, most trees are found on village lands, whereas in Kinshasa access is more complicated because of the mix of private lands and a large plantation. Three types of informal or customary access to resources were

identified: 1) land ownership; 2) renting land; and 3) buying trees (Table 3). Land ownership is obtained either by inheritance or long-term land purchase from local authorities. Renting land from local authorities or a landowner to produce woodfuel and possibly also crops can be agreed upon for a shorter period of time, varying from a few weeks to a few years. When the sole purpose is woodfuel production, this is called *collaboration*. The fee is often paid in cash for fuelwood or a proportion of charcoal production. Buying individual trees is more common near Kisangani and costs around USD 10–30 per tree. Except for inherited land, all other types of access apply to both local producers and producers from outside the region. For local charcoal producers, land ownership is the main way to obtain access (61%). Outsiders work mostly as *coopérants* (59%), renting land and surrendering part of their production in return. This results in higher access costs for charcoal producers from outside the region (USD 70.5 per year) than for local producers (USD 44.1 per year). Overall, producers' access costs remain relatively low, amounting to 4% of total revenues for charcoal producers in the Kinshasa supply zone and 9% of total revenues for those near Kisangani. For all producers, access is mainly negotiated with the local traditional authorities (*chef de groupement* or *chef de terre*). In the Kinshasa region, the head of a charcoal producer group generally negotiates access on behalf of the group. For local producers, these negotiations are relatively easy, although they involve implicit obligations such as respecting local traditions and sacred forests, and sharing part of the proceeds with village authorities. For producers from outside the region, payment is made to village elites, and maintaining good relations with villagers and respecting local norms are also key conditions for gaining and maintaining access. Costs differ depending on whether the producer is local (lowest), from outside village land (higher), or accessing private land (highest) (Trefon *et al.*, 2010). Producers are largely exempt from official taxes because it is landowners (village notables or private owners) who are required to pay tax for woodfuel exploitation. During transport and trade, transporters and merchants have to deal with State authorities taxes (see section 3.2.2), reflected in the high transportation costs.

Local access rules also depend on the land tenure systems in the supply region. Around Kinshasa, in Bas-Congo, most land has been sold to concessionaries, and access is often costly. Vermeulen *et al.* (2011) indicate that in Bas-Congo, where there is extreme pressure on wood resources despite local replanting customs, access is organized by the lineage chiefs (*chefs de lignées*) who provide lineage members with permanent agricultural lands and grant temporary contracts to outside producers. Further away from the capital, in the provinces of Bandundu and Equateur, free access to resources is offered by farmers who want forested land cleared for agriculture. On the Bateke Plateau, customary chiefs control access to land. Access is always temporary, even for local villagers, and involves payments in cash or a share of production. This temporality makes reforestation or domestication unattractive and aggravates the pressure on tree resources in the region (Vermeulen *et al.*, 2011). In Kinshasa, 21% of charcoal producers and 26% of fuelwood producers reported planting trees useful for fuelwood and charcoal. However, most (78%) producers around Kinshasa have never planted trees for woodfuel and, in Kisangani, none had planted trees.

3.3.2 Access to markets

Producers tend to work alone and are self-sufficient. The main factors influencing access to markets according to producers are high costs of corruption during transport, long distances, high transport costs, and the periods of high demand (year's end, return to school). Transport costs amount to 31% of total revenues of charcoal producers in the Kinshasa supply zone, whereas these costs constitute only 11% of total revenues of charcoal producers in the Kisangani supply zone. Most (80%) accompany their product to the urban markets, or send a representative from their producer group. Some producers indicated that they do not go to the city for fear of being poisoned, bewitched, or robbed, as people recognize they are rural farmers. Most finance their own activities (99% in Kinshasa and 83% in Kisangani). Some Kisangani producers use informal loans and savings groups.

Most (60%) charcoal producers sell to any buyer; 40% sell to a regular buyer. These buyers are often intermediaries or traders (99% in Kinshasa and 92% in Kisangani). Producers from Kinshasa region rarely (1%) sell directly to households or restaurants, although 9% in Kisangani sell directly to households. Prices are generally negotiated on the basis of quantity of bags and charcoal quality. For fuelwood, the main clients are local intermediaries (93% in Kinshasa and 79% in Kisangani), followed by restaurants (4%) and households (1% in Kinshasa and 18% in Kisangani). Rural intermediaries (*rabatteurs*), mainly men living in the supply zone, organize charcoal or fuelwood collection through groups of producers. When a truckload is ready, they contact urban traders, who then organize transport and pay producers. Both producers and traders pay these intermediaries. Urban intermediaries, known as *mama* or *papa manœuvre* sometimes go to rural zones to collect woodfuel, pre-financed by urban customers. They also work in urban markets, organizing sales of truckloads of woodfuel arriving in the depots, using their personal networks to sell quickly and avoid paying too many taxes and bribes, a practice confirmed by Trefon *et al.* (2010).

