Information Access, Market Trade and Rural Livelihoods in the Peruvian Amazon: An Analysis of Communication Networks and Price Uncertainty in Riverine Communities

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ABSTRACT

Information is an important part of livelihood decision making for rural peasants throughout the developing world. In recent times, the role of market information has become a topic of particular interest in development circles, given the global rise and increasing accessibility of information, brought about by technological innovations, notably the internet and mobile phones. In this study we examine the traditional social structures that facilitate access to market price information among *ribereño* producers in four villages along the Tahuayo River in the northeastern Peruvian Amazon. Further, we assess the factors that contribute to market price information uncertainty and the implications for household livelihood strategies. Methods include summary statistics, network analysis using NetDraw, and Probit and OLS regression models. Data were collected between June and August, 2011 and included informal interviews with the three Tahuayo River boat operators, participant observation, daily notation of market prices for four products of high regional importance: yuca, plantain, aguaje and charcoal, and semi-structured household interviews (n=70) with heads of households in the four study villages. Additionally, we use household survey data collected between June and November, 2010 from the same sampled households (n=70), and historic market price data from 1994, 1995 and 1998. Our results show that produce prices in Belén are highly variable as a result of unstable and, sometimes unpredictable market supply, which contributes to information uncertainty among *ribereño* producers. Information about market prices is primarily communicated by word of mouth from other members of the village; knowledge of market prices is variable and dependant on who has been to the market that week. Finally, telephone ownership did not appear to improve household knowledge of market price information, probably due to other issues such as lack of access to electricity supply, low affordability of telecommunication, and lack of an informant to call in the markets of Iquitos.

RESUME

La connaissance des prix du marché est un élément important du processus décisionnel au sujet des moyens de subsistance pour les paysans en milieu rural à travers les pays en voie de développement. Ces derniers temps, son rôle est devenu omniprésent ces milieux, compte tenu du développement mondiale et l'accroissement de l'accessibilité de l'information, provoquée par les innovations technologiques, notamment internet et les téléphones mobiles. Dans cette étude, nous examinons les structures sociales traditionnelles qui facilitent l'accès aux prix du marché entre les producteurs *ribereño* dans quatre villages longeant la rivière Tahuayo dans le nord-est de l'Amazonie péruvienne. De plus, nous évaluons les facteurs qui contribuent à l'incertitude de l'information sur le marché des prix et les implications sur les stratégies de subsistance des ménages. La méthodologie comprend des statistiques sommaires, des analyses de réseau en utilisant NetDraw et Probit et des modèles de régression OLS. Les données ont été recueillies au cours de Juin et Août 2011 et comprenaient des entretiens informels avec les trois exploitants de bateaux de transport par la rivière Tahuayo, des observations des participants, des relevés quotidiens des prix du marché pour quatre produits de haute importance régionale (le yuca, la banane plantain, le aguaje et le charbon de bois) et des entrevues semi-structurées auprès des chefs de ménages (n = 70) dans les quatre villages études. Nous utilisons aussi des données sur les ménages recueillies entre Juin et Novembre 2010 auprès des mêmes ménages échantillonnés (n = 70), et des données historiques des prix du marché entre 1994 et 1996. Nos résultats démontrent que les prix des produits du marché de Belén sont très variables en raison de l'approvisionnement instable du marché, voire parfois imprévisible, ce qui contribue à l'incertitude de l'information au sein des producteurs *ribereño*. L'information sur les prix du marché est principalement transmise de bouche à oreille par les autres membres du village. La connaissance des prix du marché est variable et dépend de la personne qui a été au marché pour cette semaine. Enfin, posséder un téléphone n'a pas amélioré la connaissance des ménages des prix du marché, probablement en raison d'autres problèmes sous-jacents liés à l'utilisation d'un téléphone comme le manque d'infrastructures électriques, l'accessibilité des télécommunications et de l'absence d'un informateur à appeler à Belén.

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CHAPTER 1. INTRODUCTION

Since colonial times, the Peruvian Amazon region has remained relatively poor and underdeveloped despite natural resource abundance and historic periods of significant economic boom (Barham & Coomes, 1994; Coomes, 1995). In this region physical infrastructure, such as roads to facilitate faster and greater mobility between regional centers, is lacking and modern communications technologies, such as radio, telephone and internet, reach very few (INEI, 2007a). The geography of the Peruvian Amazon further limits communication across the region as it is characterized by a relatively low rural to urban population ratio and a rural population dispersed over a large territory. As a result, information generally travels in an informal way and the means by which rural peasant households, known locally as *ribereños*, access the necessary information to inform their livelihood choices depends on the various networks of social relations in which they are embedded.

Ribereños in the Peruvian Amazon rely on the sale of agricultural and forest products in nearby urban markets for income generation, yet the revenues they earn from the sale of primary goods are modest compared to the mark-up prices they pay for manufactured household items (terms of trade). The regional lack of infrastructure entails a high level of uncertainty when bringing products to market as the poorer the infrastructure, the less competitive the marketing systems, the less information is available, and the more risky the transactions, the more unfavourable the terms of trade (de Janvry, Fafchamps, & Sadoulet, 1991, p. 1402).

In this study we seek to contribute to our understanding of the role information access plays in rural livelihood strategies among *ribereño* communities in the northeastern Peruvian Amazon, and empirically to examine the potential implications of unequal access to information (among households and between households and other agents involved in the sale of agricultural and forest products) on household welfare. Access to information about current market prices, new seeds and planting materials, new technologies, and labour market opportunities plays a key role in *ribereño* livelihood decisions and can directly influence household economic welfare. However, despite this recognition, little empirical attention has been given to better understanding the structures that facilitate information sharing, particularly as an avenue for rural development opportunities. In our study we specifically focus on household access to market price information given the importance of market sales to total household income.

Purpose and Objectives

The purpose of this study is to examine the structural and social factors that contribute to market price information uncertainty among *ribereño* producers in the Peruvian Amazon and examine their implications on household livelihood strategies. A better understanding of traditional information communication systems in *ribereño* communities is vital to improving information efficiency and can help better direct formal interventions to operate where they will have the most impact.

The specific objectives are twofold.

1. To examine the commercialization of agricultural and forest products in the Region of Loreto, Peru by *ribereño* households, particularly those within a day's travel to Iquitos, in an effort to better understand the factors that contribute to price variability and, in turn, affect household marketing decisions.
2. To identify the social structures that facilitate household access to market price information and examine whether differing socioeconomic and village characteristics contribute to household success at estimating prices received by producers (FOB) in the largest urban market of the Peruvian Amazon: Belén, in Iquitos.

1.2 Literature Review

1.2.1 Peasant Livelihoods

The term "peasant" has been used throughout the developing world to describe poor, rural populations whose livelihoods are predominantly agrarian-based with family labour representing the main productive input, and whose economic activities involve a combination of subsistence and market-oriented output. Key features of peasant economies are their limited economic power and the imperfect markets in which they operate for such things as credit, insurance, labour, and land (de Janvry, et al., 1991; Ellis, 1993). Additionally, as described by Ellis (1993), peasants operate within informal commercial markets and possess imperfect access to market information, which makes them highly vulnerable to price fluctuations.

Peasant livelihoods are complex and vary depending on the social, environmental, and political structures in which they are embedded. Initiatives aimed at promoting rural development and enhancing livelihoods for the rural poor must first address these challenges. Within this context Chambers and Conway (1992) conceptualized the sustainable livelihoods

framework in which they recognized the notions of "capability", "equity", and "sustainability" as key components of rural livelihood systems. The sustainable livelihoods framework was further developed by Reardon and Vosti (1995) to incorporate the links between rural poverty and the environment, and by Scoones (1998), Bebbington (1999), and Ellis (2000) to include the various processes and actors that facilitate access to capital assets and, in part, influence household economic decisions. This framework has become one of the standard approaches for researchers studying peasant economies throughout the developing world.

The sustainable livelihoods framework asserts that households draw from a series of capital assets (household asset portfolio) to build their livelihood strategies. These assets include natural, physical, human, social, and financial capital (Bebbington, 1999; Ellis, 2000; Scoones, 1998). Natural capital refers to the naturally available environmental resources that people use to generate a living including land, water and biological resources (Ellis 2000; Scoones 1998); physical capital refers to the physical assets used to generate income, often in the form of technology, but they also include infrastructural assets such as roads, power lines, and water supplies (Ellis 2000); human capital refers to household labour mediated by skills, education and health that contribute to determining what type of activities individuals are able to engage in (Ellis 2000; Scoones 1998); and finally social capital refers to the various social relations in which actors engage with one another, the state and civil society to facilitate the exchange of knowledge and influence access to other forms of capital (Bebbington, 1999; Ellis, 2000; Putnam, 1993). From this perspective, if a household wants to increase their stock of any one capital asset they must either increase returns from their current capital asset portfolio or expand this portfolio by diversifying into new activities. Often the latter strategy will see households engaging in non-farm or off-farm based activities (Barrett, Reardon, & Webb, 2001; Ellis, 2000).

Livelihood strategies have implications for both poverty and the environment (Reardon & Vosti, 1995). Poverty results from a household's inability to increase their surplus above a minimum dietary line (Reardon & Vosti, 1995) based on the assets they have, and lack of available means to increase these assets (Barrett, et al., 2001). As a result, rural peasants are generally assumed to be risk adverse and construct their livelihood strategies with the goal of generating maximum returns while minimizing risks to unexpected shocks (Dercon, 2002). However, households are also limited in their ability to best allocate resources and gain maximum return, by the information available to them. Information in peasant societies often

travels slowly, is not readily available, and is not replicated across time and space (i.e., imperfect information) (Ellis, 1993, p. 11). In the absence of perfect information, most rural peasants must rely on their social networks to find the information they need (Fafchamps, 2006).

1.2.2 Social capital and social networks

At the heart of social networks is social capital. Social capital provides benefits to individuals through social relations from collective action and through participation in various social clubs, organizations and institutions (Putnam, 1993). Central to the concept is the idea that social capital is productive and generates benefits to the individual by mitigating access to other forms of capital (Scoones, 1998; Ellis, 2000). Social capital plays an important role in enhancing the benefits of investment in both physical and human capital (Putnam, 1993) and becomes vital in determining access to resources through the exchange of knowledge or skills or by facilitating access to financial capital (Bebbington, 1999). The notion of social capital is particularly relevant in rural livelihood studies given the informality of peasant economies and the imperfect markets in which they operate. Social capital, mitigated through various networks of social relations, is founded on the basis of trust and reciprocal action which can contribute to reduced socioeconomic vulnerability and increased opportunity (Hanson, 2004). Indeed, in the absence of formal markets for credit and insurance, research has shown that peasants rely on their respective social networks such as kin, religious, family, neighbourhood, or occupation as a safety net in hard times (Beall, 1995; Hanson, 2004; Kadigi, Mdoe, & Ashimogo, 2007; McSweeney, 2004).

Recently researchers have begun to take a more structural approach to understanding how individuals derive benefits from social capital by examining the relationships among individuals from a social network analysis perspective, recognizing it as a useful tool for its ability to observe and relate a wide range of social phenomena (Borgatti, Mehra, Brass, & Labianca, 2009). Similar to social capital, social network analysis is grounded on the notion that the social ties have important consequences for them (Freeman, 2004; Wasserman & Faust, 1994). Taking a social network approach, Cinner and Bodin (2010) used a sample of 27 coastal communities in Kenya, Tanzania, Madagascar, Seychelles, and Mauritius to understand how different economic sectors were connected in the context of household economies, and to understand how changes take place in rural livelihoods according to socioeconomic development processes and increasing population density. Some studies have demonstrated the usefulness of social networks to

understand how information is shared in traditional societies. For example, Crona and Bodin (2006) and Sanchez and Pinkerton (2009) observed community reactions to resource scarcity and resource management practices in fishing communities in Africa and Mexico, respectively, and identified how information about specific resources is shared within and between identified groups (determined by occupation), and how this knowledge transfer might affect their behaviour. Crona and Bodin (2006) found that fishermen tended to have similar ecological knowledge, and that communication occurred primarily within subgroups of fishermen who use the same type of gear, whereas non-fishermen groups demonstrated a lack of ecological knowledge, possibly explained by the weak ties between fishermen and non-fishermen. Among the findings of Sanchez and Pinkerton (2009), they noted that fishermen tended to access different social networks and share information on the abundance and location of fish less under perceptions of resource scarcity. With regards to rural agricultural markets, Clark (2006) used social network analysis to examine how information is transferred throughout the supply chain for select agricultural products in rural Bolivia, and identified central actors in the network that would be crucial to building cohesion in parts of the network that might be lacking access to information.

1.2.3 Information access and rural livelihoods

Information is an inherent part of peasant livelihood strategies and helps inform household economic decisions about how best to allocate scarce resources in order to generate maximum returns. Households seek information on prices in nearby agricultural markets, labour opportunities, new technologies (Chibnik, 1994; Ellis, 1993), production techniques and input use (Isaac, Erickson, Quashie-Sam, & Timmer, 2007), and how and where to acquire planting materials (Coomes, 2010). However, it is widely acknowledged in the literature that households operate within imperfect markets and this can lead to missed opportunities and creates barriers to development. Ellis (1993, p. 11) contends that poor information results in fragmentation of markets, so that exchanges are not replicated across places and time. In other words, although similar exchanges (for example the sale of plantain) may occur at the same time in various locations (i.e., across places), these exchanges are independent from one another (i.e., not replicated), meaning that prices and the terms of trade vary from one place to the next and are dependent on what information is available in any particular location at the time of the

transaction. He explains how imperfect information acts to the disadvantage of rural peasants by favouring people in the social structure who do have information, such as merchants and officials. Nevertheless, he emphasises that it is not so much the provision of information that acts to disadvantage rural peasants but rather ensuring "…the *quality, timeliness*, and *relevance* of the information with respect to *location*, *latest alternatives* etc." (Ellis, 1993, pp. 100-101 emphasis added).

Although imperfect information in peasant economies has been widely acknowledged in the literature the topic had largely been ignored as grounds for empirical research until recently, following the global phenomenon of increased information availability brought about by information communication technological innovations, notably the internet and mobile phones. Starting in the late 1990s, as the availability and ease of access to information increased in wealthier countries, development practitioners became concerned with how this might negatively affect the global poor by widening the information gap and, in turn, the poverty gap. This concern paved the way for a branch of development practice commonly referred to as *Information and Communication Technologies for Development* or ICT4D (Heeks, 2010; IIED, 2009; Unwin, 2009).

ICT4D projects are concerned with providing information technologies to the global poor and building the skills to use these technologies. Initially these projects involved installing rural tele-centers in remote communities (Heeks, 2010; Heeks & Kanashiro, 2009). In the beginning there was great optimism about ICT4D projects to contribute to poverty alleviation and development. However, as Heeks (2010, p. 629) explains, by the mid-2000s many of these projects had failed because they had been modeled after the "Global North and incorporated design assumptions and requirements that significantly mismatched local realities in the average developing country". In the wake of these failures, several authors (Clark, 2006; Heeks, 2010; Heeks & Kanashiro, 2009; IIED, 2009) have argued for a return to community-centered approaches stressing that, for ICT4D projects to succeed at improving opportunities for rural peasants, they must first take into account local contexts such as geographical limitations (e.g., physical accessibility to tele-centers), infrastructural limitations (e.g., access to electricity), education levels, and ease of adaptation to information communication technologies, and account for the social and cultural dynamics that traditionally facilitate information circulation (i.e., how people communicate traditionally). In other words, ICT4D projects should be an extension of

traditional communication systems rather than substitute them. They argue that if these are taken into account, it becomes easier to identify the most vulnerable actors and target projects according to where they will have the greatest impact while operating in a context that is culturally appropriate.

Although national governments in many developing countries, including Peru[1], continue to expand their ICT4D policies (Heeks 2010), researchers now emphasise a more people-centered approach taking into account social relations and traditional communication networks. At the heart of this approach is the concept of social networks. Social networks are particularly interesting in the study of information access given that in traditional societies communication generally travels by word of mouth and therefore "what you know is who you know" (Crona & Bodin, 2006). Researchers have turned to social network analysis as a tool to examine the role of information transfer in economic activities such as how fishermen communicate during periods of resource scarcity (Ramirez-Sanchez & Pinkerton, 2009); how information about agroforestry practices is shared across villages (Isaac, Dawoe, & Sieciechowicz, 2009; Isaac, et al., 2007); communication patterns among resource users (Crona & Bodin, 2006); and to examine the linkages between household access to information and marginalization in agricultural extension programs (Hoang, Castella, & Novosad, 2006). To date no studies have examined information access in agricultural markets from a social network perspective despite acknowledgement in the literature of the importance of price information in rural livelihood decisions.

1.2.4 Peasant marketing: the role of information in trade

Rural peasants throughout the developing world are linked to agricultural markets in nearby urban centers through the sale of primary products. Yet in agricultural markets "information is poor, scarce, maldistributed, inefficiently communicated and intensely valued […] The level of ignorance about everything from product quality and going prices to market possibilities and production costs is very high" (Geertz, 1978, p. 29). Historically, rural peasants living in isolated villages throughout most of the developing world had very limited access to information regarding market prices and other production-related information (Eggleston, Jensen

[1]In Peru, for example, I attended a national conference in July, 2011 on ICT4D in which several local telecom companies, NGOs, and representatives from a couple different universities throughout Peru were present. However, discussions largely centered on expanding telecommunication infrastructure and less on how people with limited economic means to access these technologies might benefit from their wider coverage.

and Zeckhauser, 2002). Over the last decade, the diffusion of information communication technologies has contributed to improvements in this area, notably cell phone usage in Asia and Africa, however, where these technologies are not widely diffused the challenges of acquiring market price information in peasant communities, remain. Such is the case for remote villages in the northeastern Peruvian Amazon.

In addition to the challenges of acquiring market price information, peasants often live distant from urban centers and, therefore, face high costs associated with bringing products to market , notably transportation costs, and the opportunity costs of time searching for information (search costs) (de Janvry, et al., 1991; Eggleston, et al., 2002; Geertz, 1978). Once they arrive in the market they face negative terms of trade whereby the prices they receive in the market for selling their primary products are lower than prices they must pay for consumer items bought (de Janvry, et al., 1991). The high costs associated with marketing household products means that producers must constantly be searching for market price information and monitoring supply and demand in order to know whether it is profitable to bring their products to market.

In markets, prices are the primary instrument that facilitates coordination of supply and demand and transmits information to market actors in order for them to make efficient decisions. (Eggleston, et al., 2002, p. 63). A large body of literature in the field of economics, appropriately named "information economics", describes the implications of information asymmetries on supply and demand, prices, and on market efficiency (Grossman & Stiglitz, 1980; Stiglitz, 1989). It is generally accepted that markets perform less efficiently when not all actors have access to the same information (i.e., information asymmetries, as per Akerlof, 1970). When market information is available to all actors (in other words, when all actors have perfect information), prices more accurately represent what is actually happening in the market (supply and demand), and there is less room for price arbitrage. All actors benefit from reduced search costs. Conversely, in a market with information asymmetries inefficiency results from either oversupply of products with little demand or undersupply of products that have a large demand (Eggleston, et al., 2002; Grossman & Stiglitz, 1980).

Recent studies have pointed to mobile phones as a potential technology to address these issues, notably how mobile phones can help reduce risk and uncertainty in marketing and reduce market price volatility by better informing supply and demand (Abraham, 2007; Jensen, 2010), reduce price arbitrage in agricultural markets (Aker, 2010), and improve farmer participation in

agricultural markets (Muto & Yamano, 2009). Abraham (2007, p. 15) argues that mobile phones, unlike data heavy technologies such as the internet which require a level of sophistication by its users that many people in rural areas throughout the developing world do not possess, "represent a continuation of the oral tradition which most people are comfortable with".

1.3 Study Context

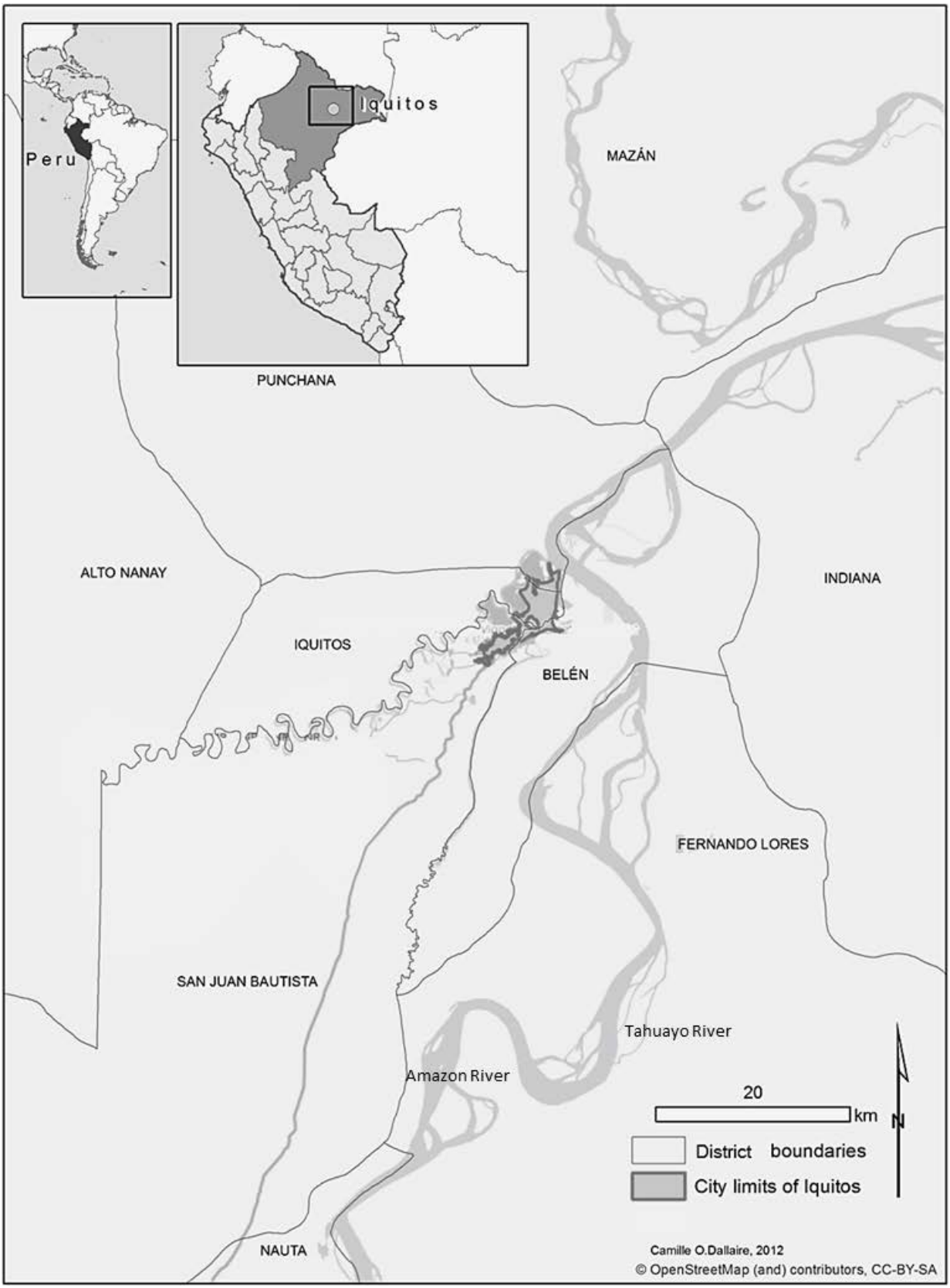
1.3.1 Setting

This study was carried out in four rural villages along the Tahuayo River, in the northeastern Peruvian Amazon, Region of Loreto, and in the region's largest urban center, Iquitos (Figure 1.1). Loreto covers an area of 8851.95km² and is home to 891,732 people (INEI, 2007a), making it the largest region in the Peruvian Amazon by both territory and population. The regional landscape is characterized by dense tropical forest by a series of rivers and tributaries flowing down from the Andes. The largest of these rivers are the Napo, and the Marañon and the Ucayali Rivers which merge to form the Amazon River. These vast river networks are a defining feature of the region and influence agricultural production cycles, and as "river highways" connecting people and villages, and facilitating the transport of products to market (Chibnik, 1994; Salonen, Toivonen, Cohalan, & Coomes, 2012).

The population of Loreto is largely urban, with 583,391 people, or 65.4%, living in cities and 308,341 people, or 34.6%, living in rural areas in 2007 (INEI, 2007a). Most of the urban population is concentrated in and around Iquitos (pop. 406,340), the capital city of Maynas Province and largest urban center in the Peruvian Amazon. Iquitos is only accessible by air and boat travel to the rest of the country. Nevertheless it is the center for economic activities in Loreto. Its relative isolation from the rest of the country and the world, in addition to its large population relative to other centers in the region, contribute to a steady demand for agricultural and forest products from surrounding rural areas thereby fuelling a market for rural producers to sell their products and earn income.

Historically, the economy of the Peruvian Amazon has been heavily dependent on international demand for forest products. Since the late-ninetieth century, the regional economy has been characterized by cyclical periods of heightened economic prosperity (boom) corresponding to increased international demand for forest products including rubber, barbasco, timber and, most recently petroleum and coca (Barham & Coomes, 1994; Coomes, 1995),

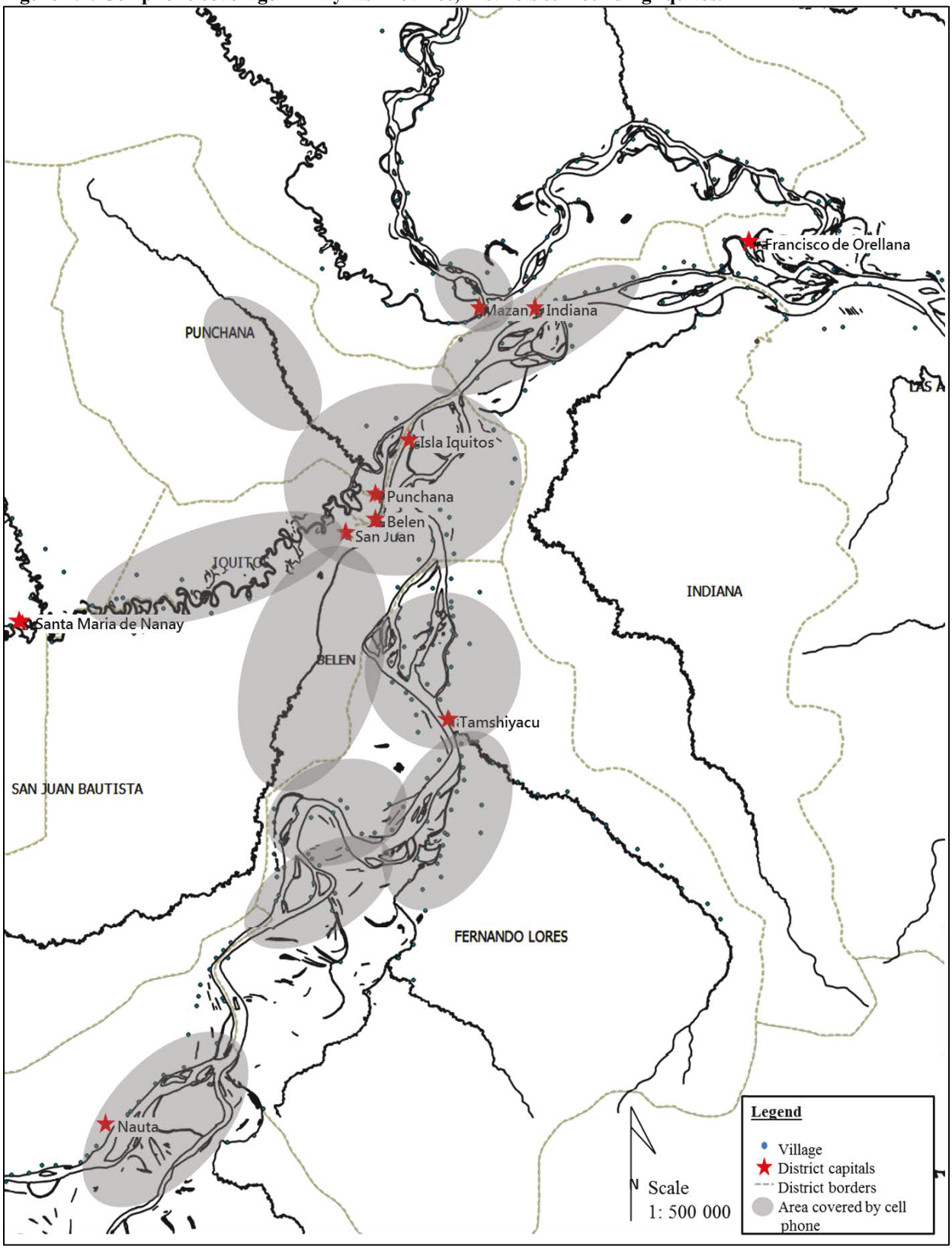
Figure 1.1: Map of Districts of Maynas Province and city of Iquitos, Loreto, Peru.



followed by economic decline (bust) as cheaper, more efficient substitutions have emerged onto the global marketplace. These boom periods contributed to the growth of the city of Iquitos, which today continues to be an important regional capital and dominant center for the commercialization of agricultural and forest products from nearby communities. Unfortunately, the economic gains sustained during these boom periods were episodic and contributed little to sustained economic growth in the region. As several authors have pointed out (Brondizio, 2004; Coomes & Barham, 1997; Padoch & de Jong, 1990), the history of economic booms in the Amazon basin has generally favoured large scale landowners and commercial exporters. With the exception of Iquitos, little long term investment in infrastructure was made during those periods such as roads, electricity, and phone lines to connect the highly dispersed rural population. The lack of infrastructure particularly poses challenges for trade and commerce in the region, which continue to be carried out in a very informal manner (Padoch, 1987; Salonen, et al., 2012).

Indeed, with respect to information infrastructure in Loreto, the distribution is heavily skewed by Iquitos. According to the latest national census data (INEI, 2007a) less than half the population of Loreto possesses a radio (47.3%) and most of those who do (55.5%) are located in and around Iquitos (INEI 2007a). Only 45% of people in Loreto possess a TV and most of them (71.8%) are located in and around Iquitos. Only 1.9% of the population has internet access of which 65% live in and around Iquitos. Few people have telephones (20%) and again most of those people are concentrated in and around Iquitos. These figures highlight the general lack of access to formal means of communication by a large, rural, portion of the population and further point to the informal nature of communication and access to information in the region. Nevertheless, it is possible that telephone ownership has increased since the 2007 census was taken given the expansion of cell phone coverage in the region in recent years. According to the Organismo Supervisor de Inversión Privada en Telecomunicaciones (the government regulating body for private investment in telecommunications in Peru) – OSIPTEL – in 2012 cell phone coverage in Maynas Province extended up the Amazon River as far as Nauta, downstream as far as Indiana, along the Napo River in the area surrounding Mazan, up the Nanay River towards Santa Maria de Nanay, and up the Itaya River near Iquitos (Figure 1.2). In spite of this cell phone coverage is still heavily concentrated in communities closest to Iquitos and other district capitals.

Figure 1.2: Cell phone coverage in Maynas Province, Districts surrounding Iquitos.



Source: Map drawn from GIS data provided by Dirección de Hidrografía y Navigación, Iquitos, Peru. Cell phone coverage data taken from Osiptel (2012).

1.3.1.1 Study area

Research took place in the largest agricultural market in the Peruvian Amazon, "Belén", which spans over twenty six street blocks (Padoch 1987), and is also an extensive shantytown with an urban population of 19,474 people (INEI 2007b). Belén market is located in Belén district, one of four districts making up the city of Iquitos. It is located along the calm Itaya River, in the southeastern corner of the city. The community known today as Belén was founded circa 1886 on the banks of what used to be a small lake and branch of the Itaya River near its confluence with the Amazon River. Belén began as a lowland farming community and slowly expanded into the upland hills. At the start of the 20th century, it was the primary port of entry into the city of Iquitos. Since then, the population of Belén has grown substantially in response to various periods of economic boom in the region, most recently of which was the petroleum boom in the 1970s. The sale of agricultural produce and forest products in Belén market is an important source of income for rural producers within a day's travel to Iquitos, and provides employment for close to 6000 people as merchants and vendors (INEI 2007b). Moreover, Belén is important to the urban population in Iquitos that relies on the market to supply its consumption needs.

