3-2020

Effectiveness, equity, and ethics of Costa Rica's Payment for Environmental Services Program.

Anna J Carter
University of Louisville

EFFECTIVENESS, EQUITY, AND ETHICS OF COSTA RICA'S PAYMENT FOR ENVIRONMENTAL SERVICES PROGRAM

Anna Carter

A Thesis Submitted to the
Faculty of the College of Arts and Sciences of the
University of Louisville

Department of Political Science
University of Louisville
Louisville, KY

February 24, 2020

Effectiveness, Equity, and Ethics of Costa Rica's Payment for Environmental Services Program

Anna Carter

Abstract: This paper examines the effectiveness of Costa Rica's Payment for Environmental Services, or PSA program, which provides government subsidies to participants who protect forested lands or reforest their land. Effectiveness is determined in terms of the program's progress in reversing deforestation and generating reforestation efforts, with particular attention paid to the success and failings of the program in reaching small landowners. The claim that the PSA program can act as a tool for human development is evaluated through its accessibility to small landowners. Finally, the ethical costs and benefits of the market based scheme underlying the PSA program as a process of commodifying nature is examined, looking to existing literature to determine if market based solutions negatively or positively change the values small landowners hold about the environment. This paper fills a unique gap in the existing research on Costa Rica's PSA program as it combines practical concerns about the effectiveness of an environmental policy with questions of equity and ethics. Methodologies of policy analysis, a sociological approach, and philosophical examination of the PSA program are synthesized to conclude that the program is somewhat effective in curbing deforestation and regenerating reforestation, institutional and financial barriers still restrict small landowner access to the program, and ethical concerns about the nature of the program have remained unrealized. Answering these questions supports the conclusion that the PSA program should continue to be implemented, but understood as only one small part of the fight in addressing the climate crisis.

Keywords: payment for environmental services, environmental ethics, access, Costa Rica

Introduction

Comprising only .03% of the planet's land mass, Costa Rica is home to 6% of the world's plant and animal species, situated in a unique biodiversity hotspot that makes the preservation of its forests invaluable (Sanchez-Azofeifa et al. 2007). Deforestation threatens the health of the planet in a variety of ways, including loss of carbon sequestration, loss of oxygen production, soil erosion, and loss of biodiversity (Sanchez-Azofeifa et al. 2007). However, the benefits of nature are not seen directly in the daily lives of landowners. When faced with preserving the ecosystem of leaf cutter ants, or clearing one's land to create a plantation that generates profit, people are wont to choose the latter. Much like the rest of Latin America, Costa Rica suffered from rampant deforestation from the 1960s through the 1980s, with land largely being cleared for agriculture and cattle ranching use (Pagiola 2008). Because environmental services like biodiversity, natural beauty, watershed protection, and greenhouse gas mitigation do not have a price tag attached to them, they cannot compete in a capitalist market. Beginning in 1997, Costa Rica's Payment for Environmental Services program, or PSA program, was an innovative approach to conservation that was intended to halt and reverse deforestation (Pagiola 2008).

Environmental services are defined as the multiple benefits humans accrue from the function of ecosystems. Costa Rica's PSA program identifies four of these services: greenhouse gas mitigation, scenic beauty, hydrological services, and biodiversity (Pagiola 2008). These services are not measured individually, but assumed to be a 'bundle' equally produced by each hectare of land. Services like scenic beauty are particularly difficult to measure and assign a price tag, so bundling preserves recognition of the benefit while still maintaining the viability of

ecosystem services in a market based system. The PSA program is meant to address the market failure of negative externalities, in which the cost of environmental degradation is not factored into the final market cost of economic activities like creating a plantation, resort, or factory (Silvertown 2015). If those costs are made explicit and payments are made to landowners whose property provides environmental services, nature can then become competitive in the market.

Another touted benefit of payment for environmental services programs include the capacity for human development, especially in poor and rural areas (Sanchez-Azofeifa et al. 2007). By financially rewarding landowners for preserving their trees or using their land to plant new trees, the PSA program can act as a source of additional income without a major investment required from participants. While the PSA program cannot replace participants' primary source of income, it acts as supplemental income which can improve the livelihood of small landowners. By attaching financial compensation to certain land uses and practices, the PSA program also has the potential to positively impact values concerning the environment held by small landowners. To see direct financial benefits as a result of environmentally friendly land use encourages landowners to be responsible in their interactions with ecosystems, and creates a network of landowners with knowledge about sustainable land use that can be spread to non-participants.

Having been implemented for 20 years, there is now a large body of literature available on the successes and failings of Costa Rica's PSA program. A diverse body of research on the environmental, economic, and social impacts of the PSA program has developed, and similar programs have been implemented in other nations throughout the world. Now that Costa Rica's

program has had two decades to develop, it is important to reflect on its impacts. This paper aims to answer three questions:

1.) Has the PSA program been effective in reversing deforestation and generating reforestation?
2.) Has the PSA program been equitable in terms of its accessibility to small landowners?
3.) Has the PSA program impacted the values held by small landowners toward nature?

This paper will fill a gap in the existing literature by synthesizing policy concerns of effectiveness, sociological concerns of equity, and philosophical concerns of ethics to determine whether the PSA program is a viable policy solution that can address the multi-faceted concerns of environmental justice. Policy makers cannot be concerned purely with the effectiveness of a program, but must also ask questions about for whom and how a program is beneficial. Interdisciplinary research methods encourage a variety of viewpoints to be considered, and prevent positivist approaches from clouding the understanding of the real human impacts that occur when policy is implemented. A purely data driven approach to the PSA program would ignore the social and ethical considerations of such a policy. While numerical data is valuable and will be used as evidence in following sections, oral interviews conducted by several researchers in the field, including Schwartz (2017), Lansing (2014), Schröter et al. (2018), and

Ross (2016) with program participants and conceptual, philosophical arguments will also be presented as equally valuable evidence to consider when forming a conclusion.

This paper will argue that Costa Rica's PSA program is somewhat effective in terms of its progress in reversing deforestation and generating reforestation efforts, though issues remain in regards to additionality. Additionality is the measure of what practices would have remained the same without the implementation of a policy, such as the downward trend in deforestation rates already present in Costa Rica before the PSA program. Additionality is a confounding factor that must be accounted for when attempting to determine the true impact of a policy on individual and societal practices. While policymakers have worked to make the PSA program equitable by enrolling more small landowners, many substantial institutional and financial barriers remain. No conclusion can be given regarding if small landowners' values have changed due to the ethical ramifications of the PSA program, but I argue that the PSA program should continue to be implemented as the conceptual ethical benefits outweigh the potential costs.

