CASH FOR CARBON: A RANDOMIZED CONTROLLED TRIAL OF PAYMENTS FOR ECOSYSTEM SERVICES TO REDUCE DEFORESTATION, Jayachandran et al. (2016)

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INTRODUCTION

Context and Importance

Deforestation, a major contributor to carbon emissions and biodiversity loss, is a critical issue in developing countries. Amidst this, Payments for Ecosystem Services (PES) programs have emerged as innovative strategies to balance environmental conservation with economic incentives. This paper situates itself within this pressing global challenge.

Research Question

"How effective is a PES program in reducing deforestation and what is its cost-effectiveness in a developing country context?"

This question probes the intersection of economic incentives and environmental conservation, a vital area in environment and development economics.

Literature Review

- Börner et al. (2017): found PES effective in reducing deforestation in high-risk areas in the Brazilian Amazon.
- Robalino and Pfaff (2014): noted the variable impact of PES in Costa Rica, influenced by local conditions and program design.
- Charoud et al. (2023): highlighted that the success of PES programs in Chiapas, Mexico. It reduced deforestation both after a single 5-year contract and after two consecutive contracts, but the impacts are only detectable in higher deforestation-risk parcels.

Contribution to Literature

The Jayachandran et al. (2016) study adds significant value by empirically testing a PES program in Uganda through a randomized controlled trial. It stands out for its dual focus on the environmental impact (reduction in deforestation rates) and economic evaluation (cost-effectiveness), filling a crucial gap in existing literature. The findings offer actionable insights for implementing and scaling PES programs in similar contexts.

DATA OVERVIEW

Satellite Data: used high-resolution QuickBird satellite imagery for landscape analysis at baseline (May-June 2011, extended to December 2011-January 2012) and endline (December 2012-March 2013), complemented by historical Landsat images and ground validation by Nature Harness Initiatives (NAHI).

Survey Data: conducted detailed surveys among 1099 Private Forest Owners (PFOs) for demographics, land use, and environmental data. Timelines were April-May 2011 for baseline and post 2011-2013 PES program for endline.

Administrative Data: from Chimpanzee Sanctuary and Wildlife Conservation Trust (CSWCT), covering 564 PFOs in treatment villages and 535 in control, with a 32% program take-up rate.

METHODOLOGY

Model Specification

An ordinary least squares (OLS) regression model to assess the PES program's impact, employing the following equation:

$$TreeCover_{ij} = \alpha + \beta Treat_j + \gamma BaselineTreeCover_{ij} + X_{1ij} \cdot \delta + X_{2ij} \cdot \mu + \varepsilon_{ij}$$

where $TreeCover_i$ denotes the endline tree cover for private forest owner i in village j, and $Treat_j$ indicates whether the village was assigned to the treatment group.

Key Variables

- **Outcome Variable:** endline tree cover, determined around each forest owner's home.
- **Primary Independent Variable:** assignment to the PES program (1 for treatment, 0 for control).
- **Controls:** include baseline tree cover, subcounty fixed effects, village-level variables for stratification, and pre-intervention vegetation measures.

Statistical Considerations

Clustering at the village level addressed the non-independence of errors, enhancing estimate robustness.

RESULTS

1) The Program's Impact on Deforestation

- **Reduction in Deforestation Rates:** tree cover in treatment villages declined by only 2% to 5%, compared to a 7% to 10% decline in control villages.
- **Effect Size:** an average increase of 0.27 hectares in tree cover per program participant, demonstrating a significant contribution to forest conservation initiatives.

2) Program Take-up and Compliance

- **Take-up Rate:** 32%. Surprisingly, higher than the impact on deforestation, suggesting that participants may have had higher-than-average counterfactual deforestation rates.
- **Compliance:** approximately 80% compliance rate underling the effectiveness of financial incentives in altering environmental behaviors.