For the rural component of our study, research was concentrated along the Tahuayo River, which is located some four to five hours upstream from Iquitos by riverboat (*colectivo*) at its mouth, in the District of Fernando Lores (Figure 1.1). The Tahuayo is primarily a black water river characterized by seasonally and permanently flooded forests. However, given the Tahuayo River's proximity to the Amazon and, in part, lying within the Amazon River floodplain, the lower mouth of the river more closely resembles that of the sentiment rich whitewater rivers. Over 19 villages (Instituto del Bien Comun, 2001) make up the population along the Tahuayo River watershed. Residents are a mix of Amerindian and European descent, mestizos, locally referred to as *ribereños* given that they largely reside along the many rivers and tributaries in the Amazon. They are primarily subsistence farmers that also practice fishing, hunting and the extraction of forest products to maintain a livelihood. The study was carried out in four villages along the Tahuayo including three upland villages: Nuevo Triunfo, Nuevo Valentín, and Santa Cruz and one lowland village: Tapira Nuevo I (see Figure 2.3, Chapter 2).

1.3.2 Local inhabitants and livelihoods: *ribereños*

In the Amazon, the rural peasantry represents a social group of mixed Amerindian and European descent (Coomes & Barham, 1997; Mário Hiraoka, 1992), that predominantly

reside along the Amazon River and its many tributaries. *Ribereños* represent perhaps the largest rural social group in the Peruvian Amazon (Coomes & Barham, 1997). As is characteristic of peasant societies, *ribereños* are predominantly subsistence-based and practice agriculture both to meet consumption needs and as a primary income-generating source through market sales. In addition to agriculture, traditional economic activities include fishing, hunting, and extraction of forest products such as fruit, fibres, and medicinal plants (Mario Hiraoka, 1985; Padoch & de Jong, 1990; Padoch & Jong, 1992; Takasaki, Barham, & Coomes, 2001). Non-traditional off-farm or non-farm activities such as the production of handicrafts, wage labour, and participation in the more formal sector through temporary or long term migration to the urban centers (Pacheco, 2009) also contribute to the livelihood strategies of *ribereño* populations.

Household livelihood strategies are largely determined by location along the floodplain (i.e., access to lowland or upland soils or both), distance to urban markets, household composition (i.e., number of productive family members, number of adult males, dependants) and land holdings (Castro, 2009; Caviglia-Harris & Sills, 2003; Kvist, Gram, Cácares C, & Ore B., 2001; Takasaki, et al., 2001). In addition, economic activities are heavily influenced by the seasonal rise and fall of the rivers (Chibnik, 1994; Mário Hiraoka, 1992). In the dry season between June and September (*época de vaciente*) fish are more abundant and households are able to engage in agricultural activities along the low levees, mudflats, sandbars, and flood-free *restingas* (Hiraoka 1992). However, as these lands flood between December and April (*época de creciente*) fish become scarcer and agricultural activities are restricted to less productive upland, *terra firme*, fields. In some areas hunting serves as an alternate economic activity to fishing during these months (Kvist, et al., 2001).

Overall *ribereños* are poor in financial and physical capital assets with wealth concentrated in natural (forest resources, land), human (labour), and social capital (social relations). In 2010, Tahuayo River households earned a mean income of $2695 USD, owned an average of 12.56 hectares of land, and held a mean of $489 USD non-land capital assets (n=165 households in 9 villages) (Coomes, 2010b, unpublished data). Moreover, the daily rural wage was a mere $3.60 USD with lunch included or $5.34 USD with no lunch included. Empirical studies have demonstrated great heterogeneity in livelihood strategies between households in the same village, and between villages and regions dependent on household capital asset holdings and capital wealth (Castro, 2009; Coomes, Barham, & Takasaki, 2004; Kvist, et al., 2001; Takasaki, et al., 2001).

1.4 Thesis Structure

The thesis is comprised of four chapters. Chapter 2 provides an overview of the commercialization of agricultural and forest products from *ribereño* villages within a day's travel to Iquitos, in the primary urban market of Belén. I describe the history and importance of Belén market to the regional economy and use empirical data from four *ribereño* villages along the Tahuayo River to illustrate how *ribereño* livelihoods are inherently liked to Belén market through trade. Moreover, I analyze the observed price fluctuations of four economically important regional products (yuca, plantain, charcoal and aguaje) in Belén market over a three month period (June, July and August) and discuss the potential implications of price uncertainty among *ribereño* producers.

In Chapter 3, I take a more structural approach to understanding the role of market price information in household livelihood strategies, particularly when it comes to selling agricultural and forest products. The chapter begins with an analysis of social networks that facilitate access to market price information. Next, I examine the accuracy with which households know market prices by comparing household estimates with actual prices in the market. The livelihoods framework is then used to test whether certain socioeconomic and village characteristic are able to better predict household accuracy in price estimation.

Finally, Chapter 4 concludes with an overview of the findings and proposes avenues for future research.

CHAPTER 2. BELÉN MARKET: REGIONAL IMPORTANCE, COMMERCIAL ORGANIZATION AND PRODUCE PRICE VARIABILITY

2.1 Introduction

In the Peruvian Amazon approximately 26% of the working-age population is devoted to agriculture as their primary occupation (INEI, 2007b), many for whom the sale of these products represents their main income source. In addition, approximately 12% of the working age population is indirectly involved in this sector through employment as merchants and market vendors in the urban center (INEI, 2007b)[2]. This figure is even greater in the metropolitan area of Iquitos, the largest city in the Peruvian Amazon, where it is estimated that 19.8% of the working age population is directly employed in market activity either as vendors or merchants (INEI, 2007b). These figures suggest the important role of agricultural markets in rural livelihoods throughout the Peruvian Amazon, a trend that has been widely acknowledged in the literature throughout the developing world (Ellis, 1993; Fischer & Qaim, 2012; Hinrichs, 2000; Minot & Vargas Hill, 2007; Zezza et al., 2011). In fact the International Food Policy Research Institute (Minot & Vargas Hill, 2007, p. 1) estimates that between 50 to 90 percent of household income for poor rural families throughout the developing world in earned from sales in agricultural markets.

At the center of commercial activity in the Peruvian Amazon is Belén market. Belén is the largest and most diverse market in the Peruvian Amazon. It is the center of economic activity in Iquitos; where rural supply meets urban demand. Although the important role of agricultural product sales in Belén market as a source of income for rural farmers in the Peruvian Amazon has been widely recognized (Chibnik, 1994; Coomes, 1995; Coomes & Burt, 1997; Mário Hiraoka, 1989; Padoch, 1987; Padoch & de Jong, 1990; Salonen, et al., 2012); few studies have specifically examined how the market works in order to gain a more complete picture of the complex decisions and challenges that rural producers face in the market such as shifting prices, limited marketing space, knowing who to sell to, where to sell and the inner-workings of market life. In addition, the few studies that have specifically addressed market dynamics in Iquitos are now somewhat dated (Chibnik 1994; Padoch 1987)[3].

[2] These figures were calculated from the 2007 National census by taking the total working-age population of all Amazonian regions (Amazonas, Loreto, San Martin, Ucayali, and Madre de Dios) = 889,480 and calculating the total population listed under "agriculture, qualified farm workers, and fishermen" and the total population listed under "self-employed, merchants and market vendors" as primary occupation.

[3] An exception is the SIFORESTAL program, which was carried out by the Instituto de Investigaciones en la Amazonia Peruana (IIAP) and ended in 2006.

In an attempt to fill this gap, this chapter has two main objectives. First we will provide a systematic analysis of Belén market by describing its history, importance to the local economy, products commercialized in the market and the natural seasonal fluctuation of prices for staple agricultural products. Second we will examine the relationship between Belén market and *ribereño* communities along the Tahuayo River by describing how agricultural products of importance to the region are commercialized in the market.

The chapter is structured as follows: Section 2.2 introduces the study area, including a general overview of the main agricultural markets in Iquitos and an overview of the Tahuayo River. Section 2.3 describes the methods used for the purposes of this chapter. Section 2.4 presents the results including an overview of the structure and importance of Belén market to the regional economy, the commercialization process of agricultural products for villages within a day's travel to Iquitos using the Tahuayo River as a case study, and finally an analysis of price variations in Belén market for staple agricultural and forest products. Section 2.5 closes the chapter with a discussion and concluding remarks.

2.2 Study Area

This study was carried out in the northeastern Peruvian Amazon region of Loreto, in two districts of Maynas province: Belén and Fernando Lores. Belén is one of four districts forming the metropolitan area of Iquitos; the capital city of Maynas, the largest urban area in the Peruvian Amazon and primary commercial center for agricultural and forest products from surrounding regions (Chibnik, 1994; Coomes, 1995; Padoch, 1987; Salonen, et al., 2012). The metropolitan area also includes San Juan Bautista, and Punchana. Combined, these four districts have an estimated population of 457,865 people (2012 projections, INEI, 2007a). Iquitos is bounded by the Amazon River running along the northeastern edge of the city; the Itaya River running along the city's eastern limits; and the Nanay River along the west. There are no roadways linking it to the rest of the country so most goods arrive via fluvial transport into one of the city's many ports. These ports also serve as agricultural markets, the largest of which is Belén (*hereafter referred to as Puerto Belén or Belén market*).

Research for this chapter took place in Belén market and in four *ribereño* communities located along the Tahuayo River, some 6-8 hours from Iquitos by river boat. This section will describe the study setting, starting with a description of the primary markets in Iquitos, with a focus on Belén market and followed by a description of the Tahuayo River and study communities.

2.2.1 Iquitos markets

Iquitos is home to five primary agricultural markets: Morona Cocha, Belén, Masusa, Mercado de Productores, and Modelo (Figure 2.1) (IIAP 2006). With the exception of Mercado Modelo, the markets are all located along the banks of the Nanay and Itaya rivers thereby also serving as ports. Table 2.1 shows the distinguishing characteristics of each market.

Morona Cocha and Masusa are the smallest markets in terms of number of vendors[4]. Morona Cocha market is located in the district of Iquitos on the banks of Morona Cocha Lake, a branch of the Nanay River. According to IIAP (2006), Morona Cocha is known as the largest center in Iquitos for the sale of round wood and other construction materials used for building houses such as *criznejas* (palm fronds used as roof thatch). Other products such as fruit and charcoal are also sold here. Masusa port is conveniently located at the mouth of the Itaya River near its confluence with the Amazon (Figure 2.1) in Punchana district. It is the docking station for large boats, *lanchas*, coming from the upper Amazon, lower Amazon and Río Tigre. Products from *ribereño* villages arriving through this port are sold primarily in bulk and include a variety of tropical fruit, fish and wood fuels such as charcoal (IIAP 2006). In addition, a variety of manufactured products coming from other parts of Peru are transported on these ships and imported through Masusa port (Cohalan, 2007).

The Mercado de Productores (Producers Market and port) is located along the Itaya River south of Mercado Masusa in the District of Iquitos. It is an indoor complex established in 1990 by the Mayor of Maynas with the objective of providing a space free of charge for producers to offload and sell their products upon arrival in Iquitos, thus bypassing the middlemen. In practice rural producers rarely make it inside the market prior to selling their goods. Instead products are usually intercepted and sold to middlemen, *rematistas*, at the port. It is the *rematistas*, rather than the producers who sell these products inside the market complex. Products sold here originate from communities within a day's travel to Iquitos, and consist mainly of perishable tropical fruit (IIAP 2006). Officially the market can accommodate up to 69 vendors, however as of 2006 there was a total of 87 (IIAP 2006). Once the market is filled to capacity it is not uncommon to see vendors set up on the street in front of the market.

[4] IIAP lists 32 vendors each as of 2006.

Figure 2.1: Main commercial markets in Iquitos, Peru.

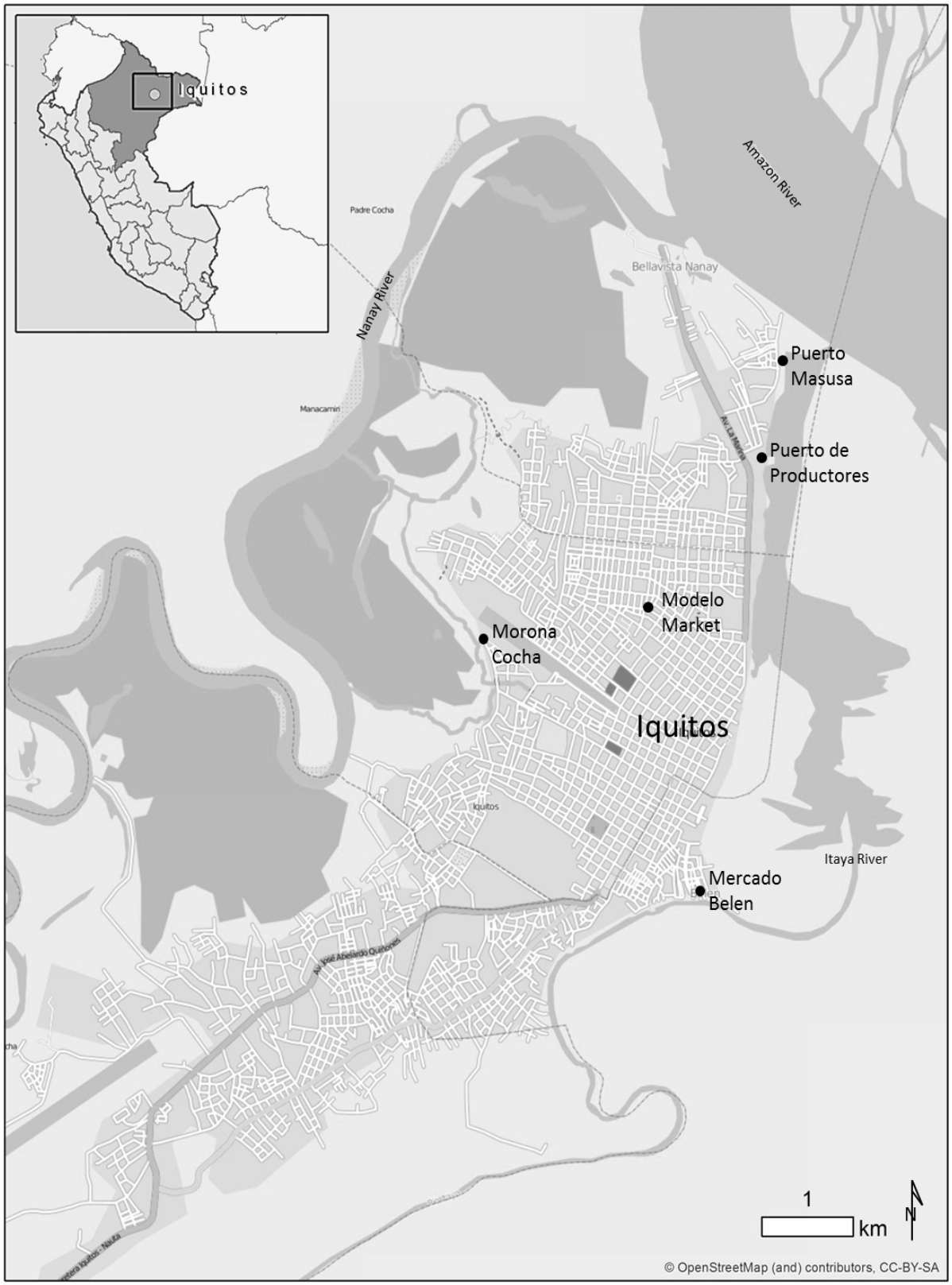


Table 2.1: Characteristics of the main commercial markets in Iquitos.

Market	Nº of vendors	Main products sold/traded	Type of commerce	Location
Morona Cocha	32	Round wood Criznejas* Other construction materials Firewood	Wholesale	Nanay River
Belén	~6000	Household items Cothing Fish Vegetables Tropical fruit Charcoal Bushmeat Live animals Medicines (natural and pharmaceutical) Handicrafts	Wholesale Retail trade Small-scale vendors	Itaya River (150,000m² - 26 street blocks)
Masusa	32	Manufactured items Tropical fruit Fish Wood fuels	Wholesale Small-scale vendors	Itaya River
Productores	70-90	Perishable tropical fruit such as plantain and aguaje	Wholesale Small-scale vendors	Itaya River
Modelo	1,700	Staple consumption products including: a variety of fish, tropical fruit, meat and charcoal	Small-scale vendors	City center

Note: *Criznejas are braided palm fronds used as roof thatch.
Source: Elaborated based on data from SIFORESTAL (IIAP 2006).

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Modelo market is also an indoor complex and, unlike the other markets, is located inland from the rivers. It is the second largest market in Iquitos in terms of number of vendors, with 1,700 registered vendors as of 2006 (Instituto de Investigaciones de la Amazonia Peruana (IIAP), 2006). Products sold here primarily consist of staple foods such as yuca, fruit, fish, meats and poultry and are sold in small quantities for direct consumption purposes. Products commercialized in Modelo market are generally bought in bulk in either Masusa port or Mercado de Productores and then sold in small quantities here (IIAP 2006).

Finally, Belén market (Figure 2.2) is the largest agricultural market in the city, encompassing a total area of 150,000m² (IIAP 2006), covering 26 city blocks (Padoch, 1987), and comprising some 6000 vendors. A wide variety of products are sold here, ranging from everyday household items and clothing to medicines and foodstuffs. The market extends between the streets of *Ramírez Hurtado, 16 de Julio*, and *9 de Diciembre* to the Itaya River (IIAP 2006). Belén market is divided into upper Belén and lower Belén. Upper Belén remains functional year-round, whereas the streets of lower Belén are flooded for half the year and are only open for commerce during the dry season. Research in Belén market was primarily concentrated in lower Belén at the edge of *Calle Jirón Itaya*: where the *colectivo* boats from the Tahuayo and Amazon Rivers dock and the first point of sale for products arriving into port. Other important commercial streets in lower Belén include *Calle Venecia* where plantain is sold in abundance and *Calle Pijuayo Belén* where yuca and a popular fruit from the Moriche Palm (aguaje) are sold.

2.2.2 Tahuayo River

The Tahuayo River is located in the District of Fernando Lores, which borders Belén district to the north. As of 2007, Fernando Lores had a population of 19,127 people with 24% residing in the urban capital of Tamshiyacu and 76% residing in the surrounding rural villages (INEI 2007a). The Tahuayo River was selected for the rural study site because extensive socioeconomic data are available (Coomes 2010b: unpublished data) and because Tahuayo communities are closely linked to Belén, by less than one day's travel downstream by river boat, and through the sale of local produce. Information gathered from these communities helped to provide a more complete picture of the rural-urban linkages in Belén market, specifically how market transactions occur. Moreover a long standing relationship had already been established between Dr. Oliver Coomes, his Peruvian assistant Carlos Rengifo who have worked in the Tahuayo area for over twenty years, and village residents. These connections proved to be most useful given the short timeframe in which fieldwork

Figure 2.2: Belén market area and its main commercial streets.

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was conducted, as village members were less reticent about speaking to us knowing we were part of this team.

Residents of the Tahuayo are primarily characterized as rural peasant producers who divide their productive activities between the practice of floodplain and upland agriculture, fishing, hunting and extraction of forest products (Coomes, 1992; Coomes, 1996). Nineteen communities make up the bulk of the population along the Tahuayo watershed (Instituto del Bien Comun, 2001) (Figure 2.3). Two lowland villages, Tapira Nuevo I and Tapira Nuevo II, are separated from the main watershed by a small island. A footpath joins villages between Nuevo Esperanza and Tamshiyacu, however given the considerable distances, fluvial transportation is most often used except when traveling to the closest neighbouring villages. By contrast Iquitos is only accessible by river and is between a six to eight hour journey downstream via river boat, *colectivo*.

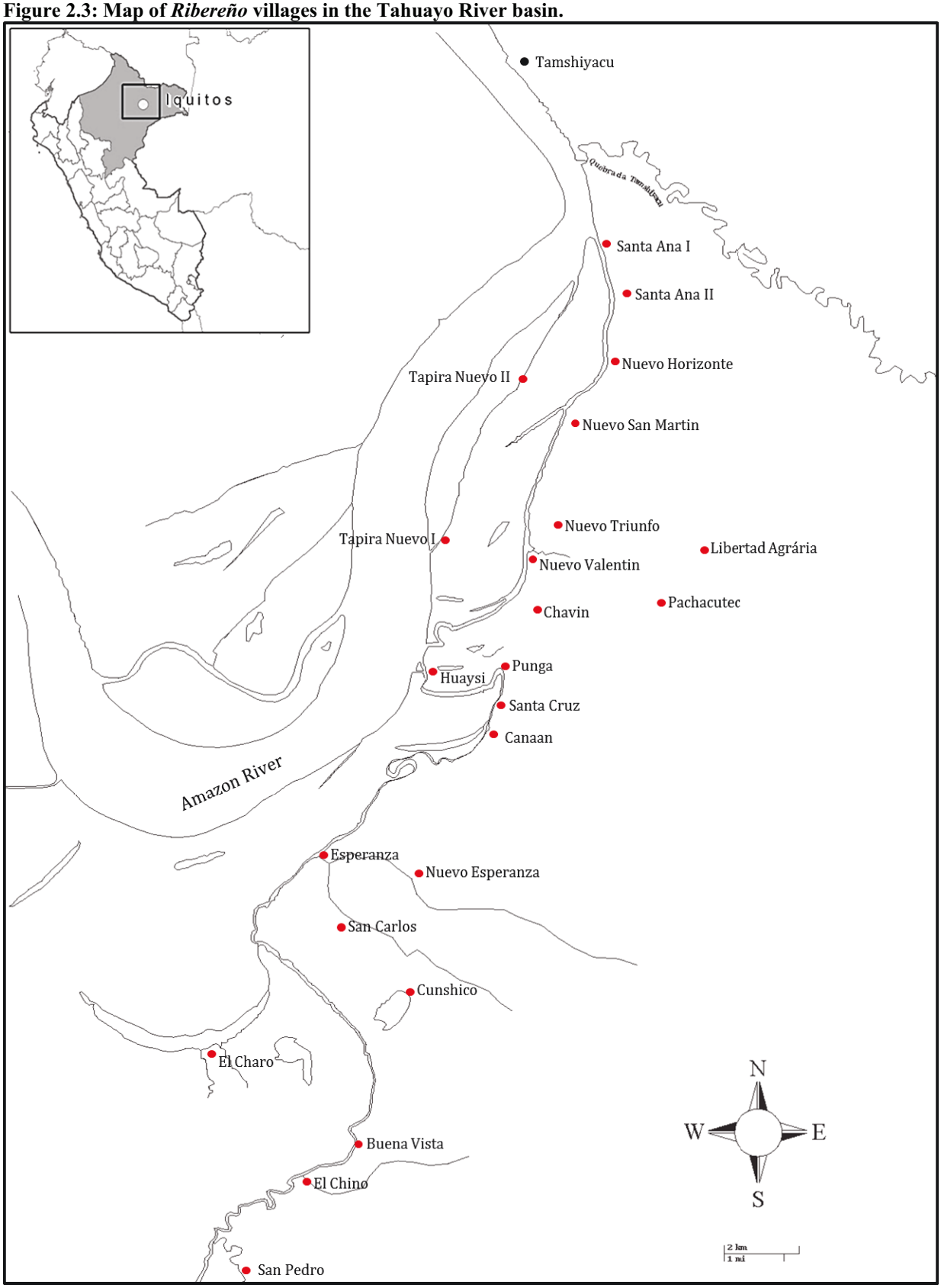
Seasons and trading patterns are strongly linked to the cyclical rise and fall of the major rivers (Chibnik 1994). The period when rivers are at their highest, *época de creciente*, is between March and May. During this time boats can navigate freely up and down the rivers. Conversely during the driest months of July to September, *época de vaciente*, navigation becomes more difficult which can affect products getting to market (Salonen, et al., 2012).

The study was carried out in four villages along the Tahuayo including three upland villages: Nuevo Triunfo, Nuevo Valentín, and Santa Cruz and one lowland village: Tapira Nuevo I. Household survey data (Coomes 2010b: unpublished data) indicates that the agricultural and forest products most widely sold among residents of the Tahuayo are yuca (*Manihot esculenta*), plantain (*Musa* spp.*)*, charcoal, corn, pineapple, and aguaje (*Mauritia flexuosa*) (Table 2.2). These products are important sources of income for Tahuayo residents. Yuca, charcoal, watermelon, plantain, pineapple, and aguaje stand out as the most economically important agricultural products for the region (Table 2.3).

2.3 Methods

This study initially set out to describe the networks that facilitate the dissemination of prices to *ribereño* households for the products they sell (Chapter 3). As the research progressed, it became clear that in order to understand how information about market prices reaches *ribereño* communities it was first necessary to understand the structure and organization of Belén market and price variation patterns for key agricultural and forest products. Fieldwork took place over three months between June, July and August 2011,

Figure 2.3: Map of *Ribereño* villages in the Tahuayo River basin.



Source: Map drawn from Landsat image dated August 7, 2011 (Center for Earth Resources Observation and Sciences, 2011); Village locations plotted from GPS points taken during fieldwork and from the Instituto de Bien Comun (2001).

Table 2.2: Products most widely sold among Tahuayo residents in nine villages, in 2010.

Product	Number of households selling	Percentage of total (N=170)	Percentage of households selling	
			Upland villages (N=119)	Lowland villages (N=51)
Yuca	151	89	87	92
Plantain	133	78	74	86
Charcoal	94	55	73	12
Corn ears	70	41	31	65
Pineapple	65	38	54	0
Aguaje	60	35	34	0
Fariña	39	23	13	49
Sachapapa	39	23	34	0
Umarí	36	21	30	0
Watermelon	36	21	11	55

Source: 2010 Tahuayo household survey data (Coomes 2010b: unpublished data)
Note: Production and sales data were taken from the 2010 Tahuayo household survey which included 9 villages; Nuevo San Martin, Nuevo Triunfo, Nuevo Valentin, Punga, Santa Cruz, Huaysi, Tapira Nuevo I and Tapira Nuevo II. Fariña is a cereal derived from yuca. Sachapapa is a type of potato. Umarí is a tree fruit (*Poraqueiba sericea*).

Table 2.3: Most important commercial products among Tahuayo River residents according to estimated market value and quantity produced in 2010.

Product	Aggregate market sales among Tahuayo residents in 2010	Average *rematista* price per unit in 2010 USD (S./2.807)	Estimated value of total earnings in USD (S./2.807)
Yuca (sacs)	8,882	9.98	88,642
Charcoal (sacs)	20,161	1.78	35,887
Watermelon (unit ~5kg)	26,400	1.25	33,000
Plantain (racine ~17.5 kg)	3,221	4.45	14,333
Pineapple (unit)	32,120	0.36	11,563
Aguaje (sacs)	950	5.34	5,073

Source: Quantities were taken from the 2010 Tahuayo household survey data which included 9 villages; Nuevo San Martin, Nuevo Triunfo, Nuevo Valentin, Punga, Santa Cruz, Huaysi, Tapira Nuevo I and Tapira Nuevo II. Average annual value per unit of product was used for producer prices in Belén. Quantities were multiplied by average sale prices in 2010.

corresponding to the end of the flood season and the beginning of the dry season (when river levels are low) in the region. Data collection followed a mixed methods approach and involved semi-structured interviews (see Household survey, Appendix 1A) with households in four *ribereño* villages along the Tahuayo River, unstructured interviews with boat operators (see Interview schedule with *colectiveros*, Appendix 1B), participant observation while riding on communal transport boats to and from Iquitos and in Belén market, and daily notation of prices in Belén market. Additional socioeconomic household survey data from nine *ribereño* villages along the Tahuayo River, collected between September and November 2010 (Coomes, 2010b: unpublished data) as part of ongoing studies in the region, were also consulted in order to generate a comprehensive understanding of the Tahuayo region's production and economy. Secondary data were consulted from several local institutions and organizations in Iquitos including the Ministry of Agriculture and the Peruvian Amazon Research Institute (IIAP). Prior to commencing fieldwork approval was sought and granted by the McGill University Research Ethics Board (see Appendix 2).

Data were collected by the author and two local Peruvian field assistants. Junior Rios Diaz, a recent university graduate from Iquitos with experience living and working in *ribereño* communities, accompanied the author on all interviews and field visits to Tahuayo villages. Gisela Aguilar, a resident of Belén district with rich knowledge and understanding of the subtleties of market life, was responsible for noting daily prices in the market. Although these activities were carried out separately, the team met once every week to ten days to exchange ideas and compare notes on what had been learned during household interviews with what was happening in the city. On several occasions the team met in Belén port to observe boats arriving and watch transactions occur. On these occasions Gisela also acted as a key informant by pointing out important actors (middlemen) and adding detail to the scene unfolding in the market (who was buying what, how much they were paying, where they would sell the product, how they would sell it, who was a buyer and who was a porter and so forth).

Fieldwork initially began in early June with a familiarization trip to nine villages along the Tahuayo River. The purpose of this familiarization trip was to meet with local officials, to purposely select which villages to work in, and to determine the primary market or markets in Iquitos where producers in the region sell their products and the main channels used to do so, i.e., how they go about selling their products. Belén market stood out as the principal market where goods in this region are commercialized. The primary transportation method used to take products to market is by *colectivo* - small owner operated river boats that

have an average carrying capacity of 5-40 tonnes (Salonen, et al., 2012, p. 26). Subsequently four communities were selected for the study based on variation in 1) community size and community structure as it was hypothesized that this may influence how information is shared between villagers; 2) whether the community had a public telephone or not and whether the *colectivero* passed by the community or not as these are indicators of potential information channels from Iquitos; and 3) location (upland vs. lowland) in order to capture differences in livelihoods types and production; (Table 2.4).

Three *colectivos* operate along the Tahuayo River: "Che Carlitos", "Sanchez" and "Guevarita" (Photos 2.1 - 2.3). All boats make three weekly round-trips, going upstream three days a week, and downstream three days a week. "Che Carlitos" and "Guevarita" travel upstream and downstream on the same days, alternating with "Sanchez" (Table 2.5). There is no boat service upstream, from Iquitos to the villages on Mondays and no boat service downstream to Iquitos on Sundays. "Sanchez" and "Guevarita" both travel as far as Chino and "Che Carlitos" travels only as far as Esperanza. The three boats vary in size and carrying capacity between 12-14 tonnes (Cohalan, 2007).

Price tracking began in late June, corresponding to when household survey data collection began on the Tahuayo River. In Belén market, price information was noted every day of the week between June 26 and August 21, except Sundays due to a lack of boat service to Iquitos from the Tahuayo on that day. Prices were calculated by asking two to three *rematistas* what they were offering for products arriving on the Tahuayo boats and then taking the average of these quoted prices. Although prices were always noted in the afternoon, they were not always noted at exactly the same time every day because Tahuayo boats did not always arrive into port at the same time every day. As a result of "Che Carlitos" lower carrying capacity it spends less time in village ports loading cargo and arrives into Belén port earlier than the other two boats, generally around 1pm. "Guevarita" would usually follow shortly thereafter, between 2pm and 3pm. "Sanchez" typically arrived into port late afternoon, between 3pm and 4pm.

Prices were noted for yuca, plantain, aguaje and charcoal. Yuca and plantain are staple food items in the local diet. Aguaje is a fruit from the Moriche palm (*Mauritia flexuosa*) abundant in permanently or temporarily flooded areas throughout Amazonia (Manzi & Coomes, 2009). The fruit is generally consumed like a snack, or in "aguajina", a drink made from its pulp and is extremely popular among Iquiteños. After plantain, aguaje is the most important fruit in the Iquitos markets (Padoch, 1988). Several different types of aguaje are found in Iquitos markets, however, the two most common varieties are "aguaje amarillo" and

Table 2.4 Characteristics of study villages, Tahuayo River, 2011.