Background

The impetus of the PSA program in Costa Rica was the extreme deforestation that had been ravaging the nation's rainforests since the 1960s. Land was cleared primarily for agricultural and cattle use, often resulting in monoculture plantations that continue to harm the ecosystems around them and support little diversity of life (Arriagada et al. 2015). Large corporations such as Del Monte and Dole have the financial capacity to buy out small landowners, who may have otherwise used the land in more diverse and sustainable ways. Land

was also cleared for timber, an issue that was addressed with the 1996 Forestry Law which required the rational use of all natural resources and prohibited change in land cover of existing forests, essentially prohibiting logging.

The PSA program coincided with the establishment of two other environmental laws along with the 1996 Forestry Law, including the 1995 Environment Law which requires a "balanced and ecologically driven environment for all" and the 1998 Biodiversity Law, which requires the conservation and "rational use" of biodiversity resources (Sanchez-Azofeifa et al. 2007). These laws created the foundation from which the PSA program could provide payments to landowners. By mandating a "balanced" environment and "rational use" of natural and biodiversity resources, and by prohibiting the continued use of Costa Rica's forests for timber, these three laws helped create the proper institutional conditions for a program meant to economically value environmental services. While a valuable policy, the 1996 Forestry Law in particular represents a confounding effect when trying to research the effectiveness of the PSA program in reversing deforestation, as deforestation itself was prohibited before the PSA program was implemented. The issue of additionality, measuring what would have changed even without the implementation of the PSA program, becomes relevant due to this prior prohibition. Additionality will be discussed more in depth in the effectiveness section.

The administration of the PSA program falls to several different organizations. At the national level, FONAFIFO, SINAC, and MINAE are the primary bureaucratic means of implementing and monitoring the PSA program. FONAFIFO, the Fondo Nacional de Financiamiento Forestal, was established under the 1996 Forestry Law as a public forestry-financing agency. FONAFIFO is responsible for administering contracts and distributing

payments to participants. SINAC, the Sistemas Nacional de Áreas de Conservación, and MINAE, the Ministerio del Ambiente y Energía, are responsible for inspection duties such as land use monitoring and overall supervision of the program in forested areas (Sanchez-Azofeifa et al. 2007). At the local level, NGOs such as the Community Blue Carbon Project act as intermediaries between FONAFIFO and small landowners with little experience navigating the bureaucratic process (Schröter et al. 2018). Civil society groups assist in spreading knowledge of the PSA program and guide landowners who may have otherwise been left out of the program due to unfamiliarity with the process or lack of initial funds.

At the international level, funding has been the primary way of participation. The PSA program has received loans from the World Bank's Ecomercado program, totaling $8 million to support contract payments, which funded the program from 2001-2006 (Pagiola 2008). The PSA program is also funded through a 3.5% fossil fuel tax, which totals around $10 million each year. Hydropower producers also support the PSA program, providing contract payments to the landowners who protect watershed basins and hydrological zones. These agreements began as voluntary, but thanks to a water tariff established in 2008, a compulsory water conservation fee is charged to water users, providing a more consistent and robust funding to FONAFIFO and thus the PSA program (Pagiola 2008). Other local and international corporations participate as fundors, but usually only provide payments to specified regions or farms that generate environmental services that directly benefit that corporation (Schröter et al. 2018).

The PSA program originally offered three modalities at its inception. Forest conservation was and remains the most popular modality. Forest conservation contracts require the landowners to protect both primary and secondary forests that remained on their lands for 5

years. In line with the 1995 Forestry Law, no land-cover change is allowed. Reforestation contracts require landowners to plant trees on agricultural or otherwise abandoned land and maintain those trees for 15 years (Sanchez-Azofeifa et al. 2007). The final modality offered was sustainable forest management, which has the same requirements as the reforestation contracts but allows for landowners to conduct low-intensity logging while participating in reforestation efforts on their land. In 2004, FONAFIFO introduced a new modality to the program intended to target small landowners. The SAF, Sistemas Agroforestales, program requires that landowners have active agricultural or cattle grazing areas on their land, and landowners are compensated for each additional tree planted on their land (Cole 2010).

Payments vary based on modality and the amount of land enrolled in the contract. For forest conservation contracts, participants receive equal installments of payments per hectare of land for the entire 5 years. Contracts can be renewed after this 5 year period, though this is not a requirement, and landowners are free to deforest their land after a contract has ended if they so wish. For reforestation contracts, participants receive decreasing installments of payments per hectare of land for the first 5 years. 50% is paid in the first year, 20% the second year, and 10% the remaining three years. For sustainable forest management contracts, the same schedule of payments is followed as reforestation contracts. In 2007, payments per hectare of land were US$210 for forest conservation, $537 for reforestation, and $327 for sustainable forest management (Sanchez-Azofeifa et al. 2007). For SAF contracts, participants are paid per tree planted, with the 2007 rate at $1.30 per tree. Participants must plant a minimum of 350 trees and a maximum of 3500, and must maintain the trees for five years. Payments are received over the first three years of the five year period, with 65% of the payment distributed in the first year,

20% in the second year, and 15% in the third year (Cole 2010). In terms of livelihood impacts, Costa Rican participants largely report using these funds for immediate needs such as clothing, food, or school fees (Blundo-Canto et al. 2018). While cash sums are transferred to households and sustainable land use practices are successfully implemented, there is no significant improvement in the livelihood of households enrolled in the program (Arriagada et al. 2015, Blundo-Canto et al. 2018). The program does not financially harm participants, but the income supplied by the program is not consistent or large enough to meaningfully change the economic situation of participants.

Effectiveness

Deforestation

While much of the literature concerned with the PSA program examines both cost efficiency and effectiveness, I focus on effectiveness. Because there have not been continuous studies on the whole of this program, but rather studies of specific geographic areas or certain modalities of the program, it is difficult to gauge how effective the PSA program truly is, a common issue when evaluating policy.

