

Payment for Environmental Services - An Example of Sustainable Management

Eliane Maria Vieira, José Augusto Costa Gonçalves, Roberto Cezar Almeida Monte-Mor, James Lacerda Maia, Giselle de Paula Queiroz

Institute of Applied and Pure Sciences, Federal University of Itajubá, Brazil

Abstract— *The payment for environmental services presents itself as a potential instrument that promotes the sustainable development, which contributes to the preservation of nature in order to keep the maintenance of environmental services performed by nature, which is fundamental to human beings. This work aims to review the PES in order to give an overview of the difference of this management system in relation to control systems and an introduction to the main systems currently implemented. It is clear by the described programs in this revision that most of them still rely on resources from the public administration, especially those cases implanted in Brazil. They are still relevant, necessary in several regions; however, they still face problems as to financial resources and still need to be dependent on the public resources to raise money. Thus, programs that do not need help from public resources could carry out an implantation of PES. Through the data presented, it is clear that the programs for the environment can be applicable in any regions. The maintainer can be public, private or a consortium between both and the goals desired by the property owners must be clear and objective.*

Keywords— *Ecosystem services, Preservation, Sustainable development.*

I. INTRODUCTION

The constant degradation of the environment over the years imposes on society and specially on the state that represents nowadays the command and control, and the private initiative once they represent the exploratory sector, the creation of new mechanisms that promote the exploitation of natural resource of sustainable form.

Practical experience has shown that hardly ever only the imposition of civil or criminal sanctions on the line of the polluter pays are not effective to maintain the environment. Thus it is more effective to encourage preservation than to apply penalties for non-compliance with environmental standards (ARAUJO JUNIOR et al., 2012).

According to Jardim and Bursztyn (2015), although there is an effort in the application of regulatory instruments,

such as command and control, environmental degradation continues to advance throughout the country. This fact can be seen when analyzing the few areas of permanent preservation (APP) and legal reserve (RL) that are effectively preserved in rural properties.

In this context, new instruments of an economic nature began to be devised that they could go beyond the traditional mechanisms of control that already exist aiming at internalizing the external costs generated by environmental degradation and to encourage traditional owners and inhabitants to preserve ecosystems with the payment of remuneration. Thus, the idea of payments for environmental services – PES arises (ARAUJO JUNIOR et al., 2012).

This work aims to review the PES in order to give an overview of the difference of this management system in concerning to control systems and an introduction to the main systems currently implemented.

II. MATERIAL AND METHODS

A non-systematic review of the literature was carried out from the consultation of articles, prioritizing those published less than ten years ago in the electronic databases of the CAPES (Coordination of Improvement of Higher Level Personnel) journal portal as well as specific journals of the study area. It was also searched by the Google search engine to collect IN the internet publications on websites, newspapers or magazines related to the topic, which were intentionally selected according to criteria of relevance to the study, since it is a recent topic and with few studies in the area. All the information collected was analyzed and when pertinent incorporated into the study for the analysis and discussion.

III. REVIEW AND DISCUSSION

The PES is a recent and innovative policy that has been introduced in both developed and developing countries (JARDIM; BURSZTYN, 2015). This differs from the traditional mechanisms of command and control, constituted by regulatory measures, which determine the technical parameters for economic activities to achieve

the expected objectives of the policy, requiring, as a rule, that all economic agents REACH the objectives set by regulation, Regardless of their costs (SEROA DA MOTTA, 2006).

Thus, PES is defined as an economic instrument based on the concept of internalization of externalities. These authors argue that economic agents must incorporate in their decisions the costs or, in the case of environmental services, the benefits of their activities with environmental effects (YOUNG, 2005).

In Brazil, coercive instruments, such as fines that are based on the "polluter pays" principle and are protected under Brazilian environmental legislation (Forest Code - Law No. 4,771 / 65 and Law on Environmental Crimes - Law No. 9605/98) have been used as a mechanism to guarantee the environmental services provided by forests and preserved natural environments. However, some authors have shown that pollution control is more effective when using incentive policies, such as those based on the "provider-recipient" principle (CLAASSEN et al., 2001).

