Creating New, Local Ecopayments Institutions In Mexico:

a framed field experiment on trust, sanctions & local coordination

(in Matching Funds sites with support for PES decentralization)

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Abstract

States pay landowners in the largest PES (payment for ecosystem services) programs, yet there is significant potential for local organization. For instance, downstream actors may offer incentives upstream to improve water quality, with locals playing all the key roles. Mexico's forest agency (CONAFOR) started to support local PES mechanisms in 2008, alongside its program of direct payments. The *Fondos Concurrentes* (Matching Funds) program solicits applications from teams − initiated by a suite of diverse local partners − that include upstream and downstream actors. We model the creation of such institutions, where multiple groups interact, and explore whether sanctions help or hurt coordination. We use a novel upstream-downstream group assurance game with free-riding at each end and a PES framing (payments flow upstream, services down) of the actors' contributions. After a field pilot, we recruited 240 downstream and 240 upstream *Fondos* participants in Xalapa (in the state of Veracruz), Merida (in Yucatan), and Cancun (in Quintana Roo). We find that initial trust-game behaviors not only align with site participants' perceptions but also have predictive power for the baseline contributions within the assurance game (baseline giving was significant, despite a zero equilibrium, perhaps due to our sample). For upstream service providers who can be sanctioned, unlike in 'motivation crowding' the threat and the use of sanctions over time both raise contributions, relative to baseline. Downstream users contribute less initially when sanctions on upstream are available, yet the contributions then rise over time, in line with upstream-downstream complementarity.

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1. Introduction

Payments for ecosystem services (PES) give incentives to actors to alter their behaviors in ways that increase services. They are voluntary transactions between providers and users of services − with transfers from users to providers conditioned on ecosystems that provide ecoservices. Being voluntary, they should benefit all involved, raising the relative attraction of PES (Shapiro 2010).

There clearly exists a potential for purely local – or 'Coasian' − organization of PES institutions. If rights are clear, e.g., if upstream landowners have the right to put cows anywhere on their land, then downstream actors can venture upstream to offer payment to restrict the placement of cows. Yet Coase (1960) allows that this is less likely if transactions costs of such negotiations are high. Then, states may want to act. Reasons for high transactions costs include the public good nature of these services and diffuse underlying biophysical relationships between ecosystem states and ecoservices (Porras et al. 2008), making commodification of services hard (Brauman et al. 2007).

To date, in fact, most such ecopayments have been made by government. Within the largest PES programs − for instance in Costa Rica, China and Mexico − states pay the landowners directly. That broadens the interpretation of 'voluntary' but all the principles remain: agencies should pay if constituents will gain more in services than is paid; while costs should be below what is paid. Government may naturally step in as 'the user' when services beneficiaries are many and diffuse. Nonetheless, there may be good reasons to increase the share of PES implemented purely locally. Lowering federal expenditures can lower taxes, regional subsidies, and volatility of PES budgets. Local organization can improve monitoring of rural areas where federal presence may be limited and can interject better understanding of the local gains and losses involved in shifting behavior.

Consistent with such motivations, and alongside its program of state payments started in 2003[2], Mexico's forest agency (CONAFOR) started in 2008 a program to facilitate local mechanisms. This *Fondos Concurrentes* or Matching Funds program solicited applications for new local PES by offering to cover half the costs of linking upstream service providers with users downstream. Any application has to include a suite of required elements, the most fundamental among them being of course some integration of upstream and downstream actors within which at a minimum the downstream agrees to pay the upstream, conditional upon an agreed suite of relevant actions. Integration or linking of upstream with down often is initiated and sustained by intermediaries. Their motivations range widely, from rural welfare upstream to species' existence value globally.

Our purpose in this paper is to model some challenges involved in creating such new institutions, within which groups interact, then to explore when various types of sanctions aid coordination − including because there have been few sanctions in Mexican PES and they may support impact.[3]

[2] Multiple studies of this national program provide useful insights into its origins, functions, outcomes, and impacts (see, for instance, Munoz-Pina et al. 2008, Corbera et al. 2010, Shapiro 2010, Alix-Garcia et al. 2015 among others).

[3] On limited PES impacts, adding to prior cites see Arriagada et al. 2012 and Robalino and Pfaff 2013. In Mexico, sanctions are not common in the national program but have occurred in monarch areas (Honey-Roses et al. 2011).

To model *Fondos*, we suggest assurance games between two groups, service providers upstream and downstream users. Yet internally, each group features the incentive to individually free-ride. We frame these actors' contributions in terms of PES (payments flow upstream, services down). A critical feature of assurance is that whether contributing is narrowly rational for any one actor depends on others' actions. Specifically, one's marginal gain from contributing more is negative when others give little but it rises with others' contributions. Usually it is positive when the other players contribute maximum effort − although, here, the highest own marginal benefit is zero. Critically, then, for assurance there can be both high and low symmetric contributions equilibria.

We believe assurance captures one critical feature for creating new institutions.[4] For contribution to a PES institution – even one that if functioning will benefit all involved − it is intuitive and important that the payoff from marshalling actors at one end of the watershed depends on beliefs about the other end. The others need to be sufficiently internally coordinated to be able to help.[5]

That said, the marshalling of actors is costly. At neither end is internal coordination guaranteed. Even if every person fully understands the complementarity of upstream and down, everyone has private incentive to let all the others at one's end bear the cost of complementary contributions.[6] For instance, should enough others from downstream go to public meetings for a new local PES and, further, should those same others downstream contribute sufficient funds to pay upstream, the marginal downstream user will fare better by not contributing to the institution − or within it. The same holds upstream. That can generate cooperation collapses at either end of a watershed which, given complementarity of upstream and down, in turn could eliminate all contributions. In other words, all this promotes the obvious, and stable, equilibrium of zero contributions by all.

Yet actors may have broader goals. Further, those may very well differ across *Fondos* locations. Thus, we might well expect that outcomes will vary by site − even for the same strategic setting. After consulting with *Fondos* staff about all their sites, and visiting 12 *Fondos* sites in mid-2013, to carry out our framed field experiment after a field pilot we chose 3 to revisit in summer 2014: Xalapa, within the state of Veracruz; Merida, in Yucatan; and Cancun, within Quintana Roo.

After our field pilot − in Coatepec[7], which is also in Veracruz − moving to the individual level we recruited 240 downstream and 240 upstream *Fondos* participants in the three other locations. To start, we examined initial behaviors in a trust game − run before the assurance game − which we framed, and implemented, as with an unknown individual at the other end of the watershed.

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[4] For Mexico, one must emphasize that upstream itself features interesting collective landowning institutions, *ejidos*. Here, in focusing on the upstream-downstream interaction, we are consciously neglecting the function of the *ejidos*. However, our next set of experiments will permit more interesting upstream-upstream interactions given sanctions.

[5] On the potential narrow rationality of cooperation given others' cooperation, see Stag Hunt game (Skyrms 2004).

[6] As stressed in Ostrom (1990), institution building is a 2nd-order collective action dilemma in the sense that while the institution is for solving an incentive problem there are also incentive problems in donations to the institution.

[7] We would be remiss not to mention the significant adjustments brought about by our learning in this field pilot. We simplified the game and, given high baseline cooperation, we made it harder by lowering own giving payoff.

