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# **Ecosystem Public Services incentive schemes for Agricultural and Forestry Private Management in Developing Countries: A Review**

**By: Cynthia Carolina Zurita Véliz**

December 14<sup>th</sup>, 2020

## **Supervisors**

Dr. José-Antonio Bonet (Universitat de Lleida)

Dr. Miguel Sottomayor (Universidade Católica Portuguesa)



**The University of Lleida**

**School of Agrifood, Forestry Science and Engineering**

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**Supervised by**

Dr. José-Antonio Bonet (UdL)

Dr. Miguel Sottomayor (UCP)

**Submitted by**

Cynthia Carolina Zurita Véliz

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## **Abstract**

Recent awareness regarding the importance of Ecosystem Services has given attention to the challenge of designing feasible, long-lasting Payment for Ecosystem Services schemes: this becomes particularly complex in developing countries, where economics resources are often scarce for the most basic and urgent need, therefore governments' efforts towards PES remain on weekly-enforced policies that appeal more to the collective consciousness about conservation rather than on real-life conditions for the directly-affected communities.

In this context, some Payments for Ecosystem Services (PES) schemes have been applied in the last decade, as a solution that intends to set feasible long-term systems, depending on the information and context conditions. The traditional concept of PES in these cases is still under debate or in need of adaptation to suit the realistic socioeconomic conditions, as well as the available information. Furthermore, some Economic Valuation Methods schemes have been tested in cases like Indonesia, Ecuador, Bolivia and Peru, as an effort to explore the Suppliers' preferences.

This document intends to present an updated State of The Art review of the published case studies of Developing Countries where these schemes has been applied for ES of the agricultural sector, and intends to provide an exploratory approach that showcases how the particularities of these countries define the future and the possibilities of having such applications as a sustainable PES scheme.

### **Keywords:**

*Ecosystem Services – Public Goods – Auctions – Payments – Agriculture – Conservation - Preferences*

# 1. Introduction

Ecosystem Services are defined as “the benefits people obtain from ecosystems” (MEA, 2005). Ecosystems provide a wide range of products and services, as timber, food, water purification, and carbon sequestration and its benefits may reach a global scale. Therefore, its benefits are also, under certain circumstances, free access services.

In the same line, Ecosystem Services that take the form of public services, exhibit the corresponding externalities characteristics, that may be positive or negative. Often, the positive ones are underprovided due to their lack of value in the marketplace (Jenkins et al, 2010). This under provision may be for several reasons, and its benefits distribution may also be unequal, and unfair for the perception of local communities that experience the impacts directly and over their livelihoods, particularly for the poorest ES recipients, as fairness is often associated in literature with pro-poor impacts (Jack et al., 2010). Societies and governments try to force internalization of the environmental damages of certain productive activities through command-and-control, quotas and other environmental control tools, but it seems to work only with stronger institutional framework, which limits it to some industrial activities and at the end, to countries or societies with clearer rules, where Coase Theorem can be applied as an approach where private actors are assumed to put in practice negotiations (Engel et al., 2008) to overcome externalities impacts.

Payment for Ecosystem Services (PES), from a market transactions approach, might be defined as a voluntary, contingent transaction around a well-defined ecosystem service, or service-producing land use, between at least one buyer and one seller, if and only if, the seller secures the ES provision (Wunder, 2005). This is a widely accepted concept, but not out of criticism, as it may include some payment schemes that do not fit the stated criteria: At which extent shall be voluntary some PES schemes, where the government participates as funding source? As most PES schemes involve government intervention and public payment schemes (Vatn, 2010). Therefore, the definition of PES schemes has required further elaboration, and as it is showed in the case studies of this document, often requires continued adaptation during the exploratory implementation.

Successful PES schemes have been implemented since a couple of decades ago, like in the European Union, where firsts PES schemes used as a tool to regulate externalities dates from 1970, thus, long before any PES implementation in Latin America (Schomers and Matzdorf, 2013). This matches the different conditions that we find in the developing countries contexts, regarding PES

schemes, those are as general as having weaker institutional and legal environments, and as precise as different histories of financial incentive programs (Schomers and Matzdorf, 2013).

When it comes to face more economic-constraining contexts, the proposal of a PES often goes into an exploratory implementation scheme, which makes sense for countries whose conditions are different compared to the ones where the successful copied cases have been implemented. Developing Countries have indeed, a different institutional setting and composition (and public perception about it), and therefore governance schemes are publicly valued in a different way. In this dissertation, we probe some cases from the central Andean region, where their socio-cultural context shapes the way that each PES scheme was implemented, and adapted, in order to fit the local social settings, defined by each case's own governance structure.

This study intends to provide a comparative vision of cases where it has been implemented, even as an exploratory exercise, some kind of Payment for Ecosystem Services scheme that aims to propose a sustainable, long-term solution for the agricultural and forestry sectors of developing countries. It starts by comparing the findings on PES systems that are "simpler", as compensation schemes, and probes further the results concerning possible further outcomes of some pilot auctioning exercises, being this last ones, the ones that explore the PES suppliers' preferences at the most, or at least, intends to.

The questions we will try to answer are:

- (1) How the socioeconomic context of the agricultural sector influences the successful application of the PES scheme;
- (2) Which are the common concerns or negative perceptions of the landowners;
- (3) Which are the most valued benefits -for the landowners- of joining a PES scheme;
- (4) The possible outcomes of Auction Applications applied furtherly in similar contexts.