10% of Costa Rica's total forest area is enrolled in the PSA program (Pagiola 2008). A study conducted in Northern Costa Rica concludes that PSA participants kept 61% of their land under forest cover, compared to 21% for non-participants (Zbinden and Lee 2005). Another study in the Osa Peninsula reports that participants had 92% of their land under forest cover, compared to 72% of non-participants. However, Pfaff et al. (2008) compared deforestation rates

for PSA program participants and non-participants and found almost no impact of the program, and that forest cover on those lands would have remained the same even without payments. However, this land already had a low probability of suffering from deforestation. Morse et al. (2009) examines the San Juan Biological Corridor and compares it with surrounding areas in order to determine deforestation rates before and after the PSA program. This study finds that the PSA program decreased deforestation in the corridor from 1.43% to .1%, and reports that 50% of PSA program participants would have cleared forest from their lands without payments. Sanchez-Azofeifa et al. (2007) found that national deforestation rates decreased under the PSA program from .06% in 1986-1997 to .03% in 1997-2000.

This literature speaks to the difficulty of assessing the effectiveness of the PSA program. There are several factors that limit the ability of researchers to understand the extent to which the PSA program has decreased deforestionation in Costa Rica. The first is the confounding factor of previous forestry laws. Because the Forestry Law of 1995 already prohibited the clearing of most forest lands, 89.1% of the land enrolled in the PSA program would have been conserved even without payments (Daniels et al. 2010). As Costa Rica implemented the PSA program in a policy mix strategy, where several aggressive environmental protection laws were put into place in a short amount of time, it is difficult to disentangle the effects of those previous laws from the effects of the PSA program (Pagiola 2008).

Previous forestry laws lead to another difficulty in addressing the impact of the PSA program, additionality. Additionality requires one to imagine a counterfactual scenario in which a PSA participant would not be enrolled in the program, and what they would then do with their land. The PSA program operates on the assumption that if there is a more profitable option than

leaving the forest intact, landowners will clear their land. Calculating additionality is difficult, as researchers do not necessarily have access to PSA program participants to determine their counterfactuals with certainty, and must estimate additionality based on local market trends and the current profitability of other land uses. There is no consistent method used to evaluate additionality throughout the literature on the PSA program. Pfaff et al. (2008) use statistical pairing of PSA program and non-PSA program farms based on biophysical traits and accessibility to determine comparable land use. Morse et al. (2009) compared deforestation rates before and after the PSA program in a biological corridor, which is a targeted or high priority area, compared to non-targeted areas, and considered the next best land use as gathered from farm-level survey data. Sierra and Russman (2006) determined additionality by observing non-PSA farm's land use in the same region. Because there is no standardized method of calculating additionality, it can be a struggle to determine the impact of PSA payments on land use decisions. In Daniels et al.'s (2010) analysis of the reliability of the previous four studies' methods of calculating additionality, Morse et al.'s (2009) region specific analysis of before and after deforestation rates was found to be the most reliable, whereas Sanchez-Azofeifa et al.'s (2007) method of comparing before and after national deforestation rates was found to be the least reliable. Both Sierra and Russman (2005) and Pfaff et al. (2008) used methods found to be moderately reliable, using regional or farm specific data rather than national data. These results suggest that additionality can most reliably be measured by identifying regional specific factors and counterfactual situations, which is consistent with the variable results produced by studies measuring the effectiveness of the policy on reversing deforestation. Landowners do not exist as a monolithic group across Costa Rica, and local factors impact their land use decisions. In short,

while creating counterfactual situations is not and should not be an exact science, narrowing the scope of the data and factors considered when measuring additionality will increase the reliability of a researcher's method.

Another issue which arises from the design of the PSA program is the lack of targeting of high priority lands, such as biological corridors. The PSA program is a voluntary program, in which participants self-select. As a result, low priority lands that are at a low risk of deforestation, or are already legally barred from deforestation, can be enrolled in the program. Because the PSA program receives more applications than it can accept, and has no method of filtering low priority lands from high priority lands, this could be negatively impacting the effectiveness of the program (Pagiola 2008). However, Pagiola has also suggested that the PSA program was offered as a quid pro quo for the prohibition of clearing forests, reducing resistance to the initial legislation that is likely responsible for the total decline of deforestation.

Another confounding factor emerging from the voluntary nature of the program is institutional path dependence. Daniels et al. (2010) explains that landowners who participated in pre-PSA forest conservation initiatives were over represented in the early cohorts of PSA participants. This speaks to the power of information accessibility and familiarity with the bureaucratic functions of FONAFIFO. Because these pre-PSA participants had already worked with forestry officials and understood the process of enrolling and institutionalizing their land, they made up two-thirds of the participants interviewed of the 1998-1999 cohort. In comparison, 60% of the non-PSA landowners in the same geographical region had zero familiarity with the program. Sierra and Russman (2006) further support this claim, noting that early

PSA-participants had more familiarity with the program requirements and individuals monitoring land use.

In terms of decreasing deforestation, the majority of the literature available supports the conclusion that the program has had little to no impact. On the deforestation front, the program was not effective. However, this does not mean that the PSA program has had zero impact on the environmental health of Costa Rica, but rather speaks to the aggressive policy mix the country implemented just a few short years before the PSA program began. Because there was a ban on forest clearing prior to the PSA program, it follows that the program itself is not the sole impetus for deforestation decline. Deforestation remains extremely low in Costa Rica, and several studies suggest that the true benefit of the PSA program may be its impact on reforestation, which will be explored in the next section.

Reforestation

The PSA program may struggle to reduce already low deforestation rates, but a benefit of the program is changes in land use, such as agricultural abandonment and natural forest regeneration that prior to PSA would have been cleared (Daniels et al. 2010). By changing the land use patterns of PSA participants under the forest conservation modality, the PSA program is able to generate even more new forest growth, beyond the capacity of reforestation and SAF contracts alone. Sierra and Russman (2006) conclude that PSA participants with forest conservation contracts are more likely to abandon agricultural land use when PSA funds are used to further economic activities besides agriculture, allowing for new forest growth. However, they do caution that this forest regrowth is not covered under forest conservation contracts, thus gains

may not be permanent as landowners could clear their land of this new growth without violating their contract. They also caution that limitations from fundors like the World Bank require PSA funds to go to secondary or primary growth forested lands, not areas where the land has already been cleared or degraded. This represents a barrier to expanding the PSA program to non-forest areas that could benefit from the program.

