Because we can't eat trees:

Smallholders' willingness-to-accept to avoid deforestation in Cameroon

by

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Abstract

Reducing Emissions from Deforestation and forest Degradation (REDD) has been brought forth by the global community as a strategy to positively impact the climate. Key costs in implementing REDD strategies are the payments to individuals and/or groups that provide emission abatement through forest maintenance. In this study, estimation of compensation levels for individual smallholders in Cameroon is derived through measuring their willingness to accept (WTA) land use restrictions. Through a stated preference approach, heads of households are asked to indicate the minimum amount that each would be WTA to maintain forested land based on a hypothetical contract that would limit their land or tree clearing activities for 10 years. Smallholder perceptions were also captured through responses to Likert-type statements. Compared to previous opportunity cost estimates, WTA results suggest that generally, smallholders require more compensation to participate in REDD than production-based opportunity cost approaches indicate.

Preface

This thesis is an original work by Dara Yvette Lavers Thompson. This research project, of with this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Investigating landowners' willingness-to-accept payment to reduce deforestation through REDD mechanisms and their preferences of attributes in REDD project adoption contracts in Southern Cameroon," No. Pro00017071, December 13, 2010.

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Chapter 1 Introduction

1.1 Climate change

The Intergovernmental Panel on Climate Change (IPCC) (2013) has suggested that the atmospheric concentration of carbon dioxide (CO_2) has increased due to anthropogenic activities. Further, the IPCC 2013 Summary for Policymakers indicates there is a linear relationship between global mean surface temperature and the atmospheric increase in CO_2 (IPCC, 2013). Several anthropogenic and natural causes of emission release have been pinpointed, with the forestry sector said to contribute approximately one-fifth of all global emissions, as indicated by the IPCC 4th Assessment Report (IPCC, 2007). Trees, soils and peat lands are natural holding areas for carbon and other greenhouse gases (GHGs). GHGs are released through land clearing activities such as logging and slash-and-burn agriculture, thus counteracting these natural sequestration effects and contributing to atmospheric carbon levels.

1.1.1 A potential solution: Reducing Emissions from Deforestation and forest degradation in Developing countries (REDD)

In 2007, the IPCC publically recognized that deforestation in developing countries is an important global issue because of the GHG emissions released (IPCC, 2007). From this acknowledgement, Reducing Emissions from Deforestation and forest degradation in Developing countries (REDD) was created. One of the intentions of this initiative was to facilitate partnerships between high-emission industrialized countries and developing countries with significant forest cover in an effort to diminish forest management activities that generate emissions. There are several market and non-market policy mechanisms that could help to achieve REDD objectives. Policy approaches that have been utilized in the past to reduce deforestation

include: forestry sector tariffs and stumpage fees; international public expenditures that focus on economic incentives; and tightening laws to reduce access to land and resources while encouraging poverty alleviation (Sunderlin and Atmadja, 2009). However, these policies have often failed because they did not address the holistic nature of deforestation, where external sectors, political and economic drivers, corruption and governance, forest transition and the suppression of smallholder rights all play a role (Sunderlin and Atmadja, 2009). The intertwined problem of deforestation creates a multifaceted problem that needs to be attacked from multiple angles.

1.1.2 Providing compensation to reduce deforestation

One approach that may produce a longstanding result is compensation to smallholders for locally avoiding deforestation and forest degradation. This mechanism, facilitated through payments for ecosystem services (PES), can encourage individuals to act in the societal best interest by maintaining the integrity of environmental features while receiving compensation to do so (Wunder, 2005). Smallholders would be compensated to sign a contract in which their ability to utilize forested areas would be restricted for a predetermined length of time. Insecure property rights pose a problem for this type of contract in many developing nations, so legal tenure may need to be reformed in order for PES to have validity in the REDD setting.

Because much of the developing world is set in regions with unique ecosystems – the Amazon and Congo Basin Rainforests, for example – actions to reduce deforestation are integral to the function of the global ecosystem. REDD can be a relatively inexpensive policy approach for climate change mitigation, and therefore this program could make significant advances in the quest for global emissions reduction (Boucher, 2008).

1.2 Smallholder cultivation in Cameroon

Cameroon is a geographically diverse nation in Central Sub-Saharan Africa that is largely covered by the Congo Basin rainforest, the second-largest area of contiguous rainforest in the world (Justice et al., 2001). Agriculture dominates the economy, contributing 21% of GDP and 70% of employment (ITA, 2014). The traditional agricultural system in Cameroon is shifting cultivation, which is a land intensive production method that relies on slash-and-burn land clearing (Brown, 2004). Shifting cultivation puts a burden on primary forest, especially where the population is low and forests are dense and substantial (Bellassen and Gitz, 2008; Brown, 2004); over 85% of deforestation in Cameroon is said to be caused by smallholder agriculture (Kotto-Same et al., 2002). Forested areas are systematically cleared for subsistence and income-generating crops through slash-and-burn, which is a problematic practice for the global environment as it results in tremendous carbon release and biodiversity loss (Nkamleu and Manyong, 2005). Targeting the smallholder agriculturalists who are apt to utilize traditional slash-and-burn techniques is key to effectively administering REDD in regions where agriculture is the dominant deforestation driver. From a carbon-reduction perspective, Cameroon could be a substantial participant in REDD initiatives. The voluntary REDD+ database indicates three REDD activities currently in process in Cameroon, including support from the World Bank Forest Carbon Partnership Facility and a forest management project funded by the Government of Japan (Voluntary REDD+ Database, 2014).

1.3 Decision-making framework for shifting cultivation

Smallholders' decisions regarding shifting cultivation depend on many factors. Economic factors are key: higher-value commodities will be favoured for marketable surpluses to maximize revenue. However, for households

with limited market access and few other income sources, subsistence needs must be addressed as well. Factors such as food shortage risks, availability of labour, cash-income needs and cultural food preferences will all effect the likelihood of a household choosing one crop type over another (Brown, 2004). Understanding why individuals convert land from one use to another, and furthermore, how higher-carbon land uses can be maintained, is imperative in forecasting REDD success in Cameroon.

Four central suggestions for avoiding emissions are: maintaining current forest integrity and avoiding deforestation altogether, thus preserving their carbon storage properties; protecting degraded forests so that they can restore independently; assisting degraded forests in the restoration process; and establishing agroforestry plantations on currently non-forested areas (Brown et al., 1996). In the Southern Cameroon Alternatives to Slash and Burn (ASB) Humid Forest Zone (HFZ) Benchmark site, forest maintenance and agroforestry are the most likely options for both income/subsistence security and emission reduction results. In this region the dominant agroforestry activities are cocoa, both extensive and intensive, and fruit systems (Swallow et al., 2007). Through agroforestry, smallholders may continue to harvest food for subsistence, market surpluses for income, and maintain a relatively high-carbon concentration on their land.

1.4 Implementation costs of REDD

The cost of implementing REDD is typically considered in a 'top-down' fashion due to the amount of policy infrastructure required at the international and national levels to make it work. A previous aggregated top down study indicates that costs for implementing REDD internationally could reach up to 28 billion USD per year by including emissions reductions, rents earned by REDD providers, and macroeconomic market impacts (Kindermann et al., 2008). A regional-based study suggests that the costs of

avoided deforestation would be at least 7 billion USD per year for the eight largest emitting countries to reduce global land use emissions by 70% (Grieg-Gran, 2006). This study includes the costs of supplying emissions reduction credits, administration costs, and monitoring costs through a national forest inventory, yet does not take market effects into account (Lubowski, 2008).

Alternatively, some studies have addressed the 'bottom-up' opportunity cost approach; rather than considering REDD costs across international boundaries, specific local regions are considered using a blended socio-economic approach. One such study is by Swallow et al. (2007) where the authors consider the costs in the central plateau of Cameroon, including Akok and Awae villages; Ucalayi, Peru; and East Kalimantan, Jambi and Lampung in Indonesia. Within Akok village in Cameroon, the authors suggest that emissions released have resulted in returns of around 8 USD/t CO_2 eq, using the social net present value approach (Swallow et al., 2007). For smallholders, conversions from mixed food crops fallow systems to shade-cocoa agroforestry practices were found to be a 'win-win' situation; both carbon sequestration and incomes to farmers would increase (Swallow et al., 2007). Boucher (2008) analyses 29 regional opportunity cost studies for REDD, and found that the mean value for carbon abatement is 2.51 USD/t CO_2 eq. This would imply that the cost of abating carbon is relatively cheap in general, and thus converting forested areas to other uses is not very profitable (Boucher, 2008). Boucher (2008) also found that converting forests into extensive traditional agricultural systems have a very low opportunity cost – USD 0.58/t CO_2 eq.

1.5 Objectives of this study

This research offers an alternative analytical approach by inquiring about smallholders' potential participation in a REDD-like project through stated

preferences. Smallholders are key to the appropriate design of REDD activities, being that their willing participation is imperative to the success of a large scale program. The objectives of this study are to:

1. Estimate the WTA payment for farmers in Akok village to preserve intact forests, and avoid slash-and-burn agriculture on forested lands.
2. Establish a supply curve for REDD contract land in Akok village that is based on WTA, as well as a corresponding carbon abatement curve.
3. Investigate farmers' perceptions of food need, possibility of future tenure security, availability of land substitutes and cash needs.
4. Suggest how farmers' perceptions impact their WTA.

A household survey was administered in Akok village, South Province, Cameroon that presented a hypothetical REDD-like contract and requested each respondent's WTA to avoid removing trees on densely forested areas under their control (fallowed lands that had not been cleared in a decade or more). Through a verbally dictated payment card, smallholders identified the payment level that they would accept annually over the course of 10 years.

This study was done through the research framework provided by the Alternatives to Slash and Burn Partnership for the Tropical Forest Margins (ASB), which is focused on raising "*productivity and income of rural households in the humid tropics without increasing deforestation or undermining essential environmental services*" (ASB Partnership for the Tropical Forest Margins, 2013, para. 3). The Southern Cameroon site is one of several ASB benchmark sites located in the humid forest margins of central Africa, Southeast Asia, and South America. This specific study relies on generous funding by the University of Alberta and the World Agroforestry Centre (ICRAF), as well as tremendous technical and administrative support by both ICRAF and the International Institute for Tropical Agriculture (IITA).

1.5.1 Research questions

1. Are smallholders in Akok village, Cameroon willing to accept compensation to enter into a future REDD contract? If so, how much? How does this estimate compare to previous opportunity cost estimates of avoided deforestation for carbon emission reduction benefits in this region?

2. How do household perceptions of food and tenure security influence the level of desired compensation to enter into a future REDD contract for Cameroonian semi-subsistence smallholders? How do demographic household characteristics influence compensation levels?

3. How does a household's current cultivated food plots and the amount of available forested land impact the level of desired compensation to enter into a future REDD contract?

Chapter 2 Literature review

2.1 Introduction

This research requires me to review several topics. First, I summarize the development of the United Nations Framework Convention on Climate Change (UNFCCC) carbon emission reduction program, REDD, which was expanded to REDD+. I also investigate the means by which REDD programs may be developed and implemented, and discuss previous estimates of top-down costs from a global perspective. As this research focuses on REDD from the bottom-up, an extended discussion of REDD from the smallholders' perspective ensues. What tradeoffs would smallholders be required to make? How does compensation – specifically, the idea of PES – fit into this picture? The final section identifies how to situate my research amongst previous bottom-up opportunity costs through an assessment of previous studies in the developing country context.

2.2 What is REDD?

REDD is an international mechanism that has been designed by the UNFCCC, with the first major resolution in 2007 at the 13th meeting of the Conference of Parties (COP) in Bali, Indonesia (UNFCCC, 2007). During the 2010 UNFCCC COP in Cancun, Mexico, REDD+, an enhanced version of REDD, was described as a comprehensive policy approach to emission reduction from deforestation and forest degradation in developing countries that relies on positive incentives, with a focus on sustainable management of forests through conservation and enhancement of carbon stocks (UNFCCC, 2011).

Deforestation is said to produce 20% of all greenhouse gas emissions (UNFCCC, 2007), hence the need to focus attention on reducing its impact. Unique tropical forest systems, especially the three largest regions of intact tropical rainforest worldwide, Southeast Asia, the Amazon and the Congo

Basin, are a focal point of REDD/REDD+, referred to collectively as REDD for the remainder of this work. Through global cooperative action, a primary objective of REDD is to consider policy approaches and positive incentives that aim to encourage forest conservation and the enhancement of carbon stocks within developing nations (UNFCCC, 2007). These incentive mechanisms have the potential to result in a substantial reduction of greenhouse gas emissions from deforestation, while also promoting and complementing aims of other national and international sustainable development programs (UNFCCC 2007; UNFCCC, 2009).

Much of the world's tropical forest is located in developing countries where issues of poverty and food security compound the problems of forest loss. Both social and economic development are overriding issues in developing nations, and this development strategy that boasts both low-carbon global benefits and poverty eradication is essential to sustainable development (UNFCCC, 2011). REDD is a policy mechanism that promotes sustainable development and furthermore, allows developing countries to participate in the climate regime in a meaningful way (Johns et al., 2008). Although reducing emissions due to deforestation is a principal goal of REDD, the maintenance or bettering of economic conditions within developing nations is fundamental and is intended to be an added benefit of the initiative's success. In particular, the livelihoods of impecunious peoples that reside in and rely on forested regions can be improved, and thus are imperative to the success of REDD initiatives (Palm et al., 2010). Potential REDD co-benefits include poverty alleviation through pro-poor development mechanisms, human rights protection, improvement in forest governance, as well as biodiversity preservation (Brown et al., 2008).

Forests provide both private benefits and public benefits such as carbon storage, air quality improvement, biodiversity conservation and watershed

protection. The maintenance of these public benefits, specifically greenhouse gas mitigation, is the foundation of REDD; more global preservation of forests leads to more carbon emission reduction (Bosetti and Rose, 2011).

2.3 Implementing REDD

At the international level, REDD has not been solidified in terms of effective implementation; thus nations interested in REDD face challenges in creating an effective strategy (Wertz-Kanounnikoff and Angelsen, 2009). Although the general concept of REDD has been well discussed in the literature, actual implementation of programs is still in preliminary stages. Current goals of REDD are to obtain efficiency, effectiveness, equity and co-benefits – the 3E+ criteria (Dkamela, 2011). Additionally, efficient REDD programs require support through government commitment, strong coordination between state and non-state actors, and effective mechanisms that ensure both participation and sharing of benefits (Wertz-Kanounnikoff and Angelsen, 2009).

Funding will need to be a combination of private and public capital to achieve the scope and scale of ambitious emission reduction targets. Along with public funding sources, the global carbon market is said to be a fundamental and promising source of private funds for REDD funding (Pedroni et al., 2009; Chomitz et al., 2007). The details of the carbon market are important as potential sources for REDD transactions, however those details are not important to this study. Further information on the development of the forest carbon market is available in Chomitz et al. (2007) and Nepstad et al. (2013).

Critics of REDD question the ethical implications of allowing developed nations or corporations to pay poorer nations through offsets to pardon their emissions (Ghazoul et al., 2010). This dynamic can perpetuate the system of 'haves' and 'have nots' while not necessarily creating any genuine incentives

to develop new technologies in carbon emission reduction. Another consideration is how REDD impacts the rights of indigenous communities and above all, national sovereignty (Ghazoul et al., 2010). By imposing restrictions on land use, nations are not given the ability to guide land use policies according to need. In the same way, indigenous communities may involuntarily sacrifice their future land access rights on protected forests (Ghazoul et al., 2010). The permanence and lasting impacts of forested land included in REDD contracts is critical to an effective strategy; future natural events or human-caused deforestation can reduce forest carbon stocks (Laurance, 2007).

Possible supply limitations can impact REDD based on the temporal and spatial considerations discussed by Börner and Wunder (2008). Determining the potential supply of REDD project sites may require quantifiable and credible baselines that can effectively project forest cover change into the future. Comparisons to "business as usual" or "what would be" without a deforestation mitigation program are imperative to the efficient allocation of REDD resources. Spatial disaggregation of a REDD scheme requires additional resources as well (Börner and Wunder, 2008). As providers of the ES are not homogeneous in economic or environmental factors, the aggregate costs of implementing REDD require spatially-specific details. This increases the complexity and variation of implementing payment-based carbon emission mitigation projects.

2.3.1 Monitoring, reporting and verification

One of the most substantial challenges in creating REDD is the establishment of monitoring, reporting and verification (MRV) systems (Wertz-Kanounnikoff and Angelsen, 2009). Additionality and leakage are complications in setting up appropriate MRV systems for REDD. The additionality criterion implies that land that would otherwise be deforested

is targeted, rather than land that would be conserved regardless of REDD policies or programs (Gregersen et al., 2010). That is, REDD payments must be intentionally focused on otherwise-deforested land, thereby positively contributing to the global carbon balance and *adding* land to conservation efforts. Leakage concerns suggest that payments made to avoid deforestation in a specific region can cause deforestation to shift to another region, therefore causing little to no change in the net impact on the carbon balance (Gregersen et al., 2010). Both additionality and leakage require substantial technologies and infrastructure to manage, and fall under gaining efficiencies of REDD through MRV.

2.3.2 Geographical approaches to implementation

MRV of forest carbon stocks is a fundamental part of efficient participation in REDD (Herold and Skutsch, 2009). The efficiency of MRV for REDD will differ based on the scalar approach used, be it subnational, national or nested (Angelsen et al., 2008). A method for measuring stocks that is suitable for both international buyers and national governments is essential for a subnational approach, whereby a supervisory non-government organization (NGO), private company or government body oversees crediting and MRV of the system. The Clean Development Mechanism (CDM) of the Kyoto Protocol, which supported emission reduction programs in developing countries, is an example of this type of subnational program (Angelsen et al., 2008). Governments require the capacity to effectively create a system that monitors the flow of forest resources for a national approach to work. Nations must decide that REDD is a priority in order for effective implementation to occur, especially with the developments arising from the 2010 Cancun UNFCCC meeting (Bosetti and Rose, 2011; UNFCCC, 2011). The national approach relies on a national monitoring system and a target national reference emission level, which implies that domestic governments have the ability to successfully implement and enforce (Peroni et al., 2009).

Poor governance, specifically in the area of natural resources, characterizes many developing nations, and thus this approach may require substantial capacity building prior to the large-scale implementation of REDD.

The diversity of national capacities has led to recent project proposals that merge both approaches. By imposing broad-based subnational activities into a national accounting framework, efficiencies in REDD can be created (Angelsen et al., 2008). The nested approach is a bottom-up mechanism that builds capacity locally, and encourages national governments to take action to avoid deforestation (Pedroni et al., 2009). The nested scalar approach is important to appropriately and effectively engage each level of organization (national, state, region and community). Although international policy and acquisition of stakeholder funding is an integral part of the program, achieving success in REDD requires participation by national governments and local smallholders. REDD requires nested governance that extends from the global to the local scale in order to recognize and integrate the rights of local forest peoples (Sikor et al., 2010).

2.4 The costs of REDD

There is a substantial cost to the creation of deforestation mitigation programs such as REDD. Development, implementation, management, and evaluation of programs on a broad scale (whether national, subnational, nested or any variation in scale) require a comprehensive group of stakeholders and actors, all of whom require resources to function.

As a global phenomenon, the aggregate costs of REDD projects have been investigated over the past several years. These global estimates highlight the tremendous variation in anticipated program costs, and also provide insight into drivers of deforestation, impacts of REDD programs, the importance of fair compensation, and improving estimates of other REDD costs. Generally,

global aggregate costs tend to be generated using top-down or bottom-up estimation procedures. Top-down procedures apply simulation models of the global forestry sector, while bottom-up approaches use estimation procedures based on extrapolation of site-specific data on the prevalence of alternative land uses and the economic returns and carbon stock values associated with those land uses.

Kindermann et al. (2008) suggests that between 2005 and 2030, reducing deforestation by approximately 10% per year (0.3-0.6 gigajoules of CO_2 per year) would cost 0.4 to 1.7 billion USD per year worldwide. For a deforestation reduction of 50%, the authors estimate a cost of 17.2 to 28.0 billion USD annually, payable to the developing nations accountable for emission reduction (Kindermann et al., 2008). These estimates do not include transaction or implementation costs. Using a bottom-up approach, a contributor to the prominent 2007 Stern Review, Grieg-Gran (2006), indicates that the cost of entirely avoiding deforestation within the eight largest emitting nations (thereby reducing land use emissions by 70%) would be about 7 billion USD per year, or between 1-2 USD/tCO_2. A meta-analysis of 29 studies by Boucher (2008) found an average opportunity cost of 2.51 USD/tCO_2 equivalent.

The costs of implementing REDD are subdivided into three categories: implementation costs, transaction costs and opportunity costs (White and Minang, 2011). However, there is also a considerable social component in creating REDD programs. Developers of REDD programs are tasked with considering whether REDD will explicitly be a financially driven incentive program, or incorporate pro-poor strategies as well (Angelsen et al., 2008).

Implementation costs include capacity building and administrative costs as well as the monitoring, enforcement and other activities required to effectively manage a program (Lubowski, 2008). Examples of both direct and

indirect implementation costs of REDD are relocation of timber harvesting away from old growth forests to reforested areas, agriculture intensification, and titling land to indigenous communities to establish incentives for conservation (Pagiola and Bosquet, 2009). Capacity building and institution creation costs are also components of implementation costs of REDD (Pagiola and Bosquet, 2009). Although program management is a substantial and explicit cost of REDD projects, the processes associated with negotiation between buyers and sellers is also an important component of the cost of REDD. Alston and Andersson (2011) suggest that transaction costs are crucial to developing the program efficiently and can create an environment for efficiency between contractual parties. There are three major components of transaction costs that need to be addressed by any market for tropical forest conservation: negotiation of contracts, monitoring and verification of those contracts, and enforcement of contract obligations (Alston and Andersson, 2011; Lubowski, 2008).

National estimates, which include implementation and transaction costs, are less common in the literature. Variation in cost estimates can be due to the accounting stance that is considered when creating the estimate (Pagiola and Bosquet, 2009). There is a distinction between: costs to the country, whereby the maximization of national social welfare is the goal, and costs and benefits outside of the nation are disregarded; costs to individual actors that focus on the land users and rarely include program creation costs; and costs to government agencies (Pagiola and Bosquet, 2009). Due to the substantial level of uncertainty about costs within many nations it is important to interpret national values with caution (Sathaye et al., 2011).

2.4.1 Opportunity costs of REDD

Opportunity costs are often said to be the largest cost of implementing REDD, compromising 80 to 95% of the total costs of the program (Boucher, 2008).

The cost of giving up economically advantageous activities through land-use restriction contracts is fundamental for understanding the costs of REDD as well as deforestation pressures and causes within a region (Pagiola and Bosquet, 2009). Opportunity costs are produced because climate change mitigation strategies do not necessarily share objectives with other economic development approaches; with land use restrictions, both opportunity and direct costs are faced by various agents (Ghazoul et al., 2010). Forest industries provide several benefits, such as selective logging and collection of non-timber forest products, which are generally foregone through contract implementation. Although opportunity costs are both the greatest component and fundamental to understanding REDD implementation, estimating the costs of foregone opportunities for a nation is a challenge (Gregersen et al., 2010; Pagiola and Bosquet, 2009). As a further complication, identifying who gains and loses from land use restrictions through contract propositions can be problematic from an ethical perspective (Pagiola and Bosquet, 2009).