Within the trust game, participants indicated both how much they would transfer to that person out of their endowment, in the 1st stage, as well as how much they would expect in the 2nd stage. There was significant variation, across sites and individuals, for both of these two trust responses (which are less correlated upstream, consistent with varied exposures to up-down interactions[8]).

Perhaps usefully for CONAFOR's review of future applications for new local PES mechanisms, we found associations between such responses and the perceptions expressed by our participants. For instance, the downstream water users in Yucatan felt that those 'in the jungle' upstream were responsible for lower water quality in the city and they also had the lowest 1st-stage trust giving. In contrast, users in Quintana Roo felt that upstream would comply with forest conservation, should they commit to do so for payments − and those users expected more in trust's 2nd stage (including when one takes out the correlation with giving using a ratio of expected over giving). There is also individual variation, with education raising giving and interesting effects of gender, specifically higher 1st-stage giving by female users downstream but men upstream giving more (n.b. especially in Quintana Roo, we had longstanding male *ejidatorios* very familiar with PES).

Further linking to actual behaviors, trust behaviors had predictive power for assurance baselines. In particular, the more robust relationship is between the return expected in trust's 2nd stage and one's contribution in the baseline assurance round (without any treatments) played by everyone. That is particularly strong for the downstream users − almost twice as strong as for the upstream. Given that zero is the highest own marginal product of a contribution in assurance (Section 3), the baseline contributions seemed relatively high (all the numerical detail is below in Section 5). We speculatively correlate this with prior exposures to and predilections toward local PES ideas, as our sites already participate in *Fondos*, but it may be explained by starting play cooperatively. Yet even if this population is prone to cooperative contributions, in assessing the treatments we subtract out baseline individual contributions and we find there is still room for positive impact.[9]

We find that both the threat and the use of sanctions upon upstream raise giving by upstream. Thus, any 'motivation crowding' of upstream's cooperative incentives was not a dominant effect. We find that, when sanctions on upstream are available, the downstream users initially give less (we discuss below why our best explanation is inference by users based on the treatment itself). However, in line with the complementarity of upstream and down, giving rises over time in both.

Below, the rest of the paper is as follows. Section 2 provides some background on CONAFOR. Section 3 then describes our model of the interactions of contributions in creating a local PES, which is formalized most specifically in the exact details of the assurance game that we played. Section 4 gives information about our empirical setting, participants and game implementation. Section 5 then lays out our results in more details. Finally, Section 6 offers additional discussion.

[8] Another lack of correlation, which is methodologically interesting, is between these two responses in Trust games and direct answers to questions about trust on a survey after the game. We do not know why this would be the case.

[9] We also compare sanctions of behaviors upstream to groups with just information on upstream. That is vulnerable to differences across the groups, as our randomization has less power given small groups, but avoids ordering issues.

2. Mexican PES Programs: two major initiatives of the federal forest agency (CONAFOR)

2.1 National Program's Direct State-Landowner Payments (discuss more the literature on PSAH)

Mexico's largest national-level program of ecoservices payments, the Payments for Hydrological Services (*Pago por Servicios Ambientales Hidrológicos (PSAH*)), started in 2003 in response to water scarcities and deforestation. CONAFOR, the federal forest agency in charge of the PSAH, signs agreements with landowners. The landowners agree to maintain forest cover or implement practices to conserve natural land ecosystems. CONAFOR agrees to pay a fixed compensation per hectare for a period of five years (CONAFOR 2011). One's price per hectare is determined by an estimation of the opportunity costs of leaving one's land in forest. Which lands are eligible depends on the value of hydrological services and other policy criteria (Muñoz-Piña et al 2008) and as noted above an increasing set of authors have commented on the forest impacts of PSAH.

PSAH has been funded through an earmark from federal fiscal revenues derived from water fees, in an effort to create links between those who can benefit from services provided and those who can benefit from providing them (Muñoz-Piña et al 2008). Representing many services users, the federal government has remained the exclusive buyer of environmental services in the *PSAH* (Shapiro 2010). Yet as Wunder et al. (2008) have noted: "Costa Rica's PSA and Mexico's PSAH are attempting to develop additional financing sources from individual ES users to complement their public financing, and are trying to move away from their current uniform approach to payments to a much more differentiated and targeted approach in which the amount of payment and the specific land uses being paid are much more closely targeted to local conditions." That potential trend is precisely our focus, in particular given local-mechanism initiatives in Mexico.

2.2 Starting A Companion Program For Local Mechanisms (discuss institution & behavior lits)

To move in those directions, the Mexican program of local mechanisms for providing services, implemented as Matching Funds, began in 2008. It aims to provide incentives for organizational partnership and social arrangements to link the users with the providers of hydrological services. Local PES, our focus, are defined as "institutional arrangements to transfer resources from users of ecosystem services to the owners of the forestlands where the services are generated, with the aim of promoting the adoption of best management practices and the conservation of land that will maintain and/or improve the provision of these services" (CONAFOR 2011).

To facilitate such new local PES mechanisms, to finance the payments to providers CONAFOR currently will partner with a local or regional organization who, in a fashion, represent the users of the environmental services. That includes water utilities, municipal and state governments, and civil society. CONAFOR provides 50 per cent of the financing necessary to establish the program over 5-15 years (CONAFOR 2012). One distinction from the national program is that some of the monitoring is the responsibility of the local partner institutions, not of CONAFOR. Another feature is roles for intermediary or facilitating actors (agencies and other organizations). As documented by Porras et al. (2008), they often are necessary within a local PES mechanism.

A critical fact is that over 70% of Mexican forest is common property. In that setting, payments go to the governing bodies of the nucleos agrarios or communal lands, who decide how to use *PSAH* (Shapiro 2010). Some communities invest PSAH in public goods, others divide equally the payment among their members, while others have a mixed strategy (Muñoz-Piña et al. 2008). Since this feature should not be particular to the national program, it should apply to local too.

Also common to some extent across the types of PES programs is that compliance often will be is verified through satellite images. The significant percentage of common lands in the PSAH, though, implies also a role for collective-action institutions at the community level. For any such program, they will affect rules definition, monitoring and enforcement (see, e.g., Ostrom 1990).

An important part of understanding such a program in the Mexican context is poverty alleviation (Shapiro 2010, McAfee and Shapiro 2010). This can affect where the national or local funds are allocated directly (or prioritized in terms of evaluation of applications received from contractees) as well as which of the many possible forest-oriented goals are emphasized within enforcement. Of course, this element also interacts strongly with the point above about the function of program on common-property lands. The role of local social agreements will be relevant also for poverty.

To date, local mechanisms or Matching Funds are small compared to the national program. While under the national program there have been more than 2 million hectares contracted, only 300,191 hectares have been contracted under the local mechanism program. That has involved 83 local partners: 44 civil organizations; 17 state governments; 14 local governments, 6 water utilities; and 2 private companies (CONAFOR 2012). This list illustrates that, even within the effort to build new local PES mechanisms, public actors still are playing a large role in demand.