The National Water Agency - ANA (2012), also explains that the supplier-recipient model (incentive-based) is recognized to be more efficient and effective in controlling erosion and diffuse pollution than the traditional user / payer model.

It is in this context that the payment instrument for environmental services (PES) emerges, which is defined as a flexible compensation mechanism based on the "provider-recipient" principle, in which environmental service providers are paid by the beneficiaries of these services (BERNARDES, 2010).

Therefore, the purpose of this payment is to compensate those owners or squatters, who voluntarily help to preserve or produce any environmental services through resources monetary or otherwise.

The implementation of a management tool generally implies trade-offs, that is, the most efficient instrument to achieve an environmental objective may not be so efficient for a social objective, thus there is no optimal management option. It is important to consider the different characteristics of the environmental services in question to define the instrument (BÖRNER et al., 2009). The definition of the instrument goes through the understanding of the term "environmental services", so it is necessary to understand the concepts of natural ecosystem and managed ecosystem.

The natural ecosystem is a functional system, where complementary relations between living organisms and their environment occur. Thus, this system consists of biotic components (plants, animals, microorganisms) interacting in the environment, and of abiotic components (water, soil, light, humidity, temperature, etc.). The relationships between both form the structure of the

system, and the dynamic processes in which they participate constitute the function of the system.

The managed ecosystem can already be defined the ecosystem altered by human actions.

The complex interactions between the biotic and abiotic components in ecosystems ensure the survival of species on the planet.

It is identifying these relationships that the environmental services are defined and provided. More specifically, identifying ecosystem functions that provide goods and services that meet human needs directly or indirectly (Ecosystem services) (DE GROOT et al., 2002).

In this context, both the services provided to human being by natural ecosystems (ecosystem Services) as those provided by ecosystems actively managed by humans are considered for the definition of environmental services are considered.

Thus, according to Wunder et al. (2008), man-made activities that contribute to the maintenance of environmental provision are also understood as "environmental services".

Hercowitz and Whately (2008), differentiate "ecosystem service" from "ecosystem services", defining the former as one of many services provided by ecosystems (food supply, wood etc) and "ecosystem services" as the set of services not separable in Parties.

According to Millenium Ecosystem Assessment - MA (2003), environmental services can be divided into three groups:

A) Procurement services: These would be services that result in goods or environmental products of economic value, obtained directly by the use and sustainable management of ecosystems, such as water, wood and food;

B) Support and regulation services: these would be the services that maintain the ecosystem processes and the conditions of the natural environmental resources, in order to guarantee the integrity of its attributes for present and future generations, such as regulation of floods and drought, regulation of Microclimate, among others;

C) Cultural services: these would be services associated with the values and manifestations of human culture derived from the preservation or conservation of natural resources, such as leisure, religious, and other non-material resources.

Therefore, payment for environmental services can be understood as a commercial relationship based on the sale of one or more of these services to a buyer, as cited by Wunder (2005), who states that this is "a voluntary transaction in which a well defined service, or a land use that can secure this service, is acquired by at least one buyer of at least one provider, on condition that it guarantees the provision of the service (conditionality)."

There are two critical points in this definition of Wunder, the first concerns the formation of the market for the transaction to take place, and the second is in the valuation of the service.

The formation of the market is related to the level of impact of the service, which may be local, regional or global and in the demand for this service (GUEDES; SEEHUSEN, 2011).

The valuation of these services often becomes subjective, being dependent on the satisfaction of the individuals involved in the purchase process. Thus, a function of preferences, which depend on education, propaganda, cultural presuppositions, abundance or scarcity etc., ie, the value systems considered by each person (FARBER et al., 2002).

Guedes and Seehusen (2011), state that for the definition of the value of a given service, the analysis can be performed through the following groups: intrinsic values, use values and non-use values.

According to the authors, the intrinsic values correspond to the contribution of ecosystems and biodiversity in maintaining the health and integrity of these or a species, independent of human satisfaction. Being based on systems of theological or ethical value that can not be captured in monetary terms, making it excluded from the composition of the total economic value.

