

# Payments for ecosystem services: a tool to avoid risks due to unsustainable use of water resources

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## 1. INTRODUCTION

The market-based tools for managing landscape and environmental resources including water resources that incentive profit opportunities for ecosystem services (ESs) providers include direct payments (subsidies, tax incentives and payments).

This set of instruments collects the different types of incentives used to maintain or restore the supply of ESs and, among others, those defined as Payments for Ecosystem Services (PES) (Vaissière *et al.* 2020).

PES provides a payment against the provision of an ES, or the use of the natural capital that allows to obtain the service (UNEP/IUNC 2007), which is configured as an externality. They include all direct payments from ESs beneficiaries in favour of landscape-environmental resource managers and, according to some authors (FAO 2007), also indirect payments, such as those deriving from productions with specific certification. According to the fact that taking this last category of transactions into consideration means reaching different conclusions regarding the efficiency, equity and sustainability that accompany the realisation of a PES, we will consider for this article only conventional direct payments.

PES differs from the more traditional forms of incentives, as its financing derives from the voluntary and direct payment by the beneficiaries of the ES and not by the compulsory contribution.

PES seeks to internalise the externalities deriving from the use of landscape-environmental resources (Pagiola and Platais 2007) aiming to apply the Coase Theorem (James and Sills 2018), that is based on the assumption that, given certain conditions, the problems of external effects can be overcome through private negotiation directly between the affected parties regardless of the initial allocation of property rights.

The underlying financial principle of PES is based on the willingness to pay of the beneficiaries for the conservation of the service, or the undertaking of a sustainable practice, according to an inverse logic with respect to the Polluter Pays Principle (PPP), since in this case it is who benefits the payer. According to this logic, PES can be considered a tool within the so-called “Incentive-based instruments” category.

This economic tool represents an opportunity to integrate the income of land managers since they manage, conserve, restore, implement sustainable use of a landscape-environmental resource including water resources (de Lima *et al.* 2019) and, consequently, encourage sustainable management of the ecosystems. In fact, it aims to guarantee the perpetuation of the provision of an ES the most attractive option and to push land managers to adopt it. Consequently, PES becomes one of the tools that can be used to develop a market model aimed at generating income from the supply of ESs (Wegner 2016), as the ES becomes a product. In detail, the producer asserts the right to ask the consumer a price for the ES.

The main reason able to convince the purchaser to spend to obtain the ES is linked to the benefit derived, which can be identified in greater profitability (Perrot-Maitre 2006) rather than in a benefit of another nature. However, the benefit must be linked to the ES provision.

Although the recognition of the importance of services provided by landscape-environmental resources is not recent, the birth of the PES concept can be placed at the end of the Nineties, following the rapid spread of the implementation of this tool at the international level.

Starting from the first application of the formal PES mechanism in Costa Rica in 1997, developed to cope with the negative consequences of deforestation (Pagiola 2008), there are today hundreds of incentive schemes in the world that can be labelled as “PES”. Often, however, this definition is used improperly, including other “market-based” instruments among the PES. At the same time, the concept of PES is sometimes used with alternative labels, such as Compensation for Ecosystem Services (CES), or Compensation and Rewards for Environmental Services (CRES) (Swallow *et al.* 2007).

An attempt to restrict and formalise the concept was carried out by identifying a definition. For example, Wunder (2005 and 2015) identified five basic principles for the identification of a PES. In detail, to be faced with a PES it is necessary: i) a voluntary transaction, in which ii) a well-defined ES (or a use of the land to provide it) iii) is purchased by at least one buyer, iv) from at least one supplier (agricultural entrepreneur or manager of a protected area) who effectively controls the supply of the service, v) if and only if the supplier ensures its supply (i.e. conditionality). In addition, Wunder (2015) suggested that the language of service users and service providers seems to be more appropriate than that of buyers and sellers. It is worth underlining that the object of the transaction must be an ES that is realised in the form of an externality, as different is the case of an ES that can be internalised by the supplier and that, consequently, does not generate market failure. In the latter case, in fact, the creation of the PES has no reason.

The aforementioned definition is not unanimously shared in the literature (e.g. Chapman *et al.* 2020; Lliso *et al.* 2020). Muradian *et al.* (2010) argue that it is not able to take into account a number of particular schemes of PES, which operate on the basis of different principles, with not well defined ESs, or with inefficient levels of supply of the same, with imperfect information, rather than with inadequately defined property rights. Examples in this sense are the PES schemes developed in Cambodia (Clements *et al.* 2010), in which other variables intervene with respect to those enunciated in the aforementioned definition of Wunder (2005 and 2015). Moreover, there are several studies that are trying to improve the definition (e.g. Vaissière *et al.* 2020).

