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Project evaluation models in payment for environmental services: a literature review

Modelos de avaliação de projetos de pagamento por serviços ambientais: uma revisão da literatura

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ABSTRACT

Worldwide, Payment for Environmental Services (PES) programs have become a popular economic incentive strategy for environmental conservation. As they are considered recently new policies, the evaluation models of these programs are still incipient and require research in the area. Simultaneously, this study sought to understand, through a systematic review of the literature, how the literature has reported the methods of evaluating projects in PES in the light of the Theory of Change (ToC). Based on the analysis of 22 scientific documents, it was identified that the reports related to the theme are still recent in the literature and very concentrated in the rural area. It was also clear the diversity of PES objectives that go beyond the issue of environmental conservation



and encompass the social sphere. The survey also identified many studies that permeate developing countries, where PES schemes contribute to socioeconomic development. Regarding ToC, it was noticed that this theory is closely linked to sustainable development and is strongly linked to the issue of measuring the efficiency of projects. Still, the existing PES project evaluation models are disparate and diverse and very much based on qualitative analysis, suggesting the need to quantify measurement data for such schemes to detect the possible impacts of the adoption of a scheme and its counterfactual impact in the socio-environmental environment.

Keywords: evaluation models, impact evaluation, payment for environmental services, theory of change.

RESUMO

Mundialmente os programas de Pagamento por Serviços Ambientais (PSA) têm se tornado uma estratégia popular de incentivo econômico para a conservação ambiental. Por serem consideradas políticas recentemente novas, os modelos de avaliações desses programas ainda são incipientes e demandam pesquisas na área. Neste ínterim, este estudo buscou compreender, através da revisão sistemática da literatura, como a literatura tem relatado os métodos de avaliação de projetos em PSA à luz da Teoria da Mudança (TM). A partir da análise de 22 documentos científicos, identificou-se que os relatos que tange ao tema ainda são recentes na literatura e muito concentrados na área rural. Também ficou clara a diversidade de objetivos de PSA que ultrapassam a questão da conservação ambiental e abrangem a esfera social. O levantamento também identificou muitos estudos que permeiam países em desenvolvimento, onde esquemas de PSA contribuem para o desenvolvimento socioeconômico. No que tange a TM, percebeu-se que tal teoria está muito atrelada ao desenvolvimento sustentável e é fortemente ligada à questão da mensuração da eficiência de projetos. Ainda, os modelos de avaliação de projetos de PSA existentes são díspares e diversos e muito baseados em análises qualitativas, sugerindo a necessidade de quantificar dados de mensuração para tais esquemas a fim de detectar os possíveis impactos que a adoção de um esquema e seu contrafactual impactam no meio socioambiental.

Palavras-chave: modelos de avaliação, avaliação de impacto, pagamento por serviços ambientais, teoria da mudança.

1 INTRODUCTION

The issue of environmental protection is one of the most debated in the world today. There is no speculative event about the future that no longer considers it essential. Environmental valuations, in the context of negative externalities, occur through economic instruments, such as taxes, fees, charges for use, market mechanisms of quotas,



which allocate prices according to scarcity and social cost (Ferreira et al., 2021; Jack & Jayachandran, 2018).

For the Organisation for Economic Cooperation and Development (OECD, 2018), environmental goods (or services) are those that aim to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise pollution and damage to ecosystems. In the meantime, preventive policies that advocate financial payment for human activities aimed at preserving/conserving environmental goods are present in the global environmental economy.

The current environmental valuation mechanisms follow three principles: (i) the attribution of values for use (user-pays); (ii) in the case of environmental damage, the attribution for preventing use (polluter-pays); and (iii) the attribution of values for the protection of natural resources (protector-receives), among which, we highlight, the principle of paying those who protect the environment. The protector-receiver principle emerged in the United States as a way to mitigate the negative impacts of agricultural activities in river basins, configuring the preventive policy of the so-called "Payments for Environmental Services (PSA)" (Pereira & Alves Sobrinho, 2017).

Currently, PSAs, also widely called Payment for Ecosystem Services (PSE), are discussed worldwide and focus on water, carbon, biodiversity and scenic beauties. Around the world, PSA is a topic of great relevance, as it stimulates the recovery and preservation of ecosystems and changes the relationship of government and state with landowners (Ruggiero et al., 2019; Wunder et al., 2020). In Brazil, specifically, there are several initiatives of PSA; including, the country is the most widespread, in world terms, in the practice of carbon credits market, which was implemented by the Kyoto Protocol and has direct impacts on the mitigation of global warming, the biggest environmental problem faced by society nowadays (Costedoat et al., 2015).

Therefore, around the world, the PSA, when applied in a structured manner, with governance, with transparency and legal certainty, is a mechanism capable of generating many benefits for all involved by ensuring a financial return for those who restore and conserve forests and landscapes (WRI Brasil, 2021).

