

Forest regulation flexibility, livelihoods, and community forest management in the northern Bolivian Amazon

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Abstract: Since the time when forests were recognised not only as a source of wood and fibre but as a complex system closely linked to human society and other biological systems, a number of efforts and initiatives have been developed to integrate forestry within other sectors of the economy and with livelihoods, and to improve the governance of forest resources. This case study looks at the outcomes and consequences of making forest regulations related to the use of timber resources and forest management among rural communities more flexible in the northern part of Bolivia. If forest regulations are made more flexible when the rights are granted, the informal mechanisms that have been developed to access timber and benefit from its sale become eventually legitimised, and the distinction between what is prohibited by law and what is sanctioned by tradition will be lost. Thus, communities can operate either as efficient promoters of sustainable forest use or as forest predators, innovating different strategies to use timber formally or informally. If a national or regional forest policy is going to be effective, it must have the commitment of the entire government and society-wide support based on a process of joint deliberation, assessment, and coordination rooted in the local realities of users.

Keywords: Regulations, formal, informal, legal, illegal, community, individual, collective, governance changes

5.1 Introduction

In the past three decades of the 20th century, forests became recognised for their provision of direct and indirect benefits to global society, to national and local economies, and to the livelihoods of millions of people (Mery et al. 2005), at the same time people's awareness of the increasing loss of forests and global warming was growing. This triggered initiatives to change particular social, economic, and political elements of forest management in many countries. Some of these changes were meant to favour poor people and improve their opportunities to benefit from the forests, as is the case of community forest management (Cronkleton et al. 2011) or co-management (Carter and Gronow 2005). Other changes were meant to allow governments to maintain or increase control over the forests.

Changes in the way policy-makers think about the role of forests in society can be observed by analysing the regulatory framework on forest use and management in a country. Worldwide, many examples exist that describe the effects of changes in legislation on forest and tenure rights. In Latin America, for example, the revision of policies, legislation, and forest institutions merits special attention when the consequences of those initiatives affect rights, the environment, and the countries' development (FAO 2010).

Within this legal context, we can analyse changes from different perspectives: for instance, the rise of informal institutions due to imperfections in legal changes (timber extraction within communities); illegal activities due to laws and regulations that do not fit local realities (the obligation to comply with expensive and bureaucratic forest-management in-

struments among small users); and circumstances that influence social behaviour related to compliance with the laws.

Scholars have developed studies on each of the cited perspectives. For instance Gel'man (2004), in his studies of Russia's post-authoritarian transition (specifically in the formation of business networks during the process of privatisation), argues that informal institutions serve as a weapon of the weak when law is insufficiently applied. Roper (2003) shows what factors affect the ability of indigenous people to benefit from the new economic opportunities related to forest use. He mentions, for example, that people may not understand a law and may not foresee the social changes that could result from taking up certain economic opportunities.

When new economic opportunities to benefit from forest resources are created, communities and smallholders may experience problems in making use of these opportunities. Regulations often impose singular standards that are more difficult to comply with for smallholders than more economically powerful stakeholders, thereby creating access asymmetries (Larson and Ribot 2007).

Ramcilovic-Suominen and Hansen (2012) studied adherence to rules regulating local forest-based activities. They argue that compliance is influenced by numerous normative and instrumental factors, such as perceived fairness of the rules, the need for resources for livelihoods and domestic use, and the fear of sanctions. These factors affect behaviour differently in different legal and socio-economic contexts. Several scholars link the lack of compliance with the law to illegal activities, corruption, unequal benefit-sharing, and unsustainable use of resources that leads to forest degradation and, consequently, to a decline in forest-related goods and services, loss of revenues, and loss of forest-related livelihoods (Contreras-Hermosilla 2002, World Bank 2004, Contreras-Hermosilla and Peter 2005, Tacconi 2007, Ramcilovic-Suominen et al. 2010).

After important policy changes related to deforestation and forest degradation caused by private forest companies, agricultural companies, and cattle ranchers, Bolivia shows new patterns of local forest management by actors (rural communities) previously constrained or excluded from benefitting from the use of forest timber (Pacheco et al. 2010).

There are some references to rural populations in forest areas that have begun to play a key role in forest-use changes. Sierra (2001) studied the role of communities as suppliers of domestic markets. Sierra and Stallings (1998) studied local conditions in relation to export markets and the integration of local populations in an economic system. Pacheco et al. (2010) analysed the outcomes of rights exercised at the community level in the confrontation between private companies and the rural poor over access

to land. However, there is little knowledge about normative changes as a driver for the development of local strategies to access and use forest timber resources, and to change related forest management strategies according to the local social context.

For the current work, we understand the flexibility of forest regulations as the design of complementary regulatory instruments that try to recognise local strategies for use of forest timber in an attempt to overcome the law's deficiencies in facilitating the exercise of use rights by small stakeholders and rural people. Within the literature, there is no reference to this topic as presented here. Most of the work related to law and regulations is developed within the focus of forest governance (Weiland and Dedeurwaerdere 2010), with emphasis on decentralisation processes as the prominent feature of forest governance (Ribot et al. 2006).

In this chapter we present empirical evidence related to the development of local strategies for use of timber resources based on the study of the normative flexibility imposed by social and political changes in Bolivia. The process of making forest regulations more flexible in Bolivia has resulted in a more complete set of local people's user rights over forest resources than before. Based on the theory that people with secure tenure and forest-user rights are more likely to use these resources in a sustainable way, the study looks at whether this tendency can be observed in Bolivia. Do people use their forest sustainably if they have more complete forest-user rights?

