Community harvesting of trees in Peru under payment for ecosystem service schemes

A handbook illustrating results of economic games with participants in selected communities

Maria Claudia Lopez
Sara Torres
Zoila Cruz-Burga
Gisella Saldarriaga
María de Lourdes Espinoza
Frangi Valencia
Esther Mwangi
Krister Andersson

CIFOR

Community harvesting of trees in Peru under payment for ecosystem service schemes

A handbook illustrating results of economic games with participants in selected communities

Maria Claudia Lopez

Sara Torres

Zoila Cruz-Burga

Gisella Saldarriaga

María de Lourdes Espinoza

Frangi Valencia

Esther Mwangi

Krister Andersson

Work Package Seven of CIFOR's REDD+ Benefit-Sharing Project

López MC, Torres S, Cruz-Burga Z, Saldarriaga G, Espinoza M-L, Valencia F, Mwangi E, and Andersson K. 2016. *Community harvesting of trees in Peru under payment for ecosystem service schemes: A handbook illustrating results of economic games with participants in selected communities*. Bogor, Indonesia: CIFOR.

ISBN 978-602-387-030-1
DOI: 10.17528/cifor/006075

Photos by Zoila Cruz-Burga.

CIFOR
Jl. CIFOR, Situ Gede
Bogor Barat 16115
Indonesia

T +62 (251) 8622-622
F +62 (251) 8622-100
E cifor@cgiar.org

cifor.org

We would like to thank all funding partners who supported this research through their contributions to the CGIAR Fund. For a full list of the 'CGIAR Fund' funding partners please see: http://www.cgiar.org/who-we-are/cgiar-fund/fund-donors-2/

Contents

Acknowledgments **v**

1. Introduction **1**

2. The participants **4**

3. The activity representing the use of a forest **7**

4. Results **14**

a) Results Rounds 1 to 8 14

b) Results Rounds 9 to 16 15

c) Results Rounds 17 to 24 19

5. Experience **23**

6. Conclusion **24**

Figures and tables

Figures

1. Map of Peru. 2
2. Participants responses to the question "why do you go to the forest?" The percentages for this graph were rounded. 5
3. Participants responses to "I trust most people in this community." 6
4. Forest in the activity, the forest was represented by blocks of wood. Each block is equivalent to one tree. 7
5. Individual and group earnings in tokens per tree. 8
6. Decision card. 8
7. Average individual extraction in Peru in rounds 1 to 8. 15
8. Average Individual Extraction Rounds 9-16 in Peru. 17
9. Comparison of trees cut in rounds 1-8 versus rounds 17-24 after variations. 20
10. Average Individual Extraction in Peru from rounds 1 to 24. 21
11. Comparison of average extraction after treatments in the three countries. 22

Tables

1. Participant Characteristics by community. 4
2. Calculation Sheet. 9
3. The social dilemma introduced into the activity. 10
4. Description of variations of the activities from rounds 9-16, showing in parenthesis the label given to each variation. 11
5. Summary of the 24 rounds of the activity. 12
6. Summary of participant distribution per village and per variation. 12
7. Trees cut in the first 8 rounds of the activity. 14
8. Average of trees cut during rounds 9-16 of the activity for each one of the variations in Peru. 17
9. Average of trees cut during rounds 9-16 of the activity for each one of the variations in Tanzania and Indonesia. 18
10. Average number of trees cut during rounds 17 to 24 of the activity in Peru. 19
11. Average number of trees cut during rounds 17 to 24 of the activity in Tanzania and Indonesia. 21

Acknowledgments

This handbook has been produced with financial assistance from the European Commission and the United Kingdom Department for International Development. We are grateful to el Centro de Conservacion Investigacion y Manejo de Areas Naturales - CIMA Cordillera Azul, Conservación Internacional - CI, Asociación para la Investigación y Desarrollo Integral - AIDER, Bosques Amazónicos - BAM, Federación de Productores de Castaña de Madre de Dios - FEPROCAMD. We would also like to thank Lucero, Sol de Oro, Oriente Nuevo, Miraflores, Alto Ponaza, Planchón, Alegría, Monterrey, Sabaluyoc, Callería and Patria Nueva for their participation in this project. Additionally, Alisson Soche Forero and Paula Andrea Zuluaga provided valuable expertise for the data management process. Again, to everyone, thank you. . Any views expressed in this publication are those of the authors and do not represent the views of Center for International Forestry Research - CIFOR, the editors, the authors' institutions, the financial sponsors.


MADRE DE DIOS-X
TABLA DEL 5
0 X 5 = 0
1 X 5 = 5
2 X 5 = 10
3 X 5 = 15
4 X 5 = 20
5 X 5 = 25
6 X 5 = 30
7 X 5 = 35
8 X 5 = 40
9 X 5 = 45
10 X 5 = 50

1 Introduction

Communities all over the world use forests as an important part of their livelihood and many have organized ways of using their forests and regulating what is harvested when, from where, and by whom. They often also have ways of distributing benefits among their members and with non-members. In many cases, these communities are also linked with external actors such as forestry agencies and conservation NGOs who also affect how resources are used and managed through the policies/laws they implement and the incentives they offer. This study seeks to understand how people make decisions regarding the use of the forest and how different policies may affect that use. In particular, we look at the effects of providing a payment to forest users to conserve the forest, often referred to as a "payment for environmental service." A payment for environmental service as defined by Wunder (2005) is a transaction where an ecosystem service is being 'bought' by a buyer (or multiple buyers) from a service provider or a group of service providers, if the service provider can secure the ecosystem service. In general, the buyers of the ecosystem service are organizations external to the communities of forest users. These organizations find different ways to monitor the conservation of the forest, and make payments to the communities, these payments can be in cash or in kind, at the individual level or at the group level.

In this handbook, we investigate the effects of payment for forest conservation on the forest and on users' by implementing a set of activities simulating the use of a forest by a forest community. We look at the effectiveness of four different ways of providing the payment in four different variations of the activity, with an aditional variation in which no payment is administered. The five variations of the activity we created were: (1) allowing the community members to communicate among themselves without any payment or external organization involved; (2) having the external organization pay an equal amount directly to each member of the group, where community members were not allowed to communicate among themselves; (3) having the external organization pay an equal amount directly to each member of the group, where community members were allowed to communicate among themselves; and (4) having the organization make the payment to one person selected by the community (leader) after a group discussion, who then decides how to allocate the payment among community members; (5) having the same sort of payment described in (4), but with women making up a majority of the group.

