

# CONTRACT DESIGN IN COLLECTIVE PAYMENTS FOR ENVIRONMENTAL SERVICES (PES) SCHEMES

The African Development Bank (AfDB) is currently implementing the Gazetted Forests Participatory Management Project for REDD+, with the objective of improving the carbon sequestration capacity of gazetted forests in Burkina Faso while reducing poverty in rural areas. The project is supported by the Climate Investment Funds' (CIF) Forest Investment Program (FIP), aimed at addressing the drivers of deforestation and forest degradation. CIF has partnered with the World Bank's Development Impact Evaluation Group (DIME) to analyze several key factors in project delivery, including the effective use of Payments for Environmental Services (PES).

## COUNTRY CONTEXT

In Burkina Faso, a country with 48 percent arid forest cover, protecting forest resources and maximizing reforestation efforts are of paramount importance for livelihoods, ecosystems and climate protection. Forest-based economic activities contribute to over 25 percent of rural household income, as well as 5.6 percent of Gross Domestic Product (GDP)<sup>1</sup>. Forest ecosystems also provide food security and environmental protection.

## PES: IMPORTANCE & RATIONALE

The provision of PES is built on the rationale that, because forest conservation or reforestation costs are incurred locally, either by governments or local populations, while the overall climate change benefits are accrued globally, resource owners reap only a small share of the conservation benefits. I.e., while the global social benefits typically exceed the costs, individual decision-making may in fact be biased away from conservation and toward deforestation.

To boot, reduced access to forest resources may reduce local livelihood opportunities, further skewing incentives. Within this frame, PES's ability to provide compensation conditional on environmental service delivery makes it a means to shift resource owners' cost-benefit outcomes toward conservation and toward deforestation.

In line, the government of Burkina Faso is implementing a forest investment plan which includes afforestation activities using PES as an incentive scheme. This involves inviting communities living on the fringe of selected forests to participate in afforestation campaigns, whereby they plant new trees and are offered a monetary reward conditional on the survival of those trees. The theory of



## QUICK FACTS

**DATE**

September 2020

**COUNTRY**

Burkina Faso

**PROJECT**

Gazetted Forests Participatory Management Project for REDD+

**CIF FUNDING**

USD 11.5 million from FIP

**MDB**

African Development Bank

**PRODUCT TYPE**

Development Impact Evaluation (DIME)

change underpinning the scheme is that ecosystem services generate positive externalities, and therefore participants in such service provision need to be compensated to the degree that generates socially desirable levels of outcomes. The compensation requires not only the planting of saplings but also the ensuring of their survival—because seedlings are mainly destroyed by wildfires and livestock grazing,

reforestation efforts require the continued incentivization of vicinity communities to mitigate such effects.

PES are becoming increasingly popular in forest conservation programs and are viewed as an innovative and important tool that utilizes the timely delivery of conditional cash transfers as a potentially extremely effective response to both climate change and poverty. However, given that these arrangements are often delivered collectively to communities or groups, rather than to individuals, collective action failure (or free-riding incentives) present a threat to the effectiveness of the monetary incentives. A Randomized Control Trial, implemented by DIME over the period of June 2017 to June 2018, sought to shed the light on the extent to which alternative contract designs could mitigate such losses. The analysis used both survey outcomes and lab-experimental results to investigate the underlying mechanisms driving each outcome.

### PUTTING PES CONTRACTS TO THE TEST

When PES schemes are used to affect land use on private land, the incentive structure for conditional payments is straightforward, with the contract for PES functioning to compensate the very same person who signed the contract and is wholly responsible for delivering the actions required within it.

However, a significant share of the world's forest cover, including that targeted by this project, falls under some form of community or shared ownership, either *de jure* or *de facto*, and very little is known about the impact of PES in such contexts. Here, the status of conservation cannot be easily linked, one-to-one, with actions of individual agents, with collective payments creating the risk of a second order social dilemma. To test the extent to which alternative contract design options could mitigate losses due to such collective action problems, the project has designed and implemented two types of PES contracts: one using a linear payment and another using a threshold-based payment, with the intention that the latter may shift the nature of the interaction from a social dilemma to a coordination game. This is due to the fact that losses at the fall from each threshold may be significant, whereas the cost of individual effort to maintain conservation at the threshold may be less than this.

To test the difference in impact, 66 groups of five community members were randomly assigned to one of the two PES contracts, and informed that they had the opportunity to earn money as a group based on the number of saplings maintained after 9 months. The linear payment contract paid the group about USD 0.62 per tree surviving at the end of a designated time frame, with each member of the group receiving one fifth of the total income.

