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RECONCILING GLOBAL AND LOCAL BENEFITS FROM COMMUNALLY MANAGED FORESTS: EVIDENCE FROM A CHOICE EXPERIMENT ON PES IN ZAMBIA

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Abstract

Agriculture is considered as one of the major drivers of deforestation worldwide. Especially in Africa, this process is driven by small-scale agriculture. Agricultural intensification is widely proposed as measure to reduce pressure on forests. Empirical evidence suggests, however, that win-win relations between agricultural intensification and forest conservation are the exception. As option, payments for ecosystem services (PES) could be linked to small-scale agricultural support programs and safeguard reduced deforestation while achieving agricultural intensification. Nevertheless, little scientific evidence exists regarding perceptions of potential PES recipients for such designs. We report from a discrete choice experiment in Zambia, that elicited preferences of small scale farmers for PES contracts incorporating incentives for agricultural intensification. The experimental design included both monetary and non-monetary contract attributes. Our results suggest that potential PES recipients in Zambia value in-kind agricultural inputs higher than cash payments, highlighting that PES could potentially succeed in conserving forests and intensifying small-scale agriculture. Respondents also put significant emphasis on improved tenure security and non-monetary contract attributes, thus allowing to considerably reduce overall costs of PES if designed appropriately.

Key Words: Choice Experiment, Deforestation, Payments for Ecosystem Services, REDD+, Tenure Security

1. Introduction

Deforestation and forest degradation is recognized as major source of greenhouse gas emissions. For about 30 developing countries including Zambia deforestation and forest degradation is the largest source of CO_2 emissions (Van der Werf et al., 2009). Estimates for 2000-2010 account 80% of forest loss to agricultural land-use. Small-scale agriculture is found to be a major driver of deforestation in developing countries (Hosonuma et al., 2012). Reducing Emission from Deforestation and Forest Degradation (REDD+) has been proposed to reduce deforestation as part of global climate change mitigation measures (Pistorius, 2012). According to Angelsen (2009) the REDD+ debate has mostly evolved around direct incentive payments such as payments for ecosystem services (PES). PES are mainly conceptualized as interventions to increase forest rents relative to alternative land-uses, and hence reduce the direct incentives of deforestation.

At the same time, the current progress at the national REDD+ level indicates that many countries want to address agriculture as deforestation driver through agricultural intensification (Pirard & Belna, 2012; Salvini et al., 2014). There are multiple theoretical explanations that link increased agricultural yields with reduced land demand. The Borlaug hypothesis states for example that if global food demand remains constant, higher yields per hectare will reduce agricultural area. The same logic can be applied to the micro level by assuming that subsistence farmers merely fulfill their livelihood needs and hence reduce agricultural area as a results of increased yields (Angelsen & Kaimowitz, 2001). At the same time, deforestation by small-scale farmers is often caused by shifting cultivation, which relies on newly cleared and fertile forest land as cheap production input (Benhin, 2006). Increasing productivity through conserving soil fertility on existing fields could hence result in less deforestation at the household level. Potentially, increasing household income could also relax capital constraints of farmers, leading to larger areas to be cleared and cultivated.

Empirical evidence however suggests that win-win relations between agricultural intensification through technological progress and forest conservation remain the exception and are highly context dependent (Angelsen & Kaimowitz, 2001). Promoting agricultural productivity in forest-rich, frontier regions may in fact increase pressure on forests (Angelsen, 2010). Rudel et al. (2009) find in a global, cross-country analysis of historic data no general evidence for agricultural intensification reducing cultivation areas. In contrast, Ewers et al. (2009) find evidence that increased yields spared land to a limited extent in the past, but remain skeptical whether increased demand for agricultural products in future will maintain this effect.

Interventions (under REDD+) aiming at increasing agricultural productivity have to be consequently carefully designed to safeguard reduced deforestation. To our knowledge few studies evaluated the extent agricultural intensification can be linked to PES schemes (cf Karsenty, 2011). Many developing countries have a long history of government-led schemes for agricultural support of small-scale farmers such as extension services or input subsidies (Mason, Jayne, & Mofya-Mukuka, 2013). Such programs could be potentially converted to PES schemes that explicitly target reduced deforestation.

Any PES scheme aiming at achieving positive environmental outcomes, should be adapted to the environmental, political and socio-economic context (Jack, Kousky, & Sims, 2008). Better understanding preferences among small-scale farmers will be crucial to design and implement such incentive schemes at the local level. Besides maximizing the likelihood of scheme enrollment, preferences most likely also influence contract adherence at later stages (Petheram & Campbell, 2010). To our knowledge only few studies have concentrated on farmer's preferences regarding PES contracts in developing countries (Arifin, Swallow, Suyanto, & Coe, 2009; Balderas Torres, MacMillan, Skutsch, & Lovett, 2013; Kaczan, Swallow, & Adamowicz, 2013; Nordén, 2014) and none of them explicitly linked agricultural intensification with forest conservation. This paper contributes to this field by comparing farmer's preferences for direct compensation payments with support for agricultural intensification conditional on avoided deforestation. To do this we report from a choice experiment on PES in Zambia that targets small-scale agriculture as driver of deforestation.

The next section will briefly introduce the concept of PES, its relation to land tenure and review existing evidence on PES design preferences. Section 3 characterizes the research area and sample with respect to land tenure, agricultural practices and forest clearing. Section 4 summarizes the method and theory of discrete choice experiments and introduces the experimental design. The results are presented and discussed in Section 5 and 6. Section 7 concludes with policy implications and directions for future research.

2. Payment for Environmental Services and Contract Preferences

PES have received increasing attention by both scholars and practitioners in the last decades. The seminal PES definition by Wunder (2005) has been since then increasingly criticized as too narrow, market-oriented and not corresponding with PES realities. A variety of alternative definitions have been proposed in response (Wunder, 2015). Following Wunder (2015) we understand PES as "voluntary transactions between service users and service providers that are conditional on agreed rules of natural resource management for generating offsite services". The defining feature of PES is accordingly the conditionality of payments on agreed rules of natural resource management.

Due to the strict conditionality of PES, such schemes require clearly defined property rights over forests, either at the individual, community or state level (Wunder, 2009). Unclear, contested and overlapping property rights at many deforestation hotspots inhibit the implementation of PES. Areas where de-facto tenure rights are established through deforestation of open access land, renders the implementation of PES impossible, since there are no clearly defined forest stewards to pay (Wunder, 2009).

Evidence of REDD+ pilot projects highlight that formalizing land tenure of local communities is a slow process, often implying conflicts with local stakeholders and engaging in broader national land tenure debates (Sunderlin et al., 2014). Experience from pilot projects in Tanzania suggests that deforestation and degradation of forests mostly originates from within communities (Dokken, Caplow, Angelsen, & Sunderlin, 2014). Designing appropriate PES that are adapted to the context and preferences of ecosystem service (ES) providers is thus crucial to achieve desirable environmental outcomes. As stated in the article's introduction, systematic knowledge about contract design preferences among service providers remains limited. In the following we summarize the findings of discrete choice experiments and case studies that investigated preferences of PES recipients in developing countries[1].

Balderas Torres et al. (2013) conducted a choice experiment with Mexican private and community land owners to study the effect of cash payments, project duration and co-benefits on PES enrollment. Community co-benefits such as health and education services as well as employment- and income-generating projects can motivate respondents to participate in PES schemes and reduce dependency on cash payments. Kaczan et al. (2013) elicit preferences for different payment mechanisms among potential PES participants in Tanzania. They compare constant and variable individual cash payments, collective cash payments to a village fund and upfront in-kind fertilizer payments. In addition, they introduce different levels of conditionality in their design. Individual fixed cash payments are preferred over collective payments, while upfront fertilizer is the most preferred payment vehicle. At the same time, respondents revealed preferences for medium conditionality, where monitoring is conducted by local villagers, rather than forestry officer or no monitoring at all. Interestingly, large segments of respondents would accept contracts without any payments. Nordén (2014) elicit preferences for cash and in-kind training payments and PES contract length among Costa Rican land owners. Respondents show preferences for short contract lengths, are sensitive to increases in cash payments, but not sensitive to increases in in-kind payments. Arifin et al. (2009) conducted a conjoint analysis to reveal preferences for community forestry contracts in Indonesia. They find that potential farmers are willing to accept restrictions on land-use in return for secured land tenure and tree harvesting rights. Access to extensions

[1] A number of discrete choice experiments have investigated the preferences of potential PES participants of forest owners and farmers in developed countries (Beharry-Borg, Smart, Termansen, & Hubacek, 2012; Broch, Strange, Jacobsen, & Wilson, 2013; Broch & Vedel, 2011; Christensen et al., 2011; Espinosa-Goded, Barreiro-Hurlé, & Ruto, 2010; Greiner, 2015; Horne, 2006; Jaeck & Lifran, 2014; Ruto & Garrod, 2009; Schulz, Breustedt, & Latacz-Lohmann, 2014; Sorice et al., 2013; Villanueva, Gómez-Limón, Arriaza, & Rodríguez-Entrena, 2015). Due to the context specificity that should inform PES design and likely influences preferences we do not further summarize their findings.

services and inputs also increases the likelihood for contract acceptance, while contract fees decrease the attractiveness of contracts. Interestingly, they find preference for long over short term contracts.

Similar results regarding contract length are found by Zabel and Engel (2010), who report from a case study of a proposed PES for wildlife protection in India. They find that most potential recipients prefer individual over group payments. Roughly half of the respondents prefer cash over in-kind payments. Qualitative research on a potential PES scheme in Vietnam finds that potential participants strongly oppose resettlement and PES schemes with farming restrictions. Better tenure and access to land as well as training activities would motivate PES participation (Petheram & Campbell, 2010).