According to the same authors, the use values can be of direct use, when the agents benefit directly from these (such as wood and non-wood products, or scenic beauty services for tourist or recreational activities), indirect, related to the functions of ecosystems that indirectly benefit people (such as climate regulation, carbon storage, and maintenance of hydrological cycles) and option values related to leaving an option open for later use, such as maintaining biodiversity in the expectation of which components of it may be used for medical purposes in the future.

In order to define the economic contribution of environmental services, in terms of indirect use and option values, methods were developed to value them economically, since for these the values are not defined by the market (TEEB, 2010).

As stated previously by Wunder (2005), in a PES there must be at least one buyer of at least one provider. Most of these providers are rural landowners who, although they may have an environmental conscience, often have a small willingness to invest in these practices, often coupled with the low income of these individuals and the lack of public policies that somehow compensate these interventions, which generate positive externalities (GUEDES; SEEHUSEN, 2011).

Thus, the option of directing ownership to receive environmental benefits or adopting management and exploitation practices that would not provide such

services is due to the choice of alternatives whose relation between perceived benefits less the costs involved are greater (FARBER et al. 2002).

The definition of the product to be marketed is still one of the most challenging aspects in the area of environmental services (LANDELL-MILLS; PORRAS, 2002).

In addition to defining who is the buyer and who is the provider of the environmental service, according to Oliveira (2010, apud ARAUJO JUNIOR et al., 2012), such services can be understood in three ways:

- 1) as a way of integrating the traditional inhabitants of preservation areas and encouraging them to preserve it, through a contractually stipulated remuneration;
- 2) as a way to compensate for the loss of competitiveness in the market, due to the compliance with the rules of management and exploitation of resources;
- 3) as a way of gratifying the residents and landowners who voluntarily adhere to the rules of preservation.

Thus, according to this author, the relationship in a PES goes beyond the purchase and sale relationship, which may include compensation and compensation as well as compensation for the environmental service. As also stated by Kosoy and Corbera (2010).

The form of payments of these services can occur through (ARAUJO JUNIOR et al., 2012):

- 1) Tax subsidies (in Brazil, for example, ICMS-ecological);
- 2) Creation of specific funds for preservation (national or international);
- 3) Also by direct negotiations and private agreements;
- (4 Or through the capital market (eg trade in carbon credits).

Therefore, inductors, which act in the formation of demand and induce PES systems, can be divided into three voluntary interests as government-mediated payments and environmental regulations (BECCA et al., 2010)

Thus, the great difficulty in defining the limits of the market relationship can be minimized insofar as the government assumes the role of the buyer and stipulates the subsidies that would be offered, which is responsible for defining the goals to be met.

In the case of water, the environmental market acquires a local character and, consequently, is more easily reached, since the basic unit of conservation is the river basin itself being the task of defining the goals to verify the provision of the environmental service (JARDIM; BURSZTYN, 2015).

Although the unit is the hydrographic basin, the actions to be implemented are carried out at the property level. Thus the property that is inserted in the basin (or the part of it) should implement them to benefit from the payments.

Thus, according to Araujo Junior et al. (2012), the PES functions as an economic instrument based on the assumption that agents tend to change attitudes according

to the receipt of incentives and economic penalties, in order to increase their profits or their usefulness.

Thus, payments for environmental services have become a growing market instrument capable of translating positive externalities, that is, non-market environmental services, are financial incentives for owners to preserve the ecosystems that provide these services (WÜNSCHER et al., 2008).

According to Garden and Bursztyn (2015), in many cases, the level to be retained is much higher for the society than for the farmer, since the positive externalities resulting from good agricultural practices are not offset, the benefit is collective, but the costs of conservation are exclusive to the farmers.

Since the measures adopted on the properties have a positive impact radius, which in most cases exceed their limits, the benefits are not restricted to the mere receipt of payments by the producers, but somehow all the persons that are benefited directly or indirectly, as stated By Araujo Junior et al. (2012).

Still According to these authors, in this respect, it must also take into account the globally impacting aspect of the various polluting activities in the elaboration of global environmental strategies to reach the effectiveness of the protective measures, mainly because we are in a time of deep global climate change, being necessary to consider the possibility that payments for environmental services also acquires this global connotation.

