

# METHODOLOGICAL PROPOSAL FOR PRIORITIZATION RANKING OF MUNICIPALITIES FOR IMPLANTATION OF PAYMENT FOR ENVIRONMENTAL SERVICES PROGRAMS

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## Introduction

The human population receives goods (products) and services derived directly or indirectly from the ecosystems' functions (CONSTANZA et al., 1997) which propitiate the conditions and processes that sustain life (DAILY, 1997). Such benefits have been described as "ecosystem services" (MILLENNIUM ECOSYSTEM ASSESSMENT, 2005) and the term has been consistently used with that meaning in scientific literature. The services are classified as provision services (food, water, wood and fiber), regulatory services (carbon sequestering, floods, diseases, waste and the quality of water), cultural services (recreational, aesthetic and spiritual) and support services (soil formation, photosynthesis and nutrient cycling).

Based on their analysis of 17 ecosystem services associated to 16 biomes, Constanza et al. (1997) estimated the global value of such services at around 33 trillion dollars. However, considering that life on the planet is only possible because of them, their value is actually infinite (POWELL; WHITE, 2001).

The term environmental services is understood to cover all those practices that provide maintenance, recuperation, and expansion of the production of ecosystem services carried out by an environmental service provider for the purposes of appropriation or utilization (CHOMITZ et al. 1999, YOUNG, 2006).

According to the most widely adopted definition of the term, "payment for environmental services (PES)" is, in essence, a voluntary transaction whereby a clearly defined environmental service, or form of land use that can guarantee that service, is acquired by at least one purchaser from at least one provider, on condition that the provider guarantees the provision of the said service or conditionality (WUNDER, 2005). In other words,

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the basic premise is to recompense those economic agents who manage the environment and natural resources, generating environmental goods and services that benefit, not only themselves but society as a whole (AGÊNCIA NACIONAL DE ÁGUAS, 2007).

PES can be understood as a tool for environmental management and sustainable development founded on economic principles, constituting itself as a mechanism based on voluntary transactions, externalities and market failures (PAGIOLA et al., 2002; KOSOY et al., 2006; ENGEL et al., 2008; WUNDER, 2008).

According to the FAO (2004), PES mechanisms have been showing themselves to be a promising tool for financing environmental protection and restoration as well as an alternative for complementing and reinforcing existing regulations – command and control instruments of a regulatory nature and economic instruments. Seroa da Mota (1998 and 2005) states that such instruments are based on the concept of internalizing externalities, that is, those costs or benefits that are generated for third parties but which are not taken into account in the market prices (PAGIOLA et al. 2005).

Insofar as ecosystems are being degraded and the services they generate are diminishing or being lost altogether, PES arrangements are beginning to attract attention in both developed and developing countries, especially after the work of the Millennium Ecosystem Assessment (FISHER et al., 2009). It must be underscored that the scale of application of a PES program can vary from small river basins to an entire country (PAGIOLA et al., 2005; ZILBERMAN et al., 2006; WUNDER et al., 2008).

Given that Brazil's conservation policy places the onus of environmental conservation on local populations – by restricting the forms of use of the land, thereby polarizing the rural x urban conflict (FAXINA; TREVIZAN, 2011) – PES schemes become all the more important as an alternative way to improve the country's social and environmental quality.

PES programs, however, are carried out by means of market categories which have been defined by Powell and White (2001) as: private agreements, exchange schemes among agents, and payments made by the public sector (that is, when spheres of government, or a public institution that is not necessarily a state body, makes the payment for the environmental service).

In the case of PES that target river basins with a focus on water resources, Smith et al., (2006) defined four possible payment schemes: private payments, cap and trade<sup>i</sup>, certification of environmental goods and public payment, including tax mechanisms. Regardless of which category is employed, it is important to define the transaction (how much to pay), the purchaser (demand), the legal framework, the environmental service and the provider (supply/offer) (SEEHUSEN; PREM, 2011).

Wunder et al. (2008), in their comparative analysis of PES programs in developed countries and developing countries found that the programs financed by users (user-payer) were the best conceived and most appropriate for local needs and conditions. Furthermore, they had better monitoring, greater propensity for conditioned application and less confusion with lateral objectives than those financed by governments. On the other hand, government financed PES programs are capable of extrapolating the environmental sphere and internalizing measures that encourage the development of specific

sectors, such as agriculture (PAGIOLA, 2005; ZILBERMAN et al., 2006; WUNDER et al., 2008) and reducing poverty. However in regard to this last purpose, Pagiola et al. (2002) argue that if reducing poverty is the only goal, there are other, more efficacious tools than PES to achieve it.