To answer this, we focus on the following questions:

- 1) What has motivated the government to apply forests regulations in a more flexible manner?
- 2) How has the rural population made use of this flexible application of forest regulations?
- 3) What contextual (site-specific) factors generate different responses in terms of forest use among different individuals and communities (access roads, agricultural opportunities, high-value non-timber forest products [NTFPs], community forest-management plans or individual authorisations)?
- 4) How can the changes and flexibility of forest regulations promote new strategies of forest management either leading to deforestation or sustainable forest management among rural communities?

The chapter is organised in seven parts, beginning with this introduction. The second part describes the methods used to collect data and information for our analysis, as well as some contextual aspects. The third part covers the most important changes within forestry law in the past 30 years. The fourth part focuses on the key aspects of forest regulation flex-

ibility. The fifth part presents the research results. The sixth and seventh parts are the discussion and conclusions, respectively.

5.2 Methodology and contextualisation

5.2.1 Description of the study area

The northern Bolivian Amazon covers an area of about 91 000 km² of tropical rain forest, with a natural high abundance of Brazil nut trees (*Bertholletia excelsa*) and rubber (*Hevea brasiliensis*). The region is almost fully covered with forest, with a commercial timber volume of about 28 m³/ha (Poorter 1999). Brazil nut has been the most important forest product exported from Bolivia for the past three decades, and currently, its procurement and trade contribute 30% to the region's economy (Duchelle 2009, INE 2011). More than 50% of the combined cash and subsistence income of households is derived from gathering or processing Brazil nuts (MTPS 2008, Duchelle et al. 2011). Subsistence agriculture is important in all communities in the region, but only a small proportion of agricultural products is commercially traded (Zenteno et al. 2013).

In the region, approximately 30 000 rural inhabitants live in 262 communities located in the department of Pando and the Vaca Díez province of the department of Beni (MTPS 2008). During the beginning of the harvest of Brazil nuts in November–December, the population in rural settlements rises sharply as a large share of the urban population moves in to work as *zafreiros*, or Brazil nut collectors.

Relevant social and political events in Bolivia have influenced people's livelihoods during the past two decades. Important changes in the country's forest regime and related regulations took place between 1996 and 2002 (de Jong 2004). As a result of changes in the Forestry Law, for the first time, communities could organise to become legal forestry entrepreneurs. In addition, important parts of forestry administration were decentralised and passed to departmental and municipal governments (Pacheco 2006). Since 1996, an extensive land tenure reform has been implemented, which resulted in 40% of forest lands being placed under the control of forest communities (Ruiz 2005, INRA 2007). From 2003 to 2008 regional programs provided support for community-based forest management, technical assistance to implement forest management plans, loans for small-scale Brazil nut extraction, and support to local cooperatives (Cronkleton et al. 2009), although in other parts of Bolivia (Santa Cruz department) that had started in 1998.

5.2.2 Methodology

Methods and data collection

The study relied on a combination of different approaches to answer the research questions presented in the introduction. A quantitative method to study the success of community forest management (CFM) in relation to livelihoods was performed to identify factors that promote communities to engage formally or informally in the management of forests (questions 1 and 2).

A qualitative method was performed to respond the last two questions, to understand the processes of developing new strategies and the consequences of normative flexibility. The study reports on quantitative surveys to identify and confirm trends in changes of forest use strategies.

To identify changes over time, data would be needed from different time periods for the same study areas. However, we used two surveys carried out by different researchers in 2009 (Cano et al. 2011, Zenteno et al. 2013) and 2011 (Cano et al. 2013) in the same region. These surveys compared some key variables related to timber extraction and sale, such as household variables (related to family members), household income and sources, household agricultural and forest variables, household expenditures, community social relations, and community institutional access (mostly related to the community's capacity to develop forest management plans). We validated this information with quantitative data provided by the Bolivian forest service about the number of clearing plans (authorisations to deforest small plots for agriculture and sell the valuable timber trees cleared) approved for community members and the number of authorisations to extract and sell small volumes of timber, no more than 11.3 m³ (*Autorizaciones de aprovechamiento de volúmenes menores*). Additionally community members were interviewed using a random sample.

The qualitative method consisted of interviews using semi-structured questions directed at different actors (chainsaw mills, carpentries, brick factories, small timber sawmills). We also conducted in-depth interviews with local leaders, community members, and other key informants. We collected the narrative of changes related to forest use and agricultural production occurring in 2009 and after 2011.

Zenteno et al. (2013) interviewed 239 households in 16 selected communities that reported to live at least 10 months per year in the community over a wide geographic area in the northern Amazon region (Table II 5.1). The quantitative data was collected by Cano et al. during 2012, involving interviews with 31 key informants in five communities in the same area. This selection aimed to track variation in annual and seasonal activities, and therefore this sample was

Table II 5.1 Resources available in 16 communities in the northern Bolivian Amazon.

Community	Community type	Timber ^a	Brazil nut ^a	Other NTFPs ^a	Surface per household ^b	Size ^c	Number of households interviewed (% of the total)
San Antonio (Riberalta)	Agro-extractive	L	L	L	S	L	19 (37)
Santa María	Agro-extractive	L	L	L	S	L	19 (25)
Desvelo	Agro-extractive	L	L	L	S	S	
Bella Flor	Agro-extractive	L	L	L	S	S	
Campo Central	Agro-extractive	L	L	L	M	M	
Antofagasta	Agro-extractive	L	L	L	S	M	9 (33)
Santa fé (Riberalta)	Agro-extractive	L	L	L	M	M	15 (45)
12 de Octubre	Agro-extractive	H	M	M	S	M	15 (31)
Santa Crucito	Agro-extractive	H	H	M	M	M	15 (31)
Loma Alta	Extractive	H	H	M	M	L	26 (27)
Contra Varicia	Extractive	L	H	M	L	M	13 (42)
Galilea	Extractive	H	M	M	L	L	19 (45)
Naranjal	Extractive	L	M	M	M	L	20 (33)
Motacusal	Extractive	L	H	H	L	S	9 (47)
Iraq	Extractive	NA	H	H	M	S	9 (41)
Las Mercedes	Extractive	L	H	M	L	M	16 (42)
Remanzo	Extractive	L	H	L	L	M	15 (42)
San Antonio (Filadelfia)	Agro-extractive	H	H	L	M	S	10 (42)
Petronila	Agro-extractive	H	H	M	L	S	10 (37)