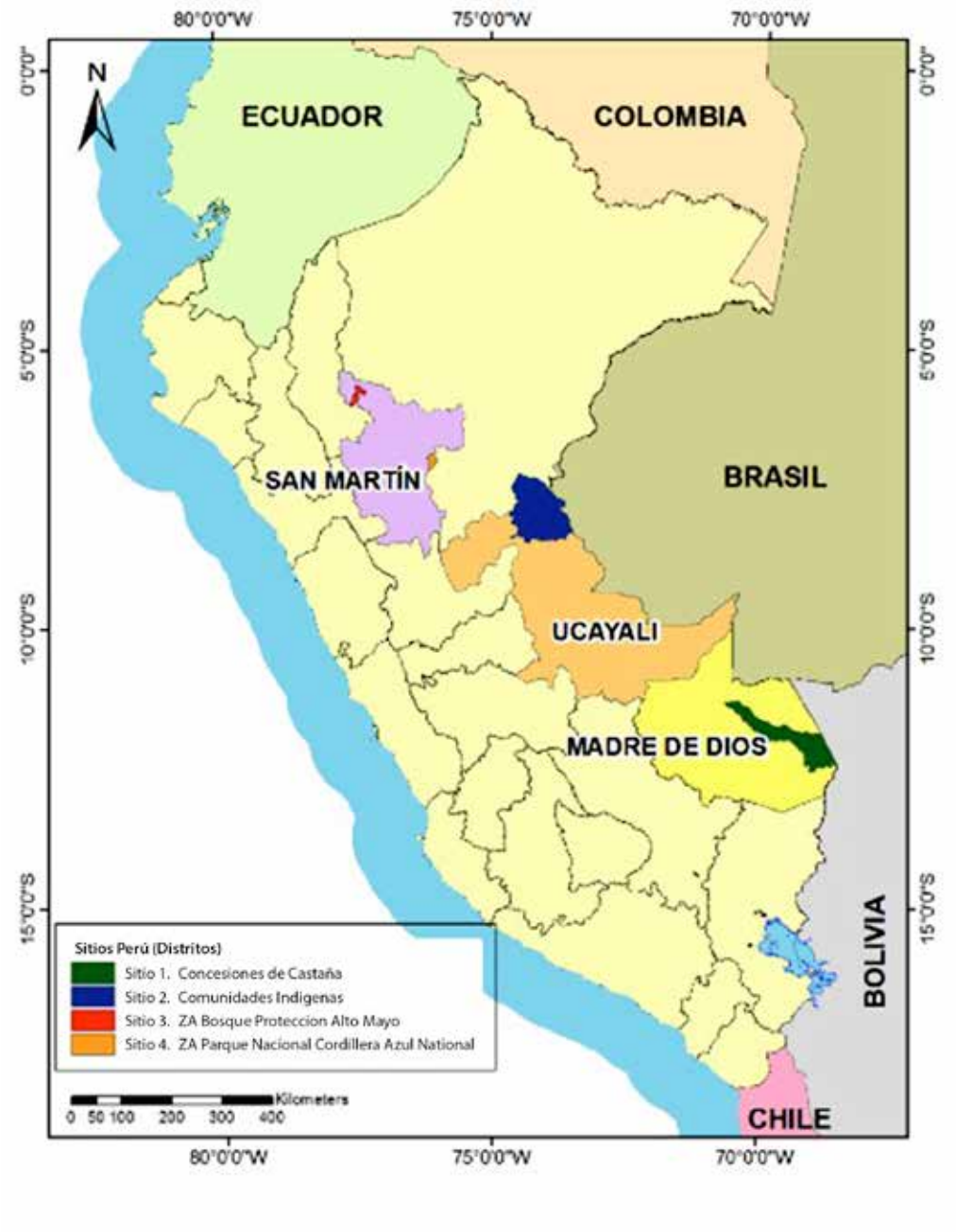

Figure 1. Map of Peru.

This project was carried out in rural communities in Peru that live near forests and use them in different ways. The communities were Alegría, Alto Ponaza, Callería, Lucero, Miraflores, Monterrey, Oriente Nuevo, Patria Nueva, Planchón, Sabaluyoc and Sol de Oro. Some, but not all of these communities participated in REDD+ projects implemented by NGOs from 2009-2014. See Figure 1 for the location of these villages.

For the study we selected communities that were part of a payment for environmental services (PES) scheme (Alegría, Alto Ponaza, Callería, Oriente Nuevo, Planchón, Sol de Oro), and others that were not part of a PES program (Miraflores, Monterrey, Patria Nueva, Sabaluyoc and Lucero). The communities were also participating in the Center for International Forestry Research (CIFOR) broader research program on the efficiency, effectiveness and sustainability of REDD+. REDD+ is a program aimed at providing communities with incentives to use forests in a sustainable way in order to reduce the effects of climate change. When forests are degraded or destroyed carbon dioxide is emitted and this is thought to lead to increasing temperatures, which may eventually have negative effects on human welfare.

In certain communities (Alto Ponaza, Callería, Lucero, Miraflores) we held five working sessions (one for each one of the variations mentioned earlier, and explained below). In other communities (Alegría, Monterrey, Oriente Nuevo, Patria Nueva, Planchón, Sabaluyoc, Sol de Oro) we held fewer sessions due to the size of the community (see Table 1). For all sessions we invited eight different community members. During each session, we first conducted a brief survey of each participant, followed by an activity representing the use of a forest, and after the activity we administered another survey. The purpose of the surveys[1] was to gather some socio-economic information about the participants in the activity, as well as some information about the ways they interact with the forest and their perceptions after the activity. This report contains results from both the surveys and the forest activity in the 11 communities in Peru.

This study was conducted not only in Peru but also in Tanzania and Indonesia. In this report, we also include some data from Tanzania and Indonesia to give some perspective to these results. Due to the fact that we had a maximum of five working sessions in each village (but in some communities only two, testing only one type of variation described in each of them) in this brief handbook we do not present results with differences between communities in Peru. This will allow us to keep the results anonymous by not mentioning what happened in each group, focusing instead on the results aggregated at the country level.

1 We applied the initial survey before the activity to exclude any influence it may have had on the opinions expressed. The post activity survey included some questions about the activity itself and others that could have influenced had they been asked before the activity.

2 The participants

320 people participated in the Peru study, 148 women and 172 men. The average age of the participants was 38 years with an average of 7 years of education. When asked about their finantial situation 54.38% considered themselves as average, while 40.94% considered themselves to be poor compared to other people in their community. Table 1, below presents some general information on the participants in each community where we conducted the study.

Table 1. Participant Characteristics by community.

Community	Number of participants	Average Age	Number of women	Number of men	Average of years of education
Alegría	16	48.50	9	7	7.57
Alto Ponaza	40	34.80	24	16	4.56
Callería	40	37.98	14	26	9.29
Lucero	40	39.31	21	19	6.31
Miraflores	40	33.70	15	25	5.38
Monterrey	24	43.83	9	15	8.50
Oriente Nuevo	16	33.69	3	13	7.53
Patria Nueva	40	31.83	17	23	8.90
Planchón	24	50.42	11	13	7.00
Sabaluyoc	16	41.19	13	3	6.94
Sol de Oro	24	35.25	12	12	6.25
Total	**320**	**38.08**	**148**	**172**	**7.10**

As mentioned earlier, participants in this study were forest users or people living close to a forest. These participants claimed to visit the forest on average 7 days a month. When they do visit it 30.94% claim to spend half a day or less, 20.31% claim to spend an hour or less, 20.63% reported going for more than a day and 16.88% go for between a half day and a whole day. 10.63% said they never visit the forest.

When we asked participants about the different reasons to visit the forest, the majority mentioned recreation, followed by monitoring and hunting and/or fishing as presented in Figure 2. Survey responses do not specify what type of monitoring they do, or how that monitoring works. In addition, we do not have information about the type of recreation activities done in the forest. More fieldwork would be needed to address such questions.

