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Payment for Environmental Services: Concept versus Practice in Indonesia's Citarum Basin

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Abstract

The Citarum basin is in critical condition owing to various factors, such as pervasive upland farming and a high rate of land conversion, that have intensified water pollution and land degradation. Considering the extent of ecosystem alteration, a system of payment for environmental services (PES) is an option for the environmental recovery of the area. However, a greater understanding of the stages of practical implementation of this new tool is necessary in Asia, as this region seems to diverge significantly from PES's theoretical characterization. To this end, this study applies Wunder's conceptual framework to examine how the concept of PES is translated into practice and how arrangements are needed to accommodate the contextual realities of the Citarum basin. The analysis presents the variances that exist between current practical schemes and PES conceptual characterization, some of which seem to be justified by contextual needs, while others seem to compromise the program's essential nature and ultimate objective as a market-based mechanism.

Keywords: Citarum; PES; agroforestry; market-approach; Wunders' conceptual framework

1. Introduction

The Citarum is considered the world's most polluted river, and it figures significantly in the overall concerns of watershed management in Indonesia. According to the government's 2005 State of the Environment Report, "65 of the country's 400 watershed areas are in critical condition (doubling from 32 in 1992)" [1: 5]. 17 of these are in Java, where the majority of the country's population, 221 million people, live [1].

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The upper area of the Citarum basin within the Bandung district is characterized by pervasive upland farming and harvest practices that lack adequate cover and protection from soil erosion. Upland farming expanded from 6,000 hectares (ha) in 1992 to 37,000 ha in 2001. This has come mostly at the expense of primary forests, which declined from 35,000 ha in 1992 to 19,000 ha in 2001, constituting a more than 40% reduction. Meanwhile, urban settlements are expanding through the conversion of surrounding paddy fields [2]. In the last ten years, land conversion has reached almost 80% in the Citarum watershed, consequently intensifying land degradation problems, sedimentation, and water contamination, as well as increasing the frequency and severity of natural disasters, such as landslides and floods [1, 2, 3].

In the presence of such ecosystem alterations, which have triggered a series of negative impacts affecting human well-being, one option for environmental recovery in the basin is payment for environmental/ecosystem services (PES). PES is a market-approach instrument based on the principle of “beneficiary pays” rather than “polluter pays”. The scheme consists of offering incentives, commonly cash payments, to farmers, landowners, or others entrusted, in return, with protecting or enhancing the ecosystem and thus providing an environmental service (ES). This promising tool for environmental conservation, expected to be more cost-effective than indirect financing approaches and accessible for multi-stakeholder participation [4], has produced successful results in some Latin American countries, including Costa Rica. As a result, there is a growing interest in PES, evidenced through an increasing number of projects being implemented around the world. By 2006, it had been documented 123 initiatives in developing countries, 57.72% of which were occurring in Latin America, 29.26% in Asia, and 10.56% in Africa [5].

PES theory has gradually been refined and improved. Costa Rica’s successful example contributed heavily to PES conceptualization, in particular to the five-criteria framework developed by Wunder in 2005 [6], which defines the scheme as (i) a voluntary transaction, (ii) possessing a well-defined environmental service, (iii) at least one buyer, (iv) at least one provider or seller, and (v) meeting conditionality [6]. These are the fundamental criteria necessary to achieve efficiency as a market-based instrument. However, field experience has proved that meeting Wunder’s five criteria is difficult, prompting a consideration of contextual differences, focused on the aspects of equity and fairness within the programs. In developing countries, PES schemes are established in areas that target the poor or other vulnerable social groups. In these cases, the perception of fairness (i.e., access and benefit sharing) is a key factor in determining the scheme’s feasibility and achieving acceptance and legitimacy [7]. They even have an impact on reducing poverty. Attempts to achieve efficiency and equity have been seen in the Rewarding the Upland Poor in Asia for Environmental Services (RUPES) Program, initiated in Southeast Asian countries, but no evidence on poverty alleviation has been collected yet. This is where a distinct separation can be observed between efficiency and equity within the conceptualization of PES. Specifically, some scholars consider these instruments as intended “for improving the efficiency of natural resource management and not necessarily for alleviating poverty” [7: 1203], whereas others support the inclusion of social aspects such as equity. Whether the schemes focus on efficiency, which has proven to be hard to achieve in many developing countries in Asia, or strive for a more balanced PES that incorporates aspects of equity, the viability and sustainability of on-the-ground PES programs remains uncertain.