Notes: L=Low, M=Medium or on average range, H=high

^a L < 100 , M 100–500, H > 500 US/year, NA Not allowed by law

^b S < 100, M 100–500 L > 500 ha

^c S < 20, M 20–60, L > 60 households

restricted to those households that were interviewed three times in a year.

In Table II 5.1, extractive communities are those that depend mostly on timber and non-timber forest products (NTFPs, mainly Brazil nuts), agro-extractive communities depend more on agriculture, although once a year they achieve economic benefits working as Brazil nut collectors (Cano et al. 2011, 2014; Zenteno et al. 2013).

Quantitative data analyses

To understand the incentives to manage forests, we first formulated the question of whether differences in forest management exist due to the specific variables related to community type, through the sample. The existence of these site-specific variables can be an important source of divergence to a general model for understanding the probability of logging (Hobley and Shields 2000).

We used a binary chi-square test to characterise community types, aimed at overcoming the effects of higher level variables and confirming the significance of the logistic regressions (Dickinson and Basu 2005). To define the variables relevant to characterisation of the communities, we first used a productive criterion of the average Brazil nut extraction per household. This was also formulated by Stoian and Henkemans (2000). If production exceeds 100 boxes per household, the community is called an extractive community (because the higher annual production makes households more dependent on this product than on agriculture), while below this value, a community is characterised as agro-extractive. We then associated this with other variables that could relate to community characteristics cited below.

To understand which factors drive community members' decisions to undertake individual exploitation of trees, we considered a model that estimates the relation of the response variable of individual round-wood sales (a binary variable) to any explanatory variable that is associated with a household (Kahn 2005). The binary logistic regression method was used to estimate the significance of explanatory variables as factors (Barros and Hirakata 2003). The full model included one-way effects (independent) for explanatory variables:

$$\text{logit}(p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 x_{1,i} + \dots + \beta_k x_{k,i} \quad (1)$$

where p = probability of response variable, $\text{Logit } p = \ln(p/1-p)$ or the logarithm of odds, β s = coefficients of the explanatory variables, and e^{β} = odds ratio, a measure of likely change in the probability of response variable because of change in the explanatory variable from one value to the next (e.g. 0–1).

Explanatory variables consisted of variations in types of income sources and local institutional- and household-related variables (Delacote 2007, Tesfaye 2011) that are considered important factors for explaining timber extraction (Cronkleton and Albornoz 2009, Pokorny et al. 2010) and the households' agricultural and forest management practices (Fisher 2004). We also included the total income and type of income, the amount of expenditures per household in the year of the study. We used 41 selected variables that characterised households according to demographic, social, and institutional variables. These variables were included in the model for all cases, and compared to find out which variables were most consistent with the model (Menard 2001, Nakakaawa et al. 2011). All statistical analyses were performed in SPSS version 16.0.

5.3 Changes in the Bolivian forestry law

The first serious attempt to regulate the forestry sector in Bolivia took place in 1954. Two decades later, the Ministry of Peasantry and Agricultural Issues (currently called Ministry of Rural Development and Agriculture) created the Forest Development Centre (*Centro de Desarrollo Forestal*, CDF). However budget constraints, understaffing, and corruption were notorious, preventing the CDF from exerting efficient control over forest exploitation and conservation (Fredericksen 2000). In 1974, the first Forest Law was issued, with regulations following in 1977. This resulted in the allocation of logging areas in Bolivia's tropical region and the government started charging taxes on extracted timber volumes. However this type of logging contracts did not encourage enterprises to invest in forest management plans, which were considered to reduce economic benefits. Moreover, the CDF did not have the needed institutional capacity to enforce these contracts (Pacheco and Avila 2001). Also, between 1960 and 1980, indigenous groups from the highlands of Bolivia started colonising forested lowland areas and selling timber illegally. For them, the law provided no legal mechanisms to benefit from timber and thus illegal logging was widespread among both rural people and timber companies (Fredericksen 2000, Figure II 5.1).

During Bolivia's 1980–1985 economic crisis, the advantageous foreign exchange rate encouraged timber export. Increased logging activities did not, however, motivate the CDF to apply legal regulations; instead, its institutional weakness deepened (Pacheco 2007). As a result, since 1986 the CDF entered a serious institutional crisis and was unable to collect taxes and control Bolivia's forests. In 1990 a total logging ban was imposed in order to reorganise the forest sector.

In the mid-90s, as part of Bolivia's Sovereignty Plan (*Plan Soberanía*), a plan to ensure national territorial integrity, 17 timber companies were issued forest concessions in the northern part of the country (Pando department), along the border with Brazil and Peru. These concessions were renewed under the new forest regime of 1996, with 15 families holding concessions totalling 1 568 000 ha (Pacheco 2007).