2.4.2 Opportunity costs to smallholders

Land value is a substantial consideration when approximating costs of REDD to smallholders. The opportunity cost of avoided deforestation is the net benefit that a smallholder gives up in order to gain some other benefit; in the context of REDD, this would be maintaining forested land with high-carbon values rather than converting the forest to some other land use (Kinderman et al., 2008). Forested land with lowest-value alternative uses is more apt to be conserved when the market price of carbon, and assumingly the paid value for emission reduction is low. As the carbon price increases, forest holders will maintain land with higher valued alternative uses - or higher opportunity costs (Kinderman et al., 2008).

There are several components to the opportunity cost for local stakeholders. A substantial component is the value of agronomic and biophysical factors of alternative land use activities that lead to deforestation (Grieg-Gran, 2006). These opportunity costs depend on factors that include: types of alternative land uses, land productivity (affected by soil and climate conditions), inputs and technology, transportation infrastructure, and variation in prices of agricultural commodities (Grieg-Gran, 2006). Although the foregone economic benefits of alternative land use are the most direct cost, there are also social-cultural costs and indirect-off-site costs (White and Minang, 2011).

Local community participants in REDD are asked to give up real options to land which impact livelihoods, that are foregone with limitations on land today. Smallholders must make a tradeoff between entering binding contracts today and future use for an area of land under their control. Potential participants also are likely to face foregone economic benefits for future alternative land uses such as agriculture and potential timber sales.

The maintenance or enhancement of livelihoods is fundamental to REDD success, regardless of changes in economic activities (White and Minang, 2011; Barbier and Burgess, 2001). It is in the best interest of smallholders that REDD policies are aligned with other pro-poor or livelihood policies to ensure that both food security and climate change objectives are met. Therefore, impoverished people who are dependent on forested areas for income generation are protected. Smallholders also consider less-tangible costs when contemplating modifications to their current lifestyle, such as access to markets and changes to traditional ways of life. It is particularly difficult to measure intrinsic and non-use environmental values of alternative land uses for smallholder farmers. Similarly, appropriate compensation for the societal value for the provision of the environmental service (ES) poses a

challenge.

2.4.3 Methods for deriving opportunity costs

The most common method for deriving the opportunity cost of land, particularly in the case of REDD, is to focus on the value of productivity losses. However, this valuation method requires reliable data on returns to various land uses, production, land use trajectories, carbon stocks and costs of changes. In developing nations like Cameroon where the population of interest is predominantly concerned with ensuring household subsistence, detailed information is difficult to come by. Furthermore, such measures do not include non-observable opportunity costs to the smallholder, nor does it recognize the societal value for the provision of the ES.

Real options analysis is a possible strategy that originates in financial theory. The 'real' in this approach refers to the idea that a decision maker uses real-world alternatives when faced with a choice to make, increase, abandon, or decrease an investment. The ability for a decision-maker to be flexible in the future has a value; that is, flexibility in future decisions without obligation can alter the course of resource allocation (Trigeorgis, 1996). Furthermore, changing environments require the chosen type of analysis to additionally consider how decision-makers adapt to the current circumstances and amend previous decisions (Trigeorgis, 1996). Both call option, the right to purchase an asset at a predetermined price and put option, the right to sell the asset at a predetermined price, are fundamental to option value; there is no obligation in either case (Trigeorgis, 1996). Thus strategic action and adaptation to the environment can be captured with the real options approach.

Alternatively, the standard net-present-value (NPV) approach does not account for the ability to defer an investment decision due the possibility of additional earnings on current investments and changing future costs in the

market (Luehrman, 1998). The NPV approach assumes that the decision cannot be held off. This ability to recognize that decision makers have choices that are exemplified by irreversibility, flexibility and uncertainty is a definite asset of the real options approach (Mithöfer and Waibel, 2008).

Taking the real options approach yields insight into how landowners decide what to do with their land from both intrinsic and use perspectives (Zinkhan, 1991). Additional data that would be necessary for this analysis includes risk preferences of household decision-makers, and insight into internal discount rates of each decision-maker. Most importantly, I would require a series of prices to estimate with real options. Given the unavailability of both price and risk preference data for this study, I focus on contingent valuation methods for determining the perceived costs of REDD programming in this region.

Production-based approaches can overlook the costs and values associated with household subsistence activities, while placing the majority of emphasis on marketable goods. As Akok smallholders are predominately focused on subsistence activities, a method that includes values of non-market production would be useful. Contingent valuation methods are relevant economic valuation techniques that can be used when market valuations do not adequately capture social value, as in the case of Akok.

Forest users can be incentivized to provide an ES that benefits the rest of society through PES. As previously discussed, forest users in Akok are hypothesized to obtain value from the forest, such as non-use values such as food security and tenure security. In fact, land rental and sale throughout the village is effectively non-existent. Villagers abide by the traditional tenure system (as further discussed in Chapter 3) and thus do not gain revenue from selling land as it is passed on to other family or community members without

compensation. Thus, employing stated preference methods to derive opportunity costs is a method to tease out these additional values.

2.4.4 Limitations of opportunity costs

Gregersen et al. (2010) identifies several concerns for utilizing opportunity costs in payment estimation. Firstly, illegal activities that result in deforestation and degrade land are not captured in this method; thus it may be inappropriate to exclusively employ opportunity cost assessments in tropical countries where illegal activities are prominent drivers of deforestation. The authors also describe a situation in which the development of large carbon markets would set the price paid to forest landowners and/or smallholders, relegating estimation of regional opportunity costs as irrelevant.

Another concern regarding opportunity costs as indicators for REDD payments is the absence of well-functioning markets (Gregersen et al, 2010). In developing nations with substantial deforestation, it is unlikely that there are well-established markets in place to derive realistic opportunity cost measures. For example, smallholders practicing slash-and-burn techniques within developing nations operate predominately outside of established and functioning market system. Thus smallholders and/or forest landowners are reliant on their perceived opportunity costs to motivate deforestation mitigation actions (Gregersen et al., 2010). As this study focuses on a missing market situation, perceived opportunity costs are an effective method to estimate the motivators behind deforestation actions.

2.5 PES and REDD

Estimating the benefits of deforestation mitigation through REDD is dependent on the perceived opportunity costs borne by smallholders. Assigning economic value to non-market goods and services is beneficial for

two reasons: (1) to develop a comprehensive value for a complete environmental resource (a forested area, in this case) and (2) so that users of the environment may acknowledge the influence of these goods and services on their livelihoods (Abdullah et al., 2011). To effectively compensate smallholders for the provision of carbon emission reduction, a payment strategy becomes an integral piece in the development of REDD.

As a cornerstone of the REDD initiative, PES encourages individuals to act in the societal best interest by maintaining the integrity of environmental features, while receiving compensation to do so (Wunder, 2005). Wunder (2005) defines PES as a voluntary transaction whereby an ES or specific land use that is likely to protect that service, is being 'bought' by at least one ES buyer from at least one ES provider. PES is a system that can create incentives for program adoption for several reasons. PES creates a new income stream and/or financing opportunity for conservation efforts, is dependent on the self-interests of service users and providers rather than governments or external donations (thus is sustainable), and only provides the services for which the benefits of provision exceed the costs of providing them (Pagiola and Bosquet, 2009).

2.5.1 Challenges with using PES within REDD

PES is an established method for benefitting poor landowners and smallholders within regions with delicate and critical ecosystems due to the increase in value placed on these services by agents in the developed world (Milder et al., 2010). However, PES has several criticisms. One concern with PES in tropical regions is the relatively low demand for carbon emission mitigation, and thus there are relatively few users of the service agreeing to pay at this point in time (Wunder, 2007). The lack of knowledge about supply-side dynamics of ES within developing nations that are targeted for REDD poses an information gap as well (Wunder, 2007). In addition, the

utter complexity of a system of 'payments for doing nothing' is challenging to communicate (Wunder, 2007).

There are limitations for creating contracts with PES, particularly in developing nations where property rights are not always well defined. Additionally, poverty reduction and PES are often (indirectly or directly) common means to differing goals, and effective and efficient distribution of benefits is difficult to achieve (Muradian et al., 2010). Efficiency in PES can compete with poverty reduction goals so developing a system that is both efficient and pro-poor poses a challenge. Depending on the interests of the REDD developer, the efficiency of PES may become diluted (Wunder, 2008). In order to accommodate both poverty-reduction and efficiency goals, the research adopts a broad and inclusive definition of PES, that is "a transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources" (Muradian et al., 2010, p. 1205). Important to note is that multiple ES may be produced by tropical forest areas, and thus higher payments may be justified based on additional ES beyond carbon abatement, for example watershed and biodiversity conservation. Cerbu et al. (2011) suggest that biodiversity values influence the intensity of REDD investment across countries. The complexity of REDD implementation is not limited to PES development, however the overarching concerns of REDD are beyond the scope of this study.

2.5.2 Willingness to Accept (WTA) as an estimator for PES

Devising the appropriate payment level for PES requires an estimation tool. Many designers of PES studies utilize stated preference techniques, whereby individuals state their preferences for particular activities/behaviours, resulting in an elicitation of value (Whittington and Pagiola, 2012). Contingent valuation (CV) is utilized to estimate WTA to determine

opportunity costs in this study. Although not a typical method for deriving opportunity costs of production, WTA has many advantages (as described in section 2.5.3).

WTA is the appropriate CV method for this type of survey as opposed to willingness-to-pay (WTP). Households are providing an ES, carbon emission reduction, by not cutting down their trees. WTA identifies the value that the service provider (the supplier) would be willing to accept as compensation. Alternatively, WTP is utilized when *users* of a service identify how much they would be *willing to pay* for provision of this service. As much of the foundation of REDD is based on compensation to promote forest preservation, smallholders in Akok are service providers.

2.5.3 Advantages and disadvantages of WTA

One considerable benefit of the CV method is the ability to include non-market values and non-production factors into the decision-making process. CV also is well suited to this study as it allows changes to the WTA to capture the unobservable considerations that households are inclined to include when signing onto a contract, including existence values, community and/or household tenure security, and perceived household food requirements. The amount that a household indicates as their required level of compensation to sign into a contract inherently includes all of these use and non-use values. In addition, CV is able to estimate the economic value of non-market ecosystem goods, which makes it a universal tool that can be understood by both users of the good and policymakers alike (King and Mazzotta, 2000).

There are several advantages of the WTA approach within the context of REDD. As REDD would need to be a voluntary program, WTA is a realistic method that provides insight into the decision making process of a smallholder decision maker. Smallholders can choose to enter into the

contract regardless of their land profile and therefore the process of deliberating on various price levels is analogous to what an actual voluntary contract might look like. This can also present policymakers with estimates that may suggest 'room for a deal' (Whittington and Pagiola, 2012). WTA also allows for the integrated nature of household decision-making in the context of both missing markets and integrated production-consumption decision-making. Missing markets occur for both tradable and non-tradable inputs and outputs in this system and thus complicate the process of determining opportunity costs to the smallholder (Jack, 2010; de Janvry et al., 1991). The opportunity costs for each household are a function of the shadow prices of land, labour and other inputs that would go into agricultural development, and are non-observable where production and consumption decisions are strongly interrelated.

Furthermore, WTA captures heterogeneity in production, consumption and decision-making, rather than assuming that all agents are homogeneous. Demographic information is gathered for each smallholder, allowing the individual pricing decision to be comparable across several factors. WTA captures land use values for each smallholder that are otherwise difficult to capture. By utilizing stated preferences, we can tease out underlying reasons for contract support or opposition that are not observable, thus reflecting the real value of the ES provided (Whittington and Pagiola, 2012). WTA also captures quasi-option values. Quasi-option value involves the nature of pending potential future information that individuals would not receive if they made a change today to the land (Grafton et al., 2008). Smallholders can factor future expectations into the decision-making process when stipulating how much they are WTA to enrol in the program. Finally, WTA is complementary to other techniques, and helps to clarify the information content of financial opportunity cost analysis such as in Swallow et al. (2007).

Although there is evidence that CV can be a useful tool, generally CV is one of the most controversial non-market valuation methods. CV estimates can suffer from hypothetical bias for two reasons. The first is placing a dollar value on non-market goods, of which participants have no past experience in placing dollar values on. This inexperience leads to participants having insufficient knowledge to state their true WTA value (King and Mazzota, 2000). Secondly, the lack of a budget constraint (or in the case of WTA, lack of specific budget constraint from the hypothetical agency to compensate smallholders) can lead to hypothetical bias. Further biases can be created through CV as well. Participants may feel inclined to say 'yes' because of the natural human inclination to please others, thus creating an *enumerator bias* (Whittington and Pagiola, 2012). Respondents can be influenced by the first bid suggested by the researcher, thereby anchoring their response to this initial value (*starting point bias*). Starting point bias can be especially problematic in the case of non-market goods that do not have previously researched values (Chien et al., 2005). Also, the amount of information presented as background to the hypothetical scenario may bias the respondents' answers (*information bias*). The level (simplistic to involved) and nature of information provided to respondents will determine the validity of a CV study (Venkatachalam, 2004).

As CV requires a hypothetical scenario to be presented, there is resulting uncertainty about the nuances of the presented scenario. Both respondents and researchers need to be open to assumptions. Challenges due to scientific uncertainty in terms of direct ecosystem consequences, institutional collection/delivery of compensation and preferences for a program that is different or more involved than the one presented are major design challenges (Whittington and Pagiola, 2012). Researchers have consistently found a discrepancy between individuals' WTP and WTA. These two values should theoretically be interchangeable between preferences in ES

(Venkatachalam, 2004), however the compensating variation and equivalent variation derived through Hicksian consumer surplus is consistently found to be non-equivalent[1]. Finally, CV can lead to a wide variation of different WTP values depending on how the good is viewed, as an individual or as part of a larger inclusive package (Kahneman and Knestch, 1992). This phenomenon, known as embedding or scope effect is highly contested in the literature (Venkatachalam, 2004).

2.6 Previous research on opportunity costs and WTA in developing countries

Jack et al. (2009) utilized an auction-based revealed preferences approach to estimate a supply curve for ecosystem services created from soil-erosion control measures in Sumberjaya, Indonesia. Jack et al. (2009) also used a model including 'pro-poor' targeting contract selection as suggested through previous research by Wunder (2008) and Pagiola et al. (2005). The Jack et al. (2009) study showed that there are tradeoffs between conservation and poverty alleviation, thus suggesting that when scaling up, a REDD program in the Sumerjaya, Indonesia region lost emission reduction efficiency when ideal local social benefits through pro-poor selection are upheld.

Regional-level work by Swallow et al. (2007) focuses on Akok village, as well as Awae regions within Cameroon. The authors employ land use transition maps and plot-level data on NPV and carbon stocks to estimate the abatement cost curve of the HFZ Benchmark site within Cameroon. Within Akok village, Swallow et al. (2007) suggest through experimental results that abatement would cost around 8 USD/t CO_2 eq, using the social NPV approach. The report indicates that both emissions could be reduced and smallholders

[1] See Venkatachalam, 2004 for additional discussion on the WTA-WTP gap.

could receive a new income stream by shifting crop-fallow agriculture to denser shade-cocoa systems. Brown (2004) introduces a shifting cultivation model for Akok region that is utilized throughout this study. Subsequent work within the Akok region by Brown (2006) explains that there are many factors involved in smallholders' land use decisions, such as land availability, population density, productivity-related factors, proximity to other fields and protection of land use rights. The author suggests that decision-making criteria unrelated to productivity have a significant impact on how smallholders choose to cultivate their lands (Brown, 2006).

I choose to focus explicitly on previous research that investigates smallholders' opportunity cost estimates for provision of ES, including the response of local land owners/smallholders to contract options. Additionally, I explore regionally based studies around the Akok region of Cameroon. I determine that the problem can be addressed with techniques that are further defined in Chapter 4.

This research is a detailed case study that complements previous regional opportunity cost estimates by Swallow et al. (2007) and applies Brown's (2004) dissertation work and subsequent publication (2006) regarding household land clearing decisions within the HFZ. There are several differences in methodology between this study and that done by Swallow et al. (2007), in addition to different estimation approaches. Swallow et al. (2007) investigates the regional opportunity cost assuming homogeneous smallholders throughout the representative plot approach (see White and Minang, 2011). Comparatively, my work explicitly investigates heterogeneity, distinct variation in plot size and field type between smallholders, among the population as a determinant of opportunity costs. There are temporal differences as well, in that Swallow et al. (2007) is an *ex post* study where opportunity costs are based on conditions in the recent past. In contrast my

study focuses on opportunity costs based on an uncertain future, by offering a hypothetical yet realistic 10-year binding REDD-like contract. By integrating household decision-making criteria determined by Brown (2006) into the analysis, my study hypothesizes that smallholders are dynamic agents that optimize the allocation of their effort to the lands that are available. I pay particular attention to the perception of local smallholders, and the possibilities of decision-making criteria beyond production.

Chapter 3 Cameroonian context

3.1 Introduction

This chapter explores the local context of this study in Cameroon. First, I discuss shifting cultivation in the context of the traditional semi-subsistence farmer, and the specifics of shifting cultivation in Central Africa. The *Bulu* tenure system is then discussed in detail in relation to the Forestry Law of 1994 within Cameroon. Lastly, the smallholder household is discussed within the pending context of REDD. How, from a local perspective, would a contract need to be devised to be attractive to the smallholders in Akok village? What specific factors do households in Akok village consider?

3.2 Shifting cultivation

Shifting cultivation is the most dominant agricultural system in Central Africa (Diaw, 1997). Small producers clear land so that underlying fresh nutrient-rich soils can be utilized for food crops and small plantations (Brown, 2004). Slash-and-burn forest clearing (or *swidden agriculture*) is a key feature of this customary system, with ash and decomposing tree roots contributing organic matter and nutrients to the soils. Through this process, deforestation is exacerbated as trees are burned rather than harvested for wood, which is often viewed as a misappropriation of resources (Ngobo, 2009) (Figure 1). Given the challenges smallholders have acquiring technologies to harvest older standing trees for wood products, burning the standing timber can be the most readily accessible and feasible method in establishing an agroecosystem or food crop.

Within Central Africa in particular, shifting cultivation is highlighted as a method to manage soil fertility as well as to maximize agricultural productivity without additional inputs (Diaw, 1997; Kleinman et al., 1995).

Locally, shifting cultivation may be considered to be ecologically sustainable given that it does not depend on additional inputs often derived from fossil fuels. However there are considerable externalities of shifting cultivation on the global populace in the form of carbon emissions from the slash-and-burn process.

Figure 1: Recently cleared area within the Akok region in South province, Cameroon.

3.2.1 Shifting cultivation system throughout Akok region

Shifting cultivation typically progresses the land from a high-carbon stock state, primary forest, to a low-carbon state, such as a groundnut or cassava field. The features of the land area being cultivated determine the progression of the system (Figure 2). A primary or high forest area that has not been utilized for agriculture within the last 40 years is dense with underbrush and large trees so is difficult to utilize without extensive

modification. Thus, smallholders will selectively burn the area to reduce much of the underbrush and plant crops, particularly forest melon (*esëp*), in this initially extremely fertile soil. *Esëp* is a sequential step to move from a densely treed parcel of land to an agricultural field; some foliage is physically removed and cultivated plants are dispersed between the large trees. *Esëp* is typically planted during the dry season (Diaw, 1997). Once this crop has matured for approximately one year, the produce is harvested and the land is burned. This results in a forest fallow field (*fulu*), which is left to dry over the course of several weeks to several months. The next progression of field, the mixed food crop (*afub owondo*), is the most important land type for subsistence. For a total of three years (or six growing seasons), crops such as cassava, cocoyam, plantain and peanut are cultivated. The mixed food crop, *afub owondo*, is cultivated semi-annually. Another specification of food crops, known as *asan*, are created by clearing vegetation from lowland peat fields that are based more on the geography of the land.

The next succession after a food crop is fallow. Smallholders allow the land to lay uncultivated for a period of time in order for underbrush to redevelop and nutrients to re-establish within the soil. There are several classifications of fallow within the *Bulu* tenure system: young (1-4 years, *nyengue*), old (4-10 years, *ekotok*), very old (10-20 years, *nfos ekotok*) and degraded secondary forest (20-40 years, *nfos afan*). Older fallows will re-grow large trees relatively quickly, taking on the appearance of a forest (Figure 3). Any fallow may be used to create an *afub owondo* field or other crop, however the longer the land lays fallow, the more fertile the soil.

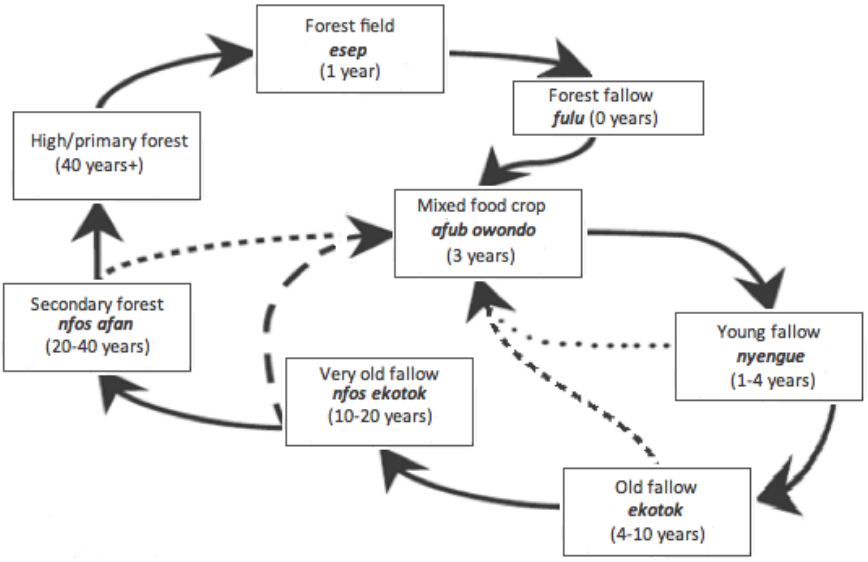

Figure 2. The typical *Bulu* shifting cultivation system in Southern Cameroon (adapted from Brown, 2004 and Diaw, 1997).

3.2.2 Impact of population pressures on cultivation practices

As there are low population pressures in most of the rural densely forested regions, shifting cultivation occurs throughout Cameroon and puts excessive burden on primary forest (Bellassen and Gitz, 2008; Brown, 2004). In some areas, however, increasing population pressures have modified the system to become more of a rotational fallow system (Kotto-Same et al., 2002). Farmers in Akok do not need to reuse the same parcel of land, as the low population results in a large amount of intact primary forest land. Shifting cultivation is a useful method for the farmers to access newly slash-and-burned fields with higher nutrient content, which is partially because of generally poor soil fertility within the region. Soil fertility is relatively poor despite Akok being situated within the Congo Basin rainforest, with acidic ferralitic soils, clay content ranging from 10-50 percent and a nitrogen level of between 0.007 and 1 percent (Ngobo, 2009).