Today, PSA has become an environmental management tool, complementing the policy tools that were previously largely focused on command and control measures



(Ezzine-De-Blas et al., 2016; Lapeyre et al., 2015). However, the context in which most PSA schemes operate is often characterised by high uncertainty in the accountability of environmental services, due to the biophysical complexities associated with the relationships between land use and these services (Pascual et al., 2010).

According to Wunder (2007), as PSA programmes are provided over time, one must always have an idea about what would hypothetically happen without the PSA scheme, i.e., build some counterfactual service baseline (Sills et al., 2006). In the words of Araújo (2019), environmental effectiveness is defined as the change in the provision of services induced by the programme, compared to what would happen in the absence of PSA intervention.

In this sense, evaluation is key to improving the effectiveness and efficiency of conservation programmes (Kleiman et al., 2016). Evaluating, therefore, PSA programmes is a way to understand how these policies impact the public involved (Bauchet et al., 2020). In addition, impact measurement is a gap that presents itself to investors, entrepreneurs and scholars who seek to measure the impact and transformation generated considering the hypotheses elaborated in the Theory of Change (TM) (Sugahara & Rodrigues, 2019).

In this context, this study seeks to understand, through the systematic literature review, how literature has reported the methods of evaluating PSA projects in light of TM. PSA schemes are recent and evidence about their effectiveness is still scarce and quite confusing (Araújo, 2019; Engel, 2015; Ferreira et al., 2021), since such schemes result from complex ecological and social processes and are interfered with by a range of spatio-temporal scales (Pascual et al., 2010). It is in the midst of this gap that the pertinence of this study is based on seeking to better understand the models of project evaluation in PSA. In addition, Börner et al. (2017) state that advances in project evaluation theory and research are needed to broaden human understanding of how such policies interact and benefit the socio-environmental environment.

In this same sense, Costedoat et al. (2015) add that PSA programmes are not easily measurable and that the recent development of evaluation methods is essential for counterfactual estimation of PSA programmes. This is because, in many biomes, given the overexploitation of the soil, there is a compromise in the capacity to offer



environmental services and, therefore, it is necessary to promote actions aimed primarily at the protection, sustainable use and recovery of ecosystems (Ferreira et al., 2021).

For example, the research by Ruggiero et al. (2019) demonstrated that PSA has a positive effect on forest cover and regeneration in the Brazilian Atlantic Forest; however, the overall conservation impact was relatively low and conservation gains were considered questionable. This proves the need for incremental planning and monitoring models of the actual effectiveness of the project.

This article is organised to include, in addition to this introduction, a theoretical reference in section two, which is composed of a brief history of payment for environmental services and the themes of project evaluation and the Theory of Change. The methodology used, in turn, is in section three; the analysis and discussion of the results, in section four; the final considerations in section five, followed by the references used throughout the development of this study.

2 THEORETICAL REFERENCE

2.1 PAYMENT FOR ENVIRONMENTAL SERVICES - PSA

The pioneering of the PSA is credited to the United States, which in 1985 implemented the *Conservation Reserve Programme*, which promoted economic incentive for land conservation practices on rural properties. Such a programme, with a PSA scheme, has as its greatest example the city of New York that, to meet the standards of the *Safe Drinking Water Act* of 1986, in 1997, opted to acquire and to recover areas of the *Catskill* basin to conserve the water supply instead of investing in a treatment plant (Pereira & Alves Sobrinho, 2017).

To this day, thanks to the partnership with rural landowners supported in the schemes of PSA, New York and some neighbouring cities still do not need to have a water treatment plant. The water is only chlorinated, fluoridated and drained by gravity. The water comes from the *Catskill* Mountains, at 1,200 metres (6,000 ft) altitude and 200 kilometres (120 mi) north of New York City. There, the rural landowners preserve their forests and adopt handling practices that do not pollute the waters. The City of New York funds farmers in the *Catskill* Mountains, where *Greene's* main springs are located, purchasing properties, renting land, paying farmers for the conservation of the water



sources and investing in the infrastructure of the site, such as the construction of bridges for crossing animals, the construction of tanks for storing manure and the payment, even, of the region's sewage system (Pereira & Alves Sobrinho, 2017).

In Latin America, the first formal PSA programmes (although not using such terminology) were started in the mid-1990s in the Cauca River valley in Colombia. But the PSA really took off after Costa Rica instituted the world's first federal PSA programme, the *Programme of Paid for Servicios Ambientales* (PPSA), in 1997 (Hanley & White, 2014; Martin-Ortega et al., 2013).

For the institutional sustainability of the PPSA, the Costa Rican government has enacted laws whose legal framework establishes the scope and recognition of environmental services, funding sources and governance mechanism. The financing mechanism was based on a fund, the *National Fund for Forestry Financing* (FONAFIFO), initially fed by a tax on fossil fuels, to remunerate landowners who conserved and restored the native forest. Currently, other sources also feed FONAFIFO, such as state financial contributions received from the Republic's ordinary and extraordinary budgets, donations or credits received from national and international organisations; and local private companies.