In 1996, the new Forest Law (*Ley Forestal 1700*) was approved with three innovative elements: area taxes instead of taxes per logged volume, a new concession regime, and new forest management regulations (Fredericksen 2000). In addition, the Forest Law promoted a new institutional framework for forest use, which included the creation of the new forest division (*Superintendencia Forestal*, SF), the involvement of the prefectures in the definition of policies, and the creation of the Municipal Forestry



Figure II 5.1 Illegal chainsaw processed timber waiting for the right moment to be transported.
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Units (*Unidades Forestales Municipales*, UFM), in order to identify and supervise municipal forestry areas to which local communal groups (*Agrupaciones Sociales del Lugar*, ASLs) would be granted forest-use rights (Ferroukhi 2003). In 1998, the acceptance of the affidavit for the declaration of timber volumes to be logged led to a poor implementation of the new forest regime; several years later, this resulted in depredations of two timber species (*Amburana cearensis* and *Cedrelinga* spp) in addition to mahogany. Selective logging of only the most commercial species used to be the pattern of logging in Bolivia, currently the number of species harvested has increased to about 20.

The new forest regime gave rise to forest management plans (FMPs) in order to stimulate the introduction of sustainable forest management (SFM) regardless of the scale of operation. FMPs are not required for non-commercial forest uses but are essential for all types of commercial activities. Both forest concessionaires, including ASLs, as well as private landholders are compelled to elaborate such plans – including forest inventories – as an instrument to regulate commercial logging activities. FMPs have to comply with many technical requirements, mainly a minimum cycle of 20 years between logging operations on the same area, a minimum

cut diameter, restrictions on cutting less abundant species (less than 0.25 trees/ha), and the mandate to leave 20% of the species harvested in the stand to guarantee a security margin for species preservation (Pacheco 2005).

In order to increase forest access for rural people (communities and indigenous people) the SF designs specific instruments, e.g. for instance the clear-cutting operations. This instrument requires formal authorisations based on annual cutting plans, which, in turn, must be formulated based on land-use plans at the parcel level. Clear-cutting fees are equivalent to 15 times the forest tax (USD 15/ha) plus of 15% of the logged timber's value. However, clear-cutting operations up to 5 ha, accumulated over time, are exempted from fee payment. This means that once any single landholder exceeds deforestation of 5 ha on that plot, the landholder is required to pay clear-cutting fees (Pacheco 2005).

According to some scholars, forest regime implementation has confronted various obstacles. To cope with those obstacles, the SF has approved additional measures called “exception regimes.” Three main exception norms have been issued by the SF: 1) allowing forest logging on private properties equal or less than 200 ha (Resolución Ministerial N°132/97), by which landowners can log timber exempt from the

management plans; 2) allowing small-scale farmers holding less than 50 ha to log in areas less than 3 ha without presenting land-use plans at the parcel level; and 3) approving small-scale timber producers to initiate their forest operations with only an annual logging plan and within areas not formalised yet as municipal forest reserves due to the bureaucratic steps required to set them up (Pacheco 2004).

According to the second exception, permits for logging in areas less than 3 ha (ITE No. 087/2000, March 2000) were approved as a way to enable small landholders to extract timber from their plots based on an inventory of the commercial species to be exploited, without having to develop a forest management plan. The only constraint was that these permits would be issued for one time only for each rural landholding. The third exception measure that allowed ASLs to undertake their forest operations without an approved FMP, as well as within areas not formally constituted as municipal forest reserves (ITE No. 09/98, June 1998), was aimed at correcting problems arising from the slow and bureaucratic process of creation of such reserves (Pacheco 2005).

Since 2003, the administration of Bolivian forests has become a victim of limitations in staff appointments, reduction of the operating budget, and, accordingly, a reduced capacity to monitor and regulate forests. As a direct consequence, forest clearance has since increased to 100 000 ha per year. In 2008, after several years of intense struggles and debate among members of the new government, rural populations, and private timber companies, a national decree introduced community forest organisation (OFC in Spanish) to achieve social and political objectives related to the equity of access and benefits distribution from forests. This decree legalised all forest activities related to timber extraction undertaken by peasant and indigenous communities, promoted the reallocation of lands among rural people (Cano et al. 2011), and consolidated rural communities' rights over forests, providing alternative ways to achieve individual timber extraction authorisations for communities.

In 2009, the SF changed its institutional denomination to Regulatory Authority and Social Control of Forests and Lands (*Autoridad de Fiscalización y Control Social de Bosques y Tierras*, ABT). The ABT inherited the institutional and political tradition of the SF and also began to change regulations through directives, without having legal roots in the existing Forest Law 1700. In this way, rural communities started to be favoured by new government strategies that broaden forest governance to the detriment of timber and agro-industrial companies.

Finally, in 2012, under the slogan "Governance in the forests," a legal directive (*Directiva ABT N° 002/2012 – Norma de acceso a los recursos forestales y articulación con productores pequeños*) was cre-

ated to rule the access to forest resources directed to small timber and processing facilities. The goal is to promote and secure a responsible and planned use of natural resources and to boost industrialisation through the development and strengthening of a productive base at different levels, as well as conserving the environment.

It is evident that changes in forest legislation in Bolivia have been a result of changing political ideas of different governments. This has led to constant institutional and normative improvisations in forestry since the administration of Evo Morales came to rule. Consequently, the latest stage facilitates the exercise of rights by small users (communities and indigenous people) according to their specific social and economic context, following a long period of social inequity and exclusion of the rural poor from the right to use forests.

5.4 Flexibility in forest regulations

When Bolivian Forest Law 1700 entered into force in 1996, the only way to extract and sell forest products for commercialisation was through specified forest management instruments, such as concessions. However, only private companies had the capital, knowledge, and institutional links to achieve a 20-year-cycle forest concession (see section 5.3 in this chapter).

Thus, the law continued to benefit private companies, because rural communities have no capital to invest in drawing up FMPs to comply with formal regulations for use of timber, although in other parts of Bolivia large management plans have been developed with the assistance of NGOs. To deal with this barrier communities started to negotiate selling of tree stands with private companies, but the prices were low since the company assumes the cost of the FMP, which is charged on the total cost of the tradable timber.