The presented literature has informed the particular design attributes, that we included in our experimental design. Before presenting the choice experiment method and design in detail, the next section elaborates on the study context and sample.

3. Study Context and Sample Characteristics

3.1. Land Tenure and Implications for PES

Zambia is with 67% one of the most densely forested countries in Africa, while experiencing high deforestation rates (annual estimates between 0.3 - 0.6%) (FAO, 2011; Vinya, Syampungani, Kasumu, Monde, & Kasubika, 2011). Small-scale agriculture is considered as one of the major driver of deforestation in Zambia (Vinya et al., 2011). The majority of forests in Zambia is under de-facto customary management (61.5%), followed by state (23%) and private (10.6%) management. Formally, statutory ownership of all land (and forests) is vested in the state, even though land legislation recognizes management rights related to customary tenure and private leaseholds (FAO, 2015). De-facto customary tenure can be summarized for the research areas as follows. The traditional chiefs overlooking a defined (but often disputed) geographical area appoint for each village a headman/-woman. Within the village boundaries, the headman is then responsible for distributing land to inhabitants and newly arriving migrants. The customary land tenure in our research site can be characterized as a mix of de-facto common and private property rights. Unoccupied or undistributed land is considered as de-facto common property and can be accessed by locals to collect firewood, poles or non-timber forest products. Other land-uses such as agriculture or charcoal production are restricted to land that has been distributed by traditional authorities to individuals. This distributed land is perceived by locals as private property. If sufficient undistributed land is available, households commonly receive an area larger than immediately needed for agriculture. Consequently, many households “own” forest areas next to their fields.

Recognizing only community ownership of forests, would consequently not fully acknowledge the current customary land tenure regime. Due to the mixture of de-facto community and private property of forested areas, PES based on conserved forest land would be difficult. We therefore collected preferences for incentives payments that compensate farmers for remaining on their current agricultural land and not converting forests to new cultivation areas, irrespective whether the forest is located on private or communal land. In addition to minimizing distributional issues regarding PES, this design also addresses direct leakage. Direct leakage describes the relocation of destructive behavior by PES recipients to areas that are not covered by PES either on-farm or to different locations. Direct leakage is especially likely, where adjacent forest areas have suitable soil, weak protection or low prices (Wunder, 2008). Given that unoccupied customary land can be acquired without any payments, PES recipients could easily shift their forest clearing to neighboring areas that are not covered by the PES scheme. Hence, introducing conditionality at the individual level reduces risks of direct leakage.

We are aware that individual level conditionality does not necessarily results in the conservation of forests at the community level. Therefore, we acknowledge that such a PES scheme has to be complemented with village level arrangements. These need to safeguard that forested land is not given to non-participants such as migrants or that outsiders can access forest for degrading activities such as charcoal production. Moreover, monitoring of conditionality could be also partly transferred to the community level. In order to elicit preferences for individual and not collective payments, we excluded any community aspect from the design of the choice experiment.

3.2. Sampling

The study is based on a sample of 320 small- and medium-scale farmers located in Mumbwa District in the Central Province of Zambia, located roughly 160km from the nation's capital. Sampling was conducted at different levels. The particular research area was selected due to a wide range of forest-agriculture landscapes, including areas with small forest mosaics. But despite the geographical proximity to Lusaka, areas further away from main roads still host significant areas of forest. The research area is neighboring the Kafue National Park and is part of a dedicated buffer zone, the Mumbwa Game Management Area.

In particular, we purposely sampled two chiefdoms (Chibuluma and Kabulwebulwe). The chiefdoms comprise 45 and 73 villages respectively and accommodate roughly 1400 households each[2]. In a second step, lists of all villages in both chiefdoms were compiled and 30 villages were selected randomly[3]. A pilot study with 73 respondents was implemented in 8 villages to generate prior estimates used for the final design of the experiment (see Section 4.4). The final choice experiment was implemented in 22

[2] Estimates for households were collected on the village level. These number are however only tentative and data from 20 villages was not available.

[3] Two randomly selected villages could not be covered by the study. In one case the headman denied permission to conduct research, while the headman position in another village was vacant and recruiting of respondents proved difficult.

villages. Prior to data collection, a household list was attained from each village headman. Based on this list 18 households were randomly selected and the household head was invited for the experiment.[4]

3.3. Sample Characteristics

Table 1 summarizes socio-economic and agricultural characteristics of the respondents. While most farmers grow maize for subsistence as staple food, a growing number of farmers have adopted cotton as the area hosts a number of (international) cotton companies with out-grower schemes. On average each interviewed household has a total cultivation area of 17 acres. However, on average only 63% of this area was cultivated in season 2014/15. Farming households commonly rotate within their fields to allow for extended fallow periods. At the same time adoption of fertilizer draws an ambivalent picture. Overall 62% of respondents have used fertilizer in the agricultural season 2014/15, while on average households used fertilizer in 2.6 of the last 5 years. Despite this the overall amount of fertilizer remains at a low level with an average of 29 kg/year applied to one acre of cultivated land. Average cash income for the households is 706 US$ per year. Households heavily rely on crop production for cash income generation, as they derive on average 44.6% from farming. On average each respondent considers 14.8 acres of forest to be under her ownership, even though this number is highly unevenly distributed. Out of 317 respondents, 40% have an informal written confirmation from traditional authorities that they own at least one plot. None of the interviewed households hold a formal title for their land.

TABLE 1 HERE

The low rates of fertilizer application and a relatively extensive use of cleared areas for agriculture relate to an overall high demand for newly cleared land. Table 2 summarizes key indicators for the clearing behavior of our sample. Between 2010 and 2014, 48% of our sampled households cleared forest for agriculture. In 2014 alone, 22% of the households have extended their fields. These households on average cleared an area of six acres in 2014 and 9.6 acres between 2010 and 2014. However, the cleared areas significantly differ with the smallest area cleared in 2014 of 0.24 acre and the largest of 84 acres. The total cultivation area of our sample increased from 3961 to 5439 acres between 2010 and 2014, an increase by 37.3%. 42% of the respondents indicated that they plan to clear additional forest between 2015-17. On average these households intend to clear 5.5 acres.

TABLE 2 HERE

[4] Some villages comprised fewer than 18 households. In other cases, invited households could not participate. Two respondents refused to participate in the choice experiment and were excluded from the dataset. The final dataset comprises 320 respondents. 83% of respondents were household heads. In the remaining cases the household head was either currently not present, or unable to attend the experiment due to illness or handicap.

4. Method and Experimental Design

4.1. Theory and Econometric Models[5]

Discrete choice experiments rest on the assumption that respondents' choices between hypothetical alternatives reveal an actual preferences order. In our choice experiment each alternative (PES contract) is described by a set of attributes (see Section 4.3). In line with Random Utility Models we assume that decision maker n is confronted with $j = 1, \dots, J$ alternatives, that each generate an utility U_{nj}. We presume that decision maker n maximizes her utility by choosing the alternative with the relatively largest utility.

Let U_{nj} denote the overall utility of decision maker n for alternative j that consists of a systematic, observed utility component V_{nj} and an unobserved utility component ε_{nj}.

(1) $U_{nj} = V_{nj} + \varepsilon_{nj}$

The observed utility component of decision maker n is assumed to be a linear additive function of x_{njk} variables for $k = 1, \dots, K$ attributes that describe alternative j, each weighted with a coefficient β_{njk}:

(2) $V_{nj} = \sum_{k=1}^{K} x_{njk}\, \beta_{njk}$

From the perspective of the researcher $\varepsilon_{nj} \forall\, j$ is not known and can be treated as random with the joint density of the random vector $\varepsilon'_n = \langle \varepsilon_{n1}, \dots, \varepsilon_{nJ} \rangle$ denoted as $f(\varepsilon_n)$. This allows to derive the probabilities that decision maker n chooses alternative i over j:

(3) $P_{ni} = \text{Prob}\big(U_{ni} > U_{nj}, \forall\, i \neq j\big)$

(4) $\quad = \text{Prob}\big(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj}, \forall\, i \neq j\big)$

(5) $\quad = \text{Prob}\big(\varepsilon_{ni} - \varepsilon_{nj} > V_{nj} - V_{ni}, \forall\, i \neq j\big)$

The probability of individual n choosing alternative j can be expressed as logit formula, under the assumption that ε_{nj} is identically and independently distributed with an extreme value distribution. This model is known as conditional logit model and has become the standard of analyzing discrete choice data:

(6) $P_{ni} = \frac{\exp(V_{nit})}{\sum_j \exp(V_{njt})}$

In contrast to the conditional logit model that assumes fixed parameter coefficients over the whole population, the random parameter logit (RPL) model assumes that the coefficients β_{jk} vary over decision

[5] If not mentioned otherwise, this chapter is based on (Train, 2009).

makers (but not across choice situations) with density $f(\beta)$. This density can be characterized by parameters θ such as mean and variance of $\beta's$ in the population.

Consider that decision maker i faces a sequence of choice situation $t = 1, \ldots, T$ with J alternatives. Under the assumption that ε_{nj} is identically and independently distributed with an extreme value distribution over decision makers, choice situations and alternatives, the probability of a choice sequence can be derived from the product of logit formulas conditional on β:

(7) $$L_{ni}(\beta) = \prod_{t=1}^{T} \left[\frac{\exp(V_{nit})}{\sum_j \exp(V_{njt})} \right]$$

Because β is not known, the unconditional choice probability can be derived from the integral over all possible values of β:

(8) $$P_{ni} = \int L_{ni}(\beta) f(\beta) \, d\beta$$

The RPL model randomly assigns each respondent an estimate for all $\beta's$ drawn from the distributions of the estimated random parameters. In order to establish whether a respondent is at the upper or lower part of the distribution due to systematic influence, we introduce an additional interaction between individual-specific covariates and attributes (Hensher, Rose, & Greene, 2015, pp. 626–627). Through this we can estimate to what extent preferences for specific development outcomes are influenced by socio-demographic covariates such as gender, income or age (cf Ek & Persson, 2014).