According to Ezzine-de-Blas *et al.* (2019) and Yu *et al.* (2020) trying to incorporate all the PES into one definition seems difficult. In fact, the PES that are found in reality often differ considerably from one another, mainly due to the different application context.

The source of financial resources used and the management/administration of the PES tool may be different: financiers can be directly the users of the ES (private scheme), or the Public Administration (PA), as a third party, can act on behalf of the purchasers/beneficiaries of the ES (public scheme). Furthermore, the PA can act as a pure public-private scheme actor, belonging to the private scheme, rather than as a PES administrator, as well as a provider of financial resources, according to the logic of the public scheme (UNECE 2007). Generally, while the case of private financiers is based on schemes of limited geographical areas, in the case of public schemes the intervention has a broader scope, although it is not precluded from the possibility of operating also locally (Engel *et al.* 2008; Ezzine-de-Blas *et al.* 2019). Moreover, the stimulus to participation may be different: while in the case of private financing of PES, participation is mainly voluntary

for both parties, or prompted by the need to adapt to adopted rules, in the case of PES financed by the PA only the suppliers voluntarily join the tool.

PES can foresee the payment of the managers of the landscape-environmental resource for the mere conservation or for the creation of an ES. Consequently, there are different impacts that these two different PES schemes can produce on the economic activities of the interested area (i.e. reduction, rather than increase of the activities).

From the point of view of the beneficiaries it is important that the recipient of the payment has in fact the ability to manage the resource from which the ES derives.

There are different methods of determining the compensation in the transaction. Nevertheless, a number of types of compensation that are more widespread can be identified. In detail, the determination of the contribution based on a predetermined percentage of the beneficiaries' income, or the predetermination of an annual amount. FAO (2007) also points out that the compensation can be either monetary, or in another form (e.g. food, training or employment, better conditions for stipulating contracts).

From the point of view of the duration, firstly it is necessary the PES is sufficiently long to guarantee sustainability and secondly it is fundamental to be sure about the high probability of perpetuation of the good practices that are encouraged with the PES.

To summarise, the development of a PES must follow certain criteria: the PES must be realistic, as the opportunity costs must be covered by the payments, voluntary, and must also respect the principle of conditionality. Finally, it must respect the condition of equity.

## 2. PAYMENTS FOR ECOSYSTEM SERVICES AND WATER RESOURCES

As mentioned above, PES is a tool that could be implemented in heterogeneous scenarios with the aim to improve natural capital management, including water resources use. It is from the experiences collected by using this tool in real contexts that some of its positive and negative aspects have emerged.

First of all, there are several positive characteristics that can be recognised. PES is attractive as it is able to move additional financial resources, ensuring that the planned payment is bound to the performance of a specific practice involving the landscape-environmental resources, and producing a justification to the transaction.

In addition, PES creates an improvement of benefits compared to the starting situation (additionality). However, in order to satisfy the condition of addition-

ality the identification of the basic reference represents an extremely difficult task, which could have effects on the determination of the efficiency of the tool (Masiero *et al.* 2017).

In favour of PES, it is necessary to remember its flexibility, which allows for the renegotiation of the agreement reached between the parties when the conditions used to stipulate the transaction are modified. Although this feature may be a source of instability and a threat to the continuation of the proposed improvement of ES provision, it constitutes a guarantee of greater effectiveness, since the modified conditions of the context may require a change in the agreement (e.g. entity or duration of payment, objectives to be achieved) in view of a gradual improvement.

Regarding “efficiency”, it should be noted that PES approach ensures that the users of ESs provide funding resources to support only anthropic activities they consider beneficial practices to be financed.

The effectiveness of PES is strongly dependent on the socioeconomic context in which they have been implemented. PES can be created in contexts with different levels of socio-economic development and with rather heterogeneous features. However, it seems that in rural areas PES is able to express its potential. In these areas, that according to the OECD methodology occupy 90% of the territorial surface of the European Union, a dominant role is played by anthropic activities that heavily influence the provision of ES. Since agricultural lands represent a large part of the surface used, the consideration of PES takes a role of primary importance among any approach aimed at preserving the services provided by the ecosystem. For this reason, the use of PES schemes seems to be fundamental in these areas (The Katoomba Group 2008).

There are several difficulties in the implementation of PES. The creation of this tool, in fact, is not a simple procedure and requires negotiation processes between the interested parties, which in some cases could be complex and expensive. PES approach is not feasible in contexts where there is a high risk of conflict between resources (Huberman and Shepherd 2010).

Often it is necessary to guarantee the presence of an actor with intermediary functions, or to guarantee the definition of specific rules.

Even the lack of basic information (prices, methods of measuring the ES, etc.) for participants can be an obstacle to PES development. To create a PES, for example, in addition to defining and measuring the ES, it is essential to evaluate the financial value of the service. Referring to this last point, on the one hand, it seems relevant to remember the difficulties of the estimation process of landscape-environmental assets. On the other hand, the underestimation of services deriving from landscape-environmental resources represents a limitation of considerable importance for the optimal definition of a PES scheme.

