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Investigating smallholders' preferences for the design of REDD contracts: A case study in Akok village, Cameroon

by

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Dedication

This thesis is dedicated, in loving memory, to my dad Bob Schmidt, who passed away while I was preparing this thesis. Though you couldn't express it in the end, I know how much it meant to you to see me accomplish my goals. Thank you for quietly teaching me that "education is the most powerful weapon you can use to change the world" (Mandela 2003). You were the strongest and the gentlest man I've ever met. I love you and miss you every day.

This thesis is also dedicated to my mum, Jane Schmidt, who has become my best friend and my confidante. Thank you for your unconditional love, support and guidance over the years. You have taught me to stand up for what I believe in and to be independent, strong and honest. I thank you for everything, but especially for your love and friendship.

Abstract

This thesis examines smallholders' preferences for the design of hypothetical contracts to Reduce Emissions from Deforestation and forest Degradation (REDD) in Akok village, Cameroon. An attribute-based stated choice experiment survey was conducted to elicit smallholders' preferences for various attributes and key stakeholders within the REDD value chain. A series of choice models, a latent class model and willingness-to-accept values were estimated. Results indicate substantial preference heterogeneity within the population, showing two distinct preference classes. The first class is very reluctant to enter into a REDD contract under any condition, and the second class is interested in participating if they are fairly compensated. In general, the attributes of the value chain did not influence the decisions to accept a REDD contract; rather, the decisions appear to be based on financial compensation for participation.

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Chapter 1: Introduction

1.1 Climate change mitigation and designing REDD mechanisms

Tropical forests store 25 percent of the world's terrestrial carbon (FAO et al 2008), and they absorb more than 15 percent of the carbon dioxide (CO_2) emitted each year from human consumption (Bonan 2008; FAO et al 2008). Tropical forests play a vital role in global carbon mitigation, but increasing forest degradation and deforestation has turned these important carbon sinks into large sources of CO_2 emissions. In 2007, the Intergovernmental Panel on Climate Change reported that nearly 13 million hectares of tropical forest are lost each year, contributing 17.4 percent to the total global carbon emissions. In other words, cutting down trees in tropical forests releases more greenhouse gases into the atmosphere each year than the entire global transportation sector (Stern 2007; IPCC 2007). The most obvious climate change implication of the removal of trees from forested land arises from the net loss of carbon stored in tree biomass and forest soils. This impact is amplified by the reduction in the size of the carbon sink potential due to the land-use change (Bonan 2008; Gitz and Ciais 2004). It is evident that environmental conservation policy and commitments to mitigate climate change will not be achieved without clear strategies to reduce emissions from deforestation and forest degradation in developing countries.

Nearly twenty years ago, 192 countries joined the United Nations Framework Convention on Climate Change (UNFCCC) – a treaty formed to stabilize the concentrations of anthropogenic greenhouse gases released into the atmosphere. Each year all countries party to the convention meet at the Conference of Parties (COP) to discuss current scientific evidence, review emissions inventories and assess mitigation efforts to date. The annual COP meetings provide a chance for a collective assessment of the progress towards meeting climate change goals, and a venue for negotiation of new commitments within the UNFCCC framework. At the COP meetings in Montreal (2005), Bali (2007), Copenhagen (2009), and Cancun (2010), respectively, the initiative to Reduce Emissions from

Deforestation and Forest Degradation in developing countries (REDD) has emerged as the current mitigation option with the largest and most immediate carbon stock impact potential (IPCC 2007). Since 2005, discussions on the scope of REDD have evolved from including only deforestation (RED), to the addition of forest degradation (REDD) and now forest conservation, sustainable management of forests and enhancement of forest carbon stocks are all included in what is called REDD-plus (REDD+). Further, a whole-landscape approach to reducing emissions from all land uses (REALU) has been suggested as a way to address the drivers of deforestation, reduce leakage concerns, and eliminate the need for precise 'forest' definitions (van Noordwijk et al 2009). In the remainder of this paper, the acronym REDD will refer to all activities including both REDD and REDD+.

REDD mechanisms are considered to be practical and cost-effective opportunities for large reductions in CO_2 emissions if appropriate institutions and financial incentive systems are created (Swallow et al 2007). Central to the implementation of REDD is making performance-based payments to forest owners to reduce emissions and sequester carbon; in other words making payments for environmental services (PES). The purpose of PES is to create a positive incentive for forest protection and conservation by giving monetary value to the carbon stored in trees. The drivers of deforestation, the structure of forest tenure systems, the logging and harvesting concessions and forest governance all vary widely country by country especially in low-income and developing nations. Thus, broad policy objectives can become difficult to attain. Due to the nature of the problem and the major socio-economic differences among the world's forested nations, efficient PES schemes to reduce forest loss need to be based on locally appropriate and site-specific incentive options and will engage key stakeholders on the farm, community and government levels (Harvey et al 2010; Angelsen 2009b).

1.2 The developing country context: Cameroon

Many socio-economic complexities arise as global leaders attempt to structure effective policy to tackle issues surrounding REDD, due primarily to the location of the vast majority of the world's remaining rainforests. Fifty-seven percent of the world's forests, including nearly all tropical rainforests, are found in developing countries (The Nature Conservancy 2010). Because millions of poor people worldwide rely on the resources found in the tropical forest margins for their livelihood (The Nature Conservancy 2010), the issues of deforestation and forest degradation are complex. This study is focused on one village in Southern Cameroon, one of the six countries sharing the Congo Basin. The Congo Basin is home to the second largest remaining tract of natural rainforest worldwide and comprises ninety percent of the tropical forests left in Africa (Justice et al 2001). Cameroon has often been referred to as "Africa in miniature" for its geographical and cultural diversity. However, Bellasen and Gitz (2008) describe the situation in Cameroon as "African deforestation in miniature" due to the complexity and diverse underpinnings of causes, consequences, and costs of deforestation.

Throughout Africa as a whole, between 1980 and 2000, sixty percent of new agricultural land came at the expense of intact tropical forests and thirty five percent came from degraded forests (Gibbs et al 2010). Cameroon has one of the highest rates of forest loss in central Africa – more than thirteen percent between 1995 and 2000 (Atia et al 2010). Forest loss over the last two decades in this region was driven, in large part, by the growth in rural populations and a shift from planting cocoa and coffee to more land-intensive crops such as plantain, cassava and oil palm (Ndoye and Kaimowitz 2000). In Cameroon, more than 85 percent of deforestation is attributed to smallholder farmers using shifting cultivation slash–and–burn techniques to extend the forest margin areas, unlike Southeast Asia and the Amazon where large-scale agricultural operations are dominant (Kotto-Same et al 2002). Another example of forest degradation prevalent in Cameroon is the removal of tall trees from shade cocoa plantations. Typically, shade cocoa fosters a high-carbon, multi-strata and multi-species

agroforest (Sonwa et al 2007), but as the cocoa plantations are intensified shade trees are removed in order to increase yield (Bisseleua et al 2009). The loss of intact forest and the increase in forest degradation means that, generally, land-use in Southern Cameroon is transitioning rapidly from a high-carbon state to a low-carbon state.

1.3 Achieving objectives through a REDD value chain

Central to the problems of deforestation and forest degradation in the humid forest zone of Southern Cameroon are the decisions of smallholder farmers to clear forested land for cultivation. Although land-use change is vital for economic and social development, it does not come without a cost (Wu 2008). Previous studies have shown that land use change in the humid tropics is driven by land users seeking to increase their economic returns, yet deforestation does not always create substantial benefits for the damage that is caused (Minang et al 2008). To understand the costs and benefits of deforestation we can examine two different levels of accounting. First, at the global level, where deforestation is not always economically rational – contributing large amounts of very costly greenhouse gases to the atmosphere for very small returns. But second, at the ground level, where the costs of burning a stand of trees to create agricultural land by a small-scale farmer, creates benefits for his farm's production and returns. By developing a REDD value chain for carbon – where farmers or forest managers are implementing practices to reduce emissions from deforestation, aggregators and verifiers are turning those reductions into certifiable carbon credits, and end users are purchasing the carbon credits as offsets to their emissions - forest conservation becomes a rational economic choice. If farmers considered the impact of carbon values in their economic decision making, the potential for successful REDD schemes could develop.

Although there has been very little research done on the efficiency and efficacy of achieving REDD policy objectives at the farm level, considerable work has been done on other forms of voluntary agri-environmental schemes (Wilson 1996;

Brotherton 1989, 1991; Ruto and Garrod 2009). These types of programs generally follow the PES framework, providing compensatory payments to motivate the farmer to contract with an agency to produce an environmental service. The voluntary nature of such programs, as would be similar with some REDD projects, means that participation and support by farmers is imperative to achieving the policy objectives (Espinosa-Goded et al 2010). Thorough understanding of farmer's perceptions and attitudes toward the design, implementation and benefits of voluntary REDD schemes is important for policy development.

1.4 Research objectives

The principle objective of this study is to investigate household perceptions and preferences towards the attributes of REDD contracts. This study aims to identify what types of contracts the average smallholder in Akok village, Cameroon would favor over the current farming situation. Stated preference data will be used to estimate how different payment prices and contract designs may influence smallholders' decisions to adopt local-level REDD projects.

A thorough understanding of farmer's perceptions and attitudes toward the design, implementation and benefits of REDD schemes is important for policy development. Existing market-based approaches to carbon emission reduction programmes have shown that the integrity of the value chain for carbon depends upon the relationships built between players at each link in that chain. Farmers engage in contracts with someone (i.e. government, an NGO, or a private firm), who then acts as a type of broker or aggregator for carbon. The specific contracts between farmers and aggregators outline the attributes at each level of the value chain including: the level of REDD payments, specific time periods of the agreement, by whom and when the contracts will be monitored, reported and verified, and who is financing the programme or purchasing the certified emissions reductions. Each step in the chain adds value, however, farmers' willingness to participate in REDD schemes can be both positively or negatively

impacted by the design of the value chain and the contract agreements. The value chain for REDD, and the allocation of benefits along that chain, must therefore be understood in order to know whether specific REDD mechanisms be will locally appropriate and successful. Velarde et al (2009) recognize that although it is clear that the REDD value chain will have to include many key stakeholders, each with important roles in monitoring, certification and verification; it is yet unclear how the "incentives for effective stewardship" and "immediate and efficient emission reductions" can be combined in a fair and efficient REDD value chain. Fairness in this context means rewarding the efforts of farm and forest users' current conservation efforts and ensuring that all REDD contracts are voluntary and transparent. At the same time, a fair REDD program will accommodate meaningful processes to ensure that the local communities' rights to give or withhold their free, prior and informed consent (FPIC) is respected. Efficiency in this context means focusing on low-cost reductions in high-emissions areas.

Through investigating farmer preferences for specific attributes and key stakeholders within the REDD project contracts, this study aims to concentrate on the role that attributes of hypothetical REDD contracts can have on increasing the likelihood of farmer participation and thus the success of the policy as a fair and efficient emissions management and high-carbon conservation strategy.

1.5 Thesis structure

The thesis is divided into five chapters and proceeds with the Literature Review, Methods, Results, and Conclusions. Chapter 2 provides an overview of the key background information surrounding the development and implementation of REDD in developing countries, a description of the state of the carbon market and how a PES scheme would function. This is followed by a description of the livelihood strategies of producers in the village of Akok and specific drivers of deforestation in Southern Cameroon. The information provided in chapter 2 serves to motivate the study design and methods used. Chapter 3 continues with a review of the theoretical basis of the study, survey design and data collection.

Chapter 4 summarizes the results of the study and the thesis concludes with a detailed discussion of results and conclusions in Chapter 5.

Chapter 2: Literature Review

2.1 The context of REDD in developing countries

The most recent Global Forest Resource Assessment done by the FAO (2010) indicates that rates of deforestation vary widely across the globe, with a marked decrease in some regions and continued high rates in others. The highest rates of deforestation are found in developing countries, especially those situated in the humid tropics (FAO 2010). The driving forces of deforestation in the tropics are varied, yet there are some underlying threads that make these regions particularly vulnerable to forest exploitation. A brief overview of these issues is presented in section 2.1.1. In order to understand the rationale behind using payments for environmental services to avoid deforestation, it is vital that the reasons that forest is being lost in these regions are understood. Section 2.1.2 examines the opportunity costs of avoided deforestation in the tropics, and is followed by an outline of the important elements of REDD design in section 2.1.3.

2.1.1 Drivers of deforestation and forest degradation

The drivers and underlying causes of deforestation, as well as the demand for agricultural land vary around the world. Geist and Lambin (2002) explain that each tropical forest zone has a complex set of proximate causes and underlying driving forces that will ultimately influence the degree and rates of deforestation in a given location. Proximate causes include human activities carried out at the local level that directly impact forest cover, such as agricultural expansion, wood extraction and shifting cultivation. Underlying driving forces behind deforestation include the national to global scale economic policies and forest laws, as well as socio-economic factors such as cultural expectations, population growth and integration of technology. It is important to understand that deforestation is caused by a synergy of several causal factors, not a single factor, and it is the broader institutional, political and economic pressures that influence the proximal decisions that are ultimately causing deforestation (Geist and Lambin 2002). Figure 2.1 shows the various underlying forces that tend to reinforce and exacerbate the proximate causes of tropical forest loss.

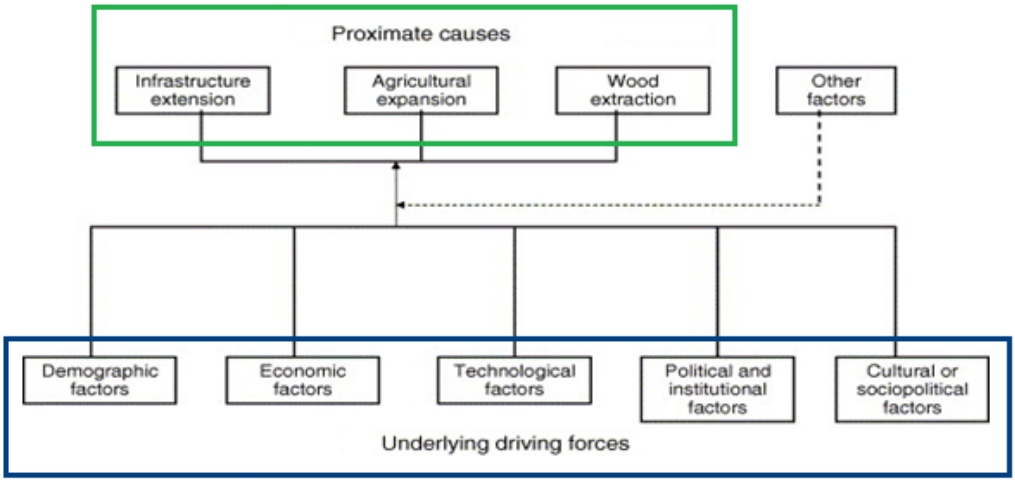

Figure 2.1 Drivers of deforestation in developing countries (adapted from Geist and Lambin 2002).

In South America's tropical forest regions, large commercial agricultural exports are driving the need for additional land, while smallholders play a much less significant role in deforestation (Stern 2007). Between 2000 and 2010, South America had the highest net forest loss of any region, with nearly 4.0 million hectares cleared each year (FAO 2010).

In Africa, things are different. Although the commercial logging sector and the frequency of illegal logging are still two important concerns, it is still the abundance of small-scale subsistence farmers using shifting cultivation cropping systems that are driving a large proportion of the deforestation throughout Central and East Africa (Stern 2007). African countries as a whole had the second highest net loss of forest through the 2000-2010 decade, losing about 3.4 million hectares annually (FAO 2010).

In Asia, we are witnessing yet another type of change. Over the last decade, Asia has seen a *net gain* in forest area of more than 2.2 million hectares per year (FAO 2010). This gain can be attributed to the large scale afforestation projects happening throughout China during the first decade of this century (FAO 2010). But despite this afforestation, a combination of both small-scale farmers and large timber and agricultural enterprises continue to dominate the landscape with the high rates of deforestation in South East Asia (FAO 2010).

This type of land-use transition – where we see a marked decrease in forest area as societies undergo phases of economic development, industrialization and urbanization, and then we see a partial recovery of forest area as the opportunity costs of deforestation rise – is coined the "forest transition" (Mather 1992; Rudel 1998). Most of South America and Africa are still in the early phases of the forest transition, going through a rapid decline of forest area, while most of Asia is now moving into the later stages, with a marked increase in forest cover.

The theory behind the forest transition has several implications for REDD. Satake and Rudel (2007) outline two hypotheses that arise from the forest transition theory. The first is the "forest scarcity" hypothesis, which is rooted in microeconomic theory and presumes that as tropical forests become scarce, the value of their forest products increase and likewise, prices rise. This triggers people to afforest and to protect the remaining tracts of forested land. The "forest scarcity hypothesis" could explain the rapid aforestation happening in Asia that was described earlier. The second hypothesis, "the ecosystem services hypothesis" is very important to the efficient functioning of REDD in developing countries. It proposes that the degradation of the landscape and the loss of ecosystem services provided by the forests as deforestation occurs, make the forests *less* valuable, thereby increasing the vulnerability of the forests even further.

2.1.2 Opportunity costs of reducing deforestation

To date, studies investigating the efficiency of reducing emissions from deforestation using PES schemes have used net present value (NPV) opportunity costs of current land uses to estimate the required levels of compensation (such as Swallow et al 2007; Stern 2007). Recently, Gregersen et al (2010) and Ghazoul et al (2010) have questioned the use of opportunity costs as the most reliable way to determine realistic estimates of the payments that would induce real forest conservation. Compensation based on market-based opportunity costs may be an acceptable practice in locations where consumers are participating in a well-functioning market economy; however, when looking at subsistence-based

communities operating outside of formal market systems, the use of opportunity costs may overestimate what some people would accept as compensation, especially for those engaged solely in subsistence farming, while risk-averse households or those with diversified earnings will be apt to demand compensation greater than the expected net opportunity cost (Southgate et al (2009); Gregersen et al 2010; Ghazoul et al 2010). Under the assumption that rational economic agents would like to be paid at least as much as they are giving up, estimates of opportunity costs of REDD typically use the rent price of the highest forgone available land-use (i.e. crop price or timber value). However, in the developing country context, stated values of required compensation for REDD contracts would include the households' unobserved motives (i.e. tenure security, risk-aversion, labour issues, etc.); thus, stated values could provide a more realistic measure of the true costs to induce farmers to reduce deforestation

2.1.3 Issues surrounding the implementation of REDD

Despite the relatively simple idea behind REDD – where individuals, projects, communities and countries are rewarded for reducing emissions from forests – it is not a simple mechanism to put into practice (Angelsen 2008). While REDD mechanisms, specifically PES schemes, have the potential to deliver significant reductions in emissions at relatively low costs, while aiding in sustainable development, many difficult issues need to be addressed before REDD can be effectively implemented at the national and sub-national level. These issues have been rigorously detailed by many research groups, as well as within numerous publications by the Forest Carbon Partnership Facility (FCPF) of the World Bank, the Centre for International Forestry Research (CIFOR), the Alternatives to Slash-and-Burn project (ASB), the Government of Norway, as well as several peer-reviewed journals. A brief review of some of the key elements that continue to lead the debate is included in the next sections[1].

[1] For a more in-depth analysis of these issues and others see Arild Angelsen's book titled "*Moving Ahead with REDD: Issues, Options and Implications*" (2008).

Reference levels

One of the most contentious issues with implementing REDD is the question surrounding the establishment of credible reference levels or baselines (Karsenty 2009). Baselines are used to assess a project's performance in achieving real reductions in emissions from deforestation and degradation. In other words, the reference levels ensure that the project meets the *additionality* requirement, i.e. additional to any reduction that would have occurred in the absence of the project and shows that the reduction in emissions is in fact the direct intent of the project (Minang et al 2007).