A major weakness of RPL models is, however, the need for a-priori assumptions about the distributions of random parameters (Greene & Hensher, 2003). A special case of the RPL models is the latent class model (LCM). Instead of assuming that the parameters are continuously distributed with parameters θ, a discrete distribution of β with a finite set of values is assumed. As a consequence, LCMs do not require any a-priori distributional assumptions for $f(\beta)$. LCMs assume that each decision maker is a member of an unobserved latent class q with specific parameter estimates β_q'. The choice probability for alternative i among J alternatives by decision maker n in T choice situations is hence conditional on class membership q:

(9) $$\text{Prob}[y_{nt} = i | \text{class} = q] = P_{nt|q} = \frac{\exp(V_{qit})}{\sum_j \exp(V_{qjt})}$$

The probability of a particular choice sequence with choice situations $t = 1, \ldots, T$ can be derived from the product of choice probabilities:

(10) $$P_{n|q} = \prod_{t=1}^{T} P_{nt|q}$$

The prior probability for decision maker n belonging to latent class q can be expressed as a logit formula, where z_n' represent individual characteristics that determine class membership and respective parameter estimates θ_q for each class:

(11) $$H_{nq} = \frac{\exp(z_n' \theta_q)}{\sum_{q=1}^{Q} \exp(z_n' \theta_q)} \qquad q = 1, \dots, Q,\ \theta_Q = 0$$

Finally, leading to the overall choice probability as the summed product of class membership probabilities and the respective choice probabilities conditional on class membership:

(12) $$P_{ni} = \sum_{q=1}^{Q} H_{nq} P_{n|q}$$

4.2. Contract Design and Choice Situations

For reasons explained in Section 3.1 the hypothetical PES contracts comprised individual-level payments in return for a contractual commitment of individuals not to clear any forest areas. The contractual requirement was described to the respondent as follows:

> *Imagine that somebody is offering you a contract where you commit yourself not to clear additional forest for agriculture, neither on your current nor on any other land.*

Each respondent was confronted with four choice situations, which consist of two separate questions each. This design is adapted from (Veldwijk, Lambooij, de Bekker-Grob, Smit, & de Wit, 2014). First, respondents were presented two PES contracts and were asked which of the two contracts they preferred. Afterwards, they were asked whether they would accept the preferred contract over the status quo. The two-step design for each choice situation allows to combine multiple datasets. We decided to report here models of the combined dataset only to harness the full information of the dataset[6]. In addition to the first choice question between two contracts, we included the second question separately. The dataset hence comprises two questions per choice set, yielding with 320 individuals and four choice sets each a total of 2,560 choice observations. In order to improve understanding of the choice tasks and alternatives, each contract was explained in depth by the enumerator and the respondents were free to ask any questions during the experiment (see APPENDIX A for a choice set example).

One major weakness of discrete choice experiments is the hypothetical nature of valuation. The discrepancy between hypothetical, merely stated and real valuation is known as hypothetical bias. Researchers have applied numerous methods to reduce this bias such as certainty corrections and cheap talk (Little & Berrens, 2004). We decided to exclude follow-up questions on response certainty since this question could trigger additional insecurity among respondents and hence influence later choices. Given that the effect of cheap talk in discrete choice experiments remains ambiguous (Ladenburg &

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[6] The results of the presented models with different datasets are reported in the appendices. There we include a dataset whereby each choice situation was merged to one reply, comprising two contracts and the status quo option. In addition, we report the results from the first questions only.

Olsen, 2014), we decided to reduce the cognitive burden for respondents and only include a very concise reminder in the introduction: "Please keep in mind, that your choices have no impact in reality. However, take your time and try to make choices as careful as possible."

4.3. Attributes & Hypothesis

Prior to designing the choice experiment, a literature review was conducted to identify PES contract attributes potentially relevant in the context of our case. Further qualitative, exploratory research was conducted between April 2014 and May 2015 in Zambia. We tested the experimental design in two stages with an initial pre-test with 12 respondents and a pilot study with 73 respondents in order to review attribute levels, explanation of choice tasks and contracts. The final design included five attributes, which are presented in Table 3.

The majority of choice experiments among potential PES recipients incorporated besides cash payments additional benefits such as training (Nordén, 2014) or community projects (Balderas Torres et al., 2013). One previous choice experiment on PES in developing countries found a strong preference for in-kind fertilizer over individual or collective cash payments (Kaczan et al., 2013). At the same time increasing fertilizer usage among small- and medium farmers is a policy objective in Zambia (Mason et al., 2013). We therefore included two different levels of in-kind payment with variation in the delivery plus two kind of cash payments: (a) Annual cash payments in April each year, (b) Monthly cash payments, (c) In-kind payment with agricultural inputs (seeds, fertilizer and pesticides) delivered to the village in the beginning of each growing season, (d) In-kind payment with agricultural inputs (see above) as voucher that can be redeemed in the district capital at the beginning of each growing season. Based on prior findings of Kaczan, Swallow, and Adamowicz (2013) we expect that in-kind or voucher payments are preferred over cash payments (Hypothesis 1). While in-kind payments include the delivery of the inputs to the village and voucher payment implies that transport has to be covered by recipients, we expect that in-kind payments are preferred over voucher payments (Hypothesis 2).

TABLE 3 HERE

Setting the range of monetary attribute level is critical. Generally, it is recommended to apply a scale as wide as possible for statistical reasons. Too wide ranges can however risk that certain alternatives dominate choice sets, while too narrow ranges might be indistinguishable (Rose & Bliemer, 2014). Initial levels were estimated by reviewing literature on maize yields in Zambia and further adapted throughout the pre-test and pilot. Initially levels varied between 16.4 US$ and 98.6 US$ (120-720 Zambian Kwacha) of annual transfer for each acre of currently cultivated land. After the pre-test and further qualitative interviews, we reduced the transfer levels to 8.2 – 65.8 US$ per acre and year. The corresponding values for monthly cash payments were included, if the level for payment mode was monthly. In line with prior findings (Balderas Torres et al., 2013; Kaczan et al., 2013; Nordén, 2014), we expect a preference for higher cash payments (Hypothesis 3).

A number of choice experiment also included the contract duration as attribute in their experimental design. Overall empirical evidence is inconclusive. Some studies found a preference for shorter contracts (Balderas Torres et al., 2013; Nordén, 2014), while other studies found preferences for longer contracts (Arifin et al., 2009; Zabel & Engel, 2010). In the latter cases, the provision of the environmental service required however large investments that are only likely to pay-off after longer periods. Given that clearing of forest is for most household an irregular activity, we specified a minimum contract length of 10 years and included a second level with 20 years.

In recent years, the potential of PES schemes under REDD+ have been discussed as tool to reduce deforestation rates. PES schemes could be both implemented by governments directly or through other organizations under a multi-level REDD+ scheme. For this reasons we gave two options of implementing organization: the Government of Zambia and a generic Non-Governmental Organization (NGO). To our knowledge none of the reviewed choice experiment on PES in developing countries varied implementing organization in their design.

Various timber and non-timber forest products play a significant role for the livelihoods of rural communities in Zambia and provide common coping strategies in times of idiosyncratic shocks (Kalaba, Quinn, & Dougill, 2013). In our sample, 98% of households collect firewood as cooking fuel. Poles and thatch grass is also collected by most households (90% and 67% respectively). Non-timber forest products such as mushrooms, fruits and honey are collected by a significant share of households for self-consumption (44%, 43% and 32% respectively). In contrast, the commercial use of forest products is not common. Thatch grass is the most common commercially used forest product with 6% of households selling it. Only 7% of our sample produced and sold charcoal in the last 12 months, generating on average a cash income of 108 US$. We include four levels of forest co-benefits that each specify what kind of forest products can be extracted and for what use: i) no extraction of any type of forest product; ii) only the collection of dead firewood is allowed for home consumption; iii) collection of any timber and non-timber forest product is allowed for home consumption; iv) collection of any timber and non-timber forest product is allowed for home consumption & commercial use. The last level hereby corresponds with the current level of forest use restrictions. Evidence from Vietnam suggests that potential PES recipients want to maintain rights to collect forest products (Petheram & Campbell, 2010). Due to the overall importance of forest products for rural livelihoods we therefore expect that respondents show a clear preference for weaker forest use restrictions (Hypothesis 4).

4.4. Experimental Design

The full fractional design includes 256 unique contracts based on the five attributes presented above. Each choice set consists in our case of two alternatives and one status-quo option, resulting in potentially 65,280 different choice sets. There are two main approaches to reduce the number of choice sets: a) orthogonal designs and b) efficient designs (Rose & Bliemer, 2014). Orthogonal designs are the most common method to reduce the number of choice sets. But recent empirical evidence suggests that efficient design gain more precise parameter estimates (Bliemer & Rose, 2011; Yang, Chen, Cheng, Luo, & Ran, 2014) and perform better in terms of behavioral efficiency (Yao, Scarpa, Rose, & Turner, 2014).

