



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

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

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Lopez MC, Torres S, Kusumajati TO, Budisusila A, Wijayanti LW, Priantoro AT, Sampurno SRLA, Mayasari ED, Purwanto AB, Widiyanto YBC, Wedhowerti S, Kusuma SE, Budiasmoro IYK, Setyaningsih D, Mwangi E and Andersson K. 2016. *Community harvesting of trees in Indonesia under payment for ecosystem service schemes: A handbook illustrating results of economic games with participants in selected communities*. Bogor, Indonesia: CIFOR.

ISBN 978-602-387-031-8

DOI: <http://dx.doi.org/10.17528/cifor/006134>

Photos by Titus Odong Kusumajati/CIFOR.

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We would like to thank CIRAD and IRD as well as all donors who supported this research through their contributions to the CGIAR Fund. For a list of Fund donors please see: <http://www.cgiar.org/who-we-are/cgiar-fund/fund-donors-2>

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1

Introduction

Communities all over the world use forests as an important part of their livelihood. This project is carried out with rural communities in Indonesia that use nearby forests in different ways. The communities were Aweek, Betenung, Galinggang, Jantho Lama, Lambada, Merabu, Panaan, Sebadak Raya and Tumbang Tungku. The 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”). We investigate the effects of different ways of providing this payment, allowing us to look how these different ways affect how benefits from forests, including payments, are shared among user group members. We compare the effectiveness of two alternative ways of providing this payment: (1) By having the external organization providing the payment directly to community members, and (2) By having the organization giving the payment to one person selected by the community, and then that person deciding how to allocate the payment among community members. Additionally, we looked at the effects of having more women in the group of forest users. This study was done not only in Indonesia but also in Peru and Tanzania.

In each community we held three working sessions in which we invited eight different community members. During each session we first did a survey, then an activity representing the use of a forest, and after the activity we did another survey.

For reasons of the study, we selected communities that were part of a payment for environmental service (PES) scheme (Aweek, Galinggang, Jantho Lama, Merabu, and Sebadak Raya), and also communities that were not part of that program (Betenung, Lambada, Panaan and Tumbang Tungku).

2 The participants

in Indonesia, 320 people participated in the study, among them 146 were men and 174 were women. The average age of the participants was 35 years old with an average of 8 years of education. Below, we present a table with some of this general information for each one of the villages where we conducted the study.

Table 1. Participants Characteristics per Village

Village	Number of participants	Average Age	Number of women	Number of men	Average of years of education
Aweek	16	26.31	3	13	8.81
Betenung	40	37.80	25	15	8.05
Galinggang	40	37.73	17	23	7.88
Jantho Lama	24	36.78	15	9	8.00
Lambada	40	35.36	36	4	9.32
Merabu	40	32.25	21	19	7.89
Panaan	40	37.13	20	20	7.00
Sebadak Raya	40	34.63	12	28	8.38
Tumbang Tungku	40	34.05	25	15	7.80
Total	320	35.17	174	146	8.14

Participants were forest users; and as presented in Figure 1, they use the forest in various ways. Their main uses are firewood, farming and non-timber uses.

Participants go on average 12 days of each month to the forest and when they are there 26.9% stay for half of a day and 39.4% go for the whole day. For 86.9% of the participants it is important or very important to protect the natural resources in their villages. 84.1% of the participants considered that compared to other villages close by their forest is in better condition. 74.7% of the participants believe the village and its inhabitants have done a good job in protecting their natural environment and resources but still could do more to protect them. In addition, 86.9% agree and very much agree that as an individual it is important for them to protect the natural resources of the village.