In Brazil, PES schemes are most notably present in the Atlantic Forest biome, especially in the south and southeast where most of the bigger cities are located (VELGA; GAVALDÃO, 2011; ELOY et al., 2013). A survey conducted by the Ministry of the Environment registered around 80 such projects in that biome in 2010, most of them directed at protecting water resources (GUEDES; SEEHUSEN, 2011).

Although the current literature tends to emphasize the scientific and economic basis for PES, in practice, the evolution of PES schemes has been influenced far more by policy than by science, due to the negotiating processes it involves among multiple agents (GROOT; HERMANS, 2009). It can also be seen that there are various questions that have yet to be settled with regard to the incorporation of the entire range of ecosystem services into the objectives of environmental policy.

In the light of the decentralization of environmental management, the municipality currently bears the greatest responsibility for better environmental quality and the effectiveness of its management is directly related to its institutional capacity (SCARDUA; BURSZTYN, 2003; TONI; KAIMOWTIZ, 2003).

Considering PES's potential as a mechanism for protecting and improving the quality of the environment and that the role of the municipalities is to unfold policies for the protection and conservation of natural resources, the present study aims to develop a methodology that will make it possible to evaluate the potential of the municipalities to receive PES programs with special attention to water resources based on their environmental, institutional and political characteristics.

## Material and methods

The outreach of the analysis of this study consists of the municipalities of the state of Rio de Janeiro. The data was taken from the Environment Supplement to the Survey of Basic Municipal Information (*Suplemento de Meio Ambiente da Pesquisa de Informações Básicas Municipais - MUNIC*) conducted by the Brazilian Geography and Statistics Institute (*Instituto Brasileiro de Geografia e Estatística - IBGE*) in 2008, 2009 and 2012 and published in 2012. The data was accessed on the site of the IBGE's Multidimensional Statistics Bank (*Banco Multidimensional de Estatísticas do IBGE*).

The MUNIC's purpose is to consolidate a base of municipal information on the institutional and administrative aspects of Brazilian cities and it collects data on their institutional capacity and structure, public planning, municipal government finances, social programs run by local government authorities, public service provision and urban infrastructure (IBGE, 2010).

From among the large number of variables analyzed by the MUNIC, this study selected those that are most relevant to the spheres involved in delineating a PES program focused on water resources, namely, the environmental sphere – with an emphasis on impacts and

actions with greater direct or indirect repercussions in relation to water resources – and the institutional sphere. 36 variables were selected grouped around three themes: environmental impacts, institutional capacity/structure and environmental actions (Chart 1)

For comparison purposes and to enable the eventual construction of a prioritization index for the municipalities in regard to the implementation of PES programs, for each municipality, an index was calculated for each of the three themes by dividing the sum of the occurrences of the variables selected (identified on the basis of the answers obtained from the respective municipal administrators interviewed in the MUNIC surveys) by the total number of variables for that theme. To that end, the values used were 1 or 0 according to whether the variable occurred or not, respectively. Thus according to the criteria established, a given municipality could only obtain a maximum of 14 for the Environmental Impacts theme, 15 for the Institutional Capacity/Structure and seven for the Environmental Actions theme.

**Chart 1. Distribution of the MUNIC variables selected according to themes.**

Themes	Variables	
Environmental Impacts	Environmental alteration that has affected the life of the population	
	Alteration that has jeopardized the landscape	
	Silting up of water body in the municipality	
	Agricultural activity impaired by environmental problem	
	Cattle raising activity impaired by environmental problem	
	Soil contamination	
	Degradation of legally protected areas	
	Deforestation	
	Water scarcity	
	Other impact-causing occurrences	
	Air pollution	
	Water pollution	
	Burning	
	Reduction of fish quantity/diversity or drop in quality of fish	
Institutional Capacity/ Structure	Institutional structure:	Local Agenda 21 (diagnosis/methodology)
		Existence of municipal environment fund
		Existence of specific environmental legislation
		Existence of specific body responsible for environment affairs/environment department
		Intermunicipal consortium
		Administrative agreement
		Existence of municipal environment council
		Public company
	Financial resources specifically for the environment:	Research and teaching entities
		Private enterprise
		International body or institution
		Non governmental organization
		Public body
		Other financing sources
		Pes
Environmental Actions	Intermunicipal articulation for environment, basin committee	
	Domestic and/or industrial solid waste disposal	
	Other themes addressed	
	Recuperation of water resource quality	
	Recuperation of degraded areas	
	Domestic sewage treatment	
	Recomposition of vegetation	

Source: IBGE (2010 e 2012)

The prioritization index was calculated by obtaining the simple arithmetic average of the indexes obtained for each of the three themes (Equation 1). No weighting was attributed to any one theme because the aim was to identify those municipalities with a combination of the greatest number of environmental problems, the best institutional structure and the greatest activity in the form of actions directed at improving the quality of the environment. Thus the higher the value of the index obtained, the greater would be the indication of the municipality to receive a PES program.