Woodfuel commercialization provides a range of income-generating opportunities. Besides the wholesalers, retailers, and vendors, manual laborers find work carrying and packing trucks. Some are paid in charcoal waste, in demand by users of battery-ventilated stoves in Kinshasa. Most traders are men (64% for charcoal and 58% for fuelwood sales in Kinshasa and 78% for charcoal and 73% for fuelwood sales in Kisangani). In the past, women dominated retail, but unemployment and increasing woodfuel prices have attracted men into the trade and raised its status (Ingram *et al.*, 2014).

In Kinshasa, no wholesaling was found to occur outside the formal *depot* system. However, a proportion of retail sales occur outside of the market system, out of view of State agents, with small bundles of fuelwood or bags of charcoal sold at the roadside in neighborhoods. In Kisangani, sales are less organized. In both regions, corruption, harassment, and illicit taxing of woodfuel were observed along the road, at harbors, and at checkpoints, mostly targeting transporters. It is estimated that formal taxes would cost considerably more than the current largely informal arrangements. Producers supplying Kinshasa would pay USD 31 annually, instead of the current USD 22, and producers from the Lukaya supply zone would pay USD

67 instead of the USD 60 paid currently, plus the official permit costs (USD 130 per trimester for a quantity of 50 tons of charcoal).

To summarize, customary rules largely govern access to woodfuel resources. Access depends on resource abundance, type of land tenure, whether the producer is a local or an outsider, traditional customs, social relations, gifts and payments, and respect of local rules. Local replanting customs and natural regeneration have not been sufficient to mitigate the negative effects of deforestation and degradation caused by access to woodfuel resources. Access to markets is mitigated through official depots (in Kinshasa) and markets where taxes are levied. However, in parallel, informal institutions, such as informal savings systems among producers (in Kisangani), the logistical role of rural and urban intermediaries, informal taxing and road markets have a significant influence on shaping access to woodfuel markets (Table 4).

Table 4. Woodfuel institutions shaping access to resources and access to markets

	Woodfuel institutions			
	Formal institutions	Enforcement mechanisms & extent	Informal institutions	Enforcement mechanisms & extent
Access to resources	<ul style="list-style-type: none"> Forestry Code, Land Law Fuelwood and carbonization sales permit Legal options for sustainable production: plantations; reforestation; community forests, controlled by Ministry of Environment Restricted zones such as private forests and plantations^a 	<ul style="list-style-type: none"> Formal permit system seldom applied Few official plantations and reforestation initiatives implemented Weak monitoring capacity of state administrative bodies General low level of payment of formal taxes 	<ul style="list-style-type: none"> Labor exchange Collaboration among producers Traditional land tenure Producer negotiation with local traditional authorities Maintaining good relations with landowner Gifts and payments Restricted zones such as sacred sites Informal loans or savings systems^b Local replanting customs 	<ul style="list-style-type: none"> Customary access restrictions: sacred sites, during caterpillar-harvesting season, limitations on duration or function of traditional land tenure often applied Producers' general respect local customs Payment (in cash or woodfuel) to private landowner or village authority
Access to markets	<ul style="list-style-type: none"> Taxes levied by Ministry of Environment, Ministry of Energy,¹ and other State administrations Circulation permit Woodfuel depots^a Official markets 	<ul style="list-style-type: none"> Formal permit system seldom applied Formal taxes sometimes collected by different government authorities Low presence and weak capacity of State administrative bodies to enforce in markets No enforcement or intervention by Ministry of Energy² 	<ul style="list-style-type: none"> Unofficial markets/roadside sales in neighborhoods Informal loan and credit systems^b (Most) producers accompany their produce to market Collection of woodfuel by rural or urban intermediaries 	<ul style="list-style-type: none"> Frequent bribery by various government authorities during transport to, and in, markets Irregular trading relations between producers, transporters, and vendors, often via intermediaries

^a Kinshasa only

^b Kisangani only

4. DISCUSSION: ACCESS AND RESOURCE MANAGEMENT OPTIONS UNDER PRESENT WOODFUEL INSTITUTIONS

This section discusses how woodfuel institutions affect access to resources and to markets around two urban centers in the DRC. It specifically examines the ability of producers to access markets and the resource management potential of current woodfuel institutions.