Although reference levels will have profound implications for REDD, there is still no agreed-upon method on how to set them. A national baseline can be set using: (1) historical deforestation rates; (2) business-as-usual projections (BAU); or (3) a crediting baseline (Angelsen 2008). Almost every one of the countries who have submitted plans for REDD have listed historical baselines as their point of reference for future reductions of deforestation, however reliable data of historical rates is largely unavailable in most developing countries (Angelsen 2008). The use of historical baselines may be questionable due to the potential for strategic action (i.e. inflating the historical rates to benefit from even small reductions) and due to the multi-dimensional nature of deforestation, as described in section 2.1.1. BAU baselines use forward projections of the rates of deforestation and forest degradation that would occur in the absence of any REDD intervention. BAU methods may undermine the natural progression of 'forest transitions' that may be underway in a specific region if it is not accounted for when assessing the impacts of the implemented REDD measures. If a country is in the early stages of the forest transition, the BAU method may *underestimate* future deforestation, while an *overestimation* of future deforestation is likely for a country that is in the later stages of the transition. The crediting baseline is used as another type of proxy, where projects are credited for their reductions in emissions only below that specific benchmark (Angelsen 2008).

The method that is used to determine baseline will have different impacts depending on the country (Karsenty 2009), yet most critics argue that country-specific baselines have the potential to create a lot of "hot air" in terms of additionality and environmental integrity (Angelsen 2008). However, if national circumstances are left out of the equation, and crediting baselines are solely used, there may be difficulties in achieving REDD participation at the national and sub-national levels.

Scope

The scope of REDD is an important element when discussing the range of mitigation activities that may be eligible for emission reduction credits within a REDD project. The term REDD includes both deforestation and forest degradation as factors that influence the harmful emissions currently coming from forests. As such, it is critical to understand whether the scope of REDD will include activities that reduce the loss of total forest area (avoided deforestation) and activities that will reduce the loss of carbon density of the forest (avoided forest degradation), as well as activities that will enhance positive change (Angelsen and Wertz-Kanounnikoff 2008). Table 2.1 shows the possible scope of these four types of creditable activities in a REDD programme (Angelsen and Wertz-Kanounnikoff 2008).

Table 2.1 Possible scope of creditable activities in a REDD/forestry mechanism.

Changes in:	**Reduced negative change**	**Enhanced positive change**
Forest area (hectares)	Avoided deforestation	Afforestation and reforestation (A/R)
Carbon density (carbon per hectare)	Avoided degradation	Forest restoration and rehabilitation (carbon stock enhancement)

Source: Angelsen and Wertz-Kanounnikoff 2008.

Lessons learned from the Kyoto Protocol's Clean Development Mechanism (CDM), as a predecessor of REDD, showed that including only A/R projects in the mitigation policy resulted in a weak and ineffective emissions reductions strategy. General consensus among climate policy analysts and what has now

been accepted by the UNFCCC COP is that although the scope of REDD may begin within a narrow field of vision, REDD activities will be broadened to include conservation, sustainable management, enhancement, and that forests shall eventually be part of a comprehensive agricultural, forestry and other land use (AFOLU) framework.

Leakage and Permanence

A REDD project, just as was the case under the CDM, must demonstrate a clear plan to mitigate any potential *leakage* or *externalities* arising from the project (Minang et al 2007). "Externalities" in this case may encompass any social, economic or environmental impact arising from the project area that has spillover effects to other areas. Although it is possible to have externalities that are positive and serve as co-benefits to the project, the main issues arise when negative impacts are not accounted for. "Leakage" in this case is used to explain a shift or any unplanned emissions occurring outside the project boundaries as a result of the project being put in place. Leakage can occur "whenever the spatial scale of intervention is inferior to the full scale of the targeted problem" (Wunder 2008a); thus leakages can occur at the farm, regional, national or global level of accounting (Wunder 2008a). One example described by Wunder (2008a) most relevant to this study is the impact of farm-level leakage; where the landowner enrolls one specific zone on his farm into the REDD PES programme, and then subsequently shifts all planned deforestation to another area further down the road that is not enrolled in the PES program.

Another root cause of contention that can be grouped within this requirement is the issue of "*permanence*" of carbon storage, with the understanding that a tonne of carbon sequestered in a stand of trees is only a benefit to the atmosphere as long as it stays standing (Streck and Scholz 2006; Dargusch et al 2010). Yet forests have a unique characteristic in that an unexpected release of carbon cannot be predicted or completely controlled; fire, pests and drought can release large amounts of stored carbon very quickly (Dutschke and Angelsen 2008).

Compensation to forest owners under REDD must provide incentives for long-term conservation of forests if the programme is to be effective in mitigating climate changing emissions. Options to address leakage and permanence vary from scaling-up of REDD projects, which will be difficult in the early stages of REDD implementation, to discounting benefits and banking "reserve credits" as a way of being more conservative in the credit accounting (Wunder 2008a). Chomitz et al (2007) explain that even without permanence, avoided deforestation will be crucial to climate change mitigation. REDD, even as a temporary measure, will reduce the risk of irreversible damage in the short term and will buy time for more effective investments into climate change research, technology and policies for the future (Chomitz et al 2007).

Monitoring, reporting and verification

Yet another set of contentious issues surrounding REDD implementation is the methodology, cost and accuracy of the monitoring, reporting and verification (MRV) stages of implementation. Monitoring is defined by UN-REDD as "the process of data collection over time...including...field measurements, field observations, detection through remote sensing, and interviews;" reporting is "the formal process of reporting of assessment results to the UNFCCC...;" and verification is the "the process of formal verification of reports" (UN-REDD 2009). The issues surrounding MRV stem from the limited capacity to undertake MRV in developing countries, to the rigorous standards required by the international community and the UNFCCC (Graham and Thorpe 2009). Chomitz et al (2007) argues that the transaction costs of MRV are prohibitively high at the plot level especially for smallholders, which brings about doubts of the practicality of relying solely on payments to conserve forests at the smallholder level. On the other hand, Graham and Thorpe (2009) discuss the requisite of using community-based monitoring to ensure that benefits distributed to the forest smallholders are maximized. They go on to explain that a community-based approach to MRV could address the key drivers of deforestation at the same time, by maintaining accountability at the ground level (Graham and Thorpe 2009). The agreements made in Cancun during the 2010 Climate Change Conference

called for robust and transparent sub-national monitoring and reporting systems, with the understanding that for REDD to be effective, an effective carbon monitoring and verification system is vital (UNFCCC 2011).

Safeguards

Social and environmental safeguards have been an important topic throughout REDD policy development. Safeguards can be explained as the policies and procedures put in place to mitigate any potential adverse social and environmental risks that stem from the implementation of REDD. The key environmental safeguards include biodiversity conservation, additionality, project scope, leakage, permanence, and MRV, all of which have been discussed above. However, social safeguards require extra attention as the implementation of REDD must be fair and efficient for all stakeholders. ASB and the Institute for Sustainable Development (IISD) came together to discuss some of the various social safeguards in their 3rd working paper (2011), including "the need for consistency with national objectives and priorities, transparent forest governance structures, respect for indigenous peoples and local communities, and effective participation of relevant stakeholders." Addressing these issues would ensure that the dual goals of the UNFCCC – stabilizing greenhouse gas concentrations while ensuring sustainable food production and economic development – are not compromised by REDD. Some critics argue that safeguards will add too much cost and complexity, making REDD unable to compete with other land uses and other sources of carbon credits (IISD 2011). Yet, others believe that in order for REDD to be a successful climate change mitigation strategy, it must be "pro-poor," with co-benefits to the communities factored directly into the design (Brown et al 2008).

Stakeholder engagement

According to the UN-REDD programme, "stakeholders are defined as those groups who have a stake/interest/right in the forest and those that will be affected either negatively or positively by REDD activities" (UNREDD and FCPF 2012).

However, of particular importance to this study are the indigenous and forest-dependent communities, who depend heavily on their customary right to the forests for their economic and social livelihoods. These individuals will also make up the final, farm-level link to the REDD value chain; thus, their engagement in the development of REDD is vital to establishing a fair and efficient value chain.

REDD has been touted by its many proponents as win-win for both forest conservation and poverty reduction, with the potential to deliver several benefits to indigenous peoples. However, there are groups that warn that current REDD planning may be inadequate due to the lack of free, prior and informed consent of the indigenous and forest-dependent communities (Freudenthal et al 2011). On April 12, 2012 the UN-REDD Programme and the Forest Carbon Partnership Facility released the "*Guidelines on Stakeholder Engagement in REDD+ Readiness,*" which focuses primarily on the indigenous peoples and forest-dependent communities. This document outlines the relevant policies, principles and guidance for effective stakeholder engagement. As REDD progresses from the readiness and planning stages to the implementation stage, stakeholder consultation should be far-reaching, transparent, and should facilitate a timely exchange of information (UNREDD and FCPF 2012). Consultation should aim to focus on issues of livelihoods, land-tenure, resource-use rights (customary/ancestral) and community (collective) rights in order to uphold the directives within the United Nations Declaration on the Rights of Indigenous Peoples (United Nations 2008).

2.2 The carbon market and carbon value chain

2.2.1 What is the carbon market?

Creating incentives for project developers in developing countries to reduce emissions from deforestation and forest degradation is only one part of the entire value chain for carbon. A functioning international "carbon market" will be required in order to efficiently transfer the benefits from the farm level back to the end user of the certified emission reduction (CER) credit or "offset."

More generally, the term “carbon market” is used for the credit trading system through which countries, firms or projects may buy or sell certified units of greenhouse-gas emissions or CER credits in order to meet specified national limits on emissions. The “carbon value chain” refers more specifically to the chain of stakeholders (aggregators, verifiers, etc.) who link the consumers demanding carbon offsets to the producers of the CERs at the farm- level. Figure 2.2 outlines the six “core functions” of the value chain for bio-carbon offsets, linking the consumers to the producers (Swallow and Goddard 2012).

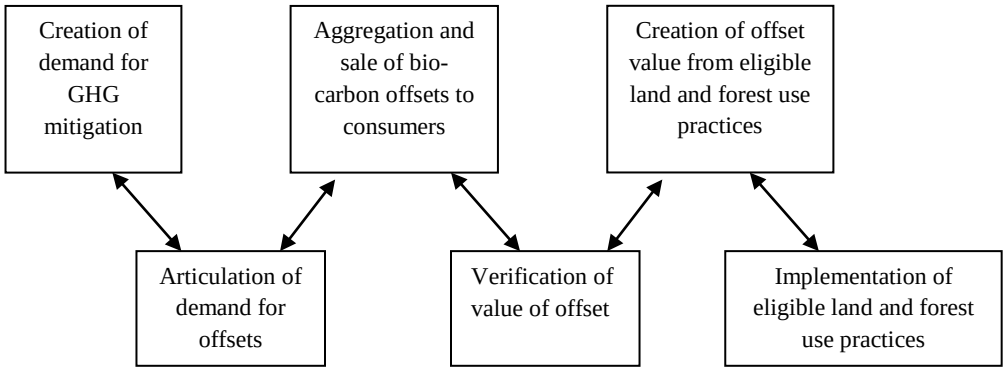

Figure 2.2 Bio-carbon offset value chain (Source: Swallow and Goddard 2012).

Carbon trading can be a viable market mechanism to trigger real reductions in greenhouse gas emissions (Swallow et al 2007); but sound governance structures are required to ensure that the value added at each link in the value chain is fair and efficient (Mehling 2009). Although there are many positives associated with carbon trading (for example: the transfer of newer/cleaner technology to developing countries), the same criticisms have arisen around the carbon market as have previously been discussed surrounding REDD; including, high transactions costs, additionality, incentives, enforcement and sustainable development (Schneider et al 2010).

The Clean Development Mechanism (CDM), introduced in 1997 as one of two market-based mechanisms of the Kyoto Protocol, is an example of an international carbon market. The CDM allows Annex I countries (those who signed the protocol and committed to reductions) to implement emission

reduction projects in non-Annex I countries (those who signed the protocol but did not commit to specific reductions), thus contributing to a global reduction in emissions at a lower cost than some home-grown initiatives (Minang et al 2007; Sutter and Parreno 2007). Although the CDM has been plagued with difficulties since its conception, the economics behind it are fairly basic; by realizing CDM projects in countries that are not able to do so on their own, the regulated nations can earn CER credits that they can then use to meet compliance targets, or to trade or sell to other nations looking to reduce their emissions (Minang et al 2007). The strength of the CDM, as is the hope for REDD, lies in the idea that it is able to meet the two objectives of the UNFCCC at once, by first assisting countries that are particularly vulnerable to the effects of climate change in achieving sustainable development and meeting the costs of adaptation and second, by assisting the regulated countries in meeting their compliance commitments (Minang et al 2007; Streck and Scholz 2006). However, one of the biggest weaknesses of the CDM policy framework remains that certifiable land-use activities are limited to only afforestation and reforestation projects and does not include any mechanisms to reduce deforestation and forest degradation (Streck and Scholz 2006). The United Nations Environment Programme RISØ Centre (URC), a leading research and advisory institution on energy, climate and sustainable development, reports that between 2008 and 2012 there have been more than 1.03 billion CERs issued under the CDM framework, of which only 0.8% are from afforestation and reforestation projects (URC 2012). The aim of a carbon market for REDD is to focus on the missing "bio-carbon" component of the CDM by creating incentives to reduce deforestation and forest degradation in developing countries.

2.2.2 Institutional foundations of the carbon market

While the number of emissions traded in carbon markets has continued to grow rapidly each year, the notion of a truly "global" carbon market remains mostly a political aspiration. Aside from the CDM, carbon markets have only really been successful as domestic and regional level systems (Mehling 2009; Swallow and

Goddard 2012). In Micheal Mehling's report for the Ecologic Institute in Washington, DC (2009), he describes carbon markets as:

> *"...a parallel existence of an evolving, top-down framework based on an international treaty that facilitates carbon trading between sovereign states, and a parallel, bottom-up layer of regional and national trading systems for eligible private entities."*

There are two streams within which these carbon markets may be categorized: (1) the *compliance market*, where regulations stipulate that a cap on or reduction in emissions is legally required; and (2) the *voluntary market*, where credits are bought and sold voluntarily outside of any governmental regulatory regimes (Guigon 2010). Of the existing carbon markets, the reality is that there are currently only a few functioning markets in the "bio-carbon" and land-use sector, the majority of which are found in the voluntary market stream (Swallow and Goddard 2012). The CDM and the European Union Emission Trading Scheme (ETS) have severe limits on the amount of bio-carbon credits that can be traded, for the most part, due to the complexity and ongoing debate surrounding effective implementation and verification (as discussed in the previous section). As of 2011, Swallow and Goddard (2012) were aware of only four compliance-based markets for agriculture and forestry carbon credits throughout the world.

The structure of the value chains for carbon in both the regulated and the voluntary markets is much the same, with the same six necessary core functions (see Figure 2.2). Swallow and Goddard (2012) summarize the key contrasts and similarities of the differing value chains for bio-carbon offsets, while clarifying the influence of policies and information along the chain, as well as the different financing mechanisms. The main differences in value chains for regulated and voluntary markets are the incentives and motivations that drive the key actors and institutions to produce and consume carbon offsets. For instance, in the province of Alberta, Canada, the demand for carbon offsets is driven by legislation that requires all large emitters (i.e. over 100,000 tonnes of CO_2e per year) to reduce the intensity of their emissions by 12 percent from the 2003-2005 baseline

averages. As such, a large market for farm-level CO_2e offset credits developed and has been supplying the market with certified offsets since its inception in 2007 (Swallow and Goddard 2012). The intermediary links within the Alberta offset system's value chain are filled by private firms, government agents, with the offset registry run by an NGO. In contrast, voluntary bio-carbon markets are created outside of governmental regulatory schemes by companies, institutions and individuals not required to reduce emissions by law, but rather are looking to better their environmental image, enhance sustainability, profit from co-benefits of environmental services or, perhaps anticipate future regulatory commitments. As such, the demand typically comes from non-government investors and offsets are usually created by small-scale farmers in developing countries within the fragile forest-margin zones. The actors and institutions in the voluntary offset systems are typically NGO's, private firms and some research organizations.

A large number of voluntary "carbon offset standards" were developed in response to the criticisms of the lack of a regulated framework within the Kyoto Protocol's CDM (Guigon 2010). These voluntary systems have been able to contribute to the development of future compliance-based emissions management offset systems by identifying issues and developing solutions to potential key issues that may plague the initial stages of implementation of future international market-based carbon trading schemes, such as REDD (Guigon 2010).

2.2.3 The role of trust in the REDD value chain

Trust is an important element of all successful interactions between people, especially in business and dealings that involve emotionally-charged subjects like money, livelihoods, family and traditions. Evidence from current markets for bio-carbon offsets show that the integrity of the value chain for carbon depends upon the relationships and the trust built between the producers, aggregators and end users of the offsets (Swallow and Goddard 2012).

There are several factors surrounding REDD that reinforce the necessity of building trust between key stakeholders. The trading of carbon offsets is done

through a "virtual futures" market (REDD-Net 2010). This type of market is fundamentally different from the markets for tangible and physical goods. Producers in developing countries are not used to dealing with a type of "good" that is nothing more than a certificate or a credit to their name. As such, feelings of suspicion can easily develop by smallholders and producers involved in REDD at the ground level (REDD-Net 2010).

Generally, smallholders are also inexperienced with contracts that stipulate specific requirements of them on their own land – land covered in forests that are extremely valuable to their families and their livelihoods. Communities within the forest margin zones are largely dependent on the resources provided by the forest. However, they are aware that the forests on which they rely also hold significant economic value for the lumber industry. These forest-dwelling communities have repeatedly witnessed the loss of forests to logging and illegal timber trafficking. In research conducted for this thesis, I found that rural residents in Akok village, Cameroon expressed significant concerns with participating in REDD contracts, stating that they believed the prolific illegal logging by industry and government in the region would never be eradicated. Given the years of exploitation, smallholders in Akok village have become suspicious and do not trust that they will receive an adequate share of the benefits of REDD (REDD-Net 2010). As such, the role of trust is vital to the successful implementation of REDD in developing countries.

2.3 Preferences and participation in PES programs

Payments for environmental services (PES) are one of the main policy instruments for REDD; designed to create incentives for farmers to adopt environmental conservation and restoration practices in exchange for monetary compensation. In recent literature, PES is generally defined using five key characteristics (Wunder 2005). In theory, "*PES is:*

1. *a voluntary transaction where*
2. *a well-defined environmental service (or land-use likely to secure that service)*
3. *is being 'bought' by a minimum of one environmental service buyer*
4. *from a minimum of one environmental service provider*
5. *if and only if the provider secures environmental service provision (conditionality)"* (Wunder 2005).

In reality, there are very few PES schemes that are able to fully satisfy every one of these requirements; rather, there are many "PES-like" programs that vary in their degree of voluntariness, clarity, rights to buy or sell, and conditionality (Wunder 2008b). It is the first condition – that PES is different from command and control policies by being based on a voluntary transaction – that is most relevant to this study. As long as the providers of the environmental service (i.e. the smallholders avoiding deforestation), have real land-use choices to make, their decisions to participate in the PES schemes will be essential to achieving the policy objectives of REDD.

To date, research looking at the preferences influencing participation in PES schemes has focused primarily on observed behavior by using revealed preferences, rather than contingent behavior and stated preferences. Post-hoc analysis of participation in PES can illicit useful information regarding the economic, household and farm-level characteristics that influence the preferences of the environmental service providers. However, when preferences and participation rates using observed behavior studies are considered subsequent to PES program design, it is not possible to interpret the impact of the various attributes of design on participation (Espinosa-Goded et al 2010). As such, when looking at the efficiency of the design for PES, stated preference studies can be very useful tools for investigating the impact of the attributes on intended participation in the program.