3.2.3 Agroforestry: Cocoa and oil palm

Cocoa agroforestry is practiced exclusively for the market in the Akok region and is a static field over the long term, so there is minimal change to historic foliage after the establishment of cocoa trees. Cocoa fields are heavily shaded, thus appearing nearly indistinguishable from secondary forests and maintaining a substantial proportion of the original carbon density (Swallow et al., 2007). Cocoa is typically introduced into the traditional shifting cultivation system after longer-term fallow, or even along with an *esëp* field, which can be considered to be a 'cocoa with fruit' field. Cocoa fields can be created at any stage of forest or very old fallow, so are not included in the diagram of shifting cultivation (Figure 2).

Oil palm is a relatively new agroforestry endeavour throughout Southwest Cameroon. Cameroon currently has plantations nationwide that range in scale from smallholdings (total of 100,000 ha), supervised smallholder plantations (total of 35,000 ha) and agro-industrial plantations (total of 59,000 ha) (Hoyle and Levang, 2012). However, I found minimal oil palm activity within the Akok region at the time of data collection so I chose to not further address oil palm activity within the context of this research[2].

[2] A thorough discussion of oil palm within the context of REDD for Cameroon is available in Hoyle and Levang (2012).

Figure 3. Very old fallow field (*nfos ekotok*) within Akok region.

3.3 Property Rights

Pivotal to implementing an efficient PES system within Cameroon is an investigation of land rights and tenure agreements. Shifting cultivation is dependent on ecological conditions, which in turn influence the rights to land. Use-values, culture and natural ecological growth cycles are fundamental to land allocation within the customary possession-based tenure system.

3.3.1 The customary Bulu tenure system

The following is an investigation into how the traditional *Bulu* land tenure system functions. The majority of rural populations throughout southern

Cameroon practice shifting cultivation methods in the context of customary clan-lineage tenure agreements. The *Bulu* system employs a provisional, cyclic method of household land allocation governed by genealogical institutions, ecological cycles, comprehensive forest management, and individual investment (Gerber and Veuthey, 2011). Customarily, new territories were identified through the "axe right" (*droit de hache*), whereby the first kin group to clear an area of forest would be endowed with permanent use rights (Robiglio et al., 2009; Diaw, 1997). The territory would then be held in the lineage of the founder, and the successive patrilineal kin therefore would hold genealogical rights to use this land (Diaw, 1997). Individuals within a community can potentially exercise the "right to create," which is a usufruct productive right that allows for forest and fallow clearing, as well as collection of non-timber forest products (NTFP) based on need (Diaw, 1997). This right can be exercised by anyone in the community or clan whether he or she is within the lineage, a newcomer who has been allocated access to a plot, or a community member who is evidently utilizing the land through obvious physical investment in the land (Diaw, 1997). However, genealogical rights trump the "axe right"; resources belong to future generations of the original founder's lineage (Gerber and Veuthey, 2011). Families within a lineage are free to utilize the land, unless the lineage collectively does not require the land at present. In these cases, the "right to create" can be exercised.

An individual or household does not hold title to the land in the *Bulu* system. While an individual or household is cultivating an area, that particular area has become the household's possession. Possession "defines the rights and duties to the use and yield of resources" (Gerber and Veuthey, 2011, p. 832). There are three broad categories of possession within the *Bulu* system, which are individual and/or household possession, lineage possession and community or clan possession. As shifting cultivation practices transform an

area of land, the possessing party of the area changes as well (Gerber and Veuthey, 2011). A household holds individual/domestic possession during cultivation and through to the old fallow stage (*ekotok*) approximately 10 years after the last crop has been harvested. Once this land transforms into a very old fallow or secondary forests (approximately *nfos ekotok* and *nfos afan*), the land falls back into the possession of the entire lineage so that anyone within the lineage can utilize it. Finally, if the land is left uncultivated long enough to grow back into secondary forest, it is available to all members of the community or clan (Gerber and Veuthey, 2011).

3.3.2 The formal tenure system: Forestry Law of 1994

Although traditional systems were officially abolished in favour of the Land Ordinance of 1974, many traditional elements are still accepted (van den Berg, 1999). The traditional cultivation system is the general overarching framework by which decisions about tenure are determined locally in Akok, as traditional *Bulu* culture is defined by and dependant on this system.

The Forestry Law of 1994 is guided towards centralized management and state ownership (van den Berg, 1999). Forests are segregated into two broad categories: permanent forests, which compose at least 30% of the nation and are earmarked for forestry and wildlife habitat over the long term; and non-permanent forests, which include communal, community and private forests (Robiglio et al., 2009; van den Berg, 1999). Private forests are sparse given the difficulty in acquiring title to forest resources (van den Berg, 1999). Communal forests are defined based on what they are *not;* these are forests that do not fall under state, council or private control. Under the Forestry Law, agricultural fallows and agroforestry areas are not considered communal forests until the pre-existing forest cover is re-established (van den Berg, 1999). Given the rapid growth within the Congo Basin rainforest, this could be in as little as 20 years.

3.4 Current tenure framework

However, land tenure in practice is situated somewhere between the traditional *Bulu* tenure system and the relatively new Forestry Law of 1994. Generally, the forest law does not allow for local management and control of forest resources (Robiglio et al., 2009). But, local populations are tied to their traditional tenure systems throughout the southern and western regions of Cameroon, based on the nature of the shifting cultivation system. Forests need to be regenerated in order for soil fertility to remain high and yields to be stable, which, without the use of modern technological farm inputs, requires periods of fallow. Thus the Forestry Law impacts long-fallowed areas that are given the time to progress to secondary or even high forests.

There are three important differences in perception of the forest between *Bulu* forest tenure and the 1994 Forest Law, as discussed by van den Berg (1999). First, the 1994 Forest Law makes a clear distinction between agricultural land and forests through the evidence of human presence through cultivation. Yet the *Bulu* system still applies property arrangements to old fallows (*nfos ekotok*) and secondary degraded forests (*nfos afan*), thus maintaining agricultural labels on these lands. Another difference is the perspective of land possession and right. The *Bulu* system simply equates labour applied to land to the creation of rights, whereas the 1994 Forest Law is much more complex in the granting of legal title. Finally, the fundamental concept of ownership differs; *Bulu* tenure does not identify exclusive property title to land while the 1994 Forest Law allows for private, exclusive rights. Gerber and Veuthey (2011) examine the differences between the Western industrial view of land classifications and the customary *Bulu* system. Notably, the *Bulu* tradition is different from modern Western tenure institutions, in that clear ownership is developed in Western arrangements. Western property distinguishes land into common property, private and

state-owned segments whereas the *Bulu* system relies on historical lineage-based possession. The fundamental difference in understanding of ownership/possession creates challenges in translating property concepts cross-culturally.

3.4.1 Integrating PES given complex property rights

The tenure arrangement in Akok results in a complex framework for PES and forest management. Determining an appropriate definition of property rights is fundamental for discussion of the *Bulu* system in terms of PES and REDD. Land use rights are necessary in considering the appropriate distribution of REDD benefits so that the providers of the environment service are fairly compensated to do so (Sunderlin and Atmadja, 2009). In the case of the *Bulu* system, PES can make sense within the existing property right framework given several caveats. First, contract negotiations would need to be exclusive to fallowed lands that are still considered to be under the control of the household for entry into the contract. Second, PES contracts would need to include both an individual and a community component in order to clarify that the land identified as conserved would not be used by the household with current rights or by others in the community with the capability of employing usufruct rights. Finally, contracts may need to guarantee that the land included in contracts would retain household and/or community *Bulu* rights over the entirety of the contract. A more thorough discussion of these suggestions is continued in Chapter 5.

3.5 Smallholder household livelihood strategy

Many rural farming households in Cameroon are dependent on land and forest resources for meeting both their income generation and subsistence needs. By entering into a contractual obligation to preserve forests that have been designated for their use, a smallholder would be making a conscious

choice to reduce the amount of land that the household could convert to other uses in the near future.

Smallholders in Cameroon make daily decisions to attempt to ensure that their families are taken care of financially, that there is enough food on the table, and that there is hope for the future – land available for cultivation in subsequent growing seasons. Current agricultural systems in the study area remain based on the traditional *Bulu* shifting cultivation model (Figure 2); thus the availability of fertile forested land is paramount for future stability. Essentially, the smallholder must substitute between cash and land production; entering into a conservation contract that guarantees a set amount of income that would otherwise not have been obtained or maintaining the possibility of using the land in the future. Giving up the potential ability to use land in the future, households are giving up the option to generate income and subsistence needs from that land.

Chapter 4 Theory and methods

4.1 Introduction

Chapter 4 aims to set up the theoretical framework and study design. From the discussion in previous chapters, I derive the conceptual framework and resulting model specification for this study. The latter half of this chapter describes the study area, survey design and the development of the hypothetical contract scenario.

4.2 Model specification

Smallholders consider several factors when deciding how to manage their land. Thus, the hypothetical REDD-like contract presented in this study requires a framework that will guide smallholders' choice regarding whether to enter the contract, and ultimately the level of compensation required to sign onto the contract. Economic theory helps to identify how individuals react to a dichotomous choice such as whether to enter or not to enter into a specific contract.

The random utility framework defines this participation decision response. Kingsbury and Boggess (1999) develop a model to describe the behaviour of landowners based on individuals responding to a dichotomous choice question. A smallholder, faced with the decision to enter into the contract that restricts land usage for subsequent years, will accept $A if he or she decides that he is better off to accept the incentive payment. Therefore, the gain in utility by participating in the REDD-like contract is

$$U(0,y;\mathbf{x}) \leq U(1, y+A;\mathbf{x}) \quad \text{(eq. 1)}$$

where 0 is the initial unchanged state of nature (no contract) and 1 is the state of nature when participating in the contract, y is the smallholder's income, A is the payment received once participating in the REDD-like contract, and **x** is a vector of additional attributes that may influence the decision to participate. This unobservable utility equation can be expressed as the observable portion, the indirect utility function, by including the identically distributed error term ε_i:

$$V(0,y;\mathbf{x}) + \varepsilon^0 \leq V(1,y+A;\mathbf{x}) + \varepsilon^1$$

(eq. 2)

From the indirect utility function, if $V(I,y;\mathbf{x}) = \mathbf{x'}\boldsymbol{\beta}_I$ where $\alpha>0$, for I = 0,1, then smallholders will participate in a program where:

$$\mathbf{x'}\boldsymbol{\beta}_I + \alpha y + \varepsilon_0 \leq \mathbf{x'}\boldsymbol{\beta}_I + \alpha(y+A) + \varepsilon_1$$

(eq. 3)

Therefore, as discussed in Kingsbury and Boggess (1999) and Cooper and Keim (1996), a probability framework for smallholders to accept $A to sign into the contract can be expressed as:

$$pr\{WTA \leq \$A\} = pr\{V^0 + \varepsilon_0 \leq V^1 + \varepsilon_1\} = pr\{\varepsilon_0 - \varepsilon_1 \leq V^1 - V^0\}$$

(eq. 4)

where $V^1 - V^0 = \Delta V = \mathbf{x'}\boldsymbol{\beta} + \alpha BID$ and $\mathbf{x'}\boldsymbol{\beta} = \mathbf{x'}\boldsymbol{\beta}^1 - \mathbf{x'}\boldsymbol{\beta}^0$.

The cumulative probability function in logistic form is:

$$pr\ (yes) = [1+e^{-(\Delta V)}]^{-1} = [1+e^{-(\mathbf{x'}\boldsymbol{\beta} + \alpha A)}]^{-1}$$

(eq. 5)

where **x** is a vector of attributes, not including the bid offer, that may influence the smallholders' participation decision, β is a vector of estimated coefficients related to these attributes, α is the coefficient on the bid variable, and BID is the bid variable. In this case, we can determine the median WTA by setting the probability of accepting the specific bid to 0.5 (indicating indifference) and then solving for A (see Kingsbury and Boggess, 1999).

Smallholders' decisions are represented as:

$$Y_i = 1 \text{ (willing to accept the contract) if } U_1 > U_0$$

$$Y_i = 0 \text{ (not willing to accept the contract) if } U_0 > U_1$$

where U_i are the true utility levels for each corresponding stated preference Yi.

4.3 Data

The dependent variable used in this model is the probability of a smallholder indicating that the household would sign a REDD-like contract for a predetermined ascending bid level. BID is the annual payment that would be delivered to each household, based on the bid table made to each respondent. The range of values from 0 CFA (0 USD) to 1 000 000 CFA (2165 USD) per hectare, where each respondent would answer "yes" or "no." This range was initially centred on Swallow et al.'s (2007) opportunity cost estimates in the Akok region, and then fine-tuned to fit a range of bids through pretesting and consultation with local researchers. The coefficient on BID is an explanatory value that derives WTA in conjunction with α:

$$WTA = \alpha + \beta_0 BID + \beta_X \boldsymbol{x} \quad \text{(eq. 6)}$$

where α is the alternative specific constant (ASC) for enrolment in the program. This ASC is calculated in conjunction with the coefficient on the bid level (β_0) in order to determine the total payment required in order for the smallholder to enrol in the program. The payment required is measured through the equation:

$$pr(yes) = \frac{1}{1+e^{-(\alpha-\beta_0)}} = -\left(\frac{\alpha}{\beta_0}\right) \quad \text{(eq. 7)}$$

which then becomes median WTA (MWTA) on the LHS of the equation. The coefficients (β) on the independent variables are then used to estimate the implications of various demographic and attitudinal differences between smallholders.

A maximum likelihood approach is used in this study to estimate the parameters of the models using the LIMDEP statistical software package. As each heterogeneous household was replicated over 21 rows to account for the different BID levels, each value was clustered around the unique household ID.

4.4 Explanatory variables

This study loosely borrows concepts from the simple household model devised by de Janvry et al. (1991) and further discussed in the context of WTA by Jack (2010) to identify the vector of attributes, **x**. The Jack (2010) model includes missing markets through both tradable and non-tradable inputs and outputs, thereby helping to estimate opportunity costs to the smallholder. WTA values for each household are estimated to be equal to at least the value of opportunity costs, which can change according to varying

shadow prices as well as differing household characteristics.[3] I assume that households would not accept a contract for a price less than their internally determined land opportunity costs. Therefore, in order for forest conservation to be viable, payments must be at least the economic returns of conversion minus the current economic benefits derived from the standing forest (Börner and Wunder, 2008).

Explanatory variables in this model are based on the hypothesized opportunity costs of signing areas of land into a use-restriction contract (as guided by Brown, 2006 and Robiglio, 2008). I infer that much of the smallholders' decision-making is driven by their *perception* of opportunity costs, which is investigated through Likert-type statements that are discussed near the end of this chapter. The relationship between smallholders' willingness to participate in the REDD contract and the economic incentive payment offered is hypothesized to be reliant on five categories of explanatory variables: a) availability of land substitutes, b) future tenure security, c) future food needs, d) cash needs and e) demographic variables (Table 1, Figure 4). A detailed description of each variable included in the econometric model as well as the expected relationships is provided in the following discussion.

The logit model:

$$p(y) = \cos(\beta_0 + \beta_1 [illegible] + \beta_2 [illegible] + \beta_3 [illegible] + \beta_4 [illegible] + \beta_5 [illegible] +$$
$$\beta_5 [illegible] + \beta_6 [illegible] + \beta_7 [illegible] + [illegible]$$

(eq. 8)

[3] Smallholders are thought to perceive some additional unstated benefits to being involved in the contract besides the cash payment. For example, this additional benefit may be in the form of better access to public services. A further discussion on this possibility is described in Arifin et al., 2009.

is used to show the relationship between hypothesized independent variables and the predicted probability of accepting the REDD contract.

4.4.1 Variable hypotheses

Because of missing and undeveloped markets, people may consider cash and food needs separately. Investigating the development of these needs as two separate household considerations focuses my hypotheses into five separate directions.

Risk perception hypothesis

Households may agree through participation in a 10-year contract, to limit the amount of older forested land that may be accessed for both subsistence and marketable crop cultivation. Tying up land in this contract may prove to be more of a burden for smallholders that have a greater proportion of older (≥10 years) fallow in their land portfolio. This phenomenon is related to the amount of risk that households are willing to take on. Households that are more risk averse would see fewer future options for cultivation by essentially eliminating a section of their land for a 10-year period and may not be as enticed to accept the payment. Smallholders that hold much of their land portfolio as older forests would weigh the implications and tradeoffs of the contract more heavily, and the level of risk would increase, thus becoming a more substantial consideration.

The amount of primary forest, secondary forest (*nfos afan*) and very old fallow (*nfos ekotok*), all land 10 years old and older, makes up the land that would be covered by the contract and not cultivated. This land is identified as OLD throughout the analysis. I infer that smallholders that have more OLD land in their profile are more apt to require a higher payment to enter into the contract due to risk aversion, therefore resulting in a lower probability of indicating yes to the proposed contract.

Buffer hypothesis

The amount of fallow that is easily cultivatable within the household's land portfolio is potentially important as it reflects the amount of land that could be converted into food crops while still fulfilling contract obligations. This land reflects the options that households have access to moving forward with the contract. Smallholders that currently have a large amount of this younger fallow would have a larger 'buffer' when the contract becomes valid.

Young fallow (*nyguene*) and old fallow (*ekotok*) are added together to indicate potentially cultivatable land variable FALLOWC. Smallholders that have a greater amount of FALLOWC are expected to have higher probability of saying yes to the contract due to their maintained options, even with contract implications.

Cocoa hypotheses

Cocoa and contract cash as complements. As cocoa is predominately a cash crop that generates income, cocoa is considered separately from other crops. Cocoa field development requires the intial investment of a relatively large cash sum. Thus, the contract could provide the generation of funds in order to stimulate investment in cocoa. Investment in cocoa can create heritage crops, which provide future income for the household, family and potentially future generations as well.

The size of cocoa fields is represented as COCOA in this analysis. Because contract cash is a needed complement to cocoa development, we expect that COCOA will be positively associated with the probability of accepting the contract. The contract cash could provide funds for either stimulating or increasing investment into cocoa development, and thus the contract itself would be more apt to be accepted.

Cocoa and contract cash as substitutes. Smallholders that are currently cultivating cocoa are already generating income on a regular basis. Investment has already been made, and the household already has a reliable source of cash through the cocoa market. In this scenario, farmers may not be as anxious to generate more cash. Cash could be a substitute for cocoa and therefore the probability of accepting the contract would be lower.

Dependent hypothesis

The number of dependent children that are currently living in the household also are expected to impact smallholders' decision making. Specifically, children that are anticipated to remain in the household over the course of the contract will require more than families without young dependents. Families with more children are expected to have a lower probability of saying yes to the contract, due to the forecasting of future food requirements, to be produced by the head of household/other adults within the household. Child dependency is the variable used for this hypothesis, noted as the number of children in the family 0-14 years old (DEPEND).

Production hypothesis

Households that have more food crops in the present are assumed to be more readily able to produce food. These smallholders are expected to be more dedicated to food production, thus facing higher opportunity costs from tying up land in the contract. Smallholders that are able to meet their food needs through subsistence farming would require higher compensation to sign into a contract as they would potentially be giving up more productivity possibilities. This hypothesis uses the size of food crops, *afub owondo* and *esëp* fields as the variable FOODC. The total size of food crops is expected to decrease the probability of the smallholder agreeing to the contract.

The size of bid (CFA/ha) was included as an independent variable as the range of bids (0 CFA/ha to 1 000 000 CFA/ha) is presented to the smallholders. We expect that as the size of bid increases (BID), the probability of agreeing to enter the contract would increase as well. The head of household's demographic characteristics are included in the model in order to act as controls. Gender (SEX), age in years (AGE) and marital status (married = 1, single or widowed = 0) (MARRIAGE) were included in the model to capture the demographic variability of the heads of household that answered the survey.

Table 1. Variables expected to influence participation decision.

Categories and Variables	Description of Variable	Predicted relationship to WTA	Predicted relationship to P(yes)
Dependent			
P(YES)	The probability of a smallholder *agreeing* to enter into contract at bid level *x*	.	.
Independent			
Hypothesized relationships			
OLD	Total amount of currently fallowed land that is older than 10 years (ha)	+	-
FALLOWC	Size of younger fallow – *nyengue* and *ekotok* (1-10 years) (ha)	-	+
COCOA	Size of cocoa agroforests (ha)	- / +	+ / -
DEPEND	Number of dependents in the household (0-14 years old)	+	-
FOODC	Total amount of dedicated food crops that household is currently cultivating – *afub owondo* and *esëp* (ha)	+	-
BID	Payment level that would be paid to the smallholder on an annual basis (CFA/year)	-	+
Household characteristics			
SEX	Gender of head of household (binary; 1=male, 0=female)	.	.
AGE	Age of head of household (years)	.	.
MARRIAGE	Marital status of head of household (binary; 1=married, 0=single or widowed)	.	.

4.5 Study design

The study was originally designed at the University of Alberta, although the details of the study were adjusted while I was on location in Cameroon. Culturally specific details were discussed at length with colleagues based in Yaoundé and with enumerators and local leaders in Akok. A combination of qualitative and quantitative tools was used to gather information for this study.

4.5.1 Study timeline

This study was conducted in Akok village between February and March of 2011. Although the research team stayed in the village for 28 days, the actual survey took two weeks to complete, between February 21 and March 7. Over the course of the researchers' stay in the village, we hosted a preliminary focus group, we administered a pre-test of the survey instrument (as adjusted during preliminary field-specific study development), we redrafted the survey instrument and recalibrated the economic tools, we administered the final survey and finally, we presented a general overview of results to the village inhabitants. The University of Alberta Human Ethics Research Board provided ethical clearance for this study in December 2010.

4.5.2 Study area

The site selected was Akok village, located in the South Province of Cameroon. As detailed in Robiglio (2008), Akok is composed of eight sub-villages. The study area was slightly expanded from the original ASB site as studied by Robiglio (2008) to include the sub-villages of Bipkwa'e, Vema, Mbilntangan and Afenegon (Figure 4). This area was selected as it had been previously studied through the ASB Partnership for the Forest Margins, with research conducted by scientists associated with the International Institute for Tropical Agriculture (IITA), the World Agroforestry Centre (ICRAF) and other research partners. Data have been collected in the HFZ Benchmark area

since the mid-1990s and thus some general historical environmental data on carbon values and land use changes were available. Based on the previous experiences with ASB, it was surmised that there would be a sufficient number of households available to survey in this region.