Mexico has also played an important role in PSA schemes. The Federal Government, through the National Forestry Commission (CONAFOR), instituted the Hydrological Environmental Services Programme (PSAH) in 2003 and the Carbon, Biodiversity and Agro-Forestry Services Payments Programme (PSA-CABSA) in 2004. These two programmes have evolved and since 2006 have been merged into the National PSA Programme. Currently, there are only two types of payments: for river basin services and for biodiversity conservation.

The Mexican experience in PSA is considered very flexible. Formed from a subsidy programme promoted by the federal government to guarantee the conservation of the forest, it has undergone adaptations and evolved, from payments based on the non-use of forests, to a programme that promotes management practices to maintain and to improve the provision of ecosystem services with the current focus on water resources. As it is designed and implemented on a national scale, there was also a need for local PSA mechanisms through matching funds. Local and regional processes are promoted, since



2008, by combining national and local efforts by establishing partnerships with local governments, the private sector and universities (Pereira & Alves Sobrinho, 2017).

The basic idea of PSA, therefore, is to remunerate those who preserve (directly or indirectly) the environment (Costedoat et al., 2015; Le Velly & Dutilly, 2016; Ruggiero et al., 2019). Basically "paying a certain amount to those who keep trees standing." By definition, PSAs are mechanisms that reward or reward those who protect nature. It is a way of "pricing" environmental goods and services and stimulating conservation, assigning them a value and constituting a market for carbon credit exchange, water conservation, the creation of ecological taxes, sustainable forest exploitation, sustainable use of biodiversity and ecotourism (Engel, 2015; Jack & Jayachandran, 2018).

With this, the environmental services are those rendered silently by nature, related to the carbon cycle, the hydrological cycle, scenic beauties, the preservation of the soil, biodiversity, among others. By means of the PSA, it is possible to have more security with respect to the preservation of genetic heritage and traditional knowledge, as well as to develop actions for the regulation of the climate and the reduction of deforestation, above all within rural properties. Thus, the PSA contributes to a greater incentive for the development of sustainable farming (Araújo, 2019; Tacconi, 2012).

The PSA remunerates rural producers, family farmers, rural settlers, traditional communities and indigenous peoples for environmental services that benefit society. It is the government, non-governmental organisations (NGOs) and even private companies that are paying for it, that is to say, the whole of society. Thus, for the PSA to make sense, environmental preservation has to be more profitable than its destruction, i.e., the gains made by the provider of ecological services have to be more significant than those that would potentially be obtained in other economic activities (Tacconi, 2012).

Ezzine-De-Blas et al. (2016), payments can be made in several ways: direct (monetary or otherwise), by providing social improvements to rural and urban communities, by offsetting linked to emission reduction certificate for deforestation and degradation, by lending through the environmental reserve quota established by the Forestry Code and by means of green bonds (*green bonds*).

There are several types of PSA modalities: (a) conservation of native vegetation; (b) restoration of degraded areas; (c) improvement of water quality; (d) carbon



sequestration; and (e) maintenance of biodiversity (Hanley & White, 2014). Among the various objectives of the PSA, the most common include: a) maintaining, restoring or improving vegetation cover in areas considered a priority for conservation; b) combating *habitat* fragmentation; c) the formation of biodiversity corridors; and d) water conservation (Engel, 2015; Le Velly & Dutilly, 2016).

Brazil has had successful examples of ASF, which have begun to appear since the 90s. The Socio-environmental Development Programme of Rural Family Production (Proambiente) and the Bolsa Floresta, created in 2003 and 2007, respectively, as pioneering programmes of PSA and of greater relevance in terms of the use of PSA schemes in the Amazon, linking to environmental services linked to carbon, water, soil quality and biodiversity. But it was the Water Producer Programme that stood out in the Federal ambit. This Programme starts with the concept of protector-receiver and aims to complement the user-pays and/or polluter-pays policies for the conservation of water resources.

Before the appearance of the Federal Law sanctioned to regulate the PSA in Brazil, the Water Producer Programme was guided in financial compensation to rural producers who voluntarily propose to adopt conservationist practices and management to reduce rural water erosion. This Programme was created in 2001 by the National Agency for Water and Basic Sanitation (ANA). It spread through almost all the states of Brazil and more intensely in Minas Gerais, the state that implemented, in 2006, the first project of this programme, the Water Conservator in the municipality of Extrema (Ferreira et al., 2021).

Recently in Brazil, legislation on PSA, which originates in the Forestry Code of 2012, was instituted in 2021, starting with Law No. 14,119 and Decree No. 10,828, both of the Federal Government. Law 14,119/21 was approved in January and it is a form of incentive for conservation and sustainable development for remuneration in exchange for the well preserved. The text creates a national policy, but the federal government vetoed the formation of a collegiate body to define the application of resources and the creation of a national cadastre on payments (Ferreira et al., 2021).

PSA initiatives are recurrent around the world. According to Pereira and Alves Sobrinho (2017) there are records of influential programmes that have taken place in



Ecuador, Peru, China, Japan, South Africa, Germany and France. The following section presents some models for evaluating projects in PSA, in order to measure their effectiveness.