When land titling finished in Pando department and most of the field measurement and verification in the rest of the northern part of Bolivia was more or less clear and defined, a process of social change began under the Morales government, affecting the former set of rights related to natural-resource access and use rights in general – and the forest in particular. This change resulted in a new state constitution and the extension of rights related to forest in favour of rural people, who now have exclusive rights to use forest resources.

The initiatives were thought to benefit the rural poor under the principle of "forests are of strategic value for the development of rural people and the state has to ensure equitable access to all local

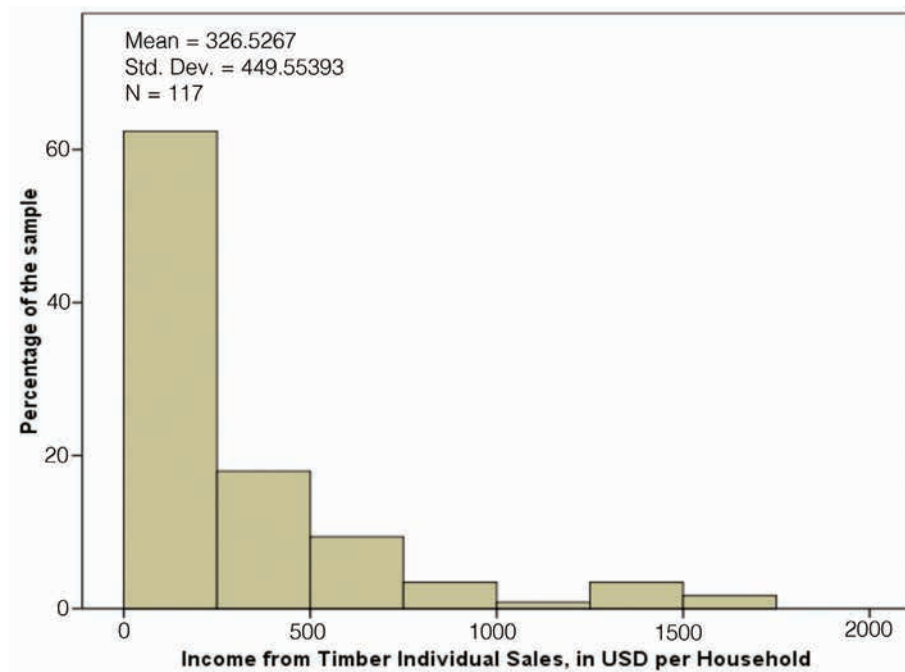


Figure II 5.2 Income from timber sales based on individual authorisation, in USD per household per year.

people and forest actors” (Bolivian Constitution, 2008). Thus, the ABT had to change the regulation policies and create new rules to favour communities and somehow recognise local arrangements for timber use.

The logging of a few trees a year per family within communities is an old arrangement within the study area (Cano et al. 2011, Zenteno et al. 2013) that can be traced back to the local informal market through middlemen, who have all the contacts to sell timber. This was the community strategy for timber use and for a long time it was considered by the forest authority as an illegal procedure subject to punishment. Today, a formal directive enacted by the forest authority (*Directiva ABT N° 002/2012*) recognises this communal arrangement, making room for an individual pattern of forest use within communities.

Currently, the arrangements between ABT and rural people in the northern Bolivian Amazon are based on authorisations to extract 4.71 m³ of timber once a year (*Directiva ABT N° 002/2012*), an arrangement still rejected by chainsaw operators who want to raise the volume to 7.07 m³ (ABT chief of Pando, personal communication), although in practice people develop informal ways to extract timber at least once a month during 7 months a year (from field interviews).

5.5 Results

5.5.1 Distribution and amount of Individual timber sales

From a sample of 239 interviews from Zenteno et al. (2013), we found that 49% of households (117) have sold timber based on individual authorisation during 2008–2009. An average of USD 326 per year resulted from the sales of three to five trees. It is worth noting that less than 5% of the sample obtained more than USD 1500 per year (Figure II 5.2).

To understand the incentives to manage forests through the sample, we first formulated the question of whether differences in forests management exist due to the specific variables related to community type. To analyse the data, the type-of-community variable has been used to determine its relation to the other site-specific variables for the sample. This variable is significantly associated with the other variables (Table II 5.2).

This association among site-specific variables separates the sample into two groups according to community type. From 239 households, 127 (54%) households are in extractive communities, while the rest are in agro-extractive communities.

We analysed differences in timber sales between extractive and non-extractive communities (Table II 5.3). No significant differences among total incomes from timber sales were found. However, we did find that prices per tree are higher for extractive communities. The number of households selling trees as well

Table II 5.2 Spearman correlation for the type-of-community variable and site-specific variables.

	Spearman correlation	Description
Ethnicity	–0.495	Community Type
Access	–0.380	0 = Extractive: communities more likely indigenous ethnic groups, with difficult access, and high amount of conserved forests
Degree of degradation of forests	0.919	1 = Agro-extractive: communities more likely non-indigenous ethnic groups, with easy access to main towns, and less conserved forests

Note: All Spearman correlations are significant at $p > 0.001$.

Table II 5.3 Number of trees and prices for extractive and agro-extractive communities.

	Community Type	
	Extractive N = 112 Mean	Agro-Extractive N = 127 Mean
Price in USD, per tree	133.83*	90.48
Income obtained in USD per year	321.59	329.72
Number of trees per year	1*	3*
Percentage of people selling trees	36**	63**

Significant differences for Mann-Whitney U, * $P < 0.05$ and ** $P < 0.01$.

