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Community conservation and a two-stage approach to payments for ecosystem services

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Abstract

Recent revisions to the theory and definition of payments for ecosystem services (PES) challenge the generally accepted dominance of direct incentives provided in a buyer–seller relationship. The revisionist thinking insists indirect incentives and a cooperative, reciprocal relationship are often more appropriate. Those characteristics, however, hark back to the indirect, cooperative interventions that constitute "community conservation", which PES was originally designed as an improvement over. In that context, this study revisits the criticisms and potential benefits of community conservation. We analyze a case study of community conservation in Peru and find that it supported an uptake of forest-friendly behaviors. We take up the suggestion of a two-stage approach to PES, but refine it based on our results that indicate an important role for cognitive (e.g. education) alongside structural interventions (e.g. provision of alternatives), and a strong role for social consensus to support conservationist behavior. Community conservation can provide these elements in a first-stage of PES to create a social context conducive to conservation. Without creating that context first, PES could destabilize local resource management norms rather than improve on them. With the social context established, however, a market mechanism can be implemented in the second stage to reinforce the new conservationist behavior.

1. Introduction

The 1980's saw the rise of decentralized, community-based approaches to natural resource management and biodiversity conservation (Hutton et al., 2005). Approaches called community-based natural resource management (CBNRM) or integrated conservation and development projects (ICDPs) became collectively known as community conservation. Community conservation attempts to create a link between development and conservation, so both can be achieved simultaneously. That often involves indirect mechanisms such as (McNeely et al., 2005): 1) redirecting labor and capital away from activities that degrade ecosystems (e.g., agricultural intensification); 2) encouraging commercial activities that supply ecosystem services (ES) as joint outputs (e.g., ecotourism); or 3) raising incomes to reduce dependence on resource extraction that degrades the ecosystem.

The successful uptake of the community conservation narrative, however, was in large part due to the popularized political and economic ideals of the time (Hutton et al., 2005) and came up against significant criticism (McNeely et al., 2005). For example, a 1999 World Bank review of integrated conservation and development projects in Indonesia concluded, "*most of the attempts to enhance biodiversity conservation in Indonesia through ICDPs are unconvincing and unlikely to be successful under current conditions*." (Wells et al., 1999, pp. 44). Specifically, the indirect mechanisms that constitute community conservation were criticized for not being cost-effective (Ferraro and Simpson, 2002), not necessarily ensuring that conservation will occur (Wunder, 2005), and for permitting alternative livelihood strategies to be incorporated as complements, rather than substitutes, to ecosystem-degrading activities (Engel et al, 2008). Directly paying people to conserve nature—effectively creating a market for the ecosystem services provided—was advocated as the conservation intervention that could overcome these issues, and the concept of payments for ecosystem services (PES) took hold.

Payments for ecosystem services (PES) are a standard economic behavior for some types of services, notably provisioning services (e.g. food, fiber). Market creation for a broader collection of ecosystem services, particularly regulating and cultural services, has grown worldwide since about 1997 with PES schemes established in New York (Chichilnisky and Heal, 1998) and Costa

Rica (Pagiola, 2008). A 2010 review of payments for watershed services identified 113 active programs in 22 countries (Stanton et al, 2010), while a review of forest carbon markets identified 226 projects in 40 countries in 2009 (Hamilton et al, 2010).

Following the critique of community conservation and the indirect mechanisms it constitutes, the recent growth of PES has generally followed the theory that providing incentives for conservation in the form of conditional, direct cash payments is the first-best conservation mechanism (Ferraro & Kiss, 2002; Wunder, 2005). A growing realization that PES theory did not match real world practices, however, culminated with a broader re-conceptualization of PES. They are now viewed as a class of incentive-based mechanisms, of which direct cash incentives are one example, but other indirect and in-kind incentives are often (and perhaps more often) used, and conditionality is not always strictly enforced (Jack et al., 2008; Sommerville et al, 2009; Muradian et al, 2010; Farley and Costanza, 2010). Along with that re-definition grew an understanding that the buyer-seller paradigm of PES that was advocated under the original PES theory (Wunder, 2005) is not always appropriate, but that in many contexts a cooperative and reciprocal arrangement is needed (Muradian et al, 2010; Farley and Costanza, 2010; Fisher et al, 2010; van Noordwijk and Leimona, 2010).

These two core elements in the revisionist PES thinking—use of indirect and in-kind incentives, and focus on cooperative and reciprocal arrangements—hark back to the community conservation that PES was originally developed as an improvement over. So, despite the criticism of community conservation, economists are now returning to it, or at least arguing for active inclusion of some of its elements in PES design. That calls for another look at community conservation, specifically reconciliation of economists' original critique of community conservation with their current return to it.

One suggestion is that the original criticism of community conservation overlooked the positive changes it had on people's attitudes and behaviors towards conservation. As put by Abbot and Thomas (2001) in a case study of integrated conservation and development in Cameroon: "*…the livelihoods program…is changing people's attitudes and behaviors, making them more positively disposed toward forest protection and the demarcation of the (buffer zone) boundary. These*

*findings are significant since there are few published studies that have attempted to look at the **outcomes**, rather than the **outputs**, of ICDPs*" (pp. 1133, emphasis added).

In this paper, we take on the challenge of Abbot and Thomas (2001) to evaluate the *outcomes* of community conservation. We analyze a case study of using community conservation to conserve *Polylepis* forest fragments in the Vilcanota Range of the southern Peruvian Andes. Economic analyses of both 1) reported conservation behavior by local landholders; and 2) locals' value of the ecosystem services (ES) provided by *Polylepis* woodlands, are carried out to see if community conservation positively disposes locals towards forest protection, and if so, through what mechanisms. Placing the results of the case study in the context of PES revisionist thinking and the behavioral literature that it invokes, we discuss the lessons from community conservation and how that may inform a two-stage approach to PES.

After this introduction, the next section discusses the study site, while the following sections in turn present the methodology, results, and a discussion of community conservation and two-stage PES, followed by conclusions.