Although the literature concerning PES is expanding, particularly those studies that emphasize the advantages of investing in natural capital that can make economic, social, and policy sense [8], there is still a dearth of case studies that can provide practical lessons. In Asia, PES schemes are still in the preliminary stages. Indonesia, a world leader in biodiversity as well as population (approximately 238 million in 2010, [9]), faces the constant challenge of effectively addressing environmental issues regarding the loss of biodiversity, due to high deforestation rates and pollution, while also supporting the livelihoods of the people and the country's economy as a whole. Incentive mechanisms such as PES have high potential for environmental conservation, which is why there are about eight identifiable projects being implemented nationwide. Two of these are in the Citarum basin, a challenging situation for which studies are still limited. Considering the importance of addressing issues in this area, this study aims to contribute, using practical examples, to the understanding of how the PES concept is translated into practice and how arrangements are made to match the realities of the context, which might diverge from the PES theoretical framework.

This study uses the conceptual framework developed by Wunder [6] to contrast the reality of current schemes in the Citarum basin with accepted PES theory. As PES has drawn substantial interest from the academia as well as from policymakers as a mechanism for achieving conservation and for potentially improving rural livelihoods, this study intends to contribute to the knowledge and evidence on how PES theory is translated into complex realities in Asia, region that challenge the viability of the pure PES concept. This study demonstrates that adaptations are necessary for workable and sustainable programs in Asia. A qualitative method is employed to analyze the rationality of the scheme arrangements and implementation, in view of their divergence from the theory. The latter includes interviews with farmers in the affected areas and with the programs' main implementers and intermediaries, as well as a review of secondary sources. The following section introduces the schemes in place in the Citarum context. Sections three and four present current PES schemes with respect to the gaps between concept and practice, and the real-life factors that necessitate a divergence from the rigid implementation from the theoretical framework. Finally, the paper ends with the conclusions and lessons drawn from PES practices in the Citarum basin.

2. Characteristics of the Citarum Basin and the PES program

The Citarum River, the largest in West Java, plays a crucial role in the basic well-being of the area's people and its economic activities [10]. This river is a source of water for about 25 million people spread across nine counties and three cities in West Java. The river irrigates more than 240,000 ha and is also a source of water intake for three hydropower dams (Jatiluhur, Cirata, and Saguling, in descending order of size) serving Java and Bali [3, 11]. Nevertheless, the river is being undervalued, as evidenced through various forms of degradation that constitute an overall challenge in Indonesia.

2.1 PES program initiatives

Although PES is not a panacea, it does offer a strategy for environmental management that could bring aggregated benefits, such as additional income for poor communities. Inspired by the success of payments for watershed services schemes in other developing countries such as Costa Rica, and taking into account other PES

initiatives within the country such as the Cidanau scheme, the Institute for Social and Economic Research, Education and Information (LP3ES; Lembaga Penelitian, Pendidikan dan Penerangan Ekonomi Sosial) initiated a PES pilot project as a facilitator with the financial assistance of the Asian Development Bank (ADB). With the intention of improving water quality and watershed service for downstream users (hydropower dams, etc.), the project identified as its main objective the reduction of erosion caused by agricultural farming in hilly areas. The upper reach of the Citarum catchments experience soil erosion of about 27.5 ton/ha per year [12] in areas where vegetable-based systems have the highest sediment yield [13]. In terms of environmental conservation, shifting the land use to forests would be the most efficient way to reduce erosion. However, this is not a viable option due to the area's high population density and the role of agriculture as the inhabitants' main occupation; instead, the intercropping of annual crops with trees was chosen. Two sites within the West Java region of the Citarum basin were deemed appropriate to address sedimentation and erosion problems and were selected for PES scheme development. These sites are as follows.