The generation of efficient designs requires prior knowledge of parameter estimates. While these can be sometimes obtained from existing studies, limited empirical evidence regarding PES required us to conduct a pilot study to gain prior estimates. Such pilot studies commonly use an orthogonal design to estimate an empirical model, of which the statistically significant parameters can be used as priors to obtain the efficient design. Existing studies suggest that limited pilot surveys with less than 200 observations suffice (Bliemer & Rose, 2011; Greiner, Bliemer, & Ballweg, 2014; Yang et al., 2014). We conducted a pilot survey with 73 individuals (292 choice observations) using an orthogonal design. Based on the estimated parameters of a conditional logit model a D-Efficient Design was generated with the software package *Ngene*.

4.5. Attribute Coding & Status Quo

As described above each choice situation included two separate questions. The status quo included as "no-choice" option in the second questions requires the definition of attribute levels for the status quo. The use of an Alternative Specific Constant (ASC) is usually included in the econometric models, as it allows to capture the overall utility derived from the status quo, without the need to specify any attribute levels (Hensher et al., 2015). However, we are able to define the status quo for the co-benefit attribute, as level where both commercial and subsistence extraction of forest resources is allowed. We therefore coded the co-benefits attribute in effects coding[7].

The remaining attributes cannot be defined for the status quo, as they only apply to situations with a PES contract. In this case a hybrid coding is preferred, whereby the category for the status quo as not present is defined as dummy base category and coded with a series of "0". Then the remaining levels are effect coded, with an additional base category defined as a series of "-1" (Cooper, Rose, & Crase, 2012).

The payment amount variable can be defined for the status quo with 0 US$. The variable can be hence treated as quasi-continuous. The final observed component of the utility models for Contract A, B and the status quo can be hence summarized as follows:

[7] When an ASC is used for the status quo, dummy coding would result in confounding the ASC with the base category effect of the dummy coded variable. In this case, effects coding is preferred over dummy coding as it specifies the estimates of the effect codes relative to the average effect of the variable and not relative to a specified base category (Bech & Gyrd-Hansen, 2005).

$$V_A = \beta_0\, annual.cash_A + \beta_1\, monthly.cash_A + \beta_2\, inkind_A + \beta_3\, voucher_A + \beta_4\, amount_A + \beta_5\, length_A + \beta_6\, no.benefits_A + \beta_7\, firewood_A + \beta_8\, subsitence.benefits_A + \beta_9\, commercial.benefits_A + \beta_{10}\, orga_A$$

$$V_B = \beta_0\, annual.cash_B + \beta_1\, monthly.cash_B + \beta_2\, inkind_B + \beta_3\, voucher_B + \beta_4\, amount_B + \beta_5\, length_B + \beta_6\, no.benefits_B + \beta_7\, firewood_B + \beta_8\, subsitence.benefits_B + \beta_9\, commercial.benefits_B + \beta_{10}\, orga_B$$

$$V_{SQ} = \beta_{SQ} + \beta_9\, commercial.benefits_{SQ}$$

5. Results

5.1. Random Parameter Logit Models

First, we report the results of the RPL model summarized in Table 4. Except contract length and voucher payments all variables seem to affect respondent's contract choice, indicated by statistically significant parameter estimates at the 0.01 and 0.001 level. The status quo parameter is clearly negative, implying that on average respondents prefer the contractual limitations of the PES contract over the status quo. On average, PES contracts would be accepted without any additional payments. In respect to payment vehicle, we find that in-kind fertilizer payment is significantly preferred over any other vehicle. The least preferred vehicle is monthly cash payment, followed by annual cash payments. Even though fertilizer voucher payment is the second most preferred level, the mean effect is not statistically significantly different from the grand mean of all four vehicle levels. In respect to payment amount, we see a significant and positive parameter, indicating that higher payments are preferred over smaller ones. The four levels of forest co-benefits show significant impact on the respondents' choices. No forest benefits are the least preferred attribute level, followed by firewood benefits only. Surprisingly, the level that permits only extraction of forest products for subsistence is preferred over the level where forest products can be collected for commercial purposes. In addition, our sample tends to prefer NGOs over the government as implementing organization. This effect is small in magnitude but significant at the 0.01 level.

TABLE 4 HERE

The model includes four random parameters that are found to be heterogeneously distributed, indicated by significant standard deviations of parameters at the 0.001 level[8]. All random parameters were specified as normally distributed. The estimated random parameter distributions allow to derive

[8] Likelihood ratio test indicates that the full random parameter model (see APPENDIX C) has no significantly better goodness-of-fit than the parsimonious random parameter model $\chi^2(6) = 3.295,\ p = 0.771$ presented here. However, the likelihood ratio test indicates that the parsimonious random parameter model provides a significantly better goodness-of-fit than the conditional logit model (see APPENDIX B): $\chi^2(4) = 226.36,\ p = 2.2e^{-16}$.

the share of respondents with a positive parameter estimate. 18.5% have a positive parameter estimate for the status quo and hence would require additional incentives to accept the proposed contracts.

While most results are in line with former empirical studies, the most surprising result is the valuation of the status quo. In order to unravel preference heterogeneity for this attribute, we present a further model that tries to explain differences in the status quo valuation. To do this we interact the mean of the status quo estimate with respondent's socio-economic covariates[9]. The results are included in the last two columns of Table 4. The estimates for the parameters remain stable with an unchanged preference order for the attribute levels. As in the previous model, estimates for contract length and voucher payments are not statistically significant.

In regard to preference heterogeneity for the status quo, we only find that education level has no statistically significant effect. Overall, we find that older and female respondents tend to value the status quo more positively. More importantly and strongly significant at the 0.001 level, respondents who plan to clear forest within the next three years (2015-2017) tend to value the status quo more positively. Our results further indicate at the 0.05 significance level that respondents with a written ownership confirmation (issued by traditional authorities) derive a stronger disutility from the status quo. In conjunction with the choice experiment we also collected data on risk aversion[10]. The interaction term between risk aversion and the status quo indicates with a negative coefficient, that more risk averse respondents tend to value the status quo negatively.

5.2. Latent Class Model

In order to explain preference heterogeneity across contract attributes, we apply a latent class logit model. These models assume that the sample is segmented in a given number of latent classes, each with shared preferences and hence specific parameter estimates. Latent class membership probabilities are then estimated for each individual conditional on socio-economic covariates. Commonly, various information criteria are used to determine the optimal number of latent classes (Andrews & Currim, 2003). Based on the Aikake Information Criterion (with punishing factor 2 (AIC) and 3 (AIC3)) and the Bayesian Information Criterion (BIC) we consider three classes as most appropriate for our analysis (see APPENDIX E). All three criteria find clear superiority of three class models compared to two class models. While AIC and AIC3 favor six and four classes respectively, three classes perform relatively good (best according to BIC) and keep the results easily interpretable. Table 5 and Table 6 summarize

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[9] APPENDIX D includes RPL models with varying number of covariates. The final model was selected according the likelihood ratio tests that indicate slightly better goodness-of-fit than model 5 ($\chi^2(1) = 3.247,\ p = 0.071$), but no significantly worse goodness-of-fit than model 3 ($\chi^2(1) = 2.3434,\ p = 0.126$).

[10] We used a design adapted from (Brick, Visser, & Burns, 2012), whereby individuals are confronted with a series of choices between a sure option with a fixed pay-off and a lottery that wins a specified amount with 0.5 probability or nothing. Each respondent was confronted with 3 choices, resulting in total of eight levels of risk aversion. We only conducted hypothetical experiments without any real pay-offs.

the parameter estimates for each class and respective class membership predictions based on socio-economic covariates. The average class membership probability is 12% for Class 1, 50% for Class 2 and 38% for Class 3.

TABLE 5 HERE

Class 1 is characterized by a positive estimate for the status quo, hereby contrasting Class 2 and 3. In order to accept any contract they would consequently need additional positive incentives. Even though they show a positive preference for payment amount, they are less sensitive to it than Class 2 and 3. At the same time, they would most strongly prefer fertilizer payments over cash payments. Interestingly, the kind of forest benefits, contract length and implementing organization does not significantly influence their contract choice, indicated by non-significant parameter estimates. Younger and female respondents who cleared less area are more likely to be a member of this class. They also plan to clear more land in the future than any other class. At the same time, they are less risk averse and have smaller farms than Class 2 (see Table 6).

The preferences of Class 2 are characterized by a strong negative perception of the status quo, a strong preference for shorter contract length and clear preferences for subsistence over commercial forest co-benefits. Similar to Class 1, they prefer fertilizer in-kind over annual or monthly cash payments. Older respondents, who cleared more in the past, but plan to clear less area in the future than Class 1, are more likely to belong to Class 2. More risk averse members are also likely to belong to Class 2. Fertilizer use in the past 5 years also predicts membership in this class, but is only marginally significant at a 0.1 level.

TABLE 6 HERE

Class 3 is characterized by a negative status quo estimate, and shows no sensitivity to the payment vehicle. At the same time, they are the most sensitive to payment amount. In contrast to the other classes, they have a significant preference for NGOs over the government as implementing organization. Also, they show a strong sensitivity to forest co-benefits and almost equally value commercial and subsistence forest-use. Male and older respondents are more likely to belong to this class. Respondents, who have cleared large areas in the last 5 years and intend to clear the smallest area in future, are also more likely members of Class 3.

6. Discussion

All three models underline that respondents have positive preferences for the amount of incentive payments. We can thus confirm Hypothesis 2, which is also in line with former studies (Balderas Torres et al., 2013; Kaczan et al., 2013; Nordén, 2014). Existing empirical evidence on the valuation of contract length is contradictory (see Section 4.3). We find in our LCM that only one segment (the largest with average 50% class probability) has a preference for shorter contracts. Older respondents are also most likely members of this class. With regard to implementing organization, all three models indicate preferences for NGOs over the government. However, the LCM suggests that only one segment of our sample is influenced by this attribute, while it seems irrelevant for the choice of the remaining respondents. Nevertheless, an involvement of NGOs would positively affect PES enrollment.