2. Case Study

2.1. *Polylepis* Woodlands

Polylepis woodlands are the highest in the world, growing up to 4,400 meters above sea level in humid conditions and as high as 5,000 meters in the arid volcanic soils of north-western Bolivia (Purcell et al, 2004). In the Andes Mountains of South America, about 20 species of *Polylepis*, locally known as queuña (various spellings), range from Venezuela south to central Argentina (Kessler, 2002). The trees stand 1-20 meters tall and characteristically shed their bark. *Polylepis* forests are one of the most threatened Neo-tropical ecosystems: 15 species of *Polylepis* are classified as vulnerable, nine of which are native to Peru (IUCN, 2010). The ecosystem provides an important habitat to many birds and mammals. In the case study area, of the bird species dependent on *Polylepis*, seven were classified as endangered, five as vulnerable and nine as near-threatened in 2005 (Aucca & Ramsay, 2005). In other locations, these woodlands also provide an important habitat for more than 30 mammal species (Yensen & Tarifa, 2002) including charismatic species such as the spectacled bear and puma.

The current distribution of *Polylepis*, although likely affected by some natural restrictions (Kessler, 2002), is predominantly determined by human activity related to subsistence practices. Describing the case study area in the southern Peruvian Andes, Aucca and Ramsay (2005) define four major anthropogenic threats to *Polylepis*. Three of these are related to agricultural practices: allowing livestock to graze in or near forest patches, burning of adjacent grassland (to supposedly speed regeneration of pastures), and transforming woodlands to agricultural land. The final and most prevalent anthropogenic threat is felling trees for fuelwood and timber.

Patches of *Polylepis* are thus generally restricted to areas where fires cannot spread and livestock do not regularly roam (Fjeldsa, 2002). The remaining patchwork is then refined by the intensity of fuelwood collection and feasibility of agriculture. The people living in the case study area, whose livelihoods depend on the forest, recognize the threats to *Polylepis* and note a decline in the quality of the trees in the forest (Jameson & Ramsay, 2007). They continue these forest-degrading practices, however, because they have no other means of getting the wood they need to survive (Aucca & Ramsay, 2005) and lack alternatives to current agricultural practices.

Polylepis woodlands provide more than wood and land. They also provide ES (Table 1) that are valuable on a local, regional, and global scale. Probably the most important service they provide is the regulation of water supply (Fjeldsa, 2002), which may become more important as tropical glaciers retreat and dry-season melt-water declines in volume (Jameson & Ramsay, 2007).

INSERT TABLE 1 ABOUT HERE

2.2. Livelihoods in the Vilcanota Range

Key socio-demographic characteristics of sampled households located in the Vilcanota Range are summarized in Table 2. Land held by a household for crop cultivation is owned by the community or land association to which they belong. Households plant multiple crop cycles each year to maximize production on their small plots. The main crops cultivated are potatoes, beans, oca, olluca, and maize, with legume cultivation more prevalent at higher altitudes and maize at

lower altitudes. A strong barter market helps trade in the region, with these high altitude farmers trading for fruits, sugar, coffee, and coca cultivated in lower areas.

Each household also keeps grazing animals on communal land, with alpaca and llama more popular in the higher altitudes and horses and cattle more popular at lower altitudes. The main purposes of keeping livestock are to help carry heavy loads of crops or fuelwood and to supply wool as a cash crop. Households slaughter only one or two large animals a year, but supplement their protein intake with chickens and guinea pigs.

Aside from subsistence production and barter trading, each household earns cash income from farm activities, such as the sale of produce, livestock, or wool, and non-farm activities. The latter includes running a small shop, selling maize beer, women selling handicrafts, and men working as porters (for tourist treks) or construction workers. Despite the diversity in livelihoods, the area is still impoverished, with 60 percent of households (in 2008) living in extreme or moderate poverty.

INSERT TABLE 2 ABOUT HERE

2.3. Conservation in the Vilcanota Range

La Asociación Ecosistemas Andinos (ECOAN) is a non-governmental organization (NGO) based in Cuzco, Peru, dedicated to preserving endangered Peruvian wildlife, particularly rare endemic and migratory bird species. ECOAN approaches its mission through community conservation. The organization's largest and longest standing project is a community-based *Polylepis* forest conservation project in the Vilcanota range of the southern Peruvian Andes. The range runs along the north-east side of the Sacred Valley between Cuzco and Machu Picchu. Since 2000, this project has formally enlisted more than 1,800 families (of 7,299) in 21 communities and informally benefited even more through its various initiatives to reduce fuelwood demand, improve sustainability of land use, and support community development (Table 3).

To help secure a forest-friendly future for this region, ECOAN is working to identify and implement long-term strategies to sustain the conservation successes of its Vilcanota project, including a self-sustaining financing strategy that permits the NGO to reduce its involvement (Aucca, 2006). Despite its focus on community conservation, ECOAN has taken smalls steps towards establishing PES to reach these goals. A pilot effort was carried out to charge bird watchers to enter a community-owned private conservation area (PCA). Proving successful, the pilot indicated a potential exit strategy; ecotourism may allow ECOAN to build on its strong base of community conservation and transition the Vilcanota project to a self-financing conservation initiative. Looking beyond the ES of scenic beauty and biodiversity protection, there may be potential to include other ES in a broad-reaching PES scheme, particularly water services provided to downstream communities (located in the Sacred Valley and beyond) and carbon services (globally beneficial).

INSERT TABLE 3 ABOUT HERE

Sitting between its initial remit as an externally-supported community conservation project and its potential future as conservation based on a market mechanism, the Vilcanota project provides an opportunity to explore the outcomes of community conservation and how that relates to the potential future implementation of PES. Importantly, this provides a good case study because when data was collected, the market structure for PES was lacking. As such, this study does not compound the effects of implementing PES market structure with the outcomes of community conservation, which is the focus of this paper.

3. Methodology

We first explore if there is a relationship between community conservation activities carried out in the area, and the behavior and attitudes of local communities. For this purpose, a household survey was carried out to collect information in four categories: demographics, land ownership, household income, and reported behavior related to forest patches. That information was supported by information about the communities these surveys were carried out in, including community conservation activities that had occurred in each.

Second, we estimate the value locals place on ES in order to facilitate better understanding of conservation behavior, specifically whether there is a relationship between community conservation activities and the locally-held value of ES. The value of ES was estimated through an innovative contingent valuation (CV) approach that was carried out as part of the household survey (for discussion of CV through household surveys see, e.g., Mitchell and Carson, 1989, Bateman et al, 2002). Details of this approach are described below.