Moreover, there is a gap in research on the success of reforestation contracts. Presumably this is due to the assumption that as long as participants in this modality comply with the terms of their contract, reforestation would be successful. Unlike forest conservation contracts, there is less concern about additionality or confounding factors when considering reforestation contracts, as participants would be unlikely to undertake the labor intensive activities required under this contract unless they were receiving some sort of compensation. Those who choose to participate in the PSA program under the reforestation modality face barriers of high start up costs. The establishment costs of a plantation are particularly high during the first four years, due to management activities (Montagnini and Finney 2010). By providing 50% of the payment in the first year of reforestation activities, the PSA program does attempt to cover part of this initial cost and reduce the burden on landowners. The additional benefit of natural forest regeneration from land conservation contracts is obviously slower and less intentional than reforestation contracts, as the regenerated forest is not receiving the same level of management and care as provided by the reforestation modality. However, due to the sheer number of forest conservation contracts under the PSA program, this additional forest growth is a significant side effect. The payments for forest conservation contracts were larger than both reforestation and forest management contracts combined at the beginning of the program (Sanchez-Azofeifa et al. 2007).

Another more recent revision of the PSA program is the SAF modality. The SAF modality allows farmers to continue to use their land for farming, called agroforestry systems, and for cattle ranching, called agrosilvopastoral systems, while planting trees. These systems prevent land degradation, which is marked by soil erosion, loss of biodiversity, contamination of water sources, and decreased agricultural productivity (Montagnini and Finney 2010). Cattle ranching and aggressive farming lead to land degradation, which inhibits forest regrowth when that land is abandoned from further use. By paying farmers per tree planted, the PSA program is not only able to generate reforestation, but it also protects biodiversity in agricultural lands, and improves the nutrient cycling in soil. SAF contracts force farmers to abandon monoculture plantations, in which one agricultural product is intensively farmed, degrading the land and preventing any survival of native plant or animal species from thriving. Montagnini and Finney report that farms participating in SAF modalities have the same levels of species richness as secondary growth forests. The accessibility of the SAF modality to small landowners will be discussed later in this paper.

Equity

Participation Patterns

One of the supposed benefits of payments for environmental services programs is their ability to address environmental concerns while improving human development through supplemental income. While improving the livelihood of small landowners was not the top priority when Costa Rica was developing its PSA program, it is meant to be one of the

advantages of these schemes in general. The question then becomes whether PSA participation is accessible to this population in the first place. Without knowledge of the program and the skills to navigate the administrative aspects of PSA, these benefits of positive human development will remain unrealized.

Zbinden and Lee (2005) found that large landowners were disproportionately represented in the program compared to small landowners. In addition, PSA participants were more likely to be better educated, more urban-dwelling, more reliant on non-agricultural sources of income, and have higher agricultural incomes than non-participants. Zbinden and Lee identify three major influences in participation for the PSA program, which include farm size, human capital, and information. Those with larger farms serve to benefit more financially from the program than small landowners, as they face similar start up costs yet receive larger payments because of their land size. Human capital includes years of education and non-agricultural management skills, both of which are usually greater in large landowners because of their relative wealth to small landowners. The ability to understand and perform the administrative tasks required of the PSA program puts larger and more wealthy landowners at an advantage. Information is crucial for this imbalance, as Zbinden and Lee found that 61% of non-participants were unfamiliar with even the basics of the PSA program. Small landowners are less likely to come into personal contact with intermediary forestry officials responsible for delivering administrative tasks to participants and provide information about the program. These intermediary roles are considered essential in making the program more accessible to small landowners, and some community organizations have formed to fill this information gap.

Lansing (2017) expresses a similar sentiment as Zbinden and Lee, noting that access to forestry programs requires engaging with state institutions that are unfamiliar to small landowners, whereas large landowners are likely to have more experience with these institutions and thus have more successful interactions. Lansing also found that even among small landowners, wealthy households out-participated medium and poor households, with wealthy households comprising 31.5% of participants, medium households 16.9%, and poor households at 15%. Of small landowner participants, the predictors for enrollment were older households with primarily non-agricultural income and labor. This is similar to Zbinden and Lee's conclusion about large landowners' income ratio. Lansing suggests that wealthy small landowners are only part-time farmers, with their income coming from professional salaries, a similarity with large landowners. Lansing notes that the older household factor of small landowner participants is not held common with Zbinden and Lee's work on larger landowners, but is a feature unique to small landowners. Older heads of house are more likely to enroll in the PSA program as a sort of retirement plan.

Multi-Institutional Property Barriers

There are several significant barriers in place that prevent small landowners from participating in the PSA program. Lansing (2014) identifies the most significant being the demands of property regularization, disjointed state institutions, and historical patterns of rural settlement. Despite intentional efforts by the state to revise the program and make it more "poor friendly," the PSA program continues to enroll significantly more large and wealthy landowners than small and poor landowners (Lansing 2017). As discussed above, a small landowner does not

necessarily correlate as a poor landowner, but even wealthy and small landowners are underrepresented compared to large landowners. From 1997-2008, 39% of PSA funds went to corporately owned lands, with only 1% going to small landowners who own state agrarian reform lands (the Costa Rican acronym IDA will be used from here out to refer to state agrarian reform lands) (Lansing 2014). The legibility of land ownership and lack of proper documentation is the primary barrier IDA farmers face when attempting to gain access to the PSA program. Land title regularization began in 2001 and is an ongoing process. Costa Rica has two different agencies responsible for recognizing the boundaries of one's land and the official owner of one's land. The Land Property Registry records the titles of purchased land, while the Cadastral Nacional stores the official cadastral surveys which mark the boundaries of one's land. Because two separate institutions are responsible for land regularization, there are often discrepancies between the title and cadastral surveys, leading to property disputes and illegible claims of ownership. The 2001 reform of land title regularization was meant to resolve these discrepancies.

Unfortunately, regularization and legibility of land ownership is further complicated by ambiguous land claims. Land squatting under Costa Rican law is a valid claim to property ownership if one has been residing there for ten years. While no longer common, this was a method by which poor peasants could obtain property. While squatters would obtain the land title, they often would not have a cadastral survey conducted. And if a cadastral survey was performed, there are still discrepancies between the official land title and the official survey. It is costly and requires familiarity with state institutions to fix inconsistencies in land titles and the cadastral surveys, preventing those who obtained their land through squatting from participating in the program. Lansing notes in an interview with an NGO worker responsible for increasing

small landowner participation, the status of the land title and the cadastral survey is one of the first screening questions asked. Unfortunately for small landowners, the cost of making their land claims legible outweighs the financial gains of the PSA program. Once there are financial barriers to the application process, many small landowners are unable to apply.