This way, the implementation of a PES program must go through the evaluation of the benefits that would be generated by this program as opposed to the costs of its implementation.

According to Wunder (2008), the current SA programs has worked with four major environmental service groups: 1) Carbon market (where countries with carbon sink deficits pay for other countries to maintain their carbon stocks, for example); 2) protection of biodiversity (in this case companies would buy protection areas, such as); 3) protection of watersheds (users of water resources of this state pay farmers who protect rivers and springs); 4) protection for scenic beauty (in this case car companies would pay for wildlife conservation for local communities).

These programs still present great challenges, once, according to Pria et al. (2013), they are innovative projects, learning from mistakes and successes is inherent to the process.

In this work, a review of the main implemented programs (or under implementation), presented below, was carried out.

PES – México - Projeto SCOLEL TÉ

The project SCOLEL TÉ is being developed in Chiapas, south of Mexico. The use of this model by means of

environmental management has presented satisfactory results according to Araújo Junior et al. (2012).

According to Furlan (2008) the project was initially funded by the European Union by the Mexican government through the implementation of a fund, the Bioclimático Fundo, under the management of farmers' organizations, the local survey institute and also the Edimburg Center for management of carbon (ECCM). Still according to the same author, means called "live planes" implement the project that are plans composed by farmers with technical assistance, which are registered in the Fund in order to become credits of carbon.

PES – Costa Rica

According to Landell-Mills and Porras (2002), Costa Rica is the most developed country in terms of public policy for environmental protection and for the use of mechanisms of PES towards the management of the hydrographic basin in Latin America.

O PES – CR was implemented in 1996 by Costa Rica. This is a national program and it aims at stopping the high rates of deforestation in that country, whose forest area had declined from 75% in 1940 to 21% in 1987 (FONAFIFO, 2016).

The management of financial resources is run by FONAFIFO (national Fund of Forest Financing) and for the regulation of the program it was implemented the forestry law number 7575 of February 13, 1996 that regulates the areas to be protected and the kind of environmental services (PAGIOLA, 2008).

The program pays for the preservation of the hydrological and landscape diversity and for the sequestration of carbon, having as beneficiary the users of water, the Costa Rican society and the global society (FONAFIFO, 2016).

Araújo Junior et al. (2012) show the linking of receipt of the property title as a vulnerable point of this program. Thus, this fact brings about discriminatory and excluding effects, especially referring to the small producers, indigenous group and also Afro-Caribbean people that do not have the property title of their lands and consequently the benefits of PES.

PES – EUA - Nova York

New York City faced the question of maintenance of good quality of the water for public supply through a joint effort. So the Whole Farm Program based on an integrated planning of properties was created. The city municipal administration has begun to finance both the actions of conservation and control of water pollution on the farms and technical assistance to farmers, considering the economic planning of the property. On this program, the areas along the rivers away from the properties and other forest areas began to receive care (PRIA et al, 2013).

According to Araújo et al (2012), thus, New York City chose to determine US\$ 1.5 billion to elaborate and put in practice, for a period of ten years, a plan for environmental protection that guaranteed the quality of the water and so avoided the necessity of filtering the water.

Still according to these authors, this modality of PES has become possible the restoration of the ecosystem of hydrographic basin that provides water to New York , besides benefiting the owners of the properties in the region, bringing forth an economy of more than US\$ 5 billion to the city.

PES – França

In the decades Of 1990, The company Perrier – Vittel (Nestlé nowadays) created a program to finance farmers in order to give them an opportunity to change their practice and technology aiming at reducing the risk of contamination by nitrate and pesticides in the aquifer in the northeast of France (PERROT-MAÎTRE,2006).

The company bought 1,500 hectares of land and offered the right of use to former owners, long-term contracts were signed with rural producers subsidizing their activities and ensuring technical support to use less intensive techniques in the use of pesticides (PERROT-MAÎTRE, 2006).