3.1. Reported Conservation Behavior

Without rigorous monitoring in the Vilcanota range, it was only feasible to rely on reported behavior related to the four primary forest-degrading activities identified by Aucca and Ramsay (2005). The survey section on household income included three subsections related to forest products, crop cultivation, and livestock rearing, where respondents were asked about the financial and economics costs and benefits of each. At the end of each subsection there were questions on damaging activities related to the relevant anthropogenic threats to *Polylepis*: the forest products section included a question on felling trees for fuel and timber, the crop section included a question on transforming woodland for cultivation, and the livestock section included a question on grazing livestock in and around woodlands, and another on burning grasslands.

To reduce response bias, for each question on a damaging activity, respondents were first reminded that other families in the area were known to carry out the activity. Then they were asked if their household currently carried out the activity and if they had carried it out in the past (i.e., 3-7 years ago, prior to the involvement of ECOAN). If the respondent reported a change in the level of an activity between the past and present (either started, increased, reduced, or completely stopped), they were then asked why the level of that activity changed (Appendix).

3.2. Local Value of ES

In a situation where respondents own the resources they are being asked to protect, it is not feasible to directly ask them their willingness-to-pay (WTP) to preserve those resources. The value of ES held by the local population was therefore elicited indirectly using the novel approach proposed by Mourato and Smith (2002) comprising three steps. In that approach, respondents were first asked for the compensation they would require to switch land use from

their current destructive activities (e.g. slash and burn agriculture) to less environmentally degrading practices (e.g. agroforestry). Mourato and Smith found that in estimating the required compensation amount for changing these activities (i.e. willingness to accept; WTA), respondents only took into consideration the short-term financial losses implied in the change in land use and not the non-market benefits arising for the enhanced ES provision under the more environmentally friendly land use. Hence, in a second step, respondents were engaged in a discussion of forest ES and asked to identify the range of services they benefited from, both market and non-market (e.g. shade, protection from wind, soil protection, leaving forest for descendents, etc.). In the third and final step, respondents were asked if they wanted to revise the required compensation amount stated initially, now taking into consideration the fact that switching to a more environmentally friendly land use would preserve many locally beneficial ES. The authors found that, on average, respondents reduced their WTA by approximately 30%, which can be interpreted as the implied local value of the provision of ES associated with the change in land use ($WTP_{IMPLIED}$).

Adopting this approach, respondents of the survey in the Vilcanota Range were asked twice about their willingness-to-accept (WTA) compensation to change current land use in part of their farm by setting land aside for reforestation with *Polylepis*, and therefore become ES providers. Following a household survey of the economic costs and benefits of agriculture, livestock cultivation and forest products, respondents were first asked for their minimum annual WTA compensation to conserve 0.33 hectares of their land that had been reforested with *Polylepis*. It was clearly stated that the capital costs of reforestation (e.g. saplings) were to be covered by external funding, because the aim was to elicit a value that was representative of the annual opportunity costs of land and labor into the foreseeable future. To reduce overbidding, the WTA question was also placed in a competitive context by explaining that if it went ahead “There would not be much money for this sort of project, so only those families with the lowest prices would be considered for the project”.

Respondents were then led through a discussion of the ways in which they might benefit from ES provided by *Polylepis*. The discussion involved agreeing or disagreeing with statements about 10 of the key ES provided by *Polylepis* woodland (as listed in Table 1).

Finally, respondents were asked again for their WTA compensation to change land use, but now taking into account the ES associated with the proposed reforested land. The difference between the WTA to change land use before and after the discussion about ES is an estimate of the value of forest ES to the households, measured as implied willingness-to-pay ($WTP_{IMPLIED}$), where $WTP_{IMPLIED} = WTA_{BEFORE} - WTA_{AFTER}$. $WTP_{IMPLIED}$ is therefore expressed in terms of a foregone compensation.

The $WTP_{IMPLIED}$ was in this case a better measure than WTP determined through direct questioning of respondents, because $WTP_{IMPLIED}$ is derived from direct WTA questions. Here, a direct WTA question is the correct measure of value based on the reference point of the respondents[1]. In the case of residents of the Vilcanota Range, the hypothetical market was a decrease in agricultural land that would be reforested and provide ES. The most salient portion of that scenario to respondents is the loss of agricultural land, meaning that the reference point is current land holding, which is the initial state. If the basis for valuation is a reference of the initial state then the appropriate measure of its value is compensating variation (Knetsch, 2009). Since WTA compensation is the compensating variation for the loss of current land holdings, the local value of ES can then be correctly estimated in an indirect way, through the difference between two WTA compensation amounts.

Finally, in order to elicit WTA, Mourato and Smith attempted to use both the open-ended and the dichotomous choice methods, but only found the open-ended question to be feasible in this specific context (see Mourato and Smith, 2002 for more details). As such, an open-ended format for eliciting WTA was used here, where respondents were asked to think through the various costs and benefits associated with both their current land uses and with the proposed land use

[1] Although traditional theories of economic behavior claim that WTP to increase welfare should be equal to WTA to avoid that same level in decrease of welfare, numerous studies have been carried out demonstrating a WTP-WTA asymmetry (reviewed in the context of environmental changes in Horowitz and McConnell 2002). Attention has been given to the limits of this asymmetry and potential explanations for its occurrence that are consistent with standard theory. The dominant standard theory explanation based on research demonstrating a lack of asymmetry is that the WTP-WTA disparity decreases with increased experience, thus changing an individual's reference point. Evidence for this explanation, however, is weak (Horowitz and McConnell 2002). Knetsch (2009) claims that experience is not necessarily relevant, but it is specifically the reference point of an individual that will determine whether or not they exhibit WTP-WTA disparity.

(reforestation) in order to arrive at a realistic and meaningful compensation amount, that would reimburse them for lost income.

3.3. Sampling and Survey Implementation

A three-day pilot survey was carried out in Thastayoc, a remote community in the Vilcanota range that was the first to work with ECOAN. A final survey was then administered to representatives of 106 households in six of the 21 communities that ECOAN now works with in the area (Table 4). Key sample characteristics were presented in Table 2. The survey was conducted face to face by the researchers and local assistants, in Spanish and Quechua. Semi-structured interviews with community and NGO leaders were also carried out to provide further context for the quantitative results.