With respect to payment vehicle, we find that in-kind and voucher are preferred over cash payments. In-kind payments are also preferred over vouchers. Even though, there is evidence for heterogeneity regarding valuation of in-kind payments. In conclusion, we can confirm Hypothesis 1 and 2[11]. Our results underline the findings of Kaczan et al. (2013), who defined in-kind payments as once-off payment at the beginning of the contract. The valuation for this vehicle could be hence influenced by strong discount rates that favor once-off payments. We find evidence that payments as in-kind agricultural inputs (including fertilizer) are preferred over cash payments of the same value and with the same frequency (annual). At first, the finding that voucher payments are preferred over cash payments may not seem intuitive, since cash payments can be spent flexibly. A randomized control trial in Kenya offering free-delivery of fertilizer early in the season significantly increased adoption rates (Duflo, Kremer, & Robinson, 2011). Their theoretical model predicts present-biased farmers to procrastinate fertilizer purchase due to costs (transport, decision-making). The same reasons could explain the observed preferences, if farmers are aware of their time inconsistencies. The overall results underline that PES schemes paying in-kind or with input vouchers could achieve secondary objectives such as agricultural intensification. The preferences for in-kind and voucher payments also indicates that certain payment vehicle can potentially reduce overall costs of PES. Which of the two payment vehicle is preferred in terms of cost efficiency depends on case-specific transaction costs.

The attribute specifying different regulations on forest co-benefits show a significant impact on respondent's choices. Hypothesis 4 is partly confirmed that (certain) less restrictive forest co-benefits are preferred over more restrictive levels. Surprisingly, we find that on average respondents prefer regulations, whereby commercial extraction of forest products is not allowed. Based on qualitative follow-up questions after the choice experiments, we explain this preference by concerns for excessive commercial extraction (mainly charcoal production)[12]. Only few households derive cash income from the collection of forest products. Many respondents however stated that a regulation of commercial extraction would conserve forests for subsistence use. Other studies highlighted the role of forest products for rural livelihoods in times of shocks (Kalaba et al., 2013). This potentially increases the valuation of subsistence use. While the hypothetical PES contract predominantly focused on regulations regarding deforestation for agriculture, these findings suggest that broader forest use restrictions could

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[11] It has to be however noted that voucher payment is not statistically significant across all models, limiting the conclusions that we can derive for this payment vehicle.

[12] While charcoal production is usually practiced at distributed and hence de-facto private land, forested areas on distributed land are commonly accessed by villagers for the collection of non-timber forest products and firewood.

be incorporated in PES schemes. This could be done at low or no additional costs (except enforcement and monitoring of such regulations).

The RPL models find a significant preference heterogeneity regarding the status quo. This is also confirmed by the LCM. On average respondents would agree on PES contracts, which contractually binds them not to clear any forest for agriculture, even without any additional payments. Kaczan et al. (2013) yield similar results for a large segment of their sample. They potentially explain it with pro-environmental preferences and different opportunity costs.

We offer two potential interpretations of this result. The strong negative valuation of the status quo is a result of the high contract acceptance in the second question of each choice set. The first explanation is related to the method of discrete choice experiments. The contract acceptance could be interpreted as "yes saying" induced by a social desirability bias. Accordingly, respondents anticipated that the interviewers wanted them to accept the hypothetical contract and acted accordingly. As a consequence, respondents would not choose according to their true preferences. The social desirability bias might be amplified by the hypothetical nature of the choice task and is hence closely connected to a hypothetical bias. Further choice experiments are advised to adapt their design, as to avoid such ambiguity of their results. Our experimental design did not include any contracts without payments, since we expected that no payment would be strictly dominated by contracts with payments. Further research should consider testing such attribute combinations, to reveal whether contracts without payments would be preferred over contracts with payment if it includes other desirable characteristics. Several additional measures can be applied to minimize biases. Kaczan et al. (2013) integrated inferred valuation (respondents are asked what they think most other people would prefer) to minimize the social desirability bias. Another option would be letting respondents secretly choose to reduce their feeling of being observed. In order to minimize the hypothetical bias, further studies could also systematically test the effect of different cheap talk scripts.

A second explanation that is supported by the interaction effects between status quo valuation and socio-economic covariates focuses on tenure security. Accordingly, the PES contract implies some implicit assumptions that are not specified in any of the attributes. The effect of such implicit attributes would be then captured by the status quo estimate. From our perspective, the implicit assumption that farmers hold the use rights to cultivate their currently used fields is a conclusive explanation for the status quo valuation. By signing a contract that permits to cultivate the existing fields, respondents can secure their (perceived) tenure. None of the respondents has a formal title deed for their land. At the same time, anecdotal evidence from the research area suggest that evictions and displacement occurred in the past. The area is neighboring a national park and is part of a Game Management Area, which defines conservation areas where no settlements are allowed. In 2015, large numbers of households have been evicted by the national parks authority as they allegedly illegally settled in conservation areas. Anecdotal evidence suggests that many households have settled there from the beginning of the 2000s. Other incidences of displacement due to large-scale land acquisitions have been reported to the researchers during the fieldwork. Facing such developments, customary law seems to reach it limits in ensuring tenure security.

Respondents with a plot title issued by traditional authorities, perceive the status quo comparatively more negative and have hence stronger preferences for a PES contract. Within the study area local households do not routinely get a written confirmation of ownership for their land. Instead they have to actively request such an informal title from the traditional authorities. We assume that respondents are unlikely to request such a confirmation, if perceived tenure security is high. If households however feel tenure insecurity, they are more likely to request an informal ownership confirmation[13]. We hence assume that having an informal plot title, is a proxy for perceived tenure insecurity. This interpretation suggests that tenure insecure respondents value the increased ownership recognition by a PES contract, leading to a more negative valuation of the status quo.

RPL and LCM indicate that the more risk averse respondents are, the less utility they derive from the status quo. In the LCM, Class 2 members are significantly more risk averse than Class 1 members and also show the strongest disutility from the status quo. On the one hand, tenure security could be one underlying explanation. As such the contracts would be perceived to decrease the risk of eviction or loss of ownership. However, having a plot title, as proxy for perceived tenure security, is negatively correlated with risk aversion ($r=-0.22$, $p<0.01$). We therefore favor another interpretation why risk averse respondents value the status quo more negatively. The contracts provide a fixed income, hence reducing the dependency on risky agricultural income that is influenced by uncertain events such as illness of household labor and weather.

We also find evidence for a strong link between clearing behavior and status quo preferences. Findings of both RPL and LCM indicate that respondents who intend to clear land in the future (next three years), value the current status quo more positively (Class 1). Respondents who want to clear land in the near future, have most likely higher opportunity costs of avoided deforestation and contractually committing not to clear forest is consequently valued more negatively. Moreover, the LCM finds that respondents who have cleared larger areas in the past five years are more likely to belong to Class 2 and 3, which derives disutility from the status quo. Overall, these findings suggest a clear trade-off between efficiency and effectiveness of the proposed PES scheme. If payments are too low, only respondents who presumably cleared sufficiently in the past will enroll, as they perceive the benefits of improved tenure security outweighing the commitment not to clear. Higher payments would be necessary in order to motivate farmers, who are most likely to clear in future, to enroll in the PES scheme. This would

[13] Qualitative interviews during the field work did not find evidence that receiving a title by traditional authorities depends on payments or kinship.

reduce the economic efficiency of the program. Prior identification of sub-groups of potential ES providers is consequently useful to determine PES design, specifically for setting payment levels.

Results of the LCM suggest that preferences for a variety of contract attributes are heterogeneous across different segments of respondents. Similar, results have been attained by other choice experiments on PES (Kaczan et al., 2013; Nordén, 2014). Instead of discussing in depth the preference patterns of the different segments, we would like to focus on consequences for PES design. Generally, we find that one PES contract could be designed without making trade-offs between segments. Each segment seems to be not influenced in their contract choice by certain attributes. Members of Class 3 are not concerned about the particular payment vehicle of a contact, while forest co-benefits do not affect choices of Class 1 members. More concentrated are preferences for contract length and implementing organization, that only influence contract choice among one class, but not others. Identifying sub-groups with shared preferences can thus help to adapt PES designs to one segment without necessarily compromising PES acceptance among others.

7. Conclusion

This paper set out to elicit preferences for various PES design attributes. By including agricultural inputs as compensation, we intended to study the potential of PES schemes to simultaneously reduce deforestation and improve agricultural productivity.

The results suggest that small-scale farmers in Zambia prefer receiving agricultural inputs instead of cash payments for contractually committing not to clear forest for agricultural activities. PES could hence harness synergies between environmental conservation and other developmental objectives such as agricultural intensification. This could be achieved at lower costs than solely focusing on reducing deforestation. Despite relatively homogenous ES providers, we find significant preference heterogeneity. Identifying segments with shared preferences can hence help to adapt PES schemes to specific groups, without necessarily compromising contract valuation among other groups. Moreover, non-monetary attributes such as implementing organization, contract length and especially forest co-benefits significantly impact the overall valuation of PES contracts. Being aware of such preferences allows to reduce needed payment amounts to motivate PES enrollment. More importantly, we found large parts of our sample would accept commitments not to clear without any monetary compensation. Our interpretation suggests that respondents perceive PES contracts as implicitly improving tenure security of their current land.

We belief that our paper has demonstrated the potential synergies of PES that are designed to reconcile environmental conservation and agricultural intensification. Nevertheless, we would conclude with a reflection on the research's limitations. Given the limited geographical coverage of our study, further research is needed to better understand the generalizability of our results to different contexts.