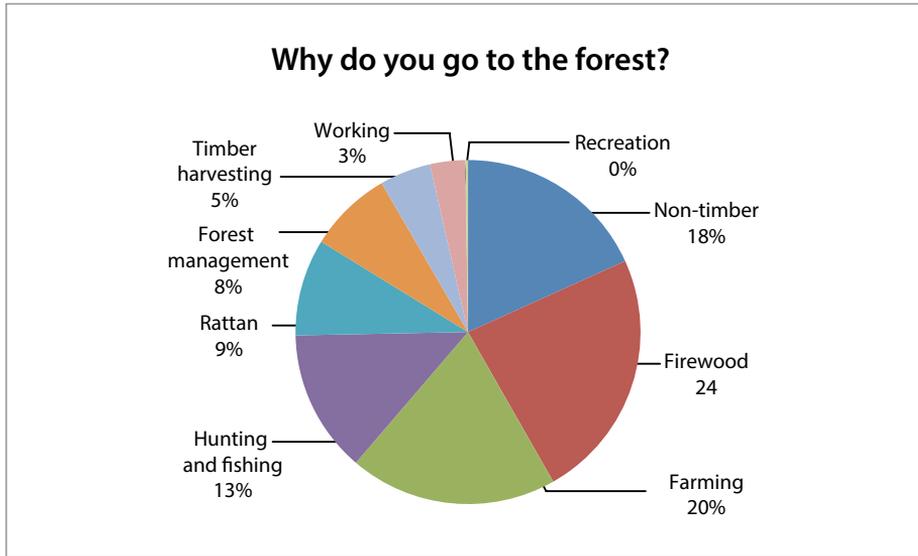


Figure 1. Participants responses to the question why do you go to the forest¹.

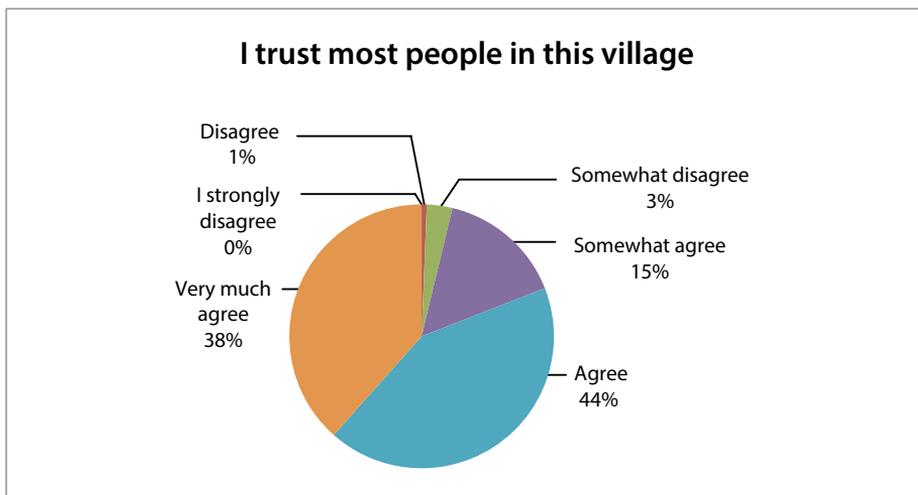


Figure 2. Participants responses to I trust most people in this village

When asked about their economic situation compared to others in their village 67.9% affirm that it is average -not so poor, not prosperous-, whereas 28.1% state that they were poor.

¹ Rattan refers to several species of palms that are used to manufacture furniture

Remarkably, 96% of the participants in the activity agree or “very much agree” with the statement that “cooperation and working together is extremely important”. . They find support in their community, 40% feel they can count on many from the community in case they need help with something and 23.75% express they can count with all the community. Figure 3 shows the percentages when ask to agree or not with the statement “I trust most people in the village”.

As part of the survey, we ask some questions related to payment for environmental services. Only 16.3% of the participants in the activities in communities where PES schemes are implemented, have heard of these types of payments, and among them 14.4% have received at least one of these payments. In the other communities (the one with no PES schemes implemented), only 2.5% of the participants had ever heard of such payment programs and as one would expect nobody in these communities had received payments from such a program.

3 The activity representing the use of a forest

The activity done (commonly called economic games) in Indonesia, Peru and Tanzania 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 3). Each participant was invited to participate in the activity only once, and each activity was played for 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 3. 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. At the end of the 24 rounds, the monitor calculated the total number of tokens made by each participant, and for each token he paid XXX XXXX .

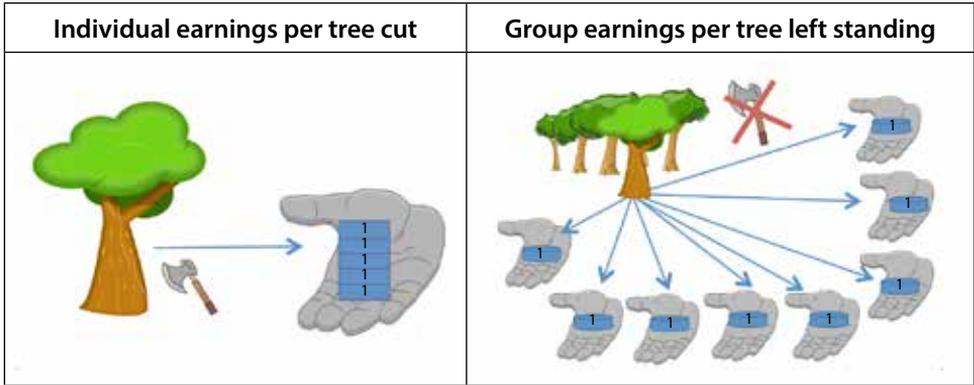


Figure 4. Individual and group earnings in tokens per tree

Participants made their decisions in private, and they informed the monitor about his/her decision, by filling one decision card (Figure 5)