The threshold payment contract paid the group a predetermined amount based on the number of trees still alive at the end of the designated time frame, with each member of

Figure 1.

### GRAPHICAL REPRESENTATION OF THE TWO CONTRACT STRUCTURES



the group receiving one fifth of the payment (about USD 240 for 400 or more trees, USD 185 for 300 to 399 trees, USD 130 for 200 to 299 trees, or USD 80 for a 100 to 199 trees, and USD 25 for 0 to 99 trees).

The two schemes were arranged such that they are pay-off equivalent, with the payment at the mid-point of each threshold value being equal in both schemes. I.e., if groups in both payment schemes behaved in the same way, the pay-offs would on average be equal.

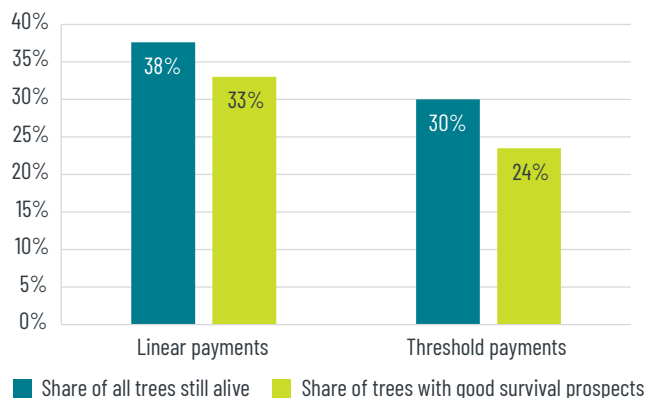
The PES contracts were signed in August 2017, across 33 sub-blocks of 11 major forests in Burkina Faso, encompassing 33,547 saplings that were planted by November 2017. The effectiveness of the contracts was assessed by measuring tree survival rates in two five-hectare reforestation plots within every sub-block, with one plot using the linear payment contract and the other using the threshold payment contract. Survival rates were measured during a verification mission in May 2018.

### FINDINGS

A theoretical model had predicted that the threshold payments would outperform linear payments by addressing efficiency losses that could arise from the collective PES contracts. As such, threshold payments were seen to have the potential to shift the nature of conservation from a possible collective action failure to a more cooperative effort—i.e., from a social dilemma scenario to a coordination game, with the latter predicted to be more conducive to public good provision. The findings of this study, however, seem to point in a different direction, raising new questions, and therefore new possibilities, on how best to distribute incentives and information.

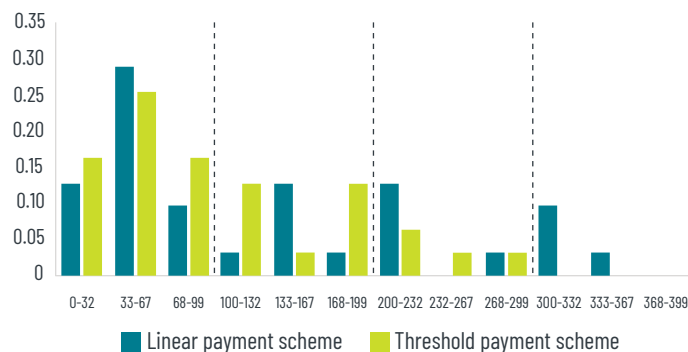
**Linear schemes showed higher survival rates.** In the tested reforestation areas, linear payment schemes performed significantly better than threshold payments, both in terms of the absolute number and quality of surviving trees.

Figure 2.  
OBSERVED TREE SURVIVAL RATES IN THE LINEAR VS. THRESHOLD  
PAYMENT SCHEMES



The difference between the schemes is 7.6 percentage points in terms of trees that were assessed to be still alive at the time of the independent verification, nine months after the start of the project, and 9.5 percentage points when counting only those trees with good survival prospects. The evaluation team hypothesizes two possible reasons for this: first, that the agents may in fact have been able to overcome the tragedy of the commons, along existing theories that humans may well be more prone to cooperate than regularly assumed; and second, that coordination in threshold games may be more difficult when there is uncertainty regarding the probability of accidentally crossing a lower threshold, which then lowers the expected marginal benefits to the invested effort—we dissect each of these below.

Figure 3.  
THE DISTRIBUTION OF OBSERVED SURVIVAL RATES, VIS-À-VIS THE  
PAYMENT THRESHOLDS



**Threshold incentives in fact significantly improved conditions for cooperation, even if performing less well on tree survival rates.** In delving into the mechanisms driving the difference in performance, the data shows that threshold payment schemes did in fact perform better on indicators for cooperation—number of maintenance meetings planned, trust in fellow group members, and the extent to which group members contributed equally to maintenance activities. Endline surveys also yielded that significantly more participants in the threshold groups felt that within-group cooperation improved over time. However, this did not result in more frequent visits to reforestation plots to undertake maintenance activities and did not in fact in increases in actual survival rates.