PES - Brasil

In Brazil , the PES has been discussed more attentively since the launching of the Program Proambiente in 2000. IT was based on an initial experience of PES in the country, however it showed several challenges to be overcome (WUNDER et al., 2008).

Thenceforth several projects of law on this subject started to be proposed by the National Congress and some federal laws already mention them, in spite of not creating a national policy about this. In addition, some states created laws on the theme, although there is not a comparative analysis of how these approved laws approach this subject. (IMAZON,2012).

In the national scope, there is the law 12.512/2011, a supporting program that aims at environmental conservation, called Bolsa Verde Program that was approved in 2011 and it has instituted the Supporting Program to the Environmental Conservation and the Program of Promotion to the farmers' activities.

The Bolsa Verde Program was established , having as example the state of Minas Gerais that, through the law 17.7227/2008, has regulated the concession of financial stimulus to owners and rural landholders (Bolsa Verde) and change the laws 13.199/1999 (State policy of hydrological resources) and 14.309/2002.

In Espírito Santo state, the law that instituted the PES was approved in 2008 .Other states have been following this tendency such as São Paulo and Minas Gerais. In the National Congress the law project number 792/07 on

environmental services is being processed. It aims at instituting a national Policy of Environmental Services and the creation of financial stimulus to the conservation and restoration of natural ecosystems (TNC, 2011).

It is perceived, in some cases, in the state scope, there is not a specific law for PES, but the content in it establishes the rules regarding it. According to ANA (National Agency for Water) (2012) the development of this kind of program at local scope is a very important from the economical point of view, because besides the impact on payment in the job and on the income, it may bring meaningful benefits to economic development associated to the environmental service itself (ANA, 2012). In many cases, environmental problems have brought about several barriers to the economic development and the PES acts a facilitating agent in order to handle these problems.

Nowadays in Brazil, there are some ongoing projects of PES, however, most of them are of regional scope. From now on, we will make a brief report of some programs.

PES Programs – Water Producer

Brazil has been taking the lead in the development and application of projects of payment for environmental services, especially in the last decade. The Agência Nacional das Águas (ANA) has been playing an important role with the creation of the program Producer of Water. This program encourages the payment policy for environmental services and implantation of projects that have as objectives the hydrological resources. In order to receive the title “Water Producer”, the projects must follow the conditions and guidelines established by ANA. With the objective of having a system of supervision of results that aims at qualifying the received benefits with its implantation it is one of the conditions that is considered an essential premise (LIMA et al., 2013).

PROAMBIENTE

PROAMBIENTE, in legal Amazonia, is a project that aims at paying for services destined to the deforestation that was avoided, to the sequestration of carbon, to the soil and water, to the preservation of the biodiversity conservation and to the reduction of inflammability of landscape. The male and female family producer, handmade fishermen, traditional population that live in the Amazon, and meet certain requirements, are beneficiaries of these programs, since the payment is made according to the group and the service provided (ARAUJO JUNIOR et al., 2012).

The implementation of this system as a public policy has become one of the oldest PES experiences in Brazil, since it began in the 2000s and has served as both a conceptual and practical reference for current PES works (ONISHI et al., 2013).

ICMS Ecológico e Bolsa Floresta

According to Araújo Júnior et al. (2012), the ecologic ICMS, also known as “ecologic tax”, has been adopted in many states in Brazil to subsidize and stimulate the actions of conservation. Thus, allowing the Brazilian townships to receive part of the raised financial resources of tax of Imposto Sobre Circulação de Mercadorias e Serviços (ICMS) as a recognition for environmental services done to the society, being this service defined in creation and maintenance of units of conservation.

Still according to the same author, the Bolsa Floresta é destinado to the population that lives in the units’ state of conservation. The author states that the stimulus has as main objective is the conservation of forests and hydric resources, preservation of biodiversity and reduction of greenhouse effect gases. The payment of families that live in these areas is done through an specific card. Each month is paid R\$ 50,00, since the families meet the goals established by the program.

Cajari Carbon – Amapá

According to Superti et al. (2015), the Cajari Carbon Project was implemented approaching traditional extractivist population of a unit of conservation in a federal unit, Cajari River Extractivist Reserve (Resex – CA), located in the south of Amapá in the sentrentional Brazilian Amazon state.