There are several studies that use stated preference techniques to investigate the preferences and participation of landowners in different payments for

environmental services mechanisms (Klosowski et al 2001; Horne 2006; Ruto and Garrod 2009; Espinosa-Goded et al 2010; Whittington, D. and S. Pagiola 2012). However, there are only three studies, to my knowledge, that use stated preferences, specifically choice experiment surveys, to investigate farmer's preferences for the attributes of PES programs in developing countries. Balana et al (2011) used a choice experiment to evaluate landholder preferences for land-management attributes that would enhance the watershed services in the River Kapingazi catchment, in central Kenya. They found that although reward-based provision of environmental services encouraged pro-environmental behavior, landholders would be less likely to adopt a given management practice if they were required to commit larger land areas, for longer contract periods, and with greater restrictions on their harvesting rights. Balana et al (2011) advised that parties involved in setting up rewards for land management schemes should also focus on helping to alleviate the underlying drivers of local environmental problems if they intend to maintain sustainable watershed services in the study area.

Arifin et al (2009) and Kaczan (2011) both use choice experiment methods to quantify farmer's tradeoffs between attributes of sustainable forestry management PES contracts. Results of the study by Arifin et al (2009) suggest that farmers' in the Sumber Jaya area of Indonesia, are willing to participate in community forestry programmes with strict restrictions on land use and tree planting as long as they are assured long-term rights to the trees planted. Similarly, Kaczan (2011) found that farmers' in the East Usambara Mountains, Tanzania preferred PES contracts with stricter requirements for tree conservation rather than programs with less strict conditions. The intended participation rates in Kaczan's (2011) study increased when the programme included a one-off payment for manure fertilizer; an interesting result as it indicates the importance of co-investment in long-run farm productivity to create incentives for participation.

To my knowledge there are no previous studies using stated preference methods to investigate farmer preferences for the attributes of REDD program PES contracts. However, the studies outlined here demonstrate the effectiveness of

incorporating farmers' preferences when designing PES programs in developing countries.

2.4 Case Study: Akok village, Cameroon

2.4.1 The forest and its people

Cameroon is located in west-central Africa; its forests form the northernmost part of the Congo Basin rainforest, the second largest remaining tract of natural rainforest left in the world (Robiglio 2008). Tropical humid forest currently covers 42 percent of the country, an area spanning roughly 20 million hectares (Freudenthal et al 2011). Cameroon's two largest cities, Yaoundé and Douala, are both located within the humid forest zone and each have a population of about 2 million people (CIA 2012). There are several ethnic groups and indigenous populations that rely heavily on forest products for their livelihoods, of which the Bulu, Kozime and Beti groups, of the greater Bantu family, are dominant (Cleuren 2001). Cameroon has a population growth rate of 2.1 percent annually (2012 est.) and the degree of urbanization is now 58 percent with a rate of change of 3.3 percent annually (CIA 2012). Figures indicate that 48 percent of the 20.2 million people in Cameroon are living below the poverty line (CIA 2012).

This study was conducted in Akok village, in the South province of Cameroon. Although Akok is recognized as a village, it is made of up of a number of sub-villages along an 11km stretch of dirt road. Akok was originally identified by the ASB program (Gockowski et al 2002), as one of their three key study sites in the 1.54 million hectare Cameroon Humid Forest Zone Benchmark Area (HFZ) (Figure 2.3). The village and its surrounding forests have been the subject of several studies in the past, including but not limited to: Diaw (1997), Gockowski et al (2002), Brown (2004, 2006 and 2008), Sonwa et al (2007), Robiglio and Mala (2005), Robliglio (2008), and Cerbu (2008).

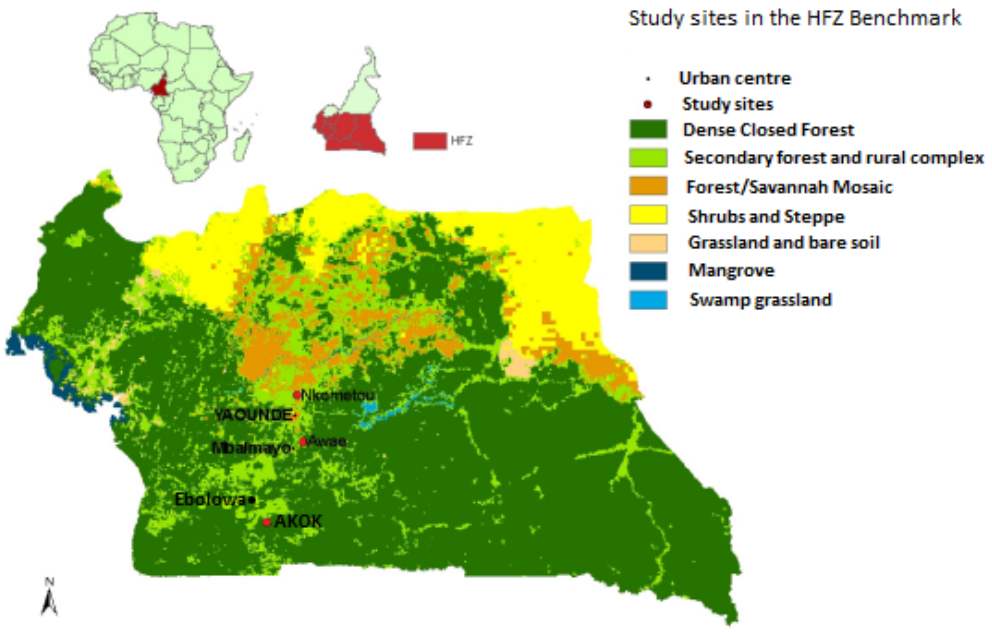

Figure 2.3 Location of the study site (Akok village) in the HFZ of Southern Cameroon. (Source: Robiglio 2008).

Akok village is fairly remote, with poor market access (nearest market town, Ebolowa, is 35km away) and low population density (7.8 persons/km^2) (Kotto-Same et al 2000). The forest ecosystem of Akok is classified as *Dense Humid Cameroon-Congolese forest* and is characterized by intermediate floristic diversity and red-yellow Orthic Ferrasol soils (Kotto-Same et al 2000). This tropical forest region follows a bimodal annual precipitation distribution with average annual rainfall between 1350 and 1800 mm (Kotto-Same et al 2000), which permits two annual cropping seasons, the first is from December to June and the second from August to November (Gockowski and Ndoumbé 2004; Robiglio 2008).

2.4.2 Livelihoods and drivers of deforestation

The forests in Cameroon play an important role in the maintenance of all types of ecosystem services. Although this study is centered specifically on reducing deforestation in order to reduce greenhouse gas emissions, reducing deforestation will also help maintain soil and watershed services, and help protect one of the most biologically diverse regions in Africa (Bergmans 1998). Environmentally,

Cameroon's rainforests are an important resource; yet, their role in human welfare by providing medicines, timber, food and fuel for the local population is also invaluable (Gbetnkom 2005).

The forests across the humid forest zone of Southern Cameroon have suffered severe losses throughout the last decade primarily for timber production and agricultural expansion (Brown 2004; Cleuren 2001; Ndoye and Kaimowitz 2000). A brief summary of the main drivers of deforestation in Akok village, logging and agriculture, are provided here[2].

Logging

In Cameroon, most logging is done selectively, by removing only the large valuable trees. In reality, logging itself need not be a major driver of deforestation; there are well-known sustainable logging practices that are used throughout the world. Selective logging typically only removes one tree per hectare on average, which accounts for less than 10 percent of the canopy cover (Justice et al 2001). Although this selective logging is damaging to the ecosystem functioning and removes between 20-35 percent of the carbon per hectare, if left to regenerate, the forest biomass can make up for the loss of the selected trees in a relatively short time (Stern 2007). However, unsustainable rates of selective logging by the timber industry has left big portions of Cameroon's forests severely degraded, and has paved the way for further exploitation (Cleuren 2001).

In 1994, the Government of Cameroon re-zoned the country's forests as either "permanent forest zone" or "non-permanent forest zone" (Cleuren 2001). Despite the irony of the naming convention, the permanent forest zone covers some six million hectares in total and is considered production forest open for logging. The non-permanent forest zone is reserved for small-scale agriculture, human

[2] See Dkamela's (2010) report on the drivers, agents and institutions in "The context of REDD+ in Cameroon," for an in depth look at the underlying causes of deforestation and forest degradation in Cameroon. Additionally, Brown (2004), Robiglio (2008), and Cerbu (2008) provide detailed analysis of the causes and factors influencing deforestation in Cameroon, and specifically in Akok village.

settlements and plantations (Cleuren 2001). Unfortunately, when the delineation of the two forest zones was implemented there was little consideration of the social history of forest use and tenure by local populations (Cleuren 2001). As a result, there is ongoing conflict between forest- dwelling smallholder farmers and the forestry companies over land, logging and rights to the forest. Because the forestry sector accounts for the majority of the export market and foreign earnings for Cameroon (Gbetnkom 2005), the formal requirement for community approval is regularly overlooked (Cleuren 2001). Since the division of the forest zones, the proportion of Cameroon's forests that have been logged is greater than any other African nation with forest resources (Brown 2004, Ndoye and Kaimowitz 2000).

Agricultural expansion

In Cameroon, agriculture accounts for 40 percent of the country's gross domestic product (GDP) and 90 percent of that agricultural activity is performed by smallholder farmers (Molua 2005). Typically, smallholders are subsistence farmers whose household requirements rely on a mosaic of shifting cultivation agriculture supplemented by hunting and fishing, as well as collection of non-timber forest products and fuel-wood (Robiglio 2008; Brown 2006). Smallholders may also maintain small-scale cocoa, coffee or palm-oil plantations for supplemental income.

Shifting cultivation refers to the way that individual farmers or households will "shift" between managing successive sets of fields of various stages of cropping, fallow and forest over their entire land-holding area (Diaw 1997). Although there are many variations on the "shifting cultivation" style of agriculture throughout the Congo basin, the slash-and-burn method of land clearing does not vary substantially throughout the benchmark area in Cameroon (Robiglio 2008).

In Akok, shifting cultivation generally follows the cycle of land use shown in Figure 2.4 (Brown 2006). The dominant field type in Akok is the *afub owondo* or 'mixed food crop,' consisting mostly of cassava and groundnuts, but can also include cocoyams, plantain, banana and leafy vegetables (Brown 2006; Robiglio

2008). As the mixed food crop requires minimal inputs and can be cultivated during either of the two cropping seasons in Akok, it is the most important source of food for households (Brown 2006). Generally, the mixed food crop is planted in a field that was previously planted as *esep* or 'forest melon,' a crop that is used to open up mature forested areas (Diaw 1997). The forest melon field is characterized by a mixture of cucumber melon and plantain, crops that require rich fertile soil that was recently forest or old fallow (Gockowski et al 2002). On occasion the mixed food crop may be planted directly into a fallow field (of any age), referred to in the local language as *ekotok*, or they may be planted directly in *fulu*, a recently cultivated forest melon field (Brown 2006). The extended fallow periods are an integral component of the cycle of land use in Akok village, as they allow for the replenishment of soil fertility (Gockowski et al 2002). Generally, the smallholders in Akok village will cultivate several fields per growing season, depending on labor availability and the household food requirements. The fields are typically small (less than half a hectare) and fragmented, although each household will keep their fields more or less in the same forest area each season (Brown 2004).

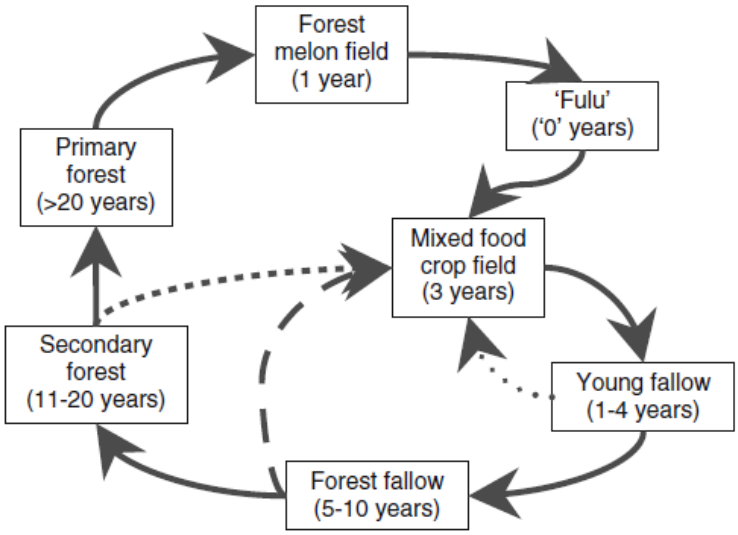

Figure 2.4 The cycle of land use for forest, fallow and the mixed food crop, as is used in Akok village, Cameroon (Brown 2006; adapted from Diaw 1997).

The general principle of shifting cultivation as a *cycle* of land use means that the removal of forest cover by smallholders during cultivation should be only temporary and regeneration should occur as that parcel of land transitions to the older stages of fallow (Bikié et al 1999). The maintenance of soil fertility in Akok is achieved primarily by retaining the cycle of fallow periods, sometimes up to 10 years between cropping rotations (Gockowski et al 2002). Although the sustainable use of shifting cultivation was possible at low population densities, the increased strain on availability of forest resources due to increased population density has caused a net loss of forest cover in southern Cameroon (Gockowski and Ndoumbe 2004). Even in Akok village, where forests are not under as intense pressure as they would be if they were are closer to markets, requirements needed to clear fallow fields as they mature means that younger fields are being cultivated more and more often (Gockowski et al 2002). When fallow periods are decreased, the fertility of the soil decreases and in turn, productivity decreases (Brown 2004). As a result of the increased need for forest resources, growing population density and decreasing in fallow length smallholders must cultivate progressively more land at any one time to meet their household's needs – a trend that leads directly to increased deforestation (Brown 2004).

One crop that is not included in the typical shifting cultivation framework but has been integral to the agricultural landscape in Southern Cameroon is the cocoa, coffee and palm-oil plantations. In Akok village, small-scale cocoa plantations are the most common of the three systems (Gockowski et al 2002). The creation of cocoa plantations is also done using slash and burn techniques. However, the majority of the cocoa fields that are maintained in Akok village are a legacy crop that was passed on through families and households. There have been very few new cocoa fields planted in the village since the price for cocoa dropped dramatically in the late 1980s (Gockowski et al 2002). Often maintaining cocoa plantations will provide positive externalities for smallholders and the environment alike; cocoa fields that are intercropped with fruit trees, medicinal plants, and larger shade trees provide medicine, food and fuel wood for smallholders while providing environmental services (i.e. long term carbon

sequestration) (Sonwa et al 2007). As such, a "fair" REDD scheme would reward smallholders' who maintain these high-carbon agroforestry crops in the long-term.

2.4.3 Land tenure and property rights

Land tenure in Southern Cameroon was traditionally claimed according to the 'axe right,' which followed the basic principle of "first in time, first in right" (Brown 2004; Robiglio 2008). Essentially, usufruct rights were retained by the first farmer (and his descendents) to clear and put a particular piece of land to productive use (Cleuren 2001). However, when the Forest Law was enacted in 1994 the government reclaimed official governance over the forest zones, and granted local populations the right to access non-permanent forest zones for community agriculture only (Robiglio and Mala 2005). In reality, the state classification system did not greatly impact the way in which the forest dwelling communities in Southern Cameroon accessed the forests. Today in Akok village, the use of forest resources follows the same sort of traditional use based on kinship and family legacy (Robiglio 2008); however, the tenure security that had long been established through customary rights to forest resources is now much less secure. Individual households impose short-term usufruct rights upon the land that they are currently cultivating and the fallow land that they have recently left to replenish. Unsustainable use of fallow lands by individual households may be a result of the reappropriation of fallow land left to regenerate to secondary forests for use by the collective family or another relative.

Chapter 3: Methods

3.1 Introduction

This chapter focuses on the methods involved in the design and implementation of the study. The chapter begins with a description of random utility theory which is the underlying theoretical basis for using a discrete choice experiment to investigate producer's preferences for REDD. Following the theoretical explanation, the methods used in the survey design, including the detailed components of the choice experiment are described. The chapter concludes with a description of the data collection and an explanation of the procedures used in model estimation.

3.2 Modelling smallholders' preferences for REDD contracts in a random utility framework

3.2.1 Conceptual model framework - Random Utility Theory

Random utility theory is the underlying theoretical framework for attribute-based stated preference methods (Grafton et al 2004). This theory, originally proposed by Thurstone (1927) and extended by McFadden (1974) and Manski (1977), provides an explanation of choice behaviour, based on the principle of utility maximization. Specifically, random utility theory is built on the premise that individuals have the ability to evaluate alternative choices and base their decisions on the relative attractiveness of the different alternatives (Ben-Akiva and Lerman 1985). Thus, the probability that an individual makes a choice from a set of alternative choices is based on an index of attractiveness, specifically the utility of that choice relative to the utility of the other choices in the set. Lancaster's attribute-based utility theory (1966) was the original point of departure from the traditional demand model. His model was able to first explain that an individuals' utility is not derived solely from the good or choice itself but rather from the characteristics that the good possesses or that make up the choice. It is this idea – that the goods and choices we make are used in combination to *produce* our

individual utility (Louviere et al 2000) – that provides the theoretical foundation for the description of the choice experiment used in this study.

Stated preference studies are commonly used in situations where there is no revealed preference data (market data) available or when estimates of the demand for new products or services are needed. Stated preference techniques are helpful when investigating how individuals evaluate the attributes of a product or service and choose among competing choice options (Adamowicz et al 1998). When random utility theory is applied to the choice of adopting a REDD contract, alternate contracts are viewed as heterogeneous goods that possess particular characteristics. Demand is modeled as a selection from a finite set of different contracts for independent choice occasions (Ben-Akiva and Lerman 1985). It is assumed that individuals behave rationally, meaning they follow the basic premises of consistent and transitive preferences, and make their choices consistent with utility maximization (Ben-Akiva and Lerman 1985). Thus, for any individual

The deterministic component of the utility function

(5)

REDD contract if it were offered in their village or whether they *would not* accept a contract and would continue with their current land use practices. The respondent was also asked to rate the certainty of their decision. The use of certainty scales to validate a Yes/No response will be discussed in detail in section 3.3.2.2.

When presented with the choice of a contract, or to continue to farm as usual, the rational farmer will choose to adopt the contract if the expected utility derived from this contract is greater or equal to the utility derived from the existing cultivation practices (Arifin et al 2009). Therefore:

(7)

3.2.3 Interaction model framework and the latent class model

The limitation of the binary response model framework described above is the absence of treatment for heterogeneity; which we know is paramount to the investigation of preferences for goods and services (Boxall and Adamowicz 2002). Equation (9) is estimated on the basis of the difference in utility levels between alternatives. Therefore socio-demographics and other respondent characteristics that do not vary between choice alternatives cannot be included directly in the estimation (Grafton et al 2004). In order to model the "observable" heterogeneity individual-specific demographic characteristics can be included as interactions with attributes of the model. The interaction model estimates an extended version of the simple indirect utility function (equation 2) to infer how the effect of one alternative specific independent variable on the dependent variable depends on the magnitude of an individual specific variable (Ai and Norton 2003). Interaction models are used in the analysis to examine how the individual specific trust indices influence the preferences for the different attributes of the contract and the decision to accept or reject a given contract.

