

GOVERNMENT PAYMENTS FOR ECOSYSTEM SERVICES—LESSONS FROM COSTA RICA

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I. INTRODUCTION

Programs establishing payment for ecosystem services¹ (PES) have become an increasingly popular addition to the environ-

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1. The term “payment for ecosystem services” is taken to be synonymous with the phrase “payment for environmental services.” Both terms refer to payment to landowners to encourage them to engage in land use practices which promote the production of natural services. Most experts conclude that the substantive differences between the terms are minimal. See Sven Wunder *Payments for Environmental Services: Some Nuts and Bolts*. Center for International Forestry Research (CIFOR) Occasional Paper No. 42, 8 (2005), available at http://www.cifor.cgiar.org/publications/pdf_files/OccPapers/OP-42.pdf. But see Scherr, et al. who argue that the terms are substantively different. Sara Scherr, et. al., For Services Rendered. Current Status and future potential markets for ecosystem services of tropical forests: an overview, ITTO Technical Series No. 21 (2004) available at http://www.itto.or.jp/live/Live_Server/724/TS21e.pdf

mental toolbox. Generally speaking, PES programs involve a voluntary transaction where a external entity purchases an ecosystem service from a participating landowner² whose land provides benefits to the local, regional or global environment (and the benefits those environments provide to humans).³ Such programs frequently involve private ecosystem purchasers including individuals, corporations, and non-governmental organizations, while other programs rely on direct governmental payments for ecosystem services.⁴ Recent years have witnessed a proliferation of PES activities worldwide as private and government actors have moved to encourage conservation.⁵

This paper focuses on programs involving direct governmental PES activities in light of what they contribute to environmental conservation generally. To do so, the article draws evidence from a governmental PES designed to promote forest conservation and reforestation in the Central American nation of Costa Rica. There, governmental payments to landowners who have contracted to engage in forest-friendly practices have helped encourage conservation activities over the last 10 years.⁶ As such, the Costa Rican program provides a useful focal point to understanding how PES programs can work in concert with other governmental programs to help landowners conserve.

Before delving into specifics, the paper introduces PES programs by discussing what ecosystem services are and explaining why such services may be underprovided in society without governmental intervention. Section III reviews other governmental efforts to ensure the continued supply of ecosystem services and introduces PES programs generally. Section IV sets out the Costa Rican case and illustrates how the PES program operates and is funded. Section V provides analysis of the Costa Rican case including current enrollment and impacts. Section VI provides conclusions regarding the lessons of Costa Rican program.

2. As used in this context, private land owners may consist of individuals, collective groups, and corporations.

3. *See generally*, Wunder, *supra*, note 1

4. *Id.* at 7-8.

5. *See generally* STEFANO PAGIOLA, ET. AL., EDS., *SELLING FOREST ENVIRONMENTAL SERVICES* (2004).

6. Stefano Pagiola, *Payment for Environmental Services in Costa Rica*, MPRA Paper No. 2010 (2007), http://mpra.ub.uni-muenchen.de/2010/01/MPRA_paper_2010.pdf

II. ECOSYSTEM SERVICES INTRODUCED

A. *Ecosystem Services Defined*

It may be beneficial to first provide conceptual definitions for what is meant by the term “ecosystem services.” In a recent publication, Boyd and Banzhaf state, “[e]cosystem services are components of nature, directly enjoyed, consumed, or used to yield human well-being.”⁷ Other authors have provided more general terms. Geoffrey Heal, for instance, states that biologists refer to ecosystem services as “life-supporting and life enhancing services of natural ecosystems”⁸ Another influential and oft cited definition states:

Natural ecosystems perform critical life-support services, upon which the well-being of all society depends. These include:

- purification of air and water
- mitigation of droughts and floods
- generation and preservation of soils and renewal of their fertility
- detoxification and decomposition of wastes
- pollination of crops and natural vegetation
- dispersal of seeds, cycling and movement of nutrients
- control of the vast majority of potential agricultural pests
- maintenance of biodiversity
- protection of coastal shores from erosion by waves
- protection from the sun’s harmful ultraviolet rays
- stabilization of the climate
- moderation of weather extremes and their impacts
- provision of aesthetic beauty and intellectual stimulation that lift the human spirit.⁹

7. James Boyd and Spencer Banzhaf, Resources for the Future, *What are Ecosystem Services?* DP 06-02, 8 (2006), available at: <http://www.rff.org/rff/Documents/RFF-DP-06-02.pdf>

8. GEOFFREY HEAL, NATURE AND THE MARKETPLACE: CAPTURING THE VALUE OF ECOSYSTEM SERVICES, 1 (2000).

9. GRETCHEN DAILY, ED., NATURE’S SERVICES: SOCIETAL DEPENDENCE ON NATURAL ECOSYSTEMS (1997).

Despite differences in the specific language used, all agree that ecosystem services refer to the benefits stemming from natural systems which are necessary for humans to prosper.¹⁰ Without these services performed, nature can be significantly altered, and life as we currently enjoy it, become more difficult.¹¹

B. The Economics of Ecosystem Services

Private individuals often lack sufficient incentives to maintain property in ways conducive to the production of ecosystem services. Most would consider ecosystem services public goods,¹² which are goods defined by several characteristics—non-rivalry in consumption and difficulty in exclusive ownership.¹³ Basic economics predicts that individuals acting on their own will undersupply public goods.¹⁴

This result occurs precisely because it is difficult to exclude others from using the good.¹⁵ Private supply of public goods involves certain externality problems where a private provider of a public good bears all cost of production, but only gains a portion of the benefits. Those benefiting from the provision, on the other hand, have the temptation to free ride on any individual willing to provide the good. To overcome this problem, groups often form

10. While differences in definitions are glossed over here, many argue precise definitions are required in order to adequately produce ecosystem accounting systems necessary to rightly compensate those producing the services. Boyd and Banzhaf state “[l]oose definitions undermine accounting systems. They muddy measurement and lead to difficulties in interpretation...Accordingly, we seek more rigorously and consistently defined ecosystem service units.” Boyd & Banzhaf, *supra* note 7, at 1-2.

11. To emphasize this point, Duke Law Professor James Salzman points to the experience of Biosphere II, where the models of earth’s natural functions failed to adequately provide the atmospheric cleansing and other ecosystem services usually associated with life on earth. Due to these failings, the Biosphere II experiment prematurely shutdown to ensure the health and welfare of the human participants. This event presented disturbing implications for the real world where if ecosystem services failed to adequately function, we would have no real option to simply shut down the “experiment.” James Salzman, *A Field of Green? The Past and Future of Ecosystem Services*, 21 J. LAND USE & ENVTL. LAW 133 (2006).

12. See generally Heal *supra* note 6 at 31-33. “Public good,” also occasionally referred to as a “collective goods” in the theoretical literature are distinct from private or individually consumable goods. DAVID WEIMER AND AIDAN VINING, (2005) POLICY ANALYSIS, 72 (4TH ED 2005).