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 5. Decision card

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, he announced the earnings each participant received from the trees left standing in the group forest. Then each participant individually and in private, calculated his earnings in tokens for that round based on the tokens earned by cutting trees, plus the tokens earned for the trees left standing in the group forest. All this information was recorded in 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 moderator)	Earnings in tokens for the trees left in the forest (announced by the moderator) (80-C)	Tokens earned in this round (=B+D)
1					
2					

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 keep the trees left 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 make as many tokens as they could if they were not cutting trees and they will destroy 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, which means that the total earnings for the group are $80 \times 8 = 640$. 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).

Whereas, 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, ($120 + 70 \times 7$). This example shows how for the individual it may be better to cut all trees, but by doing that the individual is affecting the total earnings of the group. In case every participant decides to cut all trees they are allowed to cut, then the individual's earnings are 50 tokens, and the total earnings made by the group are 400 tokens (50×8).

Table 3. The social dilemma introduced in 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 were making decisions, as we just described. 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 on Table 4).

In rounds 17- 24 in all the groups, regardless of the variation they were playing from rounds 9-16, participants went back to participate in the activity like in rounds 1 to 8; thus with no communication and no type of variation -including no bonus-.

Table 4. Different variations of the activities from rounds 9-16. Under parenthesis the way that we will name the variation in subsequent tables.

Variation for rounds 9 to 16	Description
Communication (COMM)	Participants were allowed to talk amongst themselves before making decisions each round. The decisions remained private.
Bonus (BONUS)	In this variation an organization offers a bonus to the group not to cut trees from the forest. This bonus is offered every round. But if the organization finds out that the group is cutting trees, then they 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. 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 among each other before making any decision.

continued on next page

Table 4. Continued

Variation for rounds 9 to 16	Description
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. But if the organization finds out that the group is cutting trees, then they 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. Participants could communicate and had to elect a participant that would be in charge of distributing the bonus of 160 tokens, in case the bonus is given. The leader was free to distribute the bonus in any possible way. That distribution is private to the other group members.
Bonus and communication with leader and a majority of women in the group. (BONUS+LEADER+MAJORITY)	This variation is the same that "Bonus and communication with leader", but the majority of the participants were women.

Table 5 illustrates a summary of the different components of the activity across the 24 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	

4 Results

a) Results Rounds 1 to 8

Table 6 and Figure 6 give a first approximation to the results in the first 8 rounds of the activity, by comparing what participants did in Indonesia to what they did in the other two countries (Peru and Tanzania). As shown, participants were extracting in average 3.80 trees, thus they were only cutting around 4 trees of the 10 trees that they were allowed to cut, meaning that they were not being selfish or uncooperative. Compared with Peru and Tanzania, participants in Indonesia were cutting more trees, in Peru and Tanzania (together) they were cutting 2.91 trees in these first 8 rounds.

Table 6. Trees cut in the first 8 rounds of the activity.

Round	Average Individual Extraction in Indonesia	Average Individual Extraction in Tanzania and Peru
1	3.31	2.69
2	3.52	2.82
3	3.92	2.80
4	4.03	2.99
5	4.02	2.89
6	3.70	3.05
7	3.87	3.03
8	4.06	3.04
Average Rounds 1-8	3.80	2.91

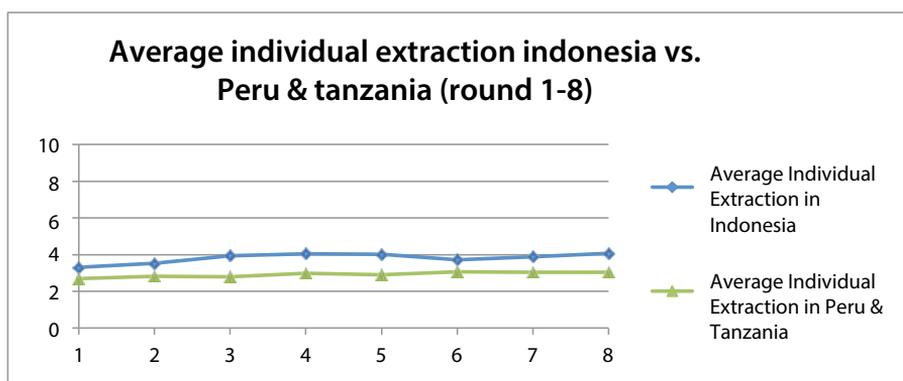


Figure 6. Average individual extraction in Indonesia in rounds 1 to 8.