Village	N^0 of households in 2011 (sample households)	Location	Travel time upstream from Iquitos by *colectivo*	Public telephone	On the *colectivo* route?
Nuevo Triunfo	21 (16)	Upland Some households have fields in the lowland White water river	4.5 hours	No	Yes
Nuevo Valentin	41 (22)	Upland Some households have fields in the lowland White water river	5 hours	Yes	Yes
Santa Cruz	21 (18)	Upland No lowland farmers Black water river	8 hours	No	Yes
Tapira Nuevo I	16 (14)	Lowland White water river	NA	No	No

Source: Author's household survey data, 2011.

Photos: 2.1, 2.2, and 2.3: Tahuayo *colectivos,* clockwise from top left: Che Carlitos, Sanchez, Guevarita.

Source: Meghan Doiron June, July, August 2011

Table 2.5: Routes and carrying capacities of Tahuayo River boats.

Boat	Furthest village served	N^0 of villages served	Trips upstream	Trips downstream	Boat capacity (tonnes per week)
Sanchez	Chino	14	Sunday Wednesday Friday	Tuesday Thursday Saturday	14 (42)
Guevarita	Chino	14	Tuesday Thursday Saturday	Monday Wednesday Friday	13 (39)
Che Carlitos	Esperanza	12	Tuesday Thursday Saturday	Monday Wednesday Friday	12 (36)

Source: Author's interviews with *colectivero* operators, 2011. Boat capacities were estimated from Cohalan (2007: 78).

"aguaje shambo". Aguaje shambo is the most valued variety. It is slightly larger than other varieties, its pulp a dark orange colour as opposed to the yellow, and it is said to be tastier than the "aguaje amarillo" variety. Charcoal is used by Iquitos residents for cooking and bought in quantity by the numerous barbecue chicken restaurants found throughout the city. As described earlier, these products are an important source of income for Tahuayo residents and are some of the most widely produced along the river. Moreover given that the study was carried out during the months of June, July and August these products were selected as they were in season and most widely represented among households interviewed.

As the Tahuayo boats docked in Belén port, Ms. Aguilar would greet them and observe what products were arriving and which *rematistas* were buying yuca, plantain, aguaje and charcoal. If possible, when the boat was not too crowded, she would board and listen to negotiations. Otherwise she waited on the shore to speak to the *rematistas*. On the days when "Sanchez", the largest boat, came into port it was easy to see who was buying what and note the price of the sale because it was the only boat. As "Che Carlitos" and "Guevarita" always traveled on the same days, Ms. Aguilar waited for both boats to arrive before inquiring about prices and then took an average of the sale prices from both boats. There were days when no yuca, plantain, aguaje or charcoal arrived into Belén market on Tahuayo boats. On these days there is a gap in the dataset. We do not know the price that *rematistas* would have been offering that day.

In addition, on several return trips to Iquitos from the Tahuayo the author and her field assistant, Mr. Ríos Diaz, rode the *colectivos*. On these occasions we observed how products are loaded onto the boats and how negotiations take place upon arrival into Belén port. In late July informal unstructured interviews were carried out with the Tahuayo boat operators to better understand their role in the commercialization process (see Interview schedule with *colectiveros*, Appendix 1B).

Data collection in the study communities was done on separate visits of 5-10 days in each community. The first community visited was Nuevo Triunfo in late June, followed by Santa Cruz and Nuevo Valentin in July, and Tapira Nuevo I in August. Data collection in Nuevo Valentin, the largest community, was divided into two visits. An attempt was made to interview all households for which 2010 data are available. This was not always possible and inevitably some households were left out of the study (see Table 2.6). Interviews were carried out by the author and the local Peruvian field assistant. Informed consent was sought verbally from respondents by the author prior to starting the interview. Interviews were conducted in the following way: the local field assistant asked all the questions on the survey and lead the

Table 2.6: Sample household composition in study villages, Tahuayo River.

Village	N^0 of households interviewed in 2010	N^0 of households interviewed in 2011	Reason for leaving out certain households	Final sample (N=70) as a % of total household population in summer 2011
Nuevo Triunfo	18	16	Both households no longer lived in the village.	76%
Nuevo Valentin	37	22	6 households no longer lived in the village, 6 households declined participation, 2 households could not participate for health reasons, 1 head of household was away during the entirety of our stay in the community.	54%
Santa Cruz	22	18	All four households had either permanently or temporarily left the village to live elsewhere.	86%
Tapira Nueva I	17	14	1 household no longer lived in the village, 1 household had incomplete land and household data for 2010 because he had only recently moved to the village, 1 household declined participation.	82%

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conversation while the author noted the answers. If there was something missing or that needed clarification the author would pose a follow up question.

2.4 Results

2.4.1 Structure and importance of Belén market to the regional economy

Belén market is where rural *campesino* life meets the city and is what drives economic activities for surrounding *ribereño* communities. A walk through Belén market on a busy weekday morning is a unique experience. It is dirty and smelly, and crowded and hot, yet the organized chaos and tremendous diversity of products encountered here provide a fascinating experience. In Upper Belén (see Figure 2.2) the narrow streets are lined with vendors selling a wide variety of agricultural and forest products alongside manufactured household goods. On one of Iquitos' main city streets, *Jr. Prospero,* leading to the market's main entrance, the sidewalks are taken over by clothing vendors selling soccer shoes, t-shirts and children's clothing. Several metres further into the market, on *Calle 9 de Diciembre*, produce vendors tend to their stalls in front of the original "Belén market" structure. Inside the building organization is somewhat forgotten as the bulk of vendors sell meat and poultry beside the occasional stand of vegetables, tropical fruit, sweets and pharmaceutical medicines. Back outside, to the northeast along *Calle Ramirez Hurtado* the smell of fish fills the air as the fresh catch lay on wooden tables in the hot sun. Come afternoon most of these will have been sold and only the smell will remain. Heading south down *Calle 16 de Julio* towards the Itaya River the street becomes increasingly narrow, lined with street vendors on both sides blocking entrances to the hardware shops and bars that lie behind. Blue tarps hang overhead and provide shelter from the hot sun. A sense of organization is lost as everyday household items are mixed with food, meat, fish, medicines, toys, personal items such as combs and toothbrushes, CDs and DVDs. The latter provide a rhythmic backdrop against the sounds of chit chat, laugher and, most importantly, the "deals of the day" as vendors compete for customers. Mixed among vendors are women selling meals of rice, fried plantain, yuca and fish or meat.

Descending to Lower Belén provides a different experience. On average the District of Belén is only 10-15 meters above the Itaya River flood zone (PeruSan, 2007). During the flood season (between March-May) the streets and houses of lower Belén are flooded (Photo 2.4) and open wooden boats, colloquially known as *peque-peques*, transport quantities of plantain, charcoal, yuca, and other agricultural products from river boats, *colectivos*, to higher ground. With each passing week, as the *vaciente* (low water) season approaches, the water

level falls and the market expands onto the floodplain. The previously flooded streets of *Jirón Itaya* and *Venecia* bustle with life, mirroring the streets of Upper Belén. In Belén port, where the busy commercial street of *Jirón Itaya* meets the Itaya River, the shore line expands as the Itaya River increasingly dries up and narrows (Photo 2.5).

Belén market is rarely quiet, and boats arrive at all hours of the day. According to IIAP (2006), the market's official hours of operation are from 3am-9am and from 2pm-5pm. During fieldwork much time was spent roaming the streets of Belén, observing market life unfold, and talking to local residents. The reality of Belén market is that it rarely sleeps. Between 9am and 2pm the market is much quieter but vendors remain at their stalls and many people can be observed perusing the stalls. From 2pm onward, the afternoon boats begin to arrive and the market becomes, once again, a vibrant scene of middlemen, vendors and porters racing to see what products are arriving and bartering for the best deal. Indeed it seems as though everyone in Belén is involved in market life in some way. And this has been the way of life for Belén residents since the community was formed.

2.4.1.2 A brief history of Belén district and market

According to the Municipal Government of Belén (Municipalidad Distrital de Belen, 2011) the community known today as "Belén" was founded circa 1886 on the banks of what used to be a small lake and branch of the Itaya river near its confluence with the Amazon River. Belén began as a lowland farming community and slowly expanded into the upland hills. From the early 20th century, agricultural and forest products were being commercialized here. During that time Belén was also the primary port and gateway to the city of Iquitos. Its advantageous location, along the calm Itaya River, provided easy access to the Amazon River yet with protection from its strong currents (PeruSan, 2007). The community of Belén continued to grow throughout the 20th century. However, it was not until the discovery of petroleum in the 1970s and the subsequent petroleum boom (Coomes, 1995) that the population of Belén grew significantly (Municipalidad Distrital de Belen, 2011; Padoch, 1987) into, what is today an extensive shantytown.

During the height of the petroleum boom, in the 1970s and early 1980s, new settlements emerged including Sachachorro, Nuevo Liberal and Pueblo Libre, to accommodate those migrating from rural areas to Iquitos in search of jobs (Municipalidad Distrital de Belen, 2011). As the population of Iquitos expanded in response to the petroleum boom, urban demand for foodstuffs also expanded (Coomes, 1995, p. 113). By the 1980s the petroleum boom had declined yet the Iquitos population continued to

Photo 2.4: Wet season (*creciente*) in lower Belén.

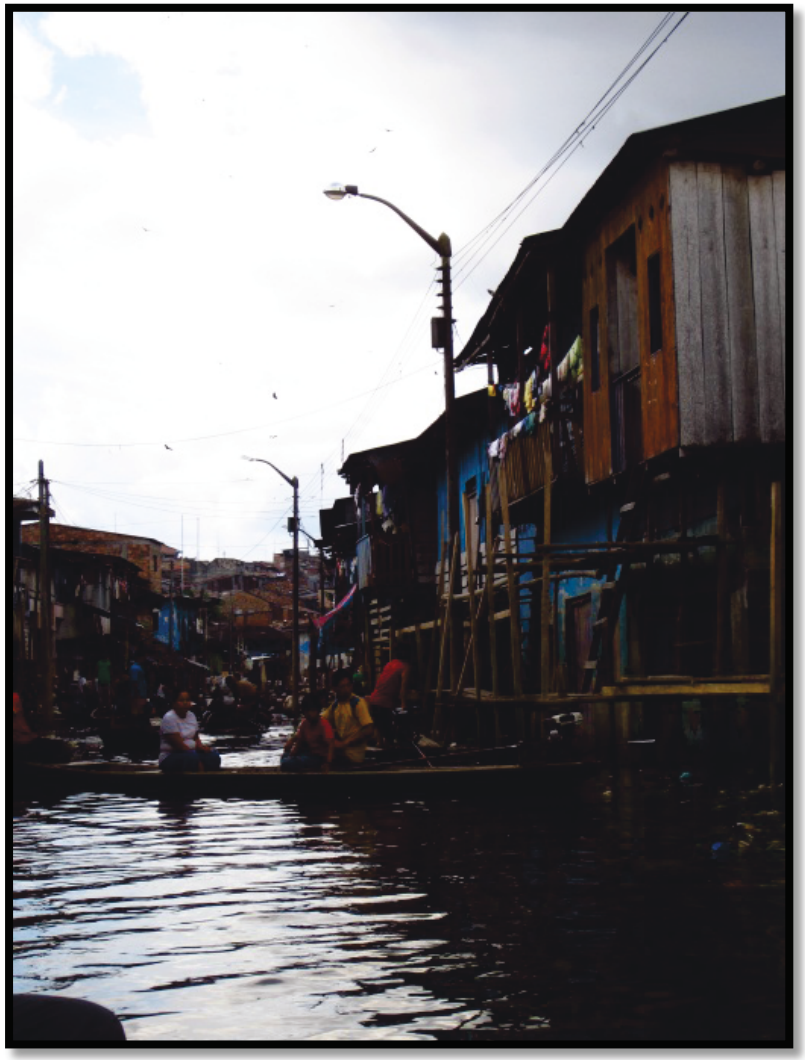

Photo 2.5: Dry season (*vaciente*) in lower Belén.

Source: Meghan Doiron, Belén, Iquitos, June and August, 2011.

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grow, fuelling a constant demand for local food products and leading to increased output from nearby communities (Coomes, 1995, p. 114).

Belén market, being Iquitos' largest agricultural market, remained an important commercial center both for rural producers as a source of income through the sale of agroforestry products, and for the urban population as an important food source. Today it continues to be the most important market in the city of Iquitos and largest market in the Peruvian Amazon (Cohalan, 2007; IIAP 2006; Padoch, 1987; Salonen, et al., 2012). The diversity of products traded affords a convenient "one-stop" location for farmers from nearby villages to sell and trade their primary agricultural products for manufactured household items such as soap, clothing, medicines, tools and gasoline.

2.4.1.3 Belén market: the economic heartbeat of rural Amazonia in Peru

Belén market is undeniably important to the local Iquitos economy and the economies of surrounding rural villages. The urban population in Iquitos relies on the supply of agricultural and forest products to meet their household consumption needs, whereas the surrounding rural populations rely on sales in the market as a source of income. While Iquitos' relative isolation from the rest of the country and the world (it may only be reached by fluvial or aerial transport) makes it costly to export Amazonian products; its relative isolation is perhaps what prevents competition through imports from industrial food markets, and ensures a steady demand for local foodstuffs. Despite an urban population of 370,962 (INEI, 2007a) there is only one large supermarket in Iquitos: e*l Pirámide, a* 200m² grocery that specializes in the sale of conserves such as canned goods, pastas and snacks (Lopez Rios, 2010). There are several other small shops, *minoristas*, located just outside Belén market on the street *Jirón Abtao* (see Figure 2.2)*,* which specialize in selling conserves, grains, and staple vegetables such as tomatoes and onions. However, for fresh fish, poultry, meat and a variety of fruit and vegetables Belén market is the main source. The lack of large supermarkets in the city means most people either shop directly in one of the city's markets or at one of the *minoristas* - who re-sell products bought from Belén market.

It is difficult to estimate the volume of sales, diversity of products and economic revenues generated by Belén market given the informal and irregular nature in which most transactions occur. Merchants do not share their records of the products they buy and sell. Some boat operators record the products they transport in order to properly collect cargo fees,

but they are not required to share this information with any regulating bodies[5]. The Peruvian Ministry of Agriculture (Ministerio de Agricultura, 2009-2010) records the prices of select agricultural products sold in Belén market three times a week, but they do not keep a register of the volume of products arriving in the market, or of market sales. Moreover many regional specific products sold in quantity, for example palm fruit and charcoal, are not recorded. The Instituto Nacional de Estadística e Informática (The National Institute for Statistics and Information) tracks information on average income and primary occupation of Belén residents, and provides information on agricultural production for the province of Maynas INEI (2007b). This is useful for understanding the proportion of Belén residents involved directly in the economic life of the market, however the data fall short of quantifying the economic contribution of the market to the local Iquitos economy. The Instituto de Investigaciones en la Amazonía Peruana (Institute for Research in the Peruvian Amazon), IIAP (2006), ran a program until 2008, *SIFORESTAL,* which provided general information about Belén market, and tracked daily prices of the most important and widely commercialized products. But, similar to the Ministerio de Agricultura, they did not gather data on volume of sales. Indeed despite overwhelming agreement in the literature that Belén market is of high importance to the local economy, it is difficult to quantify exactly what that means.

Given the lack of quantitative data on Belén market, any estimate of volume of trade is necessarily rough. Nevertheless, using average *colectivo* weight capacities and trip frequencies (Cohalan 2007, Chapter 2, pp. 31 and Chapter 3, pp. 78)[6] we estimated weekly trade of agricultural and forest products in Belén market to be between 550 to 730 metric tonnes. To arrive at this estimate we summed the total weekly cargo capacity in tonnes from all *colectivo* routes. We considered only the *colectivo* cargo given that only these small boats are able to navigate through the narrow and shallow Itaya River passage leading to Belén Port and offload their cargo directly into the market. Although not all *colectivos* dock in Belén port (many dock at the larger *Puerto de Productores*), much of what they transport, including more perishable items such as fresh fish and game, and jungle fruit (Salonen, 2012; Cohalan,

[5] To the author's knowledge boat operators record cargo details for the sole purpose of collecting cargo fees. A distinction should be made between cargo records and weight and passenger count records. Restrictions are imposed on the latter and are governed and fiscalized by the Belén port authority, as observed during boat trips to and from the Tahuayo.

[6] Boat weight capacities and frequencies were calculated from interviews with *colectivo* operators conducted between June and September, 2005 while either riding aboard the river boats or at portside. From these interviews the author identified all colectivero trading routes and total weekly boat capacity (i.e., the total capacity from all boats combined multiplied by the number of trips to Iquitos per week).

2007), nevertheless ends up being sold in the Belén market[7]. Based on cargo to passenger ratio observations while riding aboard *colectivo*s from the Tahuayo River to Belén market between June and August, 2011, and observations in Belén market and Puerto de Productores we assumed that boats operate half full of cargo and half full of passengers and that half to two thirds of all products arriving in the Iquitos ports via *colectivo* are destined for Belén market. Given the heterogeneous and variable mix of products sent to market over the seasons, we rely on the volume of trade in metric tonnes rather than attempt to estimate the value of such trade.

In addition to the large volume of trade that occurs in Belén, the market is also noteworthy for its large diversity of agricultural and forest products. A recent study by the Rainforest Conservation Fund (Parades & Mejía, 2009) inventoried a total of 390 different agricultural and forest products over a four month period alone. The authors used random sampling to take daily inventory of the products offered in Belén market over the four month period. Of the total products inventoried, 231 were of vegetable origin, 157 were of animal origin, and two were minerals. Moreover, the authors determined that 84% (n=328) of these products were of local origin, whereas the remaining 16% (n=62) originated from other locations throughout Peru. With the exception of the most commercialized products such as plantain, yuca, and aguaje, most of the products inventoried do not show up in any local or regional statistics. The lack of concrete quantitative information on Belén market, the most important regional market in the Peruvian Amazon, is perhaps a reflection of its informal organizational structure and regulation.

According to the IIAP SIFORESTAL program (IIAP, 2006), anyone seeking commercial space in Belén must officially solicit a vendor's license with the local mayor's office. The cost of renting a space can range between S/.0.50 and S/.2.50 (approximately USD$0.19-$0.95; (Exchange rate Central Reserve Bank of Peru, 2012)) depending on the location of the space. As of 2006 the number of registered vendors surpassed 4,500 with 70% women, 20% men, and 10% children (SIFORESTAL, IIAP 2006). However, unofficially the number of people directly employed by commerce in Belén market is likely to be closer to 6000 when the unregistered vendors such as middlemen (*rematistas*) selling out of their homes, wholesalers and retail merchants are taken into account. In 1987, Padoch estimated a total of 6000 retail vendors and several hundred wholesalers working out of Belén market

[7] While the larger river boats, *lanchas*, which dock in Puerto Masusa, do carry some less perishable agricultural and forest products such as salted meat and fish, manioc and plantain, and citrus fruit, the bulk of their cargo is comprised of construction materials and manufactured goods from other parts of the country (Cohalan 2007: IIAP 2006) and, therefore, we assume their impact in Belén market to be negligible.

(Padoch 1987), and the most recent census data suggests that, 20 years later, these numbers have barely changed. In 2007 the INEI census, for example, estimated that a total of 5,202 people among the working aged urban population in Belén district held a primary occupation in personal services or as vendors (either in the market or commercial center), corresponding to 27% of the total employed urban population. In addition, the census found that a total of 6,545 people were employed in commerce in some way (INEI, 2007b).

2.4.1.4 Relationship between Belén market and the Tahuayo

Residents of the Tahuayo River maintain a strong connection to Belén market. Results of our 2011 household surveys from four Tahuayo villages indicate that Belén is the most important market for residents of the Tahuayo. Respondents were asked to identify which market they sold to most frequently for select products (rice, yuca, plantain, grain maize, cob maize, aguaje, umari, watermelon, and charcoal). Of the total applicable responses (n=181) 82% indicated Belén as the primary market, followed by other markets (11%) and Tamshiyacu (7%). The relatively large percentage of 'other' responses includes those who indicated they sell in small quantities to neighbours and neighbouring villages and 3% who indicated they sold rice to the mills in Tamshiyacu and Puerto de Productores, Iquitos.

Belén is the only Iquitos port that Tahuayo River boats stop in when coming into the city. The boats strategically dock at the edge of the Itaya River which runs into *Calle Jirón Itaya*, one of the main commercial streets in the lower Belén market (Figure 2.2), which facilitates the buying and selling of Tahuayo products. Taken together, the Tahuayo boats make a total of nine trips to Iquitos each week (three trips per boat). Assuming each boat operates with half its capacity in cargo and the other half with passengers (see Table 2.5 for carrying capacity of Tahuayo River boats), the Tahuayo boats transport up to approximately 58.5 tonnes of agricultural and forest products to Belén market each week.

2.4.2 Commercialization of agricultural products by *ribereño* households within a day's travel to Iquitos: the case of the Tahuayo River

In order to better understand the organization of Belén market vis à vis the commercialization of agricultural and forest products from surrounding communities, it is necessary to understand how products are brought to market and the actors involved. This is also useful for better understanding how prices are determined (Section 2.4.3) and will serve as a point of departure for identifying potential channels through which price information reaches Tahuayo communities (Chapter 3).

Figure 2.4 below illustrates the commercialization process from start to finish for communities within a day's travel to Iquitos.[8] The flow of products between actors, the incurred transaction costs and earnings associated with a trip to the market are represented by the rows, whereas the various stages of the commercialization process and corresponding activities that take place at each stage are represented by the columns. The second row illustrates a typical path taken by *ribereños* to sell their products in Belén market (Figure 2.4, solid lines). Alternate, less common paths are highlighted by the dashed lines. Typically products are brought to market on either small private motorized boats (*peque-peques*) or owner operated small public transport river boats (*colectivos*). Peque-peques are most often the mode of transport of choice for communities closest to Iquitos or those which the *colectivos* do not serve. For *ribereño* households along the Tahuayo, products are almost always transported by *colectivo.* Upon arrival into Belén port and market, *ribereños* generally sell their products to dockside middlemen (*rematistas*) who, in turn, either sell these products in small quantities directly to consumers, or resell the bulk product to small-scale retail vendors in the market (*minoristas*) or wholesalers just outside the market (*mayoristas*).

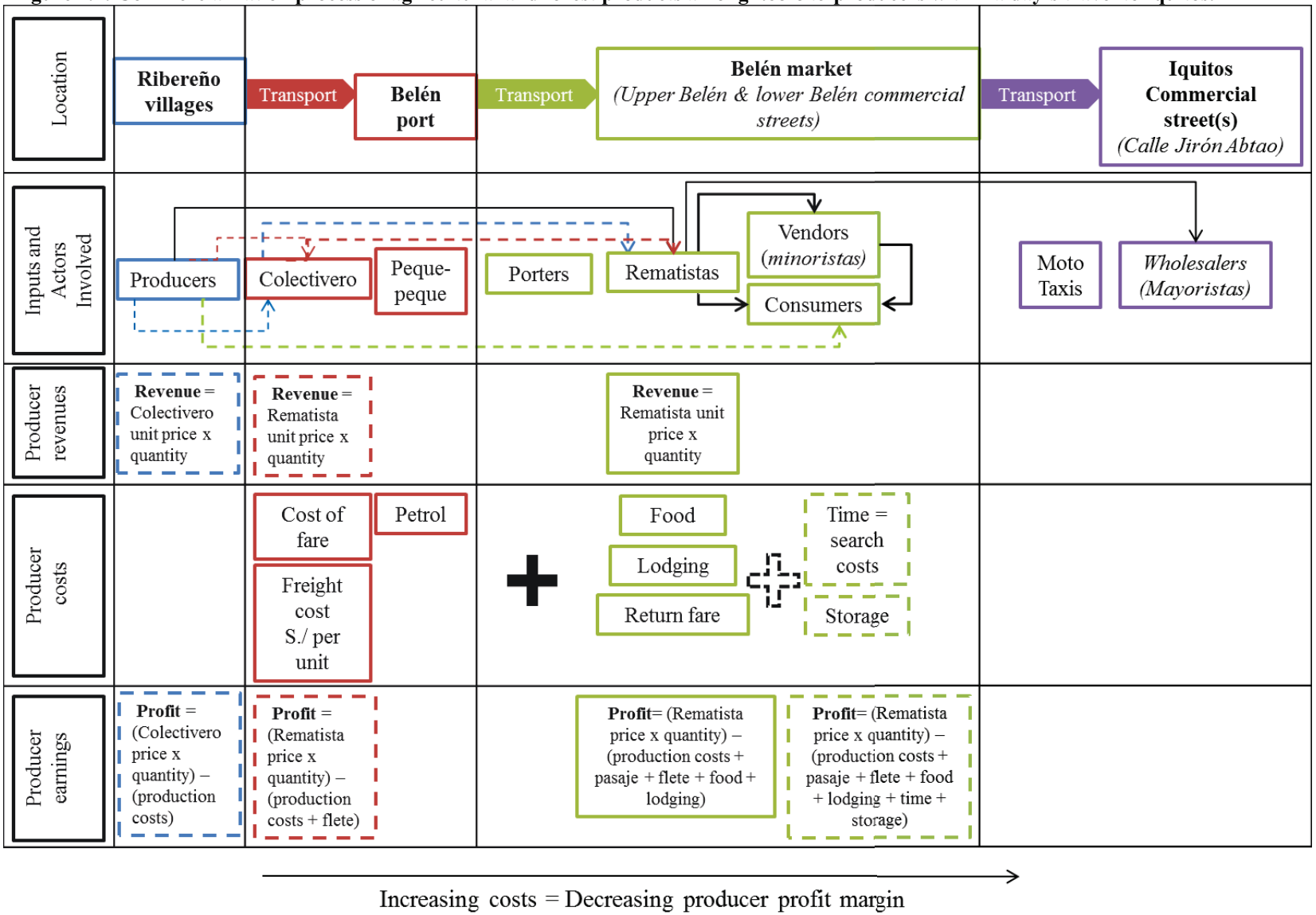
2.4.2.1 Costs of doing business

There are many costs associated with a trip to the market and these costs are an important part of the household decision making process when determining whether it is profitable to make the trip to Iquitos. As is typical of peasant households (de Janvry, et al., 1991), *ribereños* face negative terms of trade when selling products in the market, wherein the prices they earn for the sale of primary products is a fraction of the purchase prices for manufactured household items. The terms of trade depend on costs including transportation to and from the market, mark-ups by merchants, and the opportunity cost of time involved in selling (search costs) (de Janvry, et al., 1991, p. 1402).

Starting with transport fees, (Figure 2.4, producer costs; red boxes) *ribereños* from nearby villages who travel to the market in a privately owned *peque-peque* must consider the cost of fuel, whereas households that use the *colectivo* service must pay both a trip fare (*pasaje*) and cargos fees per unit of product (*flete*). For all destinations along the Tahuayo the *colectivos* charge S/.7 Nuevos Soles per person in either direction ($2.50 USD). Cargo fees are determined by the average weight and size of products and by distance to Iquitos but are

[8] For a more detailed account of the commercialization process, including river transport and communities further than a day's journey from Iquitos see Salonen *et al.* (2012); Cohalan (2007); Coomes (1992) and Padoch (1987).

Figure 2.4: Commercialization process of agricultural and forest products among *ribereño* producers within a day's travel to Iquitos.



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consistent across all boats serving a given region (see Table 2.7 for *flete* prices of commonly traded products along the Tahuayo and Photos 2.6 and 2.7 for how products are loaded onto the *colectivos*).[9] These fees are quite sizeable considering the average daily wage in the region is only between S/.10 ($3.60 USD, with lunch included) and S/.15 Nuevos Soles ($5.34 USD, with no lunch). Not surprisingly rural households interviewed along the Tahuayo stated that cargo fees were an important factor in deciding whether to bring products to market or not, generally saying that the trip to Iquitos was only worthwhile if they had a large quantity of product to sell in order to compensate for the costs of going to the market.

In addition to transport fees, producers must also consider the costs associated with spending a night in Iquitos. As explained earlier (see Section 2.3) the *colectivos* alternate between going upstream one day and downstream the next. Thus when *ribereños* arrive in Iquitos they must wait until the next day for the boat to return to their village, which adds additional costs to the trip. These costs include meals, lodging (if they do not have family in Iquitos), and transportation within the city (Figure 2.4, producer costs green boxes). A meal in Belén market can cost up to S/.5 Nuevos Soles ($1.80 USD), and transportation within the city generally costs between S/.2 and S/.3 Nuevos Soles ($0.71 and $1.06 USD) per trip. Taken together, transport fees (fare and cargo), and costs associated with spending a night in Iquitos (lodging, food and transport) add up to more than twice the average daily wage in Tahuayo River villages.

2.4.2.2 Making the sale: from *ribereño* village to Belén Market

There are several channels through which producers can sell their products. The most common is to sell to the *rematista*s who are the first point of sale for producers once they arrive into port. Photos 2.6 to 2.17 illustrate the process of bringing products to market on the *colectivo* and selling them to the rematistas. Some *rematistas* do not even wait until the boat has reached port and instead prefer to start bartering for products as the *colectivos* make their way along the Itaya River into the city (Photos 2.8 and 2.9). In these instances the *rematistas* use *peque-peques* to catch up to the vessel and scan its cargo while it is in the middle of the river. If a product interests them they jump onboard with the hope of getting a head start on haggling prices with little competition. They generally work in teams of four or five; with one steering the boat while the others daringly jump onboard. Upon arrival in port an even larger crowd of *rematistas* and porters awaits on the shores (Photos 2.10 and 2.11). At this point it

[9] Interviews with boat operators from the Tahuayo revealed this to be the case. This was also noted in Cohalan (2007).

Table 2.7: Cargo fees for agricultural products commonly brought to market by Tahuayo Households, July, 2011.

Product	Cargo fees	
	Nuevos Soles	US dollars ($1= S./2.807)
Yuca[a] (sack)	2.00	0.70
Plantain[b] (raceme)	1.00	0.40
Aguaje[c] (sack)	2.00	0.70
Charcoal[d] (sack)	0.70	0.20
Corn[e] (sack of ears)	2.00	0.70
Maize[f] (sack of grain)	2.00	0.70
Rice[f] (sack)	3.00	1.10
Watermelon[g] (per hundred)	30-50	10.70-17.80

[a]A sack of yuca weighs approximately 50kg. Sacks of yuca larger than 50kg are charged 3 Soles.
[b]A racine of plantains typically holds 50-70 plantains and weighs between 15-20kg.
[c]A sack of aguaje weighs approximately 50kg
[d]A sack of charcoal weighs approximately 20kg
[e]There are 100 corn ears in each sack
[f]A sack of grain maize or a sack of rice weigh approximately 50kg
[g]A watermelon weighs approximately 3kg

Photos 2.6 to 2.17: Typical process of bringing products to market aboard the *colectivos*

Photos 2.6 & 2.7 Loading products (charcoal) onto the *colectivero* at *ribereño* village ports, Tahuayo River.

Bartering in Iquitos: the *Rematistas*

Photos 2.8 & 2.9 *Rematistas* use *peque-peques* to reach the *colectivo* as it approaches Iquitos, and jump onboard to start negotiating prices.

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Photos 2.10 & 2.11: *Rematistas* and porters swarm the *colectivero* as it comes into port to start negotiating prices.

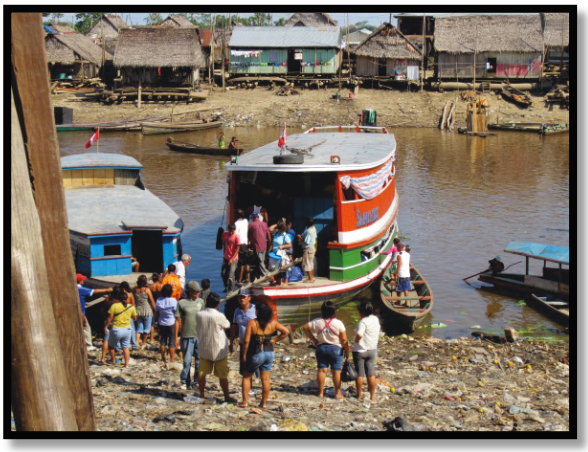

Photo 2.12 (left): Team of r*ematistas* negotiating with a producer as the boat rolls into port.
Photo 2.13 (right): The pressure to accept the *rematista* offer. A producer is not satisfied with the bid, but the *rematistas* are not taking "no" for an answer.