Moreover, discrete choice experiments are potentially compromised by hypothetical and social desirability biases. We recommend further research to systematically address this issues, e.g. by introducing measures such as cheap talk or inferred valuation. Comparing the results of such studies would also allow to better understand to which extent choice experiments elicit true preferences. Results such as ours can also be used to design pilot PES schemes which have a higher probability to be effective and cost efficient.

Lastly, our results encourage further research on the relation between PES design and tenure security. This choice experiment indicates that payment levels can be significantly reduced, if small-scale farmers receive formal property or use rights for their currently used agricultural land. It is widely recognized that PES require clearly defined property rights as least at the community level. Our results suggest that PES schemes can not only reduce costs but also provide additional developmental benefits if property or use rights are formalized at the individual level. It remains to further research to better understand how improved tenure security could be explicitly incorporated in PES schemes.

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Table 1: Respondent and Farm Characteristics of Sample

Statistic	N	Mean	St. Dev.	Min	Max
Respondent Characteristics					
Age in years	320	44.74	15.70	19	87
Gender (1 Female, 0 Male)	320	0.32	--	0	1
Household head (1 Yes, 0 No)	320	0.83	--	0	1
Education (Years of Schooling)[1]	320	6.38	3.17	0	13
Farm Characteristics					
Total Field Size (ac)	320	17.00	25.34	1.00	200.00
Cultivation Area 2014/15 (ac)	320	8.51	12.87	0.00	160.61
Cultivation Area 2014/15 as Percent of Total Field Size	320	63.03	29.22	0.00	100.00
Number of Years of Fertilizer Application 2010/11-2014/15	320	2.61	2.09	0	5
Fertilizer Application 2014/15	320	0.62	--	0	1
Fertilizer per Area 2013/14 (kg/ac)	320	29.12	43.74	0.00	359.11
Total Cash Income (2014/15) in US$[2]	319[3]	706.60	1,559.40	0.00	18,190.41
Crop Production Share Among Total Cash Income (2014/15)	307[3]	44.63	39.80	0.00	100.00
Forest Area Located on Farm (ac)	311[3]	14.77	89.96	0.00	1,235.48
Informal Land Title*	317[3]	0.40	--	0	1

[1] Education above higher secondary school is coded as 13 years; [2] 1 US$ = 7.3 ZMW;
[3] The remaining respondents could not provide this information.

Table 2: Clearing for Agriculture of Sampled Households

Statistic	N	Mean	St. Dev.	Min	Max
Clearing 2010-14 (1 Yes, 0 No)	320	0.48	--	0	1
Clearing 2014 (1 Yes, 0 No)	320	0.22	--	0	1
Cleared Area 2014 (ac)	69	6.05	12.62	0.24	84
Cleared Area 2010-14 (ac)	154	9.60	14.15	0.03	84
Expected Clearing 2015-2017 (1 Yes, 0 No)	320	0.42	--	0	1
Expected Clearing Area 2015-17 (ac)	136	5.50	11.66	0.30	125

Table 3: Attributes, Levels and Hypothesis

Attribute	Levels	Hypotheses
Payment Vehicle	Annual cash payment Monthly cash payment Input vouchers In-kind inputs	H1: Respondents prefer in-kind inputs and input voucher payments over annual and monthly cash payments. H2: Respondents prefer in-kind inputs over voucher payments.
Payment Levels	60 (8.2US$) 120 (16.4US$) 240 (32.9US$) 480 (65.8US$) Zambian Kwacha per year and acre	H3: Respondents have a preference for higher payment levels.
Contract Length	10 years 20 years	
Implementing Organization	Government of Zambia NGO	
Forest Co-Benefits	No extraction Firewood extraction Subsistence Extraction Commercial Extraction	H4: Respondents have a preference for less restrictive forest co-benefits over more restrictive levels.

Table 4: Result of the Random Parameter Logit Models

	Without Covariates		With Covariates	
	Mean	**SD**	**Mean**	**SD**
Status Quo	**-2.45***** (0.28)	**2.73***** (0.29)	**-4.38***** (1.12)	**2.52***** (0.28)
Monthly Cash Payment	**-0.80***** (0.11)	--	**-0.79***** (0.11)	--
Fertilizer Voucher Payment	0.08 (0.08)	--	0.08 (0.08)	--
In-Kind Fertilizer Payment	**1.14***** (0.16)	**0.64***** (0.15)	**1.15***** (0.16)	**0.65***** (0.15)
Annual Cash Payment[1]	-0.42	--	-0.44	--
Payment Amount	**0.02***** (0.00)	--	**0.02***** (0.00)	--
Contract Length	-0.04 (0.06)	--	-0.05 (0.06)	--
No Forest Benefits	**-1.97***** (0.18)	**0.81***** (0.13)	**-1.99***** (0.19)	**0.84***** (0.13)
Firewood Forest Benefits	**-0.23**** (0.09)	**0.54***** (0.12)	**-0.21*** (0.09)	**0.51***** (0.13)
Subsistence Forest Benefits	**1.20***** (0.10)	--	**1.22***** (0.10)	--
Commercial Forest Benefits[1]	1.00	--	0.98	--
Organization	**0.12**** (0.04)	--	**0.12**** (0.04)	--
Heterogeneity in the Mean of Status Quo				
Status Quo * Age	--	--	**0.04**** (0.01)	--
Status Quo * Female	--	--	**1.08*** (0.45)	--
Status Quo * Risk Aversion	--	--	**-0.19*** (0.09)	--
Status Quo * Education	--	--	0.13 (0.07)	--
Status Quo * Clearing Future	--	--	**1.55***** (0.41)	--
Status Quo * Plot Title	--	--	**-0.88*** (0.41)	--
AIC	2445.89		2400.88	
Log Likelihood	-1208.95		-1180.44	
Num. obs.	2560.00		2536.00	

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, · $p < 0.1$

Note: All random parameter estimates are based on 1000 Halton Draws. The random parameters are assumed to be normally distributed.

[1] The parameter of the effects-coded base category is calculated as the negative sum of the other level estimates (Cooper et al., 2012).

Table 5: Latent Class Model Parameter Estimates

	Class 1	Class 2	Class 3
Status Quo	**2.30*****	**-3.42*****	**-1.05***
	(0.40)	(0.40)	(0.41)
Monthly Cash Payment	**-1.09*****	**-1.00*****	-0.17
	(0.29)	(0.20)	(0.19)
Fertilizer Voucher Payment	0.29	0.21$^{\cdot}$	-0.27
	(0.23)	(0.12)	(0.20)
In-Kind Fertilizer Payment	**1.61*****	**1.34*****	0.17
	(0.35)	(0.24)	(0.27)
Annual Cash Payment	-0.81	-0.55	0.27
Payment Amount	**0.01***	**0.02*****	**0.03*****
	(0.00)	(0.00)	(0.01)
Contract Length	-0.00	**-0.22***	0.14
	(0.14)	(0.09)	(0.14)
No Forest Benefits	-0.32	**-1.99*****	**-2.46*****
	(0.36)	(0.27)	(0.40)
Firewood Forest Benefits	-0.44$^{\cdot}$	**0.34***	**-1.00*****
	(0.23)	(0.14)	(0.29)
Subsistence Forest Benefits	0.16	**1.02*****	**1.74*****
	(0.22)	(0.14)	(0.35)
Commercial Forest Benefits	0.6	0.63	1.72
Organization	-0.12	0.06	**0.30****
	(0.11)	(0.06)	(0.10)
AIC		2363.68	
Log Likelihood		-1135.84	
Num. obs.		2560.00	

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$

Table 6: Latent Class Membership Predictions Based on Socio-Economic Covariates

	Class 1	Class 2	Class 3
Class Intercept	--	-0.47	**0.87****
		(0.34)	(0.33)
Age	--	**0.03*****	**0.02****
		(0.00)	(0.01)
Gender (female)	--	-0.11	**-0.78*****
		(0.16)	(0.18)
Clearing 5 years	--	**0.34*****	**0.50*****
		(0.09)	(0.09)
Farmsize (ac)	--	**-0.01*****	-0.00$^{\cdot}$
		(0.00)	(0.00)
Risk Aversion	--	**0.12*****	0.01
		(0.03)	(0.03)
Fertilizer Use (5 years)	--	0.06$^{\cdot}$	0.05
		(0.04)	(0.04)
Future Clearing	--	**-0.81*****	**-1.19*****
		(0.15)	(0.16)
Average Class Membership Probabilities			
	0.12	0.50	0.38

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$

APPENDIX A Translated Choice Set Example

NEW SET 1

Question 1

Now, I will describe two contracts. Please think carefully which of both contracts you prefer.

	OPTION A	**OPTION B**
Payment Mode	Under this contract you would receive an **IN- KIND PAYMENT AS FERTILIZER, SEEDS AND PESTICIDES** before each growing season delivered to your village.	Under this contract you would receive a **VOUCHER FOR FERTILIZER, SEEDS AND PESTICIDES** before each growing season to be redeemed in Mumbwa.
Amount	**For each acre** that you are currently cultivating you would receive **EACH YEAR FERTILIZER WORTH 480 KWACHA**.	**For each acre** that you are currently cultivating you would receive **EACH YEAR FERTILIZER WORTH 60 KWACHA**.
Contract Length	The contract would be valid for **20 YEARS**.	The contract would be valid for **10 YEARS**.
Forest Resources	In this contract you would be **ONLY ALLOWED** to collect **DEAD WOOD FOR FIREWOOD**.	In this contract you would be **ALLOWED** to collect resources such as firewood, building material or fruits within the forests **FOR OWN CONSUMPTION AND SELLING**.
Implementing Organization	Under this contract the payment would be made by the **ZAMBIAN GOVERNMENT.**	Under this contract the payment would be made by an **NGO**.