13. Rivalry in consumption refers to the ability of one to consume the good without impacting another’s consumption of the same good. Excludability of ownership refers the ability of one user’s ability to exclude another from consuming the good. Public goods are held in contrast to other types of goods: private goods, which are easily excludable and rivalrous in their use consumption; common pool goods, which are not easily excludable, but rival in their use and consumption; and toll goods, which are excludable, but generally not rivalrous in their consumption. *Id.* at 72-78.

14. *Id.* at 78.

15. *Id.*

and act collectively to ensure the continued provision of a desired public good. Indeed, according to many economists and policy theorists, ensuring an adequate supply of a public good is one of the justifications of government intervention.¹⁶ Through collective action, the inequities of the system can be overcome, and each pay their share for the public good.¹⁷

C. Ecosystem Services as Public Goods

To better understand the implications of ecosystem services as public goods, consider a property owner with forested land. The wooded areas on the land perform certain ecological services including, among other things, carbon sequestration, topsoil stabilization, reduced flooding, and aesthetic beauty. The landowner represents one of many individuals who benefit from these services. For example, the landowner's neighbors may draw direct benefits from the aesthetically pleasing nature of the intact woods or may enjoy the wildlife they sustain. Those downstream from the landowner benefit from decreased flooding and water free from the topsoil which may otherwise pollute local streams. Still others in the global community benefit from the carbon sequestration services performed by those woods in conjunction with others globally.

Each of these services does not generally involve rivalry in consumption—aesthetic beauty may be appreciated by many without affecting other's enjoyment,¹⁸ clean stream water can be equally enjoyed by all those downstream,¹⁹ and the benefits from carbon sequestration can be equally enjoyed by many in the global community.²⁰ Additionally, it is difficult or potentially impossible for

16. *Id.*

17. Take for instance, the classic example of national defense as a public good. Once the defense mechanisms are put in place, one individual's reliance on those mechanisms does not impact another individual's (non-rivalry), but it is very difficult to provide the benefits of such security to one individual and not provide the benefits to another living in close proximity (non-excludability). This provides little incentive for private actors to provide for national defense. Rather, many would simply prefer to free ride off the efforts of others. To overcome this problem, individuals have formed collectives which have created rules and mechanisms whereby sufficient resources (from taxation, inscription, or other means), can be accumulated to provide for the general welfare of all. Further rules are put into place to limit the temptation to free ride on other's provision of defense through, *inter alia*, penalties for failure to pay taxes or not registering for the selective service.

18. Clearly, this argument can only be carried so far. Congestion arising from too many individuals "enjoying" the aesthetic beauty may eventually impact a viewers enjoyment.

19. However, some may benefit disproportionately from the clean stream water. For example, those who rely directly from the stream for consumption, industry, or other uses may benefit more than others who do not rely on the stream for these purposes.

20. Similar to FN 18 & FN 19, the benefits of carbon sequestration may have certain

the landowner to claim exclusive ownership of the services provided. The landowner likely cannot claim compensation from each of the beneficiaries of the services. A bill sent to neighbors to collect for the aesthetic enjoyment of the woods would almost certainly be ignored. There is simply no legal authority which would require the neighbors to pay. Similarly, no authority exists for the landowner to collect from downstream beneficiaries from the clean water or the various beneficiaries of the carbon sequestration performed.

However, in keeping the land in its current condition, the landowner faces various private costs. These may include tax obligations, maintenance costs, management costs, and other expenses found in performing upkeep on the property. In addition to these costs, the landowner forgoes other opportunities in keeping the property in its current condition. These opportunity costs include the lost profits from alternative uses of the property such as revenue generated from non-sustainable intensive forest management,²¹ farming land cleared of trees, or developing the property in other ways for residential, commercial, or industrial use.

The property owner bears the majority of the cost in allowing the ecosystem services to be performed by the wooded area, but only receives a portion of the benefits. In viewing these tradeoffs, many property owners may view it to be in their interest to change the use of the property and claim more private benefits. Doing so may result in a net loss of ecosystem services. But, the landowner only pays a portion of these costs. The total cost is spread across the other local, regional, and global beneficiaries of the wooded area.

III. AVOIDING ECOSYSTEM SERVICE LOSS

A. Traditional Governmental Approaches Promoting Delivery of Ecosystem Services

Governmental intervention has long been used as a means to

disproportionate impacts. For instance, climate experts recently concluded that the world's poorest communities may suffer more from global warming than richer communities. Raghendra Pachauri, the chairman of the United Nations' Intergovernmental Panel on Climate Change recently stated regarding a forthcoming UN report on global warming, "It's the poorest of the poor in the world, and this includes poor people even in prosperous societies, who are going to be the worst hit." Alan Zarembo and Thomas H. Maugh II, *Earth faces a grim future if global warming isn't slowed*, *U.N. Report Says*, LOS ANGELES TIMES (April 6, 2007) Located at: <http://www.latimes.com/news/science/la-ex-warming6apr06,0,4921051.story?coll=la-home-headlines>

21. Although, intensive forest management including cutting timber may simply be part of management costs if these activities are undertaken in a sustainable manner.

ensure the continued supply of ecosystem services.²² One long established method of ensuring continued provision of ecological services involves designation of protected areas— properties dedicated to conservation such as parks (national, state, and local), wildlife reserves, forestry reserves, conservancy areas, and a variety of other land management designations. In the ideal case, rules are created and enforced in such a way that the incentives to use the property in manners not conducive to the continued provision of ecosystem services are removed. Many protected areas have been created worldwide with significant success that have resulted in continued ecosystem services.²³ Yet, there have also been problems with displaced communities,²⁴ insufficient habitat protection,²⁵ and lack of funding, regulation, and mismanagement.²⁶

A second traditional mechanism involves regulation. There, governments make and enforce rules regarding the use of land which increase costs for undesirable behavior through the imposition of substantial civil or criminal sanctions. Examples of this tool at play in the United States include the Endangered Species Act (ESA) of 1973,²⁷ where United States lawmakers and administrators have sought to protect species through making rules against changing habitats in ways which may harm threatened and endangered species. Despite successes, some have criticized regulations such as the ESA with failing to provide adequate positive incentives for conservation and are inequitable.²⁸

22. People have over the years acted to set up protected areas, regulate, provide incentives for conservation, or otherwise manage land toward natural resource conservation. These activities have often not explicitly stated ecosystem services as their goal. Nonetheless, it is clear that conservation of ecosystem services was often at least an implicit goal of the collective action.

23. One recent United Nations report listed over 11.5% of global surface in protected areas. United Nations, *United Nations List of Protected Areas*, IUCN/UNEP (2003).

24. Government purchase is a best case scenario, but not always the norm. Charles Geisler points out that 70 percent of protected areas globally are inhabited by at least some humans. Government rules make life for locals living in and near the protected areas' boundaries very difficult and may create eco-refugees as populations exit to find areas where they can survive. Charles Geisler *Endangered Humans* FOREIGN POLICY, No. 130 (May-Jun. 2002) pp. 80-81.

25. See Ana S. L. Rodrigues, et. al., *Effectiveness of the Global Protected Area Network in Representing Species Diversity*, 428 NATURE 641-642 (April 2004).