b) Results Rounds 9 to 16

In Table 7 and Figure 7, we present the results of each one of the variations from rounds 9 through 16. In general, in all rounds the number of trees decreased with respect to rounds 1 through 8, except for the first round of the communication variation. This means that regardless of the type of intervention introduced in round 9, participants tend to react to all of these intervention types by cooperating more, cutting less trees. It appears that all of these interventions reduced the number of trees harvested—groups ended up conserving more forests compared to when the intervention did not exist (in rounds 1-8).

Table 7. Trees cut from rounds 9-16 of the activity for each one of the variations in Indonesia

Round	BONUS	COMM+BONUS	COMM	BONUS+LEADER	BONUS+LEADER+MAJORITY
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

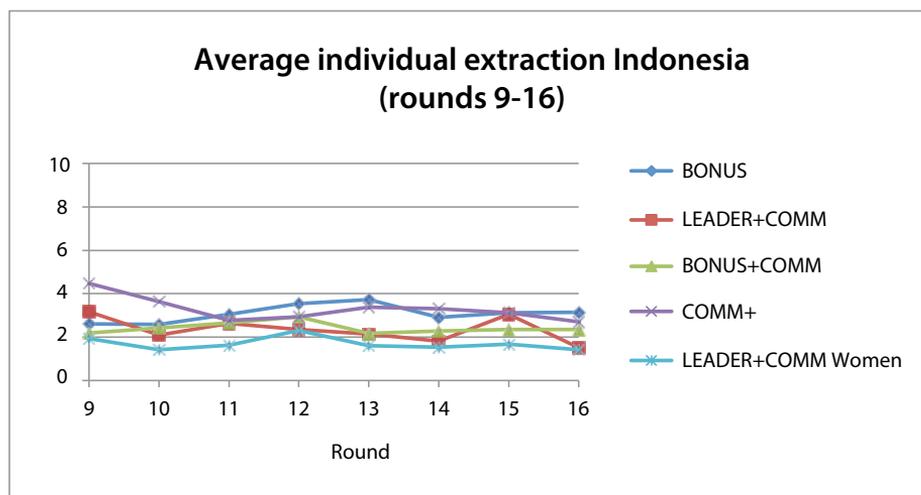


Figure 7. Average Individual Extraction Rounds 9-16 in Indonesia.

Participants playing with the variation “Communication” cut on average 3.29 trees from rounds 9 to 16, which means that with this variation they cut less trees compared to rounds 1 to 8, but the number of trees cut did not decrease dramatically. It is also noted that in rounds 9 and 10, on average, participants were cutting the same amount of trees they were cutting in rounds 1-8, so the communication was not very effective at the very beginning, but after these two rounds it started to generate less trees cut. The communication process has been proved to be an effective and useful way to increase cooperation in resource management, both in the field and in games of this kind. But clearly, at least for this particular case in Indonesia, all the other variations got better results in terms of trees left standing in the forest.

All the variations with bonus lead to less trees extracted compared to the intervention that is communication alone (without bonus). This means that having a payment in addition to communication produces more forest conservation than just communication alone. The results also show that just having the payment (without communication) also increases forest conservation compared to the situation in rounds 1-8 when there was no bonus and no communication (and therefore also no rules. . However, we also see many differences among these variations in types of interventions.

The “Bonus” variation leads to an average of 3.08 trees cut, which means that with this variation less trees were cut compared to rounds 1 to 8. But also, it is striking that the trees cut decreases in round 9 and 10, and then in the following rounds they started to increase again not the same levels of rounds 1 to 8, but extraction increases. So in the end, for this variation as for the variation “Communication” the number of trees cut did not decrease dramatically with respect to the first 8 rounds. Somehow it seems, that participants react to this variation by initially cutting less trees, but then, maybe because they did not have the possibility to communicate among them and therefore did not have any way to coordinate their actions to get the Bonus or to share information they did not continue making a real effort to cut less trees.