IDA land causes even more problems for property regularization. IDA lands are settlements with basic infrastructure where tracts of land are distributed to the poor, who can then pay off the land over a fifteen year period. During that fifteen year period, the land is still owned by the IDA. The purpose of IDA land is to be developed for agricultural use so that residents have a steady source of income. This is directly in conflict with the goal of the PSA program, which is to reduce agricultural land use and encourage reforestation. Thus, until 2003 IDA landowners were not legally permitted to enroll in the PSA program. In 2003, the IDA agreed that landowners could participate in the PSA program, but only if their land payments were up to date. Lansing identifies this payment clause as the primary barrier to IDA landowner enrollment, as it is more than common for IDA landowners to fall behind on payment or illicitly rent their land to others. The IDA debt clause is a major reason that IDA landowners make up only 1% of the PSA contracts, punishing the poor for their own socio-economic status and restricting small landowner participation in the program.

SAF Modality

One method by which the state has attempted to remedy the exclusion of small landowners is the introduction of agroforestry and silvopastoral systems. The SAF modality was developed with the goal of targeting small landowners in low socioeconomic regions, including

regions with high concentrations of indigenous people (Cole 2010). By allowing landowners to use their land for agricultural and cattle purposes, often the primary source of income for small landowners, the SAF modality offers an opportunity for previously excluded groups to participate in the PSA program. This is significant concerning participation patterns of small landowners, as the majority are wealthy and make most of their income from non-agricultural, professional activities (Lansing 2017). By targeting low socio-economic regions and requiring that participants use their land for agricultural or cattle purposes, the SAF modality can attract a larger portion of poor landowners, instead of wealthy landowners.

Another question concerning the SAF modality is how much it benefits small landowners. Receiving US$1.30 for each tree planted, with a minimum of 350 trees, the sum of the payments is not very large. Cole (2010) reports that 78% of SAF participants said that their income level had increased, and that payments exceeded the planting expenses, particularly in indigenous communities dependent upon subsistence farming. Payments were used for farm improvements or for immediate needs like clothing or school fees. Cole also notes indirect socioeconomic benefits of the SAF modality, as a farmers' association in Biolley used the tree planting as a way to recruit volunteers and ecotourists to their region. As discussed previously, one of the essential factors that can make or break the success of the SAF modality are intermediary actors. Community level organizations such as human development NGOs and farmers' associations played crucial roles in communicating program requirements, facilitating workshops with forestry officials, and providing technical support for farmers. Access to institutional mechanisms remains a barrier, as landowners who entered SAF contracts independently reported difficulty understanding contract requirements and interacting with

forestry officials. The establishment of community organizations that can facilitate interactions with FONAFIFO, SINAC, MINAE, and the forestry officials is vital to making modalities like SAF successful in reaching their target populations.

Ethics

Intrinsic Values, Exploitation, and Commodification

In addition to judging the effectiveness and equity of the PSA program, ethical questions must be considered. Environmental services as a concept creates a transactional relationship between humans and nature, in which people profit off the environment and define what parts of the environment are considered valuable to humans. The next three sections of this paper will be dedicated to examining the issues that arise from a neoliberal understanding of environmental services, how institutionalizing these programs creates a paradigm that resists deconstruction, and examining the actual and potential impacts on human-nature relationships of small landowner PSA participants. Before examining these factors, I will provide an outline of common ethical critiques and advantages of environmental services.

Schröter et al. (2014) consider several common critiques and counter-arguments surrounding the concept of environmental services. Note that these critiques are not specific to Costa Rica's PSA program, but are applied to the concept of environmental services themselves. I will use the term PSA program to refer to Costa Rica's specific program, and PES schemes to refer to the general practice of payments for environmental services. The first of such critiques is the anthropocentric nature of environmental services. Environmental services are identified only

as they are beneficial to humans. Costa Rica's PSA program specifically identifies four bundled services: greenhouse gas mitigation, scenic beauty, hydrological services, and biodiversity. By picking and choosing elements of the environment advantageous for humans, PES schemes exclude the intrinsic value of nature. Even if climate change precipitates a major human extinction, the environment will continue to change and regulate itself. There is reason to argue that the environment should be valued as a thing in and of itself, regardless of its relationship to humans. This is a biocentric form of reasoning in which nature has intrinsic value, rather than an anthropocentric form of reasoning in which nature has only instrumental values as related to humans. A counter-argument is that anthropocentric reasoning is not mutually exclusive to biocentric reasoning. Humans can recognize the intrinsic value of nature while recognizing the instrumental values through which we benefit. This anthropocentric reasoning is not necessarily negative, but rather a method through which arguments for the sustainable use of the environment can be made more legible in decision-making.

Another critique of the ES concept is that it forms an exploitative relationship between humans and nature. Casting the environment as a producer of services casts humans as consumers of the environment, rather than an integrated part of the environment. Nature's position as a product further alienates humans from engaging with the intrinsic value of the environment. If this becomes the primary way in which humans imagine the environment, it can damage our interactions with nature due to the exploitative mindset. This transactional and profit-driven view of nature is already present in the fossil fuel industry, logging industry, and many other corporate entities which depend on natural resources to both produce and profit. PES schemes run a particular danger because this mindset would be extended to everyday workers,

further complicating the ability of the world to respond to climate change. A counter-argument to this is that environmental services can actually serve as a conduit through which humans can reconnect with nature. This could be especially influential in the Western world, where modernization has led people to become increasingly removed from the environment. By identifying specific and often intangible services that the environment provides, such as scenic beauty, PES schemes posit financial value that can be understood by modern consumers. Without a specific price tag conferring a tangible value on these intangible services, consumers may ignore the necessary benefits of nature and continue to create negative externalities of environmental degradation. Instead of alienating humans from nature, PES schemes could force us to acknowledge the true value the environment holds for human well-being.

The final critique is the economic valuation of environmental services. This is essentially a 'slippery slope' argument, in which the economic valuation of some select environmental services, like greenhouse gas mitigation, could lead to the economic valuation of things like the sun, ocean currents, or gravity. This critique argues against the commodification of previously non-marketed areas. Formerly organic relations between humans and nature become commercial relationships through PES schemes. A classic Marxist critique of commodification is offered by Gomez-Baggethun and Perez (2011), in which capitalist modes of production recast previously complex social relationships into transactional exchange relationships between objects. Commodification resulting from economic valuation mystifies and obscures environmental services, reducing ecological complexity and the many biotic and abiotic factors that generate environmental services to a transactional market-based system. A counter-argument to this critique is that economic valuation of environmental services does not mean that these services

are not valued for non-economic reasons, but rather provides a way of assigning value that can be used in economic and political decision-making to protect the environment. Environmental services are limited and scarce resources, unlike the sun, ocean currents, or gravity. The commodification of nature to make the value of its services legible under current economic and political conditions does not mean that commodification is the only relationship humans can cultivate with nature.