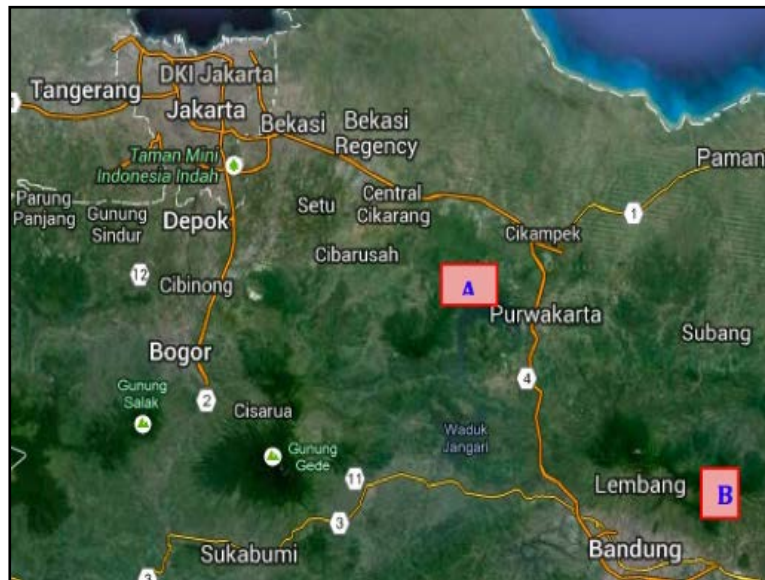
Table 1: Characteristics of Suntenjaya and Cikole village

	Suntenjaya village	Cikole village
Area	4.55 km ²	3.42 km ²
Location	Within the Lembang sub-district of the Bandung regency	Within the Lembang sub-district of the West Bandung regency
Population	7,301 by 2010 [15]	11,305 by 2006 [14].
Characteristics	This village has experienced land conversion to farming fields, which significantly increased after the Asian crisis in the late 1990s. The area's main economic activity is farming.	This village also faces land conversion, the main challenge being the building up of land. The area's main economic activities are based on dairy products, farming, and the recent development of ecotourism; the latter is a latent opportunity for the creation of other future PES schemes.

After some negotiations, schemes were initiated in 2009. In the case of Suntenjaya, parties include a group of sellers comprising 35 farmers who belong to an association called *Kelompok Tani Syurga Air* ("Farmers' Water Heaven") and a private water company, PT Aetra Air Jakarta, as a single buyer. PT Aetra Air Jakarta is a water-service company that supplies water from the Jatiluhur, a dam seriously affected, in terms of its capacity and useful life, by sedimentation. Their terms, which are sealed through a signed agreement, include the payment of a total amount of 50 million rupiah (IDR) for 22 ha, where agroforestry is to be managed by farmers offering the

ES. This contract is valid for seven years, whose terms include 50% of the payment during the first month, followed by two more disbursements of 25% each during the following six months after initiation. In Cikole, negotiation occurred between 84 farmers belonging to the association *Giri Putre* (“Cikole Village”) as sellers, and an entity of the Ministry of Forestry as a single buyer. In this case, the beneficiary also agreed to a negotiation for the enhancement of a watershed service through the reduction of erosion. The contract validity is for five years, including a total payment of 40 million rupiah for 33 ha, where agroforestry will be practiced, with 50% of the amount paid during the first month, followed by a 30% and 20% payment completed during the six months after initiation.

The following map illustrates the location of the parties involved in the Suntenjaya scheme and the considerable distance between the two parties (buyer and sellers). “A” identifies the location of the Jatiluhur dam, where PT Aetra Air Jakarta (buyer) has its main operation, and “B” identifies the area where the farmers of Suntenjaya (sellers) are located. The approximate distance between the two parties is 80 km, an area in which not all the eroded soil reaches the dam. A numerical model simulation is required to estimate the influence of the distance. There is no reference map for the Cikole scheme due to insufficient information on where the buyer situates and monitors its ES.



