



## Analysis

# Payments for ecosystem services and agricultural intensification: Evidence from a choice experiment on deforestation in Zambia



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## ABSTRACT

Agriculture is considered to be one of the major drivers of deforestation worldwide. In developing countries in particular this process is driven by small-scale agriculture. At the same time, many African governments aim to increase agricultural productivity. Empirical evidence suggests, however, that win-win relationships between agricultural intensification and forest conservation are the exception. Payments for Ecosystem Services (PES) could be linked to agriculture support programmes to simultaneously achieve both goals. Due to potentially higher profits from intensified agriculture than from pure cash transfers, potential payment recipients may prefer in-kind over conventional cash payments. Nevertheless, little scientific evidence exists regarding the preferences of potential PES recipients for such instruments. We report from a discrete choice experiment in Zambia that elicited preferences of smallholder farmers for PES contracts. Our results suggest that potential PES recipients in Zambia value in-kind agricultural inputs more highly than cash payments (even when the monetary value of the inputs is lower than the cash payment), highlighting that PES could potentially succeed in conserving forests and intensifying smallholder agriculture. Respondents who intended to clear forest within the next three years were found to require higher payments, but could be motivated to enrol in appropriately designed PES.

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## 1. Introduction

Deforestation and forest degradation is recognized as major source of global CO<sub>2</sub> emissions, especially in developing countries (Van der Werf et al., 2009). Hosonuma et al. (2012) estimate that four-fifths of forest loss between 2000 and 2010 was associated with agricultural expansion, largely driven by small-scale agriculture in developing countries. Meanwhile, increasing agricultural smallholder productivity is for many African governments a critical pathway to achieve the Sustainable Development Goals of ending poverty, achieving food security, and improving nutrition. To achieve this, many African governments reintroduced input subsidy programmes (Jayne and Rashid, 2013).

It remains however contested whether agricultural intensification decreases deforestation. Benhin (2006) highlights that in the absence of improved technologies many small-scale farmers rely on newly-cleared and fertile forest land as a cheap production input. Hence, increasing agricultural yields on existing farmland could reduce the pressure to clear new areas. At the same time agricultural intensification commonly increases the relative returns from agriculture vis-a-vis forestry, creating stronger incentives to expand agricultural areas

(Angelsen and Kaimowitz, 2001). Especially in frontier regions, promoting agricultural productivity may in fact increase pressure on forests (Angelsen, 2010). Ewers et al. (2009) conclude that increased yields of staple crops saved forest land in developing countries between 1979 and 1999. But a potential reduction in cultivated areas was counterbalanced by increasing cultivation of non-staple crops. In a global, cross-country analysis of historic data, Rudel et al. (2009) find no general evidence for agricultural intensification reducing cultivated areas. Consequently, a fundamental question is how to increase productivity of smallholder agriculture without further aggravating pressure on forests.

Payments for Ecosystem Services<sup>1</sup> (PES) are an increasingly discussed and implemented policy instrument to reduce deforestation (e.g. Muradian, 2013). PES play a central role in REDD+ as part of global climate change mitigation strategies (Angelsen, 2009). In the context of deforestation, PES are predominantly conceptualized as incentives that compensate land owners for the opportunity costs of alternative land uses.

<sup>1</sup> Following Wunder (2015, p. 241) we understand PES as “voluntary transactions between service users and service providers that are conditional on agreed rules of natural resource management for generating offsite services”.

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This paper evaluates the scope of PES schemes that restrict forest clearing by smallholder farmers by offering conditional assistance in agricultural intensification.<sup>2</sup> The underlying idea is that participating farmers receive agricultural inputs conditional on land use practices which maintain the capacity of ecosystems to provide essential services. The novelty of the proposed combination of agricultural support and PES is that farmers potentially attain benefits from increased productivity that are larger than the direct benefits received in the scheme, allowing to reduce transfer amounts compared to conventional PES. To our knowledge no literature explicitly focused on the potential link between agricultural support programmes and PES (cf Karsenty, 2011). Designing PES as supportive incentives through providing agricultural support may also outperform conventional PES in terms of complementing existing motivations for conservation behaviour. Experimental studies have shown that the supportive framing of incentives crowd-in intrinsic motivations for environmental-friendly behaviour (Frey and Jegen, 2001; Volland, 2008; Cranford and Mourato, 2014). In contrast, PES framed as pure market transactions may reduce such intrinsic motivations (Muradian, 2013; Rode et al., 2015).

To the best of our knowledge, incentivizing PES with support for agricultural intensification is a yet rarely implemented approach. There is evidence that beneficiaries can prefer in-kind payments over cash payments (Engel, 2016). One explanation is that in-kind payments can assure productive investments instead of immediate consumption (Asquith et al., 2008; Zabel and Engel, 2010). PES recipients in Bolivia opted for payments in beehives and apiculture training instead of cash (Asquith et al., 2008). In-kind payments may be furthermore a viable alternative to cash payments in locations where access to certain goods is constrained. Zabel and Engel (2010) conducted a choice experiment among potential recipients for a carnivore protection scheme in India. They find that the delivery of in-kind payments is preferred by respondents living further away from markets where access to products is connected to high transaction costs.