After this Introduction, this work provides five more Sections: Section Two provides a Theoretical Framework for our research, where the main concepts and our working definitions are provided, considering several complementary -and some other exclusive- conceptualizations by authors from the last two decades; Section Three contributes with the four case studies that exemplify the above previously mentioned PES schemes, all of them for the context of developing countries; and Section Four concludes with the comparative discussion and analysis of the four case studies, and the outcome of the comparison between them, aiming at answering the questions



posed above. Section Five accounts the reviewed literature, that includes the ones that specifically describe the study cases, and section Six contains a comparative table as Annex, based on the reviewed literature and prepared by the author.

## 2. Theoretical Framework

### 2.1 Payments for Ecosystem Services

According to the reviewed literature, one of the most used and quoted Payments for Ecosystem Services (PES) definition is the one defining a PES as a “well-defined and voluntary service provided by -at least- one buyer, one seller, where the ES provision is secured” (Wunder, 2005). This definition is also questionable since it does not include all schemes, and the main reason is that it conflicts with the nature of the government-provided PES. Why would someone else voluntarily pay for an ES whose consumption he can benefit anyway simply free-riding it? True is, often PES schemes are government implemented, regulated, supervised, and even financed by governments and public resources (Vatn, 2010). PES systems that are paid for by private funds, are designed in the form of a regulation.

Wunder’s definition, based on a The Coase Theorem’s definition of the ES markets, was later suggested by Vatn (2010) to have a subdivision of PES: genuine PES, and “PES like” approaches. In order to understand better this, it is pertinent to quote The Coase Theorem, which proposes that (1) given no transaction costs and (2) clearly defined and enforced property rights, the internalization of negative externalities can be efficiently dealt voluntarily by privates without any government intervention needed for a more efficient solution (Coase, 1960).

Consequently, as a complement to these definitions and taking in account the Public Good characteristics of some ES, Muradian et al. (2010) stated that PES “ought to be the creation of incentives for the provision of such goods, thereby changing individual or collective behavior that otherwise would lead to excessive deterioration of ecosystems and natural resources. Therefore, it may be convenient to define PES as a transfer of resources between social actors, which aims to create incentives to align individual and/or collective land use decisions with the social interest in the management of natural resources”. Note that this definition also includes government payments schemes.

As an alternative to Coase’s approach to PES, Pigou’s conceptualization clearly embraces the government funded programs targeting ES provision (Vatn, 2010), though an important divergence between the two approaches to ES provision -government usual interventions and Pigouvian approach- should be noted: government payments often relate to environmental pricing and standard procedures (Baumol and Oates, 1971), while the Pigouvian concept is based on

“taxing negative and subsidizing positive externalities within existing product markets” (Van Hecken and Bastiaensen, 2010).

PES schemes that are object of this study fall more into the Pigouvian definition of PES, since in all of them, there are public resources involved, and transaction costs are acknowledged, and their main focus relies on the incentive of positive externalities, by subsidizing them in different shapes.

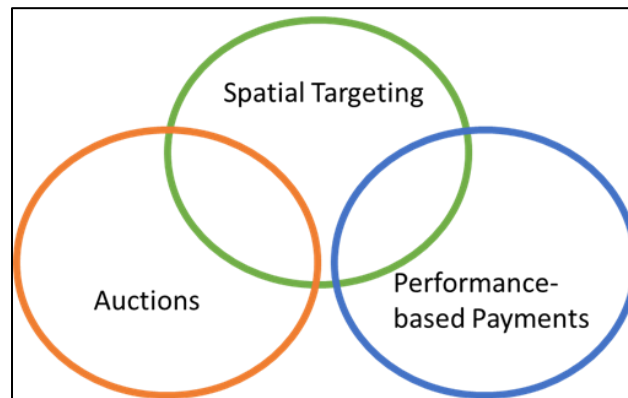
## 2.2 Governance Structures

Having strong governance institutional arrangements, particularly at a local level, is crucial to ensure the environmental effectiveness and economic efficiency of implemented PES schemes (Robalino et al., 2008): Identifying and knowing actors, practices, local rules, communication bridges, and all the components of the social environment where the PES scheme will be implemented, are important practices to ensure a smooth and effective scheme implementation, participation, and also an effective monitoring of the performance of land-management contracts, particularly in the target cases.

In a matter of efficiency, Cost–benefit targeting governance structures, as shown in Figure 1, are the ones that combine **spatial targeting** either with **auctions** or with **performance-based payments**. Cost–benefit targeting is implemented to improve economic efficiency, particularly for cases where funding is not possible to be provided by local stakeholders, and this approach is frequently referred by authors such as Haaren and Bathke (2008) and Klimek et al. (2008).

Having a **defined spatial target**, implemented performance-based schemes, and exploring the possibilities of auctions - even for a pilot implementations - have proven to provide valuable outcomes, in terms of learning to shape a better, financially and socially sustainable provision of ES.

Figure 1. Cost-Benefit Targeting Governance structures



Source: Schomers and Matzdorf, 2013

A defined spatial targeting targets payments to most vulnerable ecosystems, where the degradation of the ES has several implications further than the loss of the environmental asset itself (Uthes et al., 2010), therefore, to intend to apply a PES scheme on high-risk degradation lands will provide a great cost-benefit result, if successful, to both environmental assets and human activities.

Providing PES schemes in such sensitive, highly in need areas (Sierra and Russman, 2006) provides an increase on the PES scheme actual environmental efficiency.

The second element of these governance structure are the **Performance-based payments**, and those are extensively mentioned in literature under similar concepts such as: payments by results, result-oriented payments, outcome-oriented payments, outcome-based payments, or success-oriented remuneration, as described by Schomers and Matzdorf (2013). Those, on the contrary of centrally prescribed land used, are often tailored to local needs and context, since performance measurement obeys to specific cases, therefore, they are likely to improve economic efficiency and environmental effectiveness. They are adapted to provoke local knowledge, and active and innovative land use practices (Growth, 2005), and are meant to need lower monitoring activities.