Equation 1:

$$Ip = \frac{1}{n} \sum_{i=1}^n \frac{En}{Tn}$$

**Where:**

Ip: Is the prioritization index of the municipality

E: Value obtained by the municipality, per theme

T: Sum of the number of variables, per theme

N: Number of variables

## Results and discussion

The state of Rio de Janeiro is located in Brazil's Southeast macro-region which has the most highly developed economy and the greatest demographic density in the country. The state's 92 municipalities occupy an area of 43,780 km<sup>2</sup> and their total population is 16,369,178 inhabitants (IBGE, 2013). Over 96% of the population lives in urban areas and around 40%, that is 6,429,922 (IBGE, 2013), lives in the state capital Rio de Janeiro, widely renowned for its natural and cultural beauty, but also for its complex social and environmental problems (RIO DE JANEIRO, 2011).

The entire state lies within the Atlantic Forest biome currently restricted to a mere 7.3% of its original forest vegetation cover. The biome has been identified as the fifth most threatened area and fifth most abundant in endemic species in the world (IBGE, 2004).

Currently state and federal protected areas together amount to 17% of the surface area and encompass 41% of the remaining forests and it has various ecosystems distributed in its continental and maritime portions (COPPETEC, 2014).

In economic terms, Rio de Janeiro has the second largest GDP among the Brazilian states and its production structure is dominated by petroleum, metal-mechanical and chemical-pharmaceutical production chains and services. In the economic field, the petroleum sector is by far the most outstanding in Rio de Janeiro.

## Environmental Impacts

The most commonly identified problem present in the Rio de Janeiro municipalities is silting up. It was identified by 68.5% of the municipalities surveyed, followed by water

pollution, burning and deforestation. Of the 63 municipalities that identified silting up, 66.6% also have problems with deforestation, 65.1% with burning and 61% of them have water pollution problems.

Given the generalized situation of the degraded quality of water in the big Brazilian cities, particularly in the southeast and south (AGÊNCIA NACIONAL DE ÁGUAS, 2012), it was originally expected that water pollution would have been the commonest problem, especially in those municipalities with large populations and a concentration of economic activities and industries. In fact, however, an expressive number of them (40%) did not refer to water quality problems at all, including some municipalities located in the greater Rio de Janeiro metropolitan area like Queimados, Magé e Belford Roxo where the degradation of the waters is a well known fact (AGÊNCIA NACIONAL DE ÁGUAS, 2012).

Albeit in absolute terms the state of Rio de Janeiro does not have water resource availability problems, there are some areas that already have severe qualitative and quantitative impairments and serious water shortage problems, as is the case in the eastern part of the Guanabara Bay (DANTAS et al., 2008)..

Although the results show that the municipalities of Itaboraí, Niterói and São Gonçalo did not identify any water shortage problems, their situation is actually quite critical, especially in São Gonçalo and Niterói, as Barcellos et al. (2011) have reported. To make matters worse, large-scale projects are being installed in that region, like the Rio de Janeiro Petrochemical Complex (COMPERJ) and all the chains of activities associated to it, and that will inevitably increase pressure on the region's already scarce water resources.

Among the 29 municipalities that declared they had water shortage problems, 48.3% also had problems with deforestation and among these last, 37.9% had silting up problems too. The municipalities with the worst situations with water shortage, deforestation, silting up and water pollution problems were Miguel Pereira, Miracema, Parati, Paty do Alferes, Piraí, Rio Bonito, Saquarema and Valença, none of which are in the metropolitan region of the state.

In short, the municipalities with the greatest environmental problems were Miracema and Valença, as they had 11 of the 14 impacts that were analyzed, and those in the best situation were Cachoeiras de Macacu, Cambuci, Campos dos Goytacazes, Carapebus, Casimiro de Abreu, Itaperuna, Japeri, Magé, Nilópolis, Paraíba do Sul and Pinheiral each with only two impacts.

## Institutional Framework

In the analysis of the question of the municipalities' institutional situations, the variables were grouped in two sets: one related to institutional structure as such and the other to the sources of financing.

In regard to the institutional structure it can be seen that most municipalities (72.8%) were capable of articulating some kind of administrative agreement or arrangement; an extremely important skill for the smaller municipalities with greater administrative and institutional difficulties. According to Leme (2010), it is in that kind of

articulation that the small municipalities have found an efficient way to perform in the field of the environment.