3. Upstream-Downstream Assurance Game: building a new local mechanism

3.1 Overview

Our assurance game for building a new local institution, by bringing together multiple groups, is a new design. Inspired by the *PSA-ML*, it is an adaptation of the *Stag Hunt* (Skyrms 2004) game. 'Stag Hunt' refers to the idea that, in a hunt, hunters can either work together and catch big prey that has a greater value per person or work alone and catch small prey with less value per person. As long as each believes that a sufficient number of others will cooperate to catch the big prey (stag), so that the group can succeed in catching it, then it is rational for each to cooperate in that. But if one expects that an insufficient number of others will cooperate in that, then the individual strategy will be to defect from the collective action and work individually in catching small prey.

To be explicit, if an insufficient number of others will cooperate in the stag hunt the individual will waste their effort for nothing. Thus, both cooperation and defection can be rationale and the viability of cooperation depends on mutual beliefs or probabilities or trust (see Skyrms 2004). Thus, the Assurance or Stag Hunt game has multiple symmetric Nash equilibria − all cooperate and all defect − plus sometimes intermediate outcomes where only some people are cooperating.

Its general implication is that for some tasks' payoff structures, groups with more cooperation generate more incentive to cooperate and vice versa. Expectations based on the past are critical and behaviors can be self-reinforcing (Mayer 2014). According to Skyrms (2004), although many modern thinkers have focused on the prisoners' dilemma to model collective challenges, this emphasis is misplaced and many social interactions might be modeled as a Stag Hunt game. As a change in the beliefs, norms and expectations can induce cooperation in a Stag Hunt game, tools others than a change in the monetary incentives may help to reach a cooperative solution.

The coordination required to build a new local mechanism (as in the PSA-ML) can resemble a Stag Hunt, as can the function of such a new institution. The key point for building institutions is that all the effort of getting your end of a watershed organized is pointless, in terms of the value from an upstream-downstream institution, if the other end of a watershed is not able to function. Building institutions takes time, meetings, consensus building, process development and then all of that again whenever new situations arise that were not anticipated when the institution started.

Such complementarity in payoffs can also describe the function of an institution. If downstream works hard to collect contributions to pay for services in the next year but upstream has fallen apart and no longer is getting behavioral shifts implemented, payoffs for downstream are zero. Likewise, if upstream undertakes costly actions to cause services to flow down but downstream has fallen apart politically, so monies are unavailable, then the payoffs for upstream are zero. In fact, in both cases net payoffs are negative, as benefits are zero while the costs of contributions, or land-use shifts, certainly are not. Generally, if the other side of the deal does not do its part, then the marginal payoff from putting in more of one's own effort will be negative, i.e., a loss.

3.2 Stag Hunt Between Groups (allowing free-riding challenges at each end of the watershed)

In PSA-ML, i.e., creating a new institution, it is large groups of providers and users who interact. That yields potential for institution creation to be harder than just upstream-downstream beliefs. For an individual, what she contributes dictates her cost. However, it is the aggregate amount her group contributes that dictates the other side's gains and via complementary may lead to her gain. Thus, a novel element of our Group-Group Stag Hunt is within-group incentives for free riding.

Spelling that out, even if one perfectly understands the complementarity of the groups, as long as the other folks within one's end of the watershed contribute enough one could free-ride and gain. As the watershed's other end still might be willing to keep contributing, one may as well save. However, if one's colleagues see this as unfair, or risking collapse of a positive equilibrium, then free riding can yield failure to achieve within-group or, then, upstream-downstream coordination.

Specifically, each provider decides how much effort to contribute to creating the new local PES. Likewise, each user in the group of users decides how much effort to contribute to the local PES. For 'institution creation', all actors' efforts are inputs into creating a new, local PES organization. For 'in a PES', contributions by providers are represented by trees, while users' are seen as coins. Each participant in each group can decide between four levels of effort: 0 units or 1, 2 or 3 units.

Unlike in a public good game, nobody gets any benefits from their own group's contributions. Instead, one's earnings rise with the other group's contributions and fall with one's contributions. Cooperation (high contributions to the collective action) can be a rational strategy for anybody if they believe there will be sufficient aggregate contributions by the members of the other group. While we are unable to predict 'default' contributions levels using other regarding preferences, it is always the case that the more contributions by the other group, the better for one to contribute.

The figures below show the payoffs we used, given one's own and the other end's contributions. The latter is shown in ranges, in order to reduce the number of combinations one must consider. The sum of individual contributions by the other group ranges from 0 to 15 (5 people doing 0-3), while one's contribution ranges from 0 to 3, and there are 16 cells distinguished by their payoffs. Appendix 1 depicts how we implemented this graphically for experimental sessions in the field. There is an equilibrium with all zeros, as well as a weak cooperative equilibrium with all threes.

Payoffs In Users-Producer Assurance Game

		My contribution as provider (user)			
		0	**1**	**2**	**3**
Contribution of the group of users (providers)	**0-2**	9	6	3	0
	3-7	10	8	6	4
	8-12	11	10	9	8
	13-15	12	12	12	12

		PROVIDER			
		0	**1**	**2**	**3**
AVERAGE USER	**0**	(9, 9)	(10, 6)	(11, 3)	(12, 0)
	1	(6, 10)	(8, 8)	(10, 6)	(12, 4)
	2	(3, 11)	(6, 10)	(9, 9)	(12, 8)
	3	(0, 12)	(4, 12)	(8, 12)	(12, 12)

3.3 Treatments (upstream behaviors information vs. various sanctions based on that information)

Given our perception of relatively low use of sanctions and relatively low impact, we wanted to explore the potential for some institutional interventions that might in increase the contributions. Roughly, if programs are going to need to confront higher opportunity costs to increase impacts, for instance by increasing measurement of actually additional outcomes and cancelling contracts, sanctions of various types may be signals of dissatisfaction before more drastic actions are taken.

Experiments can be useful for exploration such potential elements of PES not yet much utilized. Had they been highly used to date, there might be better ways to comment upon their impacts. But when they have not yet been used, such framed field experiments we believe can help frame or structure two types of discussions about such policy elements: first, what exactly interventions might be − a discussion and set of choices that are forced upon us in doing experimental design; and second, what some of the relevant population thinks about this kind of potential intervention. The latter learning is as likely in post-experiment focus groups and interviews as in experiments. We see that form of learning as a strong complement to the specific behaviors within our games.