Finally, **Auctions** are the third wheel of this referred structures and are present also as “reverse” or “procurement” auctions, as they -the ones that are described in the following case studies- are targeted to the potential ES suppliers, in order to learn their desired WTA for a PES contract on their land asset, and also, other private information, such as opportunity costs (Ferraro, 2008), they have proven to be particularly successful for Conservation PES schemes (Baylis et al, 2008).

These three concepts are recurrent on the analysed study cases, as they are defining characteristics of the governance structures of each scenario

### **3. Case Studies**

To understand better the PES schemes implemented with developing world context and their main challenges, we have selected four study cases that illustrate better the actual conditions. Three of them take place in the central Andean region of South America; Bolivia, Perú and Ecuador, while the last one corresponds to Indonesia.

All of them share the context of developing countries ´characteristics and take place in rural areas where farmers face a negative externality that directly affects their livelihoods, which is the main driver to seek an improvement for the provision of a certain ES.

There are not a lot of cases implemented in this geographical region, therefore, the purpose of comparing these cases, being some of them implemented schemes and others, experiments, is a matter of opportunity regarding the available evidence.

#### **I. Bolivia: Compensation through Goods**

Los Negros Valley, borderline with the Amboró National Park of Bolivia, faces a well-known conservation challenge, at least locally: to make available an efficient watershed management that fully ensures the proper irrigation of crops downstream, despite numerous attempts at integrated watershed management, there have been few successes (Durán, 2005).

Bolivia has a long history of facing water scarcity problems linked to watershed management inefficiencies or weal development, even if its water per-capita availability is quite generous (approximately a current total demand of 1%, in relation of total supply), localized water scarcity is an issue that also involves vulnerable communities, highly dependent on water for their irrigated agriculture, and thus for their subsistence, water that currently represents 80% of the total local water demand (Durán, 2005).

However, as sensitive as this resource is, the truth is that irrigators hardly pay water tariffs, which causes an important problem of water wastage and distribution inefficiencies (Wunder and Vargas, 2005; Asquith et al., 2007).

The case of Los Negros Valley illustrates the previously generally described situation in Bolivia, and the consequence of failure of previous attempts to have an integrated watershed management (Durán, 2005). The valley covers a total area of 26.900 Ha that includes: Santa Rosa, the upstream village, with 481 inhabitants, and downstream Los Negros, that has approximately 2970 inhabitants. All of them occupied by agricultural activities. Besides human presence, the valley also hosts a variety of flora and fauna, particularly 11 species of migratory birds, among thousands of other species hosted by the neighbouring area of the Amboró National Park (637.000 Ha.). The watershed provides water resources to two different sorts of costumers: Irrigation for the communities' crops (1.000 Ha.), from Santa Rosa to Los Negros and other in-between villages; and, what might be described as environmental services, also water provision to its 4.000 Ha. of cloud forest that is the habitat of the mentioned migratory birds.

The authors consulted on the Los Negros case have identified the major issues concerning the local watershed management, both for agricultural and environmental water costumers.

Starting with the former, the agricultural activities, the issues that – from the local residents' perspective - are the major concerns connected to the watershed management problem, are deforestation and land-use changes, and also wastage or inequities concerning water distribution. This last issue depends on which of the upstream or downstream village, of course: while upstream seems to have a more favoured water availability, downstream at Los Negros the perception is that the excessive deforestation and water wastage of Santa Rosa is depriving them of a fair water distribution. A higher pressure over the soil resources has also intensified the demand of water, caused by migration of new farmers that illegally take upstream land for crop area expansion, therefore, water demand increases.

Regarding the later, the water supplies environmental services, these two simultaneously provided environmental services are the object of the implemented PES scheme, by a local NGO that managed to get two different buyers, according to their interests: The US Fish and Wildlife Services, that pays for the service with the protection of the habitat of the species in mind, and the Municipality of Pampagrande, paying for it with the conservation of the upland forest and

vegetation in mind, which is a likely<sup>1</sup> contribution to help keeping the water supply during the dry season (Asquith et al., 2007).

*Table 1. Summary of Identified Watershed Issues for the proposed PES*

	<b>Watershed for Agriculture</b>	<b>Watershed for the protection of the Habitat</b>
Deforestation	X	X
Weak Land ownership/borders	X	
Increase of Population	X	X
Water Distribution and Use	X	
Land-Use Change		X
Low Confidence between the parts	X	X