It can be seen that 66.3% of the municipalities had a municipal environment council and 59.3% had a body in their administrative structure responsible for environmental affairs in the form of a specific municipal government department; that is a feature considered to be essential for implementing environmental policies in the municipal sphere (LEME, 2010).

However, only 43.4% of them had both. In Rio de Janeiro such structures are essential for the decentralization process in environmental management, because in order for them to be empowered to apply and publish environmental infraction documents and/or initiate punitive administrative processes, they need to have such bodies in their structures and be integrated to the National Environment System (SISNAMA) (INEA, 2013).

Altogether, 72.2% of the municipalities that had an environment body also had a duly instituted environment council but, of these, only 19.7% legislated on the theme. That shows that, to some extent, those structures do not function interdependently as they should, with the exception of the act of legislating, where 100% of those municipalities that legislated had a specific environment entity in their structure.

According to Carvalho et al. (2005) the simultaneous occurrence of a Council + a Fund + Legislation is an important indicator of the degree of integration of the environmental policy in the municipal ambit. Based on the MUNIC data for 2001, those authors detected that 8.6% of Rio de Janeiro municipalities had those structure; a slightly higher figure than the one obtained by the present study (7.6%).

That difference, however, can be explained on the basis of the methodologies employed. Considering that in 2001 the MUNIC did not investigate the aspect of specific legislation for the environmental area as such, Carvalho and his collaborators used the variable "legislation on areas of special interest" which is less specific and involves areas ranging from those of interest for environmental protection to others of interest for social housing projects and consequently encompasses a greater number of municipalities.

The municipality with the best institutional situation was Rio de Janeiro city, which gave affirmative answers for seven of the variables on that theme, followed by Itatiaia and São Gonçalo. Among those which were institutionally most precarious were Mesquita and Sapucaia, who declared that they had none of the structures mentioned in the survey.

In regard to the sources of financing, 87% of the municipalities received financing from at least one source, the most representative being PES, followed by public entities. On the other hand, 12 municipalities (13%) declared that they had not received financing from any source whatever; they were Bom Jardim, Bom Jesus do Itabapoana, Duas Barras, Itaboraí, Itaocara, Itaperuna, Itatiaia, Mendes, Paraíba do Sul, Queimados, São José de Ubá and São Sebastião do Alto.

In regard to PES, the information available in the MUNIC does not allow for any systematic analysis of financial resource transfers or their market categories, only of their nature, which varies, ranging from financial resources from (federal, state) government bodies or from non-governmental organizations (NGOs) or from private sources. The data revealed that most (78.8%) of the funds transferred under the aegis of PES came



from state government sources. Sumidouro and Volta Redonda were the only ones receiving federal funds alone, while São Francisco de Itabapoana, Sapucaia and Saquarema received financing from private sources. In regard to combinations of possible sources of financing, nine municipalities received financing from both federal and state sources, Seropédica received both federal and private funds and Teresópolis had the most varied sources: federal, private and from an NGO.

Given the notable discrepancy between the state supplied financing for PES and the other categories of origin, it is believed that the former represent the transfers of money stemming from the ICMS verde (green) tax levied by states. The inclusion of the environment criterion in the calculation of the transfer of amounts levied as ICMS (tax on the circulation of goods and services) was made possible by the enactment of Law 5.100, dated October 4, 2007, which established new rules for the transfer of the ICMS to the state of Rio de Janeiro's 92 municipalities. The environment component was incorporated gradually and by 2011 it had attained the level of 2.5% of the 25% of the product of the ICMS levy. According to the State Environment Department (2014), 195 million reais were passed to the Rio de Janeiro municipalities in 2014.

Considered to be a PES mechanism, the Green ICMS incorporates ecological variables to stimulate the municipalities, through economic incentives, to implement good management practices in the areas of environmental conservation, water resources and solid waste management. May et al., (2005) examined the application of the Ecological (green) ICMS in Brazil and concluded that the tax is associated to a significant increase in protected areas in those states where it has been adopted, thereby making other states more liable to use it as a means of stimulating natural resource conservation by allocating tax revenue rather than embarking on additional spending.

The second source of financing most accessed by the municipalities after the PES was that coming from public bodies with a figure of 48.6%. All the other sources together accounted for 22%. In regard to diversity of financing sources, Barra do Piraí and Conceição de Macabu were outstanding, having accessed four of the eight sources selected by the study, and they were followed by Miguel Pereira, Nova Friburgo, Piraí and Rio Bonito, each with three. 35 municipalities accessed two sources and 38 accessed only one.

Although it had been expected would be a significant association between the structure of the municipalities and their capacity to attract financial resources because the transfers originating from the Green ICMS are conditioned to the structuring of the municipal environment system (municipal environment council, municipal environment fund, administrative body to execute environmental policy, and municipal environment brigade – State Law nº 5.100, dated October 04, 2007) that was not what the results showed.