Photo 2.14 (left): A porter offloads bags of charcoal from the *colectivo* to be sold in Belén market.
Photos 2.15 (right): Charcoal recently offloaded from the *colectivero* waiting to be taken to a buyer.


Minoristas, market vendors

Photo 2.16: Plantain waiting to be sold on *Calle Venecia* (Venice Street).
Photo 2.17: *Calle Jirón Itaya* (Jirón Itaya Street), the main commercial street in lower Belén.


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can become quite chaotic with people climbing through the windows and the front exit, none of which appear concerned with letting the *colectivo* finish docking first. In a matter of minutes deals are made (Photos 2.12 and 2.13) and the porters quickly get to work offloading products onto the main commercial street *Jirón Itaya* in Lower Belén (Photos 2.14 and 2.15). Once the products have been bought by *rematistas* they will either be sold, once again, in wholesale to restaurants or small grocery shops on *Calle Jirón Abtao* or be sold directly to consumers in the market by either large-scale vendors, *mayoristas,* or small-scale, *minoristas* (Photos 2.16 and 2.17).

The *rematistas* are not very well liked or trusted by producers and are locally referred to as either "*rob*-atistas" or "pañas" (literally meaning piranha) for offering such low buying prices and allegedly paying with fake bills. Indeed buying can be aggressive, and producers hold little bartering power and receive little respect. Yet selling to the *rematistas* is generally the only option. Without a fixed buyer, the alternative is to offload products in the market and try to sell them oneself, is too risky and time consuming (Figure 2.4 green dotted arrow and boxes). Upon arrival into Belén market producers are already in debt to the *colectivero* for their fare and cargo and, for most, the only way to pay these fees is to sell their products. Even if it is possible to pay these fees without selling their product, the producer will encounter search costs associated with trying to find a buyer in the market. Furthermore, if they are not able to sell the whole product they will have to pay storage costs or worse, risk theft or return to their village with the product.

Despite the negative image of *rematistas* as portrayed by producers, they are by no means well-to-do and "face many daily risks trying to make a modest living in the city" (Padoch, 1987:62). Indeed *rematistas* incur many costs of doing business including paying porters to offload products from the *colectivero* and transport them within the market, and the cost of maintaining storage facilities. In addition they are faced with relentless competition and must be constantly monitoring supply and demand in the spotty market (Chibnik, 1994 Padoch, 1987).

Another type of transaction that is fairly common in rural areas of the Peruvian Amazon is a type of sell order called *encomienda* whereby a household sends products to the market with the *colectivero*, who assumes the responsibility of carrying out the sale and returning the revenues on the next trip to the village (Figure 2.4 dotted maroon boxes and lines). Although households must still pay cargo fees when selling a product via *encomienda* they save on their fare and spending in the city in addition to the time they would have lost from the trip. The downside is that there is no incentive for the *colectiveros* to search for the

best price and they will generally accept the first price offered by the *rematista* (interviews with *colectiveros,* 2011). Households interviewed along the Tahuayo stated a preference for selling products by encomienda when they only had small quantities to sell in order to save on trip costs and thereby secure a higher profit margin.

Less frequent, but still noteworthy, are sales from a producer to a *colectivero* at the village port (Figure 2.4 dotted blue boxes and lines). These transactions are more sporadic and opportunistic, meaning that negotiations and sales take place on the spot as opposed to having been pre-negotiated. This type of transaction most often occurs when the price is good in the market, allowing the *colectivero* to turn around and make quick profit. Among *ribereño* households surveyed in the four study villages along the Tahuayo, 14% (n=10) reported to have sold their product this way at least once during the past year. Although the price offered by *colectiveros* is lower than what *rematistas* would offer in Iquitos, the *colectivero* exchange eliminates the risk the producer would have incurred from going to the city and either not being able to find a buyer for the product once they arrive, or earning less profit for the same product after paying for travel costs. Conversely, in Iquitos a household faces the risk of not finding a buyer, or finding a buyer but earning less money after discounting for boat fare, cargo fees, meals and lodging. During informal interviews with four *colectiveros* (the three Tahuayo *colectiveros* and one servicing the Amazon) all four reported buying products from producers in the community ports and re-selling them to *rematistas* in Belén market. Moreover, two of the four reported having pre-arranged informal agreements with buyers to sell to them at a specific price, for certain products (notably charcoal). The existence of these arrangements with buyers means that the *colectiveros* also experience minimal risk in the business deal.

2.4.3 Price Variations of Agricultural Products

Prices for the products sold in Belén market can vary substantially from day to day and week to week depending on seasonality and market supply. Boats from nearby communities arrive at all hours of the day, including through the night. Anecdotal evidence derived from interviews with Tahuayo boat operators and members of the Belén community including two *rematistas*, suggests that prices also vary throughout the day from morning to night depending on the quantity of boats and products arriving. In late August, 2011 one Belén resident informed me that she had bought a basket of yuca the day before for 5 soles. The following day, the same basket of yuca from the same vendor cost her 7 soles and she couldn't explain why. Within the market prices can also vary from one vendor to the next

according to subtle quality differences and the location of the stall. For example on June 16, 2011 I observed the price of salted *paiche* (*Arapaima gigas*) – the largest and most expensive fish in the Amazon – from three different vendors in three different locations in the market. On appearance there were no differences in the quality of product between the three vendors, yet each vendor was selling it at a different price per kilogram: 20 Soles, 22 Soles and 24 Soles (~$7.12, $7.83, and $8.55 USD).

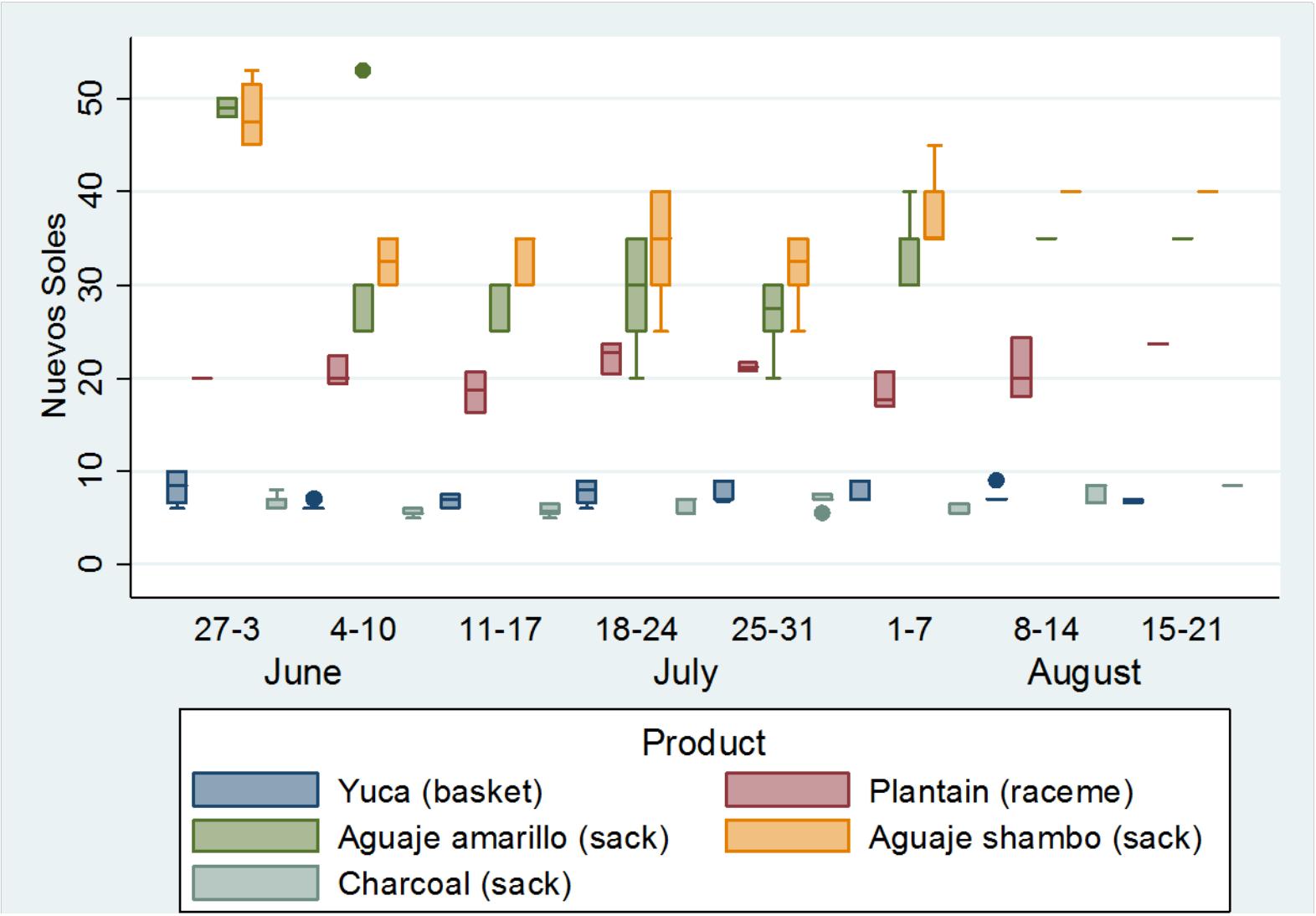
In order to understand the networks that facilitate information access about market prices to rural households along the Tahuayo, it is important to understand how prices vary over time. In this section we analyze the variation in *rematista* buying prices (FOB – Free on Board - prices) in Belén market of yuca, plantain, charcoal, and aguaje.

2.4.3.1 Price variation in Belén market

Results from our analysis of price variation over the study period show that prices can vary markedly during any given week, particularly for aguaje (Figure 2.5). For example during the week of July 18th to the 24th the observed price of a sack of aguaje amarillo (the less valued variety) ranged from S/.20 to S/.35 ($7-12 USD) and the price of a sack of aguaje shambo (the larger, tastier and more valued variety) ranged from S/.25 to S/.40 ($9-14 USD). The average price increased at the beginning of August, corresponding to a seasonal decline in output. The presence of outliers in early July marks unusually high prices observed during that time.

Charcoal had the lowest price range throughout the entire study period, with the price of a sack ranging between 5 and 8.5 Nuevos Soles ($1.78 and $3.03 USD). The highest prices for charcoal were observed in late July to mid-August. Similarly, the price of a basket (*panero*) of yuca remained relatively stable throughout the study period with a price ranging between 6 and 10 Nuevos Soles ($2.14 and $3.56 USD). The price ranges were largest for aguaje amarillo and aguaje shambo. The price of a sack of aguaje amarillo ranged between 20 and 53 Nuevos Soles ($7.12 and $18.88 USD), and the price of a sack of aguaje shambo ranged between 25 and 53 Nuevos Soles ($8.91 and $18.88 USD). Finally, throughout the study period the price range of a raceme of plantain was lower than that of either type of aguaje, but larger than either charcoal or yuca, and ranged between 15 and 24 Nuevos Soles ($5.34 and $8.55 USD). The price of aguaje amarillo fluctuated most throughout the study period as demonstrated by the largest coefficient of variation (CV=0.2102), followed by charcoal (CV=0.1649), yuca (CV=0.1602), aguaje shambo (CV=0.1586) and plantain (CV=0.1504).

Figure 2.5: Weekly price variation in Belén market of select agricultural product throughout June, July and August 2011.



Note: With the exception of plantain, prices refer to what *rematistas* were offering producers. Wholesale market prices from the Ministry of Agriculture were used to observe plantain price trends because of a lack of *rematista* data in our dataset. Although *rematista* prices would be slightly lower, the trends should look the same.

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Anecdotal evidence from Ms. Aguilar, our field assistant in Belén market, and from the Tahuayo boat operators suggested that Fridays are the busiest travel day for *ribereño* producers coming to the market to sell their products. We hypothesized that prices would be lower on Fridays presuming that *rematistas* know there will be a lot of product arriving that day. To test this hypothesis we conducted an analysis of variance (ANOVA) for each product to determine whether there was greater variation in price on specific days of the week relative to overall price variation. However, despite the perceived increase in market supply on Fridays, our results show that there is no significant statistical difference in price according to the day of the week, given the large variance in daily prices of market products (Table 2.8).

2.4.3.2 Price variation across markets in Iquitos

An analysis of daily FOB prices (i.e., the price of the product including the cost of transportation from the community to the market) in Iquitos throughout the course of a year, in 1998, demonstrates how prices vary across three major markets in Iquitos: Belén, Productores, and Masusa (Figure 2.6). Product prices are consistently lower in Puerto Masusa for all products (with the exception of charcoal, which is not sold in Puerto Masusa). This difference in price is especially evident for yuca and aguaje. Prices in Belén and Puerto de Productores do vary at times, but they follow a similar seasonal pattern.

2.4.3.3 What explains price variations?

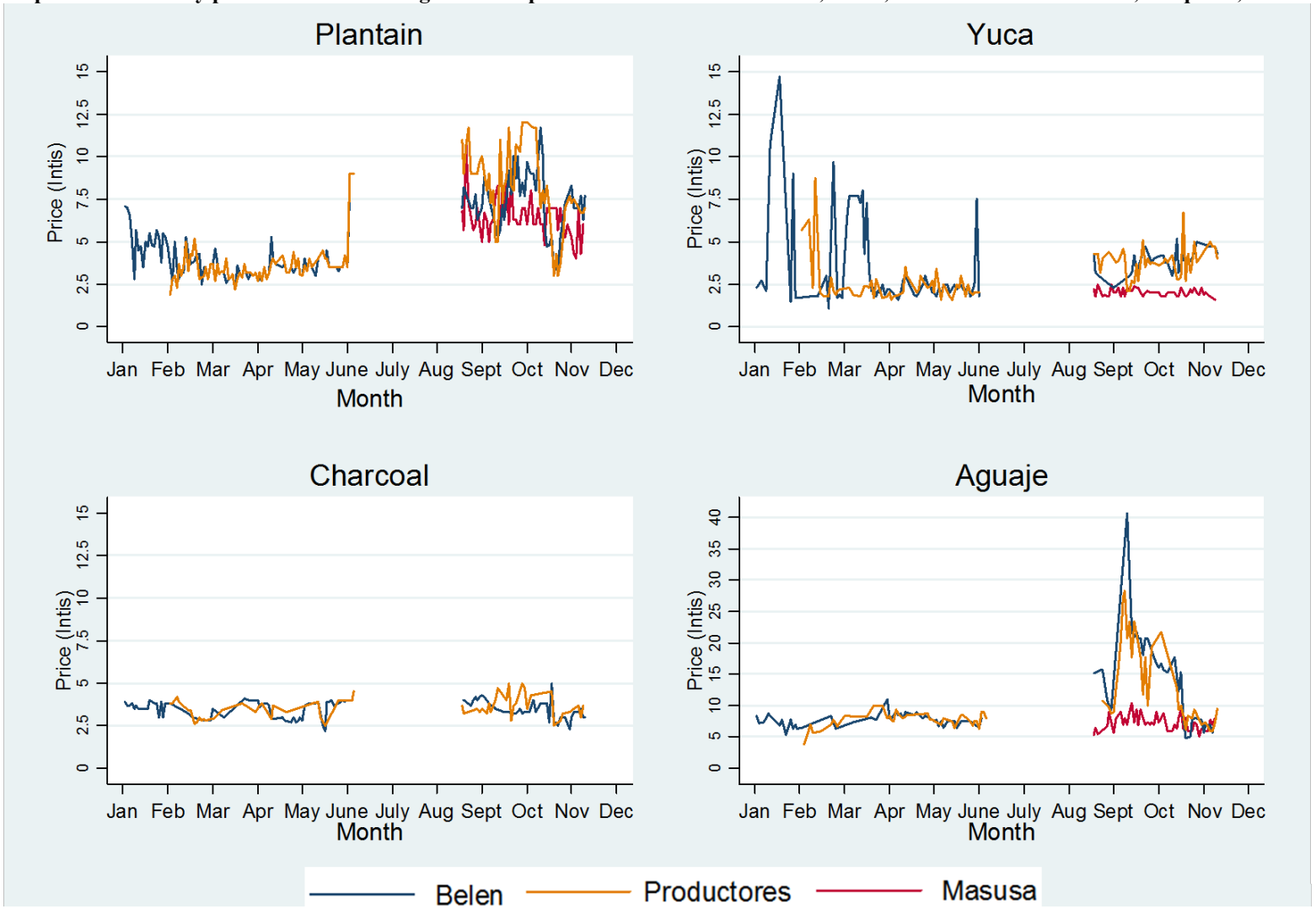
During interviews with Tahuayo households in the study communities it was frequently commented that *rematistas* get together to fix prices. In other words there is a common belief among producers that prices are determined informally between groups of *rematistas* and there is little (if any) variation in what they offer. Although it is true that there is relatively little variation in the prices *rematistas* offer (as observed in the 2011 market price data), the *rematistas* are in constant competition with one another for produce and, therefore, have little to gain by collectively setting buying prices. The lack of price variation among *rematistas* is more likely a consequence of the high risks they incur and the small profit margin they earn per unit on wholesale transactions (Chibnik, 1994: 66; Padoch, 1987) leaving them with little room to negotiate. While holding informal conversations with a charcoal *rematista* and an aguaje *rematista* in late August, 2011 both said they do not engage in price fixing with other *rematistas*. According to the charcoal *rematista*, it doesn't make sense for him to engage in price fixing with other *rematistas* because there will always be someone willing to offer a higher price, and he would lose out.

Table 2.8: Analysis of variance in daily product prices (ANOVA), Belén market, June-August, 2011.

Product	N	Mean	Std. Dev.	Degrees of freedom	F	P-value
Yuca (basket)[a]	46	7.38	1.18	5, 40	1.42	0.237
Plantain (racine)[b]	34	19.67	2.96	2,31	0.00	0.9978
Yellow aguaje (sack)[c]	44	32.18	6.77	5,38	0.70	0.6275
Shambo aguaje (sack)[c]	43	36.81	5.84	5,37	0.47	0.798
Charcoal (sack)[d]	47	6.71	1.11	5,41	0.34	0.8849

[a]A basket of yuca weighs approximately 12.5kg.
[b]A racine of plantains typically holds 50-70 plantains and weighs between 15-20kg.
[c]A sack of aguaje weighs approximately 50kg.
[d]A sack of charcoal weighs approximately 20kg.

Figure 2.6: FOB prices received by producers for select agricultural products across three markets, Belén, Productores and Masusa, in Iquitos, Peru 1998.



Note: One Nuevo Sol was worth an average of $2.94 USD in 1998. (Central Reserve Bank of Peru, 2012)
Source: Data provided by O. Coomes from "Voz de la Selva" radio program, 1994-1998.

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Overall, market supply is generally acknowledged as the primary driver of price fluctuations in Iquitos' markets. Demand in Iquitos for staple agricultural food products, especially yuca and plantain, and certain forest products such as charcoal is fairly inelastic. Products coming into Iquitos from *ribereño* villages are not exported beyond the city, thus demand for agricultural and forest products is driven by a relatively steady urban population and their consumption patterns (Chibnik, 1994; Padoch, 1987). An overabundance or shortage of these crops in the markets can have a significant impact on prices. Variation in supply can largely be attributed to seasonal production cycles and varying flood patterns among the region's three major watersheds: the Ucayali, the Marañón, and the Napo, which affect the harvests of surrounding *ribereño* villagers (Chibnik, 1994; Padoch, 1987), given that seasonal production cycles of lowland crops are dictated by river levels. As flood levels differ among the three rivers, an early harvest resulting from an unusually early flood period along one river can cause prices to drop in the market despite seemingly normal seasonal patterns elsewhere, which creates challenges for *ribereño* farmers who rely on seasonal production cycles to estimate prices in the market (Chibnik, 1994). The difference in flood levels along the major rivers may also explain the distinct prices in Puerto Masusa, given that boats arriving into Puerto Masusa transport people and products from villages along the upper Marañon and Ucayali Rivers, more than a day's travel away. Conversely Belén market and Puerto de Productores receive boats from nearby villages along the Amazon River and affluents, less than a day's travel away.

To examine the relationship between cyclical river patterns and prices in the market we compared daily FOB prices (Free on Board, i.e., the price of the product including transportation costs) in Belén market for plantain, yuca, charcoal and aguaje between June 1994 and November 1995 with Amazon River levels at Iquitos (Figure 2.7). When the river level reaches its lowest at the start of the low water season (*época de vaciente*), between late-August and October, there is a spike in the price of staple food products, notably yuca and plantain. Similarly, throughout the year the price of plantain and yuca appear to follow a cyclical pattern whereby as river levels start to fall, prices increase and as river levels start to rise, prices decrease. In general, the price of aguaje increases as river levels rise and decreases as river levels fall. However, the price of aguaje appears to be very sensitive to sharp changes in river levels, a slight decrease in the river level has the effect of a sharp increase in the price of aguaje in Belén market. Finally, the price of charcoal in Belén market is relatively stable throughout the year and does not appear to follow river level variations.

Figure 2.7a: Price variation of plantain and yuca in Belén market (FOB) compared with annual river level patterns, 1994-1995.

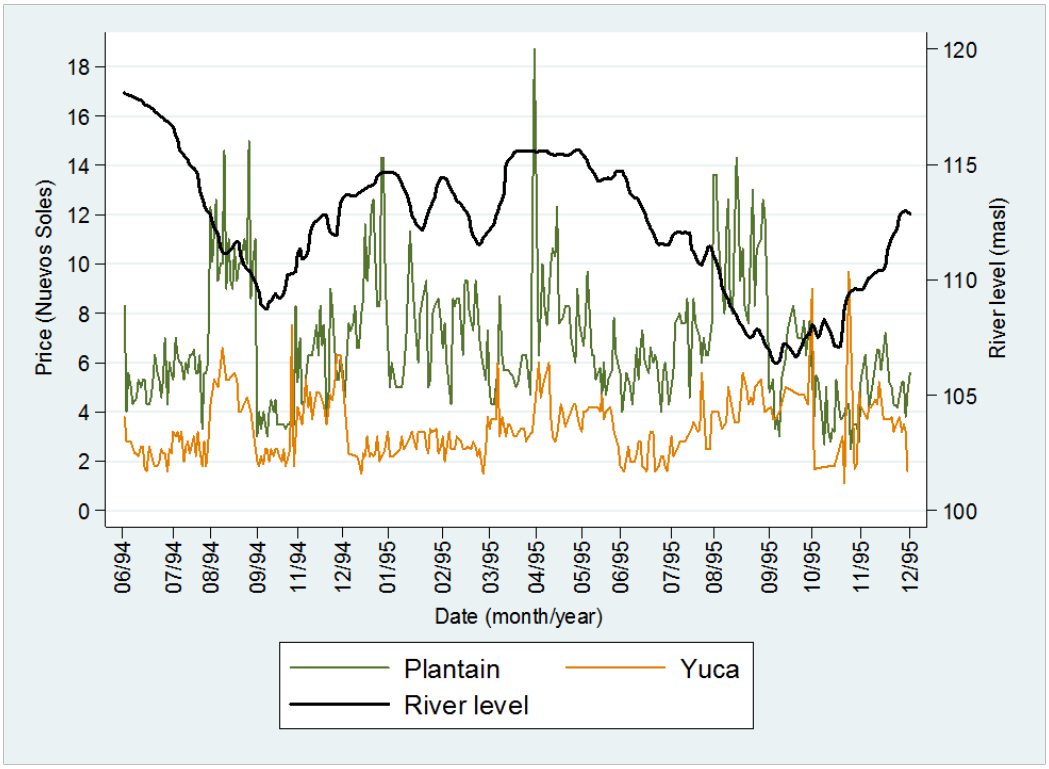
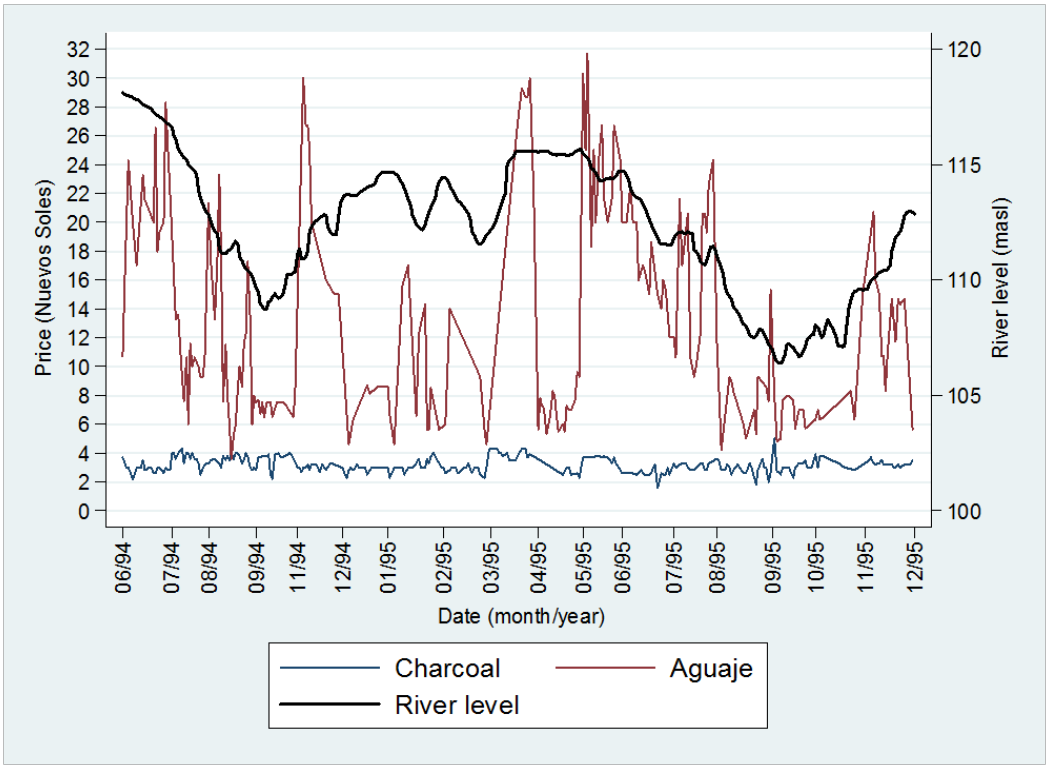


Figure 2.7a: Price variation of charcoal and aguaje in Belén market (FOB) compared with annual river level patterns, 1994-1995.



Note: The average value of 1 Nuevo Sol in 1994/1995 was $2.22 USD (Central Reserve Bank of Peru, 2012). This graph only includes days in which comparable river level and price data were available, which is why some months are missing and why some months appear shorter than others.
Source: Price data provided by O. Coomes from "Voz de la Selva" radio program, 1994-1995. River level data at ENAPU station (Iquitos) from Servicio de Hidrología y Navigación de la Amazonía de la Marina de Guerra.

The price variations we observed during the three months of fieldwork in 2011 appear to support the causal reasoning of seasonal production cycles. During interviews with *ribereño* households along the Tahuayo respondents were asked to recall the months in which they generally sell each product. With respect to aguaje, the months that were named most frequently were May, June, July, and August corresponding to the period of *vaciente* (low river levels). With respect to plantain and yuca, staple food crops, most households were not selling either product during the study period but rather were harvesting for consumption purposes only. Interestingly many households interviewed in the sole lowland community, Tapira Nuevo I, commented that 2011 had been plagued with an unusually long flood season, delaying plantain and yuca harvests. As for charcoal prices, household responses to when they sell charcoal did not show a clear monthly pattern. Unlike perishable crops, charcoal can be kept for some time waiting for the right price or opportunity to take it to the market. Anecdotal evidence from household interviews suggests that the price of charcoal during the study period was at an all-time high, but opinions varied as to why that was.

Finally, daily and weekly price variations can largely be attributed to irregular and sometimes unpredictable boat schedules. The arrival time into port can vary according to weather, river levels, and quantity of passengers (a reflection of the number and length of stops). Where information dispersion between the various rural regions of Loreto is scarce, farmers and middlemen cannot predict how much product will arrive in the market on any given day. When many boats arrive at the same time the sudden influx of product to the market will cause a sudden drop in price.

2.5 Discussion and Conclusions

The aim of this chapter was to describe Belén market including its history, commerce, and relationship with the Tahuayo River. A review of the literature revealed that Belén's location along the calm Itaya River and proximity to the Amazon made it an ideal location for small river boats to dock when arriving into Iquitos. The petroleum boom during the 1970s played a key role in Belén's growth. During that period the district population grew as a result of rural in-migration fuelled by the prospect of jobs associated with the economic boom. Despite the shortly lived duration of the petroleum boom the increased population in Belén and Iquitos during that

time ensured a steady demand for forest and agricultural products from surrounding rural communities long after the petroleum boom ended.

In spite of the long history of commercialization in Belén and its regional importance, market activities continue to operate very informally with little regulation in the way of quality control for the products sold, or for managing market prices. The lack of formal organization ensures a competitive environment in terms of market trading, with high risks and dominated by small teams of middlemen (*rematistas*) who engage in price negotiations with rural farmers. Market transactions occur sporadically and unofficially which means that for the most part trade goes undocumented. Indeed, an analysis of secondary sources, including the Ministry of Agriculture, the National Institute for Statistics and Information (INEI) and the Institute for Research in the Peruvian Amazon (IIAP) revealed little quantitative evidence pointing to the volume of sales occurring in Belén market and proportional contribution to the local economy. Nevertheless, using average weight capacity and frequency of *colectivo* boats in Belén market we estimate that between 550 and 730 metric tonnes of agricultural and forest products arrive in Belén market every week. Moreover, the number of people directly or indirectly employed by Belén market, approximately over 6000 or 24% of the working age population in Belén district clearly indicate its importance to the local economy.

The Tahuayo River was used as a case study to better understand how rural households are linked to Belén market in terms of agricultural and forest product sales, and as a reference point to discuss price uncertainty and price fluctuations in the market. Previous studies suggest that prices can and do fluctuate significantly in Belén depending on seasonality and quantity of a given product arriving in the market on any given day. The findings of this study support these conclusions. Given the relative isolation of Iquitos from the rest of the country and the world, agricultural production from surrounding regions is almost always destined for local markets. As a result, urban demand is relatively constant and prices are largely a reflection of variation in supply caused by seasonal weather patterns and a reflection of a geographically dispersed population isolated by communication links to one another.

The analysis of market organization and price uncertainty provide an indication of the conditions facing rural farmers in trying to make a living from the sale of their produce. We acknowledge that additional barriers exist between Amazonian farmers and improved economic returns such as unequal access to land and resource endowments (Coomes, 1992; Coomes &

Burt, 1997), physical access to agricultural markets (Salonen, et al., 2012), and imperfect market information (see Chapter 3). This chapter provides some context in which to analyze information networks linked to access to market prices in the following chapter.

CHAPTER 3. ACCESS TO MARKET PRICE INFORMATION AMONG *RIBEREÑO* PRODUCERS AND IMPLICATIONS FOR HOUSEHOLD WELFARE: A CASE STUDY ALONG THE TAHUAYO RIVER

3.1 Introduction

For the rural poor throughout the developing world, access to information is an inherent part of household economic decision making and thus influences livelihood strategies. Information about prices in nearby agricultural markets, labour opportunities, new technologies, what to plant, where to plant, where to fish, among other things (Chibnik, 1994; Coomes, 2010; Ellis, 1993; Isaac, et al., 2007) help farmers determine how to allocate input resources to maximize returns. As rural peasants become increasing integrated into a market economy, the need for up-to-date market price information is particularly pertinent. However, rural peasants operate in imperfect markets where access to information is not replicated between time and space (Ellis, 1993). In agricultural markets this creates inefficiency (Eggleston, et al., 2002; Geertz, 1978; Jensen, 2010) as there is often a lag time between when prices are determined and when this information reaches rural communities. In the absence of formal information channels households must rely on their social networks to find the information they need. Thus, the search costs are high as people must take time away from production activities to seek information. In the Peruvian Amazon access to markets and market price information is further confounded by the lack of physical infrastructure, such as, roads to facilitate faster and greater mobility between regional centers, and modern communications technologies such as radio, telephone and internet.