Table II 5.4 Logistic regressions for two community types.

		B	S.E.	Wald	Sig.	Exp (B)
For extractive communities	Fallow period	–0.201	0.076	6.965	0.008	0.818
	200-ha forest plan	1.329	0.657	4.093	0.043	3.778
	Constant	–0.007	0.305	0.000	0.983	0.993
For agro-extractive communities	FMP	–1.192	0.498	5.716	0.017	0.304
	Knows 50% of community members	1.280	0.427	8.971	0.003	3.596
	Constant	0.068	0.332	0.042	0.837	1.071

Note: All variables regressed at 1 degree of freedom.

as the number of sold trees is significantly higher for agro-extractive communities. This could be due to lower quality of sold woods, the traded volumes – which triple in agro-extractives communities – and easier accessibility. Extractive communities are generally located far from urban centres and they do not have operable roads year-round.

The existence of such site-specific variables can be an important source of divergence for a general model for understanding the probability of tree

logging (Hobley and Shields 2000). Therefore, we relied on communities represented in the two subsamples.

We performed a logistic regression considering the number of trees individually sold per year (Table II 5.4). Results from the logistic regression for each subsample suggest that site-specific variables are important for understanding individual wood sales. For instance, Table II 5.4 shows the variables that best explain the logistic regression models. In extrac-

Table II 5.5 Chi square test of proportions for explanatory variables in the sample.

Variable	Value	Community type		Extractive		Agro-extractive	
		Extractive	Agro-extractive	Extractive		Agro-extractive	
		Relative proportions %		A	B	A	B
Fallow period in years	mean	3.49	5.8	4.2	2.84 [#]	5.8	
< 200 ha forest management plan, or an accepted logging permit	A	90*	62	60*	30		
	B	10	34	4	6*		
> 200 ha FMP	A	68	79			25	54*
	B	32	21			13*	9
If community member knows more than 50 % of community members	A	60	38			21*	17
	B	40	62			16	46*

Significant differences for Mann-Whitney U, # P < 0.05 and X² test significant at * P < 0.05 A = no logging, B = logging.

tive communities, the likelihood of timber sales is explained by 200 FMPs and the fallow period. While in agro-extractive communities, the wood sales are explained by the existence of FMPs and knowledge among community members.

There are several explanations for the above results. Road access to communities may indicate greater importance of agricultural resources and more diversified livelihoods, creating different social, human, or economic circumstances (Zenteno et al. 2013).

To validate subsample-model selected variables, we performed a forward stepwise selection. For both models, the steps in defining the models resulted in a second iteration out of 41 variables considered. Different variables explained the existence of individual tree sales according to each community type.

Results also indicate that for both models, household- and institutional-related variables may explain, in quite opposite directions, the probability of individual timber sales. While in agro-extractive communities the existence of a group (or communal) FMP can reduce the probability of cutting trees individually, in extractive communities agricultural practices (maize, manioc, beans, bananas, rice cultivated through the slash-and-burn system) turn out to be relevant for reducing this probability (fallow periods refer to the number of years needed for the recuperation of soil fertility before using again for agriculture). Accordingly, social relations among community members are also important in agreements to approve logging.

We looked at the distribution and values of explanatory variables for the two subsamples of community types (Table II 5.5). Results indicate that extractive communities have shorter fallow periods than agro-extractive communities. Those who logged trees in extractive communities have significant shorter fallow period than those that did not log.

The proportion of community members holding 200 ha under a FMP is significantly higher in extractive than in agro-extractive communities. And it is positively correlated to logging. While in agro-extractive communities, the existence of the FMP is negatively correlated to the probability of community members to cut trees individually.

While both community types the existence of an FMP was not statistically significantly different in proportions, in agro-extractive communities, existence of these legal permits on logging, favoured less individual tree extraction. Additionally, even the proportion of community members who knew more than 50% of community peers was not significantly different among both community types; the probability of individual sells was positively correlated to well-known persons in the agro-extractive communities.

This result should be interpreted carefully. The qualitative information suggests that individual logging takes place when a community member is excluded from any communal form of authorised exploitation, while any individual authorisation promotes logging even in communities that are assumed to be out of commercial range.

5.5.2 Why institutional factors are important to reducing logging

Social community relations are relevant on members' behaviour towards using resources in an individualistic manner (Henkemans 2000, Assies 2002, Cano 2011). However, when community members have more local connections, it is expected that they may have more chances to make timber sales and also are more likely to be linked to local political spaces, such as being a community leader or a community board member, which permits networking to commercial bounds. This, in turn, gives people more opportunity to obtain social approval from the community members, when they selling timber becomes a rewarding outcomes to community or powerful groups (Poteete and Ostrom 2004). These results reinforce suggestions from Stoian (2000, 2005) on different land uses among community types in the suited context, from which it is expected that cultural practices such traditional agriculture based on longer fallow periods, as for bigger cultivated areas, is dependent to social structures as well as local livelihood strategies (Coomes et al. 2000, Perz and Almeyda 2010).

While commercialisation of timber together is a common strategy among communities, our results suggest that 49% of the population (both in agro-extractive and extractive scenarios) sell trees individually.

Local geographic conditions are important, and they may also interact strongly with social relations and with formal and informal institutional arrangements, which play a mediating role on individual actions (Cano 2013). Within this interplay, households have various strategies (Zenteno et al. 2013). While some groups will rely heavily on timber sales, others will not. From our panel data, we see that when formal regulations change, some local groups may respond quickly to the gaps in those formal mechanisms in order to impose local individual actions against collective action related to the sale of timber. Our results also indicate that extractive communities may pursue formal individual-use mechanisms to sell trees when small-scale FMPs are recognised.