Among all the variations with communication and bonus, the variation that seems to be the most effective at reducing trees cut in Indonesia is the “Bonus and communication with leader and a majority of women in the group” with an average of 1.68 trees. This variation leads to an average of 2 fewer trees cut per person with respect to rounds 1 through 8. So apparently having a majority of women in the group creates a difference in the sense that groups become more cooperative, and therefore extract less trees. The other two variations with bonus and communication lead very similar averages, for “Bonus and communication” it is 2.42 trees cut and 2.34 trees cut for the “Bonus and communication with leader”. In general we can see that providing the bonus with the opportunity to discuss makes a difference, but also that when the group has the chance to distribute the amount of money provided in the payment they cut less trees from the forest.

When we look at the ways that the Bonus was distributed in variations “Bonus and communication with leader and a majority of women in the group” and “Bonus and communication with leader” we notice that in ALL cases the bonus was distributed equally. Thus, every leader decided, when he/she had the chance to distribute the bonus to give 20 tokens to each participant. This result is very interesting, first because leaders were making this distribution in private, and participants could not know how the distribution was going to be, and second because the distribution was the same of the “Bonus and communication” variation, but because it was the result of a participation process it leads to fewer trees extracted with respect to variation “Bonus and communication”.

With respect to the leaders, in 61.7% of the rounds a woman was elected to be the leader of the group. In the groups playing under “Bonus and communication with leader” 39.1% of the elected leaders were woman and in the groups with a “Bonus and communication with leader and a majority of women in the group” 84.4% of the elected leaders were female. Thus, clearly having more women in the group had an impact in the number of women elected as leaders.

With respect to the selection of the leader, in 10 groups the same leader was elected for all 8 rounds, four were appointed for 4 rounds, two were elected for 3 rounds, eight were appointed for 2 rounds and eight were chosen only once.

During the 8 rounds of one of the leader variations the organization paid 67.2% of the times.

Table 8, shows the results from the different variations in Peru and Tanzania combined. In all variations, except for “Bonus and communication with leader and a majority of women in the group” the levels of extraction were higher in Indonesia than in the other two countries. This result is consistent with the result from rounds 1-8. These results are interesting because they show us that although the variations in general decrease the number of trees cut in the three countries, they were not equally effective. For the particular case of Indonesia, it is clear that having a majority of women in the group creates a positive effect.

Table 8. Trees cut from rounds 9-16 of the activity for each one of the variations in Peru and Tanzania

Round	BONUS Peru & Tanzania	COMM+BONUS Peru & Tanzania	COMM Peru & Tanzania	BONUS+LEADER Peru & Tanzania	BONUS+LEADER+ MAJORITY Peru & Tanzania
9	1.28	1.66	1.94	1.27	1.61
10	1.60	1.58	1.99	1.58	1.58
11	1.71	1.74	2.38	1.59	2.36
12	1.74	1.84	2.14	1.62	1.84
13	1.78	1.65	2.14	1.76	2.10
14	1.92	1.76	2.10	1.99	1.65
15	1.97	1.88	2.21	1.81	1.64
16	2.28	1.57	2.04	1.97	1.85

c) Results Rounds 17 to 24

In rounds 17 to 24 we explore the effects of removing all the variations used in round 9-16 (see table 9). Comparing the results of rounds 9-16 and 17-24, it is somehow striking that the variation after the Bonus has less trees cut than when the bonus was in place, since in rounds 17-24 the organization was not paying the bonus anymore and participants did not have the chance to communicate. In all the other variations, the number of trees cut augmented with respect to rounds 17-24, but in any case the level was as high as it was in rounds 1-8 (see figure 8). So we can say that the implementation and then removal of the bonus (regardless of the way it was implemented in rounds 9-16) had an educational effect in Indonesia conducive to less trees cut. This is also good news for the bonus (the payments) because when they are removed, participants are not inclined to use the forest more than what they did before in rounds 1-8 as it is shown in Figure 8.