26. The World Commission on Protected Areas (WCPA) notes that despite a large percentage of the earth under protected status, many of these areas "are not effectively managed" while others face "growing financial difficulties as governments cut subventions, forcing protected area managers to raise their own revenue." WCPA *Protected Areas Benefits and Boundaries*, 2 (2000).

27. The Endangered Species Act of 1973, 16 U.S.C. § 1531-1544

28. The incentives offered by the ESA have led to significant discussion regarding the operation of the Act. Some have alleged that landowners who encounter a listed species on their property may have the incentive to "shoot, shovel, and shut up." See generally Gar-

Incentives programs represent a third tool for governmental intervention promoting ecosystem services. These tools have included permitting systems such as tradable development rights, tax credits, ecosystem banking initiatives, and other incentive based programs leading to conservation. Each of these programs relies on providing a carrot in addition or instead of presenting the stick for non-compliance.

B. Payment for Ecosystem Services

Direct government payments for ecosystem services (PES) represent one type of incentive program aimed at stopping the loss of ecosystem services by offering increased direct benefits from conservation activity. Wunder defines PESs as:

- 1) A voluntary transaction where
- 2) A well-defined ES (or a land-use likely to secure that service)
- 3) Is being 'bought' by a (minimum one) ES buyer
- 4) From a (minimum one) ES provider
- 5) If and only if the [ecosystem] service provider secures ES provision (conditionality).²⁹

A variety of PES programs exist and it is important to clearly identify governmental programs as simply one type of PES activity. Private actors (generally corporations and private not for profit entities) have increasingly entered into contracts with landowners to pay for the continued production of an ecosystem service in recent years.³⁰ Examples abound—particularly in the context of payment contracts undertaken by large environmental organizations such as the Nature Conservancy and the World Wildlife Fund. For instance, in one well developed PES program, the World Wildlife Fund is helping to conserve forests on Mt. Rinjani, on the Island of Lombok, Indonesia.³¹ Other examples of private PES programs include various situations where corporations have entered into contracts with private landowners to keep their for-

diner M. Brown Jr. & Jason F. Shogren *Economics of the Endangered Species Act*, 12 *Journal of Economic Perspectives* 3, (Summer 1998).

29. Wunder, *supra* note 1, at 3. Note that the original text refers to "payment for environmental services." By Wunder's own statement, however, the "substantive difference [between 'payment for ecological services' and 'payment for environmental services'] for our purposes is minimal." *Id.* at 8.

30. *Id.*

31. World Wildlife Fund, *Payment for Ecosystem Services*, (2007) <http://www.worldwildlife.org/pes/>

ested land intact to provide carbon sequestration.³²

Governments or other local collectives, too, have increasingly acted as buyers of ecosystem services. Government programs are generally more expansive than the private programs listed above,³³ but need not be.³⁴ Substantial public programs have been undertaken in a variety of countries for a variety of ecosystem services. Examples of widespread governmental programs involving direct payments can be found throughout Latin America. (i.e. Mexico, Columbia, El Salvador, and Guatemala),³⁵ in the United States,³⁶ China,³⁷ and a variety of other nations worldwide.

IV. THE COSTA RICAN PES PROGRAM

Costa Rica, long renowned for its biological wealth³⁸ and progressive policies promoting conservation,³⁹ began developing a nation-wide PES program in 1997 to encourage private landowners to

32. Id.

33. Wunder *supra* note 29

34. Some local governments and local collectives may become involved to protect the local watershed or other natural feature providing desired ecosystem services. See, for example, John Kerr, *Sharing the Benefits of Watershed Management in Sukhomajri, India* in SELLING FOREST ENVIRONMENTAL SERVICES, MARKET-BASED MECHANISMS FOR CONSERVATION AND DEVELOPMENT 63-72 (PAGIOLA ET AL, EDS 2004), which details the efforts of several local communities in protecting a watershed through an ecosystem payment program.

35. Paul J. Ferraro & R. David Simpson, *The Cost-Effectiveness of Conservation Payments*, 78 LAND ECONOMICS 3 354 (August 2002). The majority of these programs is designed to stay deforestation, although other goals are often considered.

36. Perhaps the best example of this activity in the U.S. is the Conservation Reserve Program on the U.S. Department of Agriculture. In this program, the United States government contracts with agricultural producers “to retire highly erodible and other environmentally sensitive cropland and pasture” for a period of 10-15 years with the intent that the lands are converted to native grasslands, forests, or other “conservation uses providing environmental benefits.” USDA, *Conservation Reserve Program: Summary and Enrollment Statistics, FY 2006*, 2 (2006) available at http://www.fsa.usda.gov/Internet/FSA_File/06rpt.pdf.

37. The Chinese government recently set up the Forest Benefit Compensation Fund to restore forests. Forest Trends, *Developing Markets and Payments for Forest Ecosystem Services*, 2 (2007) http://www.forest-trends.org/documents/publications/tech_briefs/7forestservices.pdf

38. Located on the isthmus connecting North and South America, Costa Rica contains an incredible variety of life. Experts assume that despite occupying only .03% of the global land mass, the nation houses over 4% of global biodiversity. Costa Rica is estimated to contain approximately 500,000 species (including 300,000 species of insect) and ranks in the top twenty most biodiversity-rich countries world-wide. Instituto Nacional de Biodiversidad (Inbio), *Biodiversidad en Costa Rica* (2007), available at http://www.inbio.ac.cr/es/biod/bio_biodiver.htm. Other species counts show that Costa Rica contains 850 known species of birds, over 350 known species of reptiles and amphibians, 208 known species of mammals, and over 9000 known species of vascular plants. MARIO BOZA, PARQUES NACIONALES COSTA RICA 7 (1987).

39. Author Sterling Evans, for instance refers to Costa Rica as “the Green Republic” in reference to its storied tradition of pursuing environmental conservation. See STERLING EVANS, THE GREEN REPUBLIC, 64-71 (1999).

conserve forested land and reforest cleared land.⁴⁰ Since the inception of the program, it has enrolled approximately ten percent of the nation (532,668 hectares of private land),⁴¹ and is touted as contributing to an increase in forest cover throughout the nation.⁴²

A. Previous Governmental Efforts

The PES program does not represent the first governmental efforts to protect Costa Rica's natural heritage.⁴³ As seen below, Costa Rican government officials have actively sought mechanisms to protect ecosystems and the services they provide since the late 1960s.⁴⁴ In 1969, lawmakers authorized the creation of national parks, forest reserves, national monuments, wildlife refuges, and national conservation zones.⁴⁵ Protected areas were quickly established throughout the country.⁴⁶ By 1999, approximately 28 percent of Costa Rica was contained in protected areas.⁴⁷ These areas encompass a wide variety of ecosystems including cloud forest, lowland wet forest, lowland dry forest, mangroves and other wetlands, and sub alpine paramo (tropical alpine grasslands located above treeline).⁴⁸ Indeed, one leading expert has concluded that if managed appropriately, approximately 95% of Costa Rican biodiversity would be protected in the listed areas.⁴⁹

40. Stefano Pagiola, Paying for Water Services in Central America: Learning from Costa Rica, in *SELLING FOREST ENVIRONMENTAL SERVICES, MARKET-BASED MECHANISMS FOR CONSERVATION AND DEVELOPMENT*, 37 (PAGIOLA, ET. AL. EDS. 2004).