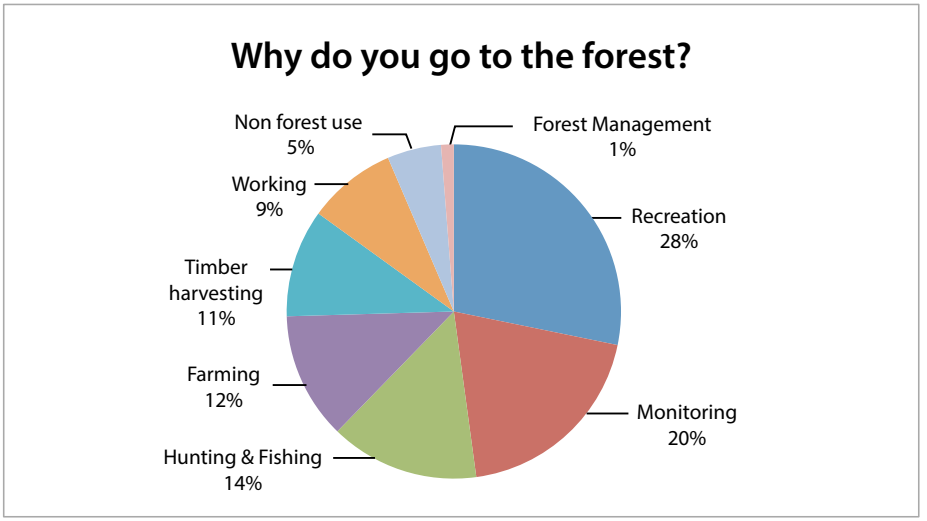

Figure 2. Participants responses to the question "why do you go to the forest?" The percentages for this graph were rounded.

We asked participants about the importance of protecting their natural resources and nature. A total of 97.19% of them strongly agreed or agreed (60.63% and, 36.56%, respectively) with the statement: "It is important for me to care for nature and protect the natural resources in my community." Among the participants, 57.5% (47.5% agree, 10.5% strongly agree) think that most people in the community care about the health and conditions of the ecosystem. Aditionally 59.1% (50% agree, 9.1% strongly agree) of the participants believe that their community has done a good job protecting its natural resources. The other answers to this particular question were: 20.3% somewhat agree with the statement and 9.1% somewhat disagree with it, while 11.6% disagree or strongly disagree. It is clear from this results that there is no consensus among the participants on the importance of caring for the natural resources in their communities. Unfortunately, the survey questions do not shed further light on these, although 67.2% (48.75% agree, 18.44% strongly agree) of the participants believe that the condition of the forest in their community is better than in other surronding communities.

During this study we also asked about trust and cooperation within the community and found that 93.44 % (41.56% agree, 51.88% strongly agree) of the participants believe that cooperation and working together is extremely important. In this study, 50.63% of the participants trust most people in their community (42.5% agree, 8.13% strongly agree), and 32.81% (28.44% agree, 4.38% strongly agree) believe that most people in the community trust one another, (see Figure 3).

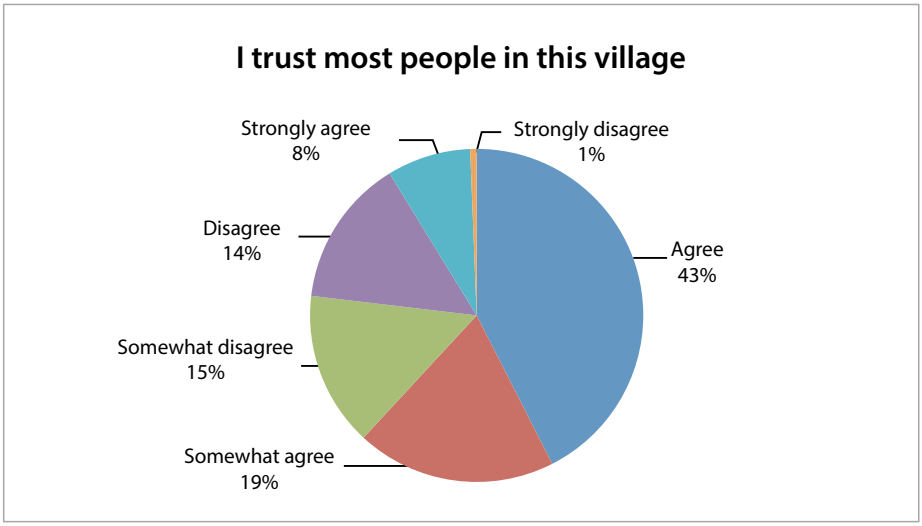

Figure 3. Participants responses to "I trust most people in this community."

As part of our survey we asked some questions about payment for ecosystem services (PES). Six of the 11 communities in our study have a PES scheme implemented. Among these communities 1.88% of the participants knew that people in their community had received payments for conservation activities. Among the participants in the activity 0.63% had received at least one of these payments. In the communities where PES has not been implemented, 6 people in total had some awarness of the existence of payment for environmental services. We did not collect information about the type of payment or the frequency of these payments. We did not ask either about the type of ecosystem service the organization is paying for, or how the payments are being shared among community members. To answer all these questions will require further fieldwork. We also did not collect information about payments in kind, including technical assistance or other types of non-monetary payment that may explain why such a small proportion of the participants had received payments, despite living in communities where a PES is implemented. This initial result is interesting because it may indicate that most of the participants had their first experience with the motion of the monetary payment during the forest activity described below.

3 The activity representing the use of a forest

The team carried out this decision-making activity (commonly called economic games) in Peru, Indonesia and Tanzania. This activity portrays a scenario where a group of forest users must decide how to use a common forest. The group consists of eight people sharing a forest with 80 trees (see Figure 4). Each participant was invited to participate in the activity only once, and each activity consisted of 24 rounds. Each round represents a day spent harvesting wood. During each round, each participant had to choose how many trees from 0 to 10 he/she wanted to cut from a shared forest containing 80 trees. This decision was made in private and without communicating with other participants in the group.

Figure 4. Forest in the activity, the forest was represented by blocks of wood. Each block is equivalent to one tree.

The monitor explained that a participant will get five tokens for each tree he/she cuts from the forest, whereas for each tree left standing in the forest each one of the participants in the group would get one token (see Figure 5). At the end of the 24 rounds, the monitor calculated the total number of tokens collected by each participant, paying each participant 0.027 cents of Nuevos Soles for each token earned during the activity.