Source: Asquith, N. et al., 2008

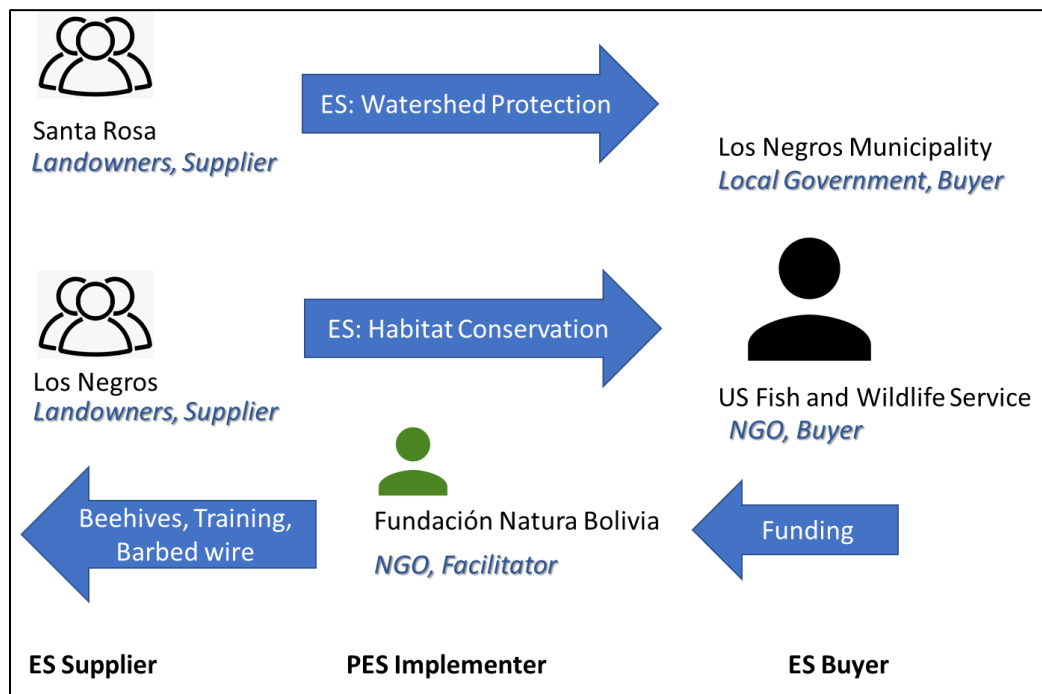
The Watershed PES system, whose covered aspects are described in Table 1, was implemented in Los Negros valley due to their favourable existing preconditions for the scheme implementation: stakeholders were clearly defined - and limited - concerning the villages that composed the up and downstream areas, which facilitated discussions and negotiations between them, and also the existence of a potential long-term water demand, since the Los Negros village population shared a general perception of an increasing water-scarcity problem locally.

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<sup>1</sup> There is no research evidence of a positive correlation between the sustained presence of cloud forest and water supply at Los Negros, but this is a commonly accepted belief by locals

Figure 2 illustrates the PES scheme implemented in Los Negros, which their implied stakeholders. Both Santa Rosa and Los Negros villages are ES providers, since both agree to the ES provision in exchange of goods and services. However, as there are two different ES in the same scheme, there are also two different buyers: the local municipality pays for the watershed protection for the purpose of agriculture, particularly in the name of Los Negros farmers; while the ES for habitat conservation that favours the migratory bird species is sponsored by the US Fish and Wildlife Service. The land opportunity cost for the upstream farmers is represented by the loss of intervention in their conserved parcels, not for farming purposes or even for building road infrastructure.

Figure 2. Los Negros PES System for Compensation



Source: Asquith, N. et al., 2008

A remarkable characteristic of this two-service scheme is its non-cash mode of payment. A traditional background involving bartering in the south American Andean region still exists, and has been a way for subsistence, particularly for the farming sector (Marti, 2006), and this case is an example of this system: recipients prefer in-kind exchanges as they represent better their



perception of reciprocally advantageous exchanges and fit better the traditional local market exchange systems (Heyman et al., 2004). So even if the cash equivalent of the compensation is valued in \$3/Ha/year, the compensation agreed during the negotiation phase consisted of beehives and free access beekeeping training to beneficiaries.

Since there was no previous, *ex ante*, formal economic study of this PES scheme implementation, there is no guarantee in advance that there would be enough willingness to pay (WTP) for the service by the downstream farmers to compensate upstream farmers land opportunity cost, once the external funding is gone.

The main obstacles to this scheme implementation were (Asquith et al., 2008):

1. Trust between parts: downstream weak institutions do not ensure that buyers would equitably contribute to the scheme; uncertainty about the conservation results;
2. Upstream landowners fear that receiving payment for submitting to the conservation agreements, in the long term, would compromise their future land rights.

Results of this implementation can be summarized as follows: a diverse understanding of the governance structure existing in Los Negros valley was obtained, particularly, their weakness, which provide valuable insights to correct future systems. To build trust bridges among the parts was indeed a major concern that the implementer could somehow manage (Asquith et al., 2008), but others, such as landownership issues, are to be corrected by the national government.

## **II. Ecuador: Stated Preferences through a Choice Experiment**

Ecuador is another Andean country, with a biodiversity context of the characteristics of a megadiverse country<sup>2</sup> and therefore, with conservation goals oriented to preserve that asset of very high biodiversity. In this particular country a legal framework currently exists to ensure biodiversity conservation, and although quite progressive in terms of nature rights (Article 71, Ecuadorian Constitution, 2008), the associated implemented policy tools so far are still to be proven

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<sup>2</sup> As defined by Conservation International on their list of 17 Megadiverse countries, identified by The World Conservation Monitoring Centre (WCMC) of the United Nations Environment Program

as efficient enough: still after being a pioneer in national laws that defend the “Rights of the Nature”, true is, conflicts between ES provision and economic interests prevail up today.<sup>3</sup>

The buffer zone of Podocarpus National Park, as shown in Figure 3, in the southern region of Ecuador hosts a large area of cattle husbandry, and that case area cover as much as 5475 Ha. That area is not included in the National Park itself, or in the surrounding watersheds of El Carmen and Pizarros. However, the case area carries importance to the supply of drinking water to the city of Loja, the closest large city in the area. Being the two above mentioned watersheds already protected by other policy tools, the remaining area (which is the case study area) is still unprotected to degradation by local livestock producers (Raes, 2017).

Figure 3. Location of III. Study Site, in Ecuador



Source: Raes, L. et al., 2017.