Rio Bonito and Volta Redonda, for example, do not have an environment fund, only a municipal environment council and yet they were the only ones to receive international financing. On the other hand, the municipality of Rio de Janeiro, which has by far the best structure and has been receiving investments from various sources, declared that it only received funds from government bodies.

Even admitting the possibility of the interviewed person's misunderstanding the question of identification of sources in the MUNIC survey, perhaps reporting private



investments as if they were public ones, or simply ignoring private investments altogether, it is nevertheless very clear that the municipalities need to expand their capacity to attract investments, diversifying their sources to go beyond government sources alone.

Given that the extent of the municipalities' institutionalization is a significant factor in regard to their management capability (TONI; KAIMOWITZ, 2003; TONI; PACHECO, 2005; NUNES et al., 2012), the data reveal the size of the challenge facing the Rio de Janeiro municipalities in their quest for effective local environmental management.

## Environmental Actions

This study showed that the recuperation of the quality of their water resources was the environmental action most commonly practiced by the municipalities, thereby corroborating the initial hypothesis that water quality was their most outstanding environmental problem.

Cachoeiras de Macacu, Nova Friburgo and Porciúncula were outstanding insofar as they had undertaken all the actions contemplated by this research. However, the opposite situation prevailed in Angra dos Reis, Areal, Cambuci, Comendador Levy Gasparian, Japeri, Macuco and Magé, which did not carry out a single one of them.

Interestingly, of the 71 municipalities that did implement actions to recuperate the quality of their waters, 57.7% articulated their actions by means of a river basin committee. These are collegiate bodies made up of representatives of the public authorities, civil society entities and water users and among their attributions is the prerogative of deciding how the financial resources obtained by charging for the use of water resources should be applied. In 2014 alone, around 12 million reals were levied in that way (INEA, 2014). Taking into account the paucity of municipal financial resources, the fact that the amounts obtained by charging for water use have to be applied preferentially in the river basins originating the water resource, and that they are a factor that induces the implantation of PES programs (BRANNSTROM, 2001; VEIGA; GAVALDÃO, 2011), it can be concluded that the participation of Rio de Janeiro municipalities in such collegiate bodies is still very small.

Among the municipalities that did carry out water quality recuperation actions, 16% (12) did not treat their sewage and neither did they dispose of solid waste. Nevertheless, 70% (50) undertook actions to recuperate degraded areas. Although the survey results had suggested that there was a greater correlation between degraded areas and water quality, it is widely known that the crucial problem involved in the degradation of water resources is the discharge of untreated domestic and industrial effluents into the rivers (AGÊNCIA NACIONAL de ÁGUAS, 2012). Furthermore, of the 46 municipalities that treated domestic sewage, three declared that they did not carry out any actions to recuperate water resources. They were Natividade, São Fidélis and Vassouras.

It could be seen that 79.3% of the 63 municipalities with silting up problems undertook actions to recuperate water quality. Of the remainder, only Lajes do Muriaé and Natividade had no kind of structure at all. Valença is worth mentioning insofar as it has a very significant institutional structure – local Agenda 21 (diagnosis/methodology),

municipal funds, environment administrative body, specific legislation, and an environment council, in addition to having administrative contracts and agreements in place and receiving financing from a government body. Nevertheless, it failed to carry out a single one of the actions to improve water quality contemplated by the survey.

Of the 58 municipalities with water pollution problems, 45 (77.5%) declared that they had carried out activities to recuperate water resources and almost half of these (48.2%) treated their domestic sewage. Valença and the municipality of Rio de Janeiro did not undertake any of those actions in spite of their more robust institutional structures.

Lastly, of the 15 municipalities registering the greatest number of impacts on water resources (silting up, pollution and shortage), eight articulated their actions through river basin committees (Engenheiro Paulo de Frontin, Natividade, Parati, Piraí, São Fidélis, Teresópolis, Valença and Vassouras) showing that there is a need to expand municipal involvement in those spheres of water resource management.

Table 1 displays some statistical information that enables comparisons to be made among the themes that were studied.

**Table 1.** Basic descriptive statistics of the Environmental Impacts, Institutional Capacity/Structure and Environmental Actions Indexes for the Municipalities of Rio de Janeiro State.