The main formal institutions regarding woodfuel resources are regulations by the Ministry of Environment that provide legal options for plantations, reforestation, woodfuel exploitation permits, and community forests. In practice however, the presence of formal institutions is very weak and the myriad of official rules are little known, seldom implemented, or arbitrarily enforced. Producers have little political visibility and generally work informally together on the basis of labor exchange, sharing revenues or skills. Trefon *et al.* (2010) have emphasized that such types of association serve individual economic interests rather than a spirit of collective, harmonious collaboration. Producers mostly access resources by directly approaching local traditional authorities. The ease and costs of such access depend on resource scarcity in the specific region and whether the producer is a local or an outsider accessing either village or private lands. The last option involves the highest costs, but all options are subject to respect for local traditions and taboos, and payment in cash or in the form of a share of the woodfuel harvested. The absence of formal institutions in the supply zones enables producers, official landowners, and traditional authorities to avoid paying official taxes. However, transporters and traders pay both formal taxes and bribes, increasing the overall transport costs for producers and market prices for consumers. The lack of formal institutions at resource level does not mean that the system is ungoverned: informal institutions govern access, clearly stipulating the arrangements that make natural capital (woodfuel resources) relatively accessible to producers with sufficient human, social, and financial capital, and this situation should not be confused with the state of anarchy described by some (e.g. Binzangi, 2004).

Markets in the two cities are organized differently and are controlled by distinct institutions. In Kinshasa, virtually all resources pass through wholesale depots to consumers or smaller markets; in Kisangani, woodfuel is sold either in markets or directly to consumers. Access to markets is mainly informal and self-organized by individual producers and traders, most of whom finance their activities through informal credit. The lack of formal credit systems and prepayments reflects the overall lack of trust between producers and traders (Trefon *et al.*, 2010). Producers sell mainly to different buyers, primarily intermediaries, typical of market-based governance networks, with arms-length exchange transactions where information flows are limited and there is no technical assistance (Gereffi *et al.*, 2005). Intermediaries play a logistical rather than financial role, bulking up, speeding up collection, transport, and sales, and avoiding or minimizing taxes. There are many vested interests in the informal systems with producers and rent-seeking actors along the chain and few motivations or disincentives to change. Producers and transporters in the DRC, who encounter and negotiate bribery by state officials at road checkpoints and markets, pay about half of what they would have to pay

to buy an official permit. This goes against the commonly held assumption that the informal sector incurs increased transaction costs and results in reduced net incomes (De Soto, 1993; Zulu and Richardson, 2013).

Despite the high value of the product and the urban–rural trade dynamics, access to resources and markets is relatively inclusive. Analysis of the woodfuel chains in these two DRC regions shows that access is open to the less privileged and to rural actors. This is in contrast to the situation often portrayed of poor producers in value chains (Van den Berg *et al.*, 2007; Webber and Labaste, 2009). Access to woodfuel resources is generally easier for local producers and more expensive for producers from outside the village or on private lands. This means that sufficient financial capital is a precondition for accessing tree resources. This is feasible for most producers, not only the wealthy elite. Omnipresent local institutions, common in the DRC and in Central Africa, such as group working and saving, working in collaboration with landowners, and payment either in cash or a share of production, facilitate poorer producers' access to resources. Most producers (80%) have direct access to markets, irrespective of their household income. Producers are aware of general urban market prices, and they secure 38% to 71% of the average retail price (Schure *et al.*, 2014). This is high compared to the proportions that producers reportedly receive in other countries: 11% in Burkina Faso (Ouédraogo, 2007); 15% in Senegal (Ribot, 1998); 20% to 33% in Malawi (Kambewa *et al.*, 2007); and 23% to 33% in Tanzania (Van Beukering *et al.*, 2007). Congolese producers hold a better negotiating position than, for example, producers in Senegal, who feel cheated by urban traders because of the powerful position of merchants, which in turn is shaped by credit arrangements and the formal permit system (Ribot, 1998). The absence of such institutions in the DRC contradicts the contention that fragile market access, low levels of collective action, and producers' low bargaining power create dependence on traders for credit, trade contacts, and transport (Sunderlin *et al.*, 2005).

Although both formal and informal woodfuel institutions impose constraints on access to both resources and markets, in practice they contribute little to the sustainability of production. Actors are aware of the environmental impacts of production but have few incentives, through existing institutions, to change their behavior to take account of longer-term product and chain sustainability. Formal institutions currently have fragmented perspectives on the woodfuel sector, with the tax and permit systems inadequately positioned to promote sustainable management of the resource or chain. The absence of state authorities in the woodfuel supply zones means that reinvestments in reforestation, tree planting, sustainable harvesting practices, and fuel-efficient production methods to reduce resource use are woefully inadequate in the face of current and growing urban demand. Neither formal nor informal institutions governing markets in the DRC promote or reward sustainable management of woodfuel resources, but rather invoke resource mining, signaled by high and increasing prices. Despite the fact that high woodfuel prices could make domestication and cultivation strategies commercially attractive in the face of resource scarcity in the Kinshasa supply zone (Homma, 1992), reforestation initiatives by producers remain rare. This is aggravated by the fact that access to the resource is often temporary, even for local villagers,