APPENDIX B Conditional Logit Model Estimates

	Combined	Question 1	Question 1 & 2
Status Quo	**-0.61*****		**-1.32*****
	(0.13)		(0.11)
Monthly Cash Payment	**-0.48*****	**-0.73*****	**-0.49*****
	(0.08)	(0.11)	(0.08)
Fertilizer Voucher Payment	-0.00	**0.15***	0.02
	(0.07)	(0.08)	(0.06)
In-Kind Fertilizer Payment	**0.63*****	**1.13*****	**0.71*****
	(0.12)	(0.17)	(0.11)
Annual Cash Payment	-0.15	-0.55	-0.24
Payment Amount	**0.02*****	**0.01*****	**0.01*****
	(0.00)	(0.00)	(0.00)
Contract Length	0.05	-0.07	0.01
	(0.05)	(0.05)	(0.04)
No Forest Benefits	**-1.53*****	**-1.51*****	**-1.30*****
	(0.13)	(0.18)	(0.11)
Firewood Forest Benefits	**-0.18***	-0.12	**-0.16****
	(0.08)	(0.07)	(0.06)
Subsistence Forest Benefits	**0.99*****	**0.89*****	**0.84*****
	(0.08)	(0.09)	(0.07)
Commercial Forest Benefits	0.72	0.74	0.62
Organization	**0.10***	0.06	**0.08***
	(0.04)	(0.03)	(0.03)
AIC	2287.10	1475.23	2664.25
Log Likelihood	-1133.55	-728.61	-1322.13
Num. obs.	1280.00	1280.00	2560.00

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

APPENDIX C Random Parameter Logit Estimates

	Full Models			Parsimonious		
	Combined	Question 1	Question 1 & 2	Combined	Question 1	Question 1 & 2
Status Quo	**-1.82*****		**-2.41*****	**-1.82*****		**-2.45*****
	(0.30)		(0.30)	(0.29)		(0.28)
Monthly Cash Payment	**-0.84*****	**-0.94*****	**-0.85*****	**-0.83*****	**-0.81*****	**-0.80*****
	(0.13)	(0.19)	(0.12)	(0.12)	(0.14)	(0.11)
Fertilizer Voucher Payment	0.02	0.18	0.07	0.03	0.17	0.08
	(0.11)	(0.11)	(0.09)	(0.10)	(0.09)	(0.08)
In-Kind Fertilizer Payment	**1.09*****	**1.34*****	**1.22*****	**1.07*****	**1.16*****	**1.14*****
	(0.19)	(0.28)	(0.18)	(0.17)	(0.22)	(0.16)
Annual Cash Payment	-0.27	-0.58	-0.44	-0.27	-0.52	-0.42
Payment Amount	**0.03*****	**0.02*****	**0.02*****	**0.02*****	**0.02*****	**0.02*****
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Contract Length	0.01	-0.05	-0.03	0.00	-0.03	-0.04
	(0.08)	(0.08)	(0.06)	(0.07)	(0.07)	(0.06)
No Forest Benefits	**-2.91*****	**-2.08*****	**-2.13*****	**-2.76*****	**-1.83*****	**-1.97*****
	(0.35)	(0.34)	(0.24)	(0.27)	(0.24)	(0.18)
Firewood Forest Benefits	-0.18	-0.18	**-0.26***	-0.16	-0.15	**-0.23****
	(0.14)	(0.10)	(0.10)	(0.13)	(0.08)	(0.09)
Subsistence Forest Benefits	**1.71*****	**1.20*****	**1.31*****	**1.60*****	**1.06*****	**1.20*****
	(0.20)	(0.18)	(0.15)	(0.14)	(0.12)	(0.10)
Commercial Forest Benefits	1.38	1.06	1.08	1.32	0.92	1.00
Organization	**0.19****	**0.16****	**0.13****	**0.18****	**0.14****	**0.12****
	(0.06)	(0.06)	(0.05)	(0.06)	(0.05)	(0.04)
Standard Deviation						
Status Quo	**2.76*****		**2.87*****	**2.68*****		**2.73*****
	(0.31)		(0.32)	(0.29)		(0.29)
Monthly Cash Payment	0.07	0.00	0.05			
	(0.34)	(0.29)	(0.21)			
Fertilizer Voucher Payment	0.23	0.47	0.34			
	(0.44)	(0.28)	(0.25)			
In-Kind Fertilizer Payment	**0.54***	**0.91*****	**0.71*****		**0.81*****	**0.64*****
	(0.27)	(0.23)	(0.17)		(0.16)	(0.15)
Payment Amount	0.01	0.00	0.01			
	(0.01)	(0.01)	(0.01)			
Contract Length	**0.41****	0.16	0.24	**0.41*****		
	(0.13)	(0.24)	(0.14)	(0.11)		
No Forest Benefits	**1.32*****	**1.12*****	**0.83*****	**1.28*****	**1.03*****	**0.81*****
	(0.20)	(0.22)	(0.15)	(0.17)	(0.16)	(0.13)
Firewood Forest Benefits	**0.65****	0.42	**0.58*****	**0.60*****		**0.54*****
	(0.20)	(0.22)	(0.15)	(0.18)		(0.12)
Subsistence Forest Benefits	0.01	0.03	0.30			
	(0.26)	(0.44)	(0.25)			
Organization	0.22	0.25	0.20			
	(0.22)	(0.16)	(0.18)			
AIC	2041.18	1452.03	2454.60	2030.72	1440.75	2445.89
Log Likelihood	-1000.59	-708.01	-1207.30	-1001.36	-709.37	-1208.95
Num. obs.	1280.00	1280.00	2560.00	1280.00	1280.00	2560.00

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

APPENDIX D Random Parameter Models with Covariates

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Status Quo	**-3.73****	**-3.72****	**-3.75****	**-4.38*****	**-3.10*****	**-3.10*****	**-4.13*****
	(1.18)	(1.18)	(1.17)	(1.12)	(0.87)	(0.87)	(0.71)
Monthly Cash Payment	**-0.79*****	**-0.79*****	**-0.79*****	**-0.79*****	**-0.79*****	**-0.79*****	**-0.79*****
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Fertilizer Voucher Payment	0.08	0.08	0.08	0.08	0.07	0.08	0.08
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
In-Kind Fertilizer Payment	**1.14*****	**1.14*****	**1.14*****	**1.15*****	**1.14*****	**1.14*****	**1.15*****
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
Annual Cash Payment	-0.43	-0.43	-0.43	-0.44	-0.42	-0.43	-0.44
Payment Amount	**0.02*****	**0.02*****	**0.02*****	**0.02*****	**0.02*****	**0.02*****	**0.02*****
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Contract Length	-0.04	-0.04	-0.04	-0.05	-0.05	-0.04	-0.05
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
No Forest Benefits	**-1.98*****	**-1.98*****	**-1.98*****	**-1.99*****	**-1.98*****	**-1.98*****	**-1.99*****
	(0.19)	(0.19)	(0.19)	(0.19)	(0.18)	(0.19)	(0.19)
Firewood Forest Benefits	**-0.21***	**-0.21***	**-0.21***	**-0.21***	**-0.22***	**-0.22***	**-0.21***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Subsistence Forest Benefits	**1.22*****	**1.22*****	**1.22*****	**1.22*****	**1.21*****	**1.21*****	**1.21*****
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Commercial Forest Benefits	0.97	0.97	0.97	0.98	0.99	0.99	0.99
Organization	**0.12****	**0.12****	**0.12****	**0.12****	**0.11****	**0.12****	**0.12****
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Heterogeneity in the Mean of Status Quo							
Status Quo * Age	**0.04****	**0.04****	**0.04****	**0.04****	**0.03***	**0.03***	**0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Status Quo * Female	**1.09***	**1.09***	**1.01***	**1.08***	0.84$^{\cdot}$		
	(0.46)	(0.46)	(0.45)	(0.45)	(0.43)		
Status Quo * Risk Aversion	**-0.19***	**-0.19***	**-0.18***	**-0.19***	**-0.19***	-0.16$^{\cdot}$	
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)	
Status Quo * Asset Index	0.15	0.16					
	(0.20)	(0.20)					
Status Quo * Education	0.10	0.10	0.11	0.13$^{\cdot}$			
	(0.07)	(0.07)	(0.07)	(0.07)			
Status Quo * Clearing 5 years	0.03						
	(0.19)						
Status Quo * Clearing Future	**1.55*****	**1.56*****	**1.59*****	**1.55*****	**1.56*****	**1.50*****	**1.53*****
	(0.42)	(0.41)	(0.40)	(0.41)	(0.41)	(0.41)	(0.41)
Status Quo * Plot Title	-0.56	-0.55	-0.52	**-0.88***	**-0.84***	**-0.89***	-0.79$^{\cdot}$
	(0.46)	(0.46)	(0.46)	(0.41)	(0.41)	(0.41)	(0.41)
Status Quo * Forest Importance	-0.12	-0.12	-0.13				
	(0.08)	(0.08)	(0.08)				
Standard Deviation							
Status Quo	**2.47*****	**2.47*****	**2.47*****	**2.52*****	**2.53*****	**2.55*****	**2.58*****
	(0.27)	(0.27)	(0.27)	(0.28)	(0.28)	(0.28)	(0.28)
In-Kind Fertilizer Payment	**0.65*****	**0.65*****	**0.65*****	**0.65*****	**0.64*****	**0.65*****	**0.65*****
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
No Forest Benefits	**0.86*****	**0.86*****	**0.86*****	**0.84*****	**0.83*****	**0.84*****	**0.84*****
	(0.14)	(0.14)	(0.14)	(0.13)	(0.13)	(0.13)	(0.13)
Firewood Forest Benefits	**0.51*****	**0.51*****	**0.51*****	**0.51*****	**0.51*****	**0.51*****	**0.51*****
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
AIC	2392.64	2390.65	2389.31	2400.88	2402.72	2404.59	2405.95
Log Likelihood	-1173.32	-1173.33	-1173.65	-1180.44	-1182.36	-1184.29	-1185.98
Num. obs.	2528.00	2528.00	2528.00	2536.00	2536.00	2536.00	2536.00