Alternatively, latent class models are used when there is some "unobservable" or "latent" heterogeneity in the population causing the data to be grouped or potentially biased in some way. The latent class model is based on the assumption that there exists some finite number of classes of preference parameters (

(11)

questionnaire, designed to collect data for the purpose of analysing factors that affect respondents' decisions to adopt or reject a hypothetical REDD contract. The survey also contained a separate contingent valuation question eliciting the respondent's willingness to accept compensation for the hypothetical contract. The latter is beyond the scope of this thesis and will not be discussed. This section will focus on the design of the survey instrument which can be found in Appendix A.

3.3.1 Survey composition

The survey consisted of eight sections, each with a specific topic relating to the preferences of the smallholder producer. The first two sections contained basic demographic questions of the respondents, including gender, education, age, marital status and affiliation to a community group[3]. The third section looked at the age profile of the household (total number of children, adults and elderly), as well as the change in the size of the household in the last ten years.

The fourth section of the survey contained questions regarding the household's access to land and forest resources. The questions in section four, relating to the description of the fallow fields to which the household has access, were based on figure 2.4. In the focus group discussion prior to the survey commencement, the people of Akok village identified that there were three main categories of fallow and two categories of forest in this area from which they would typically choose to clear and plant crops. The names of each of the field or forest types were clear, *nyengue* (young fallow), *ekotok* (old fallow), *nfos ekotok* (very old fallow), *nfos afan* (secondary forest) and *fut afan* (high forest), yet there was some disagreement on the specific age ranges that are encompassed in each of the different categories. For this reason, a question about the age at which they would consider their fallow to fall within these categories was asked. Each respondent

[3] Choice experiment literature suggests that demographic questions (i.e. income, age, education, etc) should be asked at the end of the survey to avoid any initial hostility from the respondents. In Akok we found that asking the demographic questions at the beginning was easier and the respondents were more open to answering the survey after they were given the chance to explain who they are and their farming practices.

was then asked to identify the number of fields of each type that they have access to, and the total area that makes up each category.

As discussed in the previous chapter, the uncertainty surrounding the property rights regime within the forest zones of Cameroon makes it difficult to design a tree conservation program that is guaranteed to be successful. The final questions in the fourth section were designed to investigate whether the household has exclusive rights to use the different types of fallow lands that they previously listed or whether they have to ask permission from someone in the family or community in order to cultivate them. Fundamental to REDD development is the need for an interface between the formal international climate governance structures and the less formal tenure arrangements at the local level (Graham and Thorpe 2008). These questions are an attempt to discover, at the ground level, the number of layers of control that a particular plot of forest is subject to. This information will be used in the analysis of whether that tenure system will influence the decisions of small-holders to adopt a hypothetical REDD contract.

The fifth section of the survey included a characterization of the household's current agricultural activities. The aim of this section was to investigate the different types of crops that the household is currently cultivating and in exactly what rotation they are shifting the cultivation of different field types. The initial focus group and pre-testing of the survey allowed us to isolate and ask questions regarding the four main types of fields that were cultivated in Akok: *esep* (forest field), *afub owondo* (mixed food crop field), *asan* (swamp field), and *cacaoyères* (shade cocoa fields), with the opportunity to include relevant possibilities.

The questions in section six were designed using a Likert Scale, a bipolar method of measuring either positive or negative responses to a given statement (Likert 1932). Each question was presented as a declarative statement, followed by five ordered response levels indicating their level of agreement with the statement (*strongly agree, agree, disagree, strongly disagree and not sure*). Thus, the range of responses captures the level of intensity of their feelings towards a given statement. The first half of the questions in this section were based on Brown's

(2006) discussion of the drivers of household land use decisions and were focused on their feelings towards different pressures to cultivate specific parcels of land. The second half of the set of Likert questions was designed to explore their degree of trust in different levels of organizations they might have had experience with and those that might be part of a hypothetical REDD value chain (i.e. community groups, government of Cameroon, NGO, private corporations, etc.). The use of the Likert scale questions as a prelude to the next sections of the survey is considered a useful tool because it introduces the concept of 'rating' a respondent's level of agreement, or certainty toward a contrived statement (Bennett and Adamowicz 2001), the key feature of the next section on choice and the basis for the survey.

The seventh and eighth sections of the survey required the respondents to make choices based on a detailed hypothetical REDD program scenario. The former used a choice experiment task designed to investigate the specific tradeoffs that the respondent is willing to make between their business-as-usual shifting cultivation practices and practices consistent with a hypothetical REDD program. The latter, and final section of the survey used a stated preference willingness-to-accept payment card to investigate the specific level of payment required by the respondent in order to adopt the hypothetical REDD program.

3.3.2 The choice experiment

Generally, a choice experiment is a tool that involves the presentation of the basic contextual framework, necessary background information and an explanation of the motivation for the study, it also includes a set of standardized instructions for the respondent which is followed directly by the choice task itself (Adamowicz et al 1998). The choice task involves presenting the respondent with a choice set of two or more scenarios containing a specific set of alternatives, designed to simulate the actual choice as closely as possible (Adamowicz et al 1998). When designing a choice experiment the number of alternatives in the choice set, the number of attributes making up an alternative and the number of levels of each attribute all require meaningful consideration. As the number of each of these

elements increases, the complexity of the task increases and the survey requires additional choice sets to be included in order to properly identify the effects of attributes on the respondent's decisions (Bennett and Adamowicz 2001).

3.3.2.1 Information accompanying the choice experiment

The choice experiment first presented the respondent with a preliminary hypothetical scenario outlining the details and reasons for introducing a REDD program in a village such as Akok. This prefatory page included a general introduction to the idea of a tree conservation program where an external agent would be willing to pay people in Akok to conserve the older, more carbon-rich forest within their land holdings. The biggest challenge was to create a realistic scenario outlining the necessary details of the program while including a cultural element that would be meaningful and relevant to the respondents. After the focus group and pre-testing of the initial survey, the decision was made to include two separate schematic diagrams as visual aids to minimize the variability in the interpretation of the scenario, and to standardize the base scenario across all respondents. The first diagram (Figure 3.1) was used to establish a baseline and verify the respondent's current method of shifting cultivation outlined in the focus group and previous research.

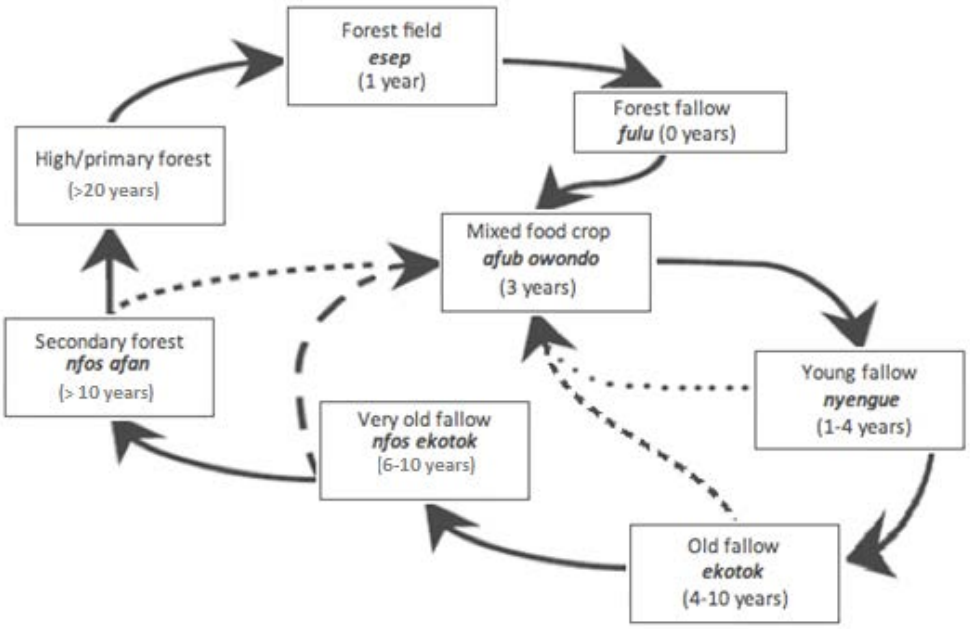

Figure 3.1 The shifting cultivation cycle of land use for forest, fallow and the mixed food crop field (adapted from Diaw (1997) and Brown (2006)).

The second diagram, figure 3.2, was used during the survey interview to represent the required *change* in their shifting cultivation practice as described in the choice experiment. Should the respondents choose to accept the given contracts, they would no longer be cultivating fallow older than ten years of age, thereby eliminating the forest field (*esep*) and creating the need for a compensation payment.

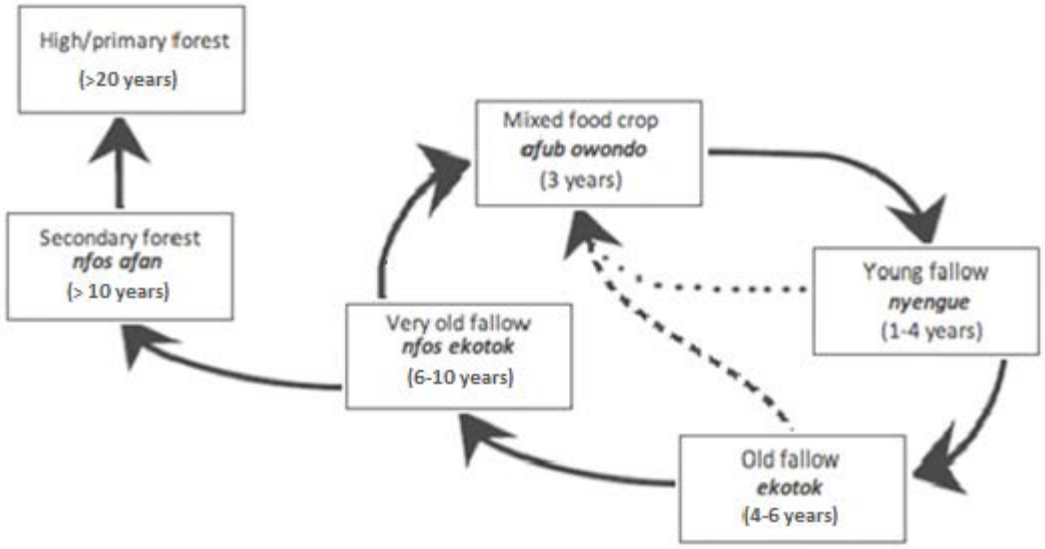

Figure 3.2 The restricted shifting cultivation cycle of land use for forest, fallow and the mixed food crop field after adoption of the tree conservation program (adapted from Diaw (1997) and Brown (2006)).

One of the topics that came to light in the focus group is that the people in Akok are aware that there is an issue with climate change and that they would be willing to modify some of their practices to help, if they are not made worse off by doing so. The general consensus was that in order to intensify the use of fallow fields to conserve the high forest areas, they would need better access to the proper tools to do so. In an effort to understand the likelihood of intensification, farmers were asked about the availability of fertilizers. The topic of fertilizers was met with both interest and concern from the community members present. They brought up several main barriers to fertilizer use: high prices, lack of knowledge of proper use, and lack of 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 someone was able to come into the village and teach them proper use. This became a common theme across this intensification inquiry: people are willing to move towards more modern (intensive) systems, yet they require significant support from external agencies to take this step. In an attempt to increase the smallholders' acceptance of the REDD programme in Akok, the agricultural extension agent was added as a

component of every contract. An additional statement, indicating that there would be an external agent working in the village that will teach the producers how to augment the production in their young fallow fields should they choose to adopt a REDD contract, was added to the choice experiment scenario outline.

The scenario outline continued by explaining the premise of a simple value chain for carbon and the idea that specific people or organizations would be involved in aggregating, verifying and paying for the certified emission reduction credits that would be produced through the conservation of forest in this program. The outline went further to explain that the integrity of such a program would depend on *who* was filling these specific roles, and how their relationships with the producers of Akok will determine the success of the program.

The description of the value chain involved in the tree conservation program was followed by an explanation of the idea that compensation would be necessary to make this program work. It explained that the developers of such a program are aware that it may be difficult for the producers in Akok to make the required changes to the way that they normally run their farming systems, thus providing the reason that they will be willing to pay for each person to participate in the program. During the pilot tests of the survey, the enumerators reported that there were numerous questions and concerns from villagers about the idea of compensation payments and worry over their property rights being taken away. Many people said that it sounds as though we are "*paying them to do nothing*" and asking whether "*the land [they] use will still belong to [them] if [they] take part in the program*." As such, a statement was included in the survey scenario that explained that they would now be paid to act as conservation agents of the forest and that the land would not be taken away from them. The enumerators of the survey spent the greatest proportion of the time with the respondents on this prefatory information to ensure proper understanding of the context prior to beginning the actual choice experiment.

3.3.2.2 Design of the choice questions

The information section was immediately followed with the choice task, where the respondent was presented with an offer to either adopt or reject a specific REDD contract comprised of experimentally designed attributes. This binary choice design framework is somewhat different from the majority of choice experiments which typically include a choice set of two or more different scenarios and a choice of "neither" (Adamowicz et al 1998)[4]. Recall that the binary choice model uses the Yes/No response format, therefore the respondent was asked to either say "Yes" to adopt a given REDD contract or "No" to continue with their normal shifting cultivation practices. The choice task was repeated four times in the survey, meaning the respondent was asked to choose whether or not they would adopt or reject four different contracts with varying attribute levels within each contract. Thus, the respondent's decision to adopt or reject a specific REDD contract would indicate their preferences towards the attributes that make up that contract.

One assumption underlying microeconomic theory and stated preference techniques is that individuals know their preferences perfectly, and are able to make stable and consistent choices (Brown et al 2008). In applications of modeling people's choices, it is common to assume that the choices are made with certainty, and the error in estimation comes strictly from missing variables or

[4] Another type of stated preference technique used in behavioural economics is the Best-Worst choice experiment, also known as Maximum Difference Scaling (Flynn et al 2007), where the choice task involves the respondent identifying the best and the worst parts of an available set of options. The best-worst approach is considered an attractive method as it allows you to investigate the attribute weight and the scales separately – something that is not possible with a traditional discrete choice experiment. The attribute weight refers to the impact that specific attribute has in the utility function, whereas the scale value represents the utility associated with that attribute taking on a specific level. Marley and Louviere (2005) claim the best-worst method is an easy task for people to complete because of the tendency for people to respond more consistently to extreme options. As such, the original survey was conceived using a best-worst framework. However, after careful review with experts in the field and an extended pilot test in Akok, this method proved to be a difficult and lengthy task for both the respondents and enumerators. The majority of the respondents in these pilot tests either accepted or rejected the contracts but found it very difficult to choose what was "best" or "worst" about it. The best-worst surveys were taking two to three hours to complete during the pilot tests. As such, the best-worst method was abandoned in order to minimize the cognitive complexity of this study and replaced with the traditional choice experiment using a binary response framework.

errors in measurement (Brown et al 2008). This is simply not a reasonable assumption, and the critics of this assumption go all the way back to Thurstone and McFadden, who each proposed models in which errors in judgement and preferences were not only allowed but were *expected* (Brown et al 2008). This is especially true in a situation where the scenario of a choice experiment is describing a new good, a hypothetical situation or a developing policy framework, as is the case of a REDD program. In order to minimize the potential hypothetical bias that tends to arise in stated preference choice experiments (as described in the recent meta-analysis by Little and Berrens (2004)) and to account for the uncertainty of preferences for a REDD program, I employed a set of certainty scale questions within the choice experiment. Certainty scales are a set of follow-up questions that allow the respondent to indicate how sure they are that they would actually make the choice that they just indicated (Morrison and Brown 2009). Typically, the scale responses are then used as a recalibration tool to switch some of the positive responses to negative responses if the individual is in fact unsure of their decision (Morrison and Brown 2009).

Researchers have long been aware that the order of asking questions in a survey can contribute bias in the responses (Perreault 1975). In order to minimise these biases, two versions of the survey were used. The first version of the survey (Version A) asked the respondent to first identify the certainty that they would participate in the program on a scale of 1-5 (where 1 = "I would definitely accept this contract," 2 = "I would probably accept this contract", 3 = "I do not know," 4 = "I probably would not accept this contract" and 5 = "I definitely would not accept this contract") and is then followed up with a binary yes/no choice. The second version of the survey (Version B) asked the respondent the binary response (yes/no) question first and was followed up by the certainty scale questions which asked them to indicate, on a 1-5 scale, how sure they are that their decision would be the same if the contract were actually offered. The scale ranged from "very sure," to "very unsure", with "somewhat sure", "I don't know" and "somewhat unsure" as the middle values, respectively.

These follow up questions asked the respondent to express their certainty for two reasons. The first reason addresses the uncertainty issue. By asking them if they are certain that in an actual scenario they would actually make the same decision it allows for some of the uncertain responses (2 through 4) to be moved into the more certain 1 (definitely yes) or 5 (definitely no) categories. The second reason was to allow the respondents the option to say "no" in a polite, socially acceptable fashion, thereby reducing the "warm-glow" bias that might arise by answering the questions in a way they believed would please the interviewer.

Another common method used in choice experiments to minimize hypothetical bias is to allow the respondent some "time to think" about their responses before they are asked to make a choice. Respondents may overinflate a stated value or preference in a choice experiment setting because they are reacting to a first impression or an unfamiliar situation. Sometimes, a survey is conducted with only one member of a household and they are asked to make choices that in reality they would spend a considerable amount of time discussing with their peers. This is especially true of the situation in a rural village like Akok where the families and clans often make decisions together, and where those families are so tightly interwoven with the rest of the community. Typically, a survey may be sent out in the mail and be returned upon completion, or there may be a preliminary information meeting prior to commencing the survey portion of a study in order to utilize the "time to think" technique in minimizing bias. However, the geographical situation and the uncertainty of retrieving the surveys if left with the respondents in Akok made it nearly impossible to incorporate a large amount of time to think in this study. At the outset the enumerators were trained to request the head of each household to answer the survey questionnaire; however they were also encouraged to promote discussion among husband and wife, brother and sister or whoever they would normally discuss household decisions with, before answering each question. The element of discussion about the survey was incorporated in an effort to reduce the hypothetical bias and enhance the validity of their responses. The focus group that was conducted prior to the commencement of the survey was thus not only a way to elicit some initial

response about our work, but it also served as a point to divulge some preliminary information. The village people who attended the focus group were all members of the community that would elicit conversation about this study with other members in their area. We were happy to find that nearly all households that responded to the survey were aware of the type of program we were proposing and had an idea of the type of questions that we were asking before we arrived at their doors.

3.3.2.3 Attributes and levels selection

The task of choosing the attributes and levels for the choice experiment was based on previous research into the potential REDD setup, PES schemes operating in other areas, the structure of current carbon markets and the key findings of our focus group discussion in Akok. The goal was to reduce the large number of important elements of a REDD program identified in the research down to only a few important attributes and levels relevant for this study. Reducing the number of attributes and levels within the design also allowed us to create a realistic scenario and maintain a cognitively simple choice task for the respondents.

Each attribute within the contract was presented as a discrete level that will subsequently allow for measuring the effect of changing these levels on the decisions to adopt or reject the hypothetical REDD contract. Each contract consisted of five attributes related to the hypothetical REDD scenario. The five attributes were: the level of payment received for joining the program, who is the agent acting as the aggregator for carbon, who is the agent that will be the verifier of the carbon sequestration, who is the agent willing to pay for the carbon offset and finally, the length of the contract. Only the last attribute, the length of time that the contract would be in place, has two varying levels, the remaining four attributes all possessed four possible levels. The specific levels associated with each attribute are presented in Table 3.1.