3) Cost-Effectiveness Analysis

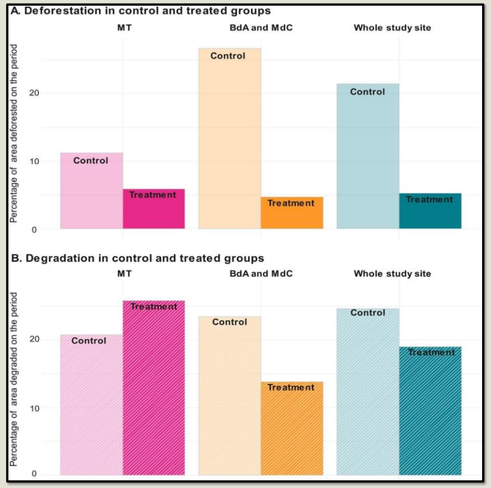
- **Program Costs vs Benefits:** the study assesses cost-effectiveness by comparing delayed CO2 emission values, at a social cost of carbon of $39 per ton, against program costs. It finds that $0.57 spent delayed a ton of CO2 emissions, worth about $1.11 per ton, resulting in a 2:1 benefit-cost ratio. This underscores the economic viability of PES programs in carbon reduction.

4) Socioeconomic Impacts

- **Economic Well-Being:** it did not significantly impact the immediate economic well-being of participants, a finding that correlates with discussions on the trade-offs between economic activities and environmental preservation. Payments compensated income loss from reduced deforestation but did not enrich participants, suggesting a balance between environmental and economic objectives.
- **Wealth inequality:** by targeting landowners, might have inadvertently increased within-village wealth inequality, as landowners are typically wealthier than non-landowners in these communities.

5) Leakage and Displacement Effects

- **No Evidence of Negative Spillovers:** there is no evidence found that the reduction in deforestation in treatment villages led to increased deforestation in adjacent areas or nearby government forest reserves. Thus, it suggests that the program's effects on reducing deforestation were real and additional. This aligns with the land use policy frameworks emphasizing the importance of comprehensive approaches to forest conservation.



Difference in deforestation trends between treated and control parcels across the study region. Panel (A) shows the level of deforestation in treatment and control groups during PES, while Panel (B) shows the level of forest degradation. Deforestation and forest degradation are expressed as share of the area. (Charoud et al., 2023)

"Deforestation is responsible for 12% to 15% of anthropogenic carbon emissions, making it the second largest source of carbon emissions after fossil fuel combustion"

LIMITATIONS OF THE STUDY

- **Selection Bias:** risk of local average treatment effect bias due to potential unobservable variables, like cultural attitudes toward nature, which might affect deforestation practices irrespective of PES participation.
- **Surveyor Influence:** personal biases and characteristics of surveyors could influence participant responses, potentially skewing results.
- **Alignment with Conventional Wisdom:** the study's conclusions might overlook long-term trends or external factors such as land tenure changes or economic pressures, which could impact deforestation rates.
- **Hawthorne Effect:** participants' self-reported data may be influenced by their awareness of being observed, potentially modifying their behavior during the study.

POLICY IMPLICATIONS

- **Awareness and Simplification:** increased awareness through community campaigns and simplifying administrative processes can boost participation.
- **Alternative Economic Development:** implementing programs that offer economic alternatives to deforestation (sustainable agriculture, agroforestry) can reduce economic vulnerability and dependence on forest exploitation. This not only provides PFOs with viable income sources but also aids in forest conservation.
- **Adaptation Based on PFO Characteristics:** tailoring the program to account for individual landowner characteristics like initial forest size and past deforestation activities can optimize effectiveness.
- **Transparency and Accountability:** implement transparent fund management and involve local communities in decision-making to build trust and maintain program integrity.
- **Continuation and Expansion:** incorporating additional incentives for activities that benefit community health and promoting reforestation can extend the program's social and environmental impacts.
- **Promoting Positive Externalities and Social Norm Change:** targeted awareness campaigns highlighting the health and environmental benefits of biodiversity conservation can foster social norm changes. Collaborating with local health organizations for educational programs can further enhance community support for conservation efforts.

Reference: Börner, J., Baylis, K., Corbera, E., Ezzine-de-Blas, D., Honey-Rosés, J., Persson, U. M., C Wunder, S. (2017). The effectiveness of payments for environmental services. World Development, 96, 359-374. DOI: 10.1016/j.worlddev.2017.03.020 ; Charoud, H., Costedoat, S., Izquierdo-Tort, S. et al. Sustained participation in a Payments for Ecosystem Services program reduces deforestation in a Mexican agricultural frontier. Sci Rep 13, 22314 (2023). https://doi.org/10.1038/s41598-023-49725-7 ; Ferraro, P. J., and A. Kiss(2002): Direct Payments to Conserve Biodiversity, Science, 298(5599), 17181719 ; Robalino, J., and A. Pfaff (2013): Ecopayments and Deforestation in Costa Rica: A Nationwide Analysis of PSAs Initial Years, Land Economics, 89(3), 432448.