INSERT TABLE 4 ABOUT HERE

Households were sampled using a mix of opportunity and snowball sampling. There is little variation in socio-economic status or lifestyle within communities, so there is no reason to believe that results from an opportunity sample would differ greatly from a random or probabilistic sample. To mitigate any difference that may occur, however, sampling was carried out at varying times of day and in both households and agricultural fields. The communities surveyed were chosen based on various factors, but the primary concern was to survey communities that ranged in accessibility. Those that were less accessible tended to be more remote and poor and are believed to be more dependent on *Polylepis* forests, but without sustainable management practices have lost those forests more rapidly. In contrast, the more accessible communities are relatively less poor and less dependent on *Polylepis* forests.

3.4. Regression Analyses

To better understand reported reduction in forest-degrading activities and $WTP_{IMPLIED}$ as well as ECOAN's impact on both, two regression analyses were carried out. The first analyzed the factors that affect whether a household acts to conserve *Polylepis* or not. The dependent variable is the probability of being a conservationist household (as strictly defined above), so based on this dichotomous response variable a logistic (logit) regression was used. The second analyzed

$WTP_{IMPLIED}$ for ES. Given the continuous nature of the response variable an ordinary least squares (OLS) regression was used.

To allow some comparability of results between the two analyses, both regression models were specified with the same explanatory variables (Table 5). We used a build-up blocking approach, where categories of variables that were expected to influence willingness to pay and/or conservation behaviour were sequentially included in the model. The key categories of explanatory variables analyzed were demographics (e.g. age, education, household size), household income (broken down by income source), land holdings characteristics, and activities carried out by ECOAN in the household's community.

In this process, variables that did not have a significant correlation with the dependent variable were removed. This was done, however, across both models concurrently so that if an explanatory variable was significant in one model it was maintained in both (e.g. WIFE). Some explanatory variables that were not significantly correlated to the response variable in either regression were however maintained in the model specifications to demonstrate validity of the results. For example, to demonstrate that no underlying, unseen demographic variables were distorting results, AGE, EDUCATION, and HOUSEHOLD_SIZE were maintained in the final model specifications. Additionally, CROP_INCREASE and CROP_DECREASE were also maintained to demonstrate that variable, short-term changes in land productivity were not disproportionately affecting conservationist behavior or value of ES. Moreover, it is an interesting result in itself that variables such as AGE or EDUCATION are found to be insignificant. Finally, incomes from all sources were included in the final model specification because when total income was included it was significant in both regressions, as economic theory might dictate. It was important, however, to recognize that total income comprises income from various activities with different relationships to woodlands and so variables for all income sources were included in the final models.

INSERT TABLE 5 ABOUT HERE

4. Results

4.1. Reported Change in Forest-degrading Activities

Seventy one percent of sampled households have at some point carried out at least one of the four human activities that threaten *Polylepis* forests, currently carrying out two on average. Of those households, 61 percent (43 percent of total sample) reported reducing or stopping all forest degrading activities since the start of ECOAN's conservation efforts. Adding this to the 30 percent of respondents that claimed to have never carried out any of these forest degrading activities, 73 percent of all households appear to be conservationist households, representing a reported 143 percent rise in the number of conservationist households in the area since ECOAN began working there.

To further minimise any potential social desirability bias arising from respondents' self-reported behaviour, we adopted a very conservative definition of a conservationist household: that is, a household that has reduced or stopped all of the forest degrading activities it once carried out, or a household that reported never having carried out any of those activities (in the past or currently).

Looking now at the level of change per activity (rather than per household), across all households there was a reported 68 percent reduction in forest degrading activities (Table 6). In addition, the majority of the reported reasons for reducing an activity were related to ECOAN's initiatives in the area. Specifically, the proportion of households that reported reducing each activity and stated a motivation attributable to ECOAN is 81 percent for fuelwood, 53 percent for livestock grazing, 68 percent for agricultural transformation, and 63 percent for burning grasslands. Those reductions can be attributed to the work of ECOAN because after reporting an increase or decrease in an activity, respondents were asked why the level of that activity changed. Based on the follow-up question and aggregating over all four forest-degrading activities, 69 percent of the (gross) reported reduction is attributable to ECOAN (Table 7).

INSERT TABLE 6 ABOUT HERE

INSERT TABLE 7 ABOUT HERE

Of the reasons for a reduction in forest-degrading activities given by respondents, three categories are attributable to community conservation work carried out by ECOAN as shown in Table 7. First, *conservation* refers to respondents' belief in the need to conserve, which is attributable to ECOAN's educational activities. Second, *energy use change* is attributable to ECOAN's provision of alternative fuels to *Polylepis* (e.g. *Eucalyptus*) and more energy-efficient stoves. Finally, the most prominent reported reason for reducing forest degradation was *prohibitions* in use of the forest. Although prohibitions were put in place by the government, it was ECOAN's involvement in the community that motivated respondents to adhere to them. Peru's Forest Law (Ley Forestal y de Fauna Silvestre) was first introduced in 1975. It initially focused on placing the rights of forest extraction in the hands of the State, but has changed over time and is now intended to structure sustainable use of forest resources (Charpentier & Hidalgo, 1999). Enforcement has historically been weak, particularly considering the dependence of rural communities on clearing or extraction of forests. Before working with any community, however, ECOAN requires the community to agree to adhere to these laws and in return provides community benefits not directly related to conservation (see "Community Development" in Table 10; Aucca, 2009).

From the regression results presented in Table 8, we see that no demographic variables affect the likelihood that a household will conserve *Polylepis*, but one income variable does. Households that receive a greater livestock income are less likely to be a conservationist household. This is notable since two of the four forest-degrading activities are related to livestock rearing: burning pastures for regeneration of grass and allowing livestock to graze in the forest. Households more reliant on income from rearing livestock are thus seemingly less likely to decrease those forest-degrading activities involving livestock.

INSERT TABLE 8 ABOUT HERE

Those individuals that agreed with more statements about the ES provided by *Polylepis* forests (see Table 1) are significantly more likely to be from conservationist households, providing some construct validity. Most importantly, the likelihood that a household will be conservationist is

significantly related to the level of community conservation that ECOAN has carried out in that community, including whether the community owns a private conservation area (PCA).

4.2. Implied WTP for ES

The distribution of compensation amounts to change land use required by individual households, before and after the discussion of ES, is depicted in Figure 1. Because these values are bounded at 0, they follow a lognormal distribution.[2] The figure shows that the discussion of ES benefits had the effect of moving the WTA distribution to the left, with more people requiring lower compensation amounts and less people requiring higher compensation amounts than initially. On average, when reminded of the benefits of ES previously discussed, each respondent decreased their required compensation amount by 127 soles (~ USD 42) per topo. As indicated in Figure 2, this $WTP_{IMPLIED}$ also follows a lognormal distribution, with the median value being 75 soles (~ USD 25) per topo.