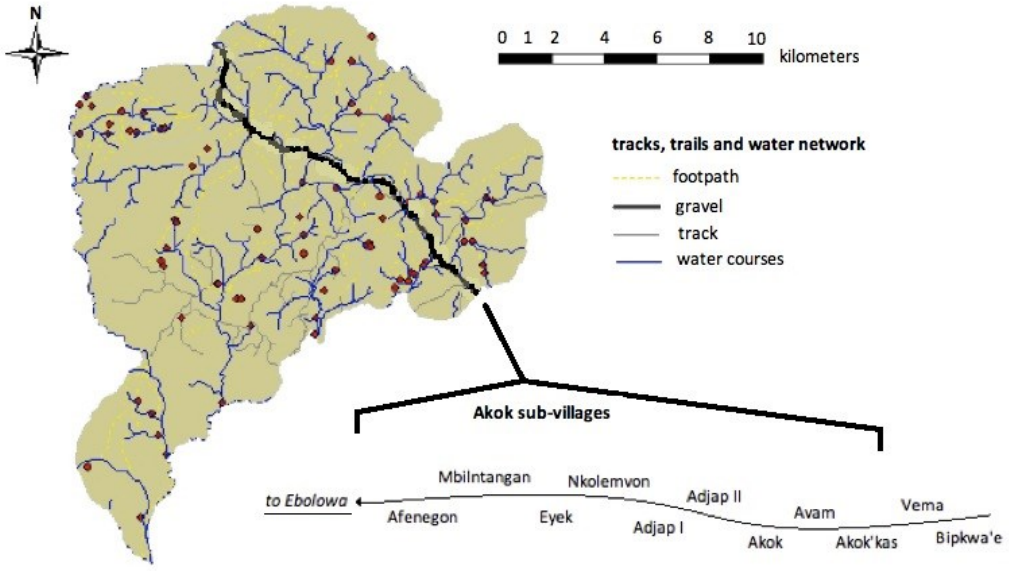

Figure 4. Map of Akok region, village and sub-villages as communicated by research assistants (adapted from Robiglio, 2008).

4.5.3 Data collection

One of the most important considerations for every aspect of data collection was language. Inhabitants of Akok are typically most comfortable conversing about land and agriculture in their indigenous language. Thus, *Bulu*-speaking research assistants and a village guide (with previous experience in the community) were invaluable to ensuring data were collected accurately and villagers were able to communicate their responses thoroughly.

We anticipated around 200 households in the region, based on conversations with IITA and ASB researchers (Valentina Robiglio, personal communication, January 15, 2011) so chose to take a census sampling approach. Census sampling also assisted in gathering demographic information for concurrent

projects by IITA. A total of 29 heads of households took part in the initial pre-test of the survey and were not included in the final version of the survey. 169 households participated in the final version of the survey. There were only two known instances where a household was unable to complete the survey. Thus, we had a 99.0% response rate.

As villagers in Akok work in their fields and are away from their homes periodically throughout the day, our enumerators pre-arranged interviews with each household whenever possible. Surveys were conducted during the hottest times of the day when working in the fields was unmanageable (approximately between 11:00 AM and 3:00 PM) and/or the evening when it became too dark to work, at approximately 6:00 PM to 10:00 PM. Pre-arranging survey times and working to accommodate the smallholders' day-to-day schedules was effective in obtaining this high participation result.

4.5.4 Focus group

Prior to carrying out the survey, a focus group was organized. One of the research assistants (whom was referred to as the village guide) was already familiar with Akok based on several previous years' experience as village correspondent with IITA. The village guide identified ten individuals in the village to represent farmers within Akok to form the focus group. These ten individuals were selected as they had significant responsibility for their household's farming practices, had lived in the village for several years (were not newcomers) and were willing to discuss their farming practices with us. Eight men and two women were invited to the focus group based on the historical knowledge of our village guide. The focus group was held on a Saturday because of the agricultural work schedule, which typically went from the early mornings until the early afternoon on weekdays (Monday through Friday). Some work would occasionally be done on Saturdays, however many of the farmers were willing to participate in the focus group

rather than tend their fields for this occasion. Sunday was unavailable to conduct any research (focus group or surveying) due to the extensive weekly church ceremony. The focus group was conducted in the *Bulu* language, and thus the Canadian researchers relied heavily on Cameroonian research assistants' translation. Participants were provided with snacks and beverages at the end of the session.

The focus group questions were split into three categories: crops and cultivation, outside organizations and tree conservation programs. For the first category, smallholders were asked about recent factors or events that may have changed cultivation practices, frequency of primary forest clearing, fertilizer access and use, and which crops farmers sell in what market(s). Previous research by Brown (2004, 2006), Robiglio (2008), Robiglio et al. (2009), and Cerbu (2008) suggest nuances of traditional *Bulu* village culture that are pertinent to understanding the context of agriculture-forest relations for this study. The focus group was used a means to investigate the role of agroforestry, namely cocoa and oil palm, in shifting cultivation. The process of shifting cultivation and market access were included in the focus group discussion due to the changing landscape of the Cameroonian agroforestry practice. Oil palm plantations are becoming increasingly more frequent worldwide and there is some potential for oil palm to become a more common crop for small to medium farmers in Cameroon, as indicated by Frank et al. (2011). Also, cocoa is currently touted as Cameroon's key to prosperity and future economic security despite the previous price collapse of the late 1980s and early 1990s. However, there is little discussion on the role of either oil palm and cocoa within the shifting cultivation framework in existing area-based studies (Robiglio, 2008; Brown, 2006).

Smallholders were asked about fertilizer use in order to investigate the potential for agricultural intensification. With a proposed REDD contract

restricting the conversion of fertile older forests and fallows into cropland, smallholders could turn to intensification to maintain or increase yields. We were interested in learning how modern intensification methods are, or might be, accepted by the community. Marketable crop varieties and the frequency of sale was included to gain insight into what smallholders would typically be selling in the market.

The next section, outside organizations, aimed to investigate institutional perceptions. These questions were necessary for another part of the broader study and were not utilized in this study.

Finally, the hypothetical contract scenario was briefly and generally introduced to the smallholders. As the concept of PES had not previously been discussed with the community, we were advised by researchers at ICRAF and IITA to present the concept prior to carrying out the study. Being compensated for essentially doing nothing is a foreign notion that may not make intuitive sense for many communities, especially in a developing community like Akok. For the most part, smallholders are only familiar with conventional market exchanges or more traditional barter systems. Therefore being paid for simply "preserving the trees" required some explanation, which was done informally throughout this section of the guided discussion.

The importance of trees from an environmental perspective was initially introduced based on a simple paragraph, read aloud by the village guide (translated into English from the French focus group question sheet given to the research assistants):

"We now know that trees are an important part for your crops and to sell them. Now we want to talk to their importance for the environment too. They help make the air clean and they perform useful functions for humans and

animals worldwide. Now let's talk about a program for the conservation of trees that can be developed in the village to help maintain these environmental services."

Following our introduction to PES, we facilitated a discussion of how a program might function within the community. Finally, we asked how compensation to participate in the program might work.

Tree conservation as a general idea was introduced in order to stimulate (or solidify) the notion that preservation is important for environmentally motivated reasons. Using the general term "tree conservation" rather than the more complex term "carbon emission mitigation" helped to give a simpler explanation for why another nation or NGO would be willing to compensate foreign smallholders in Cameroon to maintain their forests.

We required a simple, general starting point to introduce PES to the farmers. Villagers were asked to suggest ways to implement a tree conservation program within the village. By giving the farmers some stake in developing the tree conservation program – that is, brainstorming ways for the program to be developed – we hypothesized that they would be more responsive to the upcoming survey contracts. Rather than telling them how the project would be administered, they would tell us. This information was also used to fine-tune the contract scenario in the survey.

The final questions of the focus group asked about how compensation for such a program should be administered. Based on the complex nature of the *Bulu* tenure system, and the movement of possession from lineage to household to lineage, we were interested in how individuals believed payments should be made. Three possibilities were suggested to the group: household, family, or village-level. Also, the smallholders were asked about what type of compensation would be preferred, monetary (cash) or

intensification equipment/fertilizers. Payment preferences between cash and intensification assistance was included in this focus group as we were not clear on the availability of intensification or the desire for households to intensify prior to entering the field. The smallholders were also asked generally to suggest how much they believed individuals in Akok would have to be paid in order to enter into a tree conservation program. Though these values would be vague and likely inflated because of a variety of biases (discussed in 2.5.3), this approach introduced the concept of PES – and encouraged farmers to consider tradeoffs and opportunity costs of entering into the contract. Farmers that took part in this focus group therefore were given additional time to think about their response for the survey, however this was not accounted for within the survey itself. The focus group attendees were not excluded from the survey. After completing the focus group, the survey was refined again to better reflect the results.

4.5.5 Survey administration

The survey was designed to be conversational, as the inconsistent literacy levels across the village required the survey to be administered as a face-to-face interview. The village guide approached each household at least one day ahead of the proposed survey administration date in order to schedule a meeting. Each survey took approximately one hour to complete, and households were compensated with a bar of soap and a pen for their participation. Responses were kept anonymous, and respondents were reminded that they were free to stop the survey at any time. Informed consent was gathered through an information/consent form as stipulated by the University of Alberta Research Ethics Board.

A team of four research assistants, all of which speak and understand French and *Bulu*, administered the survey. The survey was written in French yet research assistants were instructed to converse with the respondents in *Bulu*

as necessary to increase comprehension.

4.6 Survey design

A mixed question format was used for the household survey, which included simple yes/no responses, ranking of alternatives, and preference scale questions. A copy of the survey is available in the appendix.

The aim of the survey was to produce data that could be analyzed with a variety of techniques. The survey focused on five main types of information:

1. Overview of the household,
2. Perceptions of land tenure,
3. Household land holdings,
4. Perceptions, and
5. WTA for contract.

The first section of the survey gathered information on household demographics and characterization. I asked about the size of household, number of dependents including their gender and ages, as well as any household size changes within the past 10 years (birth, death, or relocation). A specific focus was on the household decision maker (head of household) and their education and marital status.

The second section inquired into fallow classification and holdings. Included in this section was a simplistic exclusivity statement ("Do these fallows belong exclusively to your household?") to enhance understanding of the local perception of land tenure agreements. Within this section, I also verified the age classification for fallow land.

The third section investigated current agricultural composition, which included forest fields (*esëp*), mixed food crops (*afub owondo*), lowland fields

(*asan*), cocoa plantations and any other fields that the household cultivates. Previous vegetation for the field (i.e. the land conversion) and the variety of crops planted was included as well.

The fourth section of the survey looked into current and future agricultural activities, as well as property rights. To gather perceptions and attitudes regarding food security, tenure security, cultivation practices, and potential decisions in the face of additional revenue, declarative statements were proposed in which the individual indicated how much he/she agreed based on a Likert-type scale (strongly agree to strongly disagree). These statements were included to elicit respondents' emotions, feelings, perceptions and ideals of how their households might be impacted by a change in their future land option choices through contract agreement.

The final section of the survey utilized the designed hypothetical REDD contract in order to ask smallholders' how much they would be WTA in order to enter into the contract.

4.6.1 Hypothetical REDD contract

The hypothetical REDD contract was essential for respondents' comprehension of the CV question. The contract was described as a ten-year obligation in which the household would be directly paid for conservation of trees that the household has access to. Based on previous investigation of the literature (Harley et al., 2012; Forest Carbon Portal, 2012), a five- to ten-year contract appeared to be the most likely to be implemented if the contract was realistic. Each household would agree to maintain any forests and fallow lands that are more than ten years old (the *nfos ekotok* and *nfos afan*).

Based on the discussion from the focus group about shifting cultivation, we found that explaining the trajectory of land use change through a diagram helped to describe the contract obligations (Figure 2). Respondents were also

shown a diagram without the boxes for *esëp* and *fulu* to indicate the changes that might be required by participating in the contract, adapted from Figure 2 (see appendix). Also, as identified in the focus group, we added intensification assistance to the contract to increase acceptance. The community would receive assistance in improving production of the young fallow. External help to enhancing production was fundamental to local acceptance of the conservation program in order for participation from the community. IITA was the most recently familiar NGO involved in Akok, and thus we surmised that IITA was the organization that individuals were considering for assistance.

A considerable barrier was the explanation of REDD and PES to the community, as previously discussed in regards to the focus group. We chose to avoid using the acronym "REDD." We did not refer to the program formally as REDD in order to mitigate potential negative reactions; specifically to reduce possible collusion by anyone in the village stanchly opposed to REDD. Also, it was important that every household would receive the same amount of information about the hypothetical contract from the onset regardless of their previous knowledge. As the concept of PES is fundamentally difficult to communicate to individuals (Wunder, 2007; Whittington, 1996), we suggested that 'some organization' would like to develop a program that encouraged farmers to keep trees on the land, and that the household would be compensated to make sure that the trees were conserved.

4.6.2 WTA method

To obtain WTA values, a contingent valuation (CV) stated preference method was used. A revealed preference approach was not appropriate in this context due to the lack of markets in this predominately subsistence-based economy. As incentive compatibility could not be implemented for ethical reasons (giving/accepting money in this developing setting would create a

plethora of additional biases), other methods were utilized to reduce bias and attempt to gather a true response from villagers. 'Cheap talk,' a brief reminder of hypothetical bias, is imbedded in the survey preamble (Lusk, 2003). Also, the researchers did not accompany the *Bulu*-speaking research assistants to minimize 'yea saying' and to maintain consistency between respondents' questionnaires.

WTA instrument

The question asked was "Would you be willing to accept 100 000 CFA (for example) to participate in the contract?" As the values had to be read aloud, all respondents were asked to respond with a "yes" or "no" to each value, beginning with a payment of zero. I chose to use a single-bounded continuous bid sequence presented in a payment card format. A payment card with increasing bids (in CFA francs) was utilized rather than a single-bounded CVM in order to reduce starting point bias (Chien et al., 2005) or the ethical community misunderstandings that can arise in a tight-knit community by administering differing double-bounded bids, as conveyed by Whittington (1996). By starting every individual at zero and increasing by the same increment, each smallholder was able to identify their unique bid, rather than be anchored to the first value discussed.

Some trial-and-error in pretesting was required to identify the appropriate range of bids. Initial estimates for this research were informed based on Swallow et al. (2007), and were upper bound at 32 000 CFA/ha (69.26 USD/ha)[4]. However after the focus group, the values were increased substantially to 2 000 000 CFA/ha (4329 USD/ha) for the pre-test survey

[4] All monetary conversions throughout this thesis are converted at a rate of 1 USD: 467 CFA.

based on the inflated responses for contract acceptance acknowledged during the discussion (see Chapter 5). After initial back-of-the-envelope calculations of the payment value with the pre-test surveys, the upper bound was reduced to 1 000 000 CFA/ha (2164.50 USD/ha).

Estimating WTA

This span of values (0 – 1 000 000 CFA) was verified as a good representation of the range of WTA for the sample through non-parametric analysis of the data collected during the survey pre-test using the Turnbull upper bound method. The Turnbull method is an appropriate way to capture a monotonically increasing bid continuum (Haab and McConnell, 2002).

Both parametric and non-parametric approaches were utilized to analyze the WTA data. In addition to the parametric binary logit model, the Turnbull method and interval methods were used to generate WTA estimates for the sample and underlying population. An advantage to non-parametric methods is that they do not rely on a specific functional form (Tambour and Zethraeus, 1998). Furthermore, non-parametric approaches are simple to calculate, which was a substantial advantage while initially pretesting in the field (Kriström, 1990).

WTA results were initially calculated using the Turnbull upper bound method. Using the Turnbull method for upper bound probability of each WTP, assuming a normal distribution for the cumulative distribution function (F*j) is:

$$E(WTA) = \sum_{j=0}^{M^*} t_j f^*_{j+1}$$

(eq. 9)

where t_j is the bid level ($ amount) asked to each smallholder and f^*_{j+1} is the

probability distribution function for the next highest bid level (Haab and McConnell, 2002). Although the literature does not explicitly use Turnbull estimates for WTA measures, extrapolating the method to WTA is logical as a person's WTA is approximately the opposite of their WTP. Rather than use the highest value of 'no' as the WTP would indicate, I used the lowest value of 'yes' to convert this method into a WTA estimate.

An alternative method for non-parametric maximum likelihood estimation of CV studies is the interval method as described by Kriström (1990), and later amended by Tambour and Zethraeus (1998). The value for the nonparametric estimate of mean WTA is obtained by calculating the area below the curve for the lowest values of yes – that is, the lowest value that smallholders are willing to accept as compensation for entering into the contract.

The distilled version of this method is

$$W = \frac{1}{2}\sum_{j=0}^{j} (p_{j+1} - p_j)\ r_{j+1} + (r_j)$$

(eq. 10)

where p is the bid level and r is the ratio of yes for each level of bid j (Tambour and Zethraeus, 1998).

4.7 Analysis of perceptions

A series of Likert-type questions was included in the survey to gain insight into the perceptions that would impact how a REDD contract would be administered in Akok. Although I attempted to polarize respondents' responses with a truncated four-point version of the traditional five-point rating scale that did not include "neutral" (see Gray and Guppy, 2003), I included "not sure" as a category to capture the possibility that respondents may be unclear on the question, truly be unsure on their perspective on the

statement, or be indifferent to the declaration. It was also important to maintain awareness of potential biases when designing the Likert-type statements. A related bias is the cultural differences in responding to statements, known as *cultural bias* (Flaskerud, 2012). Finally, a common consideration in Likert questions is the nature of people to appear more altruistic than they really are. This *social desirability bias* needs to be considered by the researcher (Chung and Monroe, 2003).

Value elicitation is captured through a continuum of how much a respondent agrees with a statement, which is ordinal data. To identify how smallholders responded to perceptions, the raw data is presented as frequency of response categories. Correlations between similarly themed Likert-type statements were also calculated in order to identify the similarity between inferred valuation statements using SPSS. Kendall's tau-b is employed as a measure of correlation between the similarly themed ordinal variables. Ordinal data has a rank order yet does not have a definite interval (Romano et al., 2006). This limits the way that perception data can be analyzed, especially in the case of parametric results. Norman (2010) helps to clarify the debate around Likert scale data through parametric means. He concludes that although statistical 'laws' may be violated in analyzing ordinal data originating from scaling attitude statements through analysis of variance, t-tests and regression, these statistics are still robust when presented as a scale. I attempt to create two Likert scales from the questions asked to smallholders for the purpose of integrating perception data into regression analysis.

4.8 Estimating the marginal costs of avoided carbon emissions from WTA estimates

As a direct comparison to Swallow et al. (2007), I extend the WTA estimate to carbon stocks in the area to approximate the cost of carbon emission abatement in the Akok village region. To estimate the costs of avoided carbon

emissions, the above ground time-averaged carbon stocks of land use systems within the ASB benchmark site were applied to the smallholders' estimated hectares of each land type. As described in Swallow et al. (2007), the original ASB team within Cameroon had estimated the time-average carbon stocks within the HFZ region that were then revised based on work by Sonwa (2004). These amended carbon stock estimations were applied to the approximation of land holdings for each smallholder (Table 2). The resulting carbon stock levels were converted to total t CO_2eq/ha based on the estimated WTA for the mean smallholder within Akok village. An aggregate measure for each household's estimated carbon abatement for fallows, cultivated land, and total land holding portfolio was derived from these values, and each individual household's lowest value of 'yes' for the WTA statement was applied to each unique estimated land portfolio. This was depicted as a mean community value.

A supply cure of land offered into REDD contracts was created to highlight the spread of each heterogeneous household's stated WTA value within the community. The lowest value of 'yes' was applied to the amount of land that a household has in their profile that would be contributed to the contract, and the total amount of land at each bid level across the community was captured. Additionally, using the carbon stock estimates by Sonwa (2004), I extrapolate each smallholders' land profile to create a marginal cost curve for carbon abatement in Akok village.

Table 2. Application of above-ground carbon stock estimates to smallholder land classifications to derive opportunity costs of carbon mitigation in Akok village, Cameroon (adapted from Swallow et al., 2007 and Sonwa, 2004).

Land type	Above ground carbon estimate (t CO_2/ha)*	Land type application for this study
High forest	250	*none*
Secondary forest	200	*nfos afan*
Extensive cocoa	141	*cocoa***
Extensive cocoa with fruit	141	*cocoa*
Intensive cocoa with fruit	141	*cocoa*
Mixed/short fallow	4.5	*afub owondo, nyengue, ekotok*
Mixed/long fallow	63.3	*esëp, asan, nfos ekotok*

*Swallow et al. (2007)

**Cocoa type was not segregated into extensive/intensive, nor with or without fruit. For the purposes of this study an aggregate classification of cocoa is sufficient, given the same carbon estimate for each type.

Chapter 5 Focus group summary

5.1 Methodology

The focus group was initiated as a way to understand shifting cultivation practices and the reaction to potential forest conservation programs. As the WTA question required that individual respondents comprehend the notion of a tree conservation program, it was imperative to discuss this with the community as a whole so that clarifications could be made in the survey instrument if necessary. Furthermore, giving the individuals in the focus group a sense of ownership (asking *how* they think a program should be developed) was intended to better understand general perspectives of the program and how farmers envision the program working at their level. A list of the discussion questions can be found in the appendix.

5.2 Results

As there was a significant amount of translation and discussion over the course of the day, the session took longer than initially expected. Our session ran from approximately 10:15 AM until 12:30 PM with a 30 minute break and then again from 1:00 PM to 3:30 PM. Individuals were not obliged to stay for the entire day yet most people participated for the entire day. When the session first began there were 20 men and 4 women and by the end there were 21 men and 6 women in attendance with several people loitering outside of the venue as well. We believe that the turnout was nearly tripled from our initial invitations at least partially due to many people's curiosity (our presence in the village) as well as for an interesting activity to do on a Saturday. Our guide warned us that "this is a village" and thus we would likely have more attendees that invitees (Figure 5).

Figure 5. Focus group taking place within community hall in Akok village.

5.2.1 Crops and cultivation

Our focus group began with a discussion on the cultivation practices in Akok village and its nearby hamlets. In terms of recent factors or events that have altered cultivation practices in the village, the group focused on the introduction of modern cultivation methods by IITA. The two dominant practices discussed were planting in rows/lines and new varieties of plants. The overwhelming response was that these methods were "impractical," "do not respect the growing seasons," and that the topography was not conducive to this type of cultivation. Large trees were identified as a major obstacle to row planting, as well as the amount of physical work that was necessary to create these types of plots. Also, as farmers in this region grow many crops at once, some individuals felt that planting in rows was not practical as it took much more time. It also required more insecticides due to the increase of insects in the soil. Farmers said that they had abandoned these introduced methods once IITA completed research in this area.

The next question addressed the frequency of clearing land. The response

was mixed, as there appear to be two methods. Some individuals clear primary forest annually because they use insecticides, while most people clear every two years as they do not use insecticides. An important factor in clearing primary forest is the intended use of the field. The shifting cultivation model (Brown, 2004; Diaw, 1997) is typically followed. Determining what types of land (fallows or forest) are cleared is dependent on the amount of unused land that the individual has access to. Farmers in Akok clear their fallows through slash-and-burn every 3 to 6 years, however many stated that they do not reuse fallows due to the widespread availability of more nutrient rich forested land.

To verify the current relevance of the shifting cultivation model introduced by Diaw (1997), the farmers were asked to outline their cultivation patterns. The farmers verified that the model is still in use (Figure 2). Some further seasonal explanation was also captured during the focus group. The *merecage* (*asan*) are lowland peat lands that are cleared in October and November and planted in December. Old fallows are cleared in December and January and replanted in February and/or March. Finally, the primary forests are cleared in October and November and again, replanted in February and/or March.