Map 1: Suntenjaya PES scheme buyer and seller locations

Source: Google map

3. The PES concept versus actual programs in the Citarum Basin

In order to examine how PES is translated into reality, this paper takes Wunder’s [6] definition framework as the main model for assessment. This evaluation takes an individual review of both schemes existing in different

localities of the Citarum, one in Suntenjaya and the other in Cikole, within the Bandung regency, references that up to date have been approached in a unified manner in the literature, disregarding important individual differences, and becoming prone to confusion. Table 2 compares the PES schemes implemented in both sites according to Wunder’s criteria and presents observable gaps between theory and reality.

Table 2: PES assessment according to PES definition criteria

Criteria	Suntenjaya village	Cikole village
1. Voluntary	Voluntary Reducing erosion through agroforestry, 22 ha (2009)	Voluntary Reducing erosion through agroforestry, 33 ha (2009)
2. Environmental service (ES)	Currently increased to 26 ha (2012) Service not quantified (water quality and quantity) and not well defined	Currently increased to 38 ha (2012) Service not quantified (water quality and quantity) and not well defined
3. Seller	35 farmers organized in farmers association, Kelompok Tani Syurga Air	84 farmers organized in farmers association, Giri Putre
4. Buyer	PT Aetra Air Jakarta	Entity of Ministry of Forestry (Pustandling)
5. Conditionality	7-year contract: 50 million IDR for 22 ha Terms: 50% (1st month), 25%, 25% (approximately after 6 months) Monitoring: non-existent	5-year contract: 40 million IDR for 33ha Terms: 50% (1st month), 30%, 20% (approximately after 6 months) Monitoring: non-existent

Gaps between theoretical frameworks and reality are expected. Wunder himself states that, in practice, many schemes fall short of satisfying all criteria. In his global review, Wunder found 287 “PES-like” cases, while “no more than a couple of dozen of experiences globally” fit all five criteria [16: 280]. Ambiguity exists as to whether the Citarum PES cases meet some parts of the fundamental PES criteria, in particular (i) environmental service definition, (ii) conditionality, and (iii) the buyer’s role. The following analysis aims to identify the causes of such variances and their impact on program realization, clarifying to what extent variation may lessen the program’s efficiency and to what extent it may risk the program’s overall viability.

3.1 PES program gaps and stakeholder relationships in the Citarum Basin

3.1.1 Vague definition of environmental service

Vague ES definition is principally due to two main factors: namely, the inability to prove the impact of the ES and a weak causality linkage.

Concerning the first factor, agroforestry has been chosen as the main strategy for reducing erosion, but it is difficult to prove its impact. Agroforestry is an approach to land use that deliberately includes woody perennials (trees, shrubs, palms, bamboos, etc.) in the same land-management area as agricultural crops and/or animals. These complex systems are characterized by ecological and economic interactions [17]. In the Citarum PES schemes, agroforestry is practiced as a technique that allows intercropping between harvested vegetable areas with ranges of fruit trees, eucalyptus trees, and coffee, an arrangement based on local knowledge and the necessity of providing fair measures to farmers so they can secure cash income from valued commodity crops. Milder et al. found that agroforestry is one way to attract land stewards who will want to participate (if they perceive their involvement to be economically favorable) [18]. Agroforestry was successfully introduced in various PES programs in Costa Rica in 2005, and it is described by the Food and Agriculture Organization of the United Nations (FAO) as a significant measure to be integrated in national strategies and policies to aid farmers, communities, and industry [19]. However, although erosion can be reduced through agroforestry, it can be a very lengthy process depending on variables such as the grade of the slope and soil conditions. In the Citarum schemes, agroforestry was chosen as a procedure according to its positive attributes, but no technical assistance was provided to participants beyond mere informational sessions.