Perceiving that a reason intermediaries are so important in the creation of local PES applications is limited information flow between upstream and downstream, and knowing that information is a prerequisite for sanctions, we start by just providing information about the upstream behavior. Then, on the basis of that information, i.e., on top of providing that same information in each of the following, we add one of three types of potential sanctions as an option for the participants. That yields four treatments, three of which we compare to information alone for sanction effects:

- *Information On Upstream Behavior Alone (this is also required within all the sanctions):* after everybody has made a contribution decision, the facilitators anonymously list the actions of all the providers for all participants to see, users and providers (anonymity is achieved via random assignments of animal picture cards, so one can verify one's choice)

- *Provider-Provider Nonmonetary Sanction:* adding to the above, after seeing the list of upstream choices, for a cost of MXN$10 providers can send a red card, as a disapproval; the facilitators display the red cards received by each participant upon the behaviors list, keeping all decisions anonymous, as in the previous treatment, as well as the card senders

- *User-Provider Nonmonetary Sanction:* adding to the above, after seeing the list of the upstream choices, for a cost of MXN$10 any user can send a red card, as a disapproval; the facilitators display the red cards received by each participant upon the behaviors list, keeping all decisions anonymous, as in the previous treatment, as well as the card senders

- *User-Provider Monetary Sanction:* adding to the above, after seeing the list of the upstream choices, for a cost of MXN$10 any user can monetarily sanction any provider (as many providers as one likes though at most one sanction per provider from any user); each sanction received by a provider has a cost to them of MXB$30 and all is anonymous

4. Context & Implementation

4.1 Sites & Participants

Any local PES setting will have its own particular characteristics, so the details of the institutions that work best can vary. That said, for the most part the ecoservices providers are ejidatarios or small land-owners who live upstream on rivers or in sites of aquifers recharge, while services users are in towns downstream. How users link to users in local PES mechanisms varies a lot. While some may make voluntary donations on their water bills, others pay through water bills but do not make active donation decisions, while others are not aware their utilities are paying.

Participants within three local PES mechanisms participated in our framed field experiments, one in the state of Veracruz led by the NGO SENDAS, one in the state of Quintana Roo led by the NGO Amigos de SianKa'an and one in the state of Yucatan led by the NGO Niños y Crias. One of the main reasons for choosing these cases is that both the users and the providers function in a collective fashion. Thus, there is not a single large actor like a downstream utility manager or upstream large landowner making all the decisions. We wanted to consider first cases where the coordination of providers and users was required for making the local PES mechanism work. The providers who participated are inhabitants of ejidos that have land registered in the program and that provide water to the cities where users live: Xalapa (Veracruz), Cancun (Quintana Roo) and Merida (Yucatan). The main characteristics of participants are summarized in Appendix 2.

4.2 Recruitment & Implementation

We recruited 480 people – 240 users and 240 providers - in these locations. Sessions were run with groups of 10 users and 10 providers who played simultaneously but in different locations – always in the places where they live. Users were in the cities while providers were upstream in the case of Veracruz and in the jungle in the case of the Yucatan peninsula. Recruitment was in each case done through the local NGO implementing the *PSA-ML*. They invited providers from the ejidos (collective lands) where they are currently implementing local PES − or starting one − and, for the users, inhabitants of the cities receiving the services provided by those same ejidos.

We placed facilitators with the users and with the providers. The facilitation was run by people from Duke University and those NGOs. As providers and users were in their distinct locations, the interaction between the users and providers was done by the facilitators, using cell phones. One experimenter led all the sessions with providers and another led all the sessions with users.

Before running the assurance game, we anonymously matched one provider and one user to run the Trust game (Berg et al. 1995), framed around water and payments (see Cardenas et al. 2015). Decisions were communicated by phone, again with anonymity using identification numbers (from 1 to 10, assigned before any games). Results of these initial Trust games, done before any Assurance games, are compared with qualitative site observations and the results for Assurance. We emphasize that Assurance decisions were taken without participants knowing Trust results.

Finally, for the Assurance game, we split the providers as well as the users in two groups of five. Each group was anonymously matched with one of the groups at the other end of the watershed, and participants in each group make their individual contribution decisions. To split and match the groups, we use the color of the participants' identification number card, so providers with the green cards formed one group and providers with the yellow identification cards formed another. The green group of providers was matched with the green group of users and same for yellow.

Again, for the Assurance game we started with a baseline without any information or sanctions. Then for all other rounds there is always information on upstream and sometime also sanctions. Finally, we never tell them baseline results. Thus, we can study their expectations of sanctions.

5. Results

5.1 Trust Game, Two Responses (as independent variables)

Perhaps usefully, for CONAFOR's future review of applications for new local PES mechanisms, we found associations between such responses and the perceptions expressed by our participants. For instance, downstream water users in the Yucatan, who expressed that those 'in the jungle' upstream are responsible for the reduction in water quality for the city, had lowest Trust giving. That is seen in Table 1A, which examines differences across sites, among downstream actors, in the number of tokens entrusted to an unknown upstream individual, as the first decision in Trust.

In contrast, Quintana Roo users said that those upstream would comply with forest conservation should they commit to do so for payments − and those users expected more in Trust's 2nd stage. That is seen in Table 1B, which examines differences across sites, among downstream actors, in the tokens expected back from an unknown upstream individual, i.e., second response in Trust. (Table 1C controls for expectation's correlation with giving using an expectation-to-giving ratio). Table 1D controls for individual variation, with education raising giving and interesting effects of gender: higher 1st-stage giving by women downstream; while upstream, men are giving more (especially in Quintana Roo, those included men familiar with PES, as longstanding *ejidatorios*).

5.2 Assurance Baseline (averages & including the two trust responses as independent variables)

Further linking types of behaviors, trust behaviors had predictive power for assurance baselines. Specifically, the more one entrusted in the 1st stage of the Trust game, the more one contributed in the baseline round of the assurance or coordination game. Settings simply differ from the start, as can be seen in Table 2A which controls for the significant differences across all our locations.

In particular, the more robust relationship is between the return expected in trust's 2nd stage and one's contribution in the baseline assurance round played by everyone (without any treatments), as can be seen in Table 2B, controlling not only for all our locations but also for characteristics. Perhaps this is not surprising, as one's expectations of others might well dominate in assurance. This is especially strong for downstream, almost twice as strong as for the upstream (Table 2C).

5.3 Treatments & Upstream Providers' Contributions

We find that both the threat and the use of sanctions upon upstream raise giving by upstream. By 'threat' we mean the announcement that, for Round 1, unlike in the baseline, some actor will have the option to impose a sanction on any individual upstream participant, based on knowledge of each of the upstream contributions (recall, from Round 1 forward we always provide to everyone the list of upstream contributions. This threat of sanctions could affect Round 1 contributions and in Tables 3A and 3B we consider the change in contributions between Round 1 and our baseline, while testing the treatment effects against the omitted control of just providing the information. In sum, they were positive, thus any 'motivation crowding' upstream was not a dominant effect.

Breaking this summary down a bit, Table 3A considers both downstream sanctions on upstream together, i.e., does not distinguish between the monetary and non-monetary sanction treatments. That average effect is clearly positive and significant, again overcoming any crowding effect. However, we note there is no effect of the threat of upstream-upstream non-monetary sanctions.

This raises the question of whether the threat of downstream non-monetary sanctions had effect. Table 3B breaks out the two downstream sanction treatments to see if effects of threats differ. We find that, in fact, is it the non-monetary downstream threat that is most clearly significant (although with limited data we cannot say it is clearly statistically different from the upstream). As to why the downstream threat would have more effect, given that both are non-monetary, it certainly is consistent with the earnings for upstream coming from downstream contributions. This looks like in a world of sanctions, consistent with the long tradition of playing cooperatively to start in such repeated games, upstream takes extra trouble to signal early that it can cooperate (this ultimately works out, though we cannot know if upstream anticipated the behaviors below).