<sup>3</sup> A worldwide known lawsuit “Ecuadorian State vs Waorani tribe” addresses the conflict of amazon forests concessions, state-given, to international oil companies, whose activity causes important negative externalities to local communities. Taken from: <https://www.elcomercio.com/actualidad/waoranis-petroleras-amazonia-justicia-sentencia.html>

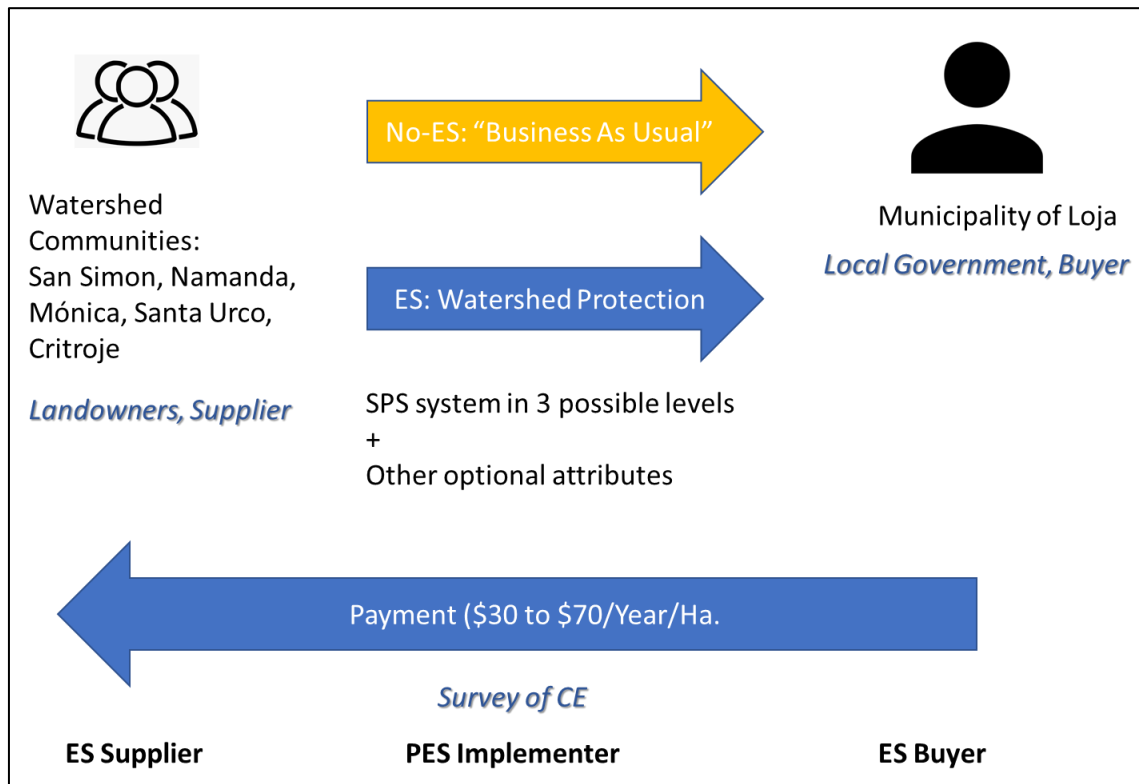
In this context, in 2016 a Choice Experiment (CE) was implemented to test milk producers' preferences and willingness to join PES contracts, particularly, to adopt Silvopastoral Systems (SPS) as well as other alternative land-management practices favourable to reduce the negative impact of cattle-raising on water quality and to the improvement of soil's water retention capacity (Iñiguez-Armijos et al., 2014).

The implemented CE model is next summarily described: The farmers (respondents) would choose only the most-preferred option, amongst two different contract specifications and a third option, named "Business As Usual" (BAU), that is, to not force them to choose a land-management option that is not satisfactory, as stated by Jaeck and Lifran (2014).

The proposed PES contracts scheme, illustrated in Figure 4, had two parts: The first one consisted of the implementation of a SPS system with/ (or without) additional land-management further requirements beyond the legal ones, and the second one, involving a payment conditional on the continuation of the agreed management measures by the farmers for the duration of the agreed contract duration (Raes, 2017).

Figure 4. exemplifies the structure given to the experiment, emphasising the option of ES non-provision option. ES providers are all the watershed communities that are not covered by other conservation measures such as land purchase or declaration of protected areas. The ES buyer is the Municipality of Loja, who is a founding member of the Regional Water Fund (FORAGUA), and whose financial resource come from a tax included in the citizens' water bill.

Figure 4. CE for PES scheme at Podocarpus National Park site



Source: Raes et al., 2017

The age and educational characteristics for the sample of 120 stakeholders participating in the CE (respondents) are next described: average age of 50, mainly primary school completed, just eight of them had some sort of university degree. For them, Milk income, among others, represents \$90/Ha./year, and total household income is \$5700/year.

Next the major results of the CE are presented. Those results refer to their willingness to join SPS, as well as other land-management attributes.

The model considered three classes, being the bigger one, of 53% of the total sample, in favour of choosing SPS vs "BAU" scheme, even with additional land-management attributes that imply conservation or reforestation, and access to water stream for cattle. Another group, consistent of 17%, would prefer a BAU scheme, and if not, would not agree to provide access to water for cattle. Finally, the other group of 30%, would mostly agree to a SPS system and with additional land-management requirements such as reforestation, but would be more reluctant to allow water access to cattle. Raes et al., (2017), described these three classes, considering their

previously described preferences, as the “PES Contractors”, the “PES Conservatives”, and the “Conservationists”.