Table 1.  
INDICATORS OF THE DEGREE OF COOPERATION WITHIN MANAGEMENT GROUPS<sup>a</sup>

	(1) FREQUENCY GROUP DELIBERATIONS		(2) TRUST IN FELLOW GROUP MEMBERS		(3) ASSESSED LACK OF EQUAL EFFORT		(4) FREQUENCY MAINTENANCE ACTIVITY	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Treatment	0.705+	0.950	0.140	0.163*	-0.054+	-0.109**	0.831	1.075
	(0.393)	(0.580)	(0.096)	(0.088)	(0.032)	(0.043)	(0.658)	(0.868)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Blocked fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
N	272	230	251	212	290	242	272	230
F-test	3.22+	2.81*	2.19	4.84**	2.90+	187.2**	1.59	19.99***

<sup>a</sup> The participant characteristics controlled for in the (b) regressions include gender, age and land area. Robust standard errors in parentheses, clustered at the forest level. +  $p < 0.125$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 2.  
PARTICIPANTS' EVALUATION OF (THE DYNAMICS OF) THEIR GROUP'S COOPERATION INTENSITY

	LINEAR PAYMENT TREATMENT	THRESHOLD PAYMENT TREATMENT	P-VALUE <sup>a</sup>
Cooperation remained high throughout	69.3%	65.2%	0.275
Zero cooperation throughout	2.1%	1.5%	
Cooperation changed over time	28.6%	33.4%	0.080
- improved over time	65.0%	81.7%	
- worsened over time	35.0%	18.3%	

<sup>a</sup> p-values obtained using a standard Chi2-test.

While higher performance on cooperation indicators at endline did not correspond to higher performance on tree survival rates in the threshold group, there are interesting findings regarding trends in cooperation over time. While both groups reported high levels of cooperation, for the linear group, 69% of participants reported intensive cooperation from the very start of the program and remaining till the end, compared to 65% in the threshold group—not statistically different. However, 65% of those in the linear payment group reported improved cooperation over time, versus 82% in the threshold group, with 35% versus 18% reporting reduced cooperation, respectively. I.e., cooperation typically intensified more with the threshold group.

**Feedback on survival rates may help improve the performance of threshold schemes.**

While cooperation within threshold groups may have been superior, this did not coincide with participants monitoring tree survival rates more often than those in the linear scheme, implying that participants may not have been influenced by the threshold payments to work toward crossing above or not falling below threshold markers. This was also evident in a lack of “bunching” of tree-counts around threshold markers, implying again that performance was not affected by participants aiming for a just-over-a-threshold number of trees. This could have resulted from insufficient information, communities’ inability to track the number of trees within their purview, or a weakness in the understanding of the assured conditionality of payments. A laboratory experiment, designed to mimic some of the essential the dynamics in the field, suggests that threshold payments may indeed be an effective instrument alongside

feedback on survival rates, and over a longer period that is more conducive to learning than a one-time intervention. In fact, the same laboratory evidence suggests that the threshold payments may in fact have outperformed linear payments had participants been provided regular updates on survival rates.

**LOOKING AHEAD**

These findings are important for the wider fight against climate change. As the international community begins to work toward submitting new Nationally Determined Contributions to the UNFCCC in 2020, as well as continuing existing work toward the Sustainable Development Goals, being able to draw from successful climate change projects will aid in designing more effective and multi-pronged projects. Examples, such as the one outlined here, that combine climate mitigation benefits, poverty reduction and increased food security will highlight how significant achievements can be made in the face of scarce international resources, and how they can be enhanced. Approaches proven to be successful will be key to designing climate-gearred policy interventions that also maximize positive welfare outcomes

**Evaluation Outputs.** Findings on the effects of linear and threshold payment contract designs on tree survival rates are being prepared for submission to the World Bank Working Paper series this fall, titled *Incentivizing Conservation in de facto Community-owned Forests*. DIME’s impact evaluation of the project is ongoing, endline data has been collected and is being analyzed, and findings are expected to be finalized at the end of 2020, with the full array of lessons shared in 2021-22.



The World Bank’s Development Impact Evaluation (DIME) group generates high-quality and operationally-relevant data and research to transform development policy, help reduce extreme poverty, and secure shared prosperity. It develops customized data and evidence ecosystems to produce actionable information and recommend specific policy pathways to maximize impact.

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