PES Schemes and Neoliberalism

PES schemes often come under fire from critics as neoliberal policies that create transactional relationships, commodify nature, and require the privatization and regulation of ecosystem functions and property rights. Lansing (2014) argues that while PES schemes often function as state subsidies rather than market-mediated sales, the necessity of property regularization and privatization causes many of the same negative outcomes as neoliberal policies. Land regularization leads to the exclusion of some groups and ignores cultural or local practices of land use or ownership. As described previously, Costa Rica runs into problems with the exclusion of IDA landowners and land squatters, who lack the funds to make their land ownership claims legible under the requirements of the PSA program and other governmental institutions. Rather than locating the problem in the PSA program itself, Lansing concludes that it is the interaction between multiple state institutions that leads to the exclusion of some landowners.

While Lansing separates PES schemes from neoliberalism as state subsidies, others have critiqued PES schemes specifically for their emergence under a neoliberal framework.

Silvertown (2015) defines neoliberalism as "the philosophy that seeks the deregulation of markets and the privatization of all possible goods and services" (643). Silvertown goes on to claim that nature is actually devalued by monetization, and casts the decision to monetize nature as a moral choice rather than an economic imperative. This is a direct contestation of Constanza et al.'s (2014) claim that humans no longer have a choice under current economic and political conditions to not use monetary valuation for conservation efforts. Silvertown argues that the claim that monetization of ES is the only option left to protect biodiversity and other environmental services has not been systematically tested, but continues to be supported because the issue is framed in a way which prevents other options from being considered. The paradigm surrounding environmental services presents the issue in such a way that valuation of nature for its intrinsic benefits is seen as insufficient to justify protection, which falsely assumes that people only care about something if it has a market-value. Not only is this a cynical mindset from which to view people, it is also a narrow mindset that ignores the many counterexamples through which people and institutions have acted collectively without financial incentive to protect global commons. An example of this capability is the Montreal Protocol, in which world governments were able to cooperate to prevent environmental and human harm from the depleted ozone layer. Despite resistance from the chlorofluorocarbon industry due to market losses they would suffer in the transition from CFCs to HCFCs, people and institutions were able to recognize the many non-monetary benefits of an intact ozone layer.

PES Paradigms

Following the criticism of PES schemes as agents of neoliberalism, there is more to be said concerning the "paradigms" of ES, and how it can create ignorance. As PES schemes become adopted by more and more nations, the collective understanding of how to address conservation concerns becomes more limited. Institutions such as the United Nations form organizations like REDD+ which facilitate PES schemes globally, further cementing PES schemes as *the* solution for mitigating the externalities of environmental services. Muradian et al. (2013) note the fatal attraction of "win-win" solutions, or policies that address environmental concerns and human development. These researchers illuminate the parallels between the dissemination of PES schemes with the dissemination of "integrated conservation and development projects (ICDPs)" which gained popularity after the Rio Summit on Sustainable Development (Muradian et al. 2013). Revisiting the success of these projects a decade later, it was found that ICDPs had made little progress in promoting conservation or human development. When attractive "win-win" policies are presented to policy makers with the resources to quickly implement them, unintended consequences are unaccounted for, and alternate options can be rejected in the face of the current policy paradigm. The simplicity of PES schemes is alluring, yet also illusory, as policies that refuse to take local context into account can fail. This can be seen in Costa Rica's PSA program by their failure to account for IDA landowners, thus creating a policy which excludes the demographic, rural and poor landowners, that the human development side of the program is meant to target.

Establishing PES schemes as the dominant framework to address ecological conservation can also have the consequence of devaluing local knowledge. Institutionally driven policies can strip local and indigenous people of environmental practices that may have been successful and

sustainable, replacing them with financially driven, neoliberal practices. Lohmann (2008) discusses the "production of ignorance" that often accompanies development projects, such as market construction, rural income programs, and surveying and mapping. The solution presented by PES schemes becomes epistemically privileged in the minds of institutional actors, as the truth of the knowledge of PES schemes is validated by organizations like the United Nations and REDD+. Knowledge and solutions produced by local people is then at an epistemic disadvantage, as that knowledge fails to be validated by these same institutions. If locally developed solutions are brushed aside for the sake of a paradigm that does not necessarily have the evidence to support its claims, institutions can create patterns of ignorance. Ignorance of the mechanisms of climate change, now simplified by the appeal of "win-win" solutions, falsely constructs a narrative in which communities are unable to find solutions for sustainable living without turning to financial incentives. The dominance of these solutions suppresses local engagement with the climate crisis and creates a sense of complacency in which people trust that the solutions considered the most attractive are the solutions that are the most effective and equitable.

The epistemic privileging of knowledge produced through institutional solutions such as PES schemes can be mitigated by the involvement of civil society organizations. Serving as intermediaries between local communities, fundors, and governmental administrations like FONAFIFO and MINAE, civil society organizations can balance the power dynamic between local communities and institutions. Schröter et al. (2018) examine the impact of the Community Blue Carbon Project (CBCP) in Costa Rica, which worked with local fishermen to protect mangrove areas. Companies that benefited from the services provided by the mangroves were the

fundors in this case. By establishing networks of trust between leaders in the CBCP, local fishermen, and representatives of the company, this organization was able to head off the issue of epistemic privilege. Fishermen familiar with the ecology of the mangrove areas were able to contribute their local knowledge, and were in turn more trusting of an outside expert on mangrove conservation provided by the CBCP. Organizations focused on both social and environmental justice working with local communities is one method by which PES schemes can avoid entrenching themselves as a paradigm that resists deconstruction and obscures alternate sources of knowledge. By retaining awareness of the power and knowledge imbalances that policies like PES schemes can create, steps can be taken to prevent this negative consequence.