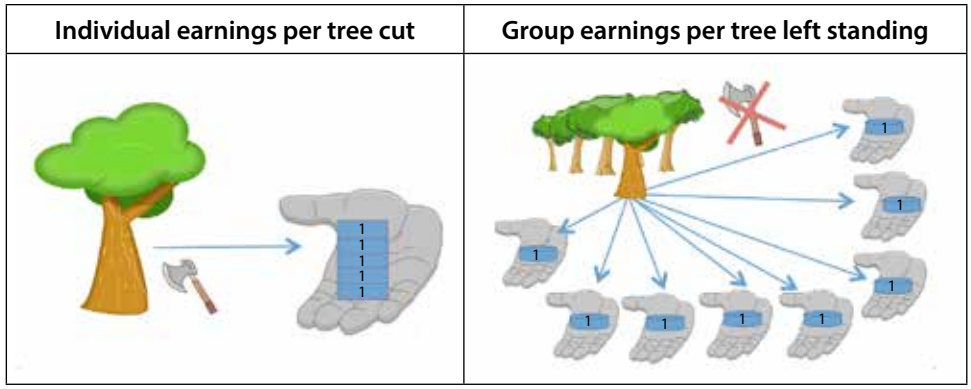

Figure 5. Individual and group earnings in tokens per tree.

Participants made their decisions in private, and reported their decisions to the monitor by filling out a decision card (Figure 6).

Decision card	
Participant number:	
Round number:	
Please mark with an X the trees you want to cut from 0 to 10.	
0 - 10	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Figure 6. Decision card.

After each round of the activity, the monitor collected the decision cards from the 8 participants, and announced in public how many trees were cut from the forest by the group, and how many trees were left standing in the group forest. Additionally, the monitor announced the earnings all participants received from the trees that were not harvested but left standing in the group forest. Then each participant individually and privately, calculated his or her earnings in tokens for that round based on the tokens earned from cutting trees, plus the tokens earned for the trees left standing in the group forest. All this information was recorded on a calculation sheet (Table 2) that participants had with them at all times. This process was repeated for 24 rounds.

Table 2. Calculation Sheet.

Round number	Trees you cut from the forest	Earnings in tokens for the trees you cut (for each tree you will receive 5 tokens) (A*5)	Number of trees cut by the entire group (announced by the monitor)	Earnings in tokens for the trees left in the forest (announced by the monitor) (80-C)	Tokens earned in this round (=B+D)
1					
2					

Explanation of the activity

This basic activity simulates a cooperation dilemma where at the individual level it is often viewed by participants to be in their best interest to cut as many trees as possible, but at the group level it is better to leave the trees standing in the common forest. In other words, there is a tension between what an individual sees as best for him or herself and what is best for the group overall. However, if everybody in the group follows the individual strategy, then in the end the group would not earn as many tokens as they could if they were not cutting trees and they will end up destroying the group forest. As shown in Table 3, if nobody cuts trees from the forest, then the earnings for each individual from the trees left in the forest are 80 tokens, and the total earnings for the group are 80*8=640. This is the way to earn more tokens as a group and we call this a *social optimum*. If every participant cuts one tree, then the earnings for each individual are 5 tokens from the tree cut + 72 tokens from the trees left in forest, thus 77 tokens per participant. The total earnings for the group in this case are 616 (77*8), which is substantially less than what the group could have earned if everyone had abstained from harvesting trees.

Thus, if one individual cuts 10 trees and the rest of the participants do not cut any trees, that individual's earnings are 50 from the trees cut + 70 from the trees

left standing in the forest= 120 tokens. In this particular case the total earnings for the group are 610, (120+70*7). This example shows how for the individual it may be better to cut all trees, but by doing so the individual is affecting the total earnings of the group. In this activity, all participants face the temptation to harvest some trees while other players refrain from harvesting all together. The example illustrated yields the highest possible *individual earnings* (for the individual cutting all 10 trees*),* but that comes with a cost in earnings to the rest of the group (because the other players in the group are not cutting any trees). In this particular case, we say that this individual is *free-riding* on the effort of others in the group to conserve the forest.

If every participant decides to do the same, and to cut all trees they are allowed to cut, then each individual's earnings are 50 tokens, and the total earnings made by the group are 400 tokens (50*8). In this case none of the participants cooperate, and this will be damaging for the forest and also for the individual and group earnings. This situation is known as a *Nash equilibrium*, a situation in which no participant can benefit from doing something different while the other participants keep doing what they are doing. In this case in which the whole group is cutting 80 trees, the only way a participant can benefit, in terms of earnings, from doing something different (cutting fewer trees) is if others cut fewer tress as well. If everyone follows this individualistic strategy the forest will disappear rapidly and participants will earn very little income from all that harvesting.

The cooperation dilemma manifests itself in this activity then by representing the advantages for the group and for the forest of not cutting trees (*the social optimum*), but showing how difficult it is to get there if there is a lack of commitment to the group and trust among its members. If participants start *free-riding*, then it will be more likely to end up in a situation like the one described in the *Nash equilibrium*.

Table 3. The social dilemma introduced into the activity.

Trees cut by individual	Trees cut by 7 other players	Earnings for individual by the trees cut	Earnings for the individual from trees left standing in the forest	Total Earnings for individual from trees cut+ trees left standing in the forest	Total earnings for the group
0	0	0	80	80	80*8=640
1	7	5	72	77	77*8=616
10	0	50	70	120	120+70*7=610
10	70	50	0	50	50*8=400

For the first eight rounds of the activity participants make their decisions as described above. Each participant decided how many trees to cut from the shared

forest, without any way to communicate with other group members or any type of external organization looking or controlling the group decision-making. From rounds 9 to 16, we included five different possible variations to the basic activity. Each group participated in only one of these five possible variations (variations are explained in Table 4). As mentioned earlier, in four communities in Peru we conducted the five variations of the activity once, and in one

Table 4. Description of variations of the activities from rounds 9-16, showing in parenthesis the label given to each variation.

Variation for rounds 9 to 16	Description
Communication (COMM)	Participants were allowed to talk among themselves before making decisions each round. The decisions remained private.
Bonus (BONUS)	In this variation an organization offers a bonus to the group to abstain from cutting trees from the forest. This bonus is offered every round. But if the organization finds out that the group is cutting trees, it will not pay the bonus. The organization cannot perfectly monitor whether or not the group is cutting trees, but each tree cut increases the probability that the organization will find out that trees are being cut. If the group cuts more than 40 trees the organization will always know they cut trees. The bonus is 160 tokens, and it is distributed equally among all participants. No communication was allowed.
Bonus and communication (BONUS+COMM)	In this variation, participants participated in the "Bonus" variation described above, but additionally they had the opportunity to communicate for 5 minutes with each other before making any decision.
Bonus and communication with leader (BONUS+LEADER)	In this variation, an organization offers a bonus to the group not to cut trees from the forest. This bonus is offered every round. If the organization finds out that the group is cutting trees, it will not pay the bonus. The organization cannot perfectly monitor whether or not the group is cutting trees, but each tree cut increases the probability the organization will find out that trees are being cut. If the group cuts more than 40 trees the organization will always know they cut trees. Participants could communicate and had to elect a participant that would be in charge of distributing the bonus of 160 tokens, if a bonus is given. The leader was free to distribute the bonus in any possible way. Group members are not informed of how the bonus is distributed.
Bonus and communication with leader and a majority of women in the group. (BONUS+LEADER+MAJORITY)	This variation is the same as "Bonus and communication with leader," but the majority of the participants were women.

community we did only four activities. In three communities we did only three activities and in three communities we did only two activities.