INSERT FIGURE 1 ABOUT HERE

INSERT FIGURE 2 ABOUT HERE

INSERT TABLE 9 ABOUT HERE

Based on the OLS regression of $WTP_{IMPLIED}$ for ES (Table 9), we find that $WTP_{IMPLIED}$ is negatively correlated with two variables. Respondents that receive a higher livestock income reported a lower $WTP_{IMPLIED}$, which aligns with the fact that livestock rearing includes two forest-degrading activities. Additionally, respondents that cultivate a greater proportion of their land have a smaller implied value of ES, very likely indicating a higher opportunity cost for

[2] The mean and median annual WTA_{BEFORE} are 783.47 soles and 700 soles (USD 261.16 and USD 233.33) per topo (1/3 hectare), respectively. The mean and median annual WTA_{AFTER} are 656.30 soles and 562.5 soles (USD 218.77 and USD 187.5) per topo, respectively. These compensation values should not be viewed as the exact payments necessary to cover the opportunity costs of reforestation under an actual PES scheme in the area. Household compensation values to switch land use to reforestation were elicited only in order to arrive at an estimate of the value that households place on ES, which as explained above was elicited as the difference between compensation amounts, i.e. as a foregone compensation ($WTP_{IMPLIED}$). In reality, because the land is community-owned, any PES scheme would have to determine the opportunity cost of total community land, which would be much lower because the community has a larger percentage of its land available for such activities, the majority of which is pasture as opposed to crop land (lower value per hectare and more substitutable).

setting aside land because they had less land available. A land constraint such as that implies construct validity of the $WTP_{IMPLIED}$ values reported. Validity is also supported by the fact that respondents that agreed with more statements on the ES provided by *Polylepis* were found to have a higher implied value for those ES.[3]

Besides number of ES respondents believed in, only three other variables have a positive and significant association with the value of ES. First, amount of household income from working as a porter on nature-based tourism treks is a significant indicator for increased $WTP_{IMPLIED}$. These households have either a greater appreciation for the local value of ES or simply a better understanding of the value gained through tourism. Second, if the respondent was a wife of the household, that also increased the valuation response, potentially because women are responsible for collecting non-timber forest products, particularly medicinal plants. Third, respondents in communities in which ECOAN has reforested more *Polylepis* also value ES more.

Interestingly, the variables that have a positive association with $WTP_{IMPLIED}$ (i.e. POLYLEPIS, CAMINOS and WIFE) have to do with respondents' direct experience with forests. In contrast, ECOAN's implementation of indirect conservation mechanisms and establishment of community-owned conservation areas (i.e. ECOAN_INDIRECT and PCA) are not significantly correlated with the value attached to ES. So although households recognize the value of ES, their $WTP_{IMPLIED}$ is seemingly associated with their experience with forests and not their experience with community conservation. As indicated above, however, conservation behavior that acted on that value was not carried out unless encouraged and facilitated by mechanisms such as those provided by community conservation.

5. Discussion

5.1. Effects of Community Conservation in the Vilcanota Range

The discussion presented here, reflects on the empirical results presented above, and places them in context of the qualitative results from the semi-structured interviews with community leaders and qualitative responses by survey respondents. Summarizing the regression results, Table 10

[3] WTA before and after the discussion of ES was also analysed using robust OLS. The results are not presented here, but the number of ES individuals believed in had no significant effect on WTA, which helps to validate the method carried out here based on *implied* WTP.

presents the key results from both the logistic regression of conservation (Table 8) and the OLS of the local value of ES (Table 9).

INSERT TABLE 10 ABOUT HERE

The OLS regression results indicate that the level of community conservation carried out by ECOAN does not correlate with the value of ES held by respondents. That value is instead correlated with respondent characteristics, particularly three that pertain to direct experience with the benefits of forests: amount of reforestation around their community, amount of household income dependent on treks, and whether or not the respondent is female. Causality is not clear in this case, but there is a reasonable argument for direct experience with forests increasing one's value of it. More importantly, there is no indication that community conservation affects that value.

In contrast, the logit results indicate that ECOAN's implementation of community conservation, and very little else, is significantly associated with the probability of being a conservationist household. Importantly, because the survey questions related to forest-degrading activities were framed as a change in behavior before and after the introduction of community conservation, we can infer at least some degree of causality of community conservation on the probability of being a conservationist household. The reported reasons attributable to ECOAN for why households reduced forest degradation can be placed into three main categories: reduced dependence, conservation, and prohibitions.

These three categories of motivation for reducing forest degradation can be discussed in terms of the two broad classes of interventions for behavior change described by psychologists. The first are structural interventions, which include provision of alternatives, regulation and enforcement, and financial-economic stimuli (Schmuck & Vlek, 2003), and are generally the focus of economists. The second are cognitive interventions, which include provision of information and education, social influences, organizational change, and changing values or morals (Schmuck & Vlek, 2003).

The first category of ECOAN-related reasons given for carrying out conservationist behavior was reduced dependence. ECOAN provided non-*Polylepis* fuel wood, greenhouses and energy-efficiency stoves that improved households' ability to conserve the forest by reducing their dependence on forest-degradation. By providing these alternatives, ECOAN implemented a structural intervention that provided alternatives to their historically forest-degrading livelihoods.

The second category was conservation. With alternatives becoming available, households must still have an understanding of the need and methods to conserve. Education to these ends was an explicit activity carried out by ECOAN, but also a dominant component of all its other activities, that was a cognitive intervention to support pro-conservationist behavior.

The most important of ECOAN's actions was building a community consensus around conservation; the cognitive intervention of social influence. ECOAN's engagement with communities depended on the community agreeing to adhere to the forest law prohibiting removal of trees from native forest. As part of that effort, community benefits were provided and framed as a reward for good environmental behavior, although conditionality on that reward was very loose. The loose conditionality appears effective, however, as indicated by the percent of respondents claiming prohibitions as their motive for reducing forest-degrading activities. Importantly, ECOAN provided social benefits at a community level, engaging community leaders to make sure their community adhered to conservation practices and concurrently making it unacceptable within the community to deforest. Overall, this created a culture of conservation: where it was once acceptable to deforest, now it is not.