According to this author, the objective of the project is the fixation of carbon to avoid emissions by means of forest conservation and by the biodiversity associated to the amazon biome. Thus, promoting the expansion of natural population of nut trees, the environmental education and investment in productive chain of Brazilian nuts to strengthen the extractivism of forest conservation and also of the biodiversity associated to the Amazon biome.

Still according to the same author, the project had as proponent the Associação dos Trabalhadores Agroextrativistas da Reserva de Cajari (ASTEX-CA)) and the work was done by a hired team and institutional partners Empresa Brasileira de Pesquisa Agropecuária – EMBRAPA/ Amapá, Instituto estadual de Floresta – IE and the Instituto Chico Mendes de Conservação da Biodiversidade – ICM Bio in addition to the non-governmental organization such as Conselho Nacional das populações Tradicionais – CNS, Associações de Mulheres of Alto Cajari – AMAC, Cooperativa Mista dos Trabalhadores agroextrativistas do Alto Cajari and Escolas – Famílias Agroextrativistas do Maracá e do carvão – EFAEX-MA and EFAC).

Water Supply of Extrema –MG

In the program Water Supply implanted in township of Extrema located in state of Minas Gerais, the payment for environmental services related to water has already been made, benefiting small landowners that participate in the project. (JARDIM; BURSTYN,2015).

According to documents of The Nature Conservancy (2011) about the program “ Water Supply of Extrema”, there are different arrangements in order to pay and receive for environmental services. And the most common example as how the system works to encourage the conservation of the environment from the point of view of resource origin are: via hydrographic Basin Committee, through specific legislation or through the free market (TNC, 2011).

It is highlighted that in the township of Extrema the PES was incorporated in the city hall according to its budget and also according to the legal frame created and regulated for this purpose. The payment is made through resources from Fundo Municipal para Pagamentos por Serviços Ambientais (FMPSA). This fund aims at valuing the property as a whole and consequently makes this property suitable environmentally speaking. Thus, the program has three focus: vegetal cover, soil conservation and sanitation.

In addition, the program has the following partners: Secretaria do Meio Ambiente e Desenvolvimento Sustentável of Minas Gerais state (SEMAD), Instituto Estadual de Floresta (IEF), Agência Nacional das Águas (ANA), Nature Conservancy (TNC), the institute SOS Mata Atlântica and Comitê PCJ (EXTREMA ENVIRONMENT DEPARTMENT, 2010).

IV. CONCLUSIONS

The payment for environmental services presents as a potential instrument to promote the sustainable development. Thus, we reach nature preservation and it becomes clear that the maintenance of all the service provided for nature is indispensable to human being. It is also clear that with these programs described in this revision that most of them come from the public administration, specially the cases implanted in Brazil, and although they are of great importance, and fundamental in many regions, they face the necessity of raising the financial resource by public manager. Examples as the program Whole farm Program, from New York – USA, from Itacaré, Bahia – Brazil and Projeto Oasis, Created by Fundação O Boticário de Proteção à Natureza. In these places, the resource is not exclusively from the government. They become examples of programs that could better the implantation of PES in many other regions, inclusive with the association with programs that have already been implanted with public resources. It would increase the area of working of them with the possibility of comprising more properties. It is perceived that the PES is implemented through a stable way. It means it is not only a form of management, but it became an example administration where the conservation of the environment is provided without letting the owners of property, which

have only that means of livelihood, to pay for the costs of conservation. The relationships that regulate the PES are very important too. There is not a regulation that can be applied as a rule for any program to be implanted. That happens because of the local specificities are biome with different characteristics. Local population group with different habits and customs, source of resources from different maintainers (public agency, management committee, among others.). Thus, it is required that the PES has its own regulatory framework in order to meet these specificities. Even being necessary to meet these local characteristics, the examples mentioned in the implanted programs, show that the programs or payment for environmental services can be applied in any region, since there is a maintainer, being it public or private or a consortium between both and they show clearly and objectively the goals to be reached by the owners of the property.