In rounds 17- 24, regardless of the variation of the activity they were participating in, all groups went back to participating in the activity under the same conditions as in rounds 1 to 8; thus there was no communication or any type of bonus or organization monitoring their actions. However at this point they have experienced the effects of making decisions under the variations to the game in rounds 9-16.

Table 5 summarizes the different components of the activity across the 24 rounds that were played in each community. In rounds 1-8 we did not have any type of variation in the activity (pre-variations rounds); rounds 9-16 introduced the 5 variations explained above (one per group); finally in rounds 17-24 the groups were not subject to any variations, but they experienced the withdrawal of the variation they previously experienced in rounds 9-16, (post-variations rounds).

Table 5. Summary of the 24 rounds of the activity.

Rounds 1-8 Pre-variations	Rounds 9-16 Variations	Rounds 17-24 Post-variations
No communication. No Bonus	COMM	No communication. No Bonus
	BONUS	
	COMM+BONUS	
	BONUS+LEADER	
	BONUS+LEADER+MAJORITY	

Table 6 lists the villages where each variation was conducted, and the breakdown of the number of participants per variation, including the number of women and men in each group.

Table 6. Summary of participant distribution per village and per variation.

Community	Variation	Number of participants	Number of women	Number of men
Alegría	BONUS	8	4	4
	COMM+BONUS	8	4	4
Alto Ponaza	BONUS	8	6	2
	COMM+BONUS	8	2	6
	COMM	8	6	2
	BONUS+LEADER	8	4	4
	BONUS+LEADER+MAJORITY	8	4	4

continued on next page

Table 6. Continued

Community	Variation	Number of participants	Number of women	Number of men
Callería	BONUS	8	0	8
	COMM+BONUS	8	7	1
	COMM	8	8	0
	BONUS+LEADER	8	1	7
	BONUS+LEADER+MAJORITY	8	6	2
Lucero	BONUS	8	4	4
	COMM+BONUS	8	4	4
	COMMUNICATION	8	5	3
	BONUS+LEADER	8	3	5
	BONUS+LEADER+MAJORITY	8	5	3
Miraflores	BONUS	8	1	7
	COMM+BONUS	8	2	6
	COMM	8	2	6
	BONO+LEADER	8	2	6
	BONUS+LEADER+MAJORITY	8	8	0
Monterrey	BONUS	8	2	6
	COMM+BONUS	8	0	8
	BONUS+LEADER+MAJORITY	8	6	2
Oriente Nuevo	COMM+BONUS	8	3	5
	BONUS+LEADER	8	0	8
Patria Nueva	BONUS	8	4	4
	COMM+BONUS	16	4	12
	COMM	8	2	6
	BONUS+LEADER+MAJORITY	8	7	1
Planchón	COMM	8	1	7
	BONUS+LEADER	8	4	4
	BONUS+LEADER+MAJORITY	8	6	2
Sabaluyoc	COMM	8	5	3
	BONUS+LEADER	8	8	0
Sol de Oro	BONUS	8	3	5
	COMM	8	4	4
	BONUS+LEADER+MAJORITY	8	5	3
Total		**320**	**152**	**168**

4 Results

a) Results Rounds 1 to 8

Table 7. Trees cut in the first 8 rounds of the activity.

Round	Peru	Indonesia	Tanzania
1	3.58	3.31	2.09
2	3.66	3.52	2.27
3	3.78	3.92	2.14
4	3.99	4.03	2.33
5	4.12	4.02	2.08
6	4.15	3.70	2.32
7	4.19	3.87	2.26
8	4.16	4.06	2.29

Table 7 and Figure 7 (below) present the average extraction decisions during the first eight rounds, in Peru and compare them to the extraction decisions of Indonesia and Tanzania. We used the data of Indonesia and Tanzania only as a reference for decisions made by the participants in Peru. We see that the average extraction during these rounds in Peru was 3.95, showing that participants were not playing so as to optimize the group earnings, which results from cutting 0 trees; but neither where they playing as in the *Nash Equilibrium* individualistic scenario, which would have been to cut 10 trees each. It is important to remember that participants during these 8 rounds did not have any way to coordinate their decisions because they were not able to communicate.

The average extraction levels in Tanzania were 2.22 and in Indonesia were 3.80. So the extraction levels in Peru were higher than in the other two countries, but similar to the ones from Indonesia. Figure 7 offers a graphical representation showing that in Peru the extraction levels increased gradually over time.

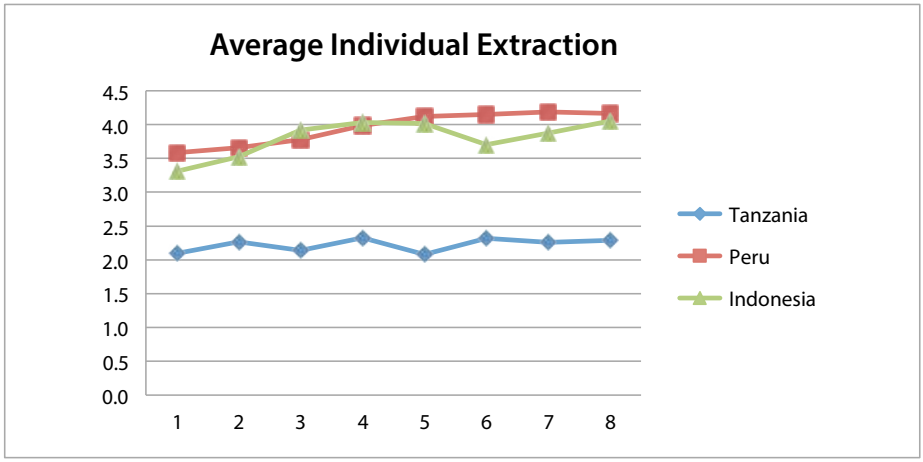

Figure 7. Average individual extraction in Peru in rounds 1 to 8.

b) Results Rounds 9 to 16

Table 8 and Figure 8 (below) present an overview of the average extraction levels in rounds 9 to 16 with all the variations tested.

The variation COMM resulted in an average extraction level of 2.89 during these 8 rounds, reducing the extraction level with respect to the first eight rounds by 1.06 trees. It is important to note that during the COMM variation participants were able to communicate but they did not receive any bonus. During the communication process participants were free to discuss any topic, but decisions had to be made in private. So even if they made agreements during the communication process, those agreements were not monitored or enforced. They could only "see" the results of the communication when the monitor announced the total number of trees extracted by the group.

In the BONUS variation, the average extraction level in these 8 rounds was 2.72, which is lower than what was extracted in the first 8 rounds by 1.23 trees. The extraction levels with this variation are not very different from the ones with COMM. Thus, the efficiency of COMM and BONUS in promoting cooperation seems to be very similar in terms of extraction levels. However the BONUS provided providing this extra payment to maintain the forest, which in this particular case produced the same results as allowing participants to communicate while making decisions in private. An interesting difference in these two variations is found in round 16, where in COMM the results were very similar to the rest of the rounds (average of 2.86), while in the BONUS variation, the extraction levels increased in the last rounds. In fact in the last round the average extraction was 3.34. Are these results showing that a bonus may not be required to get people to conserve their resources? How often can communities in Peru discuss and agree on ways to manage their resources? More fieldwork is needed to answer these questions.