as observed on the Bateke Plateau (Vermeulen *et al.*, 2011), rendering long-term investments unattractive. Longer-term investments also require a payback period that few producers can afford (Peltier *et al.* 2010). Although informal institutions governing access to resources do impose restrictions for specific areas and seasons, partially protecting some of the resource base from exploitation, these are insufficient to deter people from trying to accumulate the economic capital that can be gained from exploiting this lucrative product. The often-observed coexistence of local and external governance mechanisms regarding forest products should ideally reinforce rather than obstruct sustainable outcomes (Wiersum *et al.*, 2014). This is not the case in the Kinshasa and Kisangani woodfuel supply zones, where the coexistence of customary and statutory rules instead leads to conflict and tension between stakeholders, and there is little awareness of, or consensus on, resource management options (Trefon, 2011). Ideally, taxing woodfuel should capture actual value and internalize the price of resource management and restoration (Owen *et al.*, 2013). In practice, this is not the case. As the costs of access to high value charcoal production remain relatively low, the internalized, ‘real costs’ of restoration, agroforestry, and sustainable production practices are not included in woodfuel market pricing in either Kinshasa or Kisangani.

Formal institutions should accommodate diverse management options that combine agroforestry, plantations, and management of fallows and degraded forests, as well as improve energy efficiency at producer and consumer level to increase the sustainability of energy supply for the DRC’s major cities. At present, the legal options for sustainable woodfuel management are hardly being implemented and monitoring is virtually non-existent, especially at larger distances from the city center. New techniques, such as the production of charcoal briquettes and cogeneration of electricity from charcoal production (Mwampamba, 2013b; De Miranda *et al.*, 2013), appear promising for the DRC, but require a conducive business environment with appropriate regulations. Local management of tree resources can be supported by various activities, such as: (1) the development of simple management plans for future use of landscape units by communities. These simple management plans can contribute in the mid-term to filling the gap between absence of formal land tenure and the insufficiently sustainable character of informal arrangements; (2) the dissemination of assisted natural regeneration techniques for preservation of multi-use tree species; and (3) the (re) introduction of trees for multiple uses in the agricultural system. Especially promoting fast-growing tree species with relatively quick returns, such as *Acacia auriculiformis*, can entice farmers to replant. Such activities need local appropriation and must be embedded in national decentralization processes (Dubiez *et al.*, 2012). The demand and supply of woodfuel should be central to pro-poor energy policies, embraced by ministries responsible for agriculture, forestry, and energy, with poverty-reduction opportunities sought in policy interventions that target locally specific incentives and penalties (Shackleton *et al.*, 2007; Zulu and Richardson, 2013). This study suggests that dramatically new strategies combining and building upon the best of formal and informal institutions are required to promote the positive aspects of informality in terms of short-term livelihood benefits, while supporting initiatives that contribute to long-term resource sustainability.

5. CONCLUSION

Institutions shaping access to woodfuel commercialization materialize primarily as informal arrangements that follow the local environment and customs and mostly result from social relations and an economic rationale. Formal institutional mechanisms do exist, but these are either insufficiently implemented or unenforced and do not reflect the size and the importance of the woodfuel market and challenges facing the value chain. Instead, the woodfuel chain is characterized by a large number of illicit tax collectors, with revenues not reaching the treasury and thus not reinvested to improve long-term chain sustainability. This mirrors the complexity of access to forest product markets worldwide, with multiple types of fragmented institutions governing production and trade (Wiersum *et al.*, 2014). Competing claims are observed at different levels of the woodfuel value chains in the DRC. Low-paid officials conducting market and road checkpoint controls are not motivated to enforce the official permit system. Intermediaries providing logistical support in markets secure their profit margin by avoiding or negotiating market taxes, counteracting the efforts of, or bribing, tax collection officers. Nevertheless, many people benefit from the informal arrangements governing the Congolese woodfuel chains, and it is likely that woodfuel producers would benefit less if current regulations were more strictly enforced. However, the inability and unwillingness of existing institutions to counter the effect of the high levels of urban demand that are creating pressure on the forest and tree resource base is contributing to the low level of sustainability of the livelihoods depending on the woodfuel trade. New strategies are required that promote the positive aspects of informality, while supporting initiatives that contribute to long-term resource sustainability and meet the high levels of urban demand, given the lack of alternative energy sources.

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