Table 3.1 Attributes and levels investigated in the choice experiment

Attribute	Description of attribute	Level
Payment level	How much the farmer will be compensated for signing REDD contracts (per year)	150 000 CFA (300 USD) 250 000 CFA (500 USD) 350 000 CFA (700 USD) 450 000 CFA (900 USD)
Length of contract	The period of time that tree conservation must be maintained	10 years 20 years
Aggregator	Who will be interacting directly with the farmers (as a type of carbon broker)	Government of Cameroon NGO Private company GIC
Verifier	Who will measure and verify that carbon is maintained on the landscape	Government of Cameroon NGO Private company GIC
End user	Who is buying/holding the carbon credit generated by the emission reduction	Government of Cameroon NGO Private company Developed country

Inclusion of a payment attribute is important in the design of the choice experiment as it provides a way to estimate the benefits associated with the monetary compensation for adopting the program and is consistent with welfare economics theory. Normally, attributes associated with both time and cost are assumed to possess negative utility. The use of a willingness-to-accept method in this study, rather than the more traditional willingness-to-pay method, means that the payment to the producer will have a *positive* impact on the decision to adopt the contract, rather than a negative impact – as is the case with a willingness-to-pay approach to valuation (Kjaer 2005). Therefore, the payment is expected to have a positive impact on the utility of the producer, making them trade-off the benefit of the payment for an increase in the negatively valued attributes as well as giving up the high-carbon land uses. This trade-off represents the *indirect* method of obtaining the producer's willingness-to-accept, as they are not directly being asked their willingness-to-accept as you would with the contingent valuation methodology (Kjaer 2005).

In an area such as Akok, where the community members are all very dependent on the availability of land and natural resources for their livelihood, the length of time that the producer is required to commit to a restricted cycle of land use is an

important element (Balana et al 2011). The opportunity costs of using the older fallow land areas, that would be restricted if the producer agreed to the REDD contract, are expected to play an important role in the decision to adopt a contract or not. The longer the contract period means that land-use options and potential revenue from other economics opportunities on the land are restricted for a longer period of time (Balana et al 2011). You would expect the utility associated with a longer contract to be negative as the length of time goes from 10 to 20 years. However, Arifin et al (2009) found that the opposite holds true when investigating the length of community forestry contracts in the Sumberjaya watershed in Indonesia. In certain areas of the developing world, where tenure rights are not secure the idea of signing a contract that will preserve some of their rights to the land for a specific number of years is in fact vary favourable. The respondents in the Arifin et al (2009) study indicated through their choices that they believed that a longer contract would reinforce their property rights over that portion of land for a longer period of time. This situation means that the utility associated with the length of the commitment period is positive. It is unclear whether the respondents in Akok will evaluate the tradeoffs of a longer or shorter contract period in a positive or negative way.

The remaining three attributes represented the three key roles of the value chain, (aggregator, verifier, and end user) and the levels were represented by the four key stakeholders identified (NGO, Government, Private company, and GIC). The levels associated with these attributes were chosen based on the review of current carbon trading schemes and current discussions regarding the design of REDD policy at the international level. It is difficult to hypothesize whether the person or agency taking on specific roles in the contract will have a positive or negative effect on the producer's decisions to adopt or reject the REDD contract. The utility that each producer associates with the specific attribute level for these stakeholders will depend on the perceptions and prior experience with these types of agencies. This question of whether it matters to the producer who the specific agent is playing these key stakeholder roles in the REDD program is a key focus of this study.

3.3.2.4 Experimental design

The choice experiment was designed using the *SPSS* statistical software package so that the attributes presented in Table 3.1 were combined in an orthogonal, main effects fractional factorial design. The design included a total of five attributes: four 4-level attributes and one 2-level attribute. The complete number of contracts made up of these attributes that could be presented to the respondent is therefore (4^4 x 2^1) or 512 possible contracts. It is not feasible for all respondents to evaluate the full profile of contracts in a meaningful way; therefore a fractional factorial design was used. The final experimental design included only the minimum number of contracts required to capture the main-effects for each attribute level. All higher order interactions, meaning the interactions between levels of one attribute with levels of another attribute, are assumed to be negligible and only the strictly additive variance components can be estimated (Adamowicz et al 1994; Louviere et al 2000). The attribute levels were combined in an orthogonal design to ensure they all varied independently of one another (Bennett and Adamowicz 2001). In order to further simplify the task for respondents, the sixteen surveys were segmented sequentially into four blocks. Each respondent faced only one version of the survey, therefore they each faced only one block of the fractional factorial. Although the experimental design was the same for both versions of the survey (A and B), half of the respondents were given survey version A with the scale questions first and the binary choice as a follow up, and half were given survey version B with the binary choice as the first question and the scale as the second question. As the fractional factorial is divided into four blocks and there are two versions it takes eight respondents to cover all possible alternatives in the design. The blocking strategy is useful to minimize the complexity and risk of fatigue when answering the survey but it increases the total number of respondents required and requires the assumption of identical preferences across respondents to the choice experiment for version A and version B, respectively (Bennett and Adamowicz 2001). Figure 3.3 and Figure 3.4 show a sample of the choice task set used in the choice experiment for version A and version B, respectively.

Figure 3.3 Sample contract and binary choice question with follow up (from survey version 1).

Contract #1A				
You will be paid *250 000 CFA* per acre per year.	**Your main contact person will be an agent from the *Government of Cameroon.* They will make all arrangements to do with your agreement.**	**You will have a technician from an *NGO* visit your farm to verify that no trees are removed before you are paid each time.**	**The people willing to pay for tree conservation are from a *Private Company.***	**The contract will be for *20 years.***

***P7Qa*. Suppose that this contract was being offered in your village. Would you agree to sign up for the program?**

1= ( ) I would *definitely* accept this contract.
2= ( ) I would *probably* accept this contract.
3= ( ) I am unsure about this contract.
4= ( ) I would *probably* ***not*** accept this contract.
5= ( ) I would *definitely* ***not*** accept this contract.

***P7Qb.* If the agreement was proposed exactly as is shown here, would you accept this agreement?**

1= ( ) Yes
0= ( ) No

Figure 3.4 Sample contract and binary choice question with follow up (from survey version 2).

Contract #1B				
You will be paid *250 000 CFA* per acre per year.	**Your main contact person will be an agent from the *Government of Cameroon.* They will make all arrangements to do with your agreement.**	**You will have a technician from an *NGO* visit your farm to verify that no trees are removed before you are paid each time.**	**The people willing to pay for tree conservation are from a *Private Company.***	**The contract will be for *20 years.***

***P7Qa*. Suppose that this agreement was being offered in your village. Would you accept this agreement?**

1= ( ) Yes
0= ( ) No

***P7Qb.* How certain are you that this would be your decision if this agreement was offered as-is in your village?**

1= ( ) I am *definitely* sure.
2= ( ) I am *somewhat* sure.
3= ( ) I do not know.
4= ( ) I am *somewhat* unsure.
5= ( ) I am *definitely* unsure.

3.4 Data Collection

The focus group discussion and survey interviews were completed during a 28-day period from the middle of February 2011 to the middle of March 2011 in Akok village. This study used a census of the entire village; a total of 169 households were included in the final survey data, 31 households were interviewed during the pre-testing, and 2 households opted-out.

The preliminary focus group was conducted in the most central of the sub-villages, and was initially intended to include only the leaders of these villages, however due to the dynamics within the village setting and many people's curiosity there was a much larger turnout than was expected.

The objectives of the focus group were: (1) to verify that the existing literature surrounding the shifting cultivation practices used in the area was still relevant and accurate; (2) to explain the idea of conserving forests as an environmental service that can provide benefits to both producers and investors; (3) to provide a venue for residents of Akok to express their views on the program and the idea of PES; (4) to generate discussion on perceptions and trust in outside organizations; and, (5) to determine a appropriate base level for the payment attributes in the contracts.

The information collected during the focus group discussion was used to clarify certain aspects of the choice experiment and survey. The shifting cultivation practices used in Akok were explained and there was a general consensus that fallow fields would be re-cultivated more often if they were able to get as much soil replenishment in a shorter time frame. The discussions were steered towards productivity of the forest lands and fertilizer use in the fallows. Although there was a resounding interest in increasing fertilizer use to increase fallow productivity, they expressed that the main barriers to use were poor access, high price and lack of knowledge on proper use. As such, in the final draft of the choice experiment, we included agricultural extension as an element of the REDD

program (i.e. an agent that would teach farmers in the community how to use fertilizer and would help gain access to low-cost fertilizer in the area).

There was a vast array of opinions surrounding the idea of a PES program to conserve forests and reduce emissions in Akok village. The idea was generally accepted, and there was lengthy discussion about how such a program might take shape in their village and which organizations might be involved.

The discussion on acceptable compensation for participation in a REDD program garnered the most lively reactions. As we expected, there were residents who were firmly opposed to such a program and were vocal in expressing very inflated prices (i.e. 5,000,000 CFA/hectare). Unfortunately, I believe that these high values may have anchored the responses of others in the group, resulting in estimates that were not credible and not useful for our survey composition. The opinion of the group was that cash payments (rather than fertilizer) were most preferable and that each family should be given control of splitting payments between households (rather than a village or group payment). In the end, four levels of cash payment were chosen based on careful examination of the contingent valuation card in section 8 of the survey during pre-tests of the survey in the field.

Four local enumerators were hired and trained to work with us in the village on all aspects of the study as they all spoke French, Bulu - the native language, and at least a small amount of English. The enumerators acted as moderators and recorders in the initial focus group and conducted all interviews with the respondents in Akok.

Chapter 4: Results

4.1 Introduction

This chapter begins in section 4.2 with a description of the survey sample demographics, reporting statistical and qualitative observations relating to landholders' levels of trust in different organizations and showing the quantitative results of the discrete choice experiment. Section 4.3 presents the results of the econometric modeling of the choice experiment and estimates of willingness to accept values for participation in the program. A latent class model and an extended interaction model are included in order to investigate the possibility of heterogeneity of preferences among smallholders for a potential REDD program.

4.2 Descriptive Statistics

4.2.1 Sample demographics

Table 4.1 presents a summary of the demographic characteristics of the sample. As I was specifically interested in speaking with the "*head of the household*" or "*the person who makes the farming decisions for this household,*" generally the eldest person in the household was interviewed. It is for this reason that the average age of the survey respondents in this study (48 years) is well above the median age of the population in Cameroon, 19.4 years (CIA 2012). Seventy-four percent of the survey respondents are male, indicating the prominence with which men in Akok are identified as the "*head of household*" and assume the role of primary decision maker with regards to farming matters for their families. The majority of the sample respondents are married and over half state that they have a secondary level of education[5]. There is a large variation in the size of the households in Akok, ranging from 1 to 46[6] people. On average, each household has 6.78 people, 41 percent of which were children (0-14 years) and 38 percent of

[5] There was no description included in the survey of the differentiation between "primary" and "secondary" education. As such these results should be looked at with caution.

[6] Large household sizes arise when there are several generations living within one household. There are also some households in Akok village that practice polygamy, making for very large households.

which were adults (21-60 years). The proportion of the survey respondents who stated that they were part of a village farming group (*Groupe d'Inniative Commune (GIC)*) was only 28 percent. However, of the people who were not already members of a GIC, nearly everybody said that they are planning to join if such a group became more accessible to them.

Table 4.1. Socio-demographic characteristics of the survey respondents (self-reported "head of household").

	Mean	Std. Dev
Sex (proportion male)	0.74	-
Age (mean no. of years)	48	14.2
Marital Status		
Married (proportion)	0.74	-
Single (proportion)	0.14	-
Widow (proportion)	0.11	-
Did not say (proportion)	0.01	-
Education		
No School (proportion)	0.02	-
Primary (proportion)	0.37	-
Secondary (proportion)	0.59	-
Higher Education (proportion)	0.01	-
Village farm group membership (GIC)		
Members (proportion)	0.28	-
Duration of membership (years)	6.28	5.18
Non-members wanting to join (proportion)	0.90	-
Household composition		
No. of children (0-14 years)	2.78	3.18
No. of young adults (15-20 years)	1.03	1.75
No. of adults (21-60 years)	2.62	2.50
No. of seniors (60+ years)	0.56	0.86
Total no. of people in household	6.85	5.72

During the focus group discussion it became apparent that although our preliminary research of the local terms describing the different types of fallow in the area were generally correct, the perception of the corresponding age ranges for each category varied significantly between households. We thus included a clarifying question in the survey to assess the respondents' perceived minimum age at which their fallow fields are considered to be within the specified category. The results, presented in Table 4.2, show the wide range of the perceived minimum age and the significant overlap of differing fallow age groups between respondents. The summary of household landholding's, including the total area of

each type of fallow and the crops they are currently cultivating, are also presented in Table 4.2.

Table 4.2 Fallow land available, perceived age of each fallow category, and current crop production per household.

Types of fallow	Local term	Mean of total area (Ha)	*Std. Dev.*	Mean of minimum age (years)	*Std. Dev.*	Range of minimum age (years)
Young Fallow	*Nyengue*	3.71	*3.33*	3.79	*1.36*	(1, 8)
Old Fallow	*Ekotok*	4.43	*3.28*	8.06	*2.94*	(4, 20)
Very Old Fallow	*Nfos ekotok*	5.35	*6.80*	16.33	*7.29*	(6, 40)
Degraded Secondary Forest	*Nfos afan*	10.42	*10.29*	22.11	*9.12*	(10, 50)
Types of crops						
Forest melon field	*Esep*	1.51	*1.49*			
Mixed food crop	*Afub owondo*	0.86	*1.05*			
Marshy field	*Asan*	0.16	*0.36*			
Cocoa agroforestry	*Cacaoyeres*	2.25	*2.30*			
Other	*Other*	0.07	*0.30*			

4.2.2 Trust statistics

Trust is being investigated in this study because it has often been argued that trust is a key ingredient to economic growth and success (Arrow 1972; Zak and Knack 2001; Etang 2010). In order for a program such as REDD to be developed and successfully implemented in Akok, as well as in other countries around the world that have historically held low levels of trust (Etang 2011), it is important to first gauge current levels of trust. One of the fundamental elements of the development of REDD is that it should be one part of a broader development strategy for these areas. However, development necessitates that there is trust between neighbors, between villagers, and between the communities and the active organizations. Trust at the village level would help ensure that smallholders who have adopted REDD programs would support each other with common farm-level interests and monitoring. Trust that smallholders place in the higher levels of organization (i.e. NGO's, Government, private companies) is fundamental to the efficient functioning of the entire REDD program, just as it is to economic development, because building those higher levels of social capital ensures that the smallholders trust that their needs will be met and that they continue to receive fair benefits from the program.

This study uses Likert-scale questions to quantify the smallholders' (self-reported) levels of trust in different sets of people and organizations. Previous studies have shown that individuals are typically most trusting of people and organizations with whom they interact on a regular basis and are least trusting of those that they do not interact with regularly (Fukuyama 1995; Etang 2010). Thus, my hypothesis was that the people in Akok would be most trusting of their fellow village members and fellow GIC members and less trusting of groups that they are not frequently interacting with (i.e. Government agents and other countries governments). Trust in NGOs and private companies can be hard to estimate, as their presence in Akok has been sporadic and sometimes not well documented, even though Akok has long been a go-to village for research studies and data collection with some NGOs and research organizations in the past. Some respondents have had direct interactions with people from these organizations and their perceptions of those previous engagements may directly affect their responses to this survey. Private companies are also known to be working in the area, which smallholders may or may not be aware of, so the amount of previous engagement between private companies and village people in Akok is also unknown[7]. The way the questions surrounding trust in NGOs and trust in private companies are framed, may have also had an impact on the smallholders' responses. These two questions were expressed as "I believe I can trust NGOs/private companies…," however, they also included the qualification of "working in your area," which may have automatically introduced a small bias if the wording made the respondents think of them as being in closer social proximity than the other groups.

Table 4.3 presents a summary of the responses to the Likert-scale questions on trust, showing that the respondents in Akok generally have a high level of trust in all of the organizations presented. Seventy percent of respondents were in positive agreement (i.e. Agree or Strongly agree) that they believe they can trust

[7]The representative levels of trust with different groups may fluctuate significantly throughout a village let alone a region or a country and thus the results must be taken as a context-specific application only.

the given group or organization, for all eight questions.[8] However, the hypothesis of an increasing level of trust with increasing social interaction is not accepted. Although there is not much variation in the results of the top three organizations, on average, respondents were most trusting of the Government of Cameroon. Fifty-eight percent (i.e. 98 out of 169) of them strongly agreed that the Government of Cameroon could be trusted. In total, 89 percent of the respondents were in positive agreement (agreed or strongly agreed) that they could place their trust in their own country's government. It should be noted that asking the question of whether they believe that they can trust in the Government of Cameroon may bring up some "yeah-saying" biases that we should be aware of. This bias may skew responses toward the positive side for this question because it is not customarily acceptable within the Cameroonian culture to openly express dissent for the government running their country, even if they disagree with the system that is in place. The next highest mean level of trust was in NGOs working in their area: 52 percent strongly agreed and 36 percent agreed (not strongly) that NGOs working in their area can be trusted. Following trust in the NGOs, the respondents placed their fellow GIC members and private companies working in their area as the fourth and fifth most trusted groups, respectively. Eighty-six percent of smallholders (who were already part of a GIC) agreed or strongly agreed that people within their own GIC could be trusted and 77 percent agreed or strongly agreed that private companies working in their area could be trusted. On average, trust in fellow village members was lower than all other organizations except for "other countries governments," with 70 percent of respondents in positive agreement (strongly agree and agree) that fellow village members can be trusted. Respondents had the lowest average levels of trust in other country's governments, which is in line with the hypothesis that smallholders' trust would be lowest with people that they are not directly interacting with. Of interest, however is the result indicating that the people in

[8] Two additional trust questions were asked, regarding the Ministry of Forest and Fauna, and the Ministry of Environment and Conservation. These questions are not included in Table 4.3 as there was no significant difference in trust between the different ministries and the Government of Cameroon.

Akok are generally less trusting of the people in their village than most other groups or organizations. This is contrary to previous studies that have found that trust diminishes with increased social interaction. Perhaps these results are due to the increased frequency of engagement with the people in one's own village that can bring an increased opportunity for disappointment or feelings of distrust.

Table 4.3 Count of responses to questions about trust in different organizations.

	Trust in the Government of Cameroon	Trust in NGO's	Trust in fellow *GIC* members	Trust in private companies	Trust in fellow village members	Trust in other countries governments
Strongly disagree	6	3	5	5	9	8
Disagree	6	8	7	14	15	12
Not sure	7	9	7	20	27	26
Agree	52	60	42	86	51	69
Strongly agree	98	88	74	44	67	53
No. obs	169	168	135	169	169	168
Mean	3.35	3.28	3.27	2.76	2.72	2.68
Std. dev	1	1.02	1.07	1.21	1.44	1.37
% not sure	4.14	5.36	5.19	11.83	15.98	15.48

A trend of an increasing middle value "not sure" response rate as the mean value of the trust levels decreases is evident in Table 4.3. It should be noted that 16 percent of smallholder's responded with "not sure" when asked whether they trust fellow village members, the highest middle value response rate of any of the trust questions. It is difficult to determine whether the people who said "not sure" were in fact unsure of their feelings, or if they were simply not willing to say how they felt or they didn't have any experience with the group; any of these reasons for being "not sure" have a probability of falling into this middle category. Although we made every effort to ensure that the way each enumerator was interpreting a "not sure" response as opposed to a "non-response" in the same way, there is some likelihood that some discrepancy between surveys is reflected here as well.

Although the survey data do not support the hypothesis of a positive correlation between trust and increasing social interaction, the generally high levels of trust we found in Akok may be important for REDD development. In order for a REDD project to be successful, i.e. the smallholders are willing to adopt the

contracts and agree to maintain the old forest on their land, one would expect the levels of trust between the smallholder and the organizations involved to be important. If the smallholder feels that they are working with an agency that cannot be trusted to fulfill their roles in the value chain, i.e. a verifier not making fair and accurate assessments of their trees, or an end user not providing the payments at specified times and dates as promised, it is unlikely that they will accept the given contract and adhere to the regulations set within it.