Theme	Average	Minimum	Maximum	Median	CV*
Environmental Impacts	0.35 ± 0.14	0.14	0.79	0.36	41.64
Institutional Structure	0.29 ± 0.11	0.07	0.60	0.27	38.88
Environmental Actions	0.55 ± 0.25	0.00	1.00	0.57	46.11

\*CV – Coefficient of Variation

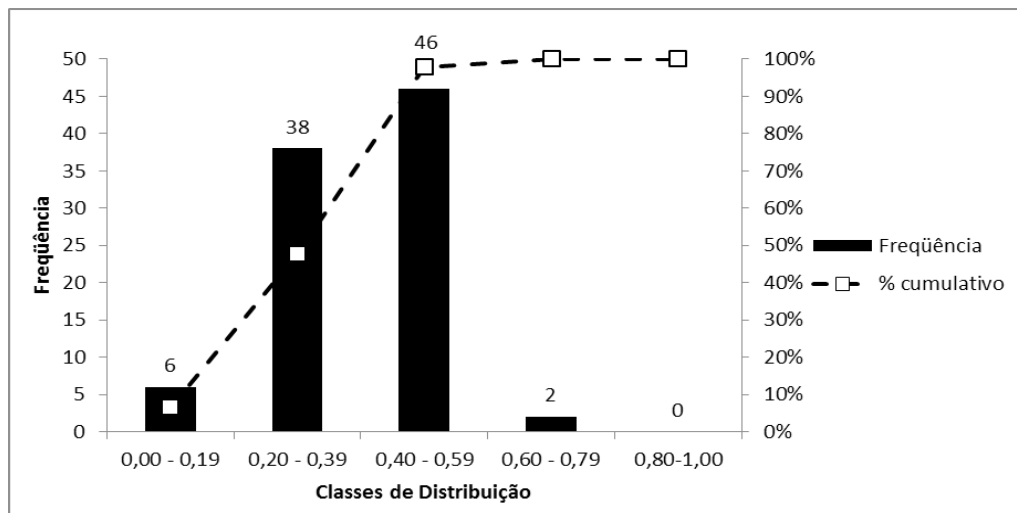
Source: Organized by the authors.

It can be seen that the environmental actions index attained the highest maximum values followed by the environmental impacts index and then the institutional structure index both of which had lower standard deviation values.

Hypothetically, the most desirable situation would be low average and median values for environmental impacts and high ones for the other two aspects. If it were not for the zero registered for the minimum value and the high coefficient of variation then the environmental actions theme would be the one that came closest to the ideal. In general terms the municipalities varied greatly in term of the environmental actions they carried out, their poor institutional structures and high number of impacts.

In regard to the final overall index obtained for the purpose of prioritizing municipalities for the implantation of PES programs with a focus on water resources, a histogram of frequency distribution in five equal ranges (0.00 – 0.19; 0.20 – 0.39; 0.4 – 0.59; 0.60 – 0.79 and 0.80 – 1.00) was prepared and is displayed in Graph 1 below.

**Graph 1. Frequency distribution of indexes prioritizing municipalities for the implantation of PES programs with a focus on water resources, by index ranges.**



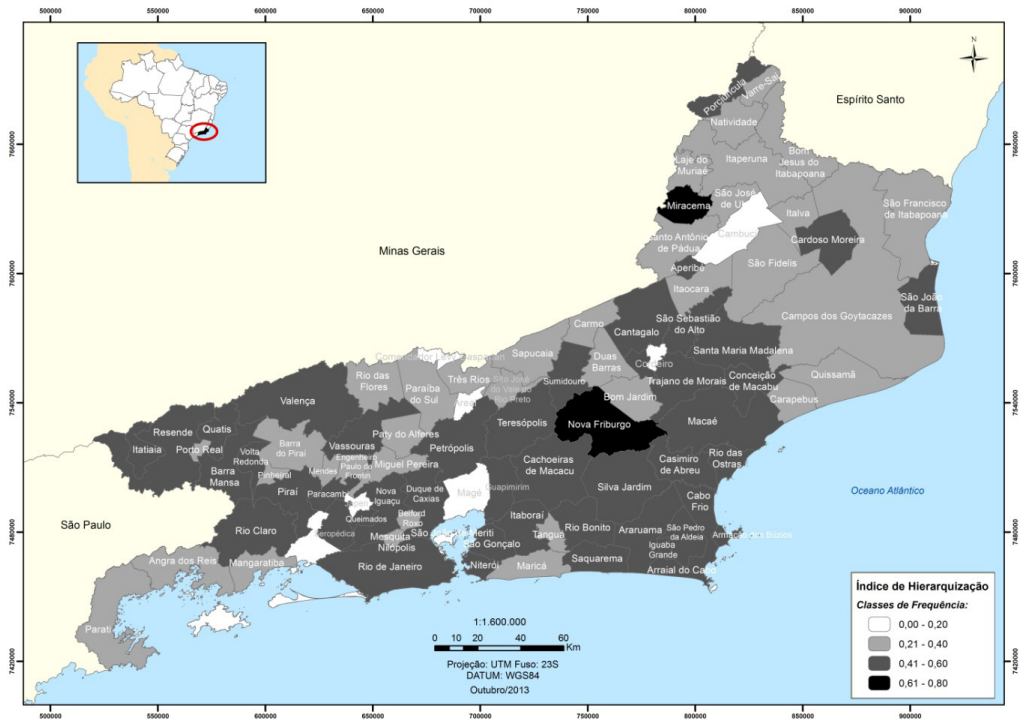
Source: Organized by the Authors.