41. FONAFIFO, *Distribución de las hectáreas y árboles contratadas en Pago de Servicios Ambientales, por año y por modalidad*, 2006, http://www.fonafifo.com/text_files/servicios_ambientales/distrib_ha_Contratadas.pdf

42. Estaban Oviedo, País recupera bosque perdido, *La Nación*, 30 de Noviembre, 2006. Available at: http://www.nacion.com/ln_ee/2006/noviembre/30/pais913190.html

43. See generally, EVANS supra note 39.

44. Id.

45. Lawmakers took this step in the wake of protracted deforestation due to agricultural use and logging. Id. at 64-71. Previous governmental efforts at creating protected areas in 1939 and 1945 had largely failed due to absence of monetary and institutional commitment from the government. See DAVID R. WALLACE, *THE QUETZAL AND THE MACAW* 28-35 (1992).

46. See generally EVANS supra note 39

47. Id. at 7 There has been some debate over the actual amount of protected land, however. In 2003, World Resources Institute recorded some 158 individual protected areas representing 23.4 percent of national area. WRI Biodiversity and Protected Areas—Costa Rica, *Earthtrends Country Profiles*, 1 (2003), available at: http://earthtrends.wri.org/pdf_library/country_profiles/bio_cou_188.pdf. Regardless of the exact percent of protected areas alleged, all concur that approximately a quarter of the nation is currently listed in a government protected area.

48. LES BELETZKY, *THE ECOTRAVELLER'S WILDLIFE GUIDE: COSTA RICA*, 14-18 (1998). It should be pointed out that this list is partial. The topography of Costa Rica allows for a wide variety of habitats found in the protected areas.

49. Alvaro Umana, a leading Costa Rican conservationist, made this judgment with the caveat that this biodiversity could be protected if these areas were managed in accordance with the laws establishing them. Charles D. Brockett & Robert R. Gottfried, *State*

The government of Costa Rica has also developed a significant regulatory regime to encourage conservation. These regulations have provided rules regarding forest protection,⁵⁰ wildlife and endangered species protection,⁵¹ topsoil conservation,⁵² protection of water,⁵³ coastal and mangroves protection,⁵⁴ biodiversity preservation,⁵⁵ and a variety of other regulations.⁵⁶ Many of the regulatory regimes have been formed, shaped, and amended in response to societal and ecological necessity.

Notwithstanding these governmental efforts at environmental protection, Costa Rica maintained one of the fastest deforestation rates in the world throughout the 1970s and 1980s, with the majority of deforestation occurring on private lands.⁵⁷ Image 1 illustrates the deforestation ravaging the country through 1986, with the dark images illustrating the decline in forest cover.

Policies and the Preservation of Forest Cover: Lessons from Contrasting Public-Policy Regimes in Costa Rica, 37 LATIN AMER. RESEARCH REV. 10 (2002).

50. For example, La Ley Forestal, Ley No. 7575, as amended

51. For example La Ley de Conservacion de la Vida Silvestre, Ley No. 7317 as amended

52. For example La Ley de Uso, Manejo y Conservacion de Suelos, Ley No. 7779

53. For example, La Ley de Aguas, Ley No. 276

54. For example, La Ley Sobre la Zona Maritimo Terrestre, Ley No. 6043

55. For example, La Ley de Biodiversidad, Ley No. 7788

56. Some of these regulations include NEPA-like provisions regarding requirements for environmental assessments and impact statements. La Ley Organica del Ambiente, Ley No. 7554, as amended.

57. Evans *supra* note 37 at 49-50.

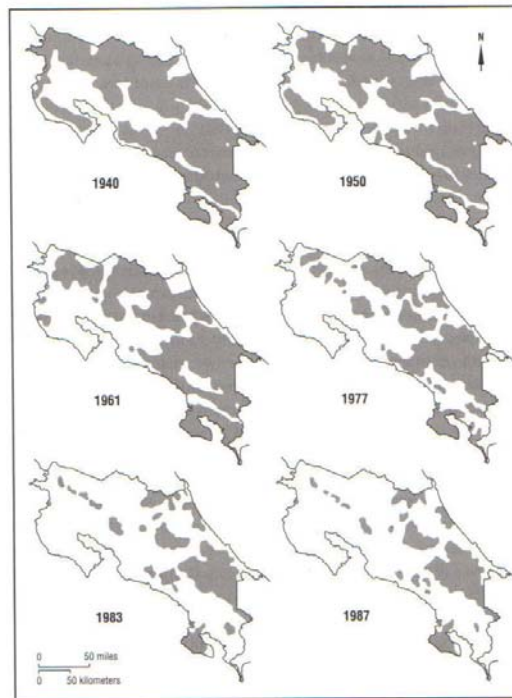


Figure 1—Decline in Forest Cover⁵⁸

Officials began to seek ways to curb this trend by providing positive incentives for private forest conservation and reforestation in the late 1970s.⁵⁹ The first foray into incentives began in 1979 with the introduction of income tax incentives to those landowners practicing reforestation.⁶⁰ In the mid 1980s, policy makers began to search for other incentive based programs. These efforts led to the introduction of the CAF (Certificado de Abono Forestal—Forest Payment Certificates) program in 1986.⁶¹ This program served as a tax credit for those who were engaged in conservation activity on their property. The credit could be applied to any tax owed to the Costa Rican government or could be sold to other individuals. The CAF program attracted a great deal of interest and by 1996, had enrolled over 40,541 hectares of land into the program.⁶²

58. Evans *supra* note at 40. Evans included this image originally created by the Fundacion Neotropica.

59. Ronnie de Camino Et Al, The World Bank, *Costa Rica Strategy and the Evolution of Land Use* 30-31 (2000).

60. *Id.* Income tax incentives were plagued with problems in that the incentive only rewarded reforestation and not conservation. Moreover, income tax in Costa Rica was only paid by the very wealthy. As such, the program did not affect the decisions made by the majority of landowners.