Indeed, agroforestry, considered a beneficial strategy for ecological stability, has a generally positive effect on the environment, but, as Ramachandran has noted, “with the wrong choice of species combinations, management practices, and lack of peoples' motivation and understanding, agroforestry may indeed fail just like any other form of land use may fail, and it will still be agroforestry in the objective sense of the word” [17: 13]. In an analysis of PES schemes, agroforestry offers no clear impact on the desired ES production (i.e., water quality and quantity due to sediment reduction). This reality highlights the importance of scientific support throughout the entire process—planning, implementing, and follow-up—of PES schemes. The adoption of unclear objectives, as stated by Kosoy et al, causes inefficiency and an increase of costs [4]. Moreover, vague ES are not sustainable over the long term; if ES are not quantified, no evidence will be yielded to attract future buyers. A lack of clear ES will also limit the expected benefits of PES, such as knowledge sharing and resilience development for locals.

Another problem is the weak causality linkage in PES schemes in the Citarum basin. That is, multiple actors are causing the problems of erosion and sedimentation, and few of them are willing to address sedimentation issues. At the same time, multiple actors are freely enjoying the benefits of ES without having to contribute to them. PT Aetra Air Jakarta, the buyer in Suntenjaya PES scheme, supplies water to part of the capital city Jakarta from the Jatiluhur, a dam used by multiple parties and which has been directly affected by the environmental degradation of the upstream (above Bandung area) users, through West Tarum Canal intake or Kalimalang. Upstream areas such as Suntenjaya village, where intensive farming is practiced in hilly areas, are targeted by PES to address erosion problems; yet, they only represent a small number of the total actors affecting the water flow for the Jatiluhur dam. The remaining untargeted actors, who carry on their bad practices, offset the efforts

made by PES sellers. It is important, therefore, to set clear causality relationship strategies and possibly widen the inclusion of PES sellers to generate a bigger ES impact.

Unclear ES is also present in the Cikole scheme, and agroforestry as a practice has been misrepresented as the correct strategy for efficiently reducing erosion. In this case, the selection of agroforestry is not completely appropriate as it lacks precise plans that support the reasons explaining why the buyer would like to reduce erosion instead of other ES (e.g., carbon sequestration). Furthermore, it lacks the right connections to the assigned target areas and the means to evaluate its impact on the ES. The Ministry of Forestry may, however, still gain some benefits through the general advantages of agroforestry, particularly if these are part of re-green public policies.

3.1.2 Weak conditionality

Weak conditionality is a persistent characteristic both in Suntenjaya and Cikole, where full payments are typically made during the first year of the program, regardless of the contract's long-term validity (seven and five years, respectively) and the apparently non-existent monitoring system to control service delivery and impact on water quantity and quality. Payments at the initial phase are important as they support participation costs for project engagement as well as attract potential ES sellers. This procedure, however, must be carefully managed so as not to distort the basic principle of PES's market approach, wherein there must be a buyer eager to obtain a paid-for service and a seller seeking the agreed remuneration for the service he or she is selling. Although monitoring can be costly, the absence of it risks the effectiveness and feasibility of PES in the long run. Successful cases, such as schemes in Ecuador, underscore that a strong focus on both ES and conditionality seem to be key factors for success. Monitoring is an essential part of the ES delivery process, unless the outcomes produce drastic changes that are too obvious to be ignored.

3.1.3 Unclear buyer's role

The issues that have been previously addressed have been associated with the role of the buyer. Despite the fact that the presence of a buyer meets one criteria of the PES definition in both schemes, the position of the buyers appears to be ambiguous due to their weak demand for ES delivery. In the Suntenjaya scheme, the buyer is a private water company, PT Aetra Air Jakarta, whose purchase adheres to the principle of corporate social responsibility (CSR) [20], and the company, therefore, is classified as a "philanthropic buyer" [18]. Certainly, this is a significant way to raise funds and create awareness among the private sector. Yet, this particular case does not reflect a clear engagement of a buyer demanding an efficient ES since there is no follow-up process after the completion of payment. On the other hand, the Cikole PES is a government-financed scheme, represented by an entity of the Ministry of Forestry. Although there is a clear difference in the buyers' natures between the Cikole government-financed scheme and the Suntenjaya private-user-financed scheme, they reflect a common ambiguity concerning their passive roles in demanding the ES delivery they are paying for. The active role of the buyer is imperative throughout the PES's entire existence. Otherwise, if the role of a donor is assumed, that assumption will constrain the successful development of the PES scheme, misconstruing its basic principles and endangering its future feasibility.