**Legend:** Frequência = Frequency    cumulativo = cumulative    Classes de distribuição = Distribution ranges.

Graph 1 shows that most (97.8%) of the municipalities were below the intermediate range, which was the range with the highest number of them (46). There were six municipalities in the lowest range (0.00 – 0.19), that is, in the worst situation, namely: Cambuci, Japeri, Areal, Magé Comendador Levy Gasparian and Macuco. Miracema and Nova Friburgo were in the second highest range (0.60 – 0.79), that is, in a better situation.

The distribution of the indexes by municipalities is shown in figure 1. In geographic terms, no regionalization factor was identified that might explain the index distribution. The lowest indexes can be found ranging from the metropolitan area of Rio de Janeiro, more industrialized and developed than most, to the central-southern part of the state which is one of its poorest and least dynamic regions (MARAFON, et al., 2005), and extending also to the northeast, where the main activity is crop and cattle farming, especially dairy farming. Land ownership is highly concentrated there, soils are poorly managed, cattle farming is open range and the region is economically in decline with merely incipient industry, trade and services (MARAFON, et al., 2005). Of the two municipalities in a better situation, one is located in the northeast of the state and the other in the mountainous region.

**Figure 1. Distribution of indexes prioritizing municipalities for the implantation of PES programs for the 92 municipalities of the State of Rio de Janeiro by Frequency Ranges.**



Source: Organized by the Authors

Legend: Índice de Hierarquização = Prioritization index Classes de frequência = Frequency ranges.

The municipalities' institutional capacity proved to be low in the light of their environmental problems and, on the basis of the information obtained by the present study, it must be acknowledged that it is quite possible that some of those interviewed in the MUNIC survey underestimated the environmental impacts or even deliberately gave a misleading answer in order to make their municipality appear to be better off than it actually was.

Unfortunately, the MUNIC data do not allow for a more detailed analysis of possible direct relations of the impacts observed to the actions unfolded by the municipalities, much less to infer whether or not the financial resources obtained by the municipalities were sufficient for the implementation of actions designed to improve the quality of the environment and/or to boost their institutional structures.

In the light of its influence on municipal capacity to manage the local environment (TONI; KAIMOWITZ, 2003; LEME, 2010), of all the results obtained by the study, the need to expand municipal institutional structures was the most relevant.

In that perspective, Wunder et al., (2009) state that the lack of institutional capacity is indeed a limiting factor in the municipal sphere, especially in regard to the implanta-

tion of PES schemes that involve direct payments to local inhabitants, so it represents a great challenge to the those municipal administrations with little or no infrastructure

Although there are many studies addressing methodologies for analyzing the implantation of PES programs with a focus on technical and economic aspects (GROOT et al., 2002; MUÑOS-PIÑA et al., 2008; GROOT et al., 2010; MÜLLER et al., 2010; MARTÍN-LOPEZ et al., 2013), there are hardly any that analyze their implantation from the institutional point of view.

Given that land use planning is the responsibility of the municipal sphere, that most PES schemes, especially those targeting water resources, are financed by public authorities (VEIGA; GAVALDÃO, 2011), and given the role of the municipality in implementing PES programs (WUNDER, et al., 2009), it is important to continue conducting studies aimed at expanding in-depth knowledge of Brazilian municipalities, especially their environmental and institutional aspects and the relations between the two.

## Final remarks

The methodology presented here shows itself to be a useful, easy-to-apply tool for distinguishing municipalities by their environmental and institutional aspects and it can be reproduced anywhere in Brazil, given the national scope of the data that originated it and the possibility it offers of making comparisons and systematic updating based on new data made available every time a new MUNIC survey is administered.

It is suggested that PES programs should continue to consider, at least in the first moment, payments made by the public sector, which, in spite of the literature's identifying them as less efficient are in fact the most currently diffused and accessible in Brazil. The municipalities of Miracema and Nova Friburgo obtained the highest indexes and accordingly they are the most eligible to receive PES programs today.