Within the last decade, the increasing availability of information communication technologies such as internet and mobile phones has pushed researchers to examine their potential use in development (a concept commonly referred to as, "Information and Communication Technologies for Development" - ICT4D). Yet some researchers have warned that ICT projects for development often focus too much on the technology and not enough on ensuring they operate within established traditional networks (Clark, 2006; IIED, 2009). In recognition of this need for a more holistic approach to understanding peasant information access recent studies have turned to social networks as a tool to examine the role of information transfer in a wide array of social phenomena including: coping with resource scarcity among fishermen (Ramirez-Sanchez & Pinkerton, 2009), knowledge transfer in agroforestry practices (Isaac, et al.,

2009; Isaac, et al., 2007), household marginalization in agricultural extension programs (Hoang, et al., 2006), and, communication patterns among resource users (Crona & Bodin, 2006).

Within this context, the purpose of this study is to examine the channels through which market price information flows to *ribereño* communities along the Tahuayo River, in the province of Maynas, northeastern Peru, and determine the factors that contribute to household knowledge of actual prices in Belén market (accuracy). Demographic and socioeconomic household characteristics, including household age, land holdings, livelihood type, market orientation, and phone ownership (cell phone or landline), as well as village variables, including village size, village location, and *colectivo* access, are examined to address the following four questions.

1. How do *ribereño* households along the Tahuayo River access information about the market prices in Iquitos of yuca (*Manihot esculenta*), plantain (*Musa* spp.), aguaje (moriche palm fruit, *Mauritia flexuosa*) and charcoal?
2. How accurately are households able to estimate the previous week's market prices in Iquitos for four important staple crops: yuca, plantain, aguaje amarillo and aguaje shambo[10], and charcoal, on any given week?
3. Do certain household and/or village characteristics (e.g., households age, livelihood type, land holdings, percentage of income from market sales, income diversification, phone ownership, frequency of travel to Iquitos, whether or not the household has family in Iquitos, and village location) predispose households to possess more accurate knowledge of market price information?
4. How do *ribereño* households along the Tahuayo River value the role of access to information about market prices in Iquitos, in the production and commercialization of the products they sell?

The chapter is organized as follows. Section 3.2 presents a description of the study area and a review of past and present local initiatives to improve market price information access to rural villages in the Peruvian Amazon. Section 3.3 describes the methods used for data collection and analysis. Section 3.4 presents the results of a field study conducted in Amazonian Peru in 2011

[10] Shambo is the more valued variety of aguaje, whereas amarillo is the common variety. Aguaje shambo is slightly larger and more reddish in colour than aguaje amarillo, which is yellow, and is said to be tastier.

and is organized in correspondence to the research questions stated above. The chapter concludes with a discussion of the findings and avenues for future research.

3.2 Study area and research setting

3.2.1 Study villages

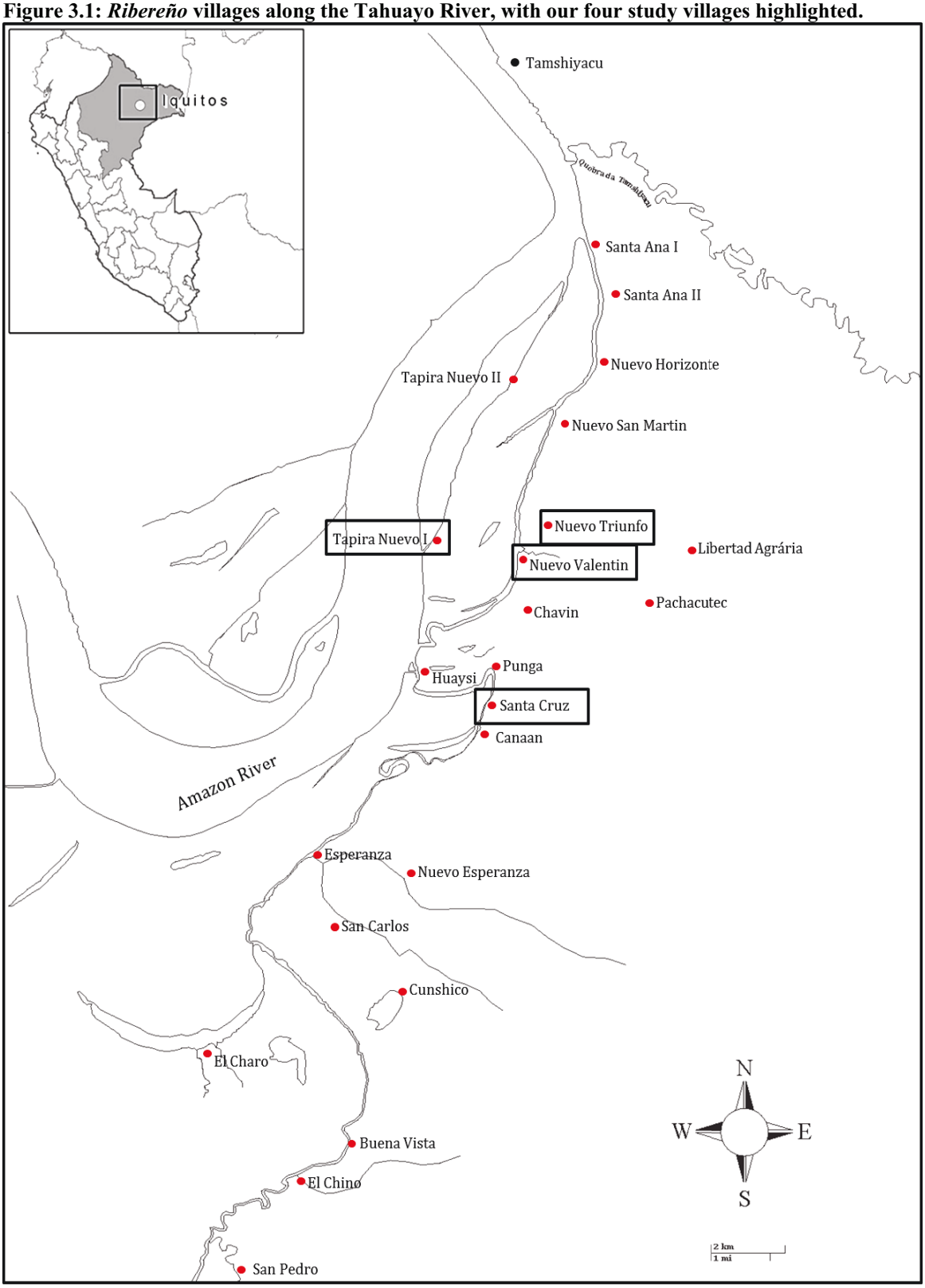
Research took place in two districts of the Loreto Region in the northeastern Peruvian Amazon: Belén and Fernando Lores. Belén is one of four districts that make up the largest urban center in the Peruvian Amazon, Iquitos. Work in Belén was concentrated in the district's largest market of the same name. Belén market is the primary market where Tahuayo households sell their agricultural and forest products (see Chapter 2). Fernando Lores is a largely rural region and work in this district was conducted with four *ribereño* villages along the Tahuayo River: Nuevo Triunfo, Nuevo Valentin, Santa Cruz and Tapira Nuevo I (Figure 3.1).

The villages of Nuevo Triunfo, Nuevo Valentin and Santa Cruz are all located directly along the Tahuayo River in upland areas known as "terra firme". By contrast, Tapira Nuevo I is located in the lowland Amazon floodplain. Previous to the 1990s the Tahuayo River had been a black water river separated from the Amazon River by a narrow levee. During the flood season in the early 1990s, the flooding Amazon River caused part of this levee to breech in front of the village of Huaysi, (Figure 3.1) allowing water from the Amazon River to invade the Tahuayo.[11] As a result, near Huaysi and the villages downstream including Nuevo Triunfo and Nuevo Valentin, the Tahuayo River is a sediment-rich white water river influenced by the Amazon River. Upstream from Huaysi, where the village of Santa Cruz is located, the Tahuayo remains a black water river. These differential biophysical and geographical characteristics of village location have implications for household production and livelihood diversity (Coomes, 1998; Padoch & Jong, 1992; Takasaki, et al., 2001). For example, the quantity and quality of fish are greater in the black water rivers (Coomes, 1998), whereas, the soils along white water rivers are generally said to be more productive (Meggers, 1971; Moran, 1989). Villages were selected from both areas (see Section 3.3: Methods).

Access to the four study villages also varies with their location. A small island separates the Tahuayo River from Tapira Nuevo I and village access is from a narrow inlet off the Amazon River. A footpath connects all villages along the Tahuayo River between Nuevo Esperanza and

[11] Personal communication with Dr. Oliver Coomes, and personal accounts from the older Tahuayo villagers.

Figure 3.1: *Ribereño* villages along the Tahuayo River, with our four study villages highlighted.



Source: Map drawn from Landsat image dated August 7, 2011 (Center for Earth Resources Observation and Sciences 2011); Village locations plotted from GPS points taken during fieldwork and from the Instituto de Bien Comun (2001).

Tamshiyacu. Tapira Nuevo I and II are connected to one another by a footpath, but can only be reached by boat from the other villages. All upland villages are served by the three daily public transport boats (*colectivos*), whereas Tapira Nuevo I does not have public boat transport to Iquitos. In the absence of a *colectivo* service, a local resident operates a transport service with a small private boat (*peque-peque*); however, travel frequency varies according to production cycles and the time of year. Santa Cruz is the farthest village from Iquitos. All villages are within a day's travel by boat to Iquitos.

According to Osiptel (2012), the Peruvian regulating body for private investment in telecommunications, cell phone coverage extends to all villages along the Tahuayo River. However, few households along the Tahuyao River own cell phones or private land lines. In general, cell phone coverage in Maynas Province is concentrated near the capital, larger towns and cities, such as Iquitos, Nauta, and Tamshiyacu (see Figure 1.2, Chapter 1). Despite the extent of cell phone coverage along the Tahuayo River, in our four study villages only 17% (n=12) of all households sampled own a cell phone and 6% (n=4) own a solar powered land line for a total of 23% (n=16) private phone ownership, and only Nuevo Valentin has a public community phone. The community phone in Nuevo Valentin is also solar powered and is located in the house of a local resident and managed by that person (Photos 3.1 and 3.2). With respect to other information communication assets, only 4% (n=3) of sampled households own a television but most households in the sample population, 72% (n=51), do own a radio.

3.2.2 Population and income

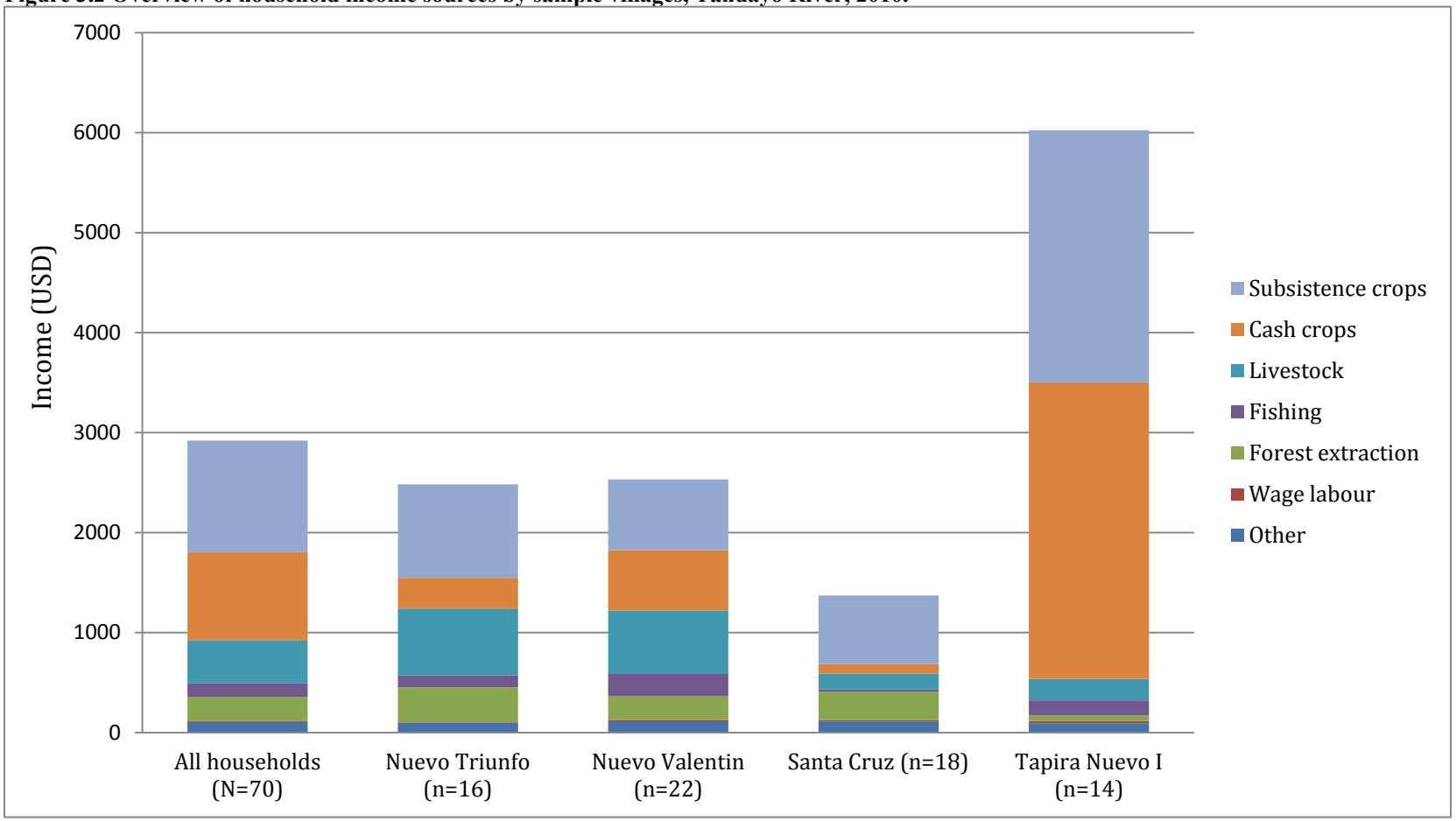
Residents of the four study villages are rural peasants whose economic activities are comprised of subsistence and market-oriented production including subsistence and cash cropping agriculture, forest extraction, fishing, and hunting. Locally referred to as *ribereños* - river dwellers – they are a mix of Amerindian and European descent (Coomes & Barham, 1997; Mário Hiraoka, 1992; Takasaki, et al., 2001). Households are economically poor with an average annual household income of $2,755USD, and average capital asset holdings valued at $512USD[12] in 2010 (Coomes, unpublished data).[13] Figure 3.2 shows the breakdown of household

[12] Product prices were taken from Belén market and represent those received by farmers arriving at the market (FOB prices). The exchange rate is based on the average 2010 US dollar exchange rate Central Reserve Bank of Peru. (2012). Interbank Exchange Rate. Retrieved May 9 2012, from http://bcrp.gob.pe/home.html.

Photos 3.1 & 3.2: Solar powered satellite community phone in Nuevo Valentin.

[13] See "Data collection" for information on 2010 household survey.

Figure 3.2 Overview of household income sources by sample villages, Tahuayo River, 2010.



Source: Derived from 2010 Tahuayo River household survey data (O. Coomes, 2010).
Subsistence crops include: yuca and plantain; Cash crops include annuals: rice, maize, beans, chiclayo, watermelon, sachapappa, and manioc grain – farina; and perennials: umari, camu-camu, aguaje and pineapple; Forest extraction includes earnings from the sale of bushmeat (hunting), charcoal, criznejas and chonta; Livestock includes: small livestock: chickens and hogs and large livestock: cattle; Fishing includes: all species of fish; Other income includes: pension income, earnings from ecotourism, shop earnings and earnings from the sale of handicrafts.

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income by sector for each village. The only lowland village, Tapira Nuevo I, has a disproportionately high average household income relative to all other households. Subsistence and cash crops dominate the income portfolios of Tapira Nuevo I households, and cash crops are the most important income source group and produce over half of total income. Santa Cruz is the poorest village, with average household income of just over half that of Nuevo Triunfo and Nuevo Valentin households, and roughly a quarter that of Tapira Nuevo I households. Subsistence crops are a significant contribution to total income for all three upland villages and represent over half of total income for Santa Cruz households. A significant proportion of total income in Nuevo Triunfo and Nuevo Valentin is generated from livestock (mostly small animals, i.e., chickens, ducks and pigs) and some cash crops, in addition to subsistence agriculture.

On average, taking the study population as a whole, market income (earnings from the sale of agricultural and forest products) represents over 80% of total household income. Earnings from the sale of primary goods allow households to increase their consumption of much needed manufactured goods such as sugar, cooking oil, clothing, kerosene, gasoline, and production assets. As such, Tahuayo households are inherently linked to market life and vulnerable to market volatility and price shocks and, consequently, being aware of what is happening in the market has implications for household welfare.

3.2.4 Initiatives to address the market price information gap

3.2.4.1 "*Voz de la Selva*" radio program

Starting in the mid-1980s through to 2008, a local radio station – "*La Voz de la Selva"* (*The Voice of the Forest*) - in Iquitos ran a radio program that broadcast daily prices for the most commonly traded agricultural and forest products in Belén market. Until 1990 the radio program was supported by the Catholic Church. In 1990, the Dutch International Development Organization (SNV) took over administration as part of a larger initiative, SIM – Market Information System - which had as its objective to improve marketing conditions for rural producers in the primary trading ports of Iquitos. SIM counted on financial support from SNV and various other sources including the Food and Agriculture Organization of the United Nations (FAO) and the Rural Farmers Committee of Maynas Province (CPAPMA) from 1994 to 1995; FAO from 1995 to 1996; and Programa Pacaya Samiria, Asociación para el Desarollo Amazónico, CARE, Caritas San José, and the Agencia Española de Cooperación Internacional

from 1998 to 1999. In 2000, the *Instituto de Investigaciones de la Amazonia Peruana* (the Institute for Research in the Peruvian Amazon) – IIAP - took over administration of the radio program as part of their larger program *Sistema de Información Forestal de la Amazonia Peruana* (Forestry Information System in the Peruvian Amazon) – SIFORESTAL - which effectively replaced SIM. *Voz de la Selva* counted on a student-led research group (*Circulo de Estudios de Mercados Amazónicos de Loreto*) – CEMA - to note prices in three primary Iquitos markets, Belén, Puerto de Productores, and Masusa, and counted on the financial support of the European Union (EU), the International Tropical Timber Organization (ITTO) and a division of the Ministry of Agriculture "INCAGRO". Unfortunately, in 2008 SIFORESTAL, and subsequently the *Voz de la Selva's* radio program, were suspended indefinitely due to a lack of funding and people to manage the program.[14] Anecdotal evidence from *ribereño* villagers suggests that the radio program overall had a positive response. However, no impact assessment was ever carried out to determine whether or not the program attained its objectives of reducing price uncertainty for rural producers and, thus, increasing their bargaining power in the market.

3.2.4.2 BIOINFO: Program for Research on Biodiversity Information in the Amazon

In 2009, IIAP launched a new project called BIOINFO to replace SIFORESTAL in an effort to continue addressing the information needs of remote rural communities. The project began with an extensive study in the Napo river basin, to compare the information demands of rural producers with information supply so as to better target the information gap. The researchers found that, overwhelmingly, the type of information most demanded by the rural populations was information about market prices. However, the top three types of information that most often reached these villages were police headlines, sports, and entertainment headlines (Instituto de Investigaciones de la Amazonia Peruana (IIAP), 2011). These results point to the demand for market price information among *ribereños* in rural Amazonia Peru and the lack of access to it.

In an effort to meet the informational demands of rural and remote communities, BIOINFO has taken a more technology-driven approach than its predecessor SIFORESTAL. Fuelled by growing discussions in academic circles of the potential for information and communication technologies to contribute to development – widely referred to as ICT4D – the

[14] Personal communication with Isaac O'Campo and Luis Calcina, BIOINFO program coordinators, July 7th 2011.

project's output to date has included improving the quality and quantity of information available online and synthesizing it in a user-friendly website. With that, there has also been a greater emphasis placed on expanding internet access to rural communities and providing training workshops.[15] Given that the project is still in its early stages, its impact is yet to be seen. Although this work is important and a step in the right direction, technology-driven initiatives have yet to have much relevance to the Tahuayo River given the lack of basic communication infrastructure and the low education levels among villagers.

3.2.4.3 Expansion of cell phone coverage

On the information infrastructure side, a local telecom company in Peru, FITEL, has been working to extend coverage to remote rural villages in all of Peru as part of their project "*Banda Ancha*", which began in 2010. They have been working on expanding phone and internet coverage to rural communities in Loreto and San Martin Regions as part of their project *Integración Amazónica Loreto-San Martin* (Amazon Integration Loreto-San Martin). The project objectives are to expand both cell phone and land phone line coverage, and to work with local governments, and health and education centers in each community to provide internet access. In addition, the program has been working with local governments to create and finance capacity building programs to accompany the technological expansion. According to FITEL, as of July, 2011 the project had directly and indirectly benefited 166,843 people in 277 communities across the two regions.[16] As of 2011, the reaches of this project extended to the upper Napo and Marañon watersheds and did not include the Tahuayo or its district center, Tamshiyacu.

3.3 Methods

3.3.1 Data collection

Data collection took place over a three month period between June and August, 2011. Research approval was granted by the McGill University Research Ethics Board prior to commencing data collection (see Appendix 2). The Tahuayo River was selected as the study site because extensive socioeconomic household data were available from the previous year as part of an ongoing study conducted by Prof. O. Coomes on the impacts of river change along the

[15] Ibid.

[16] These data were noted from a presentation given by a FITEL representative during an ICT4D conference hosted by IIAP in Iquitos, on July 7, 2011.

Tahuayo River, with the assistance of his Peruvian expert, Carlos Rengifo. These data were collected through household surveys administered to all participating heads of household in each village between August and October 2010, which solicited information on household demographics, land holdings, economic participation and non-land assets. Pre-existing knowledge of the villages, combined with their geographic proximity allowed us to hypothesize the presence of sub-regional information networks. In addition, the long standing relationship between Dr. Coomes, Carlos Rengifo and Tahuayo villagers helped the author establish the trust and collaboration of sample households quickly over the short timeframe in which fieldwork was conducted.

A familiarization trip to all nine villages for which 2010 data were available was carried out in early June with the assistance of Carlos Rengifo. In each village we explained the purpose of our visit to the elected village leader (*Teniente Governador*) and requested permission to work in the village. During these informal meetings, the *Teniente Governadores* were asked a series of questions about village characteristics, information which we later used to purposefully select which villages to include in the study. Four study villages were selected to account for: 1) variation in village size and organizational structure (the number of social organizations) as it was hypothesized that this may influence how information is shared between villagers; 2) whether or not the village had a public telephone and whether or not the *colectivos* stopped in the village as these are indicators of potential information channels from Iquitos; and 3) location (upland or lowland) in order to capture differences in livelihood types and production (see Table 2.4 in Chapter 2).

Fieldwork involved two main components: semi-structured socioeconomic household surveys in the villages, and noting prices in Belén market. Informal interviews were also held with Tahuayo *colectivero* operators to provide additional contextual data and to assess information gathered during household surveys. Interviews were conducted with the aid of a local field assistant, Junior Rios Diaz. We intended to interview all those heads of households in each study village who had been interviewed for the 2010 survey. This was not always possible as some households no longer lived in the village and others simply declined to participate. The household composition in Nuevo Valentin had changed quite considerably since the 2010 survey was conducted as many old households had left and new ones arrived. As a result the proportion of households interviewed in Nuevo Valentin is less than for the other three villages. Table 2.6 in

Chapter 2 outlines the composition of sample households by village.

All three *colectivo* boat operators were interviewed in late-July. Price tracking in Belén market was carried out daily for the duration of fieldwork with the help of a local Belén resident, Gisela Aguilar. Each day when the Tahuayo *colectiveros* would arrive into port, Ms. Aguilar would observe which products were arriving on these boats. If yuca, plantain, aguaje or charcoal were arriving she would take note of the prices *rematistas* were offering producers for these products. Rematista prices are determined based on the landed value in Belén market, i.e., FOB prices, and thus include the cost of transportation from the community to the market. If one of these products was not being traded on a given day then it was noted as "not applicable", even if the product was being traded somewhere else in the market. Thus, "market prices" only concern those prices relevant to exchanges with Tahuayo residents. For a detailed description of data collection in the market, see Chapter 2.

Data from the 2010 household survey used in this study include household demographics (e.g., household age, composition, whether or not the household had family in Iquitos), and wealth and livelihoods (e.g., total land holdings, production, and income). The 2011 household survey gathered quantitative and qualitative data on market price information sources, the commercialization process, frequency of travel to Iquitos, household knowledge of price information, and phone ownership. Respondents were asked their opinion on the importance, ease of access, and timeliness of market price information on an ordinal scale and to explain their answer (see Results, Section 3.4.4). Next, respondents were asked how frequently they travel to Iquitos during the months of June, July, and August (the full duration of the fieldwork), to list the products they sell, and to explain the various ways they go about selling these products (see Results, Sections 3.4.2 & 3.4.3).

To gather data on sources of market price information we presented households with a hypothetical scenario around their knowing the price of yuca, plantain, aguaje amarillo, aguaje shambo and charcoal that week. We asked them to list up to three people, in order of importance, whom they would ask to get this information and the communication medium they would use to interact with each person (phone or word of mouth). Respondents also were asked to describe their relationship with each person named and the frequency with which they interact. Finally, respondents were asked to list the actual price of yuca, plantain, aguaje amarillo, aguaje shambo

and charcoal in Belén market for the current and previous weeks. If they were aware of these prices they were asked to name the person who told them the price and the communication medium used to do so.

To gain a better understanding of the commercialization process, and of the role of the *colectivero*, the author and her assistant, Junior Ríos Diaz, travelled via the *colectivos*, "Guevarita" and "Sanchez" to and from Iquitos on several occasions prior to interviewing the *colectivo* operators. We later conducted informal interviews with the operators, including questions related to where and when they operate their services, the cargo they transport, and about how they discuss prices with Tahuayo villagers.

3.3.2 Data analysis

Microsoft Excel was used to manage open-ended survey question data and household income and production data in order to classify households into livelihood types. Qualitative household survey data were classified into common themes and provide context to the statistical analyses results. STATA 11 (StataCorp LP, 1985-2009) was used for all statistical analyses including descriptive and summary statistics, Fisher's exact test for multiple group comparisons of categorical data, Student's t-tests for two group difference of means comparisons, and probit and Ordinary Least Squares regression models. NetDraw (Borgatti, 2002) was used to construct and analyse network structures.

To classify households into a livelihood type category an approach similar to Barrett, Mesfin, Clay and Reardon (2005) was taken. First, the total income from each of the following possible income sources was calculated using STATA 11: subsistence crops, cash crops, forest extraction, fishing, small livestock, large livestock, and other income (refer to Figure 3.2 for details of what is included in each category). Income was calculated using the market value for each product in August 2010 and multiplying it by the total production. Second, the income portfolios of each household were examined separately and the category that generated the most income was highlighted. If a higher percentage of total income was generated from subsistence crops than any other one income group, the household was categorized as a "subsistence farming household" (n=33), and so forth for "cash cropping" (n=17) and "forest extraction" (n=11) households. Earnings from small livestock contributed to the category of subsistence farmers and earnings from fishing contributed to the category of forest extraction as did earnings from

handicrafts. Two households earned over a third of their total income from fishing alone and, thus, were considered "fishing households" and are exceptions to this classification. These households were categorized as "other" (n=9), which also included four households whose primary income source is raising cattle, two households whose primary income source is pension earnings and one household whose income portfolio is equally divided between subsistence farming, cash crops and forest extraction. A measure of income diversity was also calculated by summing the total number of contributing income groups (see Characterization of households by livelihood type, Appendix 3).

Summary and descriptive statistics for market price information sources were analyzed in STATA 11 and cross tabulated by village and livelihood type. Fisher's exact test was performed to test for independence among the categorical data. This non-parametric equivalent to a Chi-squared test was used due to the presence of values less than five in some of the categories. A set of separate network diagrams were drawn in NetDraw (Borgatti, 2002) for each product in the hypothetical and actual scenarios in order to analyse differences in network structure by village and by key socioeconomic predictors of household behaviour including household age, livelihood type, and land holdings, for a total of eight network diagrams per product. Empirical studies in the Peruvian Amazon have demonstrated great heterogeneity in livelihood strategies between households in the same village, and between villages and regions according to household capital asset holdings (particularly land holdings) and capital wealth (Coomes, et al., 2004; Kvist, et al., 2001; Takasaki, et al., 2001). Thus, we hypothesize that heterogeneous livelihood strategies and differences in asset holdings also have implications for how a household accesses information and the level of accurate information available to them.

Analysis of the networks followed the methodological foundations of social network analysis (SNA), which is a structural approach based on the study of interactions among social actors and is grounded on the notion that the various social ties in which actors are involved has important consequences for them (Freeman, 2004; Wasserman & Faust, 1994). The approach has its roots in the behavioural fields of sociology and anthropology (Wasserman & Faust, 1994) but has been gaining increasing interest in the social sciences over the last decade. Using this approach, the researcher tries to determine the effects of a given phenomenon on the actors based on their position and degree of centrality in the network. For the purposes of this study, only a visual inspection of the networks was performed as these networks showed a lack of

cohesiveness and did not permit the calculation of network statistical indicators such as measures of centrality, in-degree and out-degree. Nevertheless, as described by Clark (2006) in a similar study, there is much to be learned by simply looking at the network structures.

To determine which households were best able to estimate FOB prices in Belén market (hereafter referred to as "market prices"), we calculated the range, mean, standard deviation, and coefficient of variation for all *rematista* and village price responses for each product. Given that not all households were interviewed on the same day of the week a decision was made to use the household estimates for the previous week's prices over the current week's prices in order to avoid bias in responses from households interviewed at the beginning of the week versus those interviewed at the end of the week. For the purposes of this study a week follows the calendar week, Monday to Sunday, which also corresponds to respondents' interpretation of a week.

To determine what constituted an "accurate" response we first considered all household responses that fell within the *rematista* range. To get a complete picture, strip plots were generated in STATA to compare all household observations against all *rematista* (middlemen) observations. The mean and range were also calculated and plotted. This provided an easy visualization tool to identify the number of household responses that fell within the *rematista* range. First, we graphed all observations by product and week to determine whether households were able to predict certain products better than others. Second, we graphed all observations by village and product to determine whether households in certain villages were able to predict market prices better than others. On occasion more than one *rematista* price was observed in the market on the same day. For example, the price of charcoal could be between 5 and 7 Nuevos Soles, depending on the quality of the wood. Rather than taking the mean, both observations were graphed. Similarly, if a household stated that the price of charcoal the week before had been both 5 and 7 Soles, depending on the quality, both observations were graphed but the household was only counted once if they were accurate.

Once we determined how well household estimated prices matched actual *rematista* market prices, we constructed linear regression models to test both awareness of market prices (i.e., whether or not the household was able to estimate the price, for each product) and accuracy of knowledge of market prices against a set of independent socioeconomic and village variables. Table 3.1 below describes the independent variables we tested in the model.

Table 3.1 Overview of independent variables tested in our multiple regression models.