Interest for intensification came up over the course of preliminary research, and was echoed in the focus group. Therefore, I asked farmers about the availability of fertilizers. The reaction was quite intense. People brought up several main barriers: price, knowledge of proper use, and access. Traditional cultivation methods are used because farmers simply do not understand how to use fertilizers and have not had access (financial or spatial availability). However, many people mentioned that they would be more apt to employ fertilizers and insecticides if an agency was able to come in and teach them proper use.

One example that was brought up in a negative light was the introduction of the *Calliandra* shrub by IITA (Figure 6). This plant was promised to fertilize the land, however farmers here have experienced the opposite effect. *Calliandra* spreads quickly, causes soil to be infertile, and has very hard roots, which make working in the fields more difficult. Farmers here have stopped using *Calliandra* and have a relatively negative perception of fertilizers and IITA due to the lack of continuing support. A common theme across this intensification inquiry was that people are willing to move towards more modern (intensive) systems, yet they require significant support from external agencies to take this step.

Figure 6. *Calliandra* variety fertilizing plant as indicated by research guides within Akok region.

The final question asked regarding crops and cultivation was the crops that farmers sell in the market. The following crops were identified, in order of quantity sold: cocoa (*cacao*), cassava (*manioc*), plantain, cocoyam (*macabo*), cucumber (*concombre*), peanut (*arachide*) and corn (*maize*). Cocoa is grown

exclusively for the market, while the other crops are both subsistence and market crops. Feeling that they are receiving a 'fair price' varies, and depends on both what farmers are selling in the market and the current market price. Farmers in Akok village sell their product in Ebolowa, the nearest town.

5.2.2 Outside organizations

Although this information was primarily collected for my peer researcher, the data collected during this conversation provides insight into my research as well. General feelings towards organizations that could potentially interact with people in the village were explored through a series of questions.

When asked about external organizations, the group immediately focused on IITA. We believe that this was because IITA has had the most profound effect on the majority of our focus group (farmers) and has been the most active in this region. The most recent experience in this village was a study regarding cassava and soil fertility, undertaken by IITA (IITA, 2006). Research on the constraints to cassava production within the region resulted in the farmers being introduced to techniques to improve field management, increase yield and decrease the frequency and intensity of African Root and Tuber Scale (an insect species that infects the underground parts of cassava and prevents young plants from developing tubers) (IITA, 2006).

Famers present at the focus group suggested that as *Bulu* people, they are open to positive relationships with outside organizations. Conversely there was a sense of exploitation and frustration as many researchers have come to collect biological information for their laboratories, yet people in this village have not seen any results; "they never bring any solutions to the problems that they are researching." The term 'deception' was mentioned by many of the farmers.

We attempted to move the conversation to focus on other organizations by

asking the people to think about other groups as well. However, the consistent response by vocal members of the focus group was that all organizations do the same thing, and that the experience typically turns out to be negative for people in the village.

The next question asked which organizations people in Akok trust the most. Again, the group concentrated on IITA. A woman came in from outside to express her aversion, and stated that they (IITA) would come and bring new plants and ideas but would leave without giving enough help and guidance. She also said that farmers have no way to communicate with IITA to say that these new plants and ideas are not working. Generally, the feeling was that people here have had enough of the research, and need help to get to the next step (implementation as well as maintenance and follow-up).

One comment was made about the government. An individual suggested that President Paul Biya has big expectations for agricultural development, yet there are no subsidies or other assistance to do so. Many farmers expressed the opinion that the multitude of ideas to enhance agriculture, from both external organizations and the government, is simply not translating into action.

A final question about the most 'palatable' organizations – groups that people here felt best and trust the most – led to an interesting conversation. People here would prefer to deal with a group that understands agriculture rather than forestry because "they can't eat trees." Because of this, many people have the most confidence in IITA, provided IITA makes the next step from experimentation and research to action for local people.

Farmers mentioned that they need financial services to help bring their practices into more modern, intense and industrial operations so that they can experience more benefits. Because of this, people are also interested in

dealing with private forest companies, as they would see direct results from the money. One example mentioned was KIP. KIP is a private company that builds water well infrastructure in the region.

5.2.3 Tree conservation programs

As an initial introduction to the concept of tree conservation, our village guide started this section of the discussion by reading out a briefing paragraph, which he translated into *Bulu*:

> We now know that trees are an important part for your crops and that you sell your crops at the market. Now we want to talk about the importance of trees for the environment too. They help to make clean air and they perform useful functions for humans and animals worldwide. We will now talk about a program for conservation of trees that can be developed in the village to help maintain environmental services.

This introduction yielded several responses, the majority of which pertained to the government. Farmers said that they want to preserve their own forests and understand the importance of conservation. However, they feel powerless against the government. As the government hands out land titles, they would be unable to make any use-right changes – and government agents can cut down trees on the people's lands. This led to a discussion of two types of exploitation that people here feel. The first, as previously mentioned, is the 'top-down' problem – enforcement by government power to cut trees freely. The other is that farmers can allow government agents and logging companies, for example, to cut down trees on their land in exchange for payment ('bottom-up').

The first question asked the group how they thought a tree conservation program should be developed in the village, and who should be involved in

implementation. One interesting comment was that the people themselves are able and willing to implement the program, yet they feel that doing this would be ineffective as the government could overturn any program without repercussion. There were three main suggestions that were agreed upon by most of the farmers in our group.

1. An initial suggestion was community forestry. Collectively, the village could protect the forest with the assistance of an organization provided that the entire group would agree to this type of agreement. Yet the potential exploitation of large trees by people in the village is a recognized problem, as well as the current entitlement to land.
2. Another suggestion was to increase the production in the young fallow. To do this, an organization would come and show the people how to cultivate their young fallows so that there would be no need to use the older fallows. The use of fertilizers is not necessary in this type of system. Rather, the people would be able to conserve trees and maintain production simultaneously.
3. The third suggestion was reforestation, expressed as a universal legal obligation to replant any trees that are cut down. However, farmers mentioned that it is important that these obligations apply to everyone: the government, companies, individuals, groups, organizations, etc.

To complete the conservation program questions, farmers were also asked about how compensation would work best for them. We asked what level of payment (household, family or village) would be preferred and also the method of payment (cash, equipment, fertilizer, etc.). Participants insisted that the payment be made in cash as they could then make discretionary choices about what to purchase. The group differed on the level of payment that should be made. Some families divide up land and decide about which family members use which areas together; thus the collective family level

would be best. However, many families have already divided up land, so household payments would be preferred. Participants generally agreed that they thought that if a tree conservation program came to the village, it should be up to them to decide how the payment should be divided (household or family).

To get a sense of what an appropriate payment might be, we asked how much they thought the typical payment would need to be on a per hectare per year basis. Some participants were not willing to respond, as they believed that we wanted to buy the forests that belonged to them. There was a significant amount of disbelief in the fact that they would be paid for effectively "doing nothing." The two estimates that we were able to gather suggested that payments of 5 million CFA (approximately 10 000 USD) and 7 million CFA (14 000 USD) per hectare per year would be appropriate. One farmer suggested that the annual gross revenue for a typical field is about 5 million CFA per hectare.

Generally, the participants were not able to come to a consensus on an appropriate price and had a difficult time comprehending and believing that they would be paid simply for conservation. However, most responded positively to the concept of a tree conservation program and indicated that conservation is a common interest. However, the payment for such a program that ties up a large proportion of their lands would need to be high enough so that people in the village actually experienced significant benefits from participation.

5.3 Summary

We invited eight men and two women to the focus group, as this ratio was suggested to be reflective of the head of household diversity. Survey results suggest that this is appropriate gender diversity for heads of household in the

community, and is corroborated in the survey results (see Chapter 6). The focus group was successful as a qualitative data collection method, and assisted in anchoring the quantitative component of this research to realistic opportunities and experiences within the village. Individuals in the community were willing to respond to all of the questions that were asked of them, and appeared to deliver thoughtful and genuine answers. The large number of villagers that were present at our group was also indicative of their willingness to participate in this study. The one anomaly in response consistency was the payment question – which was predicted to generate off-the-cuff hypothetical answers from the onset. This provided an initial 'red flag' for development of an appropriate and effective WTA strategy to elicit the most realistic response possible. Overall, the villagers were welcoming and forthcoming with information that proved to be invaluable for verification of existing literature, comprehension of the situation within the village, and gaining insight into local perspectives.

Figure 7. Research Assistant Dominique fielding questions from villagers during the course of the focus group.

Chapter 6 Results

6.1 Introduction

The previous five chapters have provided the theoretical and research background to evaluate the willingness for smallholders in Cameroon to accept compensation to reduce deforestation through REDD-like contracts. The aim of this chapter is to link the theoretical model to the study area in Akok in order to investigate the implications for REDD. This chapter analyzes the payment characteristics of smallholders as well as perception-based factors that are inferred to affect their participation choice.

This chapter begins by presenting demographic results for households within Akok, followed by both parametric and non-parametric analyses of smallholders' WTA based on the theoretical model outlined in Chapter 4. The remainder of the chapter describes results of Likert-type perception statements.

6.2 Sample demographic characteristics

In total, 169 surveys were administered throughout a total of 11 sub-villages that compose the greater village of Akok (see Figure 6, Chapter 4). The household census approach achieved an overall response rate of 99 percent.

In order to encourage realistic behaviour in the face of a possible REDD-like contract, we requested that survey respondents should be the designated heads of household (*chefs de ménage*). As the primary household decision-makers would likely receive input from other family members when making impactful decisions regarding future land holdings and income opportunities, other members of the household were not excluded from providing input during administration of the survey. In the absence of the *chef de ménage*, the

self-identified next most important decision maker was invited to respond to the survey. Overall, 74% of the respondents to this survey were male, and the mean age of respondents was 48 years (Table 3).

Table 3. Household descriptive statistics for respondent households in Akok (original data obtained from survey of Cameroonian smallholders, February 2011).

Description	Mean	Min	Max
Gender of respondent (1=male; 0=female)	.742 (.437)	0	1
Age of head of household (years)	48.4 (14.24)	23	78
Marriage status of head of household (1=married; 0=single or widowed)	.752 (.428)	0	1
Size of household (number of people)	6.98 (5.75)	1	46
Number of child dependents aged 0-14 years in the household	2.79 (3.19)	0	20
Change in household size within the last 10 years	*Increased: 58.6%* *Decreased: 17.8%* *No change: 23.7%*		

*Standard deviation presented in brackets

The definition of a household was characterized locally based on discussions with researchers at IITA. The mutually agreed upon definition of a household is (translated from French):

"Consisting of a man and/or woman married or widowed, unmarried children, and other members of the family economically dependent living in the same habitat."

Based on this definition, the typical household in Akok has seven members. This ranges from one single dweller (an elderly widow/widower) to 46 members in a polygamous extended family household. Figure 8 identifies the mean breakdown of age within the average household.

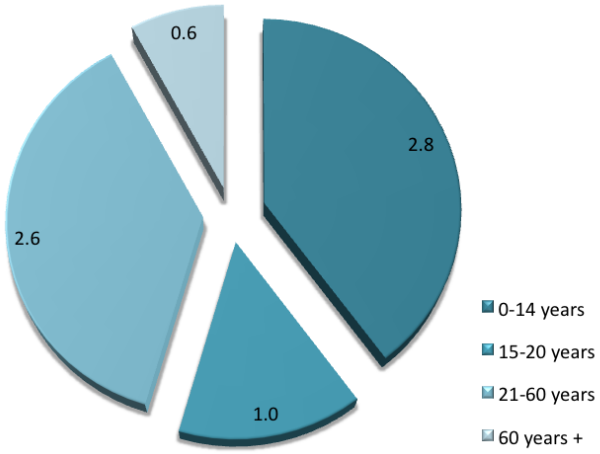

Figure 8. Mean composition of households in Akok village, Cameroon, shown in number of household members.

More than half (58.6%) of the households reported an increase in household size within the last 10 years. This was primarily due to births (98%). For the households that experienced a decrease in household size over the same time period, most were due to children leaving the village to attend school in the city (67%), rural exodus (30%) and death (20%).

6.3 Household land profile

Each household was familiar with the shifting cultivation model as the framework to identify land holdings. Following a preliminary discussion during the focus group (see Chapter 5), an additional category of cultivated low-lying peat lands, called *merecage* or *asan*, was included in the model to reflect the specific context of Akok.

The mean land profile for households in Akok village was 29.0 ha total, of which 24.4 ha is fallow available to cultivate in the future (Figure 9). Each household within the village was reported to be actively cultivating a mean of 4.86 ha of land at the time of the survey, which includes mixed food crops (*afub owondo*), forest melon (*esëp*), wetland (*asan*) and cocoa fields (Table 4). Most households currently cultivate forest melon (79%), mixed food crops (84%), and have cocoa agroforestry (79%) plots in their land profile (Table 4). Smallholders that currently do not cultivate mixed food crops typically create a new mixed food crop each year. Over half of smallholders utilize *esëp* and *asan* fields to produce food.

The majority of smallholders have not personally created a cocoa field, but rather retain access to existing cocoa agroforests that were established by previous generations and passed down within their families as heritage land plots. The other commercial agroforestry endeavour in the region, oil palm, was practiced by 5 of the 169 surveyed households in Akok, and accounted for approximately 4.1 ha within the entire village.

Table 4. Household cultivated land type general statistics for respondent households in Akok (original data obtained from survey of Cameroonian smallholders, February 2011).

Cultivated land type	Crops on field (ordered by frequency)	Mean (ha) *All*	Mean (ha) *Land type>0*	HH (%) *Land type>0*	Max (ha)
forest melon (*esëp*)	cucumber, plantain, cocoyam, cassava, banana, corn, cocoa*	1.36 (1.35)	1.72	79	8
mixed food crop (*afub owondo*)	peanut, cocoyam, cassava, plantain, corn, yam, tomato, pepper, potato, folon, sugarcane, okra	.835 (1.04)	.801	84	4
lowland peat – marecage (*asan*)	cocoyam, corn, folon, plantain, cucumber	.142 (.294)	.567	24	1.5
other	oil palm, plantain, corn, pepper	.0483 (.200)	.622	8.3	1.5
cocoa agroforestry	cocoa, cocoa with fruit	2.34 (2.29)	2.96	79	12
Total		**4.86 (3.49)**			

*Cocoa was cultivated on *esëp* fields by 4 respondents in the village. As it was not the dominant or exclusive crop on the field (as it would be to be categorized as cocoa agroforestry) this data remained within the *esëp* category.

**Standard deviation presented in brackets.

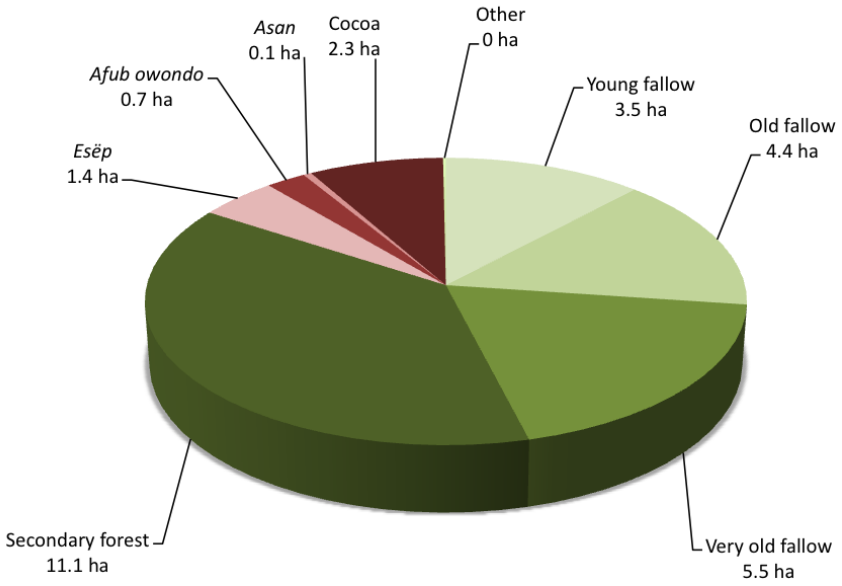

Figure 9. Average household land profile in Akok. Total mean land holding is 29.0 ha, including access to 7.9 ha of young and old fallow, and 16.6 ha of very old fallow and secondary forest.

6.4 Evidence of shifting cultivation

Smallholders were asked to identify the origin of each cultivated field in order to compare this information to the shifting cultivation model presented by Diaw (1997) and Brown (2006). Cocoa was missing in this original model, so determining the original land type for this agroforestry endeavour was interesting for this study.

Most smallholders convert high forest into the transitionary *esëp* fields (60%), however many also utilize secondary forest (21%) and very old fallow (13%) to create *esëp* fields (Table 5). *Afub owondo* was created from several different types of fallow, but most frequently from old fallow (63%). Interestingly, *asan* fields are "off-season fields that are cultivated in lower lying areas where there is sufficient moisture to carry a crop through the long dry season" (Brown, 2004, p.76). Although the majority are cultivated from marshland (*merecage*), smallholders identified that they are also created from other types of forest and fallow. Finally, cocoa agroforestry had been

created from nearly every variety of original land type. 47% of cocoa fields originated from lands that were fallow for at least 10 years prior to being converted to cocoa (high forest, secondary forest, very old fallow and old fallow).

Table 5. Shifting cultivation comparison for smallholders based on anecdotal evidence of their personal cultivation practices.

Original land/fallow type	Crop to transition into (% of smallholders transitioning from each land type)			
	Esëp	*Afub owondo*	*Asan*	*Cocoa*
High Forest	**60**	1	7	18
Secondary Forest	21	1	5	11
Very Old Fallow	13	14	7	3
Old Fallow	6	**63**	9	15
Young Fallow	1	9	7	3
Forest Fallow (*fulu*)	0	7	0	0
Esëp	0	6	0	17
Swamp (*merecage*)	0	0	**66**	**33**
Number of households with this field type	134	142	**40**	**133**

6.5 Access to land

Due to the complex nature of the *Bulu* possession-based land acquisition and use system and the introduction of the Forestry Law of 1994, understanding how smallholders perceived the use of their land was integral to inferring how payment eligibility would work in this region. The mean perceived fallow access for all smallholders is 8 hectares of fallow less than 10 years of age (*ngyunge* and *ekotok*) and 16.5 hectares of fallow greater than 10 years old (*nfos ekotok* and *nfos afan*). The *Bulu* system suggests that households

hold the rights to their currently cultivated lands as well as fallows up to approximately 10 years old (Gerber and Veuthey, 2011). 73% and 85% of smallholders in the region believed that they have exclusive use over young fallows (*nyengue*) and old fallows (*ekotok*) respectively. The remaining households believed that the household required permission prior to acting on the land, implying that this land actually falls into lineage, community or clan possession. Alternatively, these households could potentially be renting land from others in the community or were assuming that the Cameroonian Forest Law would take precedence over local tradition. For secondary degraded forests (*nfos afan*) and very old fallow (*nfos ekotok*), the majority of households still believed that they had exclusive use, although the traditional system suggests that the entirety of the lineage has right to use fallow that has reached more than 10 years. Fewer smallholders require permission to utilize these older fallows as well.

Table 6. Smallholders' perceived access to land in Akok village, Cameroon.

Type of fallow	Average age of fallow (years)	Exclusive use (%)	Require permission before use (%)
Young fallow (*nyengue*)	3.8	73	22
Old Fallow (*ekotok*)	8.1	85	22
Very old fallow (*nfos ekotok*)	16.4	64	17
Degraded secondary forest (*nfos afan*)	22.1	64	15

6.6 Willingness-to-accept (WTA)

To quantify the necessary financial incentives to allow smallholders to adopt the restricted cultivation contract, a WTA question was included in the survey. A single-bounded continuous bid sequence was applied for this

question, and was presented in a payment card format. This mechanism required significant pre-testing to find an appropriate range of bids, which was investigated during the focus group and initial field pre-test in Akok. Prior to entering the field, I created a bid continuum based on the findings in the Swallow et al. (2007) opportunity cost study that was conducted in the same region. This was modified several times based on advice from other researchers once arriving in Cameroon and validated through non-parametric results acquired during the focus group and pretesting. The final payment card mechanism employed bid levels ranging from 0 CFA/ha to 1 000 000 CFA/ha (2141 USD/ha) (Table 7). The lowest value, 0 CFA, implies that the smallholder would voluntarily participate in the contract without external compensation from the implementing agency. On the other end of the spectrum, I assume that 1 000 000 CFA (2141 USD) per hectare would be substantially higher than a feasible compensation level in carbon mitigation contracts, however it could be requested by individuals with high option value or that currently capture large returns on their existing land.

Two of the 169 surveys conducted had missing values, so were not included in the WTA estimate. Initial results from the survey showed that 94.0 percent of all respondents (141 out of 167) accepted the contract within the range of bids offered and that 6.0 percent of respondents (10 out of 167) refused to participate in the contract within the range of bids offered. 9.6 percent of respondents (16 out of 167) were actually willing to pay to participate in the contract (WTA < 0) (Table 7). This reverse-WTA (WTP) was captured through a binary discrete question that was asked to those smallholders that immediately answered "yes" to WTA at 0 – "would you be willing to pay to enter this contract?"

The proportion of acceptance responses at each bid level strictly increased as the bid value rose, suggesting an overall higher acceptance rate at higher bid

levels. This shows an acceptance rate of greater than 50 percent if compensation value was greater than or equal to 200 000 CFA/ha (428.26 USD/ha).

Table 7. WTA response rate by bid category.

Bid level (1000 CFA/ha)	Bid level (USD/ha)	Yes response	No response	Cumulative Acceptance rate (%)
< 0	< 0	16	151	9.6
0	0	24	143	14.4
50	107	44	123	26.3
100	214	61	106	36.5
150	321	68	99	40.7
200	428	89	78	53.3
250	535	99	68	59.3
300	642	112	55	67.1
350	749	113	54	67.7
400	857	122	45	73.1
450	964	128	39	76.6
500	1071	147	20	88
550	1178	150	17	89.8
600	1285	153	14	91.6
650	1392	153	14	91.6
700	1499	153	14	91.6
750	1606	153	14	91.6
800	1713	154	13	92.2
850	1820	154	13	92.2
900	1927	154	13	92.2
950	2034	154	13	92.2
1000	2141	157	10	94.0

6.6.1 Non-parametric results: Turnbull

The payment card elicited monotonicity, with 94% of the respondents stating 'yes' to the highest bid (1 000 000 CFA). The E(WTA) for all smallholders in this village is 226 047 CFA/ha (484 USD/ha), with a 95% confidence interval of 461 USD/ha to 516 USD/ha. The range of bids is from <0 CFA/ha (identified in the data set only as WTP) to >1 000 000 CFA/ha (Figure 10).