61. *Id.* at 31

62. Marco Vinicio Araya B., *Financiamiento de Bosques y Plantaciones Forestales:*

Based on the success of the CAF program, the CAFA (Certificado de Abono Forestal Adelantado—Advanced Forest Payment Certificates) program was introduced.⁶³ CAFA functioned similarly to CAF, but was specifically designed to provide a prepayment to landowners wishing to undertake reforestation efforts. Like its predecessor, CAFA had a great deal of success and by 1997 had been credited with reforestation of 36,887.80 hectares of land.⁶⁴

Both the CAF and CAFA programs were set to be phased out by the Forestry Law of 1996.⁶⁵ In lieu of these programs, the law established the CCB (Certificados para la Conservacion del Bosque—Forest Conservation Certificates) program which worked similarly to the other programs listed above, but include a 20 year conservation commitment by those who participate, and require that the land not be harvested for a time prior to enrollment.⁶⁶

B. The Costa Rican PSA Program

Building on the incentive programs listed above, Costa Rican governmental officials also began searching for other programs in the mid-1990s to encourage forest conservation and regeneration on private lands. In 1997, the Costa Rica government created the PSA (Pagos por Servicios Ambientales—Payment for Environmental Services) program.⁶⁷ In many ways the PSA program represented a direct continuation of the CAF and CAFA programs listed above.⁶⁸

The PSA program seeks to promote four ecosystem services performed by Costa Rican forests.⁶⁹ These include: 1) Mitigation of greenhouse gas emissions; 2) hydrological services which help protect water for human consumption, irrigation, and energy production; 3) protection of biodiversity; and 4) provision of scenic beauty.⁷⁰ To promote these services, the PSA program allows private property owners to enter contracts with the government to

Pago por Servicios Ambientales, REVISTO FORESTAL CENTROAMERICANA, enero-marzo 17 (1998).

63. de Camino, Et. Al. supra note 59 at 30

64. Araya supra note 62 at 17.

65. Ley No. 7575 passed Feb. 5, 1996, as amended. This Forestry law represented an overhaul of the nation's forestry laws and practices.

66. de Camino, et. al. supra note 59 at 33

67. Ley No. 7575 supra note 65.

68. For instance, the PSA program borrowed the same payment structure listed by the CAF program. Indeed, the first payments came in the form of CAF certificates. Pagiola, supra note 6 at 2.

69. Ley No. 7575, supra note 65 at Art. 3(k).

70. Id.

undertake those land use practices which enable the continued provision of the listed forest ecosystem services. The details of the program are discussed below.

1. *Eligibility and Contracting*

Enrollment in the PSA Program is completely voluntary, but regulations may restrict the amount of land an individual landowner can enroll in the program. An individual landowner is allowed to enroll up to 300 hectares in the program.⁷¹ Landholdings by an NGO are not subject to any enrollment cap for the number of hectares in the program.⁷² Enrollment of land by indigenous groups within Indigenous Reserves is capped at 600 hectares.⁷³

Private landowners can individually contract with the government to enroll their land, or the landowners can cooperate with larger NGOs.⁷⁴ If the private party acts alone, he/she is responsible for undertaking a private contract. If the landowner acts in concert with others through an NGO, the program allows for a global contract covering several listed properties.⁷⁵ Indigenous groups enter the program through a contract specific to indigenous reserves with the contracting entity as an entity representing the reserve.⁷⁶

Not all private land in Costa Rica is in similar condition and not all landowners share the same land management goals. In light of these facts, the PSA program offers several types of contracts. The principle contract types which have existed since the creation of the PSA program include forest conservation contracts and reforestation contracts.⁷⁷ A third type of contract targeting sustainable forest management and sustainable forestry was available prior to 2000.⁷⁸ An agro-forestry contract was introduced

71. Edgar Ortiz Malavasi & John Kellenberg, *Program of Payments for Ecological Services in Costa Rica*, IUCN Forest Conservation Program, 4 (2002) available at: http://www.iucn.org/themes/fcp/publications/files/flr_costarica/flr_ortiz_kellenberg_ext.doc

72. *Id.*

73. Indigenous reserves are treated as a special category in that land within the reserves is generally not owned by individuals, but is rather held collectively by members of the indigenous group.

74. Malavasi & Kellenberg, *supra* note 71

75. *Id.*

76. *Id.*

77. Pagiola, *supra* note 6 at 3. Pagiola, notes that while the Costa Rican government uses the term "reforestation" contract, the actual intent of governmental operations seems geared toward promoting timber plantations with the use of this type of contract. Pagiola chooses to refer to these types of contract as "timber plantation contracts" to avoid any confusion as to this intent. While I understand this reasoning, I have chosen to keep the language used by the Costa Rican officials.

78. These contracts committed property owners to sustainable forestry over a 15 year period and entailed payouts of approximately \$327 U.S. for each hectare enrolled dispersed

in 2004 and efforts are currently ongoing to create a contract for natural forest regeneration.⁷⁹

Each of these contracts has different management goals and payout schemes. For instance, a forest conservation contract has the goal of protecting established primary secondary growth forests.⁸⁰ Property owners contract to leave their property in its current condition for a period of five years—with the possibility of renewing the contract for future five year periods.⁸¹ In consideration of these conservation efforts, the government of Costa Rica pays enrollees in forest conservation contracts approximately 42.00⁸² dollars per year for each hectare enrolled, with payments continuing over a five year period (210.00 from the five-year total). These contracts account for the majority of participants in the PSA program.⁸³

In contrast to forest conservation contracts, a reforestation contract is designed to promote tree growth in areas previously degraded or abandoned agricultural land, with particular emphasis on the establishment of timber plantations.⁸⁴ These contracts are considerably more lucrative—with payments totaling about \$550.00 U.S. per enrolled hectare distributed over a five year period.⁸⁵ The contract, however, also requires a larger commitment with the landowner contracting to maintain the reforested area for a period of fifteen to twenty years—depending on the tree species selected for reforesting.⁸⁶ Due to more stringent enrollment requirements these contracts represented less than 10% of all PSA program participants in 2002.⁸⁷

In 2006, the government of Costa Rica announced a new payment scheme.⁸⁸ Forest conservation contracts now pay \$64 dollars

over each five year period of the 15 year commitment. Malavasi and Kellenberg note that nine percent of PSA contracts in 2002 involved sustainable forestry. Malavasi & Kellenberg *supra* note 71 at 4

79. Pagiola *supra* note 6 at 3.

80. Malavasi & Kellenberg, *supra* note 71 at 4

81. *Id.*

82. The actual amount has until recently been placed in Colones, the national currency of Costa Rica. The figure given represents the exchange rate value *Id.*

83. *Id.* at 5

84. Pagiola, *supra* note 6 at 3.

85. *Id.* at 7. The payment scheme for reforestation contracts dictates a 50% distribution in year one, 20% distribution in year two, 15% distribution in year three, 10% distribution in year four, and 5% distribution in year five. Malavasi & Kellenberg, *supra* note 71 at 5. This distribution occurs in this fashion to account for the frontloaded capital investment required to replant trees, which diminishes once the trees are established.