V. CONCLUSION

A conclusion section must be included and should indicate clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

ACKNOWLEDGEMENTS

An acknowledgement section may be presented after the conclusion, if desired.

REFERENCES

- [1] AGÊNCIA NACIONAL DE ÁGUAS – ANA. Manual Operativo do Programa Produtor de Água / Agência Nacional de Águas. 2ª Ed. Brasília. P. 84, 2012.
- [2] ARAUJO JUNIOR, M. E. DE.; CICILIATO, R. X. Os Pagamentos por Serviços Ambientais (PSA) como alternativa na construção da sustentabilidade ambiental em países europeus e americanos. Revista Eletrônica Direito e Política. 7 (1), p. 551-584, 2012.
- [3] Becca, M.; Carrol, N.; Moore Brands, K. State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide. Retrieved June 22, 2015, from <http://www.ecosystemmarketplace.com/documents/acrobat/sbdrm.pdf>. 2010.
- [4] Bernardes, C.; Sousa Junior, W. C. Pagamento por Serviços Ambientais: Experiências Brasileiras relacionadas à Água. V Encontro Nacional da Anppas, Florianópolis, Brasil, p. 11, 2010.
- [5] Börner, J. Serviços ambientais e adoção de sistemas agroflorestais na Amazônia: elementos metodológicos para análises econômicas integradas. In: Porro, R. Alternativa agroflorestal na Amazônia em transformação. Brasília, DF: Embrapa Informação Tecnológica. 2009.
- [6] Claassen, R.; Hansen, L.; Peters, M.; Breneman, V.; Weinberg, M.; Cattaneo, A.; Feather, P.; Gadsby, D.; Hellerstein, D.; Hopkins, J.; Johnston, P.; Morehart, M.; Smithclassen, M. Agri-environmental policy at the crossroads: guideposts on a changing landscape. USDA-ERS Report. Retrieved June, 21, 2015, from https://www.ers.usda.gov/webdocs/publications/41216/32146_aer794_002.pdf?v=41484. 2001.
- [7] De Groot, R. S.; Wilson, M. A.; Boumans, R. M. J. A typology for the classification, description and valuation of ecosystem functions, goods and services. Ecological Economics, 41(3), p. 393-408, 2002.
- [8] Departamento do Meio Ambiente de Extrema. Projeto conservador das Águas. Retrieved June 21, 2015, from <http://extrema.mg.gov.br/conservadordasaguas/>. 2010.
- [9] Farber, C. S.; Costanza, R.; Wilson, M. A. Economic and ecological concepts for valuing ecosystem services. Ecological Economics, Amsterdam, 41 (3), p. 375-392, 2002.
- [10] Fundação Grupo Boticário. Oasis. Retrieved January 18, 2017, from <http://www.fundacaogrupoboticario.org.br/pt/o-que-fazemos/oasis/pages/default.aspx>. 2017.
- [11] FURLAN, M. Função promocional do direito no panorama das mudanças climáticas: a ideia de pagamento por serviços ambientais e o princípio do protetor-recebedor. 296. Doctoral dissertation, Universidade Católica de São Paulo, São Paulo. 2008.
- [12] FONAFIFO. Pago de Servicios Ambientales. Fondo Nacional de Financiamiento Forestal - FONAFIFO - Costa Rica. Retrieved December 2, 2016, from <http://www.fonafifo.go.cr/psa/index.html>. 2016.
- [13] Guedes, F. B.; Seehusen, S. E. Pagamento por Serviços Ambientais na Mata Atlântica Lições aprendidas e desafios. Brasília: Ministério do Meio Ambiente – Secretaria de Biodiversidade e Florestas, p. 128, 2011.
- [14] Hercowitz, M.; Whately, M. Serviços Ambientais: conhecer, valorizar e cuidar: Subsídios para a proteção dos mananciais de São Paulo. São Paulo: Instituto Socioambiental, p.120, 2008.
- [15] Instituto Do Homem E Meio Ambiente Da Amazonia (IMAZON). Marco regulatório sobre pagamento por serviços ambientais no Brasil. Organização de Priscilla Santos; Brenda Brito; Fernanda Maschietto; Guarany Osório; Mário Monzoni. – Belém, PA: IMAZON; FGV, p. 78, 2012.