That culture was clearly present in the communities surveyed. When asked if there will be enough forests in the future for our children and grandchildren, 46 percent of respondents said "no." All of these respondents claimed that more needed to be done to protect the forests while indicating an earnest desire to do so. Of the 54 percent of respondents that answered "yes," when asked why, all of them qualified their response with a belief that continued and improved conservation is required to secure that future. Whether they responded "yes" or "no" to this question did not matter. The important outcome was that 100 percent of respondents stated a

belief in conserving *Polylepis*.[4] Further the semi-structured portions of research and qualitative responses in surveys strongly supported the notion of a community consensus around conservation, as put by one respondent "hay una conciencia de conservación." Indeed creating communities and social norms within them is the prime mechanism through which community conservation works (Pretty, 2003).

Overall, ECOAN's strategy to promote forest conservation included various activities, all of which fall within the traditional definition of community conservation. Based on the motivations most cited by respondents for not carrying out forest-degrading activities, two clear themes emerge. First, ECOAN's community conservation activities were successful in part because they included a blend of structural and cognitive interventions. Second, the cognitive intervention of social influences was reportedly the most important. Further, it is important to recognize that community conservation activities, at least in this instance, were not able to change people's values for forest. That seemingly takes some other form of intervention, potentially direct experience with it as indicated by the valuation results.

As discussed above, ECOAN is searching for a more self sufficient financing mechanism to carry them into the future. With some early eco-tourism experience, PES has been suggested as a potential to provide that financing in the future. Due to space constraints, an in-depth discussion of feasibility of PES in this area does not fit here. One important point in favor of it, however, is that a social context that is conducive to PES has been established. That is a potentially necessary step for successful market-based conservation, as we now discuss.

5.2. Developing a pro-conservation social context: A first-stage to PES?

One key factor affecting the feasibility of PES is the potentially high costs of developing the necessary conditions to support such a scheme. That can involve *"establishing the principle; developing the necessary institutions; addressing issues of property rights and tenure; ensuring*

[4] There may be concern that because the survey was carried out through ECOAN there might have been some interviewer bias, particularly in this question. The interviewers, however, noted sincerity on the part of respondents for this response. Further, there was no change in the response based on whether the interviewer was an ECOAN project manager, a temporary/new ECOAN employee, or not an ECOAN employee. Indeed, for the valuation questions, dummy variables for interviewers were included in initial analyses and found to have no significant explanatory power, providing further support to the claim that interviewer bias was minimized.

that there are supportive administrative and judicial processes; providing education and training on contracts, management, monitoring and enforcement; and encouraging the adoption of non-agricultural livelihoods" (Frost & Bond 2008, pp. 785).

Funding the costs associated with establishing the conditions for PES through the payments themselves runs the risk of raising the price to buyers to unaffordable levels or reducing the benefits to suppliers to un-incentivizing levels. The success of PES may be limited in places where a supportive environment does not already exist. To overcome this difficulty, Frost and Bond (2008, pp. 785) suggest *"a two stage approach: an initial phase, supported externally to establish the necessary conditions, followed by an operational phase governed by free-market principles."*

That notion is intuitive: similar to a business investment, the fixed capital must be established with the up-front costs underwritten before a market-mechanism can be effectively implemented. Those concepts are even being played out at the international level. For example, a proposed three-phased approach to reduced emissions from deforestation and forest degradation (REDD) (Meridian Institute, 2009) is providing the basis for discussions on how to effectively implement greater inclusion of forest carbon in international climate change agreements.

To date, however, the staged (or phased) approach to PES has defined "necessary conditions" primarily as the need for interventions related to formal institutions such as creating representative governing bodies, securing property rights, improving contracts, etc. Adequate institutions are essential for the success of PES, but we must also consider the local behaviors and attitudes towards conservation in the area PES is to be implemented in.

An important question in discussing use of common-pool or open-access resources is whether overuse and conflict are best dealt with through "*strict regulatory policies set by higher level governments, or that instead one should rely on endogenous formation of use regimes*" (van den Bergh, 2007, pp. 530). One particularly significant finding is that externally imposed rules and monitoring can reduce, de-stabilize, or even completely destroy co-operation over common-pool resource use (Ostrom, 2000). Or similarly, "*if the rules are seen to come from another*

stakeholder group (or from 'above') then the legitimacy of the rules and compliance by local stakeholders is greatly compromised (Marshall, 2005)." (Fisher et al, 2010, pp. 1258).

That raises the question, when a PES program is implemented does it support or contradict the social norms and attitudes towards conservation held by the individuals it is trying to incentivize? Research relevant to this question is sparse, but what is available indicates this question is important. For example, Ma et al (2010) found that attitudes can affect a US farmer's willingness to consider enrolling in an agri-environmental scheme. Further, Chen et al (2009) found that neighborhood-level social norms influenced the re-enrolment rates of farmers in China's grain-to-green program (Chen et al, 2009).

Importantly, those results are based on the action of individuals on excludible land. A large portion of PES schemes, already implemented or being developed, are in the context of 1) communities (not individuals along) and 2) protection of rival, but non-excludible resources, both of which imply a much larger concern for the social context.

The first stage of two-stage PES should therefore not only focus on establishing the formal institutional components of PES, but must also establish a social context conducive to PES. Community conservation can provide lessons on, or potentially even be a model for, achieving that. Community-based initiatives for resource management work through various mechanisms designed to develop new social norms and attitudes (Pretty, 2003), and the empirical results presented here indicate that those mechanisms were successful in developing the new forest-friendly behaviors and attitudes that Abbot and Thomas (2001) suggested should be the metric for success of community conservation.

5.3. Second Stage of Two-stage PES

Once the social context is conducive to the conservation that PES is intended to incentivize, direct payments may be more effective. Although proponents of the traditional view of direct PES might not agree, the revisionist thinking urges a review of how incentives are perceived. As discussed above, if viewed as externally imposed rules, they can destabilize any hope of common-pool or open-access resource management. Further, as often discussed in the re-

conceptualization of PES (e.g., Sommerville et al, 2009; Farley and Costanza, 2010) an extrinsic incentive, particularly a cash incentive, can have negative consequences; it can backfire.