86. *Id.*

87. *Id.*

88. This change was announced in Decree No. 22336 Decreto No. 22336—MINAE, Artículo 2. Available online at: http://www.fonafifo.com/text_files/servicios_ambientales/Decretos/Dec32226.pdf

per year/ hectare enrolled for each year over a five year period.⁸⁹ Reforestation contracts now bring \$816 paid out over the duration of ten years.⁹⁰ Some experts fear that the increase in payment represented in the forest conservation contracts exceeds the money available.⁹¹ Accordingly, the increases in payouts may actually reduce the amount of contracts which can be offered in the future.⁹²

2. *Planning, Monitoring, and Enforcement*

Once the type of contract is selected, the landowner submits an application to enter the PSA program.⁹³ Before the land is enrolled, each landowner is required to develop a sustainable forest management plan for the property in accordance with the contract sought.⁹⁴ The plan is prepared by a certified private forester known as a “regente.”⁹⁵ Each plan includes information regarding:

land tenure and physical access; topography, soils, climate, drainage, actual land use, and carrying capacity with respect to land use; plans for preventing forest fires, illegal hunting, and illegal harvesting; and monitoring schedules.⁹⁶

In the application, the landowner specifically promises to undertake the specific practices laid out in the plan.⁹⁷ From the government side, applications, contracting, and monitoring within the PSA program is handled by the National Forest Financing Fund, known by its acronym FONAFIFO (Fondo Nacional de Financiamiento Forestal).⁹⁸ This government agency operates eight regional offices throughout the country to facilitate local outreach for the Program.⁹⁹ FONAFIFO officials accept the application. If the

89. Id.

90. Id.

91. Pagiola, *supra* note, 6 at 7-8.

92. Id.

93. Applications for entry in the PSA program can be obtained at any of the FONAFIFO regional offices or online. Examples of the applications can be found at http://www.fonafifo.com/paginas_espanol/servicios_ambientales/sa_requisitos.htm

94. Simmon Zbinden and David R. Lee, *Paying for Environmental Services in Costa Rica: An Analysis of Participation in Costa Rica's PSA Program*, 33 *WORLD DEVELOPMENT* 2, 257 (2005).

95. Id.

96. Pagiola *supra* note 6 at 7.

97. Zbinden & Lee *supra* note 94 at 257.

98. Pagiola, *supra* note 6 at 7. FONAFIFO undertook this task in 2003. Prior to that time, SINAC (Sistema Nacional de Areas de Conservacion—National System of Conservation Areas) managed the contracts in conjunction with several not for profit agencies.

99. Participants must contact the regional office closest to the property to be enrolled. FONAFIFO, *ESPP Processes and Requirements*, available at: <http://www.fonafifo.com/>

plan contained in the application is deemed satisfactory, the land is enrolled in the program.

The first payment from the PSA generally occurs when the plan is accepted. However, further payments come only after verification that the plan is being carried out.¹⁰⁰ The regente who helped develop the land management plan generally also performs the monitoring to ensure that the plan is acceptably placed into action.¹⁰¹ Various documents are submitted verifying compliance to the terms of the contract throughout its duration.¹⁰²

As payment for development of the plan and monitoring to ensure that the plan is placed in action, the regentes usually receive 15 percent of all payments on the land.¹⁰³ If violations are found by the regente, they must be reported to the government and payments cease.¹⁰⁴ If a regente is found to be falsifying management plans or not reporting violations of those plans, the government may remove the regente's professional forester license as well as face other legal sanctions.¹⁰⁵ FONAFIFO performs occasional audits on regentes' work to ensure that no fraud is being perpetrated.¹⁰⁶

3. *Funding for the Program*

While FONAFIFO now oversees the PSA program, the original function of the agency was to gather and distribute funds for the PSA program.¹⁰⁷ As designed, the PSA program was to obtain funding from a variety of sources. Particular focus was placed on the beneficiaries of the ecosystem services performed by Costa Rican forests with the intent that these beneficiaries carry the brunt of the responsibility to finance the fund.¹⁰⁸ To date, this end has not been met.¹⁰⁹ Yet, significant steps have been made toward beneficiaries paying for the services provided.

Interestingly, the government of Costa Rica has sought to fund the PSA program by generating income for the beneficiaries of the

[paginas_english/environmental_services/sa_requisitos.htm](#)

100. Pagiola, *supra* note 6 at 7

101. Zbinden & Lee, *supra* note 94 at 257

102. *Id.*

103. *Id.*

104. *Id.*

105. *Id.*

106. Pagiola, *supra* note 6 at 7

107. See generally Pagiola, *supra* note 40, at 41

108. *Id.* at 41-42.

109. As discussed below, a significant amount of funding for the PSA program comes from international donors, including the World Bank.

ecosystem services noted in the Forestry Law. As noted above, these ecosystem services are:

Mitigation of gas emissions [leading to] the greenhouse effect (fixation, reduction, sequestration, storing and absorption);

Water protection for urban, rural or hydroelectric uses;

Protection of biodiversity for its conservation, sustainable, scientific and pharmaceutical uses; research and genetic improvement; protection of ecosystems and life forms; and

Natural scenic beauty for tourism and scientific purposes.¹¹⁰

Funding sources have been sought from beneficiaries from each of these services.

a. Mitigation of Greenhouse Gas

Various funding mechanisms have been created to receive payment from the beneficiaries from the mitigation of greenhouse gases. These have included the imposition of a fossil fuel tax, the international sale of carbon bonds, and carbon offset payments. Of these, the fossil fuel tax has to date provided the majority of funding for the PSA program.¹¹¹ Since 2001, Costa Rica has charged a 3.5% tax on all fossil fuels sold. This translates into an inflow of approximately ten million dollars annually into the PSA fund. While significant, the money generated by the fossil fuel tax represents a lower figure than the sum originally envisioned in the 1996 Forestry Law, which created a 15% fossil fuel tax, with a third of all revenue generated from the tax presented to FONAFIFO.¹¹²

A second source in funding for the PSA program is generated through the international sale of carbon bonds and other carbon offsets. Initially, the government of Costa Rica placed a great deal of hope on such sales as a mechanism to finance the forestry fund. In 1997, this hope was realized when the government of Norway purchased \$2 million dollars worth of carbon bonds to offset 200,000 tons of Carbon Dioxide produced in the Scandinavian na-

110. FONAFIFO, *Environmental Services, Concept*, available at: http://www.fonafifo.com/paginas_english/environmental_services/sa_concepto.htm

111. Pagiola, *supra* note 6 at 3

112. Brockett & Gottfried, *supra* note 49, at 29

tion.¹¹³ Despite the hopes of Costa Rica, the Norway purchase has been the largest such transaction to date.¹¹⁴

The government of Costa Rica maintains hope that increased interest in global warming will only increase international desire for carbon offsets. Indeed, these hopes have been partially borne out through global commitments financed through the World Bank's BioCarbon Fund which is currently providing over 2 million dollars to finance reforestation and conservation of over 4,000 hectares of agricultural land in the Brunca region of Costa Rica.¹¹⁵

Further efforts have involved the sale of carbon services to private corporations. Examples include Tenaska, a Nebraska-based energy company which provided \$500,000 to the government of Costa Rica to offset the CO₂ produced by a power plant operating in Washington State¹¹⁶ Similarly, Italian company Lifegate recently purchased sizeable quantities of carbon services from the Costa Rican government.¹¹⁷ Most recently, FONAFIFO officials floated the idea that tourists visiting Costa Rica could contribute to the forestry fund through voluntarily opting to offset the carbon produced by their journeys.¹¹⁸ One airline operating in Costa Rica, Nature Air, is currently considering such a voluntary payment to offset carbon production.¹¹⁹ It is likely that similar purchases will proceed in the future providing further funding to the program.

b. Water Protection, Protection of Biodiversity, and Protection of Scenic Beauty

Costa Rican officials have also targeted beneficiaries of the other types of ecosystem services mentioned. These included, water protection, biodiversity protection, and the protection of scenic beauty. First, Officials have also sought to garner funding for the PSA program from those who benefit from the water protection offered by Costa Rican forests. Five types of beneficiaries of the water protection have been identified: hydroelectric power genera-

113. Id. at 30

114. Although, the Netherlands did purchase 334,000 dollars in carbon bonds in 1999. Id.

115. Jorge M. Rodriguez, FONAFIFO, *Carbon Sequestration in Small and Medium Farms in the Brunca Region, Costa Rica*. Available online at <http://carbonfinance.org/docs/FONAFIFO-COOPEAGRI.pdf>.