2.2 PROJECT EVALUATION

Evaluation is the process of making value judgements on the activities and results of a project, policy or strategy (Kleiman et al., 2016). Impact assessment necessarily entails two elements: (i) constructing a detailed and precise description of the performance of a programme; and (ii) comparing with a pre-established criterion or standard for judging performance (Cotta, 2014).

When it comes to evaluation, there is a very wide range of evaluation methods that can be made. For example, programme evaluation is an evaluation category, which itself also has at least five sub-categories of types of evaluations: needs assessment, theoretical evaluation, process evaluation, impact assessment and efficiency evaluation (Kleiman et al., 2016).

The needs assessment comprises a systematic study that identifies the nature, scope and causes of a need. This type of assessment defines and describes the target population to be met, as well as determines the intervention necessary to solve the need (Costa & Castanhar, 2003).

On the other hand, the theoretical evaluation assesses the theory that is behind the programme, that is, verifies if it is viable and feasible and if it attends to the needs of the target population. Specifically, the theoretical evaluation describes the theory and therefore gives rise to the nomenclature of the so-called "Theory of Change" (TM), as well as determining the quality of the project through literature review, expert panel and interviews (Cotta, 2014). This will be best for TM in topic 2.3.

Process evaluation, in turn, is known as "from theory to practise". While TM says how the programme should work, the process evaluation studies what happens in practice and therefore evaluates the implementation of a programme. In other words, the process evaluation is descriptive evidence, it is carried out during the implementation of the programme, it measures progress against objectives, it can be carried out by the



programme team or by the external partner and it predicts continuous and frequent monitoring (Costa & Castanhar, 2003).

The impact assessment, once, aims to identify the changes attributable to the programme. This assessment subcategory measures how much progress against objectives is caused by the programme (Sills et al., 2006). Preferably, the impact assessment is carried out externally with the support of the programme teams. It is punctual and time-limited, and offers causal evidence. It is also designed before implementation, with the final results after the programme is implemented (Finkler & Dellaglio, 2013). The impact assessment is measured by subtracting the result that these same beneficiaries would obtain in the hypothetical case of not participating in the programme (Costa & Castanhar, 2003).

Usually, the impact is assessed for three main reasons: i) improving the programme, i.e. generating information focused on the design or redesign of the programme, with the purpose of improving its performance and its results (finding concrete solutions and implementing them in the short term, besides allowing to understand the relative importance of the components and processes of the programme); ii) making public spending more efficient, by emitting a judgement on the efficient use of resources (useful for making decisions in relation to the allocation of resources and the continuity of the programme, since it interests high level decision makers (e.g. governors, mayors, legislators); and iii) generating knowledge about public policies, i.e.g. knowledge in social and economic sciences (produces knowledge about the mechanisms and effects of an intervention, as well as serving as a basis for innovations and new approaches, with potential for replications and for gains in scale) (Costa & Castanhar, 2003).

One assesses the impact when there are unanswered causal questions, when there is uncertainty about the best intervention strategy to tackle a problem, when a pilot programme is being implemented, when a programme is expected to be extended, when a programme is being implemented gradually, or when the programme incorporates new services or new beneficiaries (Finkler & Dellaglio, 2013).



Finally, the efficiency assessment is a cost-benefit analysis, because it compares the benefits (results) of the programme with its costs (resources used). Such an assessment implies monetizing the costs and benefits and is usually carried out *ex ante*. When it comes to the cost-effectiveness analysis, the efficiency assessment compares the change in the main impact variable with the programme costs and thereby allows comparing the relative impact of different interventions. In this case, it is usually performed *ex-post* (Cotta, 2014).

In light of the above, it should be noted that evaluation methodologies include evaluating the best use of resources in the search for the best possible result, bringing a continuous improvement in strategies, programmes and public policies (Cotta, 2014). Specifically in projects involving PSA schemes, the evaluation seeks to understand, besides the issue of project transparency (Tacconi, 2012), an expansion of sustainable development results (Martin-Ortega et al., 2013). The following section focuses on the Theory of Change and its relationship to Environmental Services Payments.

2.3 THEORY OF CHANGE - TM

It was observed that the theoretical evaluation gave rise to the "Theory of Change". TM is a broad and illustrated description of how a change is expected to happen in a particular context. More specifically, it is a means of having knowledge of how far one goes (results) and how one arrives (processes), since it details all the implicit changes that have to occur between the activities of a programme and its long-term objectives (Santos et al., 2022).

This theory aims at communication and description of intervention, design of intervention and strategic planning, and monitoring and evaluation. Basically, TM gives rise to the so-called "logical milestone", which consists of a tool that shows how the activities of a project relate to its results, objectives and impacts (Rodrigues, 2019). Thus, TM can have different forms, which consists of a dynamic map on the programme, which shows the cause and effect relationship between the different elements and the results of an intervention, and is a tool not only descriptive but explanatory, whose results have contextual influence (ENAP; J-PAL, 2022).