The levels of trust identified using the Likert-scale questions are subsequently used to determine whether an increasing level of trust in outside organizations (NGO's, private companies, the Government of Cameroon and other country governments), relative to village organizations, will significantly increase the probability of a smallholders' willingness to accept a given REDD contract (results presented in section 4.5). The hypothesis is that as the smallholders' levels of trust in outside organizations increases relative to their trust in fellow village members and fellow GIC members, the probability that they will accept a given REDD contract will also increase. Therefore, a trust index is created by first taking an average of each smallholder's reported levels of trust in two aggregated groups, "insiders" and "outsiders," based on the assumed social proximity of the organization to the smallholder[9]. The "insider" group includes those organizations closest to the smallholder, i.e. the fellow GIC members and the fellow village members. The "outsider" group includes the NGOs, the Government of Cameroon (including the two ministries), the private companies, and the other countries governments. A ratio of insider trust to outsider trust is calculated as the trust index. The value of the trust index will be higher for those people who are relatively more trusting of outside organizations and will be lower for the people who are relatively less trusting of outside organizations.

[9] The *assumed social proximity* is that the smallholders' are interacting more frequently with fellow villagers and the fellow GIC members than they are with the NGO's, Government, private companies and other governments. The distinction is made at this point following Etang's (2010) study "Analysing the Radius of Trust in Rural Cameroon."

Figure 4.1 presents the frequency of the trust index for all of the survey respondents, based on the survey version sub-samples. The calculated trust indexes ranges from 0.48 to 3.2, with a mean of 1.05 and a standard deviation of 0.38. Although the mean is centered close to 1, indicating that the average respondent has a fairly equal trust in inside and outside organizations, there is a longer right-side tail showing that the respondents have a relatively high trust in outside organizations. A t-test is used to check whether the mean trust index values of the two survey version sub-samples are significantly different from each other. The test results show that the two sub groups are not significantly different (p-value = 0.67) from each other.

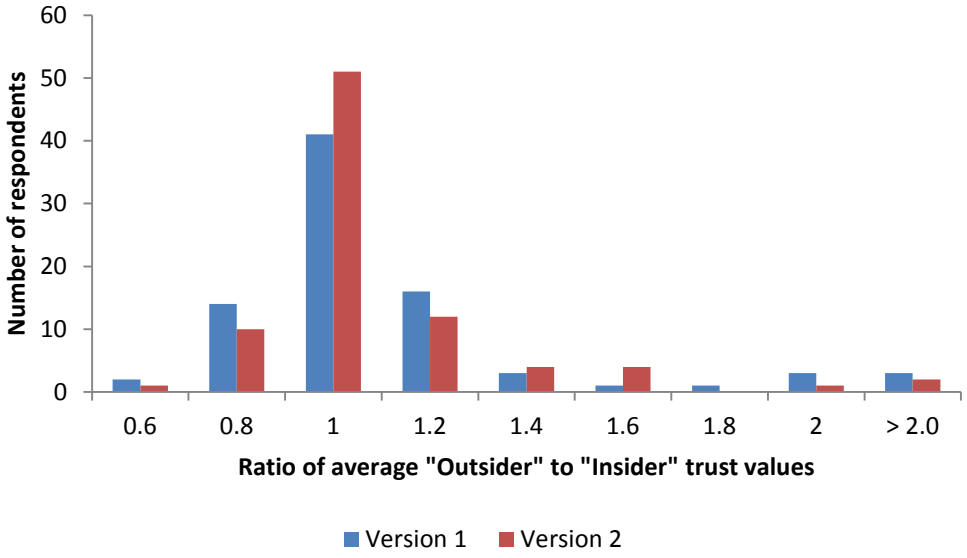

Figure 4.1 Histogram of the frequency of trust ratios

respondents were "somewhat sure" they would accept the given contract. There were a higher proportion of middle category ("I don't know") responses by those who answered survey version 1 than those who answered version 2 (4.5 percent versus 0.9 percent, respectively). There is also a difference in the number of respondents who are sure that they are *not* willing to accept the contract with 19 percent of version 1 respondents saying they would "definitely not accept" the contract and only 11 percent of version 2 respondents saying No and stating they are "very sure" of the decision to reject the contract.

Table 4.4 Summary of the responses to the choice experiment survey questionnaire.

Survey version 1				**Survey version 2**			
First question: Suppose that this contract was being offered in your village. Would you agree to sign up for the program?		*Second question:* If the agreement was proposed exactly as is shown here, would you agree to sign up for the program?		*First question:* Suppose that this contract was being offered in your village. Would you agree to sign up for the program?		*Second question*: How certain are you that this would be your decision if this contract was offered as-is in your village?	
Definitely accept	85			Yes	275		
		Yes	84			Very sure	93
		No	1			Somewhat sure	148
Probably accept	139					I don't know	2
		Yes	137			Somewhat unsure	26
		No	2			Very unsure	6
I don't know	15			No	65		
		Yes	3			Very sure	39
		No	12			Somewhat sure	7
Probably not accept	33					I don't know	1
		Yes	7			Somewhat unsure	10
		No	26			Very unsure	8
Definitely not accept	64						
		Yes	0				
		No	64				

4.3 Results of the stated preference models

4.3.1 Base models of very sure responses

Several studies have suggested that over/under-estimation of the true value that respondents are willing to pay/accept is a common hypothetical bias that arises in contingent valuation and choice experiment methodology (Blomquist et al 1999; Blomquist et al 2009; Little and Berrens 2004; Morrison and Brown 2009). The use of follow-up certainty scales has arisen as an effective means of calibrating the hypothetical mean willingness-to-pay (WTP) values in order to find more

realistic values (Morrison and Brown 2009; Little and Berrens 2004). Calibration of the WTP responses is done by eliciting some information about how "certain" the respondents are of their answers. Specifically, the number of no and yes responses are counted differently depending on the certainty of the answer. For example, only those respondents who are "very certain" of their response could be included as a "yes" response in one type of analysis, whereas another study may include all those that are "very certain" and "somewhat certain" as "yes" response. Currently, there is no standard "cut-off" point for the certainty of the responses, the decision to include some responses and not others is adjusted by the researcher and is considered to be context dependent (Morrison and Brown 2009).

There has been decidedly less work done to understand the relationship between real and hypothetical willingness-to-accept (WTA) measures than on willingness-to-pay (WTP) (List and Shogren 2002). Similar to the conclusion that WTP estimates are generally overstated in hypothetical trials, one might suppose that the opposite holds true when investigating WTA values. The idea behind this being that a respondent may understate the value they are willing to accept because it is a hypothetical situation and they want to "do the right thing" by asking for less money. Whereas, in a situation where the choice was real and they were held accountable to the decision they made, they would not accept the amount offered, but would rather ask for a higher payment. There is also the possibility that the respondent may overstate their WTA values, thinking that if a real program were offered in the future the payment offered may be based on their response to the current survey. List and Shogren (2002) compiled a list of studies that compare real and hypothetical statements in both WTP and WTA cases. Their results show that there is experimental evidence to support both overstated and understated values of WTP and WTA (List and Shogren 2002). As per the WTP case, the WTA studies did not suggest there is one accepted "calibration factor" or "cut-off point" that can explain the gap that arises between real and hypothetical WTA values, but rather the results are context specific (List and Shogren 2002).

The first three conditional binary logit models presented in Table 4.5 were estimated for the survey data using a certainty calibration that included only the very certain responses as positive responses for accepting the given contract. This model follows the convention in the literature that says that individuals that are uncertain of their choices generally become a "no" when the choice becomes consequential. The dependent variable in all three models took on the value of 1 for all responses where the smallholder answered "Yes" to accepting the given contract and would "Definitely accept" or was "Very sure" of their response. All other responses were included as a "No" response. The first model (Model 1) includes only the data from survey version 1, the second (Model 2) includes only survey version 2 and the third (Model 3) included the combined data from both versions 1 and 2. These models use only the contract attributes as explanatory variables of the utility function, no individual characteristics are included. Therefore, the conditional indirect utility of accepting the contract can be written as:

(15)

Table 4.5 Binary logit models of very certain preferences for a hypothetical REDD contract in Akok, based on subsamples of the two survey versions.

	Survey version 1 (Model 1)			**Survey version 2 (Model 2)**			**All data (Model 3)**		
	Coef.	**Std. Error**		**Coef.**	**Std. Error**		**Coef.**	**Std. Error**	
ASC	-2.567	0.658	***	-1.850	0.570	***	-2.172	0.428	***
Payment[a]	0.005	0.002	**	0.003	0.002		0.004	0.001	***
Time	-0.005	0.608		-0.187	0.551		-0.091	0.405	
Aggregator GOV	0.052	0.385		-0.034	0.344		0.003	0.255	
Aggregator NGO	0.060	0.232		0.028	0.216		0.043	0.157	
Aggregator PRIVATE	-0.087	0.248		0.029	0.223		-0.011	0.164	
Aggregator GIC[b]	*-0.024*			*-0.024*			*-0.035*		
Verifier GOV	-0.145	0.339		0.148	0.325		0.005	0.233	
Verifier NGO	-0.122	0.398		0.084	0.358		-0.015	0.263	
Verifier PRIVATE	0.179	0.225		-0.146	0.222		0.008	0.157	
Verifier GIC[c]	*0.088*			*-0.085*			*0.001*		
End user GOV	-0.261	0.407		-0.107	0.354		-0.184	0.265	
End user NGO	-0.203	0.255		-0.002	0.223		-0.092	0.167	
End user PRIVATE	0.016	0.401		0.297	0.379		0.150	0.274	
End user DEV.CNTRY[d]	*0.448*			*-0.188*			*0.127*		
No. obs.	336			340			676		
d.f.	11			11			11		
LLF	-178.06			-194.07			-374.67		
Mcfadden	0.058			0.027			0.036		

Note: *, ** and *** denote significance at 0.10, 0.05, 0.01 probability levels, respectively.
[a]:data for the level of payment has been rescaled for ease in modeling, dividing by a factor of 1,000.
[b,c,d:] : Implicit coefficients are calculated as the negative sum of the estimated effects coded coefficients:

A likelihood ratio test is used to check whether the preferences arising from the subgroups of the two different survey versions are significantly different from each other.[10] The test results show that the two sub groups are not significantly different (

alternative specific constant (ASC) and on the level of payment (

The remaining qualitative attributes associated with the key stakeholders in the contracts show a general lack of significance due to the large standard errors of the coefficients in the models. The attributes associated with the aggregators, verifiers and end users in the contract are not significant in any of these three models (all

per year based on a 10-year contract period. The WTA values presented are for three hypothetical contracts that have an agent from the respective administering organization filling *all three* key stakeholder roles within the value chain: aggregator, verifier and end user.[11]

Table 4.6 WTA values (in USD) (per hectare, per year for a 10-yr contract) for three hypothetical contracts, using the coefficients from the base model (Model 3).

Contract Attributes			Base model of certain responses (Definitely accept/Very sure Yes) (Model 3)
Aggregator	**Verifier**	**End User**	**WTA (USD) (per Ha, per year)**
Gov	Gov	Gov	$1,351.76
NGO	NGO	NGO	$1,289.90
Private	Private	Private	$1,172.70

Although an actual REDD program may not be aggregated, verified and financed entirely by one organization, for the purpose of this analysis, I include these three simplistic contracts as a baseline level of smallholder preferences and WTA of the specific organizations. The first involves the Government of Cameroon as the directing agency, the second is directed by an NGO and the third is directed exclusively by a private company. These contracts represent three plausible applications of a possible REDD scenario developing in Cameroon. Figure 4.3 presents the WTA values graphically with the mean WTA values indicated by the black perpendicular lines. The WTA value is found at the 50 percent level of probability of acceptance.

The WTA amounts of the three different administering organizations are not significantly different from one another. The contract being administered by the Government of Cameroon has the highest WTA value, $1,351.76 US per acre per year, indicating that the average respondent is less attracted to adopting a contract administered by his/her own country's government then a contract with an NGO or a private company. In other words, the average smallholder requires the most compensation in order to agree to take part in a program with the Government of

[11] These calculations are done including the

Cameroon. The average smallholder requires $1,289.90US or $1,172.70US per acre, per year in compensation for taking part in a program administered by an NGO or a private company, respectively.[12]

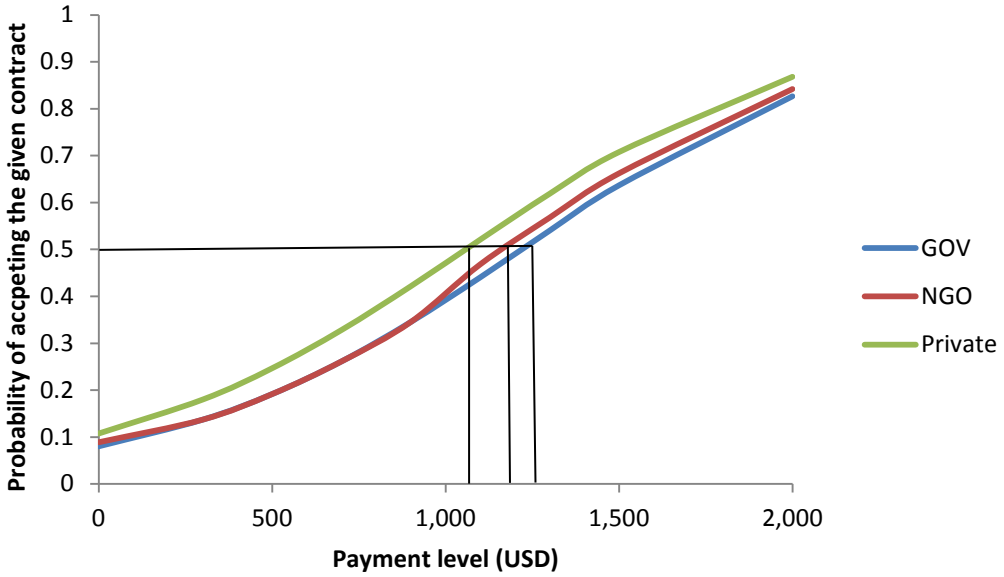

Figure 4.3 Probability of a very certain acceptance of the given contract (model 3) versus the level of compensation, WTA values are indicated at the 50 percent probability level (black lines). Contracts are based on a 10-year period with aggregator, verifier and end user from the respective organization.

In the description of choice experiment, it was explained that the changes to the farming practices would only influence the areas of forest and fallow that have more than 10 years of growth. The smallholders would no longer be cultivating the forest melon fields (*esep*), and would be re-cultivating the younger fallow fields more often. The cultivation and maintenance of cocoa agroforestry fields would not be impacted by the REDD PES program. However, the high values of WTA that were estimated from the stated choice experiment results lead me to believe that the smallholders may have been including both the costs of decreased soil fertility and the opportunity cost of creating cocoa agroforestry plots in their values of required compensation. Vosti et al (2005) and White and Minang (2010) report that the financial profitability of a typical slash-and-burn system in

[12] Several additional contracts, with mixed organization administration were included in the calculations of WTA; however they produce similar results with only slight variations in the dollar values.

the ASB Cameroon Benchmark area can range between $300 USD to $600 USD per hectare per year and the financial profitability of a cocoa-agroforestry system can range from about $500 USD to $1,400 USD per hectare per year. Thus, the WTA results in Akok may, at first, seem quite high when compared to the economic situation in Akok, but they are in fact quite plausible when compared to the findings of Vosti et al (2005) and updated in White and Minang (2010).

4.3.2 Heterogeneity of preferences

The results of the choice experiment presented in Table 4.5 and the WTA values presented in Table 4.6 represent the median preferences of smallholders in Akok under the assumption that their preferences are homogenous. However, preferences for goods and services are epitomized by heterogeneity (Boxall and Adamowicz 2002). Thus, it is likely that amongst the smallholders in Akok there exists a range of preferences for the hypothetical REDD contracts. There are two methods for classifying individuals in a choice experiment, both of which are used in this study. The first is a method of classification called latent class analysis, where the researcher does not observe the basis for the classification, but uses statistical techniques to uncover "latent" classes that exist based on the choices the respondents are making. The second is an *a priori* method where the researcher is imposing the classification, i.e. the data is re-organized or a sub-sample of the population is examined against a base model to investigate the preferences of the particular subset. This method is employed later in the chapter, section 4.3.2.2, where the preferences arising from the base model (Model 3) are compared with a model of the uncertain responses.

4.3.2.1 Latent class model results

Latent class analysis is used here to attempt to categorize the range of smallholders' preferences into discrete segments of the population that represent the main "types" of individuals. A two-class model is chosen because the higher class models had very high standard errors, likely due to the small size of the

dataset[13]. A preliminary unrestricted latent class model was estimated using the full utility function as in Model 3 above (found in Table 6.1 in Appendix B). However, due to the relatively small sample size and the consistent findings of insignificance of all of the value chain attributes on the preferences of the respondents, a secondary restricted model is estimated that includes only the constant and the payment (

Table 4.7 Binary logit model of preferences for a hypothetical REDD program with two latent classes (based on the very certain response base model 3).

	Parameters for class 1 ("reluctant" participants)			**Parameters for class 2 ("interested" participants)**		
	Coef.	Std. Error		Coef.	Std. Error	
ASC	-5.149	1.240	***	-0.956	0.558	*
Payment[a]	0.008	0.003	***	0.007	0.002	***
Average class probabilities	0.676			0.324		
Class probability model (Class 1)						
ASC	-1.038	1.717				
Trust	-0.207	0.557				
Age	0.038	0.017	**			
Education_none	-2.214	1.928				
Education_primary	-0.255	1.501				
Education_secondary	0.687	1.491				
Education_higher[b]	*1.782*					
Young fallow	-0.022	0.059				
Old fallow	-0.007	0.007				
Very old fallow	0.002	0.001				
Secondary forest	-0.002	0.001	**			
No. obs.	676					
d.f.	22					
LLF	-292.99					
McFadden Pseudo R2	0.223					
AIC	614					

Note: *, ** and *** denote significance at 0.10, 0.05, 0.01 probability levels, respectively.
[a]: data for the level of payment has been rescaled for ease in modeling, dividing by a factor of 1,000.
[b]: Implicit coefficient,

What is immediately apparent is the large difference in alternative specific constants, between the two classes. Although both constant coefficients are negative, class 1 has a much greater negative value indicating that the respondents in class 1 require a great deal of compensation in order to accept the given contract and are, in general, fairly reluctant to take part in the program. The preferences shown by the respondents in this reluctant class are akin to those reported in the whole base model (model 3). Class two has a much smaller negative constant coefficient, indicating that although those smallholders still require a payment in order to accept the given contract, it does not weigh as heavily on their utility and preferences as a whole, as such, I refer to them as "interested." The interested people apparently find some value in the program itself, and are therefore willing to take part in the program even with very little

monetary compensation. The coefficients associated with the payment are positive for both classes, as expected, and are not statistically different from one another. The positive value means that the smallholders in both classes have an increasing marginal utility of money, i.e. even though the interested individuals are willing to participate for very little compensation, they will still be happier if you pay them more money. There is a 68 percent probability that the average smallholder will have preferences akin to those that are more reluctant, making class 1 the larger of the two classes.

Class membership is influenced by the age of the respondent and by the amount of secondary forest (hectares) that they have access to. As the respondents get older they are more likely to be more akin to class 1, showing their aversion to participating in the program. The smallholders with more secondary forest are more likely to fall into class 2, indicating that smallholders who have greater areas of secondary forest at their disposal are more likely to be interested in participating in the program and may require less compensation. The trust index and the level of education do not have significant influence on class membership.