The main outcome of this CE, besides the characterization of the respondents, is the conclusion that a simple majority of them (53%) are potential PES Contractors, and if we also consider the other 30% defined as “Conservationists”, there is evidence that at least, SPS could be implemented with a reasonably good disposition among the local communities.

### **III. Andean Region of Perú and Bolivia: PACS**

In this case, the same PES system was implemented in two similar-context places: bolivian and peruvian Andean farming groups participated into a agrobiodiversity conservation practices auction, under the name of Payments for Agrobiodiversity Conservation Services (PACS), with the purpose of reducing losses on genetic diversity on crops (Narloch, U., 2013).

The bolivian study site is located close to the Uyuni salt flats, on the southern *Altiplano*<sup>4</sup>, while the peruvian site is on the peruvian border of the Titicaca Lake, on the Northern Altiplano. For both places, quinoa crops represent a key role for the farmers’ livelihoods. A diverse range of varieties of quinoa (*Chenopodium quinoa*) can be found on that area, each well adapted to the high ecological and climatic variability of the andean Altiplano (Tapia and Fries, 2007), as it is shown on Figure 5.

Quinoa producers in both cases redirected their efforts favouring some varieties, among others, due to prices and demand from the international market (Rojas et al., 2009). This situation led to a loss of quinoa diversity, by this favouring of varieties with greater potential for return in the market, mainly the white quinoa varieties, to the detriment of other varieties with less commercial value.

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<sup>4</sup> The Altiplano is a plateau located in the central Andean region, at an average altitude of 3800 meters, which defines the nature of its endemic flora and fauna.

Figure 5. Location of I. and III. study sites, in Perú and Bolivia.

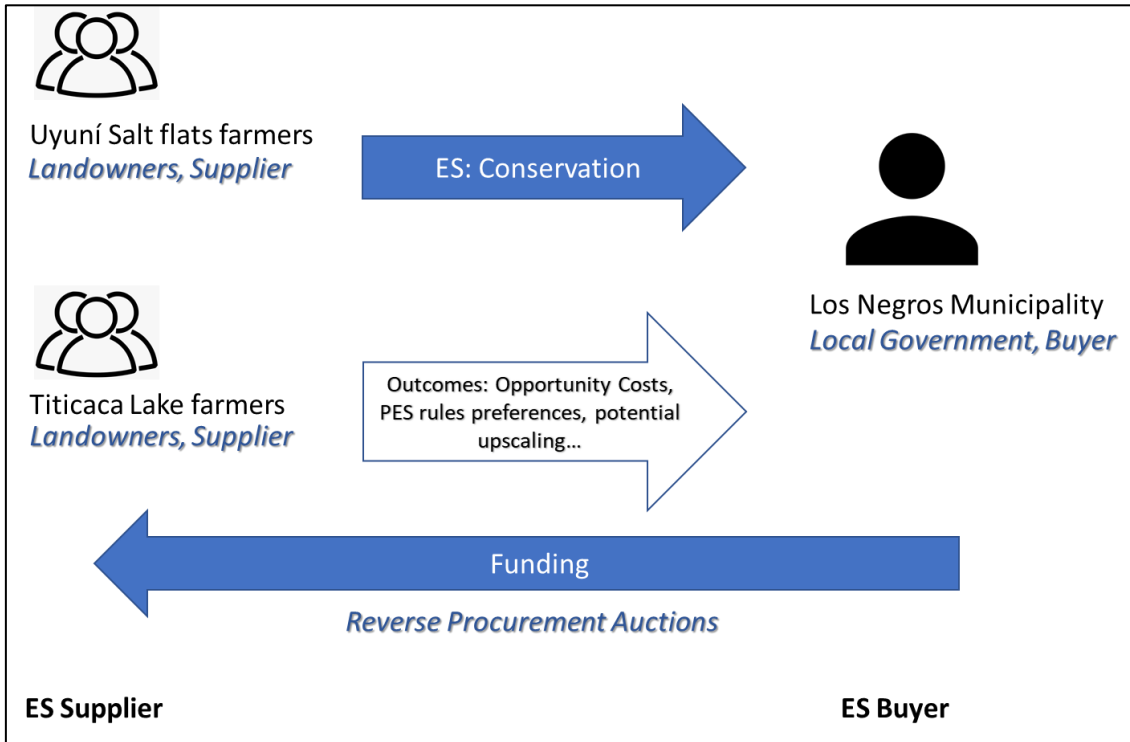


Source: Asquith, N., et al., 2008; Narloch, U. et al, 2013)

Both peruvian and bolivian sites have, for the purpose of this analysis, similar contexts: both quinoa producers have the same market conditions, as they are determined by international demand of quinoa, and socioeconomic context of altiplano share common ethnic backgrounds and governance practices, as ancestral society rules of the Quechua and Aymara people. However, there is one important difference: in the bolivian case, land tenure issues are far weaker than in the peruvian case, which later proved to be an important divergency on results (Narloch et al., 2013).

The auctions scheme is as described in Figure 6, both farmer groups where asked to submit bids for conservation contracts for their plots. The auction was targeted to farmer groups, to take advantage of the community governance structure, as well as to perceive better their understanding for eventual service provision at a landscape level (Prager et al., 2012).

Figure 6. PACS scheme for bolivian and peruvian Altiplano sites



Source: Narloch et al., 2013

The results of both pilot auctions allowed to learn that in the peruvian site, the expected price for conservation of their land is three times higher than in the bolivian site, as the average payment per conserved land is \$37,04/Ha./year , in comparison with \$10,45/Ha./year. This seems to match with the reflected characterization of the sample, whose inputs, based on a community-based wealth ranking exercise (Bellon, 2001), allowed to determine that the peruvian farmer group is composed by 12% of low-wealth class, against 47% of the same category on the bolivian side.