116. Laura Tangle & Doug Fine, *Rainforests for Profit: Businesses Sell Nuts, Tourism, and 'Carbon Storage'* U.S. NEWS AND WORLD REPORT, Apr. 20, 1998, at 40.

117. Pagiola supra note 6 at 6.

118. Alejandra Vargas M., *Pais quiere ser primera nacion con balance neutron de carbono*, LA NACION, 21 de febrero 2007, available at http://www.nacion.com/ln_ee/2007/febrero/21/aldea1002694.html

119. Id.

tors, municipal water supply systems, irrigation systems, industrial users, and inhabitants of flood zones.¹²⁰ Of these, Hydroelectric producers have historically been the most involved in payment into the forestry fund.¹²¹ However, newer programs have sought a wider array of water beneficiaries. In 2005, Costa Rican officials announced a new water tariff program targeting water users throughout the country.¹²² When fully operational, the program will generate over four million dollars annually for the PSA program.¹²³

Reaching the beneficiaries of biodiversity services and scenic beauty has been more difficult. Domestic programs targeting ecotourism and other beneficiaries have to date not borne fruit.¹²⁴ However, the World Bank and the Global Environmental Facility have donated approximately 18 million dollars to FONAFIFO to carry out conservation activities which benefit biodiversity.¹²⁵ These payments in many ways appear to compensate Costa Rica for the biodiversity Costa Rican forests provide to sustaining global biodiversity.¹²⁶

V. THE COSTA RICAN PES PROGRAM ANALYZED

A. *Participation and Increased Forest Cover*

In the years since its creation, demand for enrollment in the PSA has been constant. Between 1997 and 2001, the program had enrolled more than 284,000 hectares of land—over five percent of total national territory.¹²⁷ Since that time, participation has steadily increased. By 2006, the PSA program had enrolled 532,668 hectares of land through contracts with over 6000 landowners (or collectives of landowners).¹²⁸ This amount totals approximately 10 percent of national area. Table 1 shows the steady increase in PSA program participation since 1997.

120. Pagiola, *supra* note 40 at 47

121. *Id.*

122. Pagiola *supra* note 6 at 4-5

123. *Id.*

124. Pagiola, *supra* note 6, at 6

125. *Id.* at 5

126. *Id.*

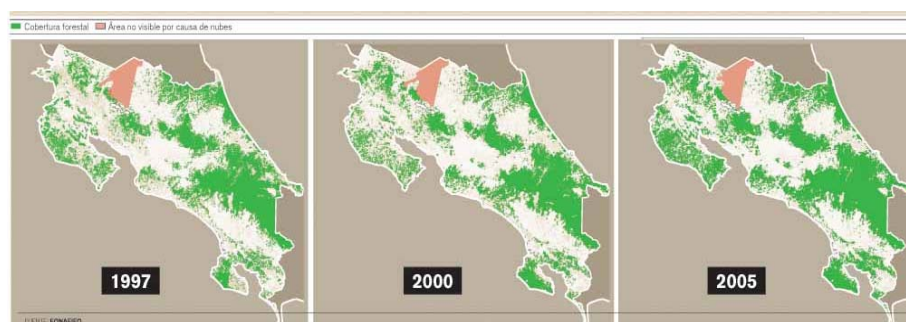
127. Zbinden & Lee *supra* note 94 at 258.

128. FONAFIFO *Distribución de las hectáreas y árboles contratadas en Pago de Servicios Ambientales, por año y por modalidad en el periodo 1997-2006*, 2006, available at: http://www.fonafifo.com/text_files/servicios_ambientales/distrib_ha_Contratadas.pdf

Table 1 PSA Hectares and Contracts by Year¹²⁹

<u>Year</u>	<u>Hectares Added</u>	<u>Number of Contracts</u>
1997	102,784	1,200
1998	59,916	597
1999	64,781	622
2000	29,040	271
2001	27,907	297
2002	24,904	279
2003	68,765	672
2004	72,638	760
2005	57,095	755
2006	24,838	619
Total	532,668	6,062

In addition to the actual enrollment figures into the program, there are other indicators that the PSA program has had a positive impact on Costa Rican forests. One metric testifying of the success of the PSA program is the changing degree of forested area in the county. Satellite imagery has consistently shown an increase in forest cover on private land since the creation of the PSA program.¹³⁰ This increase in forest cover can be seen in the darker areas represented in Figure 2 below.¹³¹

**Figure 2—Satellite Imagery Showing Increase in Forest Cover¹³²**

129. Id.

130. Estaban Oviedo, Pais recupera bosque perdido, *La Nacion*, 30 de Noviembre, 2006. Available at: http://www.nacion.com/ln_ee/2006/noviembre/30/pais913190.html

131. Although, clearly the satellite images also capture forest cover changes which may be occurring on public as well as private lands.

132. LA NACION, *Crecimiento del area Boscosa*, 30 de Noviembre 2006 Available at:

The most recent satellite imagery indicates that between 1997 and 2006, overall forest cover throughout Costa Rica had increased by over ten percent.¹³³ Areas around Guanacaste, the northern Caribbean, and some areas in the southern parts of the nation increased forest cover by proportionally larger amounts.¹³⁴ For instance, forest cover in the province of Guanacaste, located in the Northwest portions of the country had increased by eighteen percent.¹³⁵

B. Potential Issues and Future Directions

While it is clear that current trends in Costa Rica are garnering environmental benefits, understanding the causes leading to those trends is somewhat more difficult. Recent academic efforts have found that lands enrolled in the PSA program have larger forested areas than lands not participating in the programs.¹³⁶ However, it is unclear how much this aspect has resulted from self-selection bias—where those who are most interested in conservation, may already be conserving.¹³⁷

Further evidence suggests that different types of individuals are attracted to the program, testifying that it has not produced uniform incentives. In summing up some of the differences observed between program participants and non-participants, Zbinden and Lee state, “three major influences appear to determine participation in Costa Rica’s PSA program: farm size, human capital and economic factors, and information.”¹³⁸ Of these, farm size and human capital and economic factors may prove difficult for the program.