Three variations provided participants the possibility to communicate and receive the bonus: COMM+BONUS, BONUS+LEADER, BONUS+LEADER+MAJORITY.

COMM+BONUS is a variation that combines the characteristics of COMM and BONUS, so one might expect this variation to be more efficient than these other two variations alone. However this was not the case in Peru. The average extraction level during this variation was 2.83, so the extraction levels were slightly higher than for the BONUS alone, and slightly smaller than for the COMM alone. This result is somewhat surprising because it appears to suggest that the fact participants were able to discuss and to get the bonus was not enough to lead them to coordinate their actions to extract fewer trees from the forest in order to receive the bonus, at least not when you compared to the results when they could only communicate, or those when they could only get the bonus. Additionally, with COMM+BONUS if participants got the bonus the organization was distributing it in equal shares among all participants, meaning that participants did not have to worry about how to share the bonus. Apparently the fact that the organization was offering the bonus and was distributing it to all community members was not as effective in increasing cooperation compared to just COMM or BONUS.

The variation BONUS+LEADER was the variation leading to the least extraction (among all variations used in rounds 9 to 16), thus increasing the cooperation among participants. In this case the average extraction of trees was 1.81. This variation resulted in a reduction of almost 2 trees with respect to rounds 1-8, and of 1 tree with respect to COMM+BONUS. Cooperation increased in Peru when participants were able to select a leader to distribute the bonus. This result is very interesting if we compare it with COMM+BONUS since in this variation the leaders controlled the bonus, and its distribution was kept private (only the leader knew how she/he was allocating the bonus), therefore the leaders could have distributed it in ways that might not have seemed fair to all the participants. This result is even more interesting when we overlay the levels of trust in others inside the community reported in the survey. The result in this variation suggest that participants trusted the leaders they were choosing and, even more importantly, they trusted them more than the external organization to allocate the bonus. It may be the case that an equal distribution of the bonus was not more appealing for them than a distribution made based on other criteria that they might have discussed in the activity.

The variation BONUS+LEADER+MAJORITY is identical to BONUS+ LEADER but in the former the majority of the group members are women. The average extraction level in this variation is 2.43. Although BONUS+LEADER+ MAJORITY led to lower extraction levels than COMM+BONUS, it was not as effective as BONUS+LEADER, and the only difference compared to that variation was the number of women in the group. This result corroborates some of the results found for BONUS+LEADER, discussed earlier. The fact that a leader was elected

to distribute the bonus had a positive impact on the decisions of the participants. Additionally, Figure 8 shows that BONUS+LEADER+MAJORITY produced fluctuations in average extraction levels, which ranged from 1.69 to 3.22 compared to fluctuations in BONUS+LEADER, which ranged from 1.54 to 2.11. Does this mean that it was more difficult to reach an agreement when more women were in the group? Or was it because the leaders in these groups were not distributing the bonus in a fair way? Is it that women in these communities are not as accustomed to making this type of decisions? Further research is needed to explore these questions.

Table 8. Average of trees cut during rounds 9-16 of the activity for each one of the variations in Peru.

Round	BONUS	COMM+ BONUS	COMM	BONUS+ LEADER	BONUS+ LEADER+ MAJORITY
9	2.30	2.90	2.63	1.54	2.28
10	2.67	2.67	2.64	1.70	2.14
11	2.48	2.92	3.09	1.75	3.22
12	2.66	2.93	2.70	1.93	2.30
13	2.45	2.76	2.84	1.98	3.17
14	3.17	2.86	2.94	1.89	1.69
15	2.72	3.14	3.42	1.61	2.39
16	3.34	2.43	2.86	2.11	2.23

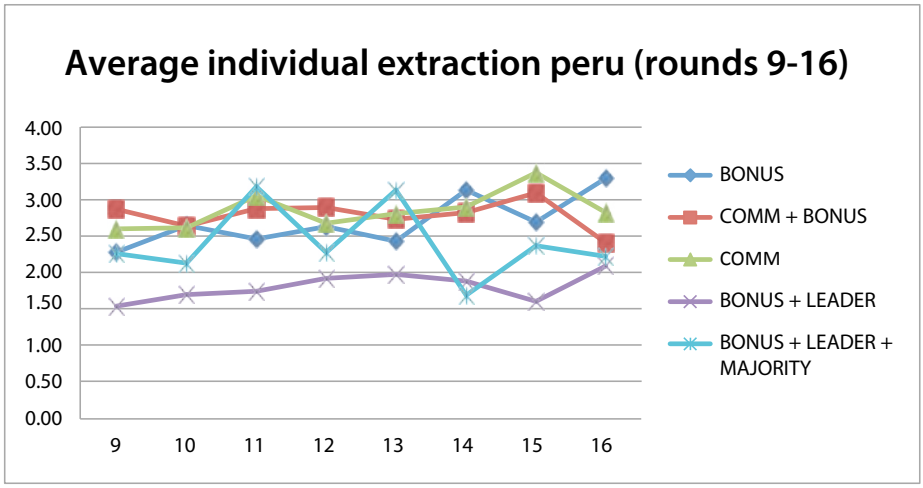

Figure 8. Average Individual Extraction Rounds 9-16 in Peru.

When we look more closely at the selection of the leader in variations BONUS+LEADER and BONUS+LEADER+MAJORITY in one group the same person was elected for six rounds (in variation BONUS+LEADER+MAJORITY),

while another group in the same variation had only two leaders throughout the eight rounds (each for four rounds). One group in the BONUS+LEADER variation had the same leader elected for five rounds. Clearly, different groups developed different strategies to choose their leader. A significant fact is that a woman leader was choosen in only 45 (37.5%) of the rounds, and only five of those female leaders were chosen as leaders twice. No woman were elected leader more than two times in a group. Even in the BONUS+LEADER+MAJORITY variation, which required having a majority of women, in the group, a woman was elected to lead in only 34 (53.1%) rounds. This is much higher than the LEADER+COMM variation, which only had woman leaders in 11 (19.6%) rounds. The fact that women were not elected to be leaders as often may be a reflection of what happens to them in real life: women may not have the chance to participate in many decision making processes related to forest or resource management in their communities.

The bonus was paid in 75 (62.5%) out of 120 rounds by the organization. When the bonus was distributed by the leader in one (1.3%) round the leader distributed the bonus unequally keeping nothing for him/herself. During 5 (6.7%) rounds the leader kept more for him/herself than was distributed to others. In nine (12%) rounds the leaders distributed the bonus not in an equal way, but they did not keep more for themselves. Finally in 60 (80%) rounds the leaders distributed the bonus equally providing 20 tokens to each player.

Table 9. Average of trees cut during rounds 9-16 of the activity for each one of the variations in Tanzania and Indonesia.