However, in agro-extractive communities, the existence of FMPs seems to reduce individual tree logging. We found that local traditional agricultural practices can influence the probability of entering into commercial timber activities in remote communities. Therefore, the formal institutional arrangements clearly affect and are associated with local needs of forest management and agricultural activities.

In this case policies that promote more flexibility in formal procurement in forested lands will need to be analysed, taking into consideration critical variations in regional and local market pressure.

One aspect to mention for extractive communities is that local livelihoods may be ensured by traditional agricultural practices, which are related to long fallow periods, while in agro-extractive communities, forest management rules depend on local social and commercial networks, which to differing extents, are the new sources of livelihoods.

5.5.3 Formal mechanisms that motivate intensification of logging

Before more flexibility in forest rules was introduced, the common way to sell trees individually was through informal or illegal channels. A few years ago, the only way to justify cutting trees within communities was for domestic use. However, there was always a trader with the right connections to buy trees from communities at a very low price and sell the timber in urban centres. The regulation allowing people to sell the trees that are being cut and burned to prepare agricultural field under the shifting cultivation opened up new opportunities for the commercialisation of timber. To sell trees from an agricultural field, people need clearing plans for a maximum of 5 ha.

An average family does not clear more than 1.5 to 2 ha for agricultural production (Cano et al. 2011, Zenteno et al. 2013), but clearing plans are generally larger (until 2012, the ABT approved up to 5 ha of forest plots for clearing plans within communities) to facilitate more benefit from timber sales under the clearing plans, especially in agro-extractive communities close to urban centres (Table II 5.6). Communities initiated a campaign of logging at different levels in order to benefit from timber sales. Now the ABT has expanded the rights of community members, allowing the transportation of timber for domestic use to urban centre when community members can show they also have houses in town where the timber can be used.

ABT data shows the number of individual authorisations for the transportation of timber from the community to urban centres (Figure II 5.3). All the communities with records in the ABT database experienced an increment in the volume of timber used between 2010 and 2011 due to this new regulation, in some cases more than seven times the volume registered the year before.

In other cases within the same community, there are individual authorisations and <200 ha FMPs, which raised the pressure to use timber through any of the different formal alternatives described above.

Table II 5.6 Number of clearing plans issued in Bolivia until 2012.

Department	Clearing plans for more than 5 ha	Clearing plans for less than 5 ha	Clearing plans for non-agricultural purposes	Total
Beni	2397	13 391	44	15 832
Cochabamba	13 628	3126	681	17 435
La Paz	2108	17 073	307	19 488
Pando	1479	2520	761	4760
Santa Cruz	352 536	34 711	6586	394 833

Source: ABT webpage (http://abt.gob.bo/index.php?option=com_content&view=article&id=357:superficie-de-pdm-autorizados&catid=28&Itemid=204) consulted in November 2013.

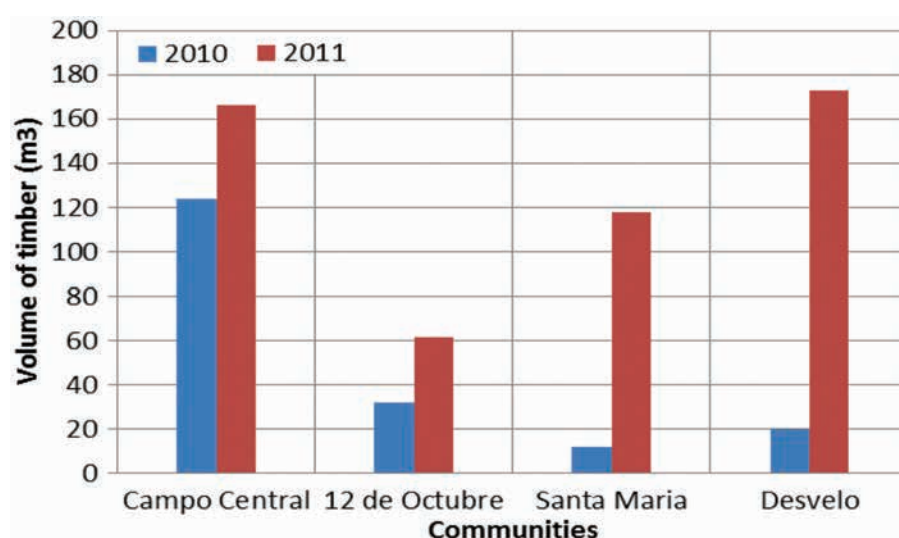


Figure II 5.3 Individual authorisations for the transportation of timber to urban areas issued to community members between 2010 and 2011.

5.6 Discussion

5.6.1 Role of communities in developing local strategies for use of timber resources and for forest management

Based on our data, a number of factors have influenced forest use within the study area. First, forest use depends on the type of community (extractive or agro-extractive). In communities where the use of timber has become an important activity, it is clear that several factors may alter the former local, traditional forest-management patterns, confirming the arguments supported by Ramcilovic-Suominen and Hansen (2012). However, the lack of compliance with the law is not necessarily linked to illegal activi-

ties, corruption, or unequal benefit-sharing (Contreras-Hermosilla 2002, World Bank 2004, Contreras-Hermosilla and Peter 2005, Ramcilovic-Suominen et al. 2010); rather, it is due to the complications in the law itself that make compliance with the law difficult for communities (Perry et al. 2007).

Proximity of communities to the market (urban centres) is likely to determine forest use by individuals and communities as collective entities. Most of the agro-extractive communities are located around urban centres and their forests are more degraded. Any increased flexibility in forest rules could have more impact in these communities. It is easy to take advantage of the nearby market, and any sort of legal individual authorisation for sale of timber can easily be applied.