4.3.2.2 Modeling strong and uncertain preferences

Two further models are included in the analysis in order to investigate the heterogeneity of smallholder preferences for the hypothetical REDD contracts based on observations in the focus group and in discussions with survey respondents. There were three different types of responses observed in Akok. There were those who would accept any contract that was offered. The choices of these people were not influenced by changing the attributes of the contracts. This first type of respondent has some underlying utility associated with the program itself that makes them want to accept a contract at any level of payment; some of these people would even be willing to *pay* to take part in the program. The second type of respondent is uncertain of his or her preferences for different attributes of the contract; therefore, their decisions are based on the trade-offs of utility associated with different attributes and different levels of payment that is offered. The payment required by these respondents was within the range of bids

that was offered in the choice experiment. Finally, the third type of respondent included the people that would *not* accept a contract at any level of payment or combination of attributes that was offered; it is within this group that you find those people who had some underlying disutility associated with the type of contract that we were discussing and neither the attributes of the contract nor the level of payment would change their decisions.

The *ex-ante* method of researcher-imposed segmentation of the survey population is used in order to classify the individuals into the three distinct classes, or "types" of respondent outlined above. Model 5 in Table 4.8 investigates the preferences for the different attributes and levels described in the contract for people with strong preferences for and against hypothetical REDD contracts[14]. These strong positive and negative responses can be analyzed in one binary logit model as the dependent variable takes a value of 1 for all those that are *strongly in favor* of the hypothetical contract and 0 for all those responses that are *strongly opposed* to the given contract. Removing all the remaining "uncertain" responses decreases the sample size to 280 observations. Model 6, also presented in Table 4.8, includes all of the responses that are within the "uncertain" group. In this model, all of the strong responses that are analyzed in Model 5 are removed, leaving the 395 observations of varying degrees of uncertainty including all responses from "probably accept" to "probably not accept" for survey version 1 and from "somewhat sure" to "very unsure" for survey version 2. Thus, the dependent variable takes the value of these uncertain respondents' corresponding binary Yes/No response. This model is used to examine whether those people that are not entirely certain of their decision to adopt the contract if it were a real situation will have significant preferences for a contract based on the different levels of the attributes in the given contracts.

[14] Strong preferences and uncertain preferences binary logit models were estimated for the separate survey versions. A likelihood ratio test shows that the preferences arising from the two separate survey version models are not statistically different from each other (

Table 4.8 Binary logit models of preferences for a hypothetical REDD contract in Akok, based on subsamples of strong and uncertain preferences.

	Strong Preferences Sample (Model 5)			Uncertain Preferences Sample (Model 6)		
	Coef.	**Std. Error**		**Coef.**	**Std. Error**	
ASC	-1.340	0.540	**	1.130	0.568	**
Payment[a]	0.006	0.002	***	0.121	0.359	
TIME	0.288	0.546		0.257	0.262	
Aggregator GOV	0.176	0.358		-0.017	0.247	
Aggregator NGO	-0.076	0.223		*-0.360*		
Aggregator PRIVATE	0.149	0.252		0.242	0.387	
Aggregator GIC[b]	*-0.249*			-0.312	0.378	
Verifier GOV	-0.294	0.314		-0.287	0.233	
Verifier NGO	-0.374	0.355		*0.357*		
Verifier PRIVATE	0.124	0.241		-0.134	0.363	
Verifier GIC[c]	*0.544*			-0.290	0.224	
End user GOV	-0.592	0.356	*	-0.184	0.386	
End user NGO	0.058	0.241		*0.608*		
End user PRIVATE	0.063	0.398		0.002	0.002	
End user DEV. CNTRY[d]	*0.471*	0.546		0.270	0.567	
No. obs.	280			395		
d.f.	12			12		
LLF	-167.75			-174.22		
Mcfadden	0.089			0.023		

Note: *, ** and *** denote significance at 0.10, 0.05, 0.01 probability levels, respectively.
[a]: data for the level of payment has been rescaled for ease in modeling, dividing by a factor of 1,000.
[b,c,d]: Implicit coefficients are calculated as the negative sum of the estimated effects coded coefficients:

The results of model 5 support the idea that the respondents with strong certainty levels are responding positively to an increasing level of payment

preferences ($p > 0.10$) for the attributes within the hypothetical REDD contracts, indicating that these individuals are not responding to the contract attributes in their adoption decisions. Of interest, however, is the positive sign of the constant coefficient in this model. A positive constant indicates that these respondents have a positive utility associated with the program, relative to the base farming situation, independent of the payment. They believe that there is value in the program itself, over and above the compensation that they are paid to participate, when compared with the option of continuing the customary shifting cultivation practices on their land. It is likely that a larger dataset would provide greater detail and insight into the preferences that smallholders have for the different attributes of a contract.

4.3.2.3 Analyzing the effect of trust on stated preferences

The latent class model (presented in section 4.3.2.1, Table 4.7) includes only the respondents that are very certain of their decisions as a "yes" response in the dependent variable and found that the trust index does not influence class membership of the respondents. All of the respondents that are somewhat uncertain of their actual responses were included in the "no" group in the previous models. However, it may be possible that it is those "uncertain" individuals who have more specific preferences for different attributes of the contracts. Their "uncertain" response may come from the difficulty in assessing the tradeoffs between the different attributes of the contract. The problem is that this isn't being picked up in the previous models because the individuals with the strong opinions on the program are masking the nuances of the uncertain group. In order to further investigate whether an increasing level of trust in "outside" organizations will influence the preferences of the smallholders in Akok, I have chosen the "uncertain" group (estimated in model 6) for further analysis. In this new extended model I use the *a priori* method of classification to select the "uncertain" group, and then investigate preferences by including the trust index in the utility function through several interaction variables. The extended model was estimated separately for each survey version as well as the aggregated data. Table

4.9 presents the results of these three models. Model 7 includes the data from those respondents who answered survey version 1 only, Model 8 includes only the respondents who answered version 2, and Model 9 includes all of the data. Model 7 provides several more significant coefficients than both Model 8 and Model 9, therefore only Model 7, based on survey version 1 data, will be discussed with respect to the influence of trust on the utility of a REDD program. Nonetheless, the likelihood ratio test used to check for statistically significant differences between the models finds that the two sub-groups are not significantly different (

Table 4.9 Binary logit models of preferences for a hypothetical REDD contract in Akok, based on subsamples of survey versions for all "uncertain" responses.

	Survey version 1 (Model 7)			Survey version 2 (Model 8)			All data (Model 9)		
	Coef.	**Std. Error**		**Coef.**	**Std. Error**		**Coef.**	**Std. Error**	
ASC	8.849	4.403	**	-3.646	5.181		2.183	2.472	
PAYMENT[a]	-0.028	0.015	*	0.023	0.017		-0.002	0.008	
TIME	-7.648	4.317	*	6.009	5.345		-0.631	2.461	
Aggregator GOV	-4.068	2.826		3.302	3.967		0.200	1.747	
Aggregator NGO	-0.965	1.691		-2.022	2.271		-0.301	1.167	
Aggregator PRIVATE	-0.463	2.274		4.740	2.691	*	-1.203	1.290	
Aggregator GIC[b]	5.496			-6.020			1.304		
Verifier GOV	1.595	2.561		-1.490	3.147		0.027	1.700	
Verifier NGO	7.276	3.408	**	-3.653	2.770		0.951	1.483	
Verifier PRIVATE	-0.852	1.608		0.624	2.132		-0.548	1.072	
Verifier GIC[c]	-8.018			4.519			-0.430		
End user GOV	8.728	3.531	**	-4.742	3.246		1.736	1.672	
End user NGO	-3.229	1.521	**	-0.503	1.998		-2.277	1.054	**
End user PRIVATE	3.209	2.488		-3.005	3.645		1.049	1.578	
End user DEV.CNTRY[d]	-8.708			8.249			-0.508		
Trust*PAYMENT	0.031	0.014	**	-0.023	0.017		0.004	0.008	
Trust*TIME	-16.54	8.321	**	11.64	10.47		-1.889	4.672	
Trust*Agg GOV	4.106	2.667		-2.898	3.969		-0.040	1.659	
Trust*Aggregator NGO	1.457	1.697		1.879	2.237		0.477	1.118	
Trust*Aggregator PRIV	0.604	2.313		-4.733	2.525	*	1.234	1.282	
Trust*Aggregator GIC	-6.167			5.752			-1.671		
Trust*Verifier GOV	-1.463	2.460		2.246	2.948		0.225	1.586	
Trust*Verifier NGO	-7.761	3.347	**	3.020	2.520		-1.328	1.398	
Trust*Verifier PRIVATE	0.285	1.625		-0.574	2.022		0.269	1.032	
Trust*Verifier GIC	8.938			-4.693			0.834		
Trust*End user GOV	-9.098	3.429	***	4.522	3.076		-1.847	1.571	
Trust*End user NGO	2.841	1.511	*	0.612	1.935		1.986	1.034	*
Trust*End user PRIVATE	-3.563	2.454		2.735	3.549		-1.253	1.486	
Trust*End user DEV.CNTRY	9.820			-7.870			1.113		
No. obs.	187			208			395		
d.f.	22			22			22		
LLF	-82.76			-78.37			-169.9		
McFadden	0.147			0.061			0.047		

Note: *, ** and *** denote significance at 0.10, 0.05, 0.01 probability levels, respectively.
[a]: data for the level of payment has been rescaled for ease in modeling, dividing by a factor of 1,000.
[b,c,d]: Implicit coefficients are calculated as the negative sum of the estimated effects coded coefficients:

Immediately apparent when looking at Model 7 is the large number of explanatory variables that have a significant influence on the preferences for the hypothetical contracts. The interaction of

coefficient are the opposite of what I expected, likely due to some collinearity of the attributes interfering with the model. Looking at the signs of the coefficients will give us some insight into the influence of trust on smallholder's preferences for the contracts. Willingness to accept values are not able to be calculated for this model because of the lack of confidence we have in the coefficients on the payment and the constant. Thus, although we find that the preferences of the uncertain smallholders' *are* influenced by the amount of trust they place in outside organizations relative to village organizations, we cannot quantify these results with specific dollar values on the WTA.

The conditional results of the uncertain subgroup suggest that as the average smallholders' trust in outside organizations (NGO's, private companies, the Government of Cameroon and other country governments) increases they will become *less sensitive* to the payment level of the program, to the role of end user being played by an agent from an NGO and to the longer contract period. This is an interesting result because it indicates that as the average smallholder becomes more trusting of the outside organizations they will be *more likely* to adopt a contract with a lower payment, a longer time commitment or a contract with an NGO financing the program in the role of end user. On the contrary, as the trust in outside organizations increases relative to the trust in village organizations the average smallholder becomes *more sensitive* to a contract that has an agent from an NGO employed as the verifier or an agent from the Government of Cameroon acting as the end user of the program. Thus, an average smallholder who is more trusting of outside organizations relative to village groups will be *less likely* to accept a contract with a verifier from an NGO or a contract with the end user being the government of Cameroon.

Chapter 5: Discussion and conclusions

5.1 Introduction

An overview of the study is presented in section 5.2, followed by discussions of empirical and methodological findings, and the implications for REDD development, in section 5.3 and 5.4, respectively. Section 5.5 presents the implications for choice experiment methodology in developing countries. Study limitations and future research are detailed in section 5.6.

5.2 Overview of the study

A central element of REDD implementation includes making payments for environmental services to landholders in the forest-margin zones of developing countries. It is these regions where complex multiple-use land frameworks sometimes make deforestation and forest degradation imminent, but also where the greatest possibilities fo forest protection lie. The ASB Partnership for the Tropical Forest Margins has devoted significant resources into researching what will be required to develop a forest conservation regime that efficiently reduces emissions while protecting the rights of the people who depend on those complex landscapes for their livelihoods. However, the vastly different socio-economic situations, drivers of deforestation, and forest-tenure systems that are found in developing countries throughout the world, along with the necessary engagement of all sectors (local communities, government, etc.) within the REDD value chain, make developing effective REDD policies an onerous task. What motivates this study is the acknowledgement that in order for a voluntary REDD PES system to successful it must: (1) be fairly designed and implemented in a way that fully respects the rights of the local farmers and forest users to FPIC and, (2) efficiently produce measurable, reportable and verifiable reductions in greenhouse gas emissions.

This study looked at only a small piece of one of the many questions surrounding the use of PES programs for REDD. The principle objective of this study was to

investigate household perceptions of REDD value chains and to assess preferences towards the attributes of possible contracts that influence decisions to adopt local-level REDD projects, in the village of Akok, Southern Cameroon. To accomplish these goals, a household survey was conducted with the residents of Akok in February of 2011, consisting of a focus group discussion and individual interviews with the head of each household in the village. This study uses an attribute-based stated choice experiment, to elicit smallholders' preferences for various aspects of a possible REDD program. The choice experiment was designed to mimic the early stages of the process behind FPIC, by giving those who may be involved in or affected by a future REDD scheme a venue to voice their preferences towards different types and designs of REDD contracts and the associated value chains. A series of choice models, a latent class model and willingness-to-accept values were estimated using the choice data from the survey and individual-specific demographic and trust characteristics.

Results indicate substantial preference heterogeneity within the population, showing that there are some distinct preferences within the population, where one preference class is more willing to participate in a REDD program than a second class that appears much more reluctant to enter into a REDD contract. Results also indicate that the certainty with which respondents made choices to accept a given contract influences the nature of their preferences. The calibration of choice responses using the respondents' certainty levels brings about some important results and potential issues with the methodology that is used for conducting choice experiments in developing countries.

In general, the attributes of the value chain did not influence the decisions to accept a REDD contract or not; rather, the decisions appear to be based on financial compensation for participation. A range of WTA values are estimated, which are higher than previous studies looking at the opportunity cost of switching from low-carbon land-uses to higher-carbon land uses in the village of Akok. However, when we look at the land-use trajectories that would be forgone by taking part in the REDD contract, the value that smallholders place on slash-

and-burn methods to replenish soil fertility, and the fact that the majority of smallholders in Akok are reluctant to participate in the REDD program, the WTA results are high but not unbelievable.

5.3 Discussion of findings

The analysis of smallholders' preferences for REDD contracts using the choice experiment has given rise to several notable empirical findings: (1) the general indifference towards the key stakeholders taking part in the contract, (2) the high value of WTA required to elicit contract adoption, (3) the distinct preference heterogeneity found in the population of Akok village, and (4) the impact of individual levels of 'trust' on preferences for contract attributes of those people who are not certain of their decisions.

5.3.1 Demand for contract attributes

The objective of this study was to investigate how the preferences for the attributes of a hypothetical REDD value chain would influence smallholders' decisions to adopt a REDD contract. Not only was I interested in looking at the tradeoffs between different contract attributes, but I was also interested in whether changing the levels (i.e. changing the acting organizations and payment levels) of each attribute would significantly influence the preferences. Following the choice experiment literature, results are based on a model that includes only the respondents who stated that they were very certain that they would adopt the given contract. Ruling out responses from the respondents who were less certain produced the model with the most economically reliable results. The results indicate that, in general, smallholders' decisions to adopt the hypothetical contract offered in the choice experiment were not influenced by *who* was filling the specific roles at each stage of the value chain (i.e state, non-governmental organization or private sector). The respondents showed strong preferences, instead, for the level of the compensation payment they would receive if they accepted the given contract.

Recall that the restrictions of the program, outlined in the choice experiment, would require that the smallholders who chose to accept the hypothetical contract would no longer be allowed to clear the trees in fallow fields that are older than 10 years of age. That would mean that they would be required to abstain from cultivating new plots in the primary and secondary forest zones although they would have done so historically in their crop rotation (see figure 3.2 in section 3.3.2). One valuable crop that is not included in the typical slash-and-burn crop rotation diagram (figure 3.2) is the cocoa-agroforestry production. Cocoa fields are typically created in primary and secondary forest areas that have been cleared of the under-story and brush, and have then been used as forest melon fields (*esep*) for 1 to 2 years. Therefore, under the requirements outlined in the hypothetical REDD contracts, cocoa fields would also *not be allowed* to be created in primary or secondary forest land. One thing to note, however, is that the smallholders' in Akok have not been creating new cocoa fields in their region on a regular basis in recent years. The average household does maintains 2.25 ha of cocoa in Akok village (*std. dev* = 2.5), yet nearly every person cultivating cocoa explained that their fields had been passed on to them through the generations of family that lived there before them. That being said, the high values of WTA estimated in Akok make me believe that the smallholders' were recognizing the full trajectory of land-use opportunities that would be forgone, (including the opportunity cost of future cocoa production) as well as underlying issues (i.e. risk, tenure, labor, etc), if they chose to take part in the program.

5.3.2 Willingness to accept a REDD contract

With regard to the WTA results, I estimated that the average smallholder in Akok requires a payment of $1,351.76, $1,289.90, or $1,172.70 USD per hectare, per year to accept a 10-year contract with the Government of Cameroon, an NGO or a private firm, respectively. The WTA results in Akok seem quite high when compared to the economic situation in Akok, but they are in fact quite plausible when you include the opportunity cost of forgone land-use for cocoa agroforestry and the costs of the replenishment of soil fertility.

It became apparent in Akok village that there are individuals situated all along the continuum of WTA values, and although this survey only included four separate levels of payment, there were individuals who would adopt a contract for less than we offered, as well as individuals who appeared to have a much higher WTA than our maximum offer. An important implication for REDD that stems from this analysis of WTA is the idea that offering only a single payment price for adopting the contract may not be an economically efficient way of implementing a REDD scheme. There is the potential that future discussion on REDD could use reverse auctions (where producers compete against each other to "win" the payment from the buyer typically by lowering the prices) as an innovative way to reflect producers' opportunity costs in a PES programme for REDD.

5.3.3 Preference heterogeneity in Akok

By first identifying the underlying latent segmentation of the population, the results indicate that there are two distinct preference classes within the population of Akok, (1) those who are reluctant to participate in the program, and (2) those who are interested in participating. Following up with the a priori method of investigating the heterogeneity of preferences strengthens the findings by demonstrating that the subgroup of individuals who are less certain of their decisions have much different preferences for the REDD program than those who are more certain. Upon further examination of the group of "uncertain" respondents, I find that individual levels of trust influence the preferences that these respondents feel towards the different attributes of the contracts.

The existence of substantial preference heterogeneity within the population of Akok village corroborates with two similar studies using latent class analysis in the assessment of preferences for PES programs. In Akok, the larger group of respondents have a general aversion to the REDD program and thus, require a large payment in order to overcome the utility of the status quo, which is continuing with business-as-usual practices on their land. The smaller group of respondents hold some level of utility in the program itself, regardless of whether they receive monetary compensation. Ruto and Garrod (2009) found similar

results in their investigation of preferences for voluntary agri-environmental PES schemes throughout Europe, with the existence of a dichotomous split within their sample population, with a first group of "high resistance" adopters and a second group of "low resistance" adopters. Similar to the results of my latent class model, Ruto and Garrod (2009) found a large difference in the coefficients on payment; indicating that a big segment of their sample would be willing to accept relatively small incentive payments for their participation, while the second, smaller class of participants was much less willing to participate without a large payment. Similarly, Kaczan (2011) used a latent class analysis to investigate preferences for PES programs to reduce deforestation in the East Usambara Mountains, Tanzania and found distinct heterogeneity within his sample. Kaczan's results parallel the findings of my study, where a subset of environmentally minded farmers are willing to adopt the program without payment, while the second group is resistant to participation without being paid a very high amount of compensation, regardless of the attributes of the program.