There is also evidence that in-kind payments can support the adoption of environmentally friendly practices. Wunder and Albán (2008) report from two PES in Ecuador that provide training in forestry in addition to cash payments. Grillos (2017) presents PES, which provide in-kind payments with various goods that can be used for environmental conservation. Cranford and Mourato (2014) evaluated the prospective benefits of a credit-based PES scheme through a choice experiment in Ecuador. Under the proposed instruments borrowers would be required to adopt environmentally friendly agricultural practices such as agroforestry and would in return benefit from reduced interest rates. Kaczan et al. (2013) elicit preferences for different payment mechanisms among potential PES participants in Tanzania. They include an up-front fertilizer payment in addition to annual cash payments in their choice experiment. Upfront fertilizer would significantly increase the profitability of environmental-friendly agroforestry. They find that respondents would accept PES contracts of 10 years only by receiving this up-front payment.

Research on in-kind-based PES<sup>3</sup> highlights however some challenges related to alternative payment vehicles (cf Engel, 2016): a) In-kind payments are ideally divisible into small units to allow flexible compensation. In the case of training activities this seems hardly possible. b) In-kind payments are ideally required on a regular basis. For instance in the case of Asquith et al. (2008), demand for beehives and apiculture training is decreasing after some years, requiring to adopt new payment vehicles. c) In-kind payments are often required or

implemented as up-front payment, especially if it aims to promote environmental friendly practices. It seems difficult or impossible to withdraw such once-off payments in case of non-compliance (Kaczan et al., 2013). Agricultural inputs for seasonal agriculture can circumvent many of these pitfalls. First, inputs such as seeds and fertilizer can be divided into small units that would allow compensation proportional to the individual conservation efforts. Second, such inputs are usually required every year, so that annually receiving inputs can be conditional on the conservation outcomes in the prior year.

A better understanding of the preferences of small-scale farmers is crucial to designing and implementing such novel incentive schemes. Programmes based on the target group's preferences have a higher enrolment and likelihood of contract adherence (Petheram and Campbell, 2010). This relates not only to payment-related characteristics as indicated above, but also to attributes such as contract length or implementing organization. This paper sets out to answer three research questions:

1. Do potential PES recipients prefer agricultural support through input provisioning over cash payments?
2. How are such PES programmes best adapted to farmers' preferences in terms of payment-unrelated characteristics?
3. Can such programmes motivate farmers who are most likely to carry out environmentally destructive activities to enrol in PES to ensure environmental effectiveness?

Zambia provides a suitable showcase for this research, as it is one of the most densely forested countries in Africa and experiences high deforestation rates. Small-scale agriculture is considered to be one of the major drivers of deforestation (Vinya et al., 2011). At the same time, increasing agricultural productivity of small- and medium-scale farmers, particularly through a fertilizer subsidy programme, is a policy objective in Zambia (Mason et al., 2013).

PES schemes require clearly defined property rights over forests, either at the individual, community or state level (Wunder, 2009). Most PES are discussed and implemented under individual property rights of forests. In this case, recipients receive a compensation conditional on conserving the private forest area. In the case of common property forests, a larger group of forest users can potentially engage in deforestation. For this type of property rights, group-based PES where payments are conditional on the conservation performance of the group and not the individual are appropriate (Engel, 2016). Land in Zambia is vested in, administered, and controlled by the president and shall be used for the common benefit of the people of Zambia (RoZ, 1995 Art. 3, 5). Similarly, ownership of trees and forest produce on any land is vested in the president (RoZ, 1999 Art. 3). Individualized tenure on customary land such as our project area is limited to use rights (RoZ, 1995 Art. 8). Critical is in particular the stipulation of the Forest Act that trees may be felled and land cleared by residents of customary areas for the purpose of agriculture (RoZ, 1999 Art. 38). The majority of land in Zambia is under customary tenure (61%), where also most forests are found (63%) (ZFD and FAO, 2008). In these areas, local chiefs and headmen allocate individual land use rights to the local population.

In this tenure situation, individual contracts for forests with individual use rights or group payments for common forests alone would risk that deforestation is simply shifted to areas that are not covered by PES. We therefore collected individual preferences for receiving payments that compensate farmers for remaining on their current privately-owned agricultural land and not converting forests to new cultivation areas, irrespective of whether the forest is located on land used privately or communally. Such individual contracts would require however a full enrolment rate at the community level, since non-participating farmers could continue to clear both private and common forests. This hints at the general challenge of PES schemes for common property forests. There are different options for addressing these challenges ranging from individual contracts targeting most conservation-averse residents, customary and/or statutory regulatory backup and group contracts.

<sup>2</sup> Participating farmers would receive agricultural inputs, conditional that they have not cleared any additional forests for agriculture. This conditionality contrasts such instrument from conventional input subsidy programmes and complies with the PES definition provided by Wunder (2015, p. 241).

<sup>3</sup> Two studies have elicited preferences for PES with in-kind group payments such as health, education and employment projects or productive assets (Balderas Torres et al., 2013; Costedoat et al., 2016). Since these benefits would accrue at the collective level, one cannot infer which proportion is due to the in-kind payment alone.

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