The TM is therefore important as it helps to design the impact assessment, by allowing to identify the evaluation questions, generally related to the assumptions identified by the TM, and by helping to define what data to collect and what variables to measure, more specifically to understand the "why" of a programme to generate certain results and consequently to define more generalisable knowledge and mechanisms to replicate programmes in different contexts (Santos et al., 2022).

The formation of TM takes place in five steps: i) the definition of purpose, ii) the completion of the causal chain, iii) the identification of premises and risks, iv) the summary of the causal hypothesis, and v) the definition of indicators. As for the "definition of purpose", this should aim at the macro change that is to be achieved with the programme. It can also be thought of as the "reason why the programme exists" and often resembles the mission of the organisation implementing the programme (Gertler et al., 2018; Lankford et al., 2016).

In relation to the causal chain, this implies five levels, as illustrated in Figure 1. Brown et al. (2022), the TM itself is often represented in diagram format. As the chain indicates, first we need to identify the problems and needs, which explain the shortcomings that we want to face, not the objective that we want to achieve, specify the target population and which are directly related to the results of the programme. Secondly, we must map out the final results, that is, the long-term changes that we want to achieve with the programme. They are the advancement in the state of development of the target population and that are directly related to the needs (Gertler et al., 2018).

Afterwards, intermediate results must be defined, which implies the changes that take place due to the intervention and that are necessary to achieve the result, and changes in attitudes, knowledge, skills and behaviour desired. These changes are one of the main focuses of the impact assessments (Gertler et al., 2018). Consequently, the products must be defined, that is to say, the direct results of the programmed activities, which are often a reformulation of the activities from the point of view of the beneficiaries. Just as one must think about inputs and activities, that is, the resources and actions important to reach the programme products, from the point of view of who implements it (Gertler et al., 2018).

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Source: ENAP and J-PAL (2022).

After completing the causal chain is the time to identify the premises and risks. Assumptions are necessary external conditions that must be met in order for the causal chain established in TM to be valid. The risks comprise the unexpected negative effects generated by the programme. In the context of an impact assessment, assumptions and risks can be research questions that an impact assessment can answer (Finkler & Dellaglio, 2013).

It is also important to summarise the causal hypothesis in a sentence: "If [activities] generate [products], this should lead to [intermediate results] that will ultimately improve [final results], contributing to [purpose]" (ENAP; J-PAL, 2022).

Finally, it is essential to define indicators. In order to assess whether a programme is successful or not, tangible results need to be measured. Indicators should be developed to quantify inputs/activities, evaluate programme implementation, quantify results and impacts and record the perceptions of those in the programme (Jannuzzi, 2014). In this context, many studies use TM to highlight the role of implementation contexts and policy design in determining the environmental and socioeconomic outcomes of PSA initiatives (Börner et al., 2017).

3 METHODS

The present study has exploratory objective, theoretical nature and qualitative approach, starting from the collection of secondary data (Gil, 2010). As a research strategy, a systematic literature review was adopted, which, according to Okoli et al.



(2019) is a type of research that focuses on a well-defined issue that aims to identify,

select, evaluate, and synthesise evidence. In this case, we sought to identify how the literature has reported the methods of evaluation of projects in PSA in light of TM.

As for the data collection strategy, the textual search procedure was used by means of *boolean strings* defined in the search fields of the following databases: *Web of Science* (WoS), *Scopus*, and Google Academic.

These bases were chosen for being internationally known, indexing journals in several thematic areas, being widely used by researchers of different levels and academic backgrounds, and presenting a large number of documents (Bautista-Bernal et al., 2021; Bretas & Alon, 2021; Ji et al., 2020; Khatib et al., 2022; Nobanee et al., 2021).

The collection took place in the second half of 2022 and considered articles from magazines and annals of congress, in all stages of publication, written in English, Portuguese or Spanish. The search considered all the indices of the bases, as well as covering all the areas of knowledge. Given that each database has its own search characteristics, the *string* has been adapted, but in general the following syntax has been used: (*Theory of Change OR Impact Assessment OR Social Impact OR Economic Impact OR Development Public Policies*) AND (Payments for Environmental Services OR Ecosystem Services OR PSA OR PSE).

In all, 26 documents were identified, four of which were not possible to analyse, because they were closed access. The articles, in turn, were selected and managed through the *Mendeley software*. It is worth noting that, for the selection of the material, use was made of the PRISMA (Main Items for Reporting Systematic Reviews and Meta-analyses) protocol, which is configured as a *checklist* composed of several items that aim to improve the reporting of systematic reviews (Page et al., 2021). By means of this protocol, it is also possible to narrow down the data and to select the articles with greater affection for the objetive of the study. Thus, figure 2 was created to illustrate the five methodological steps taken in this research.

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Source: Prepared by the authors (2023).

4 ANALYSIS AND DISCUSSION

From the methodological description discussed above, the documents were analysed especially in terms of objective and methodology, how they approach TM and its relationship with Environmental Services Payments and the main findings and conclusions. Table 1 summarises the analyses.