Also, less Ha. For conservation were offered to be conserved in Perú, due to a higher level of small-scale landowners, against the larger, free access landraces of the bolivian community lands.

#### **IV. Indonesia: Revealed Preferences**

At Sumatra Islands, Indonesia, an experimental auction was implemented as a part of a PES project, to evaluate coffee farmers' Willingness to Accept (WTA) compensation of regarding conservation contracts for soil erosion control. The purpose of this auction was to determine the characteristics of the ES suppliers, with the idea of further analysis for scaled-up applications, regarding the financial, ecological and socioeconomic consequences of a similar PES scheme at a landscape level (Jack, B. K. et al., 2008).

The environmental goals of this initiative were: (i) the prevention of soil erosion in an area mainly occupied by coffee crops: (ii) the prevention of the aquifers degradation, and the associated detrimental effects on the resident flora and fauna biodiversity, as short-term effects, and, in the long term, (iii) the prevention of reductions on soil carbon storage (van Noordwijk et a., 1997) and (iv) the potential risk of diminishing production for the downstream hydropower reservoir that provides energy for three more Sumatra provinces.

To the best of the knowledge of this author, and also of Jack et al., (2008), at the moment of application of this experimental auction, there were no other cases of implemented auctions for PES systems, neither for conservation programs nor in the developing world countries context. The Bolivian and Peruvian pilot auctions described before as the Case Study III were implemented five years later.



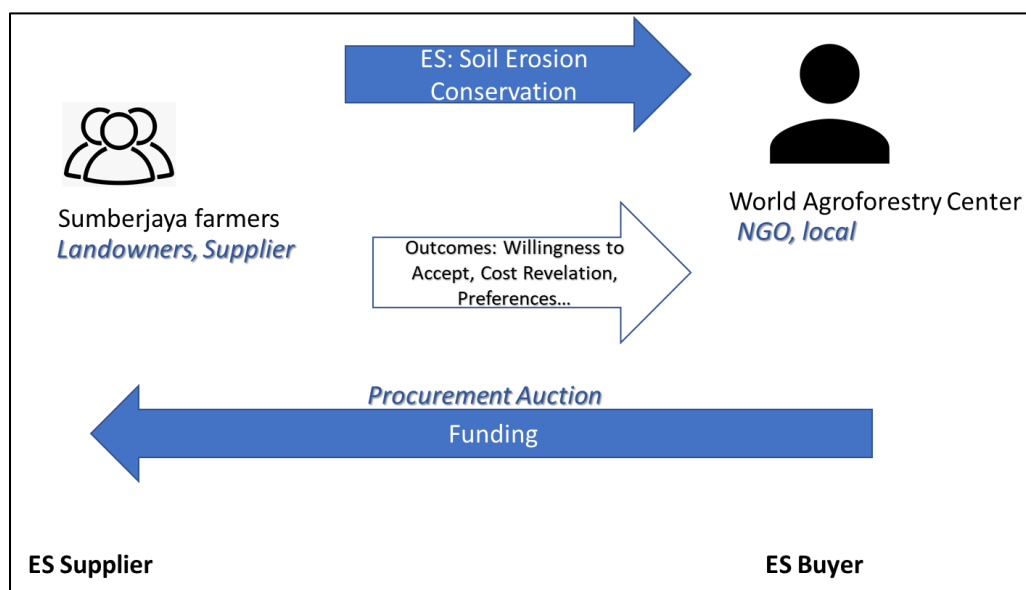
Figure 7. Location of IV. Study Site, in Indonesia



Source: Jack et al., 2008

This pilot auction was implemented in two villages of Sumber Jaya, at the Sumatra island (Figure 7), with the main objective of obtaining private information regarding their Willingness To Accept towards conservation contracts, with specific conservation attributes designed for their specific agriculture activity.

Figure 8. Auction Scheme at Sumatra Island, Indonesia



Source: Jack et al., 2008

As illustrated in Figure 8, the PES contracts offered in the auction included three verifiable land-management techniques: soil infiltration pits, vegetation strips, and ridging between coffee trees (Leimona et al. 2008). Performance was evaluated on the basis of land-use activities, rather than actual services supplied, because of monitoring difficulties and the risk burden for landholders (Wunder 2007).

As a result, the PES scheme outcome was measured under soil erosion control, rather than tons of soil erosion avoided. We also assumed that each parcel independently contributed to the overall benefit score. Thresholds, or other ecological complementarities, may alter the shape of the supply curve and the supplier's characterization (Naidoo et al. 2006).

## 4. Discussion and Conclusions

The outcomes of reviewing the study cases describe widely the implementation process, and the reformulation that were needed to secure their continuity. Therefore, it is possible to list the positive and negative aspects experienced in each one of them, which can be directly related to each case own particular conditions, and not to the general -or initial- PES scheme to be implemented. This is described in Table 2.

*Table 2. Outcomes of implemented PES systems*

	<b>Compensation Scheme</b>	<b>Stated Preferences</b>	<b>Revealed Preferences</b>
<b>Pros</b>	Easier Implementation and valuation of costs	Allows to evaluate the perception on existing policy tools	Estimation of ES Supply Curve
	Creation of “secondary market” to trade the compensation goods	Easy collection of information	Explore realistic preferences, gives valuable output to value the ES
<b>Cons</b>	Penalties hard to implement due to political reasons	Answers may be biased due to lack of interest in providing right answers	Subject to collusion, lack of trust, and moral hazards
	Highly Dependent on Trust		
	Requires Control and Monitoring		
	Dependent on Public funds and regulation		

The comparison of these four study cases allow to conclude that similar contexts in developing countries lead to similar outcomes, all of them are conservationist approaches, to vulnerable ecosystems whose locals are highly dependent on, and most of them, are also in vulnerable

economic socioeconomic conditions. Table 3, on the Annexes section, describes a detailed comparison of the cases, in several parameters, being only one of them the payment itself. This specification obeys to remark how important and enriching can the implementation of exploratory PES schemes, as a first approach to further, more resourceful schemes.