The existence of a regulatory framework suitable for fostering the creation of a PES, including the definition of property rights, is another basic condition for the implementation of a market for ESs. Sometimes, factors such as risk, price fluctuations, future expectations can represent significant obstacles to the activation of the PES. The involvement of the PA may be relevant in this context.

The identification of the best implementation method of the agreement (payment mechanism, sources of financing, elements of the agreement, etc.) could be a problem due to high transaction costs that could be considered significant obstacles to the creation of this incentive-based tool.

These costs can be very high due to the presence of monitoring and supply controlling structures of the ES. In addition, the relevant and extremely difficult role of evaluating landscape-environmental resources has been mentioned. The problem relating to the ability to monitor and evaluate ESs is fundamental, since it should allow the quantification and the relationship between the ES supply and the type of management of the ecosystem. This capacity is fundamental for the creation of a PES scheme, but is often neglected, in favour of prices determined on the basis of the financial resources of the beneficiaries (Van Halsema 2005).

As already mentioned (Masiero *et al.* 2017; Troiano and Marangon 2010), a central problem in the definition and monitoring of PES is represented by the difficulty in determining the baseline, in terms of services that must be complied with, as well as the definition of improvement qualitative of landscape-environmental resources characteristics. The latter task, which in some cases proves to be anything but simple and requires the preparation of suitable indicators, in particular as regards the landscape resources, means to take into consideration medium-long periods of time (Troiano and Marangon 2010). Consequently, the difficulties in assessing the effectiveness of the application of a PES in favor of the landscape-environmental resources could be considerable.

PES tool is very sensitive to the variations that the context in which they are implemented. For example, the increase of prices of agricultural commodities could induce agricultural entrepreneurs to renounce to participate, opting for activities that can potentially have negative repercussions on the supply of ESs. An exception is the case in which PES compensation increases in line with the price of raw materials (Engel and Palmer 2009). Therefore, it is required that the applied PES scheme has a suitable duration to guarantee the best results in terms of ESs provided, however it is also necessary for the scheme to be flexible and provided with the possibility of making changes in compliance to changes in the reference context. Therefore, the circular and discontinuous logic that the PES instrument must follow should be strongly and necessarily characterised by dynamism.

Although it is a source of additional costs, the control of the areas adjacent to the context where PES market is implemented proves to be strategic. It avoids that the improvement of the initial situation of the area affected by PES could produce detriment of neighbouring areas (“leakage” effect). To try to solve this negative effect interesting opportunities come from collective approaches in managing PES. In fact, it is necessary to emphasise the need to point out in developing PES schemes not exclusively the logic of individual profit but rather the need to act by cooperating to achieve benefits in favour of the whole community (Kolinjivadi *et al.* 2019; Narloch *et al.* 2012).

To guarantee an optimal implementation of PES it is necessary to pay attention to a double approach (Robinson and Keenan 2010): i) a top-down approach produces the necessary coordination in favour of agreements between a number of different stakeholders, the preparation of an adequate regulatory-institutional framework, adequate assistance and technical support for the development of sustainable activities; ii) a bottom-up approach, instead, could create among stakeholders an improved production of ESs. Both approaches have the same sharing vision and ideas that enhance the basis of the PES scheme.

Last not least, PES spontaneously developed by private individuals represents one of the most adequate instruments of intervention to guarantee the supply of ESs.

### 3. THE ROLE OF PUBLIC DECISION MAKERS

Although the PES are born as a market solution for the management of ESs, with the precise objective of being an alternative to the institutional public management, the role of PA in developing PES schemes has been decisive (Bateman *et al.* 2019). In particular, the role of the PA and of the communities in reducing transaction costs linked to the PES scheme creation seems to be fundamental.

The intervention of the PA aimed at supporting the dissemination of PES is important and can take place with different degrees of involvement. PA role can vary: it can adopt the more traditional role of decision-maker in the institutional framework, can act as intermediary, as well as promoter/financier of the PES, or can play the role of ESs seller. The latter is the case in which PA holds the ownership of the landscape-environmental resources from which the services object of negotiation derive. PES, in this case, becomes a tool to finance the conservation activity carried out by the PA.

By adopting its role of institutional decision-maker, PA can be present in a PES scheme in order to eliminate obstacles, to prevent or avoid difficulties for the start-up of a market between users and suppliers of ESs.