Variable	Variable type	Description	Justification and expected relationship to dependent variable
Land Holdings	Continuous	The total amount of land owned, in hectares.	Good predictor of socioeconomic behaviour (Takasaki, Barham, and Coomes 2001). Households who own less land are more likely to be forest extractors and, as a result, more aware of the prices of aguaje and charcoal.
Household age	Continuous	The nmber of years that the household has been established.	Generally a good predictor of livelihood activities and is used in the model as a control variable. It is expected that older households have more connections and experience with market sales and, therefore, may be better informed about prices.
Market orientation	Continuous	The percentage of total income earned from market sales.	Households who are more market oriented will have more contact with the market and be more aware of market prices.
Frequency of travel to Iquitos	Continuous	The average number of trips to Iquitos during June, July and August combined, rounded to the nearest whole number.	Households that travel more often to Iquitos will be more informed of market prices.
Income diversification	Discrete	The number of different income groups that form the household's total income portfolio, to a maximum of 7.	Households who are more diversified will be more aware of prices.
Phone ownership	Dummy	Household owns a phone? 1=yes, 0=no.	Correlations between increased phone access and reduced search and transport costs (i.e., less time spent looking for prices) have been found in other studies (Abraham 2007; Muto and Yamano 2009; Aker 2010) and suggest that phone ownership may improve selling efficiency.
Family in Iquitos	Dummy	Household has family in Iquitos? 1=yes, 0=no.	Households with family in Iquitos will have more direct contact with what is happening in the city and, as a result, be more aware of prices.
NT_dummy	Dummy	Household lives in Nuevo Triunfo? 1=yes, 0=no	Used as a control variable.
NV_dummy	Dummy	Household lives in Nuevo Valentin? 1=yes, 0=no.	Used as a control variable.
SA_dummy	Dummy	Subsistence farming household? 1=yes, 0=no.	Subsistence farmers will have less of an interest in knowing prices in the market.
CC_dummy	Dummy	Cash cropping household? 1=yes, 0=no.	Cash cropping households are not interested in aguaje or charcoal prices and will be less aware of these prices.
FE_dummy	Dummy	Forest extraction household? 1=yes, 0=no.	Forest extractor households will be more interested in charcoal and aguaje prices and be more aware of these prices.

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3.4 Results

3.4.1 How do *ribereño* households access information about prices in the Belén market?

The results show that price information sources vary with product type, livelihood type, and village location along the floodplain (upland or lowland). Six information source categories were identified: another village member, family or friends in Iquitos, a *colectivero*, a *rematista*, the market, and other. The information sources that participants identified as important varied when they were asked about hypothetical vs. actual scenarios (see Methods, Section 3.3.1). In the hypothetical scenario, participants indicated that a great deal of information is coming from outside the village; however, in practice the opposite is true. This finding is particularly evident in the network diagrams, which for the actual networks were highly dispersed with few central actors and many pairs of isolate nodes. The hypothetical networks were more cohesive than the actual networks, yet neither showed signs of being a *true network*, i.e., a network in which all nodes are connected to each other no matter how long the path. These findings suggest that in practice access to market price information is opportunistic, and that the importance of information sources is household specific.

3.4.1.1 Differentiated information sources

Typically non-timber forest products (NTFPs), such as charcoal and aguaje, are harvested as cash crops whereas agricultural crops, such as yuca and plantain, are mainly harvested for subsistence. This distinction is reflected both the hypothetical and the actual scenarios whereby household responses demonstrated a greater interest in knowing the price of non-timber forest products (aguaje and charcoal) over agricultural products (yuca and plantain) (Figure 3.3), as demonstrated by the larger number of "not interested" responses for yuca and plantain prices (Table 3.2). This distinction can be explained largely by village location and household livelihood types. The largest proportion of "not interested" responses for yuca and plantain were from Nuevo Triunfo and Santa Cruz, both upland villages. Households in these villages are primarily classified as subsistence farmers and forest extractors, and thus seldom sell yuca or plantain. By contrast, households in Tapira Nuevo I, the only lowland village, are all classified as cash croppers who do sell yuca and plantain but rarely produce charcoal and do not produce aguaje. Nuevo Valentin is the only truly mixed village in terms of livelihood types, with some lowland farmers who are classified as cash croppers. These distinctions are evident in household

Figure 3.3: Comparison of hypothetical and actual responses to how households get information about market prices in Belén Market for yuca, plantain, aguaje, and charcoal.

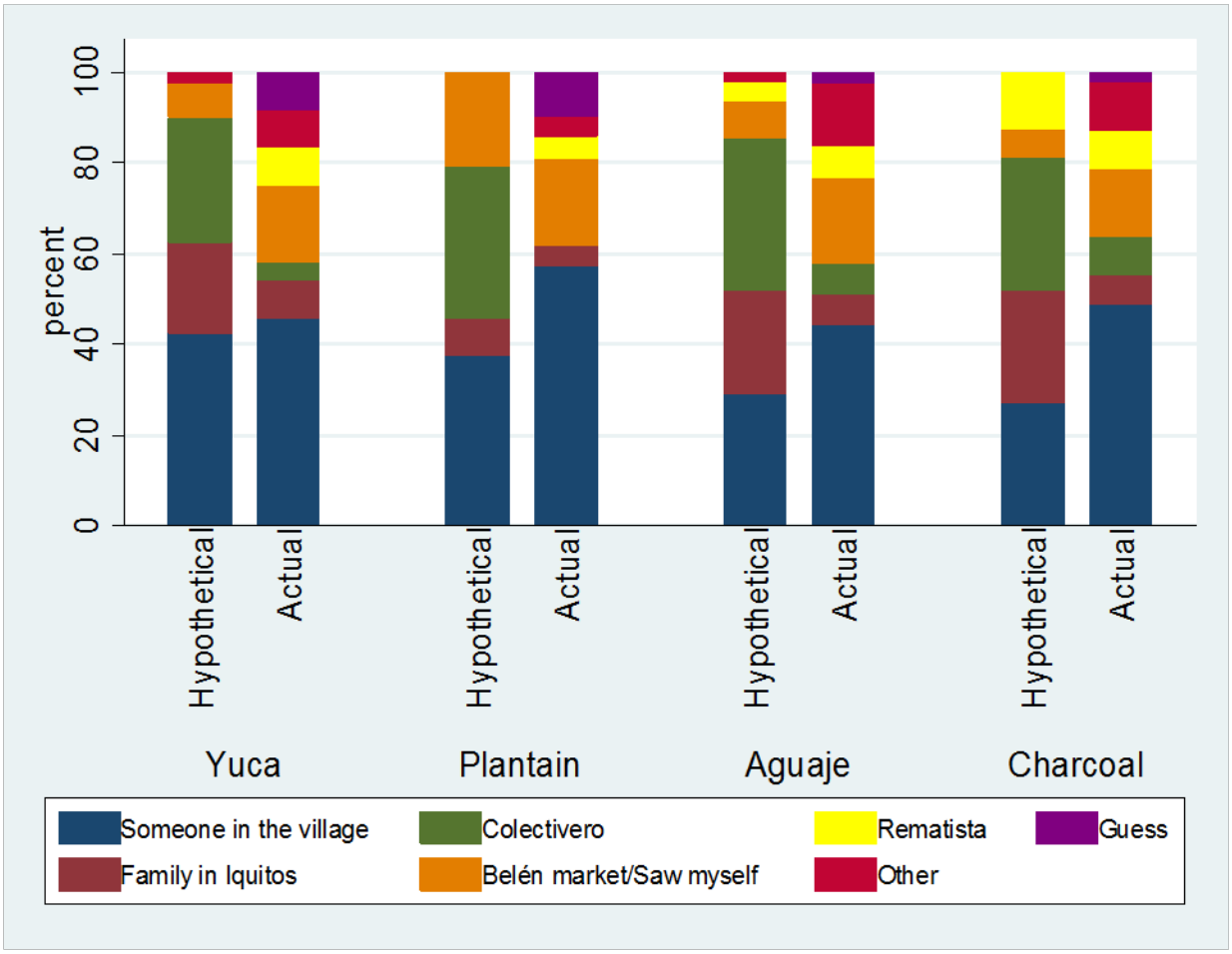

Table 3.2: Summary of household responses to the hypothetical question "If you wanted to know the price of [yuca, plantain, aguaje, charcoal] this week who would you ask first?", by village and livelihood type.

	Information source							
	Someone in the community	**Family in Iquitos**	**Colectivero**	**Belen market/saw myself**	**Rematista**	**Other**	**Not interested or not in season**	**% of total responses (N=70)**
Yuca								
% of total responses	24	11	16	4	0	1	43	100
Village with highest proportion of responses	Nuevo Tapira I	Nuevo Triunfo	Nuevo Valentin	Santa Cruz	NA	Nuevo Valentin	Nuevo Triunfo & Santa Cruz	
Livelihood type with highest proportion of responses	Cash croppers	Forest Extractors	Cash croppers	Other	NA	Subsistence farmers	Forest Extractors & Subsistence farmers	
Plantain								
% of total responses	13	3	11	7	0	0	66	100
Village with highest proportion of responses	Nuevo Tapira I	Santa Cruz & Nuevo Valentin	Nuevo Valentin	Santa Cruz	NA	NA	Nuevo Triunfo & Santa Cruz	
Livelihood type with highest proportion of responses	Cash croppers	Cash croppers and Subsistence farmers	Other	Other	NA	NA	Forest Extractors & Subsistence farmers	
Aguaje								
% of total responses	20	16	23	6	3	1	31	100
Village with highest proportion of responses	Nuevo Triunfo	Nuevo Triunfo & Nuevo Valentin	Nuevo Valentin	Nuevo Triunfo & Santa Cruz	Nuevo Valentin & Santa Cruz	Nuevo Triunfo	Nuevo Tapira I	
Livelihood type with highest proportion of responses	Subsistence farmers	Forest Extractors	Other	Other & Subsistence farmers	Other & Forest Extractors	Forest Extractors	Cash croppers	
Charcoal								
% of total responses	19	17	20	4	9	0	31	100
Village with highest proportion of responses	Nuevo Triunfo	Santa Cruz & Nuevo Triunfo	Nuevo Valentin & Santa Cruz	Nuevo Tapira I, Nuevo Triunfo & Santa Cruz	Nuevo Valentin & Santa Cruz	NA	Nuevo Tapira I	
Livelihood type with highest proportion of responses	Subsistence farmers & Other	Subsistence farmers & Forest extractors	Forest Extractors	Other	Other & Forest Extractors	NA	Cash croppers	

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responses to seeking out information sources in the hypothetical scenario (Table 3.2), wherein Tapira Nuevo I and Nuevo Valentin are most representative for yuca and plantain - coinciding with cash cropping households, and the three upland villages - Nuevo Triunfo, Nuevo Valentin and Santa Cruz - are most representative for aguaje and charcoal – coinciding with them being subsistence farmers and forest extractors.

For each product we performed a Fisher's exact test to compare whether households named different information sources, in the hypothetical scenario, according to which village they live in and their livelihood type. To do this, we assigned a dummy value to each information source (e.g., 1=someone in the village, 2=someone in Iquitos, etc.), each village, and each livelihood type. Then separate Fisher's exact pairwise comparison tests were performed with "Village" and each product, and then with "Livelihood type" and each product. Each test output a matrix with the number of observations in each pairwise grouping (e.g., for each information source, the number of people who live in each village, etc.). The p-value generated by each test represents the probability of observing these same values by chance. Results show that hypothetical information sources varied significantly by village for yuca (Fisher's exact p-value=0.013), aguaje (Fisher's exact p-value<0.01), and charcoal (Fisher's exact p-value <0.01) (Table 3.3). In addition, the information sources used for plantain, aguaje and charcoal were different in households with different livelihood strategies (Fisher's exact p-values <0.05). Thus, with regards to information sources cited for the price of yuca, where a household lives (i.e., which village they live in) has an influence over the type of information source they will seek, but these information sources vary consistently across all livelihood type groupings. And, with regards to information sources cited for the price of plantain, the type of economic activity a household engages in (i.e., livelihood type grouping) has an influence over the type of information source they will seek, but these information sources vary consistently across all villages. Aguaje and charcoal price information sources are different across both villages and livelihood types. Tapira Nuevo I, a village that does not produce aguaje and where only two households produce charcoal, obviously influences the results for aguaje and charcoal; however, removing Tapira Nuevo I from the sample does not change the significance of results.

Setting aside all "not interested" responses, for all four products the hypothetical scenario suggests that a larger proportion of price information originates directly from contact with someone in the market rather than from word of mouth with someone in the same village. This

Table 3.3: Household information sources by product, village and livelihood type.

Product	Village	Livelihood type
	Fisher's exact p-value	Fisher's exact p-value
Yuca	0.013	0.219
Plantain	0.311	0.045
Aguaje	<0.01	0.035
Charcoal	<0.01	0.038

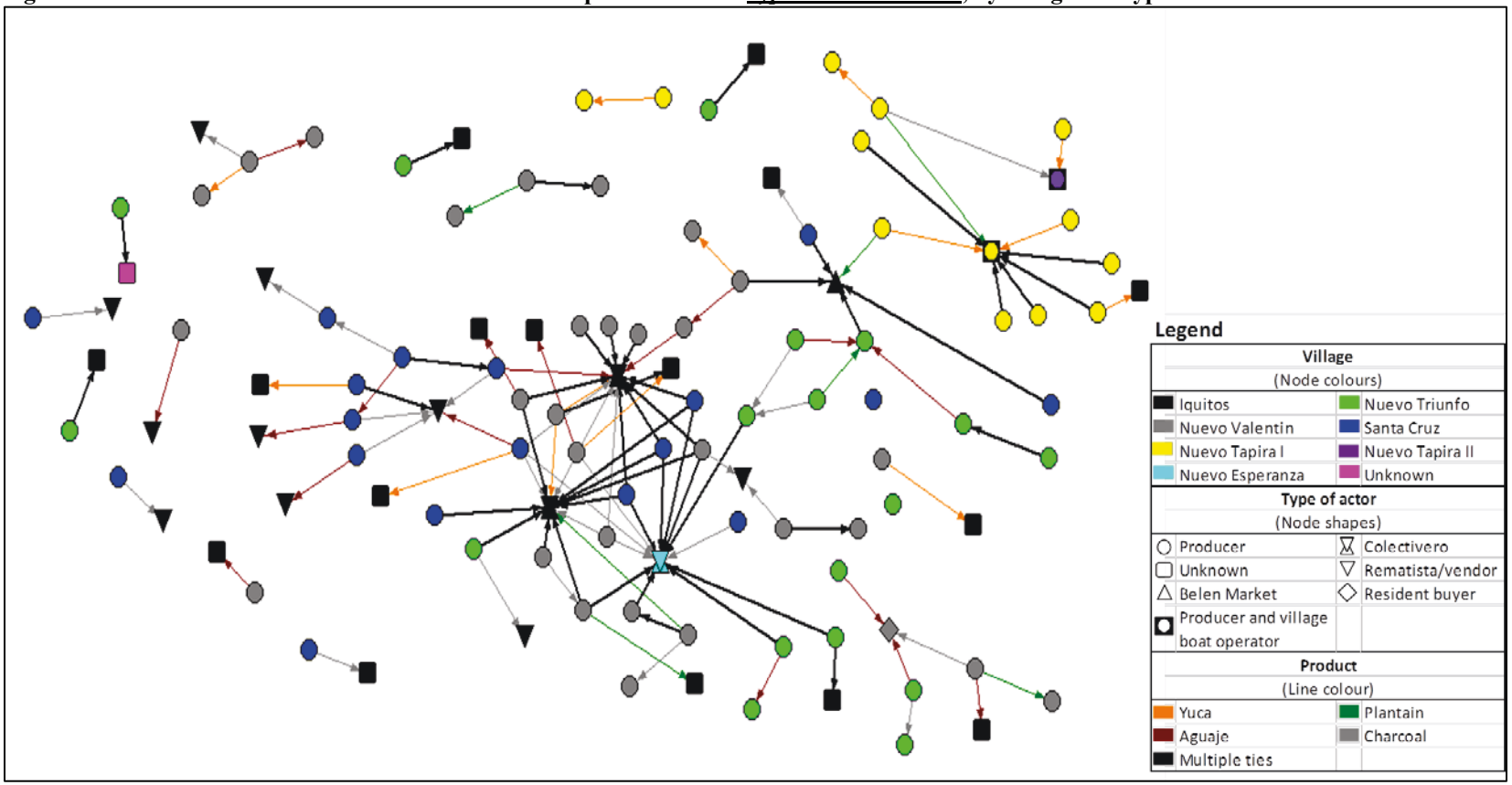
Note: P-values represent the results of multiple Fisher's exact pairwise comparison tests with dummy variables "Village" and "information type source", by product, and "Livelihood type" and each "information type source", by product. "Information type sources" include "Someone in the village", "Someone in Iquitos", "Belén market/saw myself" "*Colectivero*", "*Rematista*", "other" and "not interested".

relationship is more evident for NTFPs– about twice the number of first information sources cited were from direct contact with someone in Belén market (*colectiveros*, *rematistas*, and family or friends in Iquitos, etc.) rather than from other village members. However, not surprisingly, other village members were also frequently cited as a primary information source and were the group most frequently named second for all four products. These results suggest that those people more closely connected to Iquitos, either physically as in family in Iquitos or commercially such as *colectiveros* and *rematistas*, play an important role as information brokers. Moreover, results suggest that households prefer to rely on loose ties of people more connected to the market first, followed by closer ties such as friends, neighbours and family in the village. Tapira Nuevo I is the exception to this finding. It is the only village in which no information sources outside the village were named. This is not surprising, given that Tapira Nuevo I is more isolated than the three other villages; it is the only village in the sample where the *colectivo* does not stop and, unlike the other three villages that are connected by a footpath, Tapira Nuevo I may only be reached by boat.

Contrary to the hypothetical scenario, where households stated who they *would* ask for price information, in the actual scenario households most often cited that they had heard prices through their respective social networks (Figure 3.3). Frequently this included someone who had been to the market that week. Additionally, there was a large degree of reporting from people who had, themselves, been to the market that week or the week prior and had seen the price first hand. Thus in reality, market insiders such as *rematistas* and *colectiveros* play a secondary role. In other words, most people get their information from someone in the village rather than through direct contact with someone in Iquitos. These relationships become clearer upon examining the information network structures. The hypothetical networks proved to be more complete than the actual networks. Yet, neither the hypothetical nor the actual networks were very cohesive, suggesting that people manage information in different ways. In both cases, there were few central actors.

Figure 3.4 and Figure 3.5 compare the hypothetical and actual networks with all villages and all products. These diagrams reveal that the three *colectiveros* are the most central information sources in the hypothetical network. In the actual network, the market is the most central node. However, in both the hypothetical and the actual networks there are many missing links, and relationships, for the most part, are not reciprocal. In the actual networks the most

Figure 3.4: Network of information sources cited for all products in the *hypothetical scenario*, by village and type of actors.



Note: Node colors correspond to village and node shapes correspond to the type of actor. The lines are color coded by product. The thicker lines represent multiple ties between actors.

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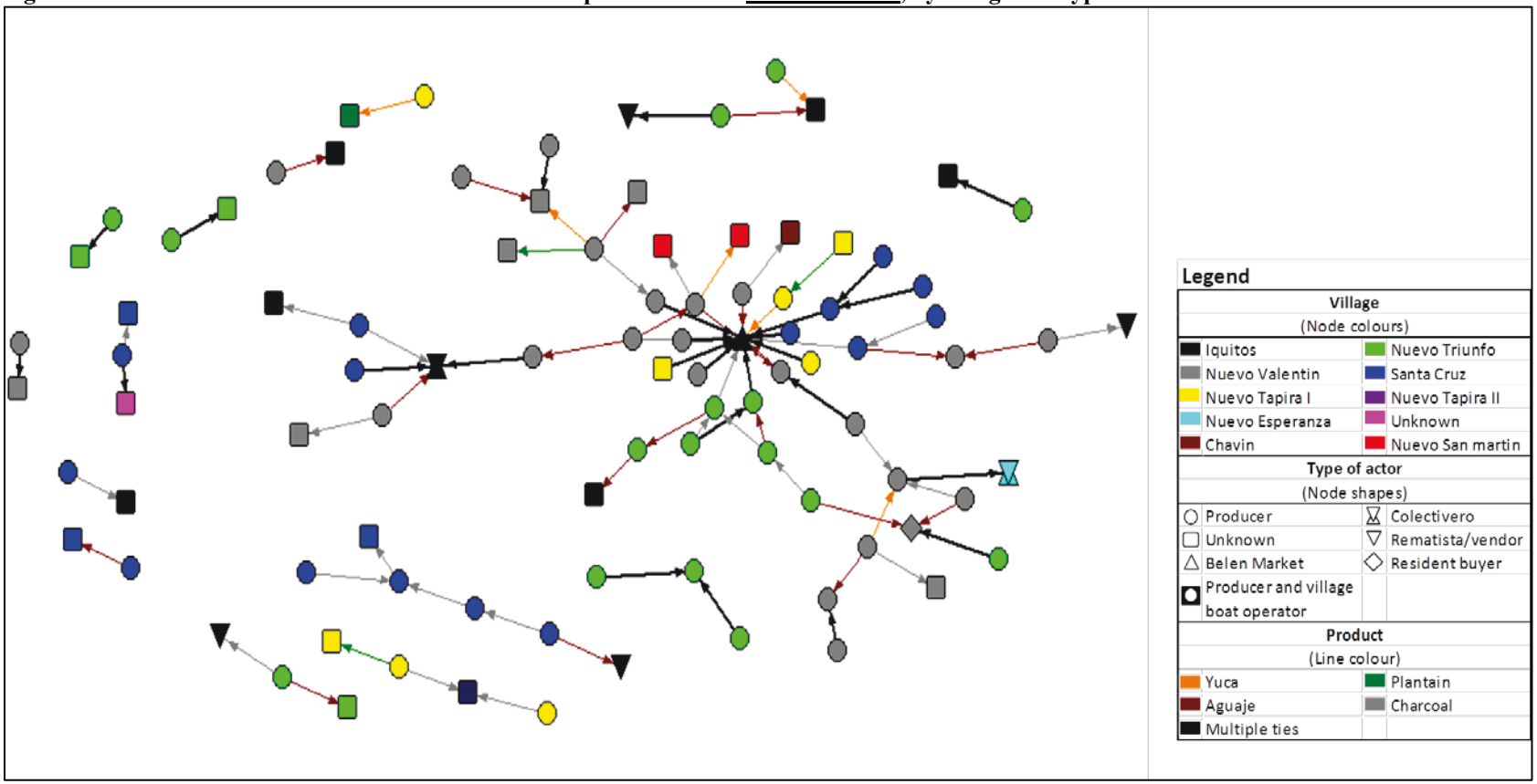
Figure 3.5: Network of information sources cited for all products in the *actual scenario*, by village and type of actors.



Note: Node colors correspond to village and node shapes correspond to the type of actor. The lines are color coded by product. The thicker lines represent multiple ties between actors.

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central actor was the market itself, followed by people who had recently been to the market. This corresponds to anecdotal evidence whereby households expressed "if you want to know the price, you have to go to the market yourself" and "if a product is ready [for market] it must be taken to the market, regardless of price". Thus, households may not know the price before going to the market but rather find out once they get there.

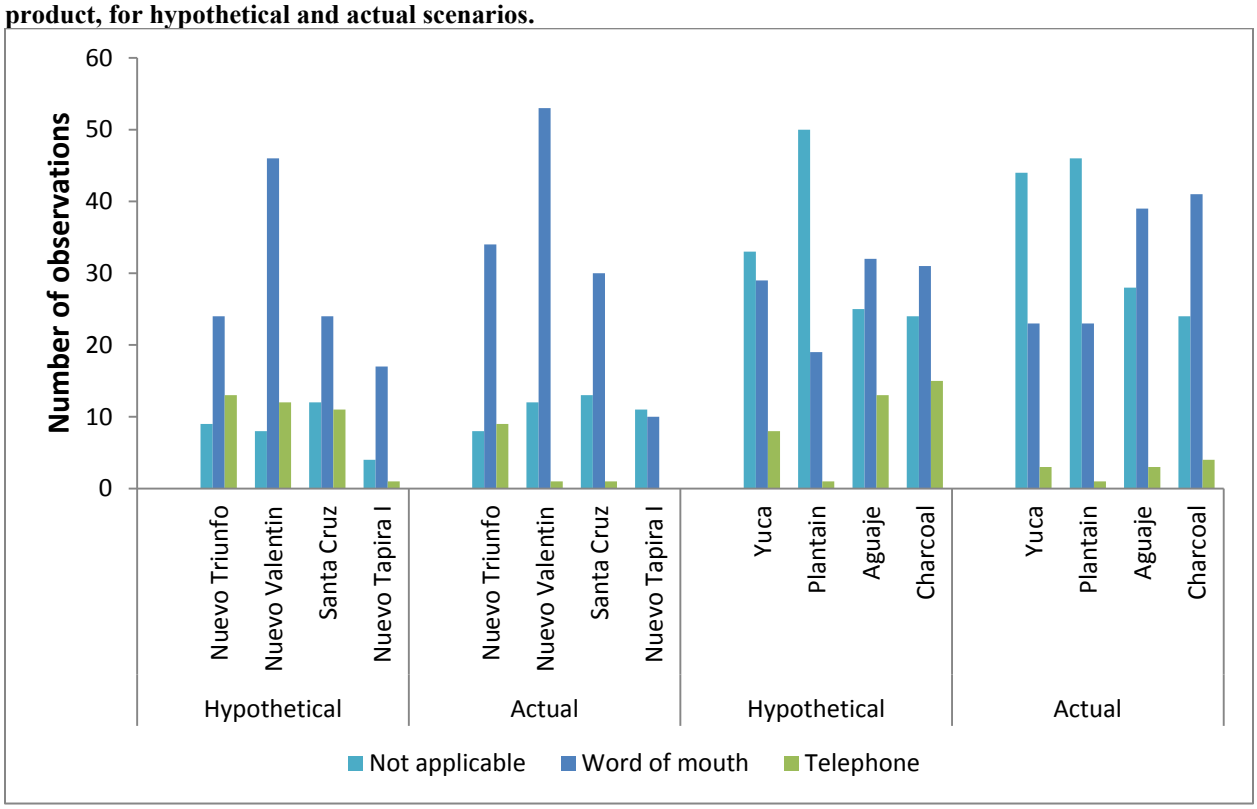
In Tapira Nuevo I, the village without regular *colectivo* service, one village member stands out in the network as most frequently named. This village member runs a boat service with a private boat and, therefore, travels frequently to Iquitos. Unfortunately, because there are a small number of actual scenario observations in Tapira Nuevo I, it is not possible to determine the degree to which this person actually acts as an information broker.

3.4.1.2 Communication media

Recent studies in Asia and Sub-Saharan Africa, examining the use of mobile phones among rural farmers and market agents as a communication tool for market price information, have shown how increased mobile phone usage can improve efficiency in the commercialization process and reduce price arbitrage in markets (Abraham, 2007; Muto and Yamano, 2009; Jensen, 2010; Aker, 2010). These studies suggest that households who have access to a telephone may have an advantage in accessing price information over those households without a telephone. In the hypothetical scenario a significant number of households stated that they would, hypothetically, call someone in Iquitos if they wanted to know the price of a product. Additionally, when households were asked about how access to market price information could be improved, they often cited the need for a telephone (33% of total responses). Figure 3.6 compares telephone use versus word of mouth as the means of communication in accessing market price information in both the hypothetical and the actual scenarios, by village and by product.

While the hypothetical scenario indicates that households would use the phone to get market price information, the actual scenario showed that these households most often actually received price information through word of mouth. There are slight differences by village and by product. In Tapira Nuevo I there is no community phone and only two people own cell phones. This is reflected in the responses whereby few people stated they get market price information over the phone. In the upland villages the number of people who said they would use the phone

Figure 3.6: Comparison of communication medium used to transmit market price information, by village and product, for hypothetical and actual scenarios.



Source: Author's household survey data, 2011.

to call someone showed little variance between villages in the hypothetical scenario. However, in the actual scenario, Nuevo Triunfo stood out as the community that most often learned of prices over the phone. This result is somewhat surprising given that Nuevo Triunfo does not have a community phone and only two households in Nuevo Triunfo reported owning a private phone (either a cellphone or satellite telephone). By contrast, in the only village with a community phone and with the largest reported number private phone ownership, Nuevo Valentin, fewer households reported using the telephone to inquire about market price information.

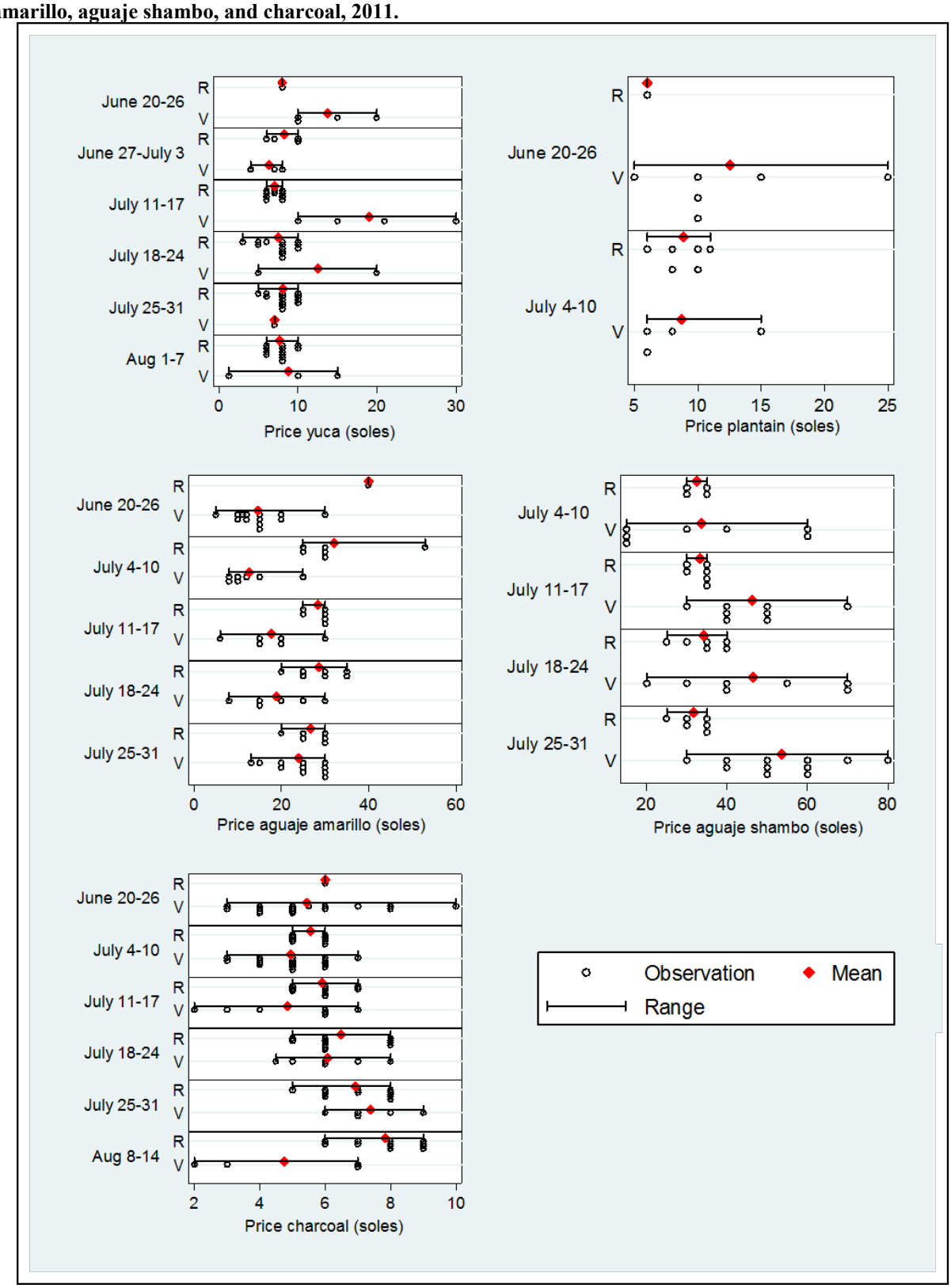
3.4.2 How well do household estimated prices match actual *rematista* prices in Belén market?