	Round	BONUS	COMM+ BONUS	COMM	BONUS+ LEADER	BONUS+ LEADER+ MAJORITY
Indonesia	9	2.61	2.19	4.47	3.17	1.92
	10	2.58	2.42	3.64	2.09	1.41
	11	3.05	2.66	2.78	2.63	1.63
	12	3.53	2.92	2.92	2.36	2.30
	13	3.72	2.17	3.38	2.14	1.59
	14	2.91	2.28	3.30	1.81	1.53
	15	3.11	2.34	3.11	3.05	1.67
	16	3.14	2.36	2.70	1.50	1.41
Tanzania	9	0.59	0.73	1.48	1.11	1.92
	10	0.89	0.77	1.55	1.51	1.41
	11	1.20	0.85	1.90	1.49	1.63
	12	1.14	1.02	1.76	1.44	2.30
	13	1.33	0.81	1.67	1.64	1.59
	14	1.08	0.94	1.54	2.05	1.53
	15	1.47	0.94	1.40	1.93	1.67
	16	1.56	0.93	1.49	1.90	1.41

When we compare the results of Peru to those of Tanzania and Indonesia we see that the average extraction levels in Tanzania were much lower than in Peru and Indonesia for all variations. Comparing Peru and Indonesia, we see that some variations were more effective in Peru (BONUS, COMM, BONUS+LEADER) and some more effective in Indonesia (BONUS+COMM, BONUS+LEADER+MAJORITY), and we do not yet have a very strong explanation for that result.

The variation that was most effective in Peru, BONUS+LEADER had an average of 1.81 in Peru compared to 2.34 in Indonesia and 1.63 in Tanzania. At the same time, the least effective variation in Peru, COMM led to an average of 2.89 in Peru and 3.29 and 1.60, respectively in Indonesia and Tanzania (see Table 8 and Table 9). Not only do the results vary by country, but the variations that were more effective in Indonesia and Tanzania were not the more effective in Peru. This result shows that variations that may be very efficient in one location may not be as efficient in another one. This may be related to the way in which resources are managed in the different locations, and also perhaps significantly, to cultural and gender differences associated with the forest management.

c) Results Rounds 17 to 24

Table 10. Average number of trees cut during rounds 17 to 24 of the activity in Peru.

Round	After BONUS	After COMM+ BONUS	After COMMM	After BONUS+ LEADER	After BONUS+ LEADER+ MAJORITY
17	2.55	2.71	2.48	2.05	3.58
18	3.42	3.21	2.75	2.29	3.45
19	3.66	3.13	2.97	2.34	4.11
20	3.78	3.65	2.88	2.43	4.11
21	3.20	3.21	2.84	2.11	4.25
22	3.42	3.49	2.92	2.34	3.89
23	3.27	3.25	2.92	2.20	4.31
24	3.83	3.63	3.03	2.70	4.44

Table 10 and Figure 9 show the results of the forest activity once the variations were removed from the activity. In almost all variations the average extraction levels were lower than in the first 8 rounds (see Figure 9); however the variation after BONUS+LEADER+MAJORITY led to some extraction levels very similar to (and even greater than) the ones found at the very beginning of the forest activity (see for example round 6 compared to round 22). On average the extraction level in rounds 17-24 was 4.02 whereas the average extraction level in the first 8 rounds was 3.95.

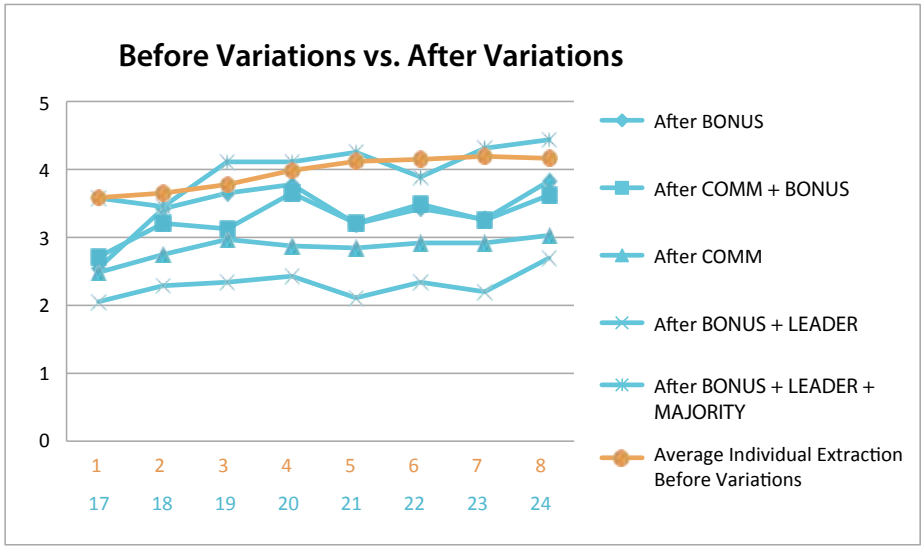

Figure 9. Comparison of trees cut in rounds 1-8 versus rounds 17-24 after variations.

Almost all average extraction levels were higher in rounds 17 to 24 than in rounds 9 to 16. In the case of BONUS+LEADER+MAJORITY the levels increase on average of more than one tree above the rounds 9-16 results. However, after COMM is an **important exception,** that had showing a slight reduction in the extraction level from 2.89 to 2.85 in rounds 17 to 24. This is an important result since it shows that the benefits of communication in Peru lasted even after the variation ended, somehow the fact that participants were able to communicate without any monetary incentive was sufficient for them to change their behavior even after they could no longer communicate. These results may reflect the fact that participants are not used to getting money to conserve their forest, but they do engage in some activities to conserve the forest.

Figure 10 shows a graphical representation of the average individual extraction throughout the 24 rounds of the forest activity in Peru. As described before, all variations lead to less extraction in rounds 9 to 16 compared to rounds 1-8. Thus all variations were effective at reducing the number of trees cut. At the same time, some variations clearly worked better than others at achieving reductions in cutting. In rounds 17 to 24 the extraction levels did not return to the levels observed in rounds 1 to 8 when no variations were available, but they did increase from levels when the variations were in place. There are two notable exceptions to this: the BONUS+LEADER+MAJORITY began an upward trend after round 18 that ended with more extraction than even before the variation. The other exception was the variation COMM which maintained the lower levels achieved during the variation.

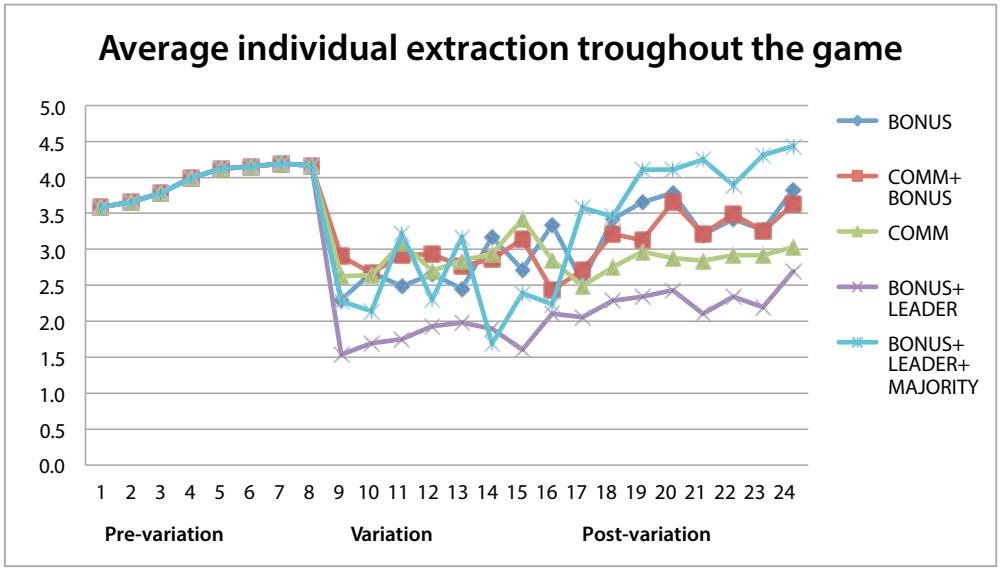

Figure 10. Average Individual Extraction in Peru from rounds 1 to 24.