4. Acceptance by local farmers

The PES schemes proposed in Citarum are expected to play an important additional role in the livelihoods of rural people. There is an overall acceptance that PES should not have a negative impact on ES providers, but rather make the most of its potential to provide livelihood benefits to poor people, whether in cash or non-cash forms. Such an approach promotes the interests of potential ES providers and bolsters complementary social goals, although some scholars [7, 21] question the efficiency of putting the extra weight of the achievement of social goals within a program designed for natural resource management. The impact of poverty alleviation or the consideration of pro-poor matters are still inexact in the context of the Citarum due to the schemes still being in their early stages. It should be noted, however, that farmers engaged in agroforestry have expressed relative satisfaction at being part of the program. Table 3 combines a set of the most common criteria, culled from the current literature, used to measure social outcomes, based on the categories of cash gains and non-cash gains; these aid in understanding the situation in the Citarum and stakeholders' reasons for embracing the program.

Table 3: PES social-impact assessment

Criteria	Suntenjaya village	Cikole village
	Each participant receives a total of over 1 million IDR (calculation based on averages of land size and approximate number of farmers)	Each participant receives a total of approximately 500,000 IDR (calculation based on averages of land size and approximate number of farmers)
1. Cash gains	<ul style="list-style-type: none"> • 50 million IDR for 22 ha • 35 participants • Average size of land/farmer: 0.3–0.5 ha • Seven-year contract, mostly paid within six months to one year 	<ul style="list-style-type: none"> • 40 million IDR for 33ha • 84 participants • Average size of land/farmer: 0.3–0.5 ha • Five-year contract, mostly paid within six months to one year
	Scientific research and knowledge sharing	
2. Non-cash gains	<ul style="list-style-type: none"> • Service not yet quantified (water quality and quantity); in need of scientific support • Exposure to many researchers (IDDRI-France, JICA, etc.) to address current problems and the potential for funding through donors 	

Social capital

Approximate 35 farmers organized in farmers' association,
84 farmers organized in farmers' association,
Giri Putre

Kelompok Tani Syurga Air

- Informational sessions and assistance provided by LP3ES, initial recruiting covered approximately 5–7 farmers interested in the program

Land tenure consolidation

Land status: community land, common property (with individual separation)
generally not certified and ruled by customary rights

Public sector programs and subsidies

- No additional benefits from the buyers (both public and private)
- Ministry of Agriculture (Directorate of Farming Land Management and Water and Land Management) provided assistance for seedling and sapling, requested by LP3ES
- Among other various current public programs at the Citarum basin, the principal is the "Integrated Citarum Water Resources Management Program" (ICWRMP), 2009–2023

4.1 Cash gains

Cash gains are one way to attract and increase farmers' participation in PES programs, particularly in countries such as Indonesia, where the majority of farmers are among the poorest citizens. The highest-priority problems, according to rural women and men, involve a lack of capital and insufficient income for basic necessities, in addition to deteriorated infrastructure [22, 23]. The average farmer's income is approximately one million rupiah per month from their harvest, which includes vegetables grown outdoors and within a greenhouse. Agriculture is the village's main economic activity, complemented by other activities including running a small shop and managing livestock. Although payments to beneficiaries are small, to compete with the opportunity cost of the ES, and do not constitute major revenue that would cover farmers' usual expenses (a kilogram of rice, for instance, sells for an average price of 9,000 rupiah), they do provide the initial capital needed for farmers to shift their practices to agroforestry (about 500,000–1,000,000 rupiah per participant, provided within six months). The estimated cost to cultivate coffee is 10,000 rupiah per sapling. In this sense, participating farmers are given the opportunity to gain income from cash crops, such as coffee, as part of the agroforestry deal, which, in addition to the PES, could be considered as the initial payment that covers the cost for the program's initial implementation. Agroforestry, which is focused on cash crops, offers income stability to farmers, which is one reason why they feel satisfied with the program.