Among these obstacles, the role of PA to reduce the presence of high transaction costs related to the implementation of a PES scheme, as well as to the negotiation of the agreements, is significant. These costs are often due to the presence of supply and demand of ES benefits composed of several individual economic agents. Fundamental is the role that PA could play by connecting sellers and buyers, or by stimulating the market mechanism by providing adequate information, training and raising awareness of the community towards sustainable use of natural capital to avoid negative effects. The role of PA becomes important to increase citizens' awareness of the benefits received from landscape-environmental resources and their sustainable management, inducing them to support their protection, through the payment of an amount of financial resources for the benefit received.

Furthermore, PA has to guarantee to all citizens the right to enjoy the main ESs, even when they do not have enough financial resources to pay for their supply, avoiding looking at ESs as luxury goods. In this condition PA has to intervene by directly financing the creation of a PES, to guarantee an adequate wellbeing of citizens.

There are several examples of PES with the presence of PA as a buyer. The most common example in this context is the agri-environmental payment, which, through the European Union Rural Development Programs (RDs), encourages agricultural entrepreneurs to persevere in maintaining the landscape-environmental resources and in the provision of ESs in favour of the community.

Pagiola and Platais (2007) noted, however, that the PES financed by the PA (i.e. PA acts as a buyer on behalf of the users), as the aforementioned agri-environmental measures, are less efficient than those financed directly by users/beneficiaries. The inefficiency that characterises this role of PA derives, firstly from the lack of direct information of PA regarding the value perceived by the beneficiaries by using the ES. Secondly, the source of inefficiency is the impossibility of the PA itself to control directly the supply of the service.

Moreover, PES financed by PA are usually founded on the payment of uniform amounts to support the ESs suppliers; furthermore, they are characterised by modest spatial differentiations and lack of specific objectives in favour of the sites in which they are implemented.

In addition, Pagiola and Platais (2007) pointed out that often in PES where PA acts as a buyer on behalf of third parties, payment is linked to quantity of inputs rather than to the actual supply of the ES. The cause of this gap derives from the impossibility of observing the level of supply of ES. Consequently, to facilitate the implementation of PES PA adopts incentives linked to the use of productive factors (e.g. land use, use of water resources), creating potential distortions and decreasing the effectiveness and efficiency of PES.

Furthermore, PES financed by the PA could make citizens less responsible, eroding their sense moral duty towards ESs protection.

Nonetheless, in favour of the efficiency of PES financed by the PA acts the opportunity to realise scale economies in transaction costs, given the considerable dimension of both number of actors and area that characterises this type of PES scheme.

In a number of cases, however, PA direct financing of PES, even if less efficient, remains the best option. For example, when i) there is a significant conflict of interest between beneficiaries and suppliers of the ES; ii) the occurrence of an unexpected increase in transaction costs is a real risk; iii) there are incentives for opportunistic behaviour among users (Wunder *et al.* 2008). In addition, the role of PA direct financial support could be relevant when ESs provision does not currently have a defined buyer on the market and despite this lack of knowledge needs protection to perpetuate the provision of these benefits.

It was also pointed out that often the PES financed by PA are able to emphasise objectives in favour of the whole society compared to those pursued by private citizens. For example, PES financially supported by PA could aim to reduce poverty in developing countries. In these cases, the development of PES could supplement local income. Addressing these additional issues through PES on the one hand confirms the importance of institutional support in order to guarantee to the local population a certain level of well-being, on the other hand it can allow the achievement of the primary objectives of PES scheme, i.e. the maintenance of the supply of ESs.

#### 4. CONCLUSIONS

Still relevant are the difficulties to be faced in order to develop optimal PES schemes in favour of the landscape-environmental resources. Firstly, we have mentioned the difficulties related to the monetary evaluation of the ES, which is the first step in determining its price in a PES scheme, as well as the identification of the best type of contract to ensure optimal implementation from a social point of view. In addition, another fundamental step in implementing a PES tool is the need to proceed with the assessment of the positive/negative consequences arising from the application of this instrument. In detail, evaluation requires the ability to have appropriate indicators and to use a sufficiently wide period of time to observe and determine the effects of the PES on the natural capital including water resources. An operation that turns out to be anything but trivial.

The use of a PES also implies an aware implementation because it is not a neutral instrument, as it usually reflects the culture of the society in which it

is implemented (Vatn 2009). Moreover PES should be adapted to the context in which it is inserted. PES was seen by a number of local communities to represent privatisation and natural capital appropriation, but several studies prove its use becomes fundamental in order to support a sustainable development of the natural capital and the maintenance of the ESs provision.

Nonetheless, the positive repercussions that appear to come from a virtuous use of PES instrument in favour of water resources and more broadly of natural capital and its services conservation tends towards a broader future use of this incentive-based tool. According to Farley and Costanza (2010), Van Hecken and Bastiaensen (2010) by using a transdisciplinary approach based on considerations related not only to efficiency, but also to sustainability and equity, PES tool may be able to more effectively capture a number of the abovementioned benefits while avoiding the most problematic effects.

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