To overcome those negative effects, incentives must be perceived as supportive, rather than coercive (Frey and Jegen, 2001). It is intuitively much easier to frame an incentive for conservation as supportive if the attitudes and behaviors of locals are *ex-ante* suited to conservation. Otherwise, in the case of communities, that incentive can easily be viewed as welfare pay-off for excluding locals from natural resources (Hutton et al., 2005; van Noordwijk & Leimona, 2009), which is perceived as coercive or implemented "from above." So a second stage of PES should perhaps view the role of incentives not to change behavior, but rather to support and reinforce conservation behaviors. Indeed, as PES revisionists evoke more lessons on incentives from psychology and behavioral economics, it may be worth a broader review of incentives' role to reinforce rather than to change behavior.

6. Conclusion

By working through community conservation ECOAN promoted conservationist attitudes and behaviors, supporting the conjecture that community conservation delivers important *outcomes* for conservation to succeed. The PES literature is increasingly recognizing the importance of those outcomes and making reference to interventions to affect them that are common in community conservation. Building on the results presented here, the PES literature and the behavioral literature it evokes, we find support, from a behavioral perspective, for the suggestion that PES may be most effectively implemented in a two-stage approach. While building the necessary institutions for PES, the first stage would be based in whole or in part on community conservation, specifically its cognitive and structural mechanisms for supporting the uptake of new behaviors and attitudes. The second stage could then provide more explicit incentives through market-based mechanisms (e.g. carbon credits, water payments, price premium on green commodities) that reinforce the new conservationist behavior. Future research should further explore this proposition.

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Appendix

Survey questions 1) on change in forest-degrading activities, and 2) implied contingent valuation of ES provided to communities by *Polylepis* woodlands (translated from Spanish survey).

Example of question on forest degrading activity	- There are families that cut *Polylepis* trees for fuelwood. Do you do this now? *Yes or No, Location if yes:*…… - Did you do this in the past? *Yes or No, Location if yes:*…… - In the past did you do it: *More, Less or the Same* - Why is there a difference between before and now? ……

WTA_{BEFORE}	- So that ECOAN could reforest, for how much per year would you rent one topo (~1/3 hectare) of your land? …… - So that ECOAN could reforest, how much would you charge to work and reforest in this topo of land that you have rented out? ……
WTA_{AFTER}	- Before, you told me that you would need (X) to rent one topo (or work in this topo of land) of your land for reforestation. Now, knowing that the forests give all of these benefits, would you lower that amount? *Yes or No* - To what? …… - Why? ……

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Table 1. Ecosystem services provided by *Polylepis* forests in the Andes Mountains and discussed during valuation (expanded from Aucca & Ramsay, 2005).

Ecosystem Service	Explanation	Discussed during valuation?	Reference
Water supply	The densely-packed, small leaves of *Polylepis* trees harvest occult precipitation from the frequent mists of the mountains, providing an additional supply of water in rainless periods.	✓	Fjeldsa, 2002
Water regulation	The woodlands, with associated mosses, regulate the flow of water and so reduce peak-flow and drought problems for local communities.	✓	Fjeldsa & Kessler, 1996
Soil nutrients	The trees add organic matter to the soil.	✓	Fjeldsa & Kessler, 1996
Soil stabilization	[The trees] provide protection against erosion, stabilising the soil with its roots, and protecting the soil from heavy rainfall with its canopy.	✓	Fjeldsa & Kessler, 1996
Genetic diversity	Wild potatoes, ulluco and oca grow inside *Polylepis* woodlands, providing a genetic resource for improving cultivated varieties in the future.	×*	Fjeldsa & Kessler, 1996
Medicinal plants	Several plants from *Polylepis* woodlands have medicinal or tonic uses.	✓	Hensen, 1992
Cultural value	*Polylepis* was an indispensable component of everyday life in ancient Andean empires and remains a vital source of natural resources and cultural value today.	✓	Capriles & Flores, 2002
Biodiversity protection	In the monotonous Andean grasslands and semi-deserts, *Polylepis* forests represent oases of life, including 51 bird species that are characteristic of *Polylepis* and numerous mammals.	✓**	Fjeldsa & Kessler, 1996; Fjeldsa, 2002
Carbon storage	Cost-competitive carbon offsets from forestry are possible with *Polylepis* grown at high altitudes.	✓	Fehsea et al, 2002

* Although genetic diversity is a valuable ecosystem service, pilot surveys and stakeholder discussions concluded that this service was the most complex to discuss, so it was not included in the final survey.

** Two discussion points on biodiversity protection were presented in the survey, one on birds and another on "other animals". *Polylepis* woodlands are particularly well known for bird diversity, attracting ecotourism, so it was believed that a separate discussion on birds was warranted.

Table 2. Characteristics of sampled households (HH) in the Vilcanota Range*.

Characteristic	Mean	
HH Size	4.6	people
Education		
Adult males	5	years in local primary school
Adult females	4	years in local primary school
Teenagers	9	years in local schools
Cash Income		
Farm activities	157	USD annually
Non-farm activities	621	USD annually
Total per capita	3.1	USD daily
Land Holding		
Total held	1.67	hectares
Cultivated at a time	0.6	hectares
Crop Production	1,600	kilos annually
"Own" land**	30	percent of HH
Livestock		
Kept	25.6	
Slaughtered	2	annually

* The values presented are based on a sample of 106 households in the Vilcanota Range that were surveyed for this study.

**Land title is actually held by the community or land association a household belongs to, but these households still stated that they owned the land they held.

Table 3. ECOAN's community conservation activities in the Vilcanota range.