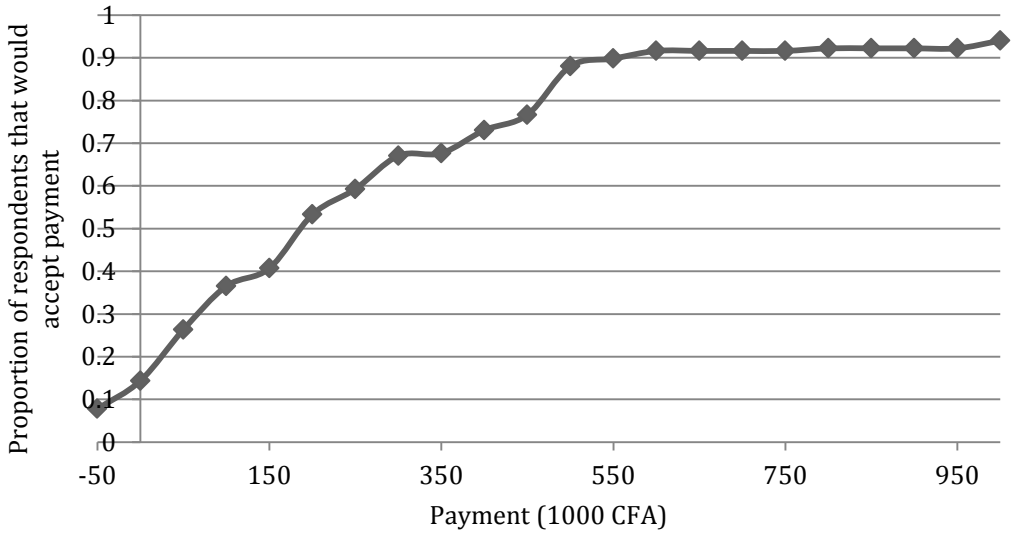

Figure 10. Turnbull upper bound non-parametric WTA results for smallholders accepting deforestation restriction contract in Akok, Cameroon.

6.6.2 Non-parametric results: Interval model

Alternatively, with the interval model, smallholders' mean WTA for contract compensation is 238 244 CFA/ha (510 USD/ha). The confidence interval is obtained by a simple bootstrap method derived by Tambour and Zethraeus (1998). The top and bottom 2.5% of WTA levels is cut off, resulting in a 95% CI of 232 287 CFA/ha to 244 200 CFA/ha (497 USD/ha to 523 USD/ha).

6.6.3 Parametric results: Binary logit model

The logit model assumes that smallholders respond to the WTA question based on the level of utility that each choice creates. Smallholders' utility is assumed to increase by stating "yes" for any given bid value. That is, accepting the contract at bid level X brings the smallholder greater utility (u) than the previous bid values or by not accepting the contract at all for those that were WTA for 0 CFA.

The logit model presented in chapter 4:

(eq. 11)

includes the independent variables expected to influence contract participation response. To infer whether there is explanatory efficiency gained by including dependent variables, I conduct a log-likelihood ratio test (see Liao, 1994). LIMDEP reports both of these values in the output for binary logit models, as well as the χ^2 value for the model. The unrestricted model, which includes demographic variables as independent variables, is compared to the restricted model which only includes the intercept. Using critical values of the χ^2 distribution table, I find the resulting χ^2 value of 1094.57 (with 9 *d.f.*) to correspond with a p-value of 0.000. Thus, the restricted model fits the data significantly better than the restricted model, and there is no evidence of a Type I error. The McFadden pseudo-R^2 for the general model is 26.8%, suggesting that the independent variables in this model explain 26.8% of the variation in the dependent variable, p(yes). However, the McFadden pseudo-R^2 severely underestimates the "true R^2" value of the model with the theoretical range [0,1] to vary from the typical output [0.20≤McFadden R^2≤0.40) (Langer, 2000). The McKelvey-Zavonia pseudo R^2 is a more effective measure, and can be estimated with maximum likelihood analysis through the Veall-Zimmerman correction of the Aldrich-

Nelson pseudo R^2 (Langer, 2000). Veall-Zimmerman correction results in a pseudo R^2 of 0.5485 indicating that the independent variables in the general model explain approximately 54.9% of the variation in the dependent variable. Table 8 presents the results of this model.

Table 8. Binary logit model of smallholders' willingness to accept for a hypothetical deforestation restriction contract, Akok Village, Cameroon, 2011.

Explanatory Variables	Estimated Coefficient	Standard Error	Wald χ^2	expβ (odds ratio)
OLD	-.00025	.00045	.3086	.9997
FALLOWC	-.00102	.00052	3.847	.9989
COCOA	-.00035	.00063	.3086	.9996
DEPEND	-.02216	.04411	.2524	.9780
FOODC	.00029	.00073	.1578	1.000
BID	.0000050292	.0000005391	87.03	1.000
SEX	-.45454	.34160	1.771	.6347
AGE	.00159	.00038	26.31	1.001
MARRIAGE	-.00032	.00031	1.065	1.000
constant	-.85692	.31361	3.502	-
	Log likelihood	-1496.350		
	χ2 (9 *d.f.*)	1094.512		
	McFadden Pseudo R^2	.2677		
	Aldrich-Nelson R^2	.5485		
	Observations (21*167)	n= 3507		
	Median WTA	170 389 CFA/ha (364.86 USD/ha)		

The total amount of old fallow land, OLD, is not a significant variable in this regression. Results from this model show that the only significant variable related to smallholder contract acceptance hypotheses is FALLOWC (p=0.000). Using the odds-ratio test, *ceteris paribus,* a one-hectare increase in the amount of young fallow that a smallholder has access to would decrease the odds of accepting the contract by 0.002%. This suggests that *ceteris*

paribus, a 10-hectare increase in the amount of young fallow available to a smallholder would decrease the odds that he/she would sign on to the contract by 0.2%. Total size of cocoa agroforests (COCOA), number of dependent children in the household (DEPEND) and size of food crops (FOODC) for smallholders were not significant in this model.

As expected, the BID variable has a positive coefficient, suggesting that as the contract payment offer increases, the likelihood of smallholders indicating 'yes' to the offer also increases. From this general model, the median WTA offer, regardless of the other independent variables in the model, is 170 389 CFA/ha (364 USD/ha). This compensation amount is the level that would cause smallholders to become indifferent between maintaining their current status quo without deforestation mitigation contracts and entering into the contract; that is, the level where pr(yes) = pr(no) = 0.5. When holding all other right hand side variables at their means, the WTA value becomes 183 166 CFA/ha (392 USD/ha).

In terms of demographic variables, the gender of the head of household (SEX) was not significant. Given that this model is representative of the entire population of Akok village, the impact of this effect is worth discussing. A male-headed household has an odds of 0.6347 of accepting the contract compared to a female-headed household which would have odds of 1 (ie. 0.3653) lower odds than a female-headed household.

AGE was statistically significant (p=0.000) and positively related to the independent variable, probability of accepting the contract. Again utilizing the odds-ratio test, a one-year increase in age suggests an increase in the probability of a respondent accepting the contract *ceteris paribus.* For a 10-year increase in a respondent's age, the odds of indicating 'yes' to the contract increases by 1.59%.

Marital status (MARRIAGE) was not statistically significant in this model.

6.7 Perceptions

Another integral component of this study is the investigation into household perceptions of factors that may lead to higher opportunity costs of avoided carbon emissions. In total, 8 questions were asked about tenure security, access to land, market responsiveness and access, and cash as investment. Descriptive analysis of the results can be found in Table 9.

Among each subset of themed statements (tenure security, access to land and cash as investment), correlation is expected to be positive and significant as each statement was originally designed to measure similar attitudes. Chi-squared goodness of fit tests were also conducted to infer if there is any statistically significant difference in demographic population subsets (based on gender and age). As all Chi-squared tests had (2x3) contingency tables, the critical value is the same throughout ($\chi 2$ crit = 5.991). There was no significant difference in Likert attitude outcomes for either age or gender with each set of themed statements. Results for both Kendall's tau-b and Chi-squared tests are presented within each section.

6.7.1 Tenure security

Two statements were devised to capture individuals' perceptions of tenure security. The first, "if I do not want someone else to be able to cultivate my fallows that are 10 years old and older, I will have to cultivate them" infers that smallholders whom agree with this statement are concerned about maintaining rights to their land. Slightly more smallholders agreed (50.6%) with this statement than disagreed (45.8%) (Table 9). The second tenure security statement, "it is important that other producers in Akok and other villages see that my land is being actively cultivated" attempts to capture the importance of active land usage. The traditional *Bulu* tenure system allows

for the right to use, thus demonstrating that if a particular parcel of land is not actively used there is a possibility that other potential users of the land would attempt to take it over. For clarity, the statement identifies Akok "and other villages" because of the variety of subvillages within the Akok region. The respondent breakdown shows more individuals agreeing with the statement than disagreeing, and fewer respondents choosing strongly disagree than disagree.

Correlation between the two tenure security statements is positive and significant at α=0.05, which indicates that both capture a somewhat similar attribute of the smallholders' perception and/or values (Kendall's tau-b is 0.405 (N=165, $p<0.05$)). Both the perceived need to cultivate young fallows in order to prevent another family/smallholder from using the land, and the importance of the village perception that smallholders' land is being actively cultivated are positively correlated.

6.7.2 Access to land

Two statements to capture the existing presence of the traditional tenure system were included in the survey. The first statement, "our household has full control over the land that we cultivate and our agroforestry plantations" investigates the confidence that each smallholder has in his/her right to currently cultivated lands. When cultivated, land parcels are said to be under full control of the household according to the traditional *Bulu* system. The Forestry Law of 1994 paints a different picture, with the government having technical ownership of most currently and previously forested land, with the exception of agroforestry (see Chapter 3). The overwhelming majority of smallholders agreed with this statement (83.9%) while 15.5% disagreed and 1.1% were unsure.

Table 9. Descriptive analysis of Likert-type statements, Akok Village, Cameroon, 2011.

Likert statement	*% of respondents, (number of respondents)*				
	Strongly agree	Agree	Unsure	Disagree	Strongly disagree
A) If I do not want someone else to be able to cultivate my fallows that are 10 years old and older, I will have to cultivate them.	28.0 (47)	22.6 (38)	3.6 (6)	28.6 (48)	17.3 (29)
B) It is important that other producers in Akok and other villages see that my land is being actively cultivated.	28.6 (48)	26.2 (44)	4.2 (7)	29.2 (49)	11.3 (19)
C) Our household has full control over the land that we cultivate and our agroforestry plantations.	56.0 (94)	28.0 (47)	1.2 (2)	7.1 (12)	8.3 (14)
D) Our household has full control over the primary forest that we have access to.	51.8 (87)	19.6 (33)	1.1 (2)	14.9 (25)	11.9 (20)
E) If I cannot produce enough food to feed everyone in my family, I can buy it at the market.	20.2 (34)	30.4 (51)	2.4 (4)	29.2 (49)	17.3 (29)
F) If the price of one of the crops that I cultivate goes up, I will clear more of my fallow that is 10 years or older.	54.2 (91)	28.0 (47)	1.8 (3)	8.9 (15)	7.1 (12)
G) If I receive additional revenue, I will invest in agroforestry.	60.1 (101)	31.0 (52)	3.6 (6)	1.8 (3)	4.2 (7)
H) If I receive additional revenue, I will invest in fertilizer.	31.6 (53)	33.3 (56)	13.7 (23)	3.0 (5)	19.1 (32)

Another component of the perception to land access is through forests. The statement "our household has full control over the primary forest that we have access to" also investigates the perception of *Bulu* traditional versus modern Forest Law of 1994 in the case of forests. Most smallholders also agreed with this statement (71.4%). Between statements D and E, Kendall's

tau-b is 0.590 (N=166, $p<0.05$), indicating that there is some similarities between these statements.

6.7.3 Market responsiveness and access

One Likert-type statement was included to explicitly ask smallholders whether the markets for food are accessible. The declaration, "if I cannot produce enough food to feed everyone in my family, I can buy it at the market" is designed to look into the tradeoff between cash and land. The small majority of smallholders agreed with this statement (50.6%). Another statement geared towards market responsiveness asked smallholders, "if the price of one of the crops that I cultivate goes up, I will clear more of my fallow that is 10 years or older." Over 80% of smallholders agreed.

6.7.4 Payments as investment capital

Smallholders were asked, "if I receive additional revenue, I will invest in agroforestry," and "if I receive additional revenue I will invest in fertilizer." Results of the first statement for investment in agroforestry show that more than 90% of smallholders within the village are willing to invest in agroforestry (60.0% strongly agree and 30.8% agree).

Smallholders tended to be less sure of their responses for potential investment in fertilizer. Again, the majority is willing to invest (31.5% strongly agreed and 33.0% agreed); yet a large proportion is adverse to fertilizer investment. A total of 23 respondents (13.7%) were unsure of what they may do in this situation.

Between the two cash investment statements, Kendall's tau-b is 0.196 (N=168, $p<0.05$), indicating that there is less correlation between these variables that the other pairs of statements.

6.7.5 Parametric results with perceptions

Each of the Likert-type questions was summed into two corresponding Likert-scale values, tenure security (TENSEC) and options for land (OPTION). I attempted to validate these scales through first running inter-item correlation matrices in SPSS and then applying Cronbach's Alpha to assess the reliability of each of the constructed Likert scales (Gliem and Gliem, 2003). For TENSEC, I found few variables that were positively correlated within the scale. The reported Cronbach's Alpha (0.326) is a poor level of internal consistency between the four statements included in the survey, as this value is much less than the required 0.8 or greater. For OPTION, I found the highest correlation between any of the two variables being 0.324, and a low Cronbach's Alpha (0.354). Statistical efficiency is not possible in using either of these created scales in a regression, thus the cohesive Likert scale variables were not used.

Through several permutations of regression analysis, I chose to still introduce some of the Likert-type statement variables. Some further explanation can be gained through simply considering the *directional* relationships between dependent variables and smallholders' perceptions, thus the results of this analysis are found in Table 10.

This regression includes 4 of the statements that align with each hypothesis:

1. "*If I do not want someone else to be able to cultivate my fallows that are 10 years old and older, I will have to cultivate them*" (CULT). This statement suggests perceptions of risk to tenure security, whereby agreeing 'more' is hypothesized to increase the probability of agreeing to a contract (positive relationship), aligning with the risk perception hypothesis.
2. "*If I cannot produce enough food to feed everyone in my family, I can buy it at the market*" (FOOD). This statement is captured in the

dependent hypothesis. Smallholders that agree more are inferred to be less apt to agree to the contract.

3. "*If the price of one of the crops that I cultivate goes up, I will clear more of my fallow that is 10 years or older*" (PRICE). Smallholders that are sensitive to the market are likely to agree more with this statement, which is hypothesized to have a negative relationship with the likelihood of accepting the contract. This consideration is captured in the production hypothesis.
4. "*If I receive additional revenue, I will invest in agroforestry*" (AGRO). This statement is consistent with the hypotheses of cash as a substitute or complement to land. If smallholders agree that cash is a complement for land and additional funds would be utilized to invest in agroforestry, the likelihood of agreeing to the contract increases. However there is also the possibility that cash is perceived as a substitute to land, thus leading to less acceptance of the contract.

Table 10. Binary logit model of smallholders' willingness to accept for a hypothetical deforestation restriction contract including Likert-type variables, Akok Village, Cameroon, 2011.

Explanatory Variables	Estimated Coefficient	Standard Error	Wald χ^2	expβ
OLD	-.00025	.00046	.3086	.9997
FALLOWC	-.00100	.00052	3.698	.9990
COCOA	-.00034	.00064	.2822	.9996
DEPEND	-.01368	.04407	.0963	.9864
FOODC	.00028	.00074	.1431	1.000
BID	.0000050797	.0000005464	86.42	1.000
SEX	-.36618	.34160	1.149	.6933
AGE	.00148	.00038	15.16	1.001
MARRIAGE	-.00020	.00031	.4162	1.000
CULT	.00106	.00024	19.50	-
FOOD	-.00325	.00073	19.82	-
PRICE	-.00152	.00034	19.98	-
AGRO	.09343	.13574	.4737	-
constant	-1.1186	.43354	6.657	-
Log likelihood		-1479.06		
χ2 (9 *d.f.*)		1129.07		
McFadden Pseudo R^2		.2762		
Observations (21*167)		n= 3507		
Median WTA		222416 CFA/ha (467.27 USD/ha)		

In this model, OLD is not statistically significant, just as in the previous model. FALLOWC is statistically significant (p=0.000). Using the odds-ratio test, a one-hectare increase in the amount of young fallow that a smallholder has access to would decrease the probability of accepting the contract by 0.1%. This suggests that *ceteris paribus*, a 10-hectare increase in the amount of young fallow available to a smallholder would decrease the likelihood that he/she would sign on to the contract by 1%. Total size of cocoa agroforests (COCOA), number of dependent children in the household (DEPEND) and size

of food crops (FOODC) for smallholders were also not significant in this model.

As in the previous model the BID variable has a positive coefficient, suggesting that as the contract payment offer increases, the likelihood of smallholders indicating 'yes' to the offer also increases. However, the constant and BID values fluctuate enough in this model to reassign the WTA estimate to 222 416 CFA/ha (increase of 52 027 CFA/ha or 111 USD/ha). More discussion on this discrepancy is included in the discussion.

In terms of demographic variables, the gender of the head of household (SEX) was not significant, yet did have a substantial magnitude. AGE was again statistically significant (p=0.000) and positively related to the independent variable, the probability of accepting the contract. Using the odds-ratio test, a one-year increase in age suggests an increase in the probability of a respondent accepting the contract *ceteris paribus.* For a 10-year increase in a respondent's age, the probability of indicating 'yes' to the contract increases by 1.48%.

The Likert variables are interpreted more broadly in this context as they are ordinal and therefore do not have consistent magnitudes between categories. CULT is positive and significant (p=0.000), thus suggesting that the more a smallholder agrees with the statement, the greater likelihood of accepting the contract. FOOD is negative and significant (p=0.000). This indicates an inverse relationship with the dependent variable, probability of accepting the contract. PRICE is negative in this context and is also highly significant (p=0.000), suggesting that the more the smallholder agrees with the statement, the less likely they are to accept the contract.

Chapter 7 Discussion

7.1 Introduction

The previous six chapters have identified the background, methods and results of investigating smallholders' WTA compensation for a REDD-like carbon mitigation project within Akok village, a community along the northern edge of the Congo Basin rainforest. I utilize this chapter to complete the circle, returning to the research questions and objectives presented in chapter 1.

This final chapter discusses the hypothetical REDD contract and resulting WTA findings for avoided deforestation in Akok village. Next is a discussion on the hypotheses and household perceptions, and how these may influence the desired compensation levels. I then discuss carbon emission abatement supply estimates within the context of other studies. Chapter 7 concludes with research constraints and considerations for policymakers based on the findings of this study.

7.2 Hypothetical REDD scenario results

A substantial finding throughout the course of this study was that there was a general outcry for help in agricultural intensification. Candid conversations during the focus group and over the course of survey data collection led to a deduction that smallholders do not actively utilize modern agricultural techniques. Rather, they rely exclusively on shifting cultivation, supplemented by infrequent trips to the market to supply food for their households. The community members do not perceive themselves to be in the position to accept a contract given their current levels of agricultural intensity without active development of production intensification options. Because the contract was made conditional on this solution, the hypothetical contract introduced a contingency plan for smallholders beyond the original

intent of the REDD contract. When asked during the survey if smallholders would invest in fertilizer, a few disagreed (19%) and were unsure (13%). This suggests a gap between the current status of input availability, access and experience, and perceived needs that may influence the acceptance of a future land use contract. Important to consider is how this additional support of intensification may impact deforestation elsewhere, and the resulting impacts on forest clearance throughout the region.

Also, the funding agency/community would need to decide on an appropriate way to distribute the payments. This research stipulates that a household-based payment would be distributed yet discussion with the community gave insight into the complexities of land use rights in this region. Tenure is a fundamental consideration, and as such is discussed later on in this chapter.

7.3 WTA estimates

Results from this survey indicate that the large majority of households (94%) in Akok would be willing to participate in a REDD-type contract that restricts their access to fallow lands for a 10-year period. This study suggests a range of median WTA, depending upon the method: 170 289 CFA/ha (364 USD/ha) estimated by the parametric binary logit model, 226 047 CFA/ha (484/ha) using the Turnbull upper bound method, and 238 244 CFA/ha (510 USD/ha) with the Kriström (1990) interval method.

Evidently, estimates of WTA depend on the method utilized. The Turnbull 95% confidence interval is 461.71 USD/ha to 516.85 USD/ha which is similar to the 95% CI found with the Kriström model, 497.40 USD/ha to 522.91 USD/ha. The parametric WTA estimate (364.86 USD/ha) is both outside and below the confidence interval for both the Turnbull and the Kriström models. The regression assumes an underlying normal (logistic) population distribution, while the non-parametric tools do not include additional

assumptions about the greater population. Further, as the regression is designed to estimate the probability of accepting the contract (P(yes)), the three models measure two different concepts.

7.3.1 WTA: Results based on hypothetical contract

From the Turnbull nonparametric estimate, there appears to be three general groups of smallholders (Figure 10). The majority, 60%, are somewhere in the middle of the payment card, accepting between 50 000 CFA/ha (108 USD/ha) and 400 000 CFA/ha (856 USD/ha) to agree to tree conservation and the associated land restrictions. The other two groups frame this majority with interesting implications. 16% of the farmers would enter into the contract for nothing – and some smallholders were even willing to pay to be included in the contract (9.6% of smallholders). Another 25% were seeking seemingly high amounts (over 400 000 CFA/ha or 856 USD/ha).

The WTA disparity may be attributed to the information that was conveyed during the focus group – a need for assistance to increase productivity. One possible explanation for the subset of the villagers that were willing to either participate for free or even pay to accept the contract was the inclusion of productivity incentives stipulated in the hypothetical contract. The contract included specifics identified as innately important during the focus group that became integral to community acceptance of the proposed hypothetical scenario. These stipulations included fertilizer access and assistance. Villagers wanted, and would require continual assistance from agricultural organizations to increase the productivity of the younger-fallow land, as this is currently a barrier to increasing and/or maintaining yields given forest maintenance. The additional benefit stream of assistance is a value-added component of the hypothetical contract, and could reframe REDD in Akok as a capacity building social development mechanism as well.

Tenure security was also implied in the hypothetical contract. By including

the clause whereby the smallholders continue to retain household access of older fallows for 10 years, the contract would override *Bulu* traditional tenure system along with the stipulations of the Forest Law. Households were thus asked to base their decision-making off of a contrived reality. Important to reiterate is that for optimum MRV in the context of REDD, land tenure requires definition. The implied tenure security that was created through the contract preamble may create the necessary environment for REDD within Akok village.

The group that were generally less willing to accept the contract was further subdivided into 6% that were unwilling to sign for any of the proposed values (up to 1 000 000 CFA/ha or 2141 USD/ha) and another 21% that would accept amounts greater that 400 000 CFA/ha (856 USD/ha), which was nearly double the mean WTA level. Although my initial thought was that the access to cocoa, and resulting revolving income was a factor, the binary logit model suggests otherwise (see section 7.4.2).