Article	Purpose and Methodology	How to approach TM and PSA	Findings and conclusions
van Noord- wijk et al. (2014)	Review local perspectives on food se- curity for four forest and landscape transition configurations in Southeast Asia, by case study.	TM is the current generic basis for achieving food se- curity, aligned with the "place theory".	There is a complexity when it comes to 'forest' and 'agriculture' and the PSA acts as a means of transition and communication for achieving food security.
Lapeyre et al. (2015)	Provide an analysis of a PSA scheme in the Cidanau watershed in Indonesia from interviews with 207 farmers.	Based on the standard PSA TM it can be assumed that farmers respond to pay- ments and change their land use decisions according to the provision of environ- mental services.	Land use patterns may not de- pend only on economic incen- tive; rather, they are likely to be determined by the local social context, traditions and economic dependence of forests.
Game et al. (2018)	Illustrate how result chains can be transformed into diffuse models of so- cio-ecological systems and how these models can be used to explore the ex- pected social and environmental im- pacts of conservation actions, by a case study.	It doesn't.	Presentation of indicators for a water fund, to be used in an in- creasingly popular and multi- purpose conservation strategy.
Lank- ford et	Propose the adoption of a theory of change to help global, national and	TM acts as a base to pro- mote transformational	TM, expressed as a global irriga- tion pact, recognises the need for



al. (2016)	local actors discuss the transforma- tional changes needed to improve the performance of large-scale irrigation.	changes in large-scale irri- gation centred on a global irrigation pact.	greater emphasis on resource sharing, knowledge, problems, risks and benefits by and among many other types of stakehold- ers, especially irrigation.
Wegner (2016)	Focus on four main aspects of PSA: ef- ficiency in environmental preservation, impacts on the well-being of local land users, interaction with local distributive justice norms and environmental man- agement, and interaction with broader national policies and socio-economic trends from the literature review.	It doesn't.	A flexible, participatory and in- tegrated PSA concept that can better explain this variety of physical, socioeconomic, and normative factors is proposed as better able to provide efficient, equitable, and resilient conserva- tion outcomes.
Varia et al. (2020)	Present a case study based on the Sys- tems Dynamics Approach, whose aim is to support policy and decision mak- ers to design effective policy strategies to promote the adoption of conservation agriculture practices in Sicily.	It doesn't.	In a long-term dynamic context, the PSA scheme provided does not represent the only driving force in the system to guide farmers towards the expected shift from conventional agricul- ture to conservationist agricul- ture. There is a need for deeper integration with other policies and interventions.
Börner et al. (2017)	Summarise research on the effective- ness of PSAs in achieving environmen- tal objectives and socio-economic co- benefits in various contexts.	TM highlights the role of: (1) contextual dimensions (political, institutional and socioeconomic conditions, spatial heterogeneity in en- vironmental service values and provision costs and in- teractions with existing pre- policies) and (2) schema de- sign (type and level of pay- ment, contract duration, tar- geting and differentiation of payments) in determining environmental and socioec- onomic outcomes.	The review suggests that the ef- fectiveness of the programme of- ten falls short of the expectations of early theorists. However, it was also found that the theory advanced enough to identify the common reasons why payment schemes fail or are successful. In addition, payment schemes are often implemented together with other policy instruments in so- called policy combinations. Ad- vances in evaluation theory and research are needed to improve our understanding of how such policy combinations interact with the targeted socio-ecologi- cal systems.
Cowie et al. (2018)	Present a scientific conceptual frame- work for the issue of neutrality of land degradation.	It doesn't.	Creation of a conceptual <i>frame-</i> <i>work</i> based on five modules.
Eshoo et al. (2018)	Test a model that uses a direct pay- ments approach to create ecotourism in- centives for residents to increase wild- life populations, through a case study.	Implementation of conser- vation strategies.	The results illustrate how an eco- tourism strategy using direct payments for wildlife sightings, along with a simple wildlife monitoring system, can increase an enforcement strategy to