Where strong connections to the market exist, local institutions and communal arrangements that are

expected to regulate forest use in the communities do not seem sufficiently robust to limit the sale of trees by individuals. Community members see the more-permanent opportunity to earn money selling trees either individually or collectively through a <200 ha FMP. Since benefits can be derived from timber sales relatively easily, community members seize the opportunity to improve their economic situations. This allows them to change their traditional rural lifestyle based on subsistence agriculture and Brazil nut collection to a more urban-based lifestyle, that is replacing agriculture and other NTFP collection with the sale of timber.

The forest areas of extractive communities, which are located farther away from urban centres, contain more valuable timber resources than the forests of agro-extractive communities. Apparently, these communities exert less pressure on these resources for economic purposes than agro-extractive communities. The dependence of members of agro-extractives communities on monetary benefits means that to keep income levels equal, they will have to sell more trees since the most valuable ones have already been extracted.

Thus, the use of individual timber sales may be determined by the level of commodification of the traditional rural lifestyle that used to be sustained by the sale of Brazil nuts only, a result not mentioned or discussed by any scholars. Where local economies depend to a higher degree on monetary income from the sale of forest products, the threat of forests degradation is greater.

In these circumstances, more flexible forest rules may create a space to develop new initiatives to widen the opportunities and ways to sell timber, thereby promoting forest degradation (forest clearing, agriculture as a justification for clearing and selling timber, or land-use change) instead of acting as a control mechanism and regulatory instrument to limit timber exploitation within communities.

5.6.2 Actors of forest degradation or of sustainable forest management?

Within the study area the process of making forest regulations more flexible seems to have contributed to the commodification of rural lifestyles and changed the traditional sources of livelihoods and incomes. In some cases (mostly among agro-extractive communities), the attribution of formal forest-user rights has contributed to the development of collective action and creation of efficient local institutions to regulate the use of timber. In other cases, the possibility to sell trees individually has motivated people to obtain private benefits rather than collective benefits.

However, efficient local institutions can regulate the use of timber through collective FMPs, and the sale of timber through individual authorisations, considering both collective and individual interests. Where livelihoods and incomes become more dependent on timber for monetary income year-round, management practices should adapt to more-intensive resource extraction.

In all communities, the motivation to engage in commercialisation of trees is to increase monetary income. Rural people's livelihoods used to depend on strenuous agricultural activities and the collection of NTFPs such as Brazil nuts and on wage labour in the bigger towns (agro-extractive communities mainly). Timber sales constitute a welcome and relatively easy source of income now that market demand is growing and logging is legally allowed. This process seems to have induced a real change in lifestyle, especially in agro-extractive communities located closer to urban areas. This change began with the importance of income from Brazil nut collection and has been given additional impulse by the sale of timber. Although some scholars argue that the above process has been going on for a very long time (Stoian 2005), the combined opportunity to sell timber and Brazil nuts has been gradually eliminating agriculture and collection of wild NTFPs as traditional livelihood alternatives.

In this case, it is important to continue to study the influence of the markets and the demand for forest resources on the evolution of rural community lifestyles, a weak link in the chain of factors studied worldwide.

5.7 Conclusions

Scholars from around the world almost unanimously call for the establishment of secure tenure and forest user rights in favour of those parties who have been traditionally excluded from formal access and user rights to forest resources (Agrawal 2007, Cronkleton et al. 2009, Alden Wily 2011).

Formalisation of tenure and access rights is thought to enable local people to develop strategies to create robust local institutions able to ensure the sustainable use of resources. When people are uncertain about future benefits, they are unlikely to invest in management systems that may initially reduce economic benefits. Customary rights are often found to be too weak to contest overlapping rights with more powerful actors, especially when market pressure increases.

Our study, however, shows that user rights granted to communities in Bolivia have not yet led to the development of robust local institutions that ensure sustainable use of the forests. One could suggest that

when the process of granting forest-use rights to previously excluded parties, such as the rural communities, stems from a process of making forest regulations more flexible to correct the law's deficiencies relative to forest actors, the result is too haphazard to promote development of robust sustainable forest management institutions.

In this kind of social context, the informal mechanisms developed to access and benefit from selling trees eventually become legitimised, as is occurring in Bolivia, obscuring the ability to distinguish what is legally prohibited and what is traditionally permitted.

Thus, communities can operate either as efficient actors and promoters of sustainable forest use or as true forest predators, innovating different strategies to use timber legally or illegally. In this sense, the devolution or granting of rights to peasant and indigenous communities to allow the use of timber resources must pass through a process of social, economic, and environmental impact assessment in order to prevent undesired outcomes. There is little evidence on the impact of proximity of markets on the evolution of social lifestyles related to use of forest resources, either timber or non-timber resources.

In addition, making forest regulations more flexible should be accompanied by clear incentives for sustainable management. Moreover, haphazard solutions may lead to what communities view as unstable institutions that can be changed anytime, prejudicing development of durable institutions. However, the time span of the present study is too short to ascertain whether secure institutions could develop, and become institutionalised in the law over long term. If the dependency on timber sales is durable and not opportunistic, people could start to engage in better management practices when it becomes difficult to keep incomes at a desired level and they may also search for alternatives which will not always be legal or sustainable, as is the case of most of the tropics.

An important lesson of the present study is the need for research and participatory planning to put new regulations in place that allow the use of forest resources to actors accustomed to use valuable forest resources, such as timber, through informal channels. Without the correct understanding of actors and markets linkages, institutional improvisations linked to the need to control the use of forest resources is not a good governmental strategy for devolving rights to forest use and recognising traditional ways to manage forests. If a national or regional forest policy is to be effective, it should have the commitment and support of the whole society as a result of joint deliberation, assessment, and coordination based on the local forest users' local realities.

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