7.3.2 WTA: Supply curve of contract land

The distribution of WTA estimates was used to develop a supply curve for contract land for the proposed hypothetical REDD-like contract at each of the proposed prices (Figure 11). The cumulative supply of contract land available within the village (all fallows greater than 10 years old) is shown for each payment level based on the lowest acceptable bid for each heterogeneous smallholder. The total amount of land available for contract acceptance is 2085.75 ha using this methodology. This supply curve is based on 123 respondents' land holdings of the possible 169, due to missing data.

7.3.3 WTA: Implications for policy

As discussed in the previous section, I show that the CV approach leads to a diverse range of acceptance for tree conservation, with the sample being split into roughly three groups: a selection of individuals willing to participate for

no compensation, the majority of the sample willing to participate given some compensation, and a portion of the population not willing to participate in the program for any of the proposed levels of compensation. The resulting graphical representation suggests a clear population subset that is willing to enter the proposed deforestation mitigation contract for a relatively low payment. Policy makers would be able to capture nearly half (1007 ha) of the available carbon-rich forest accessible by farmers in this community for 200 000 CFA/ha (428 USD/ha), less than the mean payment level.

It is important to recognize as well that there are people within this village that would not be willing to accept a contract up to 1 000 000 CFA/ha (2141 USD/ha). This is nearly five times the mean compensation level. In fact, a payment of 500 000 CFA/ha (1070 USD/ha) would mitigate another 783.5 ha, and offering payments upwards of 500 000 CFA/ha would only potentially capture another 294.5 ha. Comprehensive community-wide gains for abated emissions may not be financially viable, given such varying levels of compensation acceptance. This suggests that a diverse approach to capture as many smallholders as possible into the existing REDD contract terms will likely not lead to the best result in terms of hectares of forestland maintained.

My results also suggest that while the contract payment has a cost, there are other inputs into implementing REDD-like schemes within this region that may increase the cost. Funding capacity-building projects to encourage intensification of younger fallows appears to be a fundamental component of agreeable REDD projects here, thus there is an opportunity to compound (or 'stack') funding from other possible ES or pro-poor programs, for example, to make a contract financially viable.

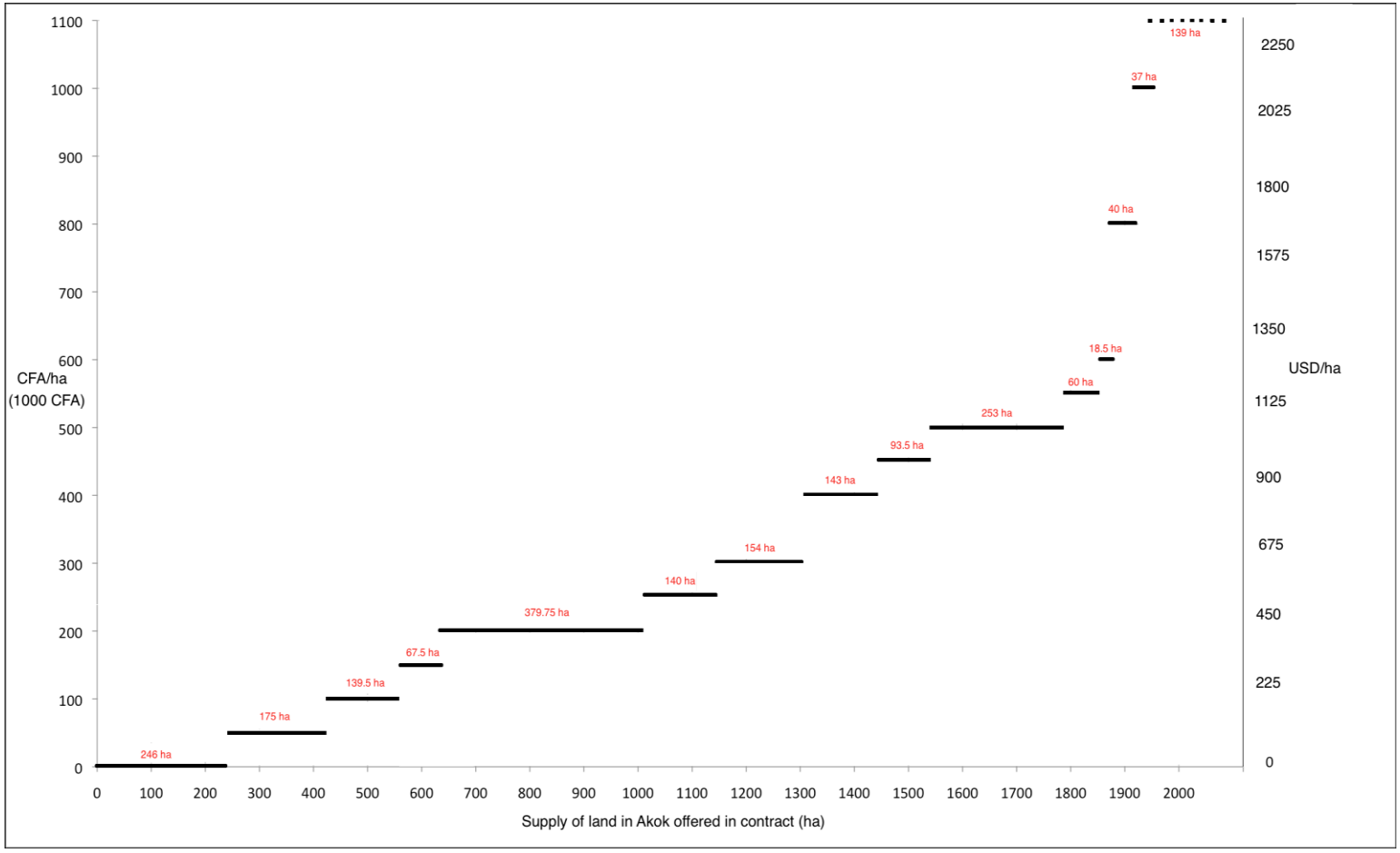

Figure 11. Supply curve of land offered into REDD contracts based on smallholder land holdings and the proposed REDD-like contract in Akok village, Cameroon (n=123).

7.4 Comparison to hypotheses

The hypotheses for the regression model and the corresponding Likert-type perception questions are discussed in the following sections.

7.4.1 Availability of fallow land

Smallholders that have more OLD land in their profile were suggested to be less likely to accept the proposed contract, in turn requiring a higher payment to enter into the contract due to perception of risk aversion. However I did not find a significant result in the model to indicate that this is the case. The majority of the mean smallholder's land profile is fallow that is older than 10 years old (Figure 9). There is a possibility that smallholders with more potentially accessible land – more OLD, in this case – are not as concerned about the amount of OLD fallow available but instead defer focus to the payment bid level itself. The older the land type, the less certainty smallholders had in their assessment of the amount available to their household. For instance, many smallholders used multiples of 10 to propose how much forestland was available. Given the substantial proportion of very old fallow and secondary forests in the average profile along with the associated uncertainty about exactly how much land really is available (in hectares), smallholders may not have been able to confidently use the knowledge of their potentially accessible land to make a decision on the contract.

On the other hand, smallholders with a larger amount of young fallow were hypothesized to have a higher probability of accepting the REDD-like contract due to the amount of land readily accessible for cultivation. The result from the binary logit model does not support this hypothesis, indicating that an increase in the amount of *nyengue* and *ekotok* available to smallholders will marginally reduce their probability of accepting the contract. Rather than the uncertainty associated with estimating land access

in the case of older fallow, smallholders appear to have certainty in the amount of fallow that would remain available to them over the short-term. Instead, the shifting cultivation evidence suggests that smallholders actually do not utilize young fallows to create food crops in great numbers (approximately 9%) – focusing much more of their initial transitions to *afub owondo* from *ekotok* (63%) and *nfos ekotok* (14%) (Table 5). Fallow land that is nearly old enough to become 'contracted' may be more of a concern for smallholders than the proportion of older, less utilized fallows that are not used as frequently for food crops. There is a tendency to create new crops, twice yearly, from *ekotok* that makes this a higher-valued fallow in terms of subsistence.

7.4.2 Cocoa and contract cash as investment

The amount of cocoa that a smallholder holds in his/her land profile was built on two separate hypotheses. The first, identifying cocoa and contract cash as complements, suggests that the compensation gained through the contract could act as investment for initial or continuing cocoa development, was not upheld in the parametric model. Alternatively, smallholders already cultivating more cocoa crops were hypothesized to be less apt to accept the contract. This proposition held, although the finding was not statistically significant.

However, smallholders in the village are keen on investing in cocoa, given the opportunity. The overwhelming majority agreed that investment in agroforestry would occur if they were to receive additional revenue in Likert statements, which contradicts the (albeit insignificant) result from the model. The perception of the contract as an additional revenue stream may have opposed the constraints put forth through restricting high forest, secondary forest and very old fallow land use, as 47% of cocoa had been developed from these land types (Table 5). Without access to these older land types,

smallholders may not have the opportunity to create income-generating cocoa crops despite having more investment capital to work with.

7.4.3 Demographic influence

Another hypothesis that I considered was the proposed inverse relationship between the number of dependent children (DEPEND) in the household and the probability of accepting the contract. This directional hypothesis held – however the independent variable was not statistically significant in the model.

I also asked a similar perception statement to identify smallholders' perceptions on food security. The statement did not produce a determinate result, with about half of the respondents agreeing and half disagreeing. I surmise that perhaps the format of the declaration caused respondents to 'hang on' to one or both individual concepts – "if I cannot produce enough food to feed everyone in my family" and "I can buy it at the market." The structure may have contributed to the lack of clarity of result in this statement.

7.4.4 Market responsiveness and production

From the logit model, I had theorized that there would be an inverse relationship between the 'dedication' of food production (identified as FOODC) and the probability of contract acceptance. The relationship was neither inverse nor statistically significant. In terms of perception questions, the results suggest that the smallholders are price responsive and will potentially modify their farming behaviour to fit the activity of nearby markets.

7.4.5 Tenure security perceptions

Many of the perception statements were designed to identify how smallholders viewed tenure, especially in light of the *Bulu* traditional system

and Forestry Law of 1994 challenges. Smallholders tended to gravitate towards maintenance of the traditional system, in which forested land still holds family or community use rights. This finding indicates that a predecessor to effective REDD PES projects is a reformed, or at least clarified, tenure system within the HFB zone in Cameroon.

7.5 Compensation estimate for abated carbon in Akok

Based on the non-parametric Turnbull WTA results, each smallholder's land profile, and the carbon stock estimates provided by ASB (Sonwa, 2004), I find that the average compensation required for smallholders to enter a hypothetical REDD contract is equivalent to 34.92 USD/t CO_2 equivalent (Table 11). The payment required ranges from 1.58 USD/t CO_2 equivalent up to 556.36 USD/t CO_2 equivalent.

Additionally, I used each heterogeneous smallholders' land profile and Turnbull WTA response to estimate a community-level carbon abatement supply curve (Figure 12). This estimate takes into account the entire land profile, including all fallow land and currently cultivated lands.

Table 11. Opportunity cost for carbon reduction through REDD-like contract in Akok village, Cameroon (n=123).

Land types included	Minimum ($/tCO^2 eq)	Maximum ($/tCO^2 eq)	Mean ($/tCO^2 eq)
Only presently cultivated land	0.76	481.00	15.50
Fallow land (including *nfos afan*)	0.68	481.00	19.42
All accessible land	1.58	556.36	34.92

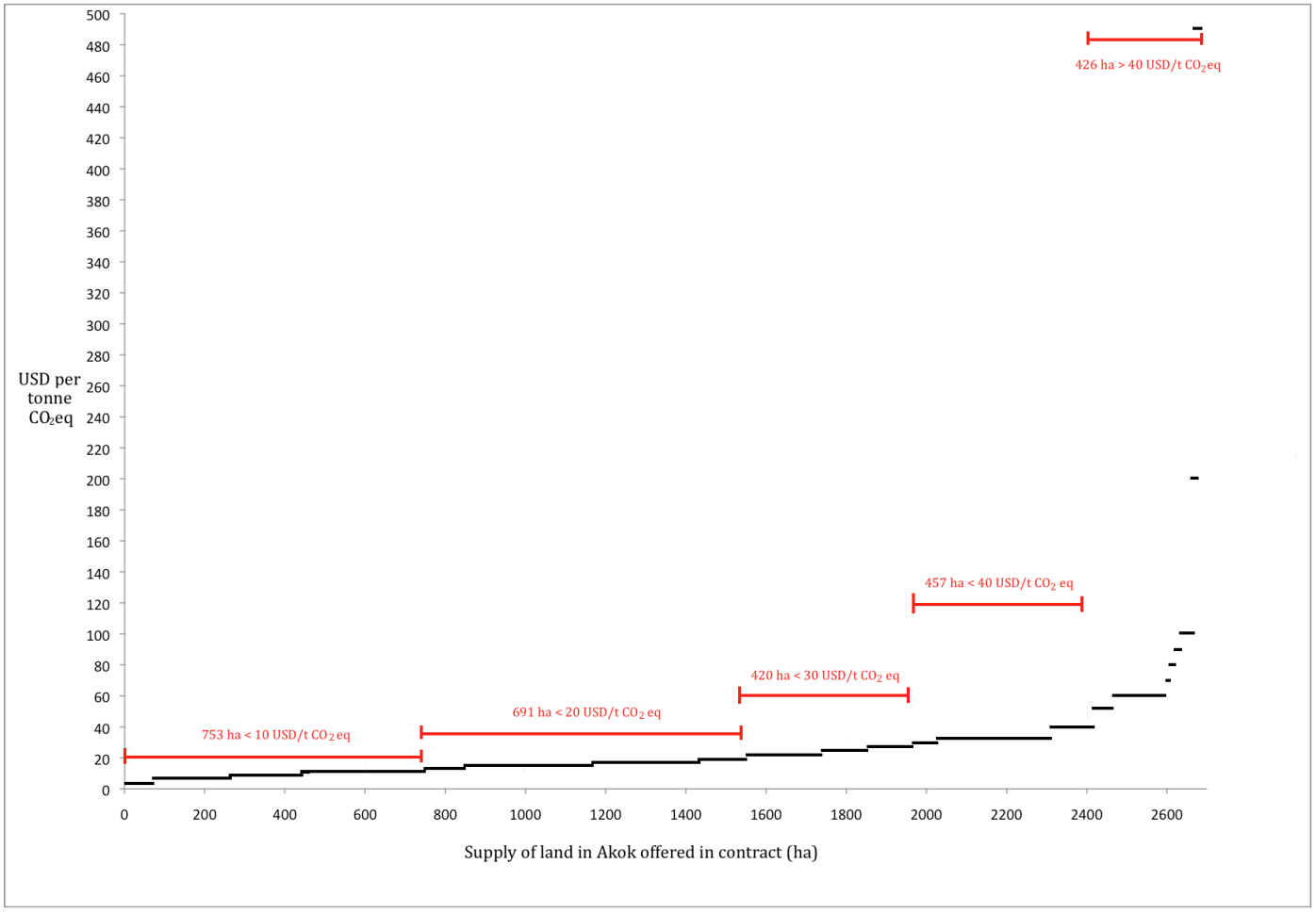

Figure 12. Greenhouse gas abatement cost curve of land offered into REDD contracts based on smallholder land holdings and the proposed REDD-like contract in Akok village, Cameroon (n=123).

The average opportunity cost for all land area that the smallholder has access to translates into approximately 34.92 USD/tCO_2 equivalent. This value is substantially higher than the opportunity costs estimated throughout the literature, from 0.58 USD/tCO_2 in traditional agricultural systems (Boucher, 2008) to 8 USD/tCO_2 (Swallow et al., 2007). The relatively high value of opportunity cost derived through the CV stated preference method is consistent with the general hypothesis throughout this study that smallholders consider much more than the forgone production when considering REDD contract acceptance.

Within the village, there is also substantial variation between each smallholder. A community payment equating to 10 USD/tCO_2 eq would capture 27% of the carbon benefits, and increasing the payment to 20 USD/tCO_2 eq would lead to over half of the possible carbon emission abatement possibilities with this contract.

This calculation suggests that heterogeneous smallholder sample estimates are higher than other constructed estimates, by a considerable factor. Boucher (2008) found at average of 2.51 USD/t CO_2 equivalent throughout several regions. Swallow et al. (2007) found that with a social discount rate of 0.001 the opportunity cost of each ton of carbon emitted was 28 USD per ton. The alternative discount rate of 0.15 suggests that the opportunity cost is approximately 11 USD per ton. When the opportunity cost derived from this study is extrapolated to the 10-year period that the contract would be binding, a social discount rate reduces the cost. For a social discount rate of 0.15, the NPV of the opportunity cost becomes 17.52 USD/tCO_2 eq; using a social discount rate of 0.001, NPV of the opportunity cost is 34.72 USD/tCO_2 eq. A higher social discount rate suggests a lower present value of future costs and benefits of a program (Harrison, 2010).

7.6 Conclusions and policy considerations

Smallholders in Akok are indeed interested in entering tree conservation REDD-like contracts conditional on several provisions. Payment has to be sufficient – and the internal opportunity costs to smallholders might be significantly higher than previous estimates suggest. Farmers are searching for a tradeoff; they are willing to tie up the more fertile land in exchange for help to enhance the fertility of their younger fallows. A more harmonious platform for The Forestry Law of 1994 and indigenous *Bulu* tenure system could be created prior to efficient household-level PES regimes being put in place. Smallholders recognize their lack of power in terms of use rights, however are dependant on the forests for their livelihood. Thus, strategies that provide both capacity building and compensation mechanisms would be suitable for Akok village.

Coming together with a common notion or idea of what REDD project entails requires local, national and developer/funder collaboration. Potential REDD funders can utilize the UNFCCC (2011) REDD+ framework and IPCC (2013) climate change recommendations to target particular areas, however implementation of projects becomes a much more complex endeavor when PES becomes involved. ES valuation methods (such as CV or NPV approaches) can be used to determine how much the ES provided by a region is worth in order to create a framework. However, it is important that smallholders living in forested ecosystems targeted for REDD projects, like Cameroon are heard. Taking a bottom-up collaborative approach to REDD is an alternative method to creating feasible programs. This allows project implementers to gain a sense of the importance of other co-benefits that could/should be created in order to have local acceptance of any new project. Also important to consider is the perceived value of the contract and the value-added aspects of the contract that are essential for the local populations to be fully engaged. Opportunity costs to the smallholder are

based on previous knowledge, food security, availability of other land, and the perception of what the contract *might* bring to the community – in the case of Akok village, it may be capacity building and potentially tenure security.

7.7 Limitations and constraints

This study has several constraints that are listed below. This is not an exhaustive list, yet it does provide insight into the context of this research.

1. Agreeableness of respondents – Smallholders may have agreed with my hypotheses without protest because of the sheer presence of researchers in the area. This sense of 'agreeableness' can impact how the survey is perceived, as well as what can be accomplished in the community moving forward. It was very important that our presence did not impact any future research in the region.
2. Missing variables – Although I conducted an extensive literature review, included each aspect from specific challenges founded through the focus group discussion, and had several conversations with current and former researchers in the area, it is unlikely that all factors that influence household's behaviour are captured in this study.
3. Using WTA to estimate a CO_2 equivalent supply curve – I relied on WTA to derive the emission reduction supply curve rather than utilizing real options approaches. However with this method, I am able to gain more direct insights onto the impact of perceptions on valuation of the project.
4. Simple contract for fallows – A shortcoming of the stated contract is the emissions created through ongoing clearing of young fallows are

not taken into account. This may impact the aggregate emission reduction to be slightly lower than originally estimated.

5. Carbon stock estimate – The derived opportunity costs of avoided carbon are crude because the applied carbon values only include above ground estimates. Forested areas have below-ground biomass that acts as a terrestrial carbon sink, as well as dead organic matter (known as necromass) that contains about 10% of the above-ground carbon stock (White and Minang, 2011). However, it is generally assumed that REDD programs will only focus on above-ground carbon.
6. Varied knowledge base – Rudimentary estimates for opportunity costs in the region are also due to smallholders' perceptions of their land area. Without a clear deed or title to the land, smallholders make estimates on the size of land that they cultivate and have access to. These estimates may vary from very accurate to extremely inaccurate depending on the knowledge base of each head of household.

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Appendix

Survey

ENQUÊTE SUR LES USAGES DE LA TERRE, LES PERCEPTIONS, ET L'ADOPTION DES PROGRAMMES DE CONSERVATION DES ARBRES PAR LES PAYSANS DU VILLAGE AKOK (CAMEROUN).

FÉVRIER/MARS 2011

PARTIE 1 : INFORMATION GÉNÉRALE ET FORMULAIRE DE CONSENTEMENT.

P1Q1	Date de l'enquête :	
P1Q2	Nom de l'enquêteur :	
P1Q3	Village :	

Explique le « Formulaire de Consentement ». Obtenir la signature du chef de ménage.

Définition de l'unité d'observation (Le ménage): un ménage est constitué par un homme et/ou une femme marié(e) ou veuf (ve) + les enfants non mariée, et d'autres personnes de la famille économiquement dépendante, vivant dans un même habitat (maison + cuisines des femmes)

PARTIE 2 : IDENTIFICATION DU CHEF DE MENAGE

		Partie réservée. Ne pas remplir.
P2Q1	**Nom/Prénom du Chef de Ménage :**	
P2Q2	**Sexe :** 1= ( ) Masculin ; 0 = ( ) Féminin	

P2Q3	**Age :**	
P2Q4	**Statut matrimonial** : 1= ( ) Marié*; 2= ( ) Célibataire ; 3= ( ) Veuf (ve) **Mariage = une vie conjugale qui est assurée soit par la dot, soit par un acte de mariage ou encore un durée de plusieurs années*	
P2Q5	**Niveau d'instruction générale** : 1= ( ) pas été à l'école ; 2= ( ) école primaire ; 3= ( ) secondaire ; 4= ( ) enseignement supérieur	
P2Q6	**Famille (**Nda bot**):**	
P2Q7	**Est-ce que vous appartenez à un Groupe d'Initiative Commune (GIC/Association/GIE/Coopérative) ?** 1= ( ) OUI ; 0= ( ) NON	
P2Q7a	**Si Oui**, **lequel** :	
P2Q7b	**Si Oui, depuis combien de temps faites-vous partie de ce groupe ?** ( ) Ans	
P2Q7c	**Si Non, avez-vous l'intention de rejoindre un Groupe d'Initiative Commune (GIC/GIE/Association/Coopérative) ?** 1= ( ) OUI ; 0= ( ) NON	

PARTIE 3 : CARACTÉRISATION DU MÉNAGE

P3: Quelle est la composition de votre ménage (l'enquêté inclus) ?