Ethical Impacts on Small Landowners

The final philosophical consideration is the impact the PSA program has on small landowners' engagement and relationship with the environment. Unfortunately, there is little literature which addresses the question of PSA programs participants before-and-after attitudes. Despite this gap in research, there is some evidence available which begins to sketch a picture of the potential ethical impacts of the PSA program. A potential positive impact on small landowners' attitude toward nature is the tangible value placed on 'undesirable' land. Land not fit for agricultural or cattle purposes is undesirable because it is not profitable, but the SAF modality allows landowners to profit by planting trees there. This can encourage landowners to value nature for the indirect benefits of environmental services, along with the direct benefits that stem from agricultural or cattle use. The accelerated agricultural land abandonment resulting from forest conservation contract participants could also be a positive ethical impact of the PSA

program, as landowners abandon traditional views about natural regrowth as encroaching on their property and instead embrace regrowth for its positive environmental impacts. Participants in the PSA program also have the capacity of gaining new knowledge about the benefits of sustainable land use which can then be diffused locally to non-participants, strengthening community knowledge to live sustainably.

Another possibility is that participation in the PSA program may not impact participants' values at all, but rather enable people to engage in activities that align with already held values. Ross (2016), Schwartz (2017), Arriagada et al. (2015), and Cole (2010) conducted interviews with small landowner participants in different PSA modalities, and all found non-financial, environmental motives for participation. A barrier to sustainable land use is poverty, in which basic needs for survival must be prioritized over sustainable practices. Heads of households must make decisions about whether to leave forest on their land intact and receive no profit, or clear that land and receive funds that could provide food, clothing, or schooling to their family. The PSA program could be a way for small landowners to enact values they already hold, and improve their knowledge of how to live sustainability without undue cost.

One would be remiss to assume that the PSA program would have solely positive impacts. General critiques of the PSA program and PES schemes overall include the transactional relationship it establishes between humans and nature. This only furthers the commodification of land and nature that small landowners are already exposed to due to their socioeconomic position. The environment becomes a product that one can and must use in order to survive. The intrinsic value of nature can be lost when programs like PSA assign monetary value, resulting in a mindset of exploitation directed toward the environment. This negative

impact has the potential of distancing people from the lifestyle changes necessary to address the climate crisis. If nature is only useful as far as it benefits an individual directly, it could become difficult to justify to landowners why they should not use slash and burn agricultural techniques on land that isn't enrolled in the program.

Conclusion

There are a variety of challenges facing the effectiveness, equity, and ethics of Costa Rica's PSA program. Rather than remain static and allow these problems to ferment, actions have been taken at local and national levels, as civil society organizations work to correct local issues and new modalities of the program, such as SAF, are introduced. Like many environmental and social programs, there are barriers that can only be discovered after the implementation of the program, such as the illegibility of traditional means of property ownership. By synthesizing literature addressing policy, sociological, and philosophical concerns that arise from the PSA program, this paper has highlighted shortcomings of the program and research gaps concerning its impact.

Though measures of effectiveness show limited impacts on reducing deforestation, the benefits from encouraging reforestation, teaching and diffusing responsible land use methods, and breaking traditions of slash and burn agriculture make the program worthwhile to continue. This assessment is further supported by the conclusions drawn concerning equity and ethics. While small landowners remain at a disadvantage in terms of access to the program, national and community institutions are aware of this disparity and have made efforts to change. Ultimately, it

is the interaction of many different institutions which restricts small landowner access to the program, a barrier which can only be addressed by continued efforts to make all government institutions more accessible to the public. Farmers' associations, civil society organizations, and forestry officials must build social networks within local communities which support the knowledge necessary for small landowners to successfully interact with unfamiliar institutions. There are many potential ethical concerns that originate from the concept of environmental services, but those concerns have largely been unrealized in Costa Rica's case, and as with equity concerns, can be mitigated through strong social networks created at a local level. Oral interviews consistently support non-financial motivations behind participants' decisions to enroll in the program (Schwartz 2017, Ross 2010, Lansing 2014), suggesting that participants do not fall victim to the concerns of commodification and nor lose sight of the intrinsic values of nature for instrumental ones.

Further research is needed in the social areas of Costa Rica's PSA program. Little research exists in which the the attitude and values of Costa Rican landowners are considered, a subject which is often discounted in policy considerations. Examining the motivations of participants before and after enrolling in the program, and any changes in values they hold toward nature could demonstrate the benefits of the PSA program and provide justifications to continue the program unrelated to financial or environmental concerns. Further research on the livelihood impacts of the PSA program for small landowners compared to large landowners is also necessary. There is still limited research which examines how PSA income impacts the daily functioning of small landowners, and whether there are even greater wealth disparities created because of large landowners improved access to PSA funds.

While PES schemes have been adopted on an international scale, they are less common in developed nations, due to their characterization as a human development project. I argue PES schemes could find success on a state-level and a local-level scale in the United States. I recommend state and local-level ventures because of the issues in measuring effectiveness and the confounding factor of additionality present in Costa Rica's program. For example, the Florida state legislature could enact a PES scheme in order to protect ecologically valued but financially devalued wetlands. Wetlands are inhabitable by humans and are often degraded for real estate or development projects. By explicitly monetizing the services wetlands provide, Florida could more efficiently and effectively deter wetland degradation than by the command and control approach that is currently implemented (Texas A&M AgriLife Extension 2007).

A final note of caution considering the widespread acceptance of PES schemes is related to Lohmann's (2008) concern about establishing paradigms of thoughts in regard to addressing the climate crisis. PES schemes are not and should not be the only solutions considered when attempting to protect ecologically valuable lands. Instead, PES schemes should be thought of as one piece of the puzzle in addressing climate change and environmental degradation. The institutional acceptance of PES schemes is not a negative, but the popularity of this solution and focus on changing individuals' practices must not obscure the corporate forces that are responsible for mass deforestation and land degradation. Corporate entities such as Dole and Del Monte generate much more profit through ecologically destructive monoculture plantations than any PES scheme could provide them, and PES schemes are not a solution for the problems created by late stage capitalism. PES schemes work as voluntary, market based programs that integrate cleanly into already existing capitalist structures. These non-radical solutions are an

important step in the fight against the climate crisis, but in the face of globalized corporate forces, voluntary solutions can only be a small part of the picture. Collective solutions such as the Paris Accords must come to be accepted by governments along with strong enforcement methods in order to do the work humanity needs to address the climate crisis.