Table 3B also clearly provides the ability to compare the two kinds of downstream sanctions, including with one table separating out the Yucatan data − given differences documented above across sites within participants stated views and the responses people provided in the Trust game. Within the upper regression, for all sites − and even when rerunning for only the Yucatan data − the positive coefficient for the monetary sanction is smaller and not significant at the 10% level. Could there be more 'motivation crowding' upstream, i.e., less acceptance of monetary sanctions? Yes, but again with limited data we cannot say statistically that the monetary effect is smaller (even for just the Yucatan data, as even less data undermines the larger difference in coefficient).

Moving to uses of sanctions, by this we mean responses to when sanctions were actually applied and to start we are combining all instances in which any of our treatment sanctions were applied, though a natural extension would be to test separately the effects of the three types of sanctions. Such responses could only arise in Rounds 2 and 3, if a sanction occurred in the previous round.

Table 3C again controls for all of our locations (which region, as considering upstream behavior) as well as individual characteristics. We note that none of those are significant for these changes. Thus, to 1st order, it is not the trends over time that are varying over space but the starting points. However the use of sanctions, in contrast, clearly does push upward the changes in contributions.

5.4 Treatments & Downstream Users' Contributions

As when considering upstream's contributions, we start by examing the effects of expectations of sanctions. For downstream actors, those are not threats because only the upstream get sanctioned. However, in the assurance game's setting of complementarity still expectations certainly enter as optimal contributions downstream depend upon what contributions are expected from upstream.

Table 4A considers the changes, from our baseline to Round 1, in the downstream contributions. We find that when the sanctions that might be put on upstream are generated also from upstream, there is no effect on downstream's giving. However, in either case in which downstream are told that they have available to them a sanction on upstream, the downstream users initially give less. Both of the Downstream-Upstream treatments in Table 4A are statistically significant (at < 5%). thus it seems having the sanctions available has lowered what downstream expects of upstream.

Such a result could come about due to expectations about motivation crowding, i.e., downstream could believe that upstream will react negatively to the idea of being sanctioned by downstream (even though they might not be troubled by being sanctioned by their own colleagues upstream). Should that be the case then, given complementarity of contributions upstream and downstream, that could lower the desired contributions downstream. However, in Tables 3, upstream reacted to both the threat and the use of sanctions by increasing contributions (not by decreasing them). In light of that result, we do not assert a (mistaken) 'crowding' expectation to explain Table 4A.

Another way such a result can come about (Bowles ####) is that beliefs downstream are shaped by the treatment itself, i.e., the setting we created. We hand downstream a sanction that can be used to punish upstream if they do not contribute as downstream feels appropriate. That setting itself could convince downstream participants that they should not expect much from upstream. If we have convinced them of that, it was quite rational of downstream to have contributed less.

A feature of the latter explanation is that it concerns expectations distinct from actual behavior. Put another way, even if the sanction setting initially led downstream to expect little of upstream, if upstream played cooperatively early on then the beliefs on the part of downstream could shift. They can update beliefs about upstream based on upstream's actual behavior, not just the setting.

Table 4B suggests that sort of process is happening as we move from Round 1 into later rounds, meaning we move from operating solely on expectations of treatment effects into real sanctions. The only significant variables are the two Downstream-Upstream treatments, just as in Table 4A, however for both downstream sanctions on upstream the signs are now reversed from Table 4A. In sum, including a result of sanctions' effects upstream, contributions trend upwards over time.

Thus, the setting can start things off in the wrong direction and that could lead things downward (creating the possibility that "a constitution for knaves" (find the cite) leads to knavish behavior). However, should actual behavior be sufficiently cooperative, it can dispel such initial concerns. Perhaps upstream might even anticipate that downstream would be worried in a sanction setting. Either way, upstream's early cooperative play and response to sanctions yields more cooperation.

6. Discussion

Stepping back to consider policy implications, we believe our findings are supportive of what we have heard from CONAFOR itself about the importance of the social capital at a prospective site. The initial contribution differences we observe are correlated with trust-game responses that, in turn, are correlated with participants' statements in surveys and focus groups about their settings. They are also somewhat persistent. In a setting of multiple equilibria, that can be determinative.

We can imagine beliefs spillovers across regions as well, in that if one local mechanism gets up and going it can influence the beliefs relevant for the challenging starting phase of others nearby. This could help to explain early weight on sites that had already had some upstream-downstream interactions, and related upstream organization, before the *Fondos* program came into existence. Consistent with Ostrom's (1990) point that starting easier could be a way to crack hard problems, *Fondos* may well have wanted to establish feasibility to improve beliefs before harder cases. The latter could include efforts to move PES into regions of higher pressure in order to raise impacts.

Our results also support a potentially positive role that could be played by more use of sanctions. We believe that currently sanctions are not common. That may link to a lack of additionality, as one would not expect to have to sanction folks to comply with contracts to simply carry out what they would have done anyway in the absence of PES. However, should PES move to stricter insistence on measured services outcomes for making conditional payments, which could involve restrictions on lands with higher opportunity costs, sanctions may play a key signalling role. In a world with significant transactions costs − i.e., all the upstream-downstream coordination costs − before simply cancelling payments for lack of service generation upstream one can send a signal.

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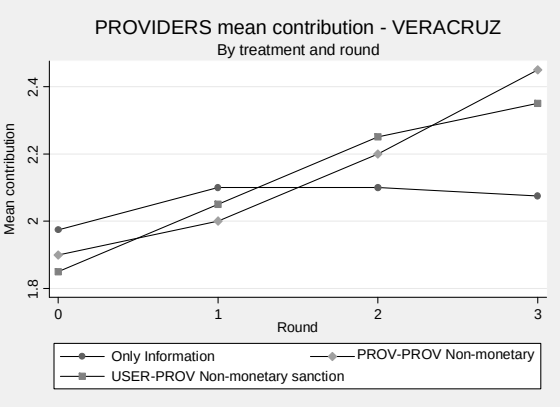
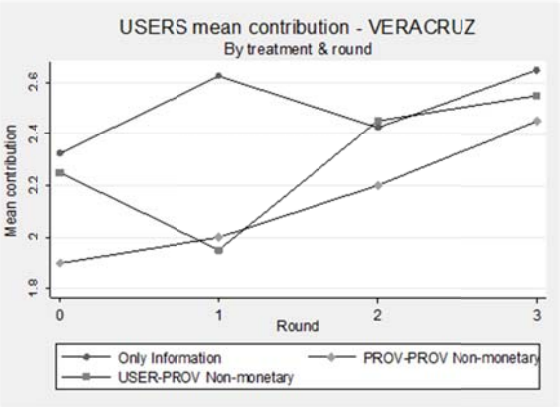
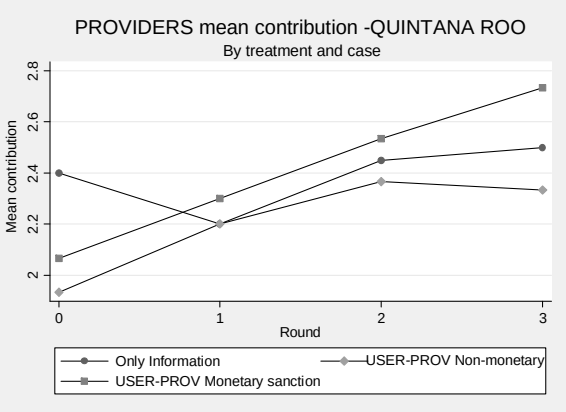
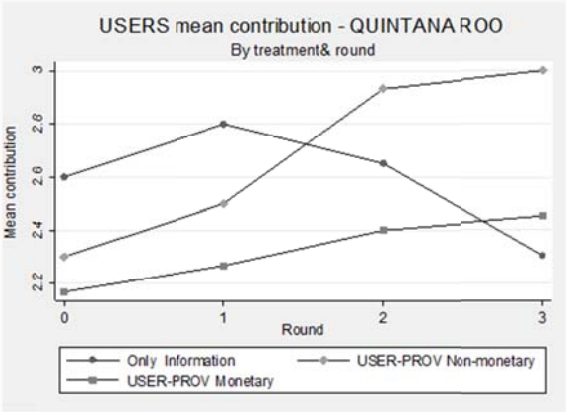
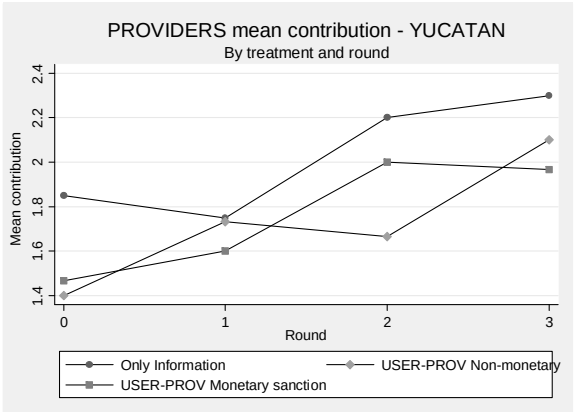
<u>Figure 1</u> assurance contributions across rounds by site and treatment