Enfants mineurs (0 - 14ans)	**Enfants majeurs (15 - 20ans)**	**Adultes (21 - 60ans)**	**Vieillards > 60ans**	***Nombre Total***
P3Q1	*P3Q2*	*P3Q3*	*P3Q4*	*P3Q5*

P3Q6	**Le nombre de personnes dans votre ménage a-t- il augmenté ou diminué depuis l'an 2001 (dix ans passée)** ? 1=( ) augmenté ; 2=( ) diminué, 3=( ) pas de change	

P3Q6a	**Expliquez votre réponse** : 1=( ) naissances ; 2=( ) mortalité ; 3=( ) exode rural, 4=( ) enfants parti en ville pour études (combien? _____) 5=( ) autres (préciser : _____)	

PARTIE 4 : ACCÈS A LA RESSOURCE TERRE

	Classification des jachères	**A quel âge considérez-vous ?** *(de quels ans à quels ans)*	**Combien de ce type avez-vous?**	**Quel est la superficie totale de ce type de jachère ?** **(Hectares)**	**Est-ce que les jachères appartiennent exclusivement au ménage ?**	***SI NON*, est-ce qu'il vous faut l'accord de quelqu'un pour les cultiver ?**
P4Q1	jeunes jachères (*nyengue)*	*P4Q1a*	*P4Q1b*	*P4Q1c*	*P4Q1d* 1=( ) OUI 0=( ) NON	*P4Q1e* 1=( ) OUI 0=( ) NON
P4Q2	vieilles jachères *(ekotok)*	*P4Q2a*	*P4Q2b*	*P4Q2c*	*P4Q2d* 1=( ) OUI 0=( ) NON	*P4Q2e* 1=( ) OUI 0=( ) NON
P4Q3	très vieilles jachères *(nfos ekotok)*	*P4Q3a*	*P4Q3b*	*P4Q3c*	*P4Q3d* 1=( ) OUI 0=( ) NON	*P4Q3e* 1=( ) OUI 0=( ) NON
P4Q4	forêt secondaire dégradée *(nfos afan)*	*P4Q4a*	*P4Q4b*	*P4Q4c*	*P4Q4d* 1=( ) OUI 0=( ) NON	*P4Q4e* 1=( ) OUI 0=( ) NON

PARTIE 5 : CARACTÉRISATION DES ACTIVITÉS AGRICOLES

P5a. Combien de champs avez-vous et de quels types sont-ils?

	Type de champ	**Est-ce que vous faites un nouveau champ de ce type chaque année ?** **Combien ?**	**Nombre total de ce type de champ**	**Quel est la superficie totale de ce type de ce type de champ ?** **(Hectares)**	**Formation végétale d'origine** *1= nyengue* *2= ekotok* *3= nfos ekotok* *4= nfos afan* *5= forêt primaire* *6= esëp* *7= autres (indiquer_____)*	**Cultures dans chaque champ**
P5Q 1	1. Champ de forêt (*esëp*)	*P5Q1a, P5Q1b* 1=( ) OUI Combien : _____ 0=( ) NON Préciser : _____	*P5Q1c*	*P5Q1d*	*P5Q1e*	*P5Qf*
P5Q 2	2. Champ mixte vivrier (*afub owondo*)	*P5Q2a, P5Q2b* 1=( ) OUI Combien : _____ 0=( ) NON Préciser : _____	*P5Q2c*	*P5Q2d*	*P5Q2e*	*P5Q2f*
P5Q 3	3. Champ de marécage (*asan*)	*P5Q3a, P5Q3b* 1=( ) OUI Combien :	*P5Q3c*	*P5Q3d*	*P5Q3e*	*P5Q3f*

		_____ 0=( ) NON Préciser : _____				
P5Q5	4. Cacaoyère	*P5Q1a, P5Q1b* 1=( ) OUI Combien : _____ 0=( ) NON Préciser : _____	*P5Q1c*	*P5Q1d*	*P5Q1e*	*P5Qf*
P5Q7	5. (Autres)	*P5Q1a, P5Q1b* 1=( ) OUI Combien : _____ 0=( ) NON Préciser : _____	*P5Q1c*	*P5Q1d*	*P5Q1e*	*P5Qf*

PARTIE 6 : ANALYSE DES PERCEPTIONS ET ATTITUDES

Il ya beaucoup de choses qui deviennent importante lorsque vous prenez des décisions au sujet de votre travail agricole et la forêt. Maintenant, je voudrais poser quelques questions sur vos opinions.

Pouvez-vous s'il vous plaît me dire si, en général, vous êtes en accord avec les énoncés suivants.

1= Tout à fait d'accord ; 2= D'accord ; 3= En désaccord ; 4= Fortement en désaccord ; 5= Pas sur

P6Q1	Si je ne veux pas que quelqu'un d'autre puisse cultiver ma *jachère* de 10 ans ou plus, je vais devoir la cultiver. ( )	
P6Q2	Il est important que les autres producteurs d'Akok et des villages voisins puissent voir que mes champs sont en train d'être activement cultivés. ( )	
P6Q3	Notre ménage a le contrôle total sur tous les champs qu'on cultive et les plantations de cultures pérennes. ( )	
P6Q4	Notre ménage a le contrôle total sur les forêts primaire (*mbiam*) auxquelles nous avons l'accès. ( )	
P6Q5	Si je ne peux pas produire assez de nourriture pour subvenir aux besoins de ma famille, je peux l'acheter au marché. ( )	
P6Q6	Si le prix de vente d'une des cultures que je cultive augmente, je défricherai plus ma *jachère* qui a 10 ans ou plus. ( )	
P6Q7	Si je reçois un revenu supplémentaire, j'investirai davantage dans la culture des arbres dans mes champs (*agroforesterie*). ( )	
P6Q8	Si je reçois un revenu supplémentaire, j'investirai dans l'achat d'engrais pour utiliser dans mes champs. ( )	

Dans chaque communauté ou lieu de travail, certaines personnes ont confiance les uns aux autres tandis que d'autres n'ont pas. Maintenant, je vais vous parler de la confiance que vous avez envers les autres producteurs, le gouvernement, et les ONG qui travaillent dans votre localité.

Pouvez-vous s'il vous plaît me dire si en générale vous êtes en accord avec les énoncés suivants.

1= Tout à fait d'accord ; 2= D'accord ; 3= En désaccord ; 4= Fortement en désaccord ; 5= Pas sur

P6Q9	Je pense que je peux faire confiance à la plupart des habitants de ce village. ( )	
P6Q10	Je pense que je peux faire confiance aux gens qui font partie du même GIC que moi. ( )	
P6Q11	Je crois que je peux avoir confiance au gouvernement Camerounais. ( )	
P6Q12	Je crois que je peux avoir confiance aux agents du ministère des forêts et de la faune. ( )	
P6Q13	Je crois que je peux avoir confiance aux agents du ministère de l'environnement et de la protection de la nature. ( )	
P6Q14	Je crois que je peux avoir confiance à la plupart des gouvernements des pays étrangers. ( )	
P6Q15	Je crois que je peux faire confiance à la plupart des ONG internationales qui travaillent dans votre localité (exemple : WWF, Oxfam, Greenpeace) ( )	
P6Q16	Je crois que je peux faire confiance à la plupart des entreprises privées qui travaillent dans votre localité. ( )	

PARTIE 7 : CHOIX EXPÉRIMENTAL SUR LA CONSERVATION DES ARBRES

Pour cette partie, nous aimerions parler de la façon dont les paysans choisissent de gérer leurs activités agricoles et leurs forêts.

Ceci est un diagramme du cycle d'utilisation de terres forestières, jachères, et de champs de cultures mixtes dans cette localité. Ce cycle n'est pas nécessairement le même que le votre, mais c'est probablement similaire.

(DIAGRAMME 1)

Beaucoup de grands arbres dans la forêt primaire et les zones de forêts d'Akok sont en train d'être coupés par les paysans qui ont besoin de la terre pour faire des nouvelles cultures de subsistance, comme l'*afub owondo.* En premier, quand les paysans font un champ d'*esëp,* ils défrichent la forêt primaire, puis la prochaine année, avant d'utiliser ce champ pour l'*afub owondo* tous les grands arbres sont enlevés et le terrain sera brûler. Quand les arbres sont enlevés ils ne laissent pas le foret se régénérer pour plus de 10 ans parce que le terrain est encore utilisé pour les cultures.

La déforestation ici à Akok devient un grand problème parce que les forêts tropicales du Sud Cameroun font partie des plus précieuses forêts qui restent au monde.

Nous aimerions maintenant parler de la conservation des arbres par ce ménage.

Certaines personnes d'ici ou d'ailleurs souhaitent développer des programmes qui encouragent les paysans de votre région à conserver les arbres sur leurs terres en raison de la contribution de ceux ci à l'amélioration de la qualité de l'air pour le monde entier.

Nous vous prions d'envisager le scénario suivant.

Supposons qu'un organisme vienne dans votre village et mette sur pied un programme de conservation des arbres.

Les paysans sont les acteurs les plus importants pour ce programme. L'organisme veut s'assurer que les paysans ont toujours ce dont ils ont besoin et que le programme contribue au développement de la communauté.

Le programme vous engage à maintenir vos forêts et vos jachères qui ont **plus de 10 ans**. Alors, au lieu d'utiliser les vieilles jachères et la forêt primaire, maintenant vous pouvez seulement faire les *afub owondo* dans les jachères qui ont moins de 10 ans. Ceci voudrait dire que vous n'allez plus cultiver l'*esëp*, comme je vous le montre dans le diagramme suivant.

Tel qu'illustré dans le diagramme 2 vous pouvez faire les champs d'afub owondo dans les nyengue, ekotok, ou nfos ekotok. Vous êtes chargé de conserver le nfos afan et la forêt primaire.

(DIAGRAMME 2)

Votre ménage individuel recevra une compensation monétaire **par hectare par an** pour chaque hectare dans lequel vous conserver les arbres. Vous serez dédommagé pour le manque à gagner dû à la conservation des arbres sur ces terres.

L'organisme connait que vous aurez besoin de faire des petits changements avec vos méthodes de travaille. Alors, il y aura un agent qui viendra vous enseigner comment améliorer la production dans les jachères qui ont moins de 10 ans.

Vos terres et vos arbres continuent de vous appartenir. L'organisme qui a mis le programme en place ne vient pas arracher vos terres. L'organisme vous paye seulement en tant qu'acteur de la conservation de ces arbres.

Pour assurer le bon fonctionnement d'un tel programme, plusieurs personnes importantes doivent être impliquées. Il est primordial que vous compreniez chaque partie de l'accord et la fonction des gens impliqués. Vous serez en relation avec un intervenant qui s'occupera de votre dossier et qui va vous apprendre comment améliorer la production dans vos jachères de moins de 10 ans. Une autre personne visitera votre exploitation agricole afin de s'assurer que les arbres soient toujours sur vos terres. Une autre personne sera responsable de vous payer pour vos efforts pour la conservation des arbres.

Maintenant, je vais vous montrer plusieurs exemples d'accords potentiels pour ce programme.

Accord	A chaque année, vous serez payé *XX* CFA par ha.	Votre interlocuteur principal sera un agent *XX*. Il s'occupera de tous les arrangements à faire avec votre contrat.	Le technicien qui visitera votre exploitation agricole afin de s'assurer que les arbres soient toujours sur vos terres avant de vous payer chaque année sera un agent d'une *XX*.	Les gens prêts à vous payer pour la conservation des arbres sont d'une *XX*.	L'accord serait pour *XX* ans.	*P7Qa.* En supposant que cet accord soit proposé tel quel dans votre village, accepteriez vous de le signer ? 1= ( ) OUI 0= ( ) NON	*P7Qb.* Comment certaine êtes vous que sa serais votre décision de signer ou non ? *(sur l'échelle de 1-5 dites moi à quel comment certaine êtes vous)*
1	350 000	ONG	Gouvernement Camerounais	Entreprise privée	20	*P7Q1a*	*P7Q1b*
2	250 000	GIC	GIC	Pays développé	10	*P7Q2a*	*P7Q2b*
3	450 000	Gouvernement Camerounais	Entreprise privée	ONG	10	*P7Q3a*	*P7Q3b*
4	150 000	Entreprise privée	ONG	Gouvernement Camerounais	20	*P7Q4a*	*P7Q4b*

Demandez en premier !

P7Qa. En supposant que cet accord soit proposé tel quel dans votre village, accepteriez vous de le signer ? *(Réponse dans le tableau)*

1= ( ) OUI

0= ( ) NON

Demandez après P7Qa !

P7Qa. Comment certaine êtes vous que sa serais votre décision (de signer ou non) ? *(sur l'échelle de 1-5 dites moi comment certaine êtes vous)*

(Réponse dans le tableau)

1= ( ) Tout à fait certaine. *(Very sure)*

2= ( ) Certaine. *(Somewhat sure)*

3= ( ) Je ne sais pas. *(Not sure or unsure)*

4= ( ) Pas certaine. *(Somewhat unsure)*

5= ( ) Tout à fait *pas* certaine. *(Very unsure)*

PARTIE 8 : VERIFICATION DU PRIX

Pour cette partie, je vais d'abord vous expliquer la question, puis ensuite vous demander ce que vous pensez.

S'il vous plaît rappelez-vous que même si ce n'est pas une situation réelle, il est important que vous essayez de répondre à cette question comme si c'était le cas. Parfois les gens disent une chose dans une enquête, mais font autres choses en réalité. Réfléchissez et essayer de répondre à la question comme si nous étions en situation réelle.

Supposons que vous êtes intéressé à participer dans ce programme de conservation d'arbres. Tout comme la dernière partie, votre ménage sera payé pour entrer dans l'accord.

Vous vous engagez à maintenir tous les arbres dans les forêts et jachères qui ont **plus de 10 ans**. Il y aura encore une personne qui vous apprendra comment améliorer la production dans vos jeunes jachères.

Pour cette partie, partons du principe que l'accord que vous signez indique qu'un ***agent d'une ONG*** sera votre interlocuteur principal, un ***agent d'une ONG*** veillera à ce que vos arbres soient encore debout sur vos terres et ***un agent d'une ONG*** paiera pour la conservation des arbres. Vous serez payé par hectare, par an. L'accord serait de 10 ans, alors vous recevrez 10 paiements (un paiement par année) durant cette période.

Maintenant, on veut discuter du montant que vous recevrez comme compensation.

P8Q1. Seriez-vous d'accord pour _____ CFA par hectare ?

Total des sommes versées par an (CFA) par hectare	**Oui, je suis d'accord avec ce montant**	**Non, je ne suis pas d'accord avec ce montant**
0	○	○
50 000	○	○
100 000	○	○
150 000	○	○
200 000	○	○
250 000	○	○
300 000	○	○
350 000	○	○
400 000	○	○
450 000	○	○
500 000	○	○
550 000	○	○
600 000	○	○
650 000	○	○
700 000	○	○
750 000	○	○
800 000	○	○
850 000	○	○
900 000	○	○
950 000	○	○
1 000 000	○	○

P8Q2. (***Seulement, s'il te dit oui à zéro CFA***) – Est-ce que tu vas payez pour entrer dans cet accord ?

- ☐ 1= OUI
- ☐ 0= NON

Merci beaucoup d'avoir travailler avec nous.

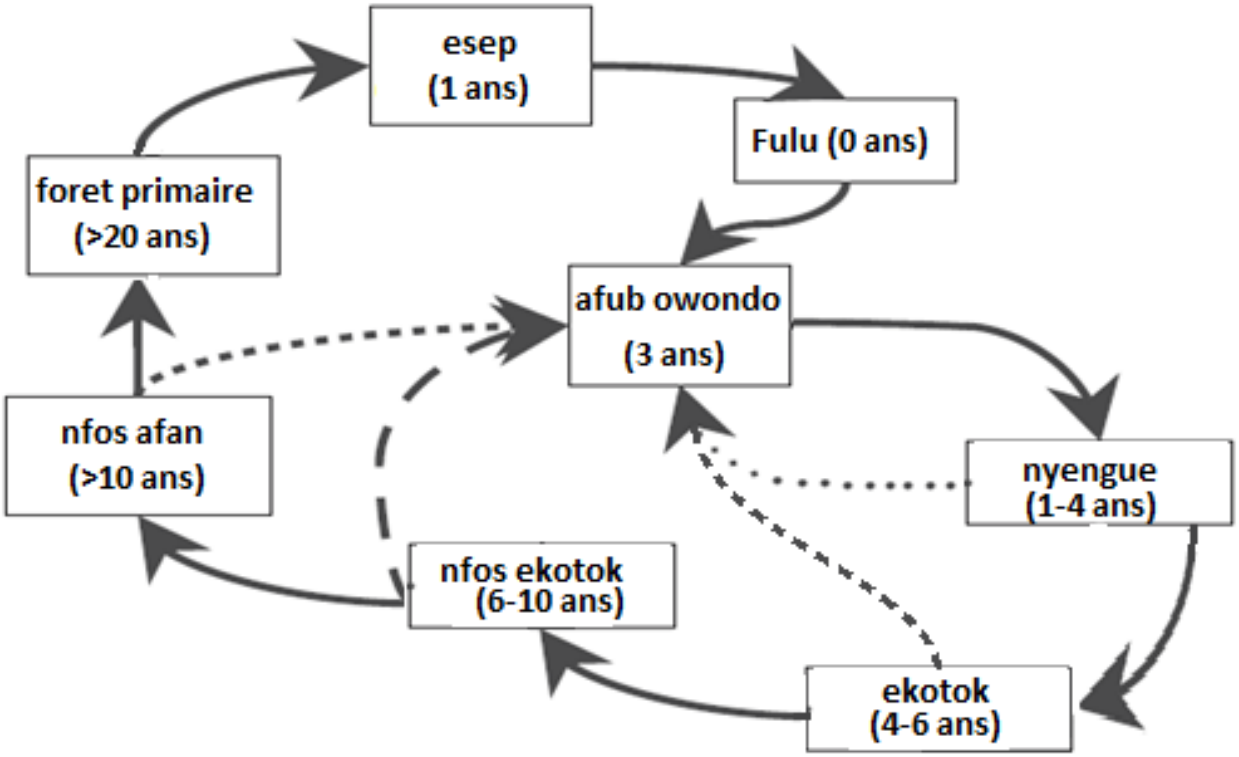

Diagramme 1. Ceci est un diagramme du cycle d'utilisation de terres forestières, jachères, et de champs de cultures mixtes dans cette localité. Ce cycle n'est pas nécessairement le même que le votre, mais c'est probablement similaire.

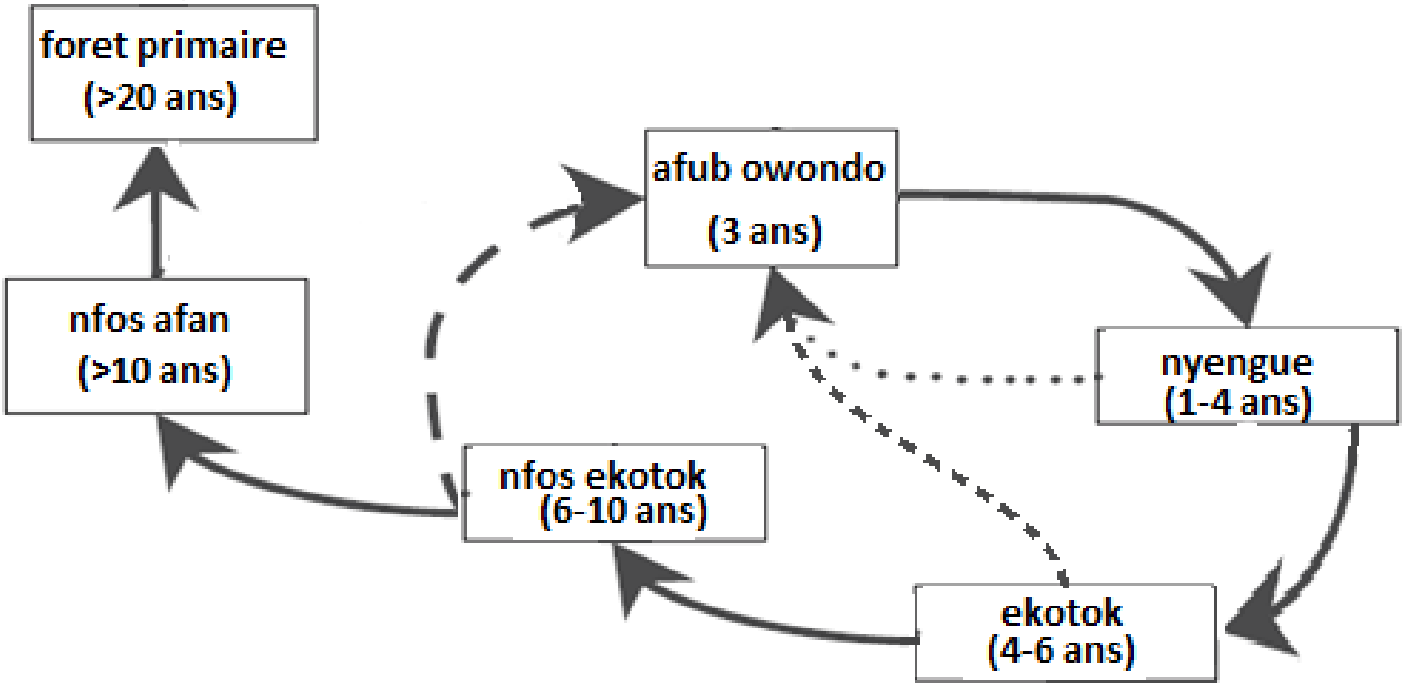

Diagramme 2. Tel qu'illustré dans le diagramme 2 vous pouvez faire les champs d'afub owondo dans les nyengue, ekotok, ou nfos ekotok. Vous êtes chargé de conserver le nfos afan et la forêt primaire.

Focus Group Questions

Cultivation and Crops

1. Are there any recent factors or events that have changed cultivation practices?

2. How frequently do farmers in Akok typically clear the primary forest to cultivate more land? (*eg. More than once a year? Once every five years?)*

3. What do people in Akok collect from the forest (non timber forest products)?

4. Can farmers in Akok easily access fertilizers? Why or why not? *(Which ones?)*

5. If farmers in Akok could access fertilizers easier, what do you think would change?

Crops to market

6. What crops do farmers sell in the market? Do they get a fair market price for these crops?

7. Where do farmers typically sell?

Outside organizations

8. Do people in the village generally communicate with outside organizations (government, NGOs, private companies), or is most communication done through the chief?

9. How do people generally feel about each of these groups (Government, NGOs, private companies)?

10. What was the last experience that people in Akok had with an outside organization? Was it positive or negative?

11. Which organizations do people in Akok trust the most?

Survey specifics

On sait maintenant que les arbres sont une partie importante pour vos cultures et que vous les vendez au marche. Maintenant on veut parler de leur importance pour l'environnement aussi. Ils contribuent à rendre l'air propre et ils remplissent des fonctions utiles pour les humains et les animaux du monde entier. Parlons maintenant a propos d'un programme de conservation des arbres qui peut etre developpe dans le village pour aider a maintenir les services environnementaux.

1. How do you think that a conservation program for trees should be developed in your village?
2. Who should be involved in implementing this type of program?
3. How do you think that compensation could work? Should it be individual, household, family or village-level payments? Money or other goods (fertilizer/equipment)?
4. More specifically, how much do you think that people in Akok need to receive as compensation if they were to enter into a tree conservation program?