When looking at the smallholder's socio-demographic characteristics that influenced preferences for REDD contracts, the latent class model suggested that older farmers tended to fall within class 1 and were only willing to participate in the program if they received a large payment in compensation. Members of the second class, those who were much less resistant to participating in the hypothetical program, even with lower payment schemes, tend to be younger and have larger holdings of secondary forest on their land. The influence of age and farm-size on PES program adoption corroborate with Ruto and Garrod's (2009) study, as well as other studies that have looked at the pre-disposing factors to participation in agri-environmental schemes (Wilson 1997; Wynn et al 2001, Vanslembrouck et al 2002). Ruto and Garrod (2009) also found that the members of the "low resistance adopters" group tended to be better educated than those that were more resistant to participation. Interestingly, the education variable in my study showed the opposite trend; respondents with higher levels of education tended to be more resistant to adopting the given contract, although this result was not statistically significant. Replicating the study in other areas, with larger

populations would be insightful and it would be necessary in order to understand whether education does play a role in preferences for REDD PES programs.

Removing the subset of the population that has a high level of certainty and examining only those that are uncertain of their decisions to adopt or reject the contracts gave me the opportunity to try to isolate significant preferences for the attributes of the contracts. The results show that the two groups (certain/uncertain decisions) have significantly different preferences for the REDD program. Members of the group with strong levels of certainty in their responses hold similar preferences to the larger group of respondents with strong resistance to adoption that was found in model 4. These respondents are quite adamant that they *will not* adopt a contract unless the payment they receive is large enough to overcome their aversions to changing their current farming practice, regardless of the attributes of the contracts. On the contrary, the group of respondents who are *not certain* that the answers they provided in this study are true to what their decisions would be if this were really offered in their village, are *very willing* to adopt a contract and will even pay to take part in the program. Studies heretofore have not paid attention to certainty issues with respect to preferences for REDD PES programs; however, the heterogeneity of the uncertainty is clearly an important aspect to understanding how these programs could work.

Although the data collected in this study does not allow me to draw conclusions as to exactly why a group of people are interested in participating in a REDD program without being compensated for the land-uses that they will have to forgo, there are a couple of possible explanations. Foremost, is the idea that although they will be required to change their farming practices, they can gain by entering into a contract with an external organization. It was explained that the contract would include the development of agricultural-extension within the community in order for smallholders' to learn practices to improve production when cultivating the younger fallow and less fertile plots of land more often. Similarly, Kaczan (2011) found that an upfront payment of fertilizer was enough compensation to elicit large support for a PES program without an additional yearly payment.

Upfront payments are not generally considered incentive compatible for a program that is carried out over a longer duration due to the loss of leverage after the benefits are handed over. Thus, the inclusion of agricultural-extension, as a type of "social capital" and as a way to ensure that the fertility of the soil will be replenished even under a REDD program, has the potential to provide long-term benefits to the producers and may be enough to elicit this strong willingness to adopt the program within this group.

Finally, the amount of trust that individual smallholders' place in different organizations does not influence the average respondent's latent class membership (model 4). However, the level of trust does influence the uncertain subgroup's preferences for specific attributes of the contract. Results of the base model (model 3), the latent class model (model 4) and the restricted "strong preference" model (model 5) all support the findings that the average smallholder in Akok village rests his decision to adopt a REDD contract on whether he will receive enough financial compensation to overcome any fear of restrictions to his land-use options that he will endure throughout the program. However, the subgroup of respondents who are "uncertain" of their decisions and are actually willing to *pay* to take part in the program that show some interesting results. Not surprisingly, as this group of respondents becomes *more* trusting of the organizations most likely to be funding a program like REDD (the "outside" organizations, i.e. NGO's, Government of Cameroon, private companies, and other countries governments) they are placing a smaller amount of the decision's weight on the level of the payment. At the same time, as their trust in outsiders increases relative to insiders, they are also more apt to participate in a contract that will last for a longer term, likely due to the belief that the benefits they accrue (i.e. the payment and the social capital) will continue throughout the whole length of the program. To my knowledge this is the first application of a choice experiment incorporates individual-specific levels of trust as an interaction variable to define the heterogeneity of preferences for PES programs.

The most essential implication for REDD that comes from this study is that assuming individuals living within the forest margins have simple preferences will be detrimental to developing a fair and efficient REDD scheme.

5.3.4 General observations of smallholders' perceptions

There are a number of observations of the smallholders' perceptions that arise from this research. One is the finding that these smallholders' are generally quite trusting of most types of organizations. Although a previous study conducted in rural Cameroon found that trust diminishes as social distance increases (Etang 2010), the residents in Akok village do not demonstrate the same "radius of trust." In Akok village, the reported levels of trust are generally high across every organization. It may be true that the smallholders in Akok do not feel that one group or organization is more or less trusting than the next. On the other hand, there could be several different methodological reasons why the variation in trust levels was so small. The first may be due to inefficiencies of the instrument that was used to elicit responses, the Likert scale method. One often-cited flaw with the Likert scale is that different respondents may interpret the scales differently and the interpretation of the scale can be based on all sorts of individual-specific factors including: gender, education, optimism, etc. The second may be that the respondents did not understand the intricacies of the different levels within the scale and thus chose the same middle values more frequently, avoiding using the extreme responses, this is known as "central tendency bias."

Without knowing whether the methodology played a part in the high average levels of trust across the organizations or whether the respondents truly feel that they can place their faith in these different groups, the implications remain the same. In order for a REDD program, or any conservation or development strategy to function efficiently it is necessary that trust extends beyond the individual household, first to fellow village members, as well as more "outside" groups such as the NGO's, private companies and governments that may be key stakeholders. Greater levels of trust will be conducive to achieving the dual environmental and social development objectives of REDD.

A second interesting observation from Akok village involves the wide range of responses to the questions regarding the minimum age of each fallow category (see section 4.2.1, Table 4.2). These questions were included in the survey as a way to clarify and follow up on the large discrepancy that was observed in the preliminary focus group; where the village members that were present did not agree on standard age ranges for the specific "types" of fallow. The survey results further exemplify the findings of the focus group discussion, where the range of minimum years has a great deal of overlap between categories. What these results imply, in terms of implementing a PES scheme for REDD is that a clear definition of the fallow or forest or age of tree will need to be defined in each region prior to a program being implemented. Expectations of a REDD contract require significant amounts of detail in order to be successful. It means that the contracts and the way that REDD will be implemented will be location and context specific, but even at that they will need detailed explanations.

5.4 Research limitations and future research

It is important to recognize the limitations of the research conducted for this thesis. This section outlines some of those weaknesses and makes some suggestions for how future studies may address those weaknesses.

Perhaps the most obvious limitation is the small size of the study. Like most field case-studies of this nature, time and budgetary constraints prevented me from achieving a larger sample size. I was only able to focus on Akok village, and as such the relatively small population (169 respondents in the choice experiment), likely hindered the statistical accuracy of the model results. A larger sample, that would include other villages throughout Cameroon, would allow for a much more robust analysis of smallholder preferences in the humid forest benchmark zone. Some of the methodological results from this study can be put to use in future stated preference studies in developing countries (i.e. the level of certainty with which the respondents are able to answer the questions), however the empirical results that were found, as well as the results that would come from a broader study of preferences in Cameroon alone, should not to be generalized beyond the

country's borders. Each region's specific demographic profile, including economic status, land and tenure laws, and resource availability, among other characteristics, have a weighty part to play in the structure within which REDD might develop. Beyond Cameroon, other countries that are vying for international investment for REDD should undertake rigorous community consultations to understand the preferences of those who are living and farming within their forest margin zones.

Another issue related to the scope of this study is the land-use change on which it focuses. As I explained at the beginning of this thesis, REDD stands for Reducing Emissions from Deforestation and forest Degradation in developing countries. In this study, I am investigating the preferences within a REDD program that really only tackles the issues encompassed within the first D of REDD. Focusing on using PES programs to reduce the emissions that are produced when smallholders' clear and burn forest and old fallow areas on their lands will be an important part of REDD; however a greater bundle of strategies that will ultimately be required for a successful global REDD program. It is beyond the scope of this thesis to discuss the impacts and solutions to reducing emissions from the second D of REDD – degradation, which includes selective logging, fire, and other management practices. Much literature has already been written and many studies are sure to come on this topic.

The third issue surrounding the scope of this study is that it does not explore the complex local, national and international institutional issues that would need to be addressed in both the design and implementation stages of REDD. This study looks into whether the local-level participants have preferences towards which levels of institution are involved in a specific REDD value chain. The resounding answer is no; participants are likely to participate in a program only if they can maximize their economic returns, regardless of the institutional structure. In Chapter 2, I explained that there are several important design elements that can lead to a well-functioning REDD scheme, including incentives and enforcement, reference levels, safeguards, as well as the institutional levels that will be

responsible for setting up a sound monitoring, reporting and verification system. An adjustment to the choice experiment to include a clearer explanation of each role (aggregator, verifier and end user), as well as each type of institution (NGO, Government, Private company and Other government) within the contract, may have improved the strength of the results. Future studies on REDD design would also do well to expand the range of the attribute levels, by adding more choices to the set, or by being more specific to the organization.

Another fundamental limitation of this study stems from the hypothetical nature of stated preference studies and the complexity of the choice experiment task. Literature regarding stated choice studies explains that strategic behavior and warm-glow biases are common when responding to hypothetical scenarios (Grafton et al 2004). Strategic behavior in this study may result in respondents providing artificially high values of willingness to accept, if they believe that those values may influence the level of payment offered in future provision of the program. Conversely, the "warm-glow" bias can result in artificially low values if the respondents are accepting a contract because they want to please the researcher or they think it might be the "right" thing to do. Willingness to accept values are also calculated based on stated hypothetical values, rather than real behavior and thus, may be artificially inflated or underestimated. The use of a binary choice format (i.e. the respondents chose to whether to accept the given contract or not) was incorporated as a way to try and mitigate the strategic bias and warm-glow effects and improve incentive compatibility of the scenario. The follow-up questions asking the respondents how "certain" they were that their response is "actually" what they would say if it were a real program were included to improve the consequentiality of the study. Results of the choice models show that by removing the respondents that were uncertain of their choices provided the most economically reliable results. Future studies would do well to incorporate a similar certainty calibration scale in order to achieve responses that may be more realistic.

Another concern with presenting the respondents with a hypothetical scenario is that they may simply believe that an actual program is unlikely or meaningless and thus, they would reject the entire scenario. In fact, during my stay in the village, I had a conversation with an elder who informed me that it didn't actually matter if they signed a contract with some company to pay them to conserve their forests because the "government would just come with their papers and take whatever trees they want... without asking them or paying them for the trees." This type of "scenario rejection" is easy to deal with if the respondent simply refuses to take part in the questionnaire, but it can cause larger problems for the choice modelling when these unreliable results are included in the dataset.

Choice experiments in themselves can be complex, and researchers argue that respondents may not fully understand the tasks that they are asked to complete. As such, biases can arise if the choice sets are too elaborate, which can undermine the reliability of the results (De Shazo and Fermo 2002). Pre-testing of the survey was done in Akok prior to finalizing the questionnaire. Results of the pre-test indicated that questions that required the respondent to do more than indicate whether they would accept or reject a single contract were too complicated for the respondents to answer. The choice was made to reduce the complexity of the task to a simple binary choice framework with a certainty scale follow-up. Changing to this format allowed me to maintain the original experimental design, which was crucial to completing the project in the given time frame; however, the simpler questionnaire limited the depth of the analysis that was possible.

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Appendix A: Survey questionnaires

Survey Version A

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

(Survey #_____Version___*Alpha 1*___)

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 ; 2 = ( ) 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 ; 2= ( ) 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 ; 2= ( ) NON	

PARTIE 3 : CARACTÉRISATION DU MÉNAGE

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

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	
P3Q6 a	**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 2=( ) NON	*P4Q1e* 1=( ) OUI 2=( ) NON
P4Q2	vieilles jachères *(ekotok)*	*P4Q2a*	*P4Q2b*	*P4Q2c*	*P4Q2d* 1=( ) OUI 2=( ) NON	*P4Q2e* 1=( ) OUI 2=( ) NON

P4Q3	très vieilles jachères *(nfos ekotok)*	*P4Q3a*	*P4Q3b*	*P4Q3c*	*P4Q3d* 1=( ) OUI 2=( ) NON	*P4Q3e* 1=( ) OUI 2=( ) NON
P4Q4	forêt secondaire dégradée *(nfos afan)*	*P4Q4a*	*P4Q4b*	*P4Q4c*	*P4Q4d* 1=( ) OUI 2=( ) NON	*P4Q4e* 1=( ) OUI 2=( ) 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**	**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**
P5Q1	**1. Champ de forêt (*esëp*)**	*P5Q1a* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q1b*	*P5Q1c*	*P5Q1d*
P5Q2	**2. Champ mixte vivrier (*afub owondo*)**	*P5Q2a* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q2b*	*P5Q2c*	*P5Q2d*
P5Q3	**3. Champ de marécage (*asan*)**	*P5Q3a* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q3b*	*P5Q3c*	*P5Q3d*

P5Q5	**4. Cacaoyères (Cultivé à : l'ombre)**	*P5Q4a* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q4b*	*P5Q4c*	*P5Q4d*
P5Q7	**5. (Autres)**	*P5Q5a* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q5b*	*P5Q5c*	*P5Q5d*

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 ans** 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 paye *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 dans votre village, sur l'échelle de 1-5 dites moi à quel niveau tu se trouve?	*P7Qb.* Si l'accord vous est proposé tel quel accepteriez vous de le signer ? 1= ( ) OUI 2= ( ) NON
1	250 000	Gouvernement Camerounais	ONG	Entreprise privée	20	*P7Q1a*	*P7Q1b*
2	150 000	ONG	GIC	ONG	10	*P7Q2a*	*P7Q2b*
3	350 000	Entreprise privée	Entreprise privée	Pays développé	10	*P7Q3a*	*P7Q3b*
4	450 000	GIC	Gouvernement Camerounais	Gouvernement Camerounais	20	*P7Q4a*	*P7Q4b*

Demandez en premier !
P7Qa. En supposant que cet accord soit proposé dans votre village, sur l'échelle de 1-5 dites moi à quel niveau tu se trouve ? *(Réponse dans le tableau)*

1= ( ) Définitivement, je n'accepterai pas de signer cet accord.
2= ( ) Probablement, je n'accepterai pas de signer cet accord.
3= ( ) Je ne suis pas sur si j'accepterai de signer cet accord.
4= ( ) Probablement, j'accepterai de signer cet accord.
5= ( ) Définitivement, j'accepterai de signer cet accord.

Demandez apres P7Qa !
P7Qb. Si l'accord vous est proposé tel quel accepteriez vous de le signer ? *(Réponse dans le tableau)*
1= ( ) OUI
2= ( ) NON

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, par an	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 va payez pour entrer dans cette accord ?

- ☐ 1= OUI
- ☐ 2= NON

Merci beaucoup d'avoir travailler avec nous.

Survey Version B

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

(Survey #_____Version___*Alpha 2*___)

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 ; 2 = ( ) 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 ; 2= ( ) 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 ; 2= ( ) NON	

PARTIE 3 : CARACTÉRISATION DU MÉNAGE

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

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	
P3Q6 a	**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 2=( ) NON	*P4Q1e* 1=( ) OUI 2=( ) NON
P4Q2	vieilles jachères *(ekotok)*	*P4Q2a*	*P4Q2b*	*P4Q2c*	*P4Q2d* 1=( ) OUI 2=( ) NON	*P4Q2e* 1=( ) OUI 2=( ) NON
P4Q3	très vieilles jachères *(nfos ekotok)*	*P4Q3a*	*P4Q3b*	*P4Q3c*	*P4Q3d* 1=( ) OUI 2=( ) NON	*P4Q3e* 1=( ) OUI 2=( ) NON

P4Q4	forêt secondaire dégradée *(nfos afan)*	*P4Q4a*	*P4Q4b*	*P4Q4c*	*P4Q4d* 1=( ) OUI 2=( ) NON	*P4Q4e* 1=( ) OUI 2=( ) 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**
P5Q1	1. Champ de forêt (*esëp*)	*P5Q1a, P5Q1b* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q1c*	*P5Q1d*	*P5Q1e*	*P5Qf*
P5Q2	2. Champ mixte vivrier (*afub owondo*)	*P5Q2a, P5Q2b* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q2c*	*P5Q2d*	*P5Q2e*	*P5Q2f*
P5Q3	3. Champ de marécage (*asan*)	*P5Q3a, P5Q3b* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q3c*	*P5Q3d*	*P5Q3e*	*P5Q3f*
P5Q5	4. Cacaoyère (Cultivé à : l'ombre)	*P5Q1a, P5Q1b* 1=( ) OUI Combien : _____ 2=( ) NON Préciser : _____	*P5Q1c*	*P5Q1d*	*P5Q1e*	*P5Qf*

P5Q7	5. (Autres)	*P5Q1a, P5Q1b* 1=( ) OUI Combien : _____ 2=( ) 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.

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Accord	**A chaque année, vous serez paye *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 2= ( ) 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	250 000	Gouvernement Camerounais	ONG	Entreprise privée	20	*P7Q1a*	*P7Q1b*
2	150 000	ONG	GIC	ONG	10	*P7Q2a*	*P7Q2b*
3	350 000	Entreprise privée	Entreprise privée	Pays développé	10	*P7Q3a*	*P7Q3b*
4	450 000	GIC	Gouvernement Camerounais	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
2= ( ) 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, par an	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 va payez pour entrer dans cette accord ?

- ☐ 1= OUI
- ☐ 2= NON

Merci beaucoup d'avoir travailler avec nous.

Appendix B: Table relating to latent class models

Table 6.1 Binary logit model of preferences for a hypothetical REDD program with two latent classes (based on the very certain response base model 3) with the full model specification.

	Parameters for class 1 ("reluctant" participants)			**Parameters for class 2 ("interested" participants)**		
	Coef.	Std. Error		Coef.	Std. Error	
ASC	-11.015	6.895		-0.629	0.739	
Payment[^]	0.023	0.019		0.006	0.002	
Time	1.880	3.657		0.029	0.716	
Aggregator GOV	-0.010	1.180		0.243	0.472	
Aggregator NGO	1.012	1.299		0.256	0.422	
Aggregator PRIVATE	0.591	0.632		-0.252	0.335	
Aggregator GIC[a]	-1.592			-0.247		
Verifier GOV	-0.014	1.696		0.130	0.499	
Verifier NGO	-2.393	2.845		-0.147	0.488	
Verifier PRIVATE	-1.340	0.972		0.263	0.381	
Verifier GIC[b]	3.747			-0.246		
End user GOV	-2.145	1.850		-0.278	0.452	
End user NGO	2.328	1.665		-0.511	0.368	
End user PRIVATE	-2.839	3.342		0.285	0.569	**
End user DEV. CNTRY[C]	2.656			0.504		
Average class probabilities	0.668			0.332		
Class probability model (Class 1)						
ASC	-1.087	1.704				
Trust	-0.150	0.551				
Age	0.040	0.016	**			
Education_none	-2.316	1.919				
Education_primary	-0.406	1.493				
Education_secondary	0.631	1.470				
Education_higher[a]	2.091					
Young fallow	-0.031	0.059				
Old fallow	-0.007	0.008				
Very old fallow	0.002	0.001				
Secondary forest	-0.003	0.001	**			
No. obs.	676					
d.f.	34					
LLF	-281.399					
McFadden Pseudo R2	0.249					
AIC	630.8					

Note: *, ** and *** denote significance at 0.10, 0.05, 0.01 probability levels, respectively.

[^]: data for the level of payment has been rescaled for ease in modeling, dividing by a factor of 1,000.

[a]: Implicit coefficient,