Table 9. Trees cut rounds 17 to 24 of the activity in Indonesia

Round	AFTER BONUS	AFTER COMM+BONUS	AFTER COMM	AFTER BONUS+LEADER	AFTER BONUS+ LEADER+MAJORITY
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

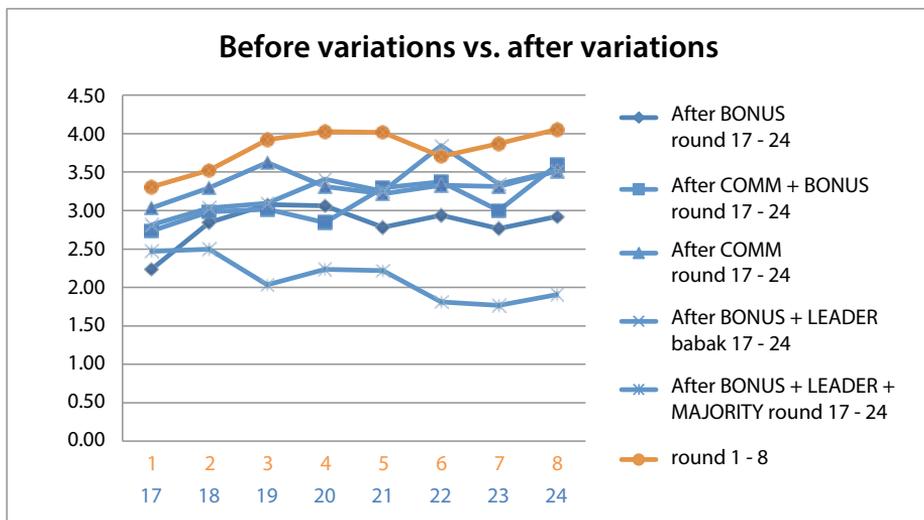


Figure 8. Comparison of rounds trees cut in rounds 1-8 versus rounds 17-24

Comparing the results from Indonesia with Peru & Tanzania we found that again as in previous rounds, except for the variation after “Bonus and communication with leader and a majority of women in the group” the levels of extractions are higher than in the other two countries.

Table 10. Trees cut rounds 17 to 24 of the activity in Peru and Tanzania

Round	AFTER BONUS Peru & Tanzania	AFTER COMM+BONUS Peru & Tanzania	AFTER COMM Peru & Tanzania	AFTER BONUS+ LEADER Peru & Tanzania	AFTER BONUS+ LEADER+ MAJORITY Peru & Tanzania
17	1.71	1.71	2.01	1.95	2.38
18	2.38	2.02	2.04	2.20	2.54
19	2.42	1.96	2.19	2.12	2.85
20	2.58	2.11	2.08	2.04	2.66
21	2.46	2.07	1.97	2.01	2.86
22	2.34	2.08	2.06	2.02	2.79
23	2.23	2.08	2.21	2.07	2.91
24	2.56	2.33	2.14	2.48	2.65

5 Experience

After we concluded the activity, we asked participants a few questions about the activity itself. Most participants enjoyed their experience in the game (97.5%) and reported having learned something new (98.8%), although we did not ask specifics about that learning process. One participant expressed that they “felt that this activity reminded him that the forest is most important”.

We asked participants that played with one of the bonus options the question: what do you think of the way that this payment was shared by the participants? 10.55% replied that it was distributed equally, and 46.09% felt that the bonus was shared in a fair way. When we disaggregated that answer between participants with leader (both of the leaders variations) and participants without leader who received bonus with no leader (bonus and bonus with communication) we found that when the community was sure that there was equal distribution among participants (bonus and bonus with communication) then they would feel that the way the bonus was shared was good and of equal distribution (17.97%) compared to those who had leaders and did not know the way the bonus was being distributed (3.13%). This same pattern repeats with the feeling of fairness but the difference is less stark where those who knew how the bonus was distributed then found this payment to be fair (49.22%) compared to those who had leaders and did not know the distribution of the bonus (42.97%). Yet we know that even when the distribution was secret it was also distributed equally, but the secrecy seemed to diminish the feeling that the distribution was fair.

6 Conclusion

The results of these activities show us that different countries react in a different way to variations. In Indonesia, all variations lead to a decrease in the number of trees cut with respect to rounds 1-8. The variations “Bonus” and “Communication”, although they reduced trees cut with respect to rounds 1-8, were the variations that were less effective at reducing the number of trees cut from the forest. All the variations with bonus and communication reduce the trees cut with respect to rounds 1 to 8. But the variation that was more effective was “Bonus and communication with leader and a majority of women in the group”. In fact among all countries, it was in Indonesia that this specific variation had the less trees cut. So clearly the presence of more women in the group had a positive impact of the groups.

In terms of the ways to share the bonus, it is noticeable than when a leader had the opportunity to distribute the bonus, in all cases, the leader spilt the bonus equally among the group members. In the groups with the majority of women, the selected leaders were more women than in the case of the groups with fewer women.



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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.

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