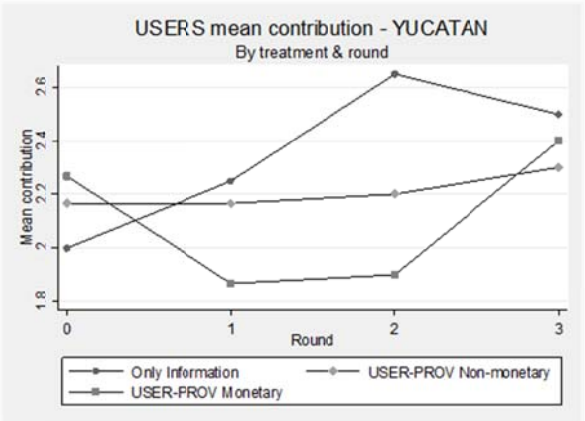












Tables 1 Trust Game responses across regions, locations and individual characteristics

Table 1A: Downstream Variation Across Regions in Trust Giving

```
Linear regression  (Yucatan omitted)                        Number of obs = 240
------------------------------------------------------------------------------
       trust |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Quintana Roo |      .5125   .2877338     1.78   0.076    -.0543425    1.079343
    Veracruz |       .675   .2894164     2.33   0.021     .1048427    1.245157
    constant |     4.3625   .1850793    23.57   0.000     3.997889    4.727111
------------------------------------------------------------------------------
```

Table 1B: Downstream Variation Across Regions in Trust Expectations

```
Linear regression (Veracruz omitted)                        Number of obs = 240
------------------------------------------------------------------------------
  return_exp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Quintana Roo |     1.5375   .8163129     1.88   0.061    -.0706559    3.145656
     Yucatan |       .225   .7337237     0.31   0.759    -1.220453    1.670453
    constant |     7.5375   .5059593    14.90   0.000     6.540748    8.534252
------------------------------------------------------------------------------
```

Table 1C: Downstream Variation Across Regions in Trust Expectations/Giving ('Hopeful Ratio')

```
Linear regression  (Veracruz omitted)                 Number of obs =     235
------------------------------------------------------------------------------
        hope |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Quintana Roo |   .2948131   .1467701     2.01   0.046     .0056207    .5840055
     Yucatan |   .1944229   .1528149     1.27   0.205    -.1066801     .495526
         age |   .0105638   .0054162     1.95   0.052    -.0001083    .0212358
      gender |   .0029734   .1206037     0.02   0.980    -.2346613     .240608
   education |  -.0144273   .0172253    -0.84   0.403    -.0483675     .019513
    constant |   1.459773   .3384529     4.31   0.000     .7928936    2.126653
------------------------------------------------------------------------------
```

Table 1D: Variation in Trust Giving by Regions, Locations and Individual Characteristics

```
Linear regression (Yucatan Downstream omitted)           Number of obs = 458
------------------------------------------------------------------------------
      trust |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+----------------------------------------------------------------
 Yucatan Up |   1.417026   .3824948     3.70   0.000     .6653191    2.168733
   Q.Roo Up |   1.303662   .3703479     3.52   0.000     .5758275    2.031497
   Vera. Up |   1.254305   .4113715     3.05   0.002     .4458477    2.062763
 Q.Roo Down |   .5224865   .2894315     1.81   0.072    -.0463255    1.0912
 Vera. Down |   .7178394   .2949125     2.43   0.015     .1382557    1.297423
        age |   .0092001   .0077622     1.19   0.237    -.0060548    .0244549
     gender |   .4012908   .2467039     1.63   0.105    -.0835497    .8861313
  gender*Up |  -.7376328   .3607277    -2.04   0.041    -1.446561   -.0287042
  education |    .067545   .0259374     2.60   0.010     .0165709    .1185191
   constant |     2.8813   .5544858     5.20   0.000     1.791584    3.971016
------------------------------------------------------------------------------
```

Tables 2 Trust Game responses have predictive power for assurance baseline contributions

Table 2A: Giving Predicts Baseline Contributions (controlling for regions & locations)

Linear regression (Yucatan upstream omitted) Number of obs = 480

contribution	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
TRUST GIVE	.0514642	.0185026	2.78	0.006	.0151068	.0878216
Vera. Up	.3977928	.117898	3.37	0.001	.1661242	.6294615
Q.Roo Up	.5547804	.1178726	4.71	0.000	.3231617	.7863991
Vera. Down	.7284938	.1178844	6.18	0.000	.4968519	.9601356
Q.Roo Down	.7868567	.1178401	6.68	0.000	.5553018	1.018412
Yucatan Down	.6507321	.1182025	5.51	0.000	.4184651	.8829991
constant	1.287255	.1226274	10.50	0.000	1.046293	1.528217

Table 2B: Expectation Predicts Baseline Contributions (| regions, locations, characteristics)

contribution	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
TRUST EXPECT	.0208397	.0062944	3.31	0.001	.0084682	.0332113
Vera. Up	.2021716	.1243566	1.63	0.105	-.0422509	.446594
Q.Roo Up	.4662856	.1398897	3.33	0.001	.1913329	.7412383
Vera. Down	.831124	.1325874	6.27	0.000	.570524	1.091724
Q.Roo Down	.8494307	.133195	6.38	0.000	.5876364	1.111225
Yucatan Down	.7299685	.1366887	5.34	0.000	.4613074	.9986296
age	.003961	.002981	1.33	0.185	-.0018981	.0098202
gender	.0921066	.0737821	1.25	0.213	-.0529118	.237125
education	-.0179286	.0100784	-1.78	0.076	-.0377377	.0018804
constant	1.351438	.178867	7.56	0.000	.9998756	1.703