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			reduce the threat of hunting and illegal trade.
Qiu et al. (2018)	Present the fundamental and guiding concepts of causal chains that link dis- ciplines and sectors that often do not in- tersect to elucidate the effects of ac- tions on ecosystems and society.	The TM and the disparities stemming from the chal- lenges of implementing sus- tainability practices.	Causal chains are well-posi- tioned to fill the sustainability gap, to provide a common framework for understanding the dynamics and interactions of coupled human-natural systems, to support evidence-based deci- sion-making, and to serve as a transformative approach to inte- grating systems in the new era of man-nature-related complex, practical, and political research.
Tengber g and Valencia (2018)	Conduct a random sample analysis of integrated <i>Global Environmental Facil-</i> <i>ity</i> projects and in-depth case studies demonstrating lessons learned and good practices.	It proposes a TM for inte- grated natural resource management projects, where short-term environ- mental and socio-economic benefits will be accumu- lated first at the local level.	The evolving scientific under- standing of factors influencing social, technical, and institu- tional innovations and transitions to sustainable natural resource management should be har- nessed and integrated into mod- els of influence and the theory of change to complex socio-envi- ronmental problems such as land degradation, and be combined with updated approaches to learning, adaptive management, and expansion.
Larson et al. (2019)	Develop an approach to impact assess- ment through qualitative research.	TM as a basis for human well-being.	Providing an assessment tool.
Ma- ganhini (2019)	Discuss concepts such as development and development as freedom through documents from institutions dealing with the environment.	It doesn't.	The action of the PSA, as an economic instrument of environ- mental management, is strategic, and represents an exercise of freedom, both instrumental and substantial as proposed by the theory of democracy as freedom.
van Noord- wijk (2019);	Review how innovation in technolo- gies, institutions and policies has been triggered and analysed, and how the adoption and reform of institutions and policies can contribute to more sustain- able agricultural practices, within the broader SDG framework, through liter- ature review.	TM is an integrated ap- proach to developing re- search in the rural area, in which it can impact on pov- erty reduction.	It offers a portfolio of "solu- tions" to deal with the complexi- ties of the concept of sustainable development.
Sug- ahara and Ro- drigues	Point out the importance of TM as a means of impact assessment in social business, in order to to demonstrate what are the essential	In the impact assessment process, the preparation of the TM, when aligned with the objectives of the	Social businesses, in the prepara- tion of TM, need to draw up the impact measurement plan based on the elements of resources,



(2019)	elements of the evaluation process, through bibliographic research.	transformation that is sought, can determine the measurement of the result and the impact generated to the public concerned.	activities, results and impacts in order to represent the identity of their institutional logics.
Bauchet et al. (2020)	Understand how PES are practised from interviews with administrators of 39 PES programmes active in the An- des.	Through TM sustainability can be effectively achieved in the PSE programmes.	Understanding PES objectives, payment methods, sources of funding, barriers and condition- alities. The paper highlights the importance of collaboration be- tween academics and PES pro- fessionals to address the dispari- ties between academically <i>pro-</i> <i>moted</i> design principles and practical implementation.
Thomp- son (2022)	Examine recent investments that have an impact on biodiversity conservation through content analysis in five pro- jects.	It examines whether dual objectives (profit and socio- environmental impact) are achievable, assessing finan- cial risks and impact risks within the change theory of each project.	There are uncertainties about the generation of profit in some pro- jects, as well as the expected re- turn delivery to investors.
Wiik et al. (2020)	Explore the impact of <i>Watershared</i> , an incentive-based conservation pro- gramme in the Bolivian Andes, through interviews.	TM supports the interven- tion to structure the project evaluation.	The paper is one of the first re- ports recorded in conservation science and demonstrates how pre-registration can help make complex research projects more transparent, avoid selective choices and reduce publication bias.
Wunder et al. (2020)	Develop a theory of change to PSA to review its imminent strengths and weaknesses in light of a growing body of impact assessment studies.	PSA recipients will really feel positively motivated in their environmental actions (land and resource use) by the extrinsic PSA rewards they receive.	SSPs are probably at least as environmentally additional as other conservation tools, based on limited evidence. The original vision of PSA as being direct, flexible, and potentially effective remains valid, but the design and implementation of PSA needs to be updated in its cost-effective functioning to better realise this potential.
Brown et al. (2022)	Provide a framework for methodical analysis of climate change impacts.	TM helps achieve the goals of conservation and human well-being.	The <i>framework</i> helps bridge the gap between conservation and climate change research commu- nities to ensure that conservation planning appropriately incorpo- rates climate science in a mean- ingful way to inform the devel- opment of appropriate conserva- tion strategies.



Hajjar et al. (2021)	Understand which policies, which pro- grammes, which technologies and which forest management strategies have been effective in alleviating pov- erty through desk analysis.	TM as a means of poverty relief.	Some of the strongest evidence for poverty reduction came from ecotourism, community forestry management, agroforestry and, to a lesser extent, PSA.
Seghieri et al. (2021)	Present a case of application of the TM concept to test this assumption in four African agroforestry systems.	TM applied to a research project exploits causal chains that are expected to result in impact, based on the results of the research and expected results in dif- ferent stakeholder groups involved in a set of inter- ventions.	TM-based development ap- proaches are promising, although evidence of their effectiveness in producing desired outcomes and impacts is a continuous process.

Source: Prepared by the authors (2023).

It was observed that worldwide, PSA schemes have become very popular tools for the preservation and restoration of ecosystem services (Le Velly & Dutilly, 2016; Pagiola et al., 2013), setting economic incentives for environmental conservation (Ruggiero et al., 2019). PSA schemes have also become a popular strategy complementary to existing conservation strategies, such as protected areas (Ruggiero et al., 2019; Wunder et al., 2020).

From the analysis of the material collected, it was identified that in fact the theme is recent, given that the oldest publication, through the search filter adopted, is from 2015. Also, there is a propensity for studies to belong to the rural area (Lapeyre et al., 2015b; van Noordwijk, 2019; van Noordwijk et al., 2014; Varia et al., 2020). Such evidence goes to meet what Pagiola et al. (2013) they argue. For the authors, the PSA, nowadays, is one of the instruments of climate change policies that aims to encourage the conservation and restoration of forests, and the adoption of more sustainable productive systems in rural properties.

