SUNSHINE AGRICULTURE
e-Newsletter

ISSN (E): 2583 – 0821

Sun. Agri.:e- Newsletter, (2024) *4*(1), 4-9

Article ID: 271

Payment for Ecosystem Services (PES): A Market Driven Approach to Environment Conservation and Sustainable Development

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Open Access

Available online at
http://sunshineagriculture.vitalbiotech.org/

Article History
Received: 2.01.2024
Revised: 7.01.2024
Accepted: 14.01.2024

INTRODUCTION

Ecosystem services encompass the natural processes that bring direct or indirect benefits to humanity. Preserving these services is crucial for a sustainable future, and incentivizing conservation through market-based approaches is imperative. Payment for Ecosystem Services (PES) is a strategy designed to foster responsible management of natural resources and encourage ecosystem stewardship. In this model, users compensate those who actively conserve and protect ecosystem services. It has immense potential in raising awareness about the interconnectedness of human well-being, including poverty alleviation, and ecosystem services. Ecosystem services, crucial for sustaining human life, are facing a rapid decline, posing significant risks to global economies and well-being. This article explores the concept of Payment for Ecosystem Services (PES) as a market-driven strategy to incentivize conservation efforts. PES involves compensating those who protect and preserve ecosystem services, offering immense potential for raising awareness and addressing interconnected challenges such as poverty. The article delves into the historical context, evolution, and current status of PES, highlighting its role in achieving ecological sustainability. The world is currently witnessing a swift decline in biological diversity, with nearly a quarter of all plant and animal species facing the imminent threat of extinction. This alarming trend is eroding the productivity, resilience, and adaptability of nature, posing significant risks to our economies, livelihoods, and overall well-being. Despite these challenges, there exists substantial untapped potential within global biodiversity. It is crucial to restore a balance between the demand for nature's goods and services and its capacity to supply them, steering towards a sustainable trajectory of production and consumption (Dasgupta, 2021). Ecosystems play a crucial role in supporting human livelihoods by providing various services.

Ecosystem services (ES) encompass the contributions of natural ecosystems and their constituent species that sustain and enhance human life, reflecting the value and advantages derived from nature (Daily, 1997; MA, 2005). Payment for Ecosystem Services (PES) involves voluntary transactions between buyers seeking ecosystem services and providers ensuring their delivery (Feng *et al*., 2018). This approach is guided by the voluntary payment principle, as beneficiaries willingly contribute to the process (Bösch *et al*., 2019).

PES operates within a framework of self-regulation by capital market forces and involves the implementation of ecological protection activities. Additionally, the concept of eco-compensation follows the principle that those who cause pollution are responsible for cleaning it up, and beneficiaries should pay for the ecosystem services they receive. This system heavily relies on government financial transfers to incentivize ecological protection and internalize externalities through economic stimuli (Zhang *et al*., 2018). Both PES and eco-compensation are recognized as effective mechanisms for achieving ecological protection objectives and preserving the balance of ecosystems (Liu *et al*., 2018). Both the Millennium Ecosystem Assessment (MEA) and The Economics of Ecosystems and Biodiversity (TEEB) advocate for the adoption of market-based instruments to internalize externalities associated with the utilization of nature's goods and services (Mäler *et al*., 2009). In this context, Payment for Ecosystem Services (PES) has garnered attention as a viable strategy to incentivize the enhancement of ecological services, thereby fostering ecological sustainability and ensuring livelihood security (Ajayi *et al*., 2012). Since the release of the United Nations Millennium Assessment Report (2005), Payment for Ecosystem Services (PES) has gained widespread recognition as a lucrative tool benefiting farmers and local communities. It serves as a means to generate positive externalities by promoting the conservation of nature and fostering a sustainable future. The discourse on ecosystem services began two decades ago, marked by influential studies from Daily (1997) and Costanza *et al*. (1997). The concept of PES proves valuable in advancing overall sustainability. Despite its evolution over three decades, PES remains in its early stages of adoption in numerous countries, particularly in developing and underdeveloped nations.

2. History of ecosystem services

The notion of the environment benefiting human society has roots extending over several millennia. The contemporary understanding of this dynamic has evolved into the concept of environmental services (Wilson, 1970). The term "nature's service" was initially coined by Westman (1977) but it was Ehrlich and Ehrlich (1981) and later Ehrlich and Mooney (1983) who provided a more detailed explanation of the term "ecosystem services." This concept gained significant traction starting in 1997 (Gómez-Baggethun *et al*., 2010). Initially used as a metaphor (Norgaard, 2010), it has now become the foundation for a growing body of literature aiming to evaluate, quantify, and appreciate the reliance of humans and society on nature. This idea, initially metaphorical, has not only spurred a substantial body of literature but has also influenced policy changes. Policymakers frequently seek assessments and economic evaluations to understand the direct correlation between biodiversity loss and declines in welfare, as exemplified by the TEEB study commissioned by the European Union (Sukhdev, 2008). Consequently, governments have collaboratively established an intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES, 2022). Simultaneously, various Payment for Ecosystem Services (PES) programs have been initiated, covering a range of services such as watershed services, biodiversity

conservation, carbon sequestration, and other ecological services.