Issue	Initiative	Goal
Fuelwood demand	Direct *Eucalyptus* fuelwood provision	Provide energy alternative
	Low-impact *Eucalyptus* plantations	Provide energy alternative
	Energy-efficient stoves	Reduce demand for fuel wood
Land Use	Reforestation	Increase habitat for wildlife and provision of ecosystem services
	Greenhouses	Diversify livelihoods through agricultural alternatives (some provided to schools to foster early environmental appreciation and supplement school lunches)
	Land Titles	Secure property rights
	Environmental Education	Educate locals on need and methods to conserve woodlands
	Private Conservation Area (PCA)	Directly conserve *Polylepis* and increase community land holdings
Community Development	Medicines	Support development and reward good environmental behavior
	Toys	
	Education Materials	
	Village halls	
	Chimneys	Decrease indoor air pollution and raise environmental awareness

Table 4. Communities and households surveyed to analyze the potential for PES in the Vilcanota Range. (HH = Number of households)

Accessibility	**Community**	**Forest**	**HH Total**	**HH Surveyed**	**Percent Surveyed**
Easy	Yanahuara	Mantanay	1600	25	1.56
Moderate	Huilloc	Queuñacocha	880	22	2.50
	Patacancha	(buffer zone)	512	23	4.49
Difficult	Tambohuaylla	Silatexse	260	10	3.85
	Quishuarani	Hatun-Huchuy Queuña	220	19	8.64
	Cuncani	(buffer zone)	312	7	2.24
Communities surveyed			3784	106	2.80
All communities			7299	106	1.45

Table 5. Explanatory variables used in logit regressions of conservationist households and OLS regression of $WTP_{IMPLIED}$ for ES in the Vilcanota range.

	Variable	Explanation
Demographic	AGE	Age of the respondent
	EDUCATION	Years respondent was in school
	WIFE*	Respondent is the wife of the household
	CHILD*	Respondent is eldest child living in household
	HOUSEHOLD_SIZE	Number of people living in household
Income	CROP_INCOME	Annual cash income (soles) from crops sold
	LIVESTOCK_ INCOME	Annual income (soles) from livestock sold
	CAMINOS	Annual income (soles) from working part-time as a porter, cook, or horse handler on tourist treks
	TRADE	Annual income (soles) from selling goods
	CONSTRUCTION	Annual income (soles) from construction
Land	LAND_USED	Proportion of land held by household that is cultivated each year
	LAND_OWN	Household claims ownership of land separate from community
	CROP_INCREASE*	Crop production increased in the past year
	CROP_DECREASE*	Crop production decreased in the past year
	ES_TOTAL	Number of ES (of 10) that respondent agreed *Polylepis* woodlands provide
ECOAN	ECOAN_INDIRECT	Average count of types of ECOAN benefits received each year since a community started working with ECOAN (does not include PCA establishment or direct *Polylepis* reforestation).
	PCA*	Community owns a private conservation area (PCA), establishment of which was supported by ECOAN.
	POLYLEPIS	Cumulative number of *Polylepis* saplings planted by ECOAN near community.

*Dummy variables. Baseline for WIFE and CHILD was "male head of household" (i.e. father/husband); baseline for CROP_INCREASE and CROP_DECREASE was "no change"; PCA is a binary dummy.

Table 6. Proportion of households that reported having reduced, maintained or increased their level of each of the four primary forest degrading activities.

	Fuelwood	**Grazing Livestock**	**Agriculture Transformation**	**Burning**	**Combined**
Reduced (a)	81.36	71.43	73.08	88.89	77.21
Maintained (b)	11.86	19.05	7.69	11.11	13.24
Increased (c)	6.78	9.52	19.23	0	9.56
Net Reduction (a-c)	74.58	61.90	53.85	88.89	67.65

Table 7. Reason given for reducing forest-degrading activities (percent provided is aggregated over four primary anthropogenic threats to *Polylepis*).

	Reason for reduction	**Percent of *gross* reduction**
Attributable to ECOAN	Prohibitions	40
	Energy use change	15
	Conservation	14
	Subtotal	*69*
Not attributable to ECOAN	Reduced need	11
	Location/Distance	9
	Other	4
	Unknown	7
	Subtotal	*31*
Total		100

Table 8. Estimated parameters for conservationist households model (Logit model with robust standard errors (SE), *p<0.10, **p<0.05, ***p<0.01)

	Variable	Coefficient	Robust SE
Demographic	AGE	0.007	0.032
	EDUCATION	-0.017	0.092
	WIFE	1.220	1.145
	CHILD	0.119	1.226
	HOUSEHOLD_SIZE	-0.137	0.186
Income	CROP_INCOME (/1000)	0.270	0.492
	LIVESTOCK_INCOME (/1000)	-1.039 *	0.582
	CAMINOS (/1000)	0.098	0.229
	TRADE (/1000)	-0.519	0.588
	CONSTRUCTION (/1000)	0.266	0.245
Land	LAND_USED	1.153	0.962
	LAND_OWN	-0.623	0.724
	CROP_INCREASE	-1.133	0.861
	CROP_DECREASE	0.205	0.769
	ES_TOTAL	1.165 *	0.625
ECOAN	ECOAN_INDIRECT	0.997 **	0.462
	PCA	2.544 ***	0.840
	POLYLEPIS (/1000)	0.063	0.047
	_CONS	-15.542 **	7.089
	Observations	106	
	Pseudo-R^2	0.224	
	Log pseudolikelihood	-48.293	

Table 9. Estimated parameters for $WTP_{IMPLIED}$ for ecosystem services model (OLS with Robust SE, *p<0.10, **p<0.05, ***p<0.01)

	Variable	Coefficient	Robust SE
Demographic	AGE	0.532	1.155
	EDUCATION	-0.416	4.929
	WIFE	77.913 *	44.853
	CHILD	-50.086	44.020
	HOUSEHOLD_SIZE	-4.833	7.298
Income	CROP_INCOME (/1000)	27.124	17.982
	LIVESTOCK_INCOME (/1000)	-69.776 ***	23.612
	CAMINOS (/1000)	33.532 ***	10.616
	TRADE (/1000)	-31.420	25.858
	CONSTRUCTION (/1000)	0.798	4.941
Land	LAND_USED	-80.113 *	43.688
	LAND_OWN	-54.527	34.735
	CROP_INCREASE	-50.717	34.298
	CROP_DECREASE	-40.075	32.903
	ES_TOTAL	44.330 ***	18.600
ECOAN	ECOAN_INDIRECT	-25.407	19.425
	PCA	-42.321	31.985
	POLYLEPIS (/1000)	5.414 **	2.518
	_CONS (x1000)	-0.277	0.227
	Observations	106	
	R^2	0.345	

Table 10. Comparing the effect of community conservation on the household value of ecosystem services provided by *Polylepis* and the likelihood of a household being conservationist (+p<0.10, ++p<0.05, +++p<0.01).

Variable	**Value of ES for households ($WTP_{IMPLIED}$) (OLS)**	**Probability of being a conservationist household (Logit)**
ES_TOTAL	++	+
ECOAN_INDIRECT	.	++
PCA	.	+++
POLYLEPIS	++	.