In regard to the outreach and application of the proposed index, it would be well to conduct further more in-depth studies of the Rio de Janeiro municipalities' management capacity because the MUNIC survey does not always provide sufficiently detailed answers. In that way it would be feasible to define the most representative variables in terms of indicating the real situation of the municipalities where greater efforts need to be made to boost the application of PES policies.

In terms of delineating PES programs as such, it is of the greatest importance to identify the level of knowledge of strategic actors in the region that is the object of interest and other aspects like land use, settlement and vocation, the cost of opportunity of land, the alternative sources of financing that exist, the institutional capacity of all the spheres of government that could be involved in the transaction, the adaptation of payment modalities, the degree of social mobilization, and the technical criteria to be used to determine which locations are to be the object of conservation

Finally, it is important to stimulate the widespread use of the MUNIC in determining government investments and programs. Its application needs to incorporate feedback mechanisms among the interviewees and those responsible for administering the survey in order to validate, expand and improve the information gathered.

## Notes

i Cap and trade is an environmental policy tool that delivers results with a mandatory cap on emissions while providing sources flexibility in how they comply. Successful cap and trade programs reward innovation, efficiency, and early action and provide strict environmental accountability without inhibiting economic growth. (available at: <<http://www.epa.gov/captrade/>>. Consulted in June, 2014).

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# METHODOLOGICAL PROPOSAL FOR PRIORITIZATION RANKING OF MUNICIPALITIES FOR IMPLANTATION OF PAYMENT FOR ENVIRONMENTAL SERVICES PROGRAMS

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Is presents a methodology for ranking of municipalities from Rio de Janeiro for implementation payments for environmental services programs (PES). Variables were selected of Pesquisa de Informações Básicas Municipais from IBGE, grouping them into themes: Environmental Impacts, Institutional Apparatus and Environmental Actions. An index per theme was calculated and they were synthesized in the final index. Miracema and Nova Friburgo stood out with highest levels. Cambuci, Japeri, Areal, Magé, Comendador Levy Gasparian and Macuco stood out the lowest. The results show that the main environmental problem was the degradation of water resources, institutional apparatus is precarious and environmental actions were not directly relate to environmental impacts present. PES arrangement should consider payments made by the government, and the municipalities needs to improve yours institutional apparatus. The methodology used is easy to apply with potential for replication throughout Brazil and periodic update with each new edition of MUNIC.

**Keywords:** Payments for Environmental Services (PES). Environmental Analysis. Environmental Management. Public Management.

Este trabalho apresenta uma proposta metodológica de priorização de municípios do Rio de Janeiro para implantação de programas de Pagamento por Serviços Ambientais (PSA). Foram selecionadas variáveis da Pesquisa de Informações Básicas Municipais do IBGE, nos temas: Impactos Ambientais, Aparato Institucional e Ações Ambientais. Foi calculado um índice para cada tema, sintetizados em um índice final. Miracema e Nova Friburgo obtiveram os maiores valores. Cambuci, Japeri, Areal, Magé, Comendador Levy Gasparian e Macuco os menores. No geral, os municípios apresentaram degradação dos recursos hídricos, aparato institucional precário e desarticulação entre as ações, seus impactos ambientais e sua estrutura institucional. Os resultados sugerem que arranjos de PSA devem considerar pagamentos efetuados pelo poder público, e que os municípios ampliem sua capacidade

institucional. A metodologia empregada mostrou-se útil, de fácil aplicação e com o benefício de poder ser replicada para todo o Brasil e atualizada a cada edição da MUNIC.

**Palavras-chave:** Pagamentos por Serviços Ambientais (PSA). Análise Ambiental. Gestão Ambiental. Gestão Pública.

Este trabajo presenta una metodología de priorización en municipios para la implementación de programas de pago por servicios ambientales (PSA) en Río de Janeiro. Las variables fueron seleccionadas a partir del Estudio de Informações Básicas Municipais, IBGE, en los temas: Impactos Ambientales, Sistema Institucional y Acciones Ambientales. Para cada uno se calculó un índice, sintetizados en el índice final. Miracema y Nova Friburgo tuvieron los valores más altos. Cambuci, Japeri, Areal, Magé, Comendador Levy Gasparian y Macuco, los más bajos. En general, los municipios tuvieron degradación de los recursos hídricos, sistemas institucionales precarios y acciones inconexas con los impactos ambientales y su estructura institucional. Se recomienda que los acuerdos de PSA consideren los pagos realizados por el Gobierno, y que los municipios amplíen su capacidad institucional. La metodología se demostró fácil de usar, con la ventaja de poder ser aplicada en todo Brasil, actualizándose con cada nueva edición de MUNIC.

**Palabras clave:** Pagos por Servicios Ambientales (PSA). Análisis Ambiental. Gestión Ambiental. Gestión Pública.

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