Table 2C: Expectation Predicts Downstream Baseline Contributions Better Than Upstream

UPSTREAM Linear regression Number of obs = 204

contribution	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
TRUST EXPECT	.0139557	.0097337	1.43	0.153	-.00524	.0331514
Veracruz	.1858315	.1464859	1.27	0.206	-.1030503	.4747132
Quin.Roo	.3620479	.1783651	2.03	0.044	.0102979	.7137979
age	.006376	.0052569	1.21	0.227	-.003991	.0167429
gender	-.0136089	.1349033	-0.10	0.920	-.279649	.2524311
education	-.0183601	.0193036	-0.95	0.343	-.0564282	.019708
constant	1.40418	.3207043	4.38	0.000	.7717263	2.036635

DOWNSTREAM linear regression Number of obs = 236

contribution	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
TRUST EXPECT	.028635	.0080095	3.58	0.000	.0128532	.0444169
Veracruz	.1117096	.0979207	1.14	0.255	-.0812311	.3046504
Quin.Roo	.1030809	.0986378	1.05	0.297	-.0912728	.2974346
age	.0003832	.0035109	0.11	0.913	-.0065346	.007301
gender	.1629154	.0805517	2.02	0.044	.0041981	.3216326
education	-.0152736	.0108337	-1.41	0.160	-.03662	.0060729
constant	2.064057	.2329516	8.86	0.000	1.605055	2.52306

Tables 3 Downstream Sanctions Raise Upstream Contributions in the Assurance Game

Table 3A: Threat of Downstream Sanctions on Upstream Actors Raises Upstream Contributions

```
Linear regression (Upstream)       LHS = contributions rise    # of obs = 240
------------------------------------------------------------------------------
 R1-Baseline |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  Up-Up Not$ |      .1125   .1921515     0.59   0.559     -.266043     .491043
Down-Up Both |   .2482143   .1077224     2.30   0.022     .0359986      .46043
       _cons |     -.0125   .0859327    -0.15   0.884    -.1817896    .1567896
------------------------------------------------------------------------------
```

Table 3B: Might There Be Less Positive Impact If Downstream Sanction Threat Is Monetary?

```
Linear regression (Upstream)       LHS = contributions rise       # obs = 240
-------------+----------------------------------------------------------------
 R1-Baseline |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  Up-Up Not$ |      .1125   .1923599     0.58   0.559    -.2664619    .4914619
Down-Up Not$ |      .2875   .1216591     2.36   0.019     .0478234    .5271766
Down-Up Yes$ |   .1958333   .1314068     1.49   0.137    -.0630469    .4547136
    constant |     -.0125    .086026    -0.15   0.885    -.1819769    .1569769
------------------------------------------------------------------------------

Linear regression (Yucatan upstream)  LHS = contributions rise   # of obs = 80
------------------------------------------------------------------------------
 R1-Baseline |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Down-Up Not$ |   .4333333   .2229605     1.94   0.056    -.0106378    .8773045
Down-Up Yes$ |   .2333333   .2229605     1.05   0.299    -.2106378    .6773045
    constant |        -.1   .1727045    -0.58   0.564    -.4438986    .2438986
------------------------------------------------------------------------------
```

Table 3C: Use of Downstream Sanctions on Upstream Actors Raises Upstream Contributions

```
Linear regression (Upstream)     LHS = Contributions rise      # of obs = 444
------------------------------------------------------------------------------
R2-R1 & R3-R2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
 GOT SANCTION |   .6019337   .1128207     5.34   0.000     .3801937    .8236738
   Up-Up Not$ |   .0423143   .1533629     0.28   0.783    -.2591082    .3437368
 Down-Up Not$ |  -.1185624   .0986737    -1.20   0.230    -.3124976    .0753728
 Down-Up Yes$ |  -.0028377   .1018304    -0.03   0.978    -.2029771    .1973018
          age |   .0012065   .0029909     0.40   0.687    -.0046718    .0070849
       gender |    .072265   .0813766     0.89   0.375    -.0876742    .2322042
    education |    .003861   .0118135     0.33   0.744    -.0193574    .0270795
     constant |  -.0029227   .1928362    -0.02   0.988    -.3819268    .3760815
------------------------------------------------------------------------------
```

Tables 4 Sanctions & Evolution of Downstream Contributions in the Assurance Game

Table 4A: Availability of Sanctions on Upstream Initially Lowers Downstream Contributions

Linear regression (Downstream) LHS = contributions rise # of obs = 235

R1-Baseline	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Up-Up Not$	-.1118309	.1852144	-0.60	0.547	-.4767817	.2531199
Down-Up Not$	-.2547525	.1184624	-2.15	0.033	-.4881736	-.0213313
Down-Up Yes$	-.3941818	.1289463	-3.06	0.003	-.6482606	-.1401031
age	-.0006923	.0042325	-0.16	0.870	-.0090321	.0076476
gender	-.07009	.0970127	-0.72	0.471	-.2612461	.1210661
education	.0088891	.0130993	0.68	0.498	-.0169221	.0347003
constant	.190799	.2747108	0.69	0.488	-.3504976	.7320956

Table 4B: Complementary Responses Under Sanctions Raise Later Downstream Contributions

Linear regression (Downstream) LHS = contributions rise # of obs = 443

R2-R1 & R3-R2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Up-Up Not$	.1132916	.1488551	0.76	0.447	-.1792713	.4058544
Down-Up Not$	.2156331	.098431	2.19	0.029	.0221749	.4090913
Down-Up Yes$	.2143575	.1057189	2.03	0.043	.0065754	.4221397
age	-.0054436	.0035129	-1.55	0.122	-.0123478	.0014607
gender	-.1168993	.0802912	-1.46	0.146	-.2747051	.0409066
education	-.0056159	.0108889	-0.52	0.606	-.0270173	.0157854
constant	.3097735	.229447	1.35	0.178	-.1411861	.7607331