In order to examine the average of household price estimates we plotted all *rematista* price observations and the weekly range and mean, against all household observations for the same week on strip plots. We first organized all observations according to the week they had been observed. We then counted the number of village observations that fell within the *rematista* range in order to get the number of "accurate" households, and identified who these "accurate" households are by cross checking with our data spreadsheet. We plotted all observed (in the case of *rematistas)* and estimated (in the case of households) prices rather than taking a daily average. For example, if a household said the price of charcoal was between 5 and 7 Nuevos Soles, depending on the quality of the wood, then both observations were plotted but the household was only counted once if they were accurate.

Our results show that households are able to estimate the price of charcoal more accurately than all other products, followed by aguaje amarillo and aguaje shambo. Figure 3.7 shows strip plots comparing household estimated prices against actual *rematista* prices by product, and Table 3.4 presents the accuracy statistics. Households in Nuevo Valentin and Santa Cruz appear to be more aware of prices than households in Nuevo Triunfo and Tapira Nuevo I. Strip plots comparing *rematista* and household estimated prices by village are shown in Figure 3.8. This may be because in Nuevo Triunfo there is little comparable *rematista* data for the week in question, and in Tapira Nuevo I households were not selling much and were therefore not interested in knowing prices.

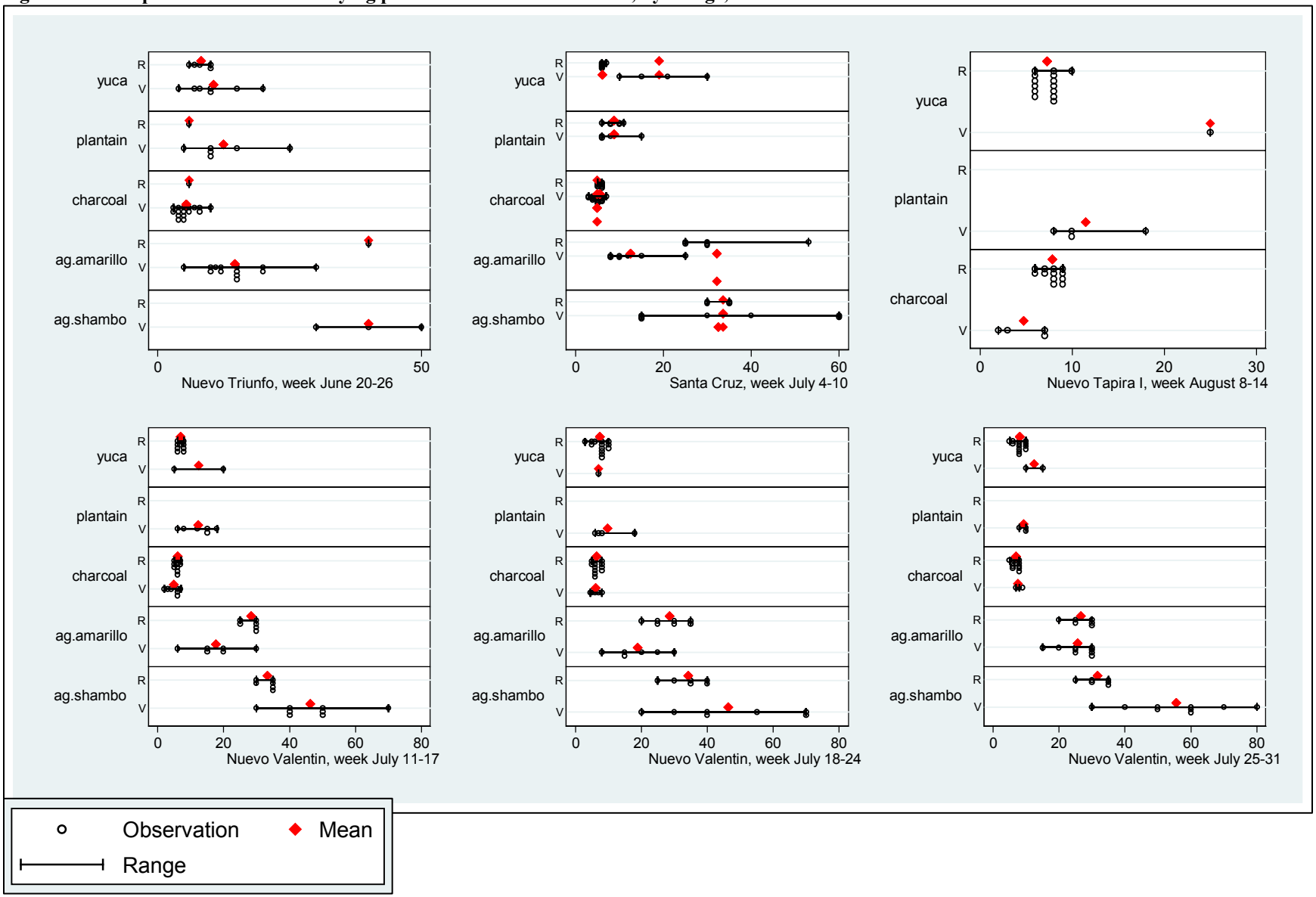
In addition to more accurate household estimates for NTFPs (aguaje and charcoal), the range of household estimated prices for these products most closely mirrored the range of

Figure 3.7: Comparison of *rematista* buying prices to village household estimates for yuca, plantain, aguaje amarillo, aguaje shambo, and charcoal, 2011.



Note: Each point represents an observation and the mean and range are also shown. V=village households and R=*rematista*.

Figure 3.8: Comparison of *rematista* buying prices to household estimates, by village, 2011.



Note: Each point represents an observation and the mean and range are also shown. V=village households and R=*rematista*.

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rematista prices, suggesting that households were more aware of how these prices were shifting. Considering the imperfect markets in which peasant households operate, where information travels along traditional lines and has a certain lag time between when prices are determined and when this information reaches *ribereño* households (Ellis, 1993), theory would suggest that households would be better able to predict product prices for the products which least fluctuate in price. It is therefore, not surprising that households were best able to estimate the price of charcoal given that its price fluctuated the least among all products throughout the study period, as demonstrated by a smaller range and standard deviation relative to other products (Table 3.4). However, contrary to expectations the prices of agricultural products (i.e., yuca and plantain) did not fluctuate much either during the study period yet the household estimated price range was nearly four times greater that of the *rematista* price range for both products (Table 3.4). These results suggest that short-term price variance is not the only factor contributing to household accuracy, but rather the type of product, i.e., NTFP or agricultural.

Further, most of the accurate responses for each product were from households that sell the product (Table 3.5). This would seem to further confirm our findings of a lack of interest in learning prices among households who do not sell the product, regardless of whether or not they produce it.

3.4.3 What predicts price knowledge accuracy?

In order to determine what predicts the accuracy of household price estimates, we first had to develop an accuracy index, which would become the dependent variable. The accuracy index is measured as the percentage that each household price estimate deviated from the mean *rematista* price. This index was only calculated for households in the three upland villages (Nuevo Triunfo, Nuevo Valentin and Santa Cruz) given the lack of comparable observations in Tapira Nuevo I (few households were selling products at the time of my visit to this village). Additionally plantain was eliminated from the model because we lacked comparable data from the market (it had been absent from the market during the later weeks of fieldwork).

Although promising, this index suffered from two limitations. First, we were unable to assign a score to households who had not given any price estimates. And second, it was not possible to create an overall accuracy index which would take into account household accuracy across all products because, for example, some households estimated the price of only one or two

Table 3.4: Summary statistics for household price estimates and actual *rematista* prices.

	Household responses					*Rematistas*				
	Mean price (./S)	**Range**	**Std dev.**	**C.V.**	**N**	**Mean price (./S)**	**Range**	**Std dev.**	**C.V.**	**N**
Yuca	12.96	28.75	7.76	0.60	18	7.45	7	1.68	0.23	47
Plantain	11	20	6.02	0.55	10	8.43	5	1.99	0.24	7
Aguaje amarillo	17.67	25	7.59	0.43	43	29.35	33	6.54	0.22	26
Aguaje shambo	22.45	45	10.42	0.46	33	24.64	44	11.02	0.45	22
Charcoal	5.45	8	1.65	0.30	53	6.25	3	0.98	0.16	56

Note: Only weeks where there was comparable data, i.e., where there were respondent *and* rematista observations, were included.

Table 3.5: Overview of how well household estimated price data matches *rematista* price data.

	All households				
	Yuca	Plantain	Aguaje Amarillo	Aguaje Shambo	Charcoal
N° of applicable responses	67	54	50	50	46
N° of people who sell	27	17	41	41	46
Total n° of accurate households (within *rematista* range)	3	4	11	5	25
N° of accurate sellers (within *rematista* range)	1	2	11	3	21
% of accurate households to applicable responses	**4**	**7**	**22**	**10**	**54**
% of accurate sellers to the number of sellers	**4**	**12**	**27**	**7**	**46**

Note: An "applicable response" is defined as any household who produces the product and did not answer that the product was "not in season". Thus applicable responses include all households who produce the product and either gave an estimated price or answered, "I don't know the price"; the "number of people who sell" includes any household who answered that they had sold the product within the last year (July 2010-July 2011); an "accurate household" is a household that estimated the price within the *rematista* range; an "accurate seller" is a household that sold the product within the last year and estimated the price within the *rematista* range; "% of accurate households to applicable responses" is the ratio of accurate households over applicable responses; "% of accurate sellers to the number of sellers" is the ratio of accurate sellers over the total number of sellers.

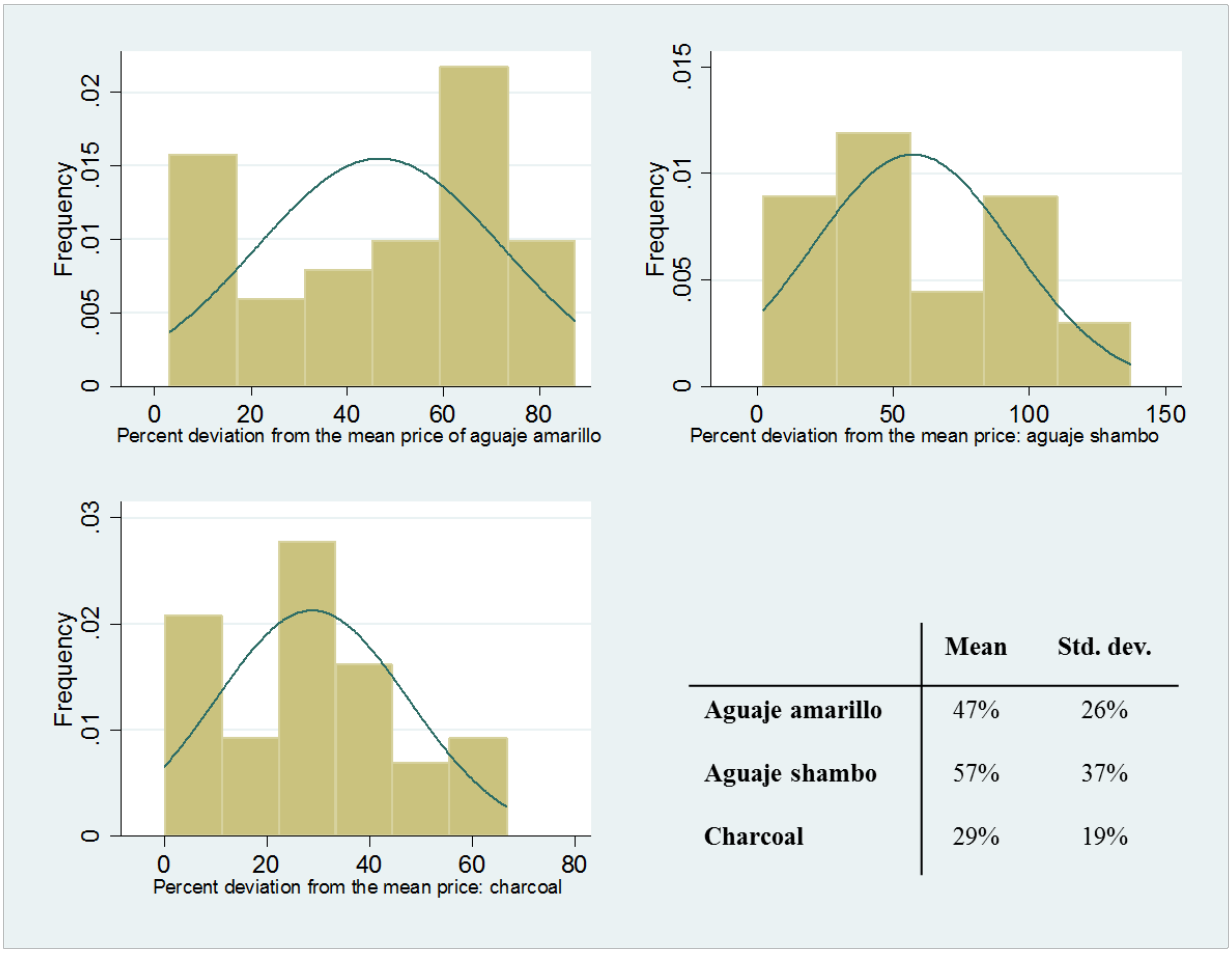
products, whereas others estimated three or four. In order to account for households who had not estimated any prices, we first tested whether there were significant differences in socioeconomic and household characteristics (see Methods, Independent variables, Table 3.1) between those households who had estimated at least one price and those households who had not estimate any prices. Results from a series of student's t-tests showed no statistically significant difference between the two groups, therefore were able to drop the households who did not estimate any prices from the model. The remaining sample included yuca (n=15 households), aguaje amarillo (n=36 households), aguaje shambo (n=25 households), and charcoal (n=39 households). The sample size of yuca was too small for multivariate regression so we eliminated that product from our analysis.

Next, we analysed the distributions of price accuracy for aguaje amarillo, aguaje shambo and charcoal by using histograms (Figure 3.9). Although the Shapiro Wilk's test for normality only showed that aguaje amarillo was not significantly non-normally distributed, all three products appeared to be non-normally distributed. There appeared to be two subpopulations within the sample – one subpopulation with high price accuracy and the other with relatively low price accuracy. Given these distributions we separated the two subpopulations for these three products and, using the Student's t-test, tested for differences between each subpopulation and the independent variables (household age, land wealth, market orientation, income diversity, family in Iquitos, frequency of travel to Iquitos, livelihood type and village). Results showed a statistically significant difference between the two aguaje amarillo and charcoal subpopulations and the variable 'village'. A greater frequency of households accurately estimated the price of aguaje amarillo in Nuevo Valentin, whereas for charcoal the least accurate households were from Santa Cruz.

3.4.3.1. Market orientation and household awareness of prices

There was little variation within the independent variables in both subpopulations for both types of aguaje, thus it was not possible to test which independent variables contribute to a household's placement in the first or second subpopulation. Charcoal, by contrast, was the product with the most observations, and had the most even representation across all three villages (n=13 for each village, for a total of 39 observations.) For these reasons charcoal was used to assess the household and village characteristics that best predict price accuracy.

Figure 3.9: Histograms of household price estimates: percentage deviation from the mean market (*rematista*) price.



	Mean	Std. dev.
Aguaje amarillo	47%	26%
Aguaje shambo	57%	37%
Charcoal	29%	19%

Results from our Probit regression model revealed that market orientation was the best predictor of whether or not a household could provide an estimate of the price of charcoal (Table 3.6 – Household price awareness). To generate this model we first tested a Probit model that included all the independent variables (Table 3.6) and found that only household age, the percentage of income from market sales, and the Nuevo Triunfo dummy were statistically significant. We retained land holdings, household age and the village dummies in the model as control variables and tested several other models for phone ownership, frequency of travel to

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3.4.3.2 Predictors of household accuracy

Our Ordinary Least Squares (OLS) regression model showed that livelihood type and village were the best predictors of charcoal price estimate accuracy (Table 3.6 - Household accuracy). In the OLS model only the village dummies and cash cropping livelihood type dummy were significant. Similar to the Probit model, all independent variables except land

Table 3.6 Regression models predicting household accuracy of price estimates for charcoal, upland villages: Nuevo Triunfo, Nuevo Valentin and Santa Cruz.

	Household price awareness loaded model	Household price awareness final model	Household accuracy loaded model	Household accuracy final model
Constant	-2.62 (-1.31)	-0.59 (-0.63)	26.99 (1.04)	34.29 (3.42)***
Land holdings (ha)	-0.023 (-0.90)	0.002 (0.12)	-0.099 (-0.30)	-0.04 (-0.14)
Household age (years)	-0.038 (-1.67)*	-0.027 (-1.58)	0.17 (0.50)	0.11 (0.41)
% of income from market sales	0.041 (2.19)**	0.025 (2.10)**	0.063 (0.34)	-
Income diversification	0.15 (0.59)	-	0.42 (0.13)	-
Average trips to Iquitos in June, July and August	0.22 (0.39)	-	0.19 (0.02)	-
Phone ownership dummy	0.78 (1.25)	-	7.55 (1.00)	-
Family in Iquitos dummy	1.25 (1.63)	-	-0.32 (-0.04)	-
Nuevo Triunfo dummy	1.72 (1.67)*	1.12 (1.58)	-17.68 (-1.88)*	-18 (-2.68)**
Nuevo Valentin dummy	-0.90 (-1.46)	-0.64 (-1.39)	-28.22 (-2.71)**	-26.16 (-3.64)***
Subsistence farmers dummy	-0.34 (-0.05)	-	3.53 (0.37)	4.91 (0.58)
Cash croppers dummy	0.303 (0.29)	-	26.97 (1.82)*	28.96 (2.35)**
Forest extractors dummy	0.68 (0.74)	-	9.72 (0.84)	10.21 (1.10)
R^2	-	-	0.4176	0.3861
F statistic	-	-	1.43	2.61
Prob>F	-	-	0.2179	0.0324
Pseudo R^2	0.2996	0.2141	-	-
χ^2 statistic	19.45	13.90	-	-
Prob>χ^2	0.0782	0.0163	-	-
Number of observations	53	53	37	37

*p-value<0.10; **p-value<0.05; ***p-value<0.01

Note: Household price awareness was tested using a Probit linear regression model. Household price awareness is a dummy variable where 1=yes, aware/able to estimate the price charcoal, and 0=no, not aware/able to estimate a price for charcoal.

Household accuracy was tested using an OLS linear regression model. Household accuracy is a continuous variable which represents the percentage that household estimated prices deviated from the mean *rematista* prices.

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holdings, household age, and the village dummies (which were left in the model as control variables) were taken out of the model and a Backward Elimination approach (i.e., where all independent variables are entered into the regression equation and then the variables that least contribute to the prediction are eliminated one at a time) was taken. Again we tested separate models for phone ownership, market orientation, frequency of travel to Iquitos, and livelihood type. Cash cropping households and households from Santa Cruz were least likely to estimate the price of charcoal correctly, whereas households from Nuevo Valentin were significantly more accurate in their estimates. Overall the model explains almost 39% of the variation in charcoal price estimate accuracy.

Despite the overall significance of the OLS regression model, few independent variables contributed in a statistically significant way. Holding all else constant, if the household lives in Nuevo Triunfo household price estimate accuracy will decrease by 18%; if the household lives in Nuevo Valentin, household price estimate accuracy will increase by 26.16%; and if the household is one of "Cash croppers" then household price estimate accuracy will increase by 28.96%. None of the distinguishing household characteristics are significant such as land holdings, household age and market orientation, which we would have expected to have a positive effect on household price estimate accuracy given that generally older households own more land, thus plant and sell more than households with less land, and are possibly more connected. We tested for multicollinearity using Pearson's correlation matrix, and found no significant multicollinearity among the independent variables.

3.4.4 Perceptions of access to market price information

Household survey results revealed that, overall, information about market prices in Iquitos is important to *ribereños* along the Tahuayo River. A total of 66% of the sample population stated that market price information is important to them (Table 3.7). Most households felt that information about market prices was easy to get when they needed it. Perceptions of the importance, ease of access, and timeliness of market price information showed no relationship to household age, land holdings, livelihood type or phone ownership. Perceptions of whether market price information was readily available and accessible when they needed it (timeliness) showed a statistically significant relationship to market orientation tercile and diversification classification. Households that are more market oriented and who are more

Table 3.7: Household perceptions of importance, ease and timeliness of information about market prices in Iquitos, by village and household characteristics.

Household grouping	Importance of information about market prices	Ease of access to information about market prices	Timeliness of information about market prices
	Fisher's exact p-value	Fisher's exact p-value	Fisher's exact p-value
Household age tercile	1.00	0.772	0.331
Land holding tercile	0.484	0.633	0.447
Livelihood type	0.315	0.954	0.669
Income diversification	0.590	0.812	0.0.031**
Market orientation tercile	0.654	0.577	0.040**
Phone ownership	0.383	0.644	0.308
Village	0.037**	0.389	0.098*

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specialized (four income sources or less) were more likely to respond that they could get information on time when they needed it. Results also showed a statistically significant relationship between the importance of information and village, and timeliness of information and village. In Tapira Nuevo I, the only lowland community, household responses were fairly evenly divided between "very important", "somewhat important" and "not very important", whereas in the upland villages most people agreed that information about market prices is "very important". In Tapira Nuevo I households revealed that they only *sometimes* get information about market prices on time (when they need it) more often than other villages. Although market price information is important overall, household interviews in all villages revealed that market price information is only very important when it comes time to sell their products, in the commercialization stage, and is not sought during production.

3.5 Discussion and conclusions

The aim of this study was to examine how market price information reaches *ribereño* households along the Tahuayo River, in the northeastern Peruvian Amazon. Our findings demonstrate that first, information about market prices, for the most part, is primarily of interest to Tahuayo households at harvest time or when the product is ready to be taken to market. Second, Tahuayo households are generally only interested in learning prices if they sell the product, and are not interested in prices for the products they produce but do not sell. Third, information predominantly travels by word of mouth along traditional lines between friends and family in the village, and seldom by telephone. Finally, our study found that there is a considerable level of variance in household price estimate accuracy that could not be accounted for by socioeconomic household and village characteristics.

3.5.1 Household interest in market prices: timing of information and type of product matter

Although market price information is important to *ribereño* households along the Tahuayo River, results showed that knowledge of prices are only very important when a product is in the final stages of harvest and ready to be taken to market. There is little evidence to suggest that market prices have a considerable bearing over household production strategies. At least in the short term, tradition and seasonal cycles appear to dictate what households will sell rather than market prices. In addition, given that most products are perishable; when they are ready to

be sold they need to be taken to the market even if the buying price generates little return. Charcoal is the exception. If stored in a dry location, charcoal can be kept for weeks or even months, allowing time for price speculation. Its longer shelf life may help explain why price variability for charcoal was lower than for other products. And low price variability may explain why households were able to better predict the price of charcoal than any other product.

The fact that households have a greater interest in knowing prices for the products they sell was demonstrated by a greater awareness of the price of non-timber forest products typically sold as cash crops (aguaje and charcoal) over those agricultural crops typically harvested for subsistence (yuca and plantain). Greater interest in learning the prices for these products also influenced *how* information was sought; in other words, the information sources used. Outside village information sources were accessed more for NTFPs (aguaje and charcoal) than for agricultural products (yuca and plantain). Tapira Nuevo I, however, was an exception; households in Tapira Nuevo I are more interested in knowing the price of yuca and plantain (products they sell most often) than aguaje or charcoal, and they only named information sources from within the village. In the absence of an outside *colectivero*, the producer who operates a community boat service to Iquitos was most often named and may act as an information broker.

3.5.2 Predictors of household accuracy

Given the higher interest in knowing prices for non-timber forest products that are sold, it is not surprising that households that derive a higher percentage of their total income from market sales (more market oriented) have a higher awareness of prices overall, as demonstrated in the results of our Probit model. Yet, being more market-oriented does not necessarily imply better price estimate accuracy, at least in the case of charcoal; 'village' proved to be the best predictor of accuracy and not 'market orientation'.

Certain village characteristics implicit in the model may partially explain the variation in household accuracy, such as village size and importance to nearby villages. For example, Nuevo Valentin was the village with the highest number of accurate responses. It is also the largest village, the only village with a public phone, the only village with a health clinic and a secondary school and has more small shops than any of the other three villages. The presence of a health clinic and a secondary school draws people from nearby villages and, as a result may have a spillover effect such that more outside information reaches Nuevo Valentin than households in

the other villages. There may also be more commercial activity within the village due to the presence of more small shops. Further, given its larger population, there may be a higher incidence of people coming to and from the market more often than in other villages, possibly contributing to a more constant flow of up-to-date information.

Nevertheless, there does appear to be a certain amount of randomness when it comes to household accuracy of price information. This randomness may be attributed to other market forces at play such as who had been to the market in any given week, whether there had been a community event that drew people in from the city, and how much the price had varied on a given week. These factors could also explain why the hypothetical and actual networks look so different.

3.5.3 Information access and the overstated roles of the *colectivero* and the telephone

3.5.3.1 The role of the *colectivero* in providing market price information

The frequency with which the *colectiveros* (boat operators) were named varied considerably between the hypothetical and the actual scenarios. In the hypothetical scenario the *colectiveros* were most often cited as the first information source, yet in the actual scenario the market and individuals who had recently come back from the market were most often cited. Certain points brought to light during household interviews may help to explain the seemingly overestimated role of the *colectivero*.

First, the *colectiveros* do not tell households the exact price of a product when asked. Instead they say the price is either "good", "bad" or "more or less good". This observation was made during household interviews and confirmed during interviews with the *colectiveros*. Households generally have an idea of what constitutes a "good" versus "bad" price based on the seasonal production cycles. Yet, not knowing the exact price leaves an element of chance and surprise upon arrival at the market and bartering to sell a product. With this in mind, it is not surprising that closer ties - such as family and friends in the village - were most often named in the actual scenario.

Second, there is a certain element of distrust when it comes to relying on *colectivero* information. A marked power imbalance exists between the *colectiveros* and *ribereño* households when it comes to market price information. The *colectiveros*, who know the prevailing market offering price of their cargo, may use this knowledge and distort the reported

price to their advantage. All three *colectiveros* engage in the buying and selling of products and, therefore, if the price is "good" they may say it is "more or less good" and offer to buy the product at a lower price in order to turn around and make a quick profit in the market. Several households brought this practice to our attention during household interviews and at least one of the three *colectiveros* admitted to doing this. Thus, whether scepticism over information received from *colectiveros* is justified or not households may prefer to rely on their close social ties, people they trust will give them more specific and undistorted information.

3.5.3.2 The telephone as a means for accessing market price information

Despite a growing body of literature pointing to the positive effects of increased phone access to rural communities throughout the developing world and improved market information, this study found no evidence to suggest that owning a phone contributes to improved information access. This could be because, as these same studies have pointed out, there are other barriers to entry such as the high cost of using a phone and the lack of technological training. In this study other barriers to entry were uncovered, including a lack of electricity to charge the phone and a lack of good contacts in Iquitos to call who would know prices accurately.

Nuevo Valentin is the only village that has electricity for several hours a night and those who have cell phones can charge them at this time. By contrast, in Nuevo Triunfo and Tapira Nuevo I there is no electricity and charging a cell phone is more complicated. In Nuevo Triunfo only one household has a power generator and they will charge a cellphone owner for a fee. In Tapira Nuevo I, households who own cell phones must go to the capital of Fernando Lores, Tamshiyacu, to charge their phone; roughly a half an hour peque-peque ride away. In addition, Nuevo Valentin is the only village with a public phone, though certain limitations were raised with respect to this including: the high cost of making a call (approximately 1 sol -$0.37 USD- per minute), the lack of phone cards needed to use the phone, the phone often does not work if it is raining (it operates on solar power) and lastly the lack of privacy when making a call.

In addition, having access to a phone is of little use for accessing market prices if the household does not have the proper contacts to get accurate information. When households were asked what was needed to improve access to market price information, 33% of respondents (n=23) stated the need for a cell phone, public community phone or radiophone. And 16% of

those interviewed (n=11) stated the need for an informant or someone in Iquitos to keep them updated on prices.

It is important for future researchers to recognize these limitations when designing projects that aim to improve information reach to remote communities. Projects that focus too heavily on the technological aspects of information access (i.e., ICT4D projects), such as expanding mobile network coverage to remote areas, risk only benefiting a select few, notably those who are already more well connected in the market. Consistent with findings from Clark (2006) and the International Institute for Environmental Development (IIED 2009), any approach at targeting the "market information gap" should first examine existing social networks and try to improve efficiency within these channels, for example linking producers with potential buyers in a way that benefits both parties.

3.5.4 Research challenges, and study design improvements for future research

3.5.4.1 Comparing household knowledge across villages with different production cycles

Fieldwork took place during the drier months of June, July and August. This created the challenge of missing price comparison data for Tapira Nuevo I. Households in Tapira Nuevo I were just starting to harvest fruit and vegetables in mid-late August at the time of my visit, and many had not begun. According to household accounts, the planting season was delayed in 2011 due to an unusually long flood season. Thus, households who generally would have been selling yuca or plantain at the time of my visit did not have any to sell. Given that households expressed an interest in asking about market prices only near harvest time, or when they are ready to take their products to the market, it was not possible to compare whether the differential information networks and distinguished village characteristics of Tapira Nuevo I play a role in household knowledge and accuracy of market price information. Ideally, researchers conducting this kind of study would be in the field over an entire agricultural cycle and ask households about prices on multiple occasions in order to get a complete data set that is comparable across villages. This was not possible given the time and resource constraints of this study and is a recognized limitation. To generate a better household accuracy index, future studies should take this into account.

The fact that households only have an interest in market prices when they are getting ready to sell their products only came to light during the course of fieldwork. For this reason,

there were more missing observations than expected from households in upland villages as well. Results from the Student's t-tests and the regression models also suggest there is a certain amount of randomness (noise) in the accuracy of household price predictions. In other words, there may be a certain degree of timeliness of when the interview was conducted and a) how the market was reacting during that week; and b) whether or not the household had recently sold that product.

3.5.4.2 Social Network Analysis and the difficulties of defining a network

This study also encountered limitations in the application of social network analysis. Future studies seeking to better understand information communication networks within and among villages should play close attention to how questions are phrased. The intention of this study was to identify different information channels by product. As such, questions were asked in a way that would permit the mapping of knowledge transfer at that particular moment. However, to get a further sense of within village interactions, questions should be phrased along the lines of "who *within the village* do you interact with on a daily basis?", "outside the village?", and "who *within the village* do you normally discuss price information with?", "outside the village?" This alternative way of constructing networks would first, permit the identification of within village interactions, in order to, second, identify the possible paths through which market price information could circulate.

Some confusion arose because we interviewed only the head of household. A snowball sampling technique whereby individuals named are sought after may provide better information to create the network. Finally, given that these results are for a specific moment, results and networks (particularly within community networks) may actually be more complete than they appear here. If households had been interviewed more than once and over a longer time period - in order to capture average interactions - we would have a better idea of who interacts with whom, in the context of price information, within and outside the village. Despite many households saying that they would ask "anyone in the community who has recently come back from the market" we suspect that this pool is actually more limited to family members or people within their closer social network. This was seemingly the case in Santa Cruz, a village that appears to be as geographically segregated as it is socially segregated.

CHAPTER 4: SUMMARY AND CONCLUSION

The purpose of this study was to examine the factors that contribute to uncertainty in market price information among *ribereño* producers in the Peruvian Amazon, in order to improve our understanding of the role information access plays in *ribereño* livelihood strategies. Whereas previous studies addressing information access among peasant societies throughout the developing world have been heavily technology-centered, our study arose in response to a need for better understanding traditional information communication systems.

Our study was set in the Peruvian Amazon, a region with limited transportation and information communication infrastructure to connect a highly dispersed rural population to the largest urban center, Iquitos. In Chapter 2, we examined the structural components of produce trade in the Loreto Region through the lens of the region's largest agricultural market, Belén. We used the Tahuayo River as a case study to describe the marketing process for villages within a day's travel to Iquitos, including the actors involved in the supply chain, and to assess the variability of prices in Belén for four agricultural and forest products of regional importance: plantain, yuca, charcoal, and aguaje. In doing so, we identified factors that contribute to price variance, and discussed the potential implications for *ribereño* households to accurately know market prices. In Chapter 3, we used key informant interview data (*n=3 colectiveros*), and data from two separate household surveys (*n=70*) in four *ribereño* villages (author's household survey data, 2011; Coomes 2010b: unpublished data), located along the Tahuayo River some five to eight hours upstream from Iquitos by public transport river boat (*colectivo*), to identify key actors that serve as information brokers by supplying market price information to *ribereño* households. Information sources were identified by product, village and household livelihood type. Finally we examined the role of socioeconomic household and village characteristics in predicting household accuracy of market price information, and found that there was little variation in price estimate accuracy that could be explained by the socioeconomic characteristics of households.