As for farm size, those with large landholdings were more interested in participating in the PSA program. With regard to hu-

http://www.nacion.com/ln_ee/2006/noviembre/30/crecimiento.jpg

133. Oviedo supra note 119

134. Id.

135. It should be noted that this reforestation figure accounts for reforestation which occurred over a 20 year period. Alejandra Vargas M., *Guanacaste recupero 18% de bosque en 20 años*, LA NACION, 6 de mayo 2006. Available at http://www.nacion.com/ln_ee/2006/mayo/06/aldea1.html

136. See eg. Zbinden & Lee, supra note 94 at 265 and Rodrigo Sierra and Eric Russman, *On the efficiency of environmental service payments: A forest conservation assessment in the Osa Peninsula, Costa Rica*, 138 59 *ECOLOGICAL ECONOMICS* 131 (2006).

137. For instance, Ortiz et al. found that a portion of their survey respondents stated that they would have conserved their land with or without the PSA program. See Edgar Ortiz Malavasi, et. al. *Impacto del Programa de Pago de Servicios Ambientales en Costa Rica como medio de reduccion de la pobreza en los medios rurales*, RUTA, available at http://www.ruta.org/admin/biblioteca/documentos/ImpactoProg_PagoServAmbientales.pdf

138. Zbinden & Lee supra note 94 at 269

man capital and other economic factors, participants relied on non farming income for the majority of their income, were more highly educated, and employed more intensive agricultural mechanisms on their property when they farmed. One potential implication of the Zbinden and Lee study is that the PSA program was only entered by those who could afford to. In other words, the program did not appeal to smaller landowners or those who relied on their properties for the principle source of income. The incentive program simply provided too little incentive.

Other studies have called into question the effectiveness of the PSA program in effectively changing existing land use patterns. One such study in the Osa Peninsula found little evidence that the PSA program had induced changes in land use practices.¹³⁹ A second study found that the PSA payments were insufficient to alleviate poverty—one factor leading to deforestation in Costa Rica.¹⁴⁰

Moreover, the PSA program has been implemented at the same time as a series of other changes in Costa Rica. As noted, a variety of other regulatory means are in effect to limit environmental degradation. It is difficult to disentangle reforestation due to the PSA from reforestation due to these regulations.¹⁴¹ Furthermore, some of the most environmentally degrading practices, such as conversion for free range cattle production have become less economically profitable as a result of the regulations.¹⁴² The decline in beef cattle profitability has certainly contributed to the reforestation rates of areas around the country, including Guanacaste, which has experienced 18% forest regeneration in recent years.¹⁴³ It is difficult at this early stage to effectively gauge the stand-alone impact to the PSA program.¹⁴⁴

VI. THE LESSONS FROM COSTA RICA—CONCLUSIONS

Three lessons are contained in the Costa Rican case. These include: 1) Landowners often face insufficient incentives to maintain their property; 2) Government intervention (or other collective action intervention) can change the incentives driving the loss of eco-

139. Sierra & Russman supra note 136

140. Edgar Ortiz Malavasi, et. al. *Impacto del Programa de Pago de Servicios Ambientales en Costa Rica como medio de reduccion de la pobreza en los medios rurales*, RUTA, available at http://www.ruta.org/admin/biblioteca/documentos/ImpactoProg_PagoServAmbientales.pdf

141. Pagiola, supra note 6 at 10

142. Vargas M. supra note 135

143. Id.

144. Pagiola notes that a variety of studies have come to mixed results on this very question. See Pagiola supra note 6 at 8-11.

system services; and 3) Direct government payments for ecological services is a promising tool for changing the incentives driving ecosystem service loss, but cannot be viewed as a panacea for conservation. Each of these will be discussed below.

- 1) *Landowners may face incentives to use their property in ways which reduce the ecosystem services performed.*

Economic theory surmises that all things equal, individuals will face insufficient incentives to provide a public good. Ecosystem services as a public good are no exception. In seeking private benefits, landowners may undertake actions which reduce the ecosystem services performed on their land. The history of Costa Rica has borne this out. Landowners there long undertook land use practices to capitalize on private benefits. These private benefits, however, came at the cost to ecosystem services as forests were cleared. Figure 1 illustrates the reduction of Costa Rican forests through 1986. It is understood that rapid deforestation reduced the ecosystem services in Costa Rica.

- 2) *Government intervention (or other collective action intervention) including PES programs can alter the incentives driving the loss of ecosystem services.*

As stated above, economists assert that governmental intervention or other collective action can overcome the individual incentives leading to undersupply of public goods. In the case of ecosystem services, governmental intervention can change the incentive structure leading to the loss of ecosystem services and create incentives for increased production of ecosystem services. Governmental tools frequently used to facilitate production of ecosystem services include protected areas, regulations, and incentive programs. PES programs represent a newly popular tool to change the incentive structure.

Governmental intervention has effectively changed the incentive structure leading to the decline in ecosystem services in Costa Rica through the creation of protected areas, regulations, incentive programs. Over the last ten years, previous governmental efforts have been supplemented with a governmental PES system—the PSA program.

In the program, landowners who contract with the government to maintain land practices favorable to the continued production of or new generation of ecosystem services receive a direct payment from the government. In the time since its creation, the PSA pro-

gram has faced consistent demand from landowners wishing to enroll. Currently, approximately ten percent of the country is enrolled in the program.

To date, it is clear that the PSA program represents an interesting approach to encouraging forest conservation. In the ten years since the inception of the PSA program, the country has increased in forested land by approximately 10 percent. While it is unclear what percentage of the increase is directly attributable to the program, it stands to reason that payments for ecosystem services factors into the increase in forest cover.

Furthermore, even if the stand-alone impact is not fully understood, it is clear that Costa Rica has established a program whereby landowners can contract to preserve their land in promise of payment. Mechanisms have been established for monitoring and enforcement of contract obligations. Importantly, practices have been put in place to fund the program and meet governmental payment obligations. While these practices have not fully become self sufficient to date, Costa Rican officials have made changes to the program to attempt to innovatively fund the program. Also, in seeking funding, the officials have focused collection efforts on those individuals and organizations which benefit most from the ecosystem services provided by Costa Rican forests.

3) Direct government payments for ecological services is a promising tool for changing the incentives driving ecosystem service loss, but cannot be viewed as a singular panacea for conservation.

The PSA program appears to have contributed to giving incentives to landowners to engage in land use practices which promote the ecosystem services performed there. The Costa Rican case, however, also warrants some caution. As noted above, the singular impact of the PSA program remains unproven at this juncture. Indeed, it is clear that the incentives offered have been insufficient to change land use practices of certain groups of individuals.

Additionally, the Costa Rican case illustrates that governmental programs to pay for ecosystem services require significant governmental resources. These resources include infrastructure to monitor and enforce, make payments, and coordinate the contracting activities. These items have not been straightforward in Costa Rica, and have changed over the years in response to needs. The resources also include actual financial ability to make the payments as required by the program. Meeting the financial obligations undertaken has proved difficult. Today, the PSA program

could not meet its financial obligations without international help.

The overall lesson, then, is that governmental PES programs are a theoretically sound mechanism to encourage the production of ecosystem services on private land, but can be difficult to implement. Caution is warranted in creating adequate incentives for targeted payment recipients. Care must also be taken to establish solid funding mechanisms and institutions to ensure that the program continues and is effective. Future research is needed to more clearly spell out how these challenges can be overcome.