APPENDIX 1 – Supporting material used in the experiental sessions

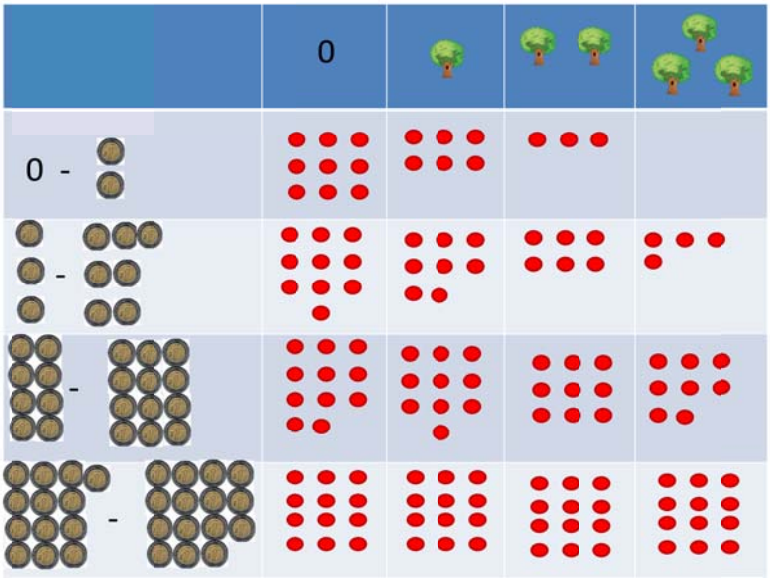


Figure A1 – Payoffs table - PROVIDERS

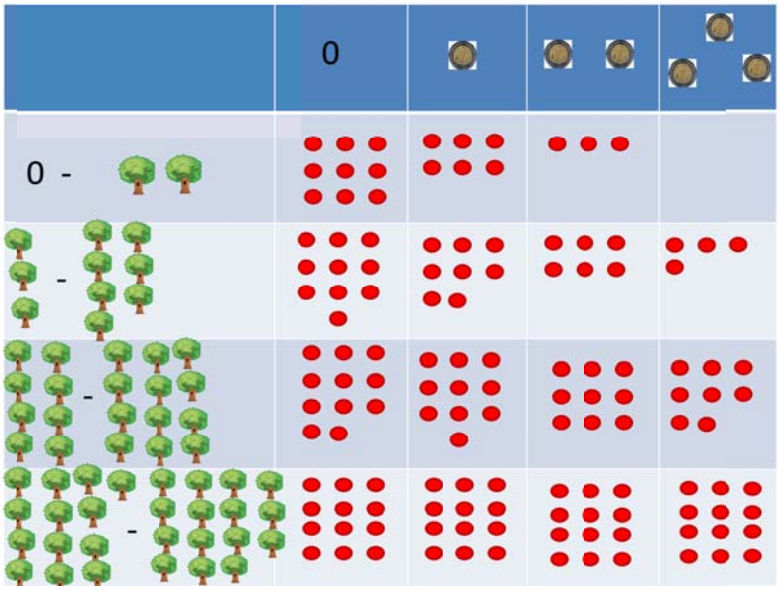


Figure A2 – Payoffs table - USERS

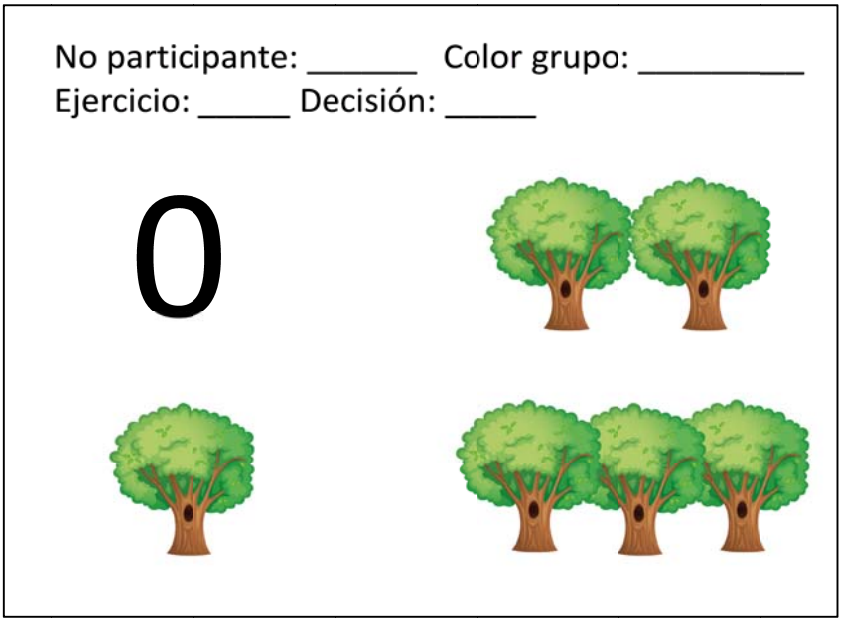


Figure A3 – Decision form PROVIDERS

Figure A4 – Decision form USERS

APPENDIX 2 – Descriptive statistics of participants by case

PROVIDERS	Veracruz	Quintana Roo	Yucatan
Sociodemographic characteristic			
Gender (% women)	57.5%	23.2%	68.3%
Age	38.3	49.3	32.5
Years of education	5.2	6.3	7.8
Household size	5.4	5.2	5.1
Time living in the community (years)	28.4	42.7	27.8
Weeekly income (US$)	$43.4	$43.4	$46.7
Weekly expenses (US$)	$32.4	$39.8	$37.6
Land property			
Farmer	62.3%	81.6%	30.4%
Land use for cropping	3.2	6.8	16.6
Ejidatario or ejidatario's wife	53.2%	78.4%	30.0%
Avecindado o comunero	45.5%	15.2%	53.7%
Small landholder	1.3%	0%	16.2%
Trust and social capital			
Participation in a community group	60%	52.9%	41.3%
How many hours a month?	17.5	8.3	9.2
Participation of community members (out of 10)	5.2	4.7	5.8
Who you can trust in your community?			
You can trust most people	25.0%	31.0%	15.0%
You can trust most people but you have to be careful with some	50.0%	43.7%	37.5%
You have to be careful with most people	21.3%	17.2%	42.5%
Who you can trust in the city?			
You can trust most people	6.3%	17.2%	2.5%
You can trust most people but you have to be careful with some	28.8%	46.0%	31.3%
You have to be careful with most people	56.3%	26.4%	62.5%
Local PES Progrma			
Does your community participante in the PES program?	76.3%	56.3%	53.8%
Days a month devoted to the forest maintenance			
0 days	13.8%	9.2%	40.0%
1-2 days	51.3%	46.0%	18.8%
3-5 days	23.8%	17.2%	23.8%
More than 5 days	7.5%	17.2%	11.3%

USERS	Veracruz	Quintana Roo	Yucatan
Sociodemographic characteristic			
Gender (% women)	55.0%	61.2%	55.0%
Age	35.1	33.3	31.9
Years of education	13.3	13.7	14.8
Household size	4.1	3.4	3.7
Time living in the community (years)	20.3	14.2	22.8
Weeekly income (US$)	$182.6	$347.2	$217.0
Weekly expenses (US$)	$115.9	$186.0	$129.9
Trust and social capital			
Participation in a community group		42.5%	35.0%
How many hours a month?		35.5	15.4
Who you can trust in your community?			
You can trust most people	10.0%	11.3%	10.0%
You can trust most people but you have to be careful with some	61.3%	67.5%	76.3%
You have to be careful with most people	20.0%	17.5%	13.8%
Who you can trust upstream / in the jungle?			
You can trust most people	8.8%	8.8%	3.8%
You can trust most people but you have to be careful with some	57.5%	68.8%	62.5%
You have to be careful with most people	28.8%	18.8%	30.0%
Perceptions about water scarcity			
Water scarcity in your community	50.0%	15.0%	16.3%
Not severe	35.0%		
Moderately severe	23.8%		
Very severe	5.0%		
At least one day without water per month	63.8%		
PES program			
Do you make a payment in your water bill for forest protection?			
Yes	5.0%	0.0%	
No	37.5%	42.3%	
Does not know	57.5%	57.5%	
How much would you be willing to pay per month? (US$)		$9.3	$2.5
How much would you be willing to pay per year? (US$)	$22.0	$111.3	$35.5