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$

APPENDIX E Latent Class Model Information Criteria

Table A-1: Information Criteria for Latent Class Models without Covariates

Classes	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
AIC	2434.4	2359.5	2336.3	2339.8	2328.2	2332.9	2349	2372.7	2366.9
AIC3	2455.4	2391.5	2379.3	2393.8	2393.2	2408.9	2436	2470.7	2475.9
BIC	2557.2	2546.6	2587.8	2655.6	2708.3	2777.3	2857.7	2945.7	3004.3
Log Likelihood	-1196.2	-1147.7	-1125.2	-1115.9	-1099.1	-1090.5	-1087.5	-1088.3	-1074.5

Table A-2: Information Criteria for Latent Class Models with Covariates

Classes	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
AIC	2433.4	2363.7	2399.7	2346.5	2435.4	2459.7	2483.2	2544.5	2579.0
AIC3	2461.4	2409.7	2463.7	2428.5	2535.4	2577.7	2619.2	2698.5	2751.0
BIC	2597.1	2632.7	2773.9	2826.0	3020.1	3149.7	3278.5	3445.1	3584.8
Log Likelihood	-1188.7	-1135.8	-1135.8	-1091.3	-1117.7	-1111.8	-1105.6	-1118.3	-1117.0

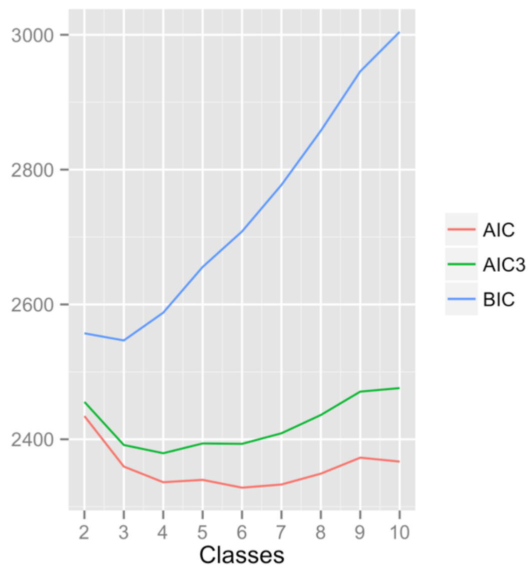

Figure A-1: Information Criteria for Latent Class Model without Covariates

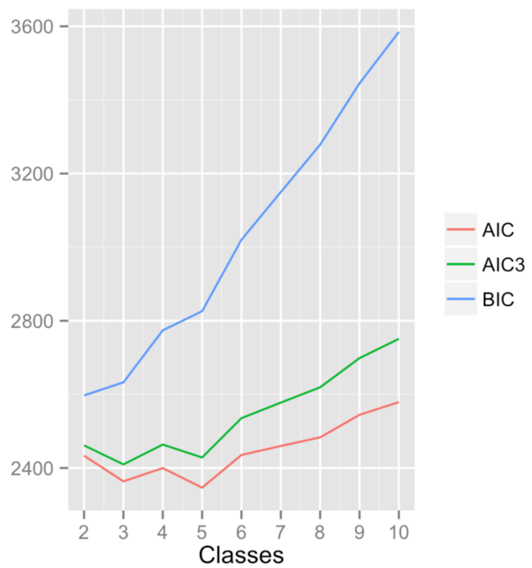

Figure A-2: Information Criteria for Latent Class Model with Covariates

APPENDIX F Latent Class Model Estimates

		Model 1			Model 2			Model 3	
	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
Status Quo	**2.32*****	**-3.40*****	-0.95	**2.32*****	**-3.16*****	0.49	**2.30*****	**-3.42*****	**-1.05***
	(0.40)	(0.41)	(0.59)	(0.40)	(0.32)	(0.61)	(0.40)	(0.40)	(0.41)
Monthly Cash Payment	**-1.09*****	**-0.97*****	-0.20	**-1.09*****	**-0.85*****	-0.51	**-1.09*****	**-1.00*****	-0.17
	(0.29)	(0.22)	(0.20)	(0.29)	(0.15)	(0.32)	(0.29)	(0.20)	(0.19)
Fertilizer Voucher Payment	0.29	0.21$^{\cdot}$	-0.26	0.31	0.14	0.20	0.29	0.21$^{\cdot}$	-0.27
	(0.23)	(0.12)	(0.21)	(0.23)	(0.10)	(0.36)	(0.23)	(0.12)	(0.20)
In-Kind Fertilizer Payment	**1.61*****	**1.31*****	0.16	**1.59*****	**1.18*****	-0.41	**1.61*****	**1.34*****	0.17
	(0.35)	(0.25)	(0.29)	(0.34)	(0.20)	(0.39)	(0.35)	(0.24)	(0.27)
Annual Cash Payment	-0.81	-0.55	0.30	-0.81	-0.47	0.72	-0.81	-0.55	0.27
Payment Amount	**0.01***	**0.02*****	**0.03*****	**0.01***	**0.01*****	**0.07*****	**0.01***	**0.02*****	**0.03*****
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.01)
Contract Length	-0.01	**-0.22***	0.15	0.01	**-0.19***	0.48$^{\cdot}$	-0.00	**-0.22***	0.14
	(0.14)	(0.09)	(0.17)	(0.14)	(0.08)	(0.28)	(0.14)	(0.09)	(0.14)
No Forest Benefits	-0.31	**-1.98*****	**-2.52*****	-0.30	**-1.87*****	**-3.94*****	-0.32	**-1.99*****	**-2.46*****
	(0.36)	(0.27)	(0.50)	(0.35)	(0.23)	(1.05)	(0.36)	(0.27)	(0.40)
Firewood Forest Benefits	-0.44$^{\cdot}$	**0.33***	**-1.03*****	**-0.47***	**0.25***	**-1.26*****	-0.44$^{\cdot}$	**0.34***	**-1.00*****
	(0.23)	(0.15)	(0.31)	(0.23)	(0.11)	(0.30)	(0.23)	(0.14)	(0.29)
Subsistence Forest Benefits	0.16	**1.00*****	**1.80*****	0.17	**0.90*****	**3.19*****	0.16	**1.02*****	**1.74*****
	(0.22)	(0.15)	(0.48)	(0.22)	(0.12)	(0.81)	(0.22)	(0.14)	(0.35)
Commercial Forest Benefits	0.59	0.65	1.75	0.6	0.72	2.01	0.6	0.63	1.72
Organization	-0.12	0.05	**0.31***	-0.11	0.05	**0.59*****	-0.12	0.06	**0.30****
	(0.11)	(0.06)	(0.13)	(0.11)	(0.05)	(0.16)	(0.11)	(0.06)	(0.10)
			Class Membership						
Class Intercept		-0.29	**0.72***		-0.10	0.50		-0.47	**0.87****
		(0.36)	(0.35)		(0.32)	(0.34)		(0.34)	(0.33)
Age		**0.03*****	**0.01****		**0.03*****	**0.01***		**0.03*****	**0.02****
		(0.00)	(0.01)		(0.00)	(0.01)		(0.00)	(0.01)
Gender (female)		-0.15	**-0.79*****		-0.25	**-0.68*****		-0.11	**-0.78*****
		(0.16)	(0.18)		(0.16)	(0.18)		(0.16)	(0.18)
Asset Index		-0.17$^{\cdot}$	-0.12		-0.16$^{\cdot}$	-0.07			
		(0.09)	(0.09)		(0.09)	(0.09)			
Clearing 5 years		**0.40*****	**0.54*****		**0.41*****	**0.50*****		**0.34*****	**0.50*****
		(0.10)	(0.10)		(0.09)	(0.09)		(0.09)	(0.09)
Migrant (5years)		**-0.38***	0.15						
		(0.19)	(0.20)						
Farmsize (ac)		**-0.01*****	-0.00		**-0.01*****	**-0.01***		**-0.01*****	-0.00$^{\cdot}$
		(0.00)	(0.00)		(0.00)	(0.00)		(0.00)	(0.00)
Risk Aversion		**0.12*****	0.01		**0.10*****	0.04		**0.12*****	0.01
		(0.03)	(0.03)		(0.03)	(0.03)		(0.03)	(0.03)
Fertilizer (5 years)		**0.09***	0.08$^{\cdot}$		**0.10****	**0.09***		0.06$^{\cdot}$	0.05
		(0.04)	(0.04)		(0.04)	(0.04)		(0.04)	(0.04)
Future Clearing		**-0.80*****	**-1.21*****		**-0.87*****	**-1.12*****		**-0.81*****	**-1.19*****
		(0.15)	(0.16)		(0.14)	(0.16)		(0.15)	(0.16)
			Average Class Membership Probabilities						
	0.12	0.51	0.37	0.12	0.57	0.31	0.12	0.50	0.38
AIC		2369.93			2364.23			2363.68	
Log Likelihood		-1134.97			-1134.11			-1135.84	
Num. obs.		2560.00			2560.00			2560.00	

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$