All studied PES systems have as main focus, conservation related goals: they go from directly compensating farmers by conservation performance, paying with goods, to an exploratory approach to understand their potential disposition to become part of a PES system. Indeed, are Conservation PES Schemes. The fact that the conservation is motivated not by altruistic, or environmental-friendly top-down policies, but for the local needs of preserving their livelihoods, is a remarkable characteristic. The local governance structures and dynamics become relevant, as well as the need to understand the background and existent society rules and needs.

Land-rights and land-tenure seems to be still a sensitive and underdeveloped topic in the rural Andean region, where still ethnic groups as Aymaras live (in Bolivia, specifically) by traditional practices and social codes rather than by standard legalized property rights. These farmers communities are aware of this irregular condition, and it may become a major concern at the time of evaluating a proposal to join a PES scheme, in terms of uncertainty about losing their land rights as “trading them” by the PES benefit.

This led us to reflect that as much as fairness in PES literature is associated with pro-poor impacts (Jack et al., 2010), in the outcomes of the study cases still most of the vulnerable social groups are left behind the PES systems. In the Los Negros case, for example, the fear of “loosing” land ownership by accepting cash payments for the ES provision was eventually overcome, however, the “new colonialists”, that is, migrants without any legal or accepted right overland, had to migrate again due to the implementation of the PES system, since this brought monitoring and control of the land use.

Another aspect that should be furtherly explored, is the dependence of the landowners, that is, the ES suppliers, to their agricultural activities and the economic vulnerability they have and how the eventual improvement of this conditions may imply a greater effort to ensure the implementation of the PES system. Payments per conserved hectare are not high, and in some cases, are barely symbolic, and it often reflects more a contribution rather than a trade-off of

opportunity costs. An important weakness of PES systems implemented in low-income communities.

To conclude the general findings of this document, to address the beforehand stated questions in the Introduction, we can conclude that:

1. The socioeconomic context of the study cases defined their willingness to join and to stay in the PES schemes: their expectations of payments or somehow, the expected retribution for their participation on the systems was highly influenced by their conditions, in all cases, vulnerable and dependent on their agriculture activity to subsist. The most illustrative case for this is the Los Negros case, where farmers accepted a retribution in the shape of beehives, whose estimative cost is \$3/Ha./year. We hardly believe such a scheme could be accepted in PES schemes of the developed world.
2. The common concerns and challenges concerning the perception of ES suppliers, that is, the landowners who would submit their plots to conservation contracts, are related to trust: trust in the system and the ES benefits, trust in the other parts' compliance to their rules, and a very specific fear of compromising their landownership by accepting payments for the provision of the ES. Governance structures are also important to acknowledge as transversal criteria for the successful implementation.
3. For the other side, the praised benefits, for the landowners perception, is also a common rule: they appreciate the conservation of the ecosystem where they live, as it represents sustainability to their livelihoods, that in most cases, is an ancestral practice that belongs to ethnic groups and whose own understanding on how the ecosystem works, can define solely their disposition to participate in a PES scheme.
4. The study cases were presented in a order of increasing complexity for the PES schemes: it went from a simpler compensation scheme, trading ES for goods, to a successful implemented auction system. The application of auctions, as it has been described before, allow more than to simple ensure financing with multicriteria land-management attributes: it allows the very important outcomes that provide characterization of the ES providers, and directly involved stakeholders. In the developing world, where there are still important definitions pending, specially regarding environmental policies, to have proper insights to determine adequate tools is a valuable asset, that auctions can support greatly.

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## 6. Annexes

7. Table 1. Comparison of Findings for the study cases

	<b>I. Bolivian Case, Los Negros (2004)</b>	<b>II. Ecuadorian Case (2016)</b>	<b>II. Perú and Bolivia Cases</b>	<b>III. Indonesian Case</b>
<b>PES Scheme</b>	Compensation System	Choice Experiment	Reverse Procurement Auction	Pilot Auction
<b>ES provided</b>	Watershed Protection  Habitat Conservation	Watershed Protection	Genetic Diversity on Crops	Soil Erosion Control
<b>Year of Implementation</b>	2004, 2005	2016	2010, 2011	2007
<b>Agriculture sector</b>	Diverse Crops	Milk	Quinoa	Coffee
<b>PES Supply inhabitants</b>	1328 people	120 persons (sample)	18 bolivian, 20 peruvian farmer groups	82 auction participants
<b>Land-Management Attributes</b>	Conservation attributes	Silvopastoral System that includes:  Trees dispersed with pastures, living fences, fruit trees and	Conservation attributes, avoid monocultives	Soil infiltration pits, vegetation strips, ridging between coffee trees



		native <i>Alnus acuminata</i> Additional land management requirements (hypothetical)		
<b>Payment</b>	U\$ 3/Ha./year (Equivalent in beehives and apiculture training, fruit trees seedlings or barbed wire)	U\$ 30 to 70/Ha./year	\$10,45/Ha./year for Bolivia  U\$37,04/Ha./year for Perú	U\$ 166 to \$177/Ha./year