A great diversity of PSA programmes was also noted, in addition to the conservation issue (Game et al., 2018; Tengberg & Valencia, 2018; Wiik et al., 2020), to consider application in irrigation systems (Lankford et al., 2016), ecotourism (Eshoo et al., 2018), poverty alleviation (Hajjar et al., 2021), social impacts (Game et al., 2018; Larson al., 2019), among others. This evidence corroborates the narratives of previous studies that claim that PSA programmes generally have multiple goals and that act in

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different areas in addition to environmental preservation (Engel, 2015; Le Velly & Dutilly, 2016). In addition, it has been identified that literature is broader when speaking of PSA than PSE (Hajjar et al., 2021; Tengberg & Valencia, 2018), since PSA programmes encompass the social strand.

It is also noted that PSA programmes are seen as a promising tool in many developing countries, as demonstrated in the study by Costedoat et al. (2015), where intervention via PSA schemes is a way to contribute to socioeconomic development.

With regard to TM and PSA programmes, it can be seen that TM serves as a very broad basis for implementing sustainability-orientated practices. Basically in all studies that bring TM, there are assumptions that, if met, can assist in the process of change and in the increase of environmental conservation, poverty alleviation and improvement of quality of life and human well-being (Lankford et al., 2016). Also, TM is also addressed as a means of assessing policy impact in order to highlight the essential elements of the evaluation process (Sugahara & Rodrigues, 2019; Wegner, 2016).

As for the models for evaluating the programmes reported in the studies, these are diverse. Eshoo et al. (2018), for example, the authors identified that an ecotourism strategy using direct payments for wildlife sightings, coupled with a simple wildlife monitoring system, can increase a enforcement strategy to reduce the threat of hunting and illegal trade. The application of causal chain theory was also identified as a means of elucidating the effects of actions on ecosystems and society (Game et al., 2018; Qiu et al., 2018; Seghieri et al., 2021).

Although some studies offer some project evaluation indicators (Game et al., 2018; Seghieri et al., 2021; Wunder et al., 2020) and some *frameworks* proposals to assist in project evaluation (Brown et al., 2022; Cowie et al., 2018), there is still a shortage of evaluation models. Such evidence can be justified given the range of socio-economic and environmental factors that determine the impact of PSA (Börner et al., 2017). For Wiik et al. (2020), impacts may also differ across strata of society and take time to materialise and become apparent to the point of being measured.

It is worth noting that the vast majority of studies are qualitative (Larson et al., 2019) or are case studies (Eshoo et al., 2018; Game et al., 2018; Tengberg & Valencia, 2018; van Noordwijk, 2019; Varia et al., 2020), interviews (Bauchet et al., 2020; Lapeyre



et al., 2015a; Wiik et al. 2020) and desk review (Sugahara & Rodrigues, 2019; van Noordwijk, 2019; Wegner, 2016). This detection corroborates Ezzine-De-Blas et al. (2016), which state that it is not yet known, quantitatively, what the real contribution of PSA schemes is and whether such mechanisms are more effective, for example, than traditional soil and water conservation projects that do not involve PSA.

5 FINAL CONSIDERATIONS

This is a study still in its initial stage that sought to understand, through the systematic review of the literature, how the literature has reported the methods of evaluation of projects in PSA in light of TM. From the analysis of 22 scientific documents, it was identified that the reports that touch on the theme are still recent in the literature and very concentrated in the rural area. It was also clear the diversity of PSA objectives that go beyond the issue of environmental conservation and encompass the social sphere. The survey also identified many studies that permeate developing countries, where PSA schemes contribute to socioeconomic development.

As far as TM is concerned, it was realised that such a theory is very much tied to sustainable development and is strongly linked to the question of measuring the efficiency of projects. Also, the evaluation models of existing PSA projects are disparate and diverse and based heavily on qualitative analyses, suggesting the need to quantify measurement data for such schemes in order to detect the possible impacts that the adoption of a scheme and its counterfactual impact on the socio-environmental environment.

Therefore, from the theoretical point of view, this survey summarises the theoretical reports coming from the project evaluation models in PSA and brings scientific perspectives that justify possible failures of schemes that fail right away in the design of the project. Also clear were some gaps that demand research in PSA and that aim for greater efficiency of the resources employed and expansion of the scope served. For example, it is suggested to use quantitative methods for impact assessment of PSA projects within the Theory of Change, since most studies, so far, are descriptive.

Already from a practical perspective, this literature review states that evaluations should develop criteria to define success based on the goals defined by the conservation programme. More specifically, the reports found from the analysis of the literature,



together with the theoretical reference addressed, serve as the basis for the establishment of projects in general, including PSA schemes.

Despite the attempt to bring as much rigour and methodological detail as possible, this study has some limitations related to the cut-off proposed for the selection and analysis of documents. Therefore, we encourage new research that updates and expands the scope of this article, to include *search strings* that cover other fields, other types of documents, languages, areas of knowledge and other databases.





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