3. Payment for Ecosystem Services

PES, or Payment for Ecosystem Services, is a conservation tool based on market principles, where those benefiting from protected, enhanced, or restored ecosystem services compensate the providers (Engel *et al*., 2008). Since the Rio Summit in 1992, PES has emerged as a highly promising innovation in biodiversity conservation strategies. Over time, it has become a viable approach to addressing the economic externalities associated with commodity production and optimal resource extraction, aiming to improve outcomes that are socially, ecologically, and economically desirable. The fundamental concept behind PES involves compensating landowners for safeguarding their land to ensure the continued provision of essential 'services' offered by nature, such as water, habitat, climate regulation, or carbon storage (Gaworecki, 2017). A key and appealing aspect of PES is its dual role in promoting environmental conservation investment and providing tangible rewards to individuals for their conservation efforts. This dual function suggests that PES holds the potential to alleviate poverty and mitigate conflicts between conservationists and local communities. Its origins can be traced back to past conservation programs, including Integrated Conservation and Development Programs (ICDPs). In market-based PES schemes, beneficiaries—either directly or indirectly—pay providers for the services rendered. These schemes necessitate the active participation of both beneficiaries and service providers (buyers and sellers), with intermediaries serving as a crucial link between the two. The scale and implementation of PES programs primarily depend on factors such as location, as well as the political and administrative commitment of governments and financing agencies. PES represents a market-driven strategy aimed at achieving environmental goals by internalizing economic externalities (Turner and Daily, 2008). Carbon sequestration, water-related services, forests, and biodiversity stand out as key areas where PES schemes are predominantly employed globally (Carroll and Jenkins, 2008). In the early 2000s (Landell-Mills and Porras, 2002), there were over 280 PES-type schemes either in development or operational, and subsequent progress has continued to be made. The Ecosystem Marketplace serves as an online information hub for PES, consolidating global information on PES programs. It discerns the market values for ecosystem services (ES), providing insights into the scale of markets for these services to some extent. The analysis focused on biodiversity, examining 39 existing programs and 25 programs in various stages of development, primarily in North America. These programs collectively represent a minimum annual market size of US$ 1.8–2.9 billion (Rath *et al*., 2023). In the realm of carbon markets, transactions for forest carbon credits have amounted to a minimum of US$ 149.2 million so far (Hamilton *et al*., 2010). For watersheds, out of 216 identified Payment for Ecosystem Services (PES) programs, only 113 were operational, engaging in active transactions with a market value of US$ 9.2 billion (Stanton *et al*., 2010). As of 2008, PES programs protected approximately 289 million hectares (Mha) of land, with the majority in China (270 Mha), followed by the USA (16.4 Mha), Latin America (2.3 Mha), and minimal coverage in Asia, Africa, and Europe (less than 0.2 Mha each) (Stanton *et al*., 2010). PES has been implemented globally since the inception of the pioneering national program in Costa Rica in 1997, including initiatives such as water funds in Latin America (Stanton *et al*., 2010), steep-slope land conversion in China (Zhang *et al*., 2008), and watershed health in the USA (Stanton *et al*., 2010). Despite its expanding significance, discussions about the potential benefits and challenges of market-based approaches for sustainable

development have gained prominence and require thorough evaluation.

4. Benefits

PES initiatives have brought about numerous advantages for both ecosystem preservation and communities. They possess the potential to influence farmer's attitude toward environmental protection, raising awareness about the connections between ecosystem services and human well-being. Farmers often perceive ecosystem services as externalities, providing little incentive for their production or conservation (Pagiola *et al*., 2007). Quantifying the monetary value of these services can demonstrate their worth to participants, encouraging conservation efforts (Pagiola *et al*., 2007). PES programs that incentivize improved extraction and land-use practices, coupled with enhanced ecosystem services, can serve as viable projects for generating livelihoods, especially for those reliant on subsistence farming (Rosa *et al*., 2004). On-site benefits of PES initiatives, such as water conservation, improved soil fertility, shading, and reduced chemical use, may initially go unnoticed by beneficiaries but become apparent once the program is implemented. Research indicates that compared to human-made technological approaches, PES projects can both protect and restore ecosystem services, yielding equal or greater net benefits due to their ability to safeguard environmental services (co-benefits). Moreover, PES has been observed to foster improved communication among stakeholders, easing tensions between upstream and downstream participants and serving as a conflict resolution tool alongside law enforcement. This leads to increased awareness among landowners and community self-policing, ultimately resulting in greater community empowerment. Recognizing environmental awareness as a crucial factor for the success and long-term sustainability of PES programs, it is imperative to empower local farmers and rural communities through education and monetary incentives. This empowerment refines and enhances their practices in favor of the environment, fostering sustainable investments in the community and achieving self-sufficiency.

5. Challenges and Opportunities

While Payment for Ecosystem Services (PES) presents a promising approach to conservation, it is not without challenges. Implementation hurdles, varying political commitments, and the nascent adoption of PES in certain regions, particularly in developing nations, pose obstacles. Additionally, the effectiveness of PES programs depends on factors such as location and administrative commitment. Opportunities lie in the potential of PES to bridge economic and ecological goals, fostering sustainable development. Addressing challenges requires international collaboration, policy refinement, and increased awareness of the benefits of market-based approaches.

CONCLUSION AND FUTURE PROSPECTS

In conclusion, the decline in biodiversity necessitates urgent action, and Payment for Ecosystem Services (PES) emerges as a viable solution. Despite its evolving significance, challenges persist, emphasizing the need for a nuanced understanding and robust evaluation of market-based approaches. PES has proven successful in protecting vast expanses of land, providing economic incentives, and fostering community empowerment. Recognizing the intrinsic link between environmental awareness and program success, it is imperative to empower local communities through education and incentives, ensuring the long-term sustainability of PES initiatives. The future of Payment for Ecosystem Services (PES) holds promise for global biodiversity conservation. Continued research, international collaboration, and refinement of policy frameworks are essential for overcoming existing challenges. The expansion of PES programs, especially in underdeveloped nations, requires concerted efforts to enhance political commitment and

financial support. The potential benefits of PES, including improved communication among stakeholders and on-site environmental benefits, underscore its significance in achieving a sustainable balance between economic development and ecological preservation. The trajectory towards self-sufficiency and community empowerment through PES can pave the way for a more resilient and interconnected global ecosystem.

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