The benefits of agroforestry, particularly on the socio-economic level, have held more appeal in terms of farmers' interests than in terms of the payment for ES, per se. There is an overall acceptance that agroforestry benefits the rural poor, a fact exemplified in the following range of gains: economic advantages (e.g., diversification of economic activities and agricultural revenues), environmental advantages (e.g., increased plant and animal biodiversity, improvement in soil fertility, mitigated impact of climate change on agriculture, and reduction of deforestation), social advantages (e.g., food security, landscape enhancement, and, in some instances, job creation), and cultural advantages (e.g., use of local and indigenous knowledge) [24]. By 2012, new and established farmers in the program increased, on their own initiative, the number of hectares designated for agroforestry in both sites, with an additional four ha and five ha in Suntenjaya and Cikole, respectively. This was done without formally engaging and renewing the PES contract; therefore, the farmers received no payment. Agroforestry represents positive implications for both the environment and the farmers' income. It can also contribute to alleviating poverty in the rural population, a group that figures significantly in the Citarum basin, and this could simultaneously contribute to avoiding the escalation of environmental degradation. Without question, agroforestry generates positive outcomes. Yet, this reality, in its actual form, seems to misrepresent the best method of efficiently reducing erosion, and it is puzzling as to whether this scenario continues to be attributed specifically to the concept of PES, if the buyer does not receive the promised ES, or if this scenario is more a general reflection of the adoption of agroforestry systems.

5. Conclusions

PES in the Citarum basin tends to diverge from the market-based mechanism approach set out in the theoretical framework, instead developing in a social context based on financial aid or donation. These programs reflect the importance of adapting and responding to ES providers' interests and contextual necessities. One of the factors that causes divergence from PES theory, with regard to stakeholders' perspectives on PES, is that farmers have indicated their interest in stabilizing their incomes by growing cash crops (i.e., coffee) as part of the agroforestry deal, but they seem to ignore the means by which they can efficiently reduce erosion. This lessens the efficiency of the program; however, it could be improved through technical training, for example.

On the other hand, programs in the Citarum basin demonstrate the misunderstandings that ES beneficiaries have about the PES concept. Beneficiaries tend to act as donors making social and environmental contributions. The current adoption of agroforestry as a practice aimed at reducing erosion has not yet offered quantified results from the Citarum's schemes. This unclear ES is one motivation behind why buyers disburse a minimal amount to facilitate the initial shift to agroforestry.

Current schemes, which place the buyer in a passive role with regard to demanding a clear ES, directly impact the continuity of schemes in the long run, introducing a significant level of uncertainty in terms of buyers' renewing their contracts in the future. This, in turn, potentially slows down the expansion of PES projects in the country and impedes the funding opportunities from the private sector. Scaling up PES programs, in light of the lessons drawn from the Citarum basin schemes, requires the following:

1. Clarifying the ES and its proper strategies for achieving the desired goals of reducing erosion, rather than just simply enhancing the environment. In this sense, agroforestry needs to reconsider its strategies, as it offers no guarantees of delivering the ES, which is fundamental to the securing of scientific support and local knowledge.
2. Establishing the main essence of PES as a market approach. Of equal importance is participants' understanding of this mechanism. Accordingly, the participants should reflect their interest in the delivery of ES. Authorities and facilitators play an important role in achieving an accurate understanding of PES and prompting willing participants to not only accept the scheme but also make it feasible in the long run.
3. Designing PES strategies to enhance their effectiveness and fairness as well as their flexibility in adapting to a changing and influencing context. Additional strategies, which receive careful analysis so as not to become countermeasures for the program, should be present to support the rural poor, particularly in developing countries.

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