- [16] Jardim, M. H.; Burszty, M. A. Pagamento por serviços ambientais na gestão de recursos hídricos: o caso de Extrema (MG). *Eng Sanit Ambient*, 20 (3), p. 353-360, 2015.
- [17] Kosoy, N.; Corbera, E. Payments for ecosystem services as commodity fetishism. *Ecological economics*, 69 (6), p. 1228-1236, 2010.
- [18] Landell-Mills, N.; Porras, T. I. Silver bullet or fools' gold? A global review of markets for forest environmental services and their impact on the poor. *Instruments for sustainable private sector forestry series*. International Institute for Environment and Development, Londres. P. 127, 2002.
- [19] Lima, A. P.; Albuquerque, R. H.; Prado, R. B.; Turetta, A. P. D.; Fidalgo, E. C. C.; Schuler, A. E. Pagamento por serviços ambientais hídricos no Brasil: experiências iniciais e os desafios do monitoramento. In : XX Simpósio Brasileiro de Recursos Hídricos. p.1-9, Bento Gonçalves. 2013.
- [20] Onishi, C. M.; Vazoller, R. F.; Reydon, B. P. Pagamento por serviços ambientais: benefícios locais e globais. *Revista DAE maio-agosto* (192), p. 16, 2013.
- [21] Pagiola, S. Payments for environmental services in Costa Rica. *Ecological economics*, 65 (4), p. 712-724, 2008.
- [22] Perrot-Maitre, D. The Vittel payments for ecosystem services: a "perfect" PES case. International Institute for Environment and Development, Londres, 24p. Retrieved December 2, 2016, from <https://www.cbd.int/financial/pes/france-pesvittel.pdf>. 2006.
- [23] Pria, A. D.; Diederichsen, A.; Klemz, C. Pagamento por Serviços Ambientais. *Sustentabilidade em Debate*, 4 (1), p. 317-340, 2013.
- [24] Seroa Da Motta, R. *Economia ambiental*. Rio de Janeiro: FGV, p. 228, 2006.
- [25] Superti, E.; Aubertin, C. Pagamentos por Serviços Ambientais na Amazônia: o desvio de um conceito – casos do Amapá e Acre. *Desenvolv. Meio Ambiente*, 35,p. 209-224, 2015.
- [26] TEEB (The Economics Of Ecosystems And Biodiversity). TEEB for local and regional policy makers. Malta: Progress Press, p. 210, 2010.
- [27] TNC - The Nature Conservancy Do Brasil. Projeto Conservador das Águas Passo a Passo: Uma Descrição Didática sobre o Desenvolvimento da Primeira Experiência de Pagamento por uma Prefeitura Municipal no Brasil. Adriana Kfoury e Fabiana Favero. Brasília. 2011.
- [28] Young, C. E. F.; Bakker, L. B. D.. Instrumentos econômicos e pagamentos por serviços ambientais no Brasil. In: *Forest Trends* (ed.) *Incentivos Econômicos para Serviços Ecossistêmicos no Brasil*. Rio de Janeiro: Forest Trends. P. 33-56, 2015.
- [29] Wunder, S.; Wertz-Kanounnikoff, S.. Payment for Ecosystems Services: A New Way of Conserving Biodiversity in Forests. *Journal of Sustainable Forestr*, p. 576-596, 2009.
- [30] Wunder, S.; Albán, M.. Decentralized payments for environmental services: The cases of Pimampiro and PROFAFOR in Ecuador. *Ecological Economics*, 65 (4), p. 685- 698, 2008.
- [31] Wunder, S.; Börner, J.; Pereira, L.; Tito, M. R.. Pagamentos por serviços ambientais: perspectivas para a Amazônia Legal. Brasília: MMA. 2005.
- [32] Wünscher, T., Engel, S., Wunder, S.. Spatial targeting of payments for environmental services: a tool for boosting conservation benefits. *Ecological Economics*, 65 (4), p. 822– 83