Table 11. Average number of trees cut during rounds 17 to 24 of the activity in Tanzania and Indonesia.

	Round	After BONUS	After COMM+ BONUS	After COMM	After BONUS+ LEADER	After BONUS+ LEADER+ MAJORITY
Indonesia	17	2.23	2.73	3.03	2.81	2.47
	18	2.84	2.98	3.30	3.03	2.50
	19	3.08	3.02	3.63	3.09	2.03
	20	3.06	2.84	3.31	3.41	2.23
	21	2.78	3.30	3.22	3.25	2.22
	22	2.94	3.38	3.33	3.84	1.81
	23	2.77	3.00	3.31	3.34	1.77
	24	2.92	3.59	3.52	3.52	1.91
Tanzania	17	1.15	0.96	1.70	1.90	1.57
	18	1.69	1.14	1.57	2.15	1.93
	19	1.59	1.08	1.68	1.99	2.01
	20	1.77	0.96	1.55	1.81	1.70
	21	1.97	1.21	1.39	1.96	1.94
	22	1.61	1.02	1.48	1.83	2.05
	23	1.53	1.21	1.73	2.00	1.98
	24	1.71	1.36	1.55	2.35	1.46

When we compare the results of Peru vs. those of Tanzania and Indonesia we find that Tanzania consistently cut less trees than the other two countries (see Figure 11). The difference is at greater than one. Among all the after variations, Peru showed the highest levels of extraction in after BONUS, after COMM+BONUS, and after BONUS + LEADER+ MAJORITY.

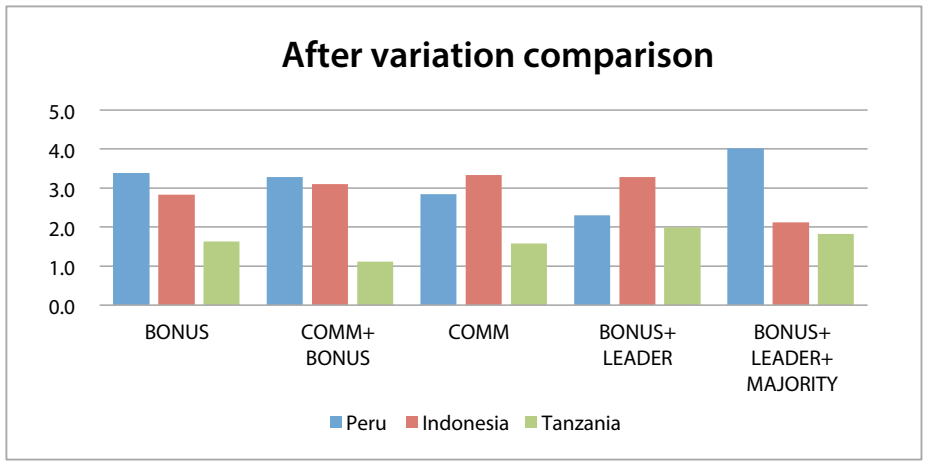

Figure 11. Comparison of average extraction after treatments in the three countries.

5 Experience

After participating in the forest activity 98.13% of the participants mentioned they had learned something new, and 99.38% stayed that day enjoyed participating in this study. Aditionally participants who played with one of the BONUS variations were asked whether or not they thought the distribution of the bonus was fair. Of these, 44.9% thought it was good and 24.6% thought it was equally distributed, 7.8% felt the distribution of the bonus resembled reality, and a 5.1% felt it was unfair. When we disaggregated the answers between participants whose bonus was distributed by the organization (BONUS+COMM) compared to those who had a chosen leader (BONUS+LEADER+MAJORITY and COMM+ LEADER) we found that 0% of the individuals in groups whose bonus was distributed by the organization thought the bonus was unfair, while 10.8% of those who chose a leader found it to be unfair. So even though trust on the leader seemed to be an important factor when making the decisions, and does increasing cooperation, in the end of the activity some people thought the distribution was unfair. The result for the BONUS+COMM is interesting because even though participants noticed that the distribution was fair, that did not lead to high more extraction levels in the game compared to BONUS+LEADER+MAJORITY and COMM+ LEADER.

6 Conclusion

A noteworthy result for Peru was the effect of communication. Participants in that variation decreased their extraction levels in rounds 9- 16 with respect to rounds 1-8, and it was the variation that led to lower cooperation in rounds 9-16, but among all variations those groups maintained (and even slightly reduced) their extraction levels in rounds 17 to 24. The effects of communication were not as significant in reducing cutting as other variations when it was in place, but they lasted for more than 8 rounds, persisting even after the communication ceased. It is even more relevant, that this persistence was only observed in the variation where communication took place alone and not in combination with one of the bonus. This suggest that the bonus was not a necessary mechanism to get participants to agree on the importance of conservation.

It is possible that the results from the forest activity also reflect a reality that came to light in the survey, namely that even in places where PES is implemented participants are not receiving monetary payments. Our survey did not explore other types of payments such as in kind payment or technical assistance thus we do not have enough information about the type of PES these communities are receiving. This may be reflected in the extraction levels observed in some of the variations involving a bonus. It is also possible that this played a role in the results described earlier for the COMM variation and its persistent effects even after the communication was removed.

In general extraction levels in Peru are similar to those in Indonesia, but very different from Tanzania. The variation leading to lowest extraction levels was COMM+ LEADER, but the levels of extraction were not as low in comparisson to Tanzania.

Some of the results may be associated with the fact that women in these rural areas of Peru are not used to participating in decision making scenarios such as the ones portrayed by the forest activity and aditional fieldwork will be needed to better understand this findings.

RESEARCH PROGRAM ON Forests, Trees and Agroforestry

This research was carried out by CIFOR as part of the CGIAR Research Program on Forests, Trees and Agroforestry (CRP-FTA). This collaborative program aims to enhance the management and use of forests, agroforestry and tree genetic resources across the landscape from forests to farms. CIFOR leads CRP-FTA in partnership with Bioversity International, CATIE, CIRAD, the International Center for Tropical Agriculture and the World Agroforestry Centre.

cifor.org

blog.cifor.org

CGIAR Fund

UKaid from the British people

Center for International Forestry Research (CIFOR)

CIFOR advances human well-being, environmental conservation and equity by conducting research to help shape policies and practices that affect forests in developing countries. CIFOR is a member of the CGIAR Consortium. Our headquarters are in Bogor, Indonesia, with offices in Asia, Africa and Latin America.