References

Arriagada R., E. Sills, P. Ferraro, S. Pattanayak. 2015. "Do Payments Pay Off? Evidence from Participation in Costa Rica's PES Program." *Plos One* 10, no. 7 (July): 1-17. https://doi.org/10.1371/journal.pone.0131544

Blundo-Canto, Genowefa,Vincent Bax, Marcela Quintero, Giselle Cruz-Garcia, Rolf Groeneveld, Lisset, Perez-Marulanda. 2018. "The Different Dimensions of Livelihood Impacts of Payments for Environmental Services (PES) Schemes: A Systematic Review." *Ecological Economics* 149 (July): 160-183. https://doi.org/10.1016/j.ecolecon.2018.03.011

Cole, Rebecca. 2010. "Social and Environmental Impacts of Payments for Environmental Services for Agroforestry On Small Scale Farms in Southern Costa Rica." *International Journal of Sustainable Development* 17, no. 3 (May): 208-216. https://doi.org/10.1080/13504501003729085

Costanza, Robert, Ralph d'Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, et al. 1997. "The Value of the World's Ecosystem Services and Natural Capital." *Nature* 387, (1997): 253-260. https://doi.org/10.1038/387253a0

Daniels, Amy, Kenneth Bagstad, Valerie Esposito, Azur Moulaert, Carlos Rodriguez. 2010. "Understanding the Impacts of Costa Rica's PES: Are We Asking the Right Questions?" *Ecological Economics* 69, no. 11 (September): 2116-2126. https://doi.org/10.1016/j.ecolecon.2010.06.011

Gomez-Baggethun, Erik, Manuel Ruiz Perez. 2011. "Economic Valuation and the Commodification of Ecosystem Services." *Progress in Physical Geography* 35, no. 5 (October): 1-16. https://doi.org/10.1177%2F0309133311421708

Lansing, David. 2017. "Understanding Smallholder Participation in Payments for Ecosystem Services: the Case of Costa Rica." *Human Ecology* 45, no. 1 (February): 77-87. https://doi.org/10.1007/s10745-016-9886-x

Lansing, David. 2014."Unequal Access to Payments for Ecosystem Services: The Case of Costa Rica." *Development and Change* 45, no. 6 (October): 1310-1331. https://doi.org/10.1111/dech.12134

Lohmann, Larry. 2008. "Carbon Trading, Climate Justice, and the Production of Ignorance: Ten Examples" *Development* 51, no. 3 (September): 359-365. https://doi.org/10.1057/dev.2008.27

Montagnini, Florencia, Christopher Finney. 2011. "Payments for Environmental Services in Latin America as a Tool for Restoration and Rural Development." *AMBIO* 40, no. 3

(May): 285-297. https://doi.org/10.1007/s13280-010-0114-4

Morse, W., J. Schedlbauer, S. Sesnie, B. Finegan, C. Harvey, S. Hollenhorst, K. Kavanagh, D. Stoian, J. Wulfhorst. 2009. "Consequences of Environmental Service Payments for Forest Retention and Recruitment in a Costa Rican Biological Corridor." *Ecological Society* 14, no. 1 (June): https://dio.org/10.5751/ES-02688-140123

Muradian, R., M. Arsel, L. Pellegrini, F. Adaman, B. Aguilar, B. Agarwal, E. Corbera, et al. 2013. "Payments for Ecosystem Services and the Fatal Attraction of Win-win Solutions." *Conservation Letters* 6, no. 4 (November): 274-279. https://doi.org/10.1111/j.1755-263X.2012.00309.x

Pagiola, Stefano. 2008. "Payments for Ecological Services in Costa Rica." *Ecological Economics* 65, no. 4 (May): 712-724. https://doi.org/10.1016/j.ecolecon.2007.07.033

Pfaff, Alexander, Juan Robalino, Arturo Sanchez-Azofeifa. 2008. "Payments for Environmental Services: Empirical Analysis for Costa Rica." Working Paper Series of the Terry Sanford Institute of Public Policy. http://sanford.duke.edu/research/papers/SAN08-05.pdf.

Ross, Cody. 2016. "Sliding-scale Environmental Service Payments and Non-financial Incentives: Results of a Survey of Land-owner Interest in Costa Rica." *Ecological Economics* 130 (October): 252-262. https://doi.org/10.1016/j.ecolecon.2016.07.014

Sanchez-Azofeifa, G. Arturo, Alexander Pfaff, Juan Robalino, Judson Boomhower. 2007. "Costa Rica's Payment for Environmental Services Program: Intention, Implementation, and Impact." *Conservation Biology* 21, no. 5 (July): 1165-1173. https://doi.org/10.1111/j.1523-1739.2007.00751.x

Schröter, Barbara, Bettina Matzdorf, Isabel Hackenberg, Jennifer Hauck. 2018. "More than just linking the nodes: civil society actors as intermediaries in the design and implementation of payments for ecosystem services - the case of a blue carbon project in Costa Rica." *Local Environment* 23, no. 6 (2018): 635-651. https://doi.org/10.1080/13549839.2018.1460808

Schröter, Matthias, Emma van der Zanden, Alexander van Oudenhoden, Roy Remme, Hector Serna-Chavez, Rudolf de Groot, Paul Opdam. 2014. "Ecosystem Services as a Contested Concept: A Synthesis of Critique and Counter Arguments." *Conservation Letters* 7, no. 6 (January): 514-523. https://doi.org/10.1111/conl.12091

Schwartz, Gregory. 2017. "The Role of Women in Payment for Environmental Services Programs in Osa, Costa Rica." *Gender, Place & Culture* 24, no. 6, (June): 890-910, https://doi.org/10.1080/0966369X.2017.1342603

Sierra, Rodrigo, Eric Russman. 2006. "On the Efficiency of Environmental Service Payments: A Forest Conservation Assessment in the Osa Peninsula, Costa Rica." *Ecological Economics* 59, no. 1 (August): 131-141. https://doi.org/10.1016/j.ecolecon.2005.10.010

Silvertown, Johnathan. 2015. "Have Ecosystem Services Been Oversold?" *Trends in Ecology and Evolution* 30, no. 11 (November): 641-648. https://doi.org/10.1016/j.tree.2015.08.007

Texas A&M AgriLife Extension. 2007. "Florida State Law for Wetland Protection." Accessed February 10, 2020. https://coastalresilience.tamu.edu/home/wetland-protection/policy-framework/state-law/florida-state-law-for-wetland-protection/

Zbinden, Simon, David Lee. 2005. "Paying for Environmental Services: An Analysis of Participation in Costa Rica's PSA Program." *World Development* 33, no. 2 (February): 255–272. https://doi.org/10.1016/j.worlddev.2004.07.012