4.1 Summary of key findings

Nine key findings emerge from this research regarding price uncertainty and household awareness of market prices.

Structural factors contributing to market price uncertainty

1. Trade in Belén market occurs very informally, is unregulated and, for the most part, undocumented. The lack of formal monitoring and record keeping of volume of trade in Belén market makes it difficult to monitor trends and predict market supply. Unpredictable market supply has implications for *ribereño* households in nearby villages trying to estimate prices. A lag time exists between when prices are established and when that information reaches *ribereño* households and, during this time, prices often change. Even with the best information, there is no way to predict supply on any given day and the price can well change between the time it takes for a household to organize their product for market sale once they hear the price is good, and the time they reach the market.
2. The prices of agricultural and forest products in Iquitos markets are very sensitive to changes in market supply and fluctuate considerably throughout a week, a month, and the year. The price of charcoal fluctuates least, followed by yuca and plantain. Aguaje has the most considerable price variation of all the products studied and has the widest absolute range. Changes in market supply are related to seasonal production cycles and river levels (cyclical changes in supply), and to the number of boats arriving into port with said product on any given day (daily and weekly price variations). Seasonal patterns do contribute to some predictability when it comes to market prices. The prices of yuca and plantain generally have an inverse relationship to river levels (when river levels rise, prices drop and when river levels fall, prices increase). The price of aguaje follows a similar cyclical pattern to river levels but is sensitive to sharp decreases in river levels. The uncertainty surrounding market supply within a given week contributes to unpredictable prices.
3. In the city of Iquitos, product prices in Puerto Masusa are generally lower than in Puerto de Productores and Belén market. This is possibly related to market supply. Puerto Masusa is supplied by more distant communities (i.e., more than a day's travel), whereas Puerto de Productores and Belén market are supplied by villages within a day's travel to Iquitos. Prices in Belén, the largest market in the city, are similar to those in Puerto de Productores.

Social factors contributing to household awareness of market prices

4. Information about market prices is of primary interest to Tahuayo households at harvest time or when the product is ready to be taken to market. Obtaining market price information implies search costs and, because prices fluctuate so much over the course of a harvest season and from week to week, households are only interested in how prices are moving (i.e., up or down) when they are ready to make a trip to the market.
5. Households in the four study villages along the Tahuayo River are generally interested in prices for the products they sell and not the prices for the products they produce primarily for subsistence, though some surplus may be sold periodically. This was reflected by a greater interest in inquiring about the price of non-timber forest products sold as cash crops as opposed to agricultural products typically harvested for consumption, and by greater awareness of NTFP prices.
6. Information about market prices along the Tahuayo River primarily comes from within the village and is communicated by word of mouth between friends and family. Further it is largely dependent on who has been to the market on a given week. Our results demonstrated that access to a public telephone or, surprisingly, a private phone (i.e., cell phone or landline), does not strongly influence household knowledge of market prices.
7. Boat operators (*colectiveros*) are potentially important sources of outside information and act as information brokers with respect to up-to-date information on market prices. In our study, the *colectiveros* were frequently named in the hypothetical scenarios but not in the actual scenarios. Possible reasons for this were discussed in Chapter 3, most notably, that the *colectiveros* do not tell households exact prices, and because the *colectiveros* themselves engage in the buying and selling of products. However, research has shown that markets operate more efficiently when all actors have better information (Eggleston, et al., 2002; Grossman & Stiglitz, 1980; Jensen, 2010). With this in mind, there appears to be potential for the *colectiveros* to have a more active role in information transmission without compromising their occasional role as middlemen.
8. Households who derive a greater percentage of total income from market sales (i.e., who are more market oriented) have a greater awareness of prices overall.
9. Residents in one village, Nuevo Valentin, showed a greater awareness for prices in Belén market. This could be attributed to community characteristics such as the larger size, the

presence of a secondary as well as a post-secondary school attended by students from other communities, the presence of a health clinic, and perhaps more commercial activity in the village (i.e., more small shops).

4.2 Implications and conclusion

Results of our study demonstrate the complexity of price information acquisition among *ribereño* households in the hinterland of Iquitos markets. As we have shown, agricultural and forest product prices in Belén market are highly variable and this variability is strongly linked to changes in market supply. Initiatives to improve *ribereño* access to market price information must first address the issue of product price variability by finding ways to improve market supply predictability and timing. This is not an easy task in Amazonia, a region that is as dependent on river level changes for production as it is for ease of transportation. Given the reliance on natural "river highways" for transportation, the supply of products to market cannot always be well timed or planned (Salonen, et al., 2012). A potential avenue to improve information about market supply could be through boat operators by, for example, obliging them to communicate their location and cargo prior to arriving into port. This might be particularly useful for boats coming from distances further than a day away, in order to alert closer villages to hold off on sending products to market and avoid flooding the market of product and driving down the price. Recent work by Salonen, Toivonen, Cohalan and Coomes (2012) has been done to address the issue of physical accessibility. Additionally, ongoing research is being conducted by M. Salonen (personal communication in August 2011 regarding dissertation work) addressing the issue of boat movements and timing.

Results from our study also indicate that initiatives to improve access to market price information among *ribereño* producers must take into account the importance and vital role of personal interactions and word of mouth communication. We caution those practitioners who promote technology-centered approaches that do not address underlying social issues such as the need to link rural producers with informants in Iquitos, poverty and the affordability of information technologies. In addition, technology-centered approaches, such as expanding mobile networks to rural villages, must not ignore underlying infrastructure deficiencies, notably whether electricity is available. If the proper electricity infrastructure is not in place, if households cannot afford information technologies, and if households do not know the proper

people to contact in order to get good information about prices in the Iquitos markets, then technology-centered approaches will not have the desired impact. Indeed, despite the enthusiasm over information communication technologies, and specifically the expansion of cell phone coverage to rural communities, initiatives such as the "Voz de la Selva" radio program that announced prices over the radio may still be most effective in providing timely and valuable information to poor rural producers in the Peruvian Amazon.

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APPENDIX 1. SURVEY INSTRUMENTS

1.A Household survey

Encuesta sobre la estructura de redes de información en la región del Tahuayo
Entrevistas a ser administrados con el hombre del hogar

Nombre de la comunidad_____ Fecha_____

Código del hogar_____ **El código de la casa debería corresponder con el código de casa de los encuestas de 2010*

Nombre del jefe de la casa: _____

Nombre de la mujer de la casa: _____

El objetivo de esta encuesta es de entender como la información se circula en la comunidad y entre las comunidades próximas. La encuesta tiene tres partes. La primera sección de preguntas tratase de información sobre los precios para la venda de productos agricolas en Iquitos. El segundo parte tratase sobre carbón, que voy a explicar un poco más tarde. La tercera parte trata de preguntas sobre una historia.

I Sección: Precios
En este primer sección les voy a preguntar sobre la venda de productos agricolas, especificamente como les envían estos productos para el mercado y como les especula/encuentra información sobre los precios.

A. Importancia y exactitud de información sobre los precios de mercado en sus actividades diarias

A1. Sobre una escala de 1 a 5; ¿Cuál es la importancia para usted en sus actividades diarias para tener acceso a la información sobre los precios de mercado? (escala de 1-5, no muy importante, muy importante).

No muy importante	más o menos importante	Muy importante
1	2	3

¿Por qué? _____

_____

A2. ¿Es fácil para usted obtener la información de precios de productos en la ciudad [Iquitos]?
Es fácil _____ No es fácil _____

¿Por qué es fácil/no es fácil? _____

A3. ¿Cuándo recibes la información de los precios, la recibe a tiempo? *Por ejemplo, cuando quieres vender sus productos, ¿se sabe a qué precio les puede vender lo mismo día que quieres vender? O recibes la información de los precios de ayer (por ejemplo) y llegas y es otro.*

Sí _____ *(si la respuesta es sí, pasa al sección B)* **No** _____ **A veces sí, a veces no** _____

Comentária:_____

_____

A4. ¿Qué crees que le faltaría para tener la información a tiempo?

_____

_____

_____

1

B. Frecuencia de viajes para Iquitos

B1. ¿Normalmente, durante esta época de seca - <u>en los meses de Junio, Julio y Agosto</u>; qué miembro de su <u>hogar</u> viaje a Iquitos con más frecuencia? *(una respuesta sola aunque se viajan con la misma frecuencia)*

Miembro(s) del hogar	Nombre	¿Cuantas veces por semana?	¿Cuantas veces por mes?	Ningún miembro del hogar viaje durante estos meses
Jefe				
Señora				
Hijo				
Hija				
Hermano				
otros				

B2. ¿Cuándo usted u otros miembros de su hogar viajan para Iquitos, en qué se van?

i. En colectivo _____ Nombre del colectivo que les lleva _____

ii. En mi propio Peque-Peque _____ iii. En bote hasta Tamshiyacu para tomar el colectivo_____

iv. Bote comunal (de la comunidad) _____

v. Otro, especificar _____

C. Venta de productos agrícolas
C1. Durante el último año [*fin de Junio 2010 hasta Julio 2011*] ¿Ha producido o vendido alguno de los productos siguientes?

Producto	Producido	Vendido	Ninguno
Yuca (saco)			
Maíz seca (kg)			
Maíz choclo (unidad)			
Plátano (racimo):			
Aguaje (saco)			
Carbón (saco)			
Umarí (saco)			
Sandia (unidad)			
Sandia(unidad):			
Criznejas (unidad):			

C2. ¿Con qué frecuencia envían productos al mercado en Iquitos?

Producto	En qué meses	Veces/semana	Veces/mes	Mercado
Arroz:				
Yuca:				
Plátano:				
Maíz seco:				
Maíz chocla:				
Aguaje:				
Umarí:				
Sandia:				
Carbón:				
Criznejas de irapay:				

Código de mercado
1 = Mercado Belen
2 = Tamshiyacu
3 = Mercado/puerto de productores
4 = otro, especificar _____

C3. ¿Cómo usted envía sus productos para el Mercado más frecuentemente?
(Numerar todos que se aplican en orden del más frecuente al menos frecuente)

Método	Orden
i. encomienda	
ii. Yo llevo los productos a Iquitos y yo mismo y les vende a alguien allá	
iii. Un miembro de la familia les lleva a Iquitos (especificar quién) _____	
iv. Les manda en colectivo para un miembro de la familia recibir y vender en Iquitos Especificar quien _____	
v. Les vendo al colectivero Especificar cual colectivero _____	
vi. Yo les vende a un comprador residente en la comunidad o en una comunidad cerca Especificar cual comunidad _____	
vii. Vendo mis productos a los rematistas cuando llegan en la comunidad para comprar	
viii. Otro, explicar _____ _____	

D. Precios de Mercado: Lazos relacionales/vínculos – JEFE DEL HOGAR

D1. ¿Si usted quería saber el precio de los siguientes productos agrícolas *esta semana*, a quien le preguntaría? *Refiere al tabela C1 para los productos producidos*
¿Cuál es su relacionamiento a esta persona? ¿Con qué frecuencia usted vea esta persona? ¿Con qué modo de comunicación esta información fue comunicada?
(Nombre de la persona y razón, relación al respondiente, método de comunicación y frecuencia de interacción en *días por semana)*

	Jefe del hogar											
	1ra persona				2da persona				3ra Persona			
	Nombre Razón (¿por qué?)	rel	com	fre	Nombre Razón (¿por qué?)	rel	com	fre	Nombre Razón (¿por qué?)	rel	com	fre
Saco de yuca												
kg maíz												
Unidades de Choclo												
kg de arroz												
Racimo (mediano) Plátano												
Saco de Aguaje												
Saco de Carbón												
unidad Sandia												
unidad Criznejas												

Códigos de la relación

1 = familia en la comunidad
2 = familia en la ciudad
3 = vecino/a
4 = amigo/a
5 = colectivero
6 = residente comprador
7 = alguien en la ciudad, especificar quien _____
8 = rematista
9 = otro, describir _____

Códigos para el modo de comunicación

1 = visita
2 = viaje en el colectivo para la ciudad
3 = juego de fútbol
4 = teléfono
5 = radio
6 = una minga
7 = reunión
8 = otro, describir

D2. ¿Si tu quería saber el precio de los siguientes productos agrícolas *hoy*, a quién le preguntaría primero? – JEFE DEL HOGAR

	Jefe del hogar											
	1ra persona				2da persona				3ra Persona			
	Nombre Razón (¿por qué?)	rel	com	fre	Nombre Razón (¿por qué?)	rel	com	fre	Nombre Razón (¿por qué?)	rel	com	fre
Saco de yuca												
kg maíz												
Unidades de Choclo												
kg de arroz												
Racimo (mediano) Plátano												
Saco de Aguaje												
Saco de Carbón												
unidad Sandia												
unidad Criznejas												

Códigos de la relación

1 = familia en la comunidad
2 = familia en la ciudad
3 = vecino/a
4 = amigo/a
5 = colectivero
6 = residente comprador
7 = alguien en la ciudad, especificar quien _____
8 = rematista
9 = otro, describir _____

Códigos para el modo de comunicación

1 = visita
2 = viaje en el colectivo para la ciudad
3 = juego de fútbol
4 = teléfono
5 = radio
6 = una minga
7 = reunión
8 = otro, describir

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E. El conocimiento de los precios de mercado

E1. ¿Usted sabe cuánto están pagando o pagaban en Belen por… *Anota el precio. Si no sabe anota NS*

	esta semana	la semana pasado	No es la época	Precio que ofrecen compradores en Belén o rematista
Yuca (panero)				
maíz seco (kg)				
Maíz choclo (por ciento)				
Arroz (kg)				
Plátano (racimo mediano)				
Aguaje *amarillo* (saco)				
Aguaje *colorado* (saco)				
Aguaje *Shambo* (shambo)				
Carbón (saco)				
Sandia (unidad)				
crizneja Irapay				

E2. ¿Cómo sabes de los precios de estos productos? ¿De quién ha escuchado esta información?

Nombre de la persona con les ha dicho el precio – *Si ha escuchado del colectivero, nombre del colectivero. Si ha escuchado por radio, nombre de la frecuencia de radio.*	**Código del producto(s)**

1 = yuca (saco o panero)
2 = maíz seco (kg)
3 = maíz choclo (por ciento)
4 = arroz (kg)
5 = plátano (racimo mediano)
6 = aguaje (unidad)
7 = carbón
8 = sandia (unidad)
10 = crizneja irapay
11 = todos

E3. ¿Recuerdas dónde has escuchado o le dijeron el precio de estos productos?
(Ejemplos: cuando estaba pescando, en el barco de/para la ciudad de Iquitos, durante una reunión, durante una visita con esta persona en su casa/en mi casa, por el teléfono, et

¿Donde?_____

_____

¿Cómo?_____

_____

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Sección II: Producción de carbón y cultivo en sitios de horno

En esta parte del cuestionario voy a hacer preguntas sobre la producción de carbón. Se dicen que hay gente en otros lugares que plantean cultivos sobre sitios de horno. ¿Usted ha escuchado algo sobre esto?

F. Difusión de información sobre cultivos en sitios de horno de carbón

F1. ¿Usted ha escuchado de personas que siembran en sitios de horno?

Sí _____ **No _____** (Si no, pasa al G6)

F2. ¿Usted me puede decir cómo ha escuchado?

¿Cuándo se enteró por la primera vez?

_____

¿Adónde se enteró por la primera vez?

_____

¿De quién ha escuchado por la primera vez? (Nombre y comunidad)

_____

F3. ¿A parte de la persona que antes escucho, ha escuchado de alguien más? ¿Quién? Listar hasta tres personas.
Si la/las personas no viven en la comunidad, ¿en qué comunidad vive/viven?

	Nombre	**Relacionamiento al entrevistado**	**Comunidad**	**Modo de comunicación**
1				
2				
3				

Códigos de la relación

1 = familia en la comunidad
2 = familia en la ciudad
3 = vecino/a
4 = amigo/a
5 = colectivero
6 = residente comprador
7 = alguien en la ciudad esp. Quien _____
8 = rematista
9 = otro, describir

Codigos para el modo de comunicación

1 = visita
2 = viaje en el colectivo para la ciudad
3 = juego de fútbol
4 = teléfono
5 = radio
6 = una minga
7 = reunión
8 = otro, describir

F4. ¿Conoce usted alguien en su comunidad que lo hace (siembra en sitios de horno)?

No _____ **Sí_____** *(si sí)* **quien _____**

F5. ¿Conoce usted alguien en otras comunidades que lo hace (siembran en sitios de horno)?

No _____ **Sí_____**

(Si sí)

¿Cuáles comunidades? _____

¿Quién? _____

F6. ¿Usted produce carbón?

Sí_____ **No_____** (si la respuesta es no, pasa a la pregunta G7)

¿Hace cuanto tiempo que usted produce carbón? _____

Si menos de 5 años – **¿Quién le enseño a producir carbón?**_____

_____

F7. ¿Usted siembra en sitios de horno? [que sea sus propios sitios de hornos o de sitios de otros personas]

Sí _____ **No_____**(Si no pasa al sección I)

(Si la respuesta es sí) **¿Desde cuándo usted está sembrando en los sitios de horno?**

_____

¿En cuántos sitios de horno usted está cultivando? _____

¿En qué lugares están localizados estos sitios de horno? (Altura o bajado)

_____

¿Cuáles productos siembra en estos sitios?

	Plátano
	Caña dulce
	Papa Huitina
	Ají dulce
	Otros (listar)

¿Por qué usted ha empezado sembrar en sitios de hornos?

_____

_____

III sección: La Ahuara
G. Difusión de la historia del Ahuara

G1. *En esta última sección les voy a preguntar sobre una historia. El rio Tahuayo bajo de Huaysi tiene agua blanca. Años pasados esta parte del rio tenía agua negra…*
¿Recuerda usted cuando ocurrió el cambio del rio?

Sí _____; ¿En qué año? _____

No _____

G2. ¿Usted sabe que provocó este cambio del rio?

_____

_____

_____

_____

G3. ¿Usted ha escuchado la historia del Ahuara de Huaysi?

No _____ *(si no, pasa para la próxima sección)* **Sí _____ ¿Me puedes contar la historia?**

_____

_____

_____

_____

G4. ¿Usted me puede contar de *la primera vez* que escucho la historia del Ahuara?

¿Cuando escucho por la *primera vez?*? _____

¿Dónde estabas cuando escucho por la primera vez? _____

¿Quién le conto por la primera vez? _____

G5. ¿Usted ha contado la historia para otros personas? *(hijos, familia, amigos, etc.)*

_____

_____

_____

_____

H. Papel en la comunidad

H1. ¿Hay algún miembro de su <u>hogar</u> que es autoridad de la comunidad?

No_____ Sí_____

(Si la respuesta es sí) **¿Cuál(es) miembro(s) del <u>hogar</u>?**

_____¿Qué papel? _____

_____¿Qué papel? _____

1 = Teniente Gobernador
2 = Agente municipal
3 = Coordinador/a de Vaso de Leche
4 = Presidente de APAFA
5 = Animador cristiano
6 = Promotor de salud
7 = Presidente deportiva
8 = Director de educación
9 = otros, especificar_____

I. Interactividad en la comunidad y entre otros comunidades

I1. ¿Usted u otra persona en su familia está trabajando con una ONG?

No_____ Sí _____ *(si sí)* ¿Cual ONG? ¿Qué haces?

_____

I2. ¿Usted u otros miembros de su <u>hogar</u> pertenece a una organización comunal?

Sí _____ No _____ *(pasa al J3)*

Grupo de iglesia _____ Club deportiva _____ Asociación de pescadores _____

Asociación de agricultores _____ (*ejemplo as. Libertad Agrária*) _____

Policia comunal _____ Club deportiva _____ Otro, especificar _____

I3. ¿Participe usted, u otros miembros de su familia en juegos de fútbol entre comunidades?

No_____ Sí_____ *(si la respuesta es sí)*

¿Cuáles otras comunidades participan en estos juegos? (nombrar todos)

_____

_____

J. Comunicación

J1. ¿Tiene usted un celular?

Sí _____ No _____ Otro miembro de la familia tiene y yo usa as veces _____

¿Teléfono de casa?

Sí _____ No _____

J2. ¿Hay un teléfono comunal en la comunidad que le usa?

Sí _____ No _____

¡Mil Gracias!!!!!!!!!!!!!!!!!!

1.B Interview Schedule with *colectiveros*

Preguntas para colectiveros

Viajes

1. ¿Cuantos días a la semana bajas y surcas? ¿Cuáles días?

2. ¿Hasta qué comunidad viajes?

3. ¿Cuáles meses del año no puedes pasar por el Tahuayo?

4. ¿Cuándo no puedes entrar en el Tahuayo, hasta a dónde viajes?

Carga

5. ¿Cuánto le cobra para la carga de los siguientes productos?
   a. Saco de Yuca:
   b. Saco de maíz seca:
   c. Saco de maíz choclo:
   d. Racimo [mediano] de plátano:
   e. Saco de aguaje:
   f. Saco de carbón:
   g. Bandejas de Umari:
   h. Caja de Sandia:
   i. Saco de arroz:
   j. Ciento de criznejas:

6. ¿Cuando alguien venda sus productos vía encomienda, que significa? ¿Cómo funciona?

7. ¿Hay un día de la semana que siempre hay más carga que otros días? [si la respuesta es sí, porqué].

8. ¿Hay días que el bote es demasiado llena que tienes que pasar por comunidades y dejar pasajeros y carga?

Precios

9. ¿Normalmente usted siempre averigua los precios de los productos cuando estas en el puerto? ¿Cómo haces para averiguar?

10. ¿Cuándo usted para en los puertos de las varias comunidades, normalmente hay gente que preguntan sobre los precios de productos?

11. ¿Cuándo personas en las comunidades preguntan a usted los precios de productos en Iquitos/Belen, como usted responda? ¿Les diga el precio específico, o simplemente les diga que el precio está bueno o malo?

12. ¿Usted también compra productos de los productores en las comunidades? ¿Cuáles productos?

13. [Si el colectivero compra productos] Cuando usted compra productos, ¿para quién les vende? ¿Rematista? Un comprador en la parte arriba ¿(menudeo, mayorista)? ¿Normalmente siempre vendes a lo precio que esperas?

14. ¿Según usted, los precios varían mucho de un día para otro? Por ejemplo, ¿Cuándo surcas escuchas un precio y bajas y ya es otro?

APPENDIX 2. RESEARCH ETHICS APPROVAL FORM

McGill

Research Ethics Board Office
James Administration Bldg, room 429
845 Sherbrooke St West
Montreal, QC H3A 2T5

Tel: (514) 398-6831
Fax: (514) 398-4644
Ethics website:www.mcgill.ca/research/researchers/compliance/human/

Research Ethics Board I
Certificate of Ethical Acceptability of Research Involving Humans

REB File #: 464-0511

Project Title: Information Landscapes in the Peruvian Amazon: An Analysis of Information Exchange Networks and Rural Livelihoods among Riverine Communities

Principal Investigator: Meghan Élise Doiron **Department:** Geography

Student Status: Master's Student **Supervisor:** Prof. O. Coomes

This project was reviewed on 6 May 2011 by delegated review.

Rex Brynen Ph.D.
Chair, REB I

Approval Period: _May 25, 2011____ **to** __May 24, 2012____

This project was reviewed and approved in accordance with the requirements of the McGill University Policy on the Ethical Conduct of Research Involving Human Subjects and with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans.

---

* All research involving human participants requires review on an annual basis. A Request for Renewal form should be submitted 2-3 weeks before the above expiry date.
* When a project has been completed or terminated a Study Closure form must be submitted.
* Should any modification or other unanticipated development occur before the next required review, the REB must be informed and any modification can't be initiated until approval is received.

McGill University

ETHICS REVIEW
RENEWAL REQUEST/STUDY CLOSURE FORM

Continuing review of research involving humans requires, at a minimum, the submission of an annual status report to the REB. This form must be completed to request renewal of ethics approval. If a renewal is not received before the expiry date, the project is considered no longer approved and no further research activity may be conducted. When a project has been completed, this form can also be used to officially close the study. To avoid expired approvals and, in the case of funded projects, the freezing of funds, this form should be returned 2-3 weeks before the current approval expires.

REB File #: 464-0511
Project Title: Information Landscapes in the Peruvian Amazon: An Analysis of Information Exchange Networks and Rural Livelihoods among Riverine Communities
Principal Investigator: Meghan Élise Doiron
Department / Email: **meghan.doiron@mail.mcgill.ca**
Faculty Supervisor (if student PI): Dr. Oliver Coomes

1. Were there any significant changes made to this research project that have any ethical implications? ___Yes _X_No
   If yes, describe these changes and append any relevant documents that have been revised.

2. Are there any ethical concerns that arose during the course of this research? ___ Yes _X_ No. If yes, please describe.

3. Have any subjects experienced any adverse events in connection with this research project? ___ Yes _X_ No
   If yes, please describe.

4. Is this a funded study? _X_ Yes ___No. If yes, list the agency name and project title and the Principal Investigator of the award if not yourself. This information is necessary to ensure compliance with agency requirements and that there is no interruption in funds.
   - **Oliver Coomes, SSHRC, 2008-2012, "Indigenous agriculture in Amazonia: sustainable land uses, agrobiodiversity and environmental adaptation", McGill Account No. 217818**

_X_ Check here if this is a request for renewal of ethics approval.

____ Check here if the study is to be closed and continuing ethics approval is no longer required. A study can be closed when all data collection has been completed and there will be no further contact with participants.

Principal Investigator Signature: Meghan Doiron Date: 04/17/2012.

Faculty Supervisor Signature: O. Coomes. Date: 18/04/12
(if PI is a student)

For Administrative Use	**REB:** X REB-I ___REB-II ____REB-III
___ The closing report of this terminated project has been reviewed	
X The continuing review for this project has been reviewed and approved	
___Expedited Review ___Full Review	
Signature of REB Chair or designate: [signature] Date: May 1, 2012	
Approval Period: May 1 2012 to April 30, 2013	

Submit to Lynda McNeil (lynda.mcneil@mcgill.ca), Research Ethics Officer, James Administration Building, 845 Sherbrooke Street West suite 429, fax: 398-4644 tel: 398-6831. Electronic submissions with scanned signatures are accepted but must come from the PI's McGill email.

(version 10/10)

APPENDIX 3. CHARACTERIZATION OF HOUSEHOLDS BY LIVELIHOOD TYPE

Nuevo Triunfo

Income share by source	Hid	201	202	203	204	205	206	207	208	210	212	213	214	215	216	218	219
Subsistence crops		9	24	28	34	85	39	16	59	32	39	42	34	67	45	24	26
Cash crops		8	5	10	13	1	18	7	11	7	5	3	13	23	6	1	52
Forest Extraction		35	26	10	13	13	19	15	4	42	12	22	18	0	13	29	12
Livestock		6	16	47	26	1	17	58	23	5	42	28	12	4	24	14	3
Small livestock		6	16	9	26	1	17	35	23	5	2	28	12	4	24	14	3
Cattle		0	0	38	0	0	0	23	0	0	40	0	0	0	0	0	0
Fishing		5	3	5	13	0	8	3	4	6	2	1	6	4	13	14	4
Wage labour		0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0
Other		37	25	0	0	0	0	1	0	9	0	4	15	1	0	17	3
Livelihood classification		FE	FE	O	SA	SA	SA	O	SA	FE	O	SA	SA	SA	SA	FE	CC

Nuevo Valentin

Income share by source	Hid	302	303	304	306	308	309	310	311	312	313	317	318	319	324	329	330	331	335	336	337	339	341
Subsistence crops		43	31	45	44	21	23	40	67	36	26	29	33	33	60	62	15	8	16	30	22	27	32
Cash crops		21	26	23	1	4	43	29	0	24	40	23	2	14	16	19	17	45	1	21	31	34	33
Forest Extraction		0	0	0	0	18	8	17	0	25	5	39	18	43	0	0	0	0	5	21	0	21	32
Livestock		35	39	28	50	54	17	13	30	4	29	0	2	8	23	11	3	9	78	11	27	10	0
Small livestock		35	39	28	50	54	17	13	30	4	29	0	2	8	23	11	3	9	15	11	27	10	0
Cattle		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63	0	0	0	0
Fishing		1	3	4	1	3	1	0	3	7	0	4	1	2	0	4	65	37	0	3	0	3	0
Wage labour		0	0	0	3	1	0	0	0	0	0	5	0	1	0	0	0	0	1	0	2	0	3
Other		0	0	0	0	0	8	0	0	3	0	0	44	0	0	3	0	0	0	14	18	5	0
Livelihood classification		SA	SA	SA	SA	SA	CC	SA	SA	SA	CC	FE	O	FE	SA	SA	O	CC	O	FE	CC	CC	O

Santa Cruz

Income share by source	Hid	901	903	904	905	906	907	908	909	910	911	912	913	915	917	918	919	920	922
Subsistence crops		55	25	38	67	62	48	66	57	38	46	51	42	51	66	51	67	48	66
Cash crops		7	4	1	0	6	12	2	5	3	8	2	0	22	0	1	1	6	17
Forest Extraction		0	4	30	20	23	22	11	19	25	35	31	39	16	34	24	26	23	0
Livestock		0	0	0	7	8	12	6	16	33	7	12	11	10	0	21	4	11	12
Small livestock		0	0	0	7	8	12	6	16	33	7	12	11	10	0	21	4	11	12
Cattle		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fishing		34	0	0	0	2	6	2	2	0	1	3	5	1	0	2	0	2	3
Wage labour		0	0	2	5	0	0	2	0	1	3	0	0	0	0	2	2	4	2
Other		4	67	30	0	0	0	11	0	1	0	0	3	0	0	0	0	8	0
Livelihood classification		O	O	FE	SA	SA	SA	SA	SA	SA	FE	FE	FE	SA	SA	SA	SA	SA	SA

Tapira Nueva I

Income share by source	Hid	601	603	604	605	607	608	610	611	612	613	614	615	616	617
Subsistence crops		21	41	48	68	49	54	20	33	52	69	56	61	46	56
Cash crops		72	47	33	20	32	31	77	63	18	0	39	32	52	39
Forest Extraction		0	0	8	0	9	0	0	0	0	0	0	0	0	0
Livestock		3	4	5	12	4	11	2	2	4	22	4	4	2	3
Small livestock		3	4	5	12	4	11	2	2	4	22	4	4	2	3
Cattle		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fishing		4	7	1	0	6	3	1	1	3	0	1	1	0	1
Wage labour		0	1	0	0	1	0	0	0	1	9	0	0	0	0
Other		0	0	5	0	0	1	1	0	22	0	0	1	0	0
Livelihood classification		CC	CC	CC	SA	CC	CC	CC	CC	SA	SA	CC	CC	CC	CC

Final Groups				
NT	NV	SC	NTI	Totals
SA=8	SA=10	SA=12	SA=3	33
CC=1	CC=5	CC=0	CC=11	17
FE=4	FE=3	FE=4	FE=0	11
O=3	O=4	O=2	O=0	9
n=16	**n=22**	**n=18**	**n=14**	**N=70**

Nuevo Triunfo= half subsistence based agriculture with some households practicing forest extraction and other activities, and one household devoted to producing cash crops.
Nuevo Valentin= Most diversified community. Largest percentage of households in any one activity is subsistence agriculture but more than half of all households earn a larger portion of their income from cash crops forest extraction and other sources.
Santa Cruz= Primarily a subsistence agriculture community with some households earning more income through forest extraction and other sources.
Nuevo Tapira I= A primarily cash cropping community with only a few households devoted to subsistence agriculture.