SPSAS Climate Change

Economic Aspects of Forest Restoration Policy in Brazil: An ex-post evaluation at the state level.

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INTRODUCTION

Between 2000 and 2012, tropical forests experienced the greatest forest loss, accounting for 32% of the global loss of forest cover (ALVES-PINTO et al., 2017). Many of these ecosystems can not recover passively alone, even if they are protected vigorously, at least not enough to meet the needs and impacts of our rapidly growing human population. These systems need active restoration at the local, state, national, and global levels, which is a huge job (CUNNINGHAM, 2002).

Considering, environmental restoration is one of the main strategies to mitigate climate change. And consider this, the Brazilian government, as part of the global effort ratified by the Paris Agreement, l has announced an ambitious goal of restoring 12 million hectares. In addition, Brazilian landowners need to collectively restore about 21 million hectares of native vegetation (SOARES-FILHO et al., 2014)

OBJECTIVES

The present work aims to evaluate the technical efficiency of the governmental efforts of the Brazilian states in the recovery of native vegetation. In the period from 2003 to 2013 prior to the promulgation of the National Policy for the Recovery of Native Vegetation. With this, it seeks to highlight the main bottlenecks and potential of the policy and the National Plan for the Recovery of Native Vegetation - PLANAVEG.

METHODOLOGY

The work comparatively evaluated the efforts of the Brazilian states to increase their vegetal cover. For this, we used the Data Envelopment Analysis – DEA. The work comparatively evaluated the efforts of the Brazilian states to increase their vegetal cover. For this, the Data Envelopment Analysis (DEA) was used. The DEA method is based on non-parametric mathematical models, not requiring the functional determination between inputs and products. Thus, the DEA assesses the performance of organizations and activities primarily through technical efficiency. The organizations evaluated are called Decision Making Units or DMUs (Decision Making Units), and are compared through their competitive positioning / performance in relation to a benchmark (FERREIRA E GOMES, 2012). The states were chosen as the DMUs to be evaluated, specifically the environmental organs of each state.

As a product, Global Forest Watch data on the forest cover gain between 2003 and 2013 were used. For the analysis, the product-oriented DEA model with variable returns to scale.

The definition of inputs was based on the National Policy for the Recovery of Native Vegetation. The PROVEG will be implemented through the National Plan for the Recovery of Native Vegetation - Planaveg, which has among its guidelines (TABLE 1):

Table 1 - Inputs used to calculate the technical efficiency in the recovery of vegetation cover by the Brazilian states, according to the guidelines of PROVEG.

PROVEG/PLANAVEG GUIDELINES	INPUTS USED
I - awareness of the benefits of recovery of native vegetation;	The number of servers of state environmental agencies [1]
II - the promotion of the chain of inputs and services related to the recovery of native vegetation;	Productive capacity of forest nurseries that produce native species[2]
III - improvement of the regulatory environment and increase of legal security for the recovery of native vegetation with economic use;	State expenditures with Recovery of Degraded Areas[3]
IV - the expansion of technical assistance and rural extension services for the recovery of native vegetation;	Expenditure with rural extension[4]

1- Data from ABEMA (2012); 2 – Data from IPEA (2015); 3 & 4 – Data from SIAFI/STN (2013).

RESULTS & DISCUSSION

Data collection for the different inputs and outputs in different databases generated a database that could be used for 18 of the 27 Brazilian states. For the others, the absence of data in the period evaluated prevented the evaluation of the same in this study (Table 2)

Table 2 – Database of Output and Inputs used to calculate the technical efficiency in the recovery of vegetation cover by the Brazilian states.

States	OUTPUT	INPUT 1	INPUT 2	INPUT 3 (R$)	INPUT 4(R$)
Amapá	55.393,80	138	150.000	743	72.347.747
Amazonas	178.821,20	437	1.197.000	3.455	177.660.171
Bahia	450.080,67	1250	6.185.000	6.159.127	1.155.987.840
Ceará	40.006,76	520	1.886.000	12.223.075	343.594.801
Distrito Federal	1.810,81	232	3.925.000	137.812	29.993.552
Espirito Santo	214.351,01	463	8.970.000	737.832	196.356.219
Mato Grosso	432.562,07	782	1.008.000	4.016.420	44.231.163
Mato Grosso do Sul	339.892,02	412	6.894.000	26.671	161.314.109
Minas Gerais	1.441.573,51	2869	1.273.000	1.648.001	177.395.238
Paraná	705.279,17	832	18.023.000	10.409.919	1.135.980.342
Paraíba	12.236,05	300	100.000	368.618	23.379.975
Pará	778.623,39	773	2.600.000	2.901.758	75.667.033
Pernambuco	18.290,12	617	3.180.000	1.690.832	82.638.410
Rio de Janeiro	17.341,34	1667	3.125.000	42.628.822	172.785.165
Rio Grande do Sul	660.290,68	863	2.115.500	442.565	982.991.258
Santa Catarina	665.614,57	441	12.000.000	27.232.063	450.586.965
Sergipe	18.906,55	150	42.000	22.293.206	98.397.374
São Paulo	767.159,65	4233	59.617.000	75.529.638	1.574.349.030

It can be observed in the data used, that there is a great disparity in the inputs used, which justifies the use of a model with variable returns of scale. Since, when the set of DMUs have different sizes, whatever the relevant measure for inputs and products they tend to have incomes of different **scales** (FERREIRA and GOMES, 2012).

It is even more striking that the recovery costs were below R$ 1,000.00 / ha for five of these states (Amazonas, Espirito Santo, Mato Grosso, Mato Grosso do Sul, Minas Gerais). While recent studies show that recovery costs range from R $ 5,300 to R $ 12,800 / ha, with an average of R $ 7,770 / ha. The municipalities with higher costs are located in the Center-West, South and part of São Paulo (YOUNG et al., 2016).

In these cases there is a strong indication of insufficient resources, and probably the gain of registered vegetation cover is mainly due to factors other than the direct incentives of the state government for this purpose. This can be corroborated when analyzing the percentage of forest cover gain in relation to the state area. Of these 5 states only the state of Minas Gerais had an area gain of more than 1% of the total area of the state.

Because of these results, when analyzed with DEA. 11 states were considered efficient, reaching the maximum value of technical efficiency (Table 3). However, if we observe the same data analyzed on other metrics, we can observe that in some cases efficiency is masked by the low or high level of some of the inputs used. Thus, it is clear that the volume of financial resources used as inputs in this analysis had great importance in defining which states were achieving technical efficiency. This is because all eight states had expenditures per hectare below the national average.

Table 3 – Results of the evaluation of the technical efficiency of the Brazilian state governments in increasing the plant cover between the years 2003 and 2013, using Data Envelopment Analysis.

STATES	TECHNICAL EFFICIENCY	OUTPUT (ha)	PROJECTED VALUE (ha)	RADIAL MOVEMENT	SCALE EFFICIENCY	PUBLIC EXPENDITURE /FOREST INCREASE (R$)
Amapá	1,0000	55.393,8	0,0	0,0	CRS	1.306,08
Amazonas	1,0000	178.821,2	0,0	0,0	CRS	993,53
Bahia	0,4840	450.080,7	929.495,0	479.413,9	DRS	2.582,09
Ceará	0,0810	40.006,8	496.977,0	456.970,2	IRS	8.893,94
Distrito Federal	1,0000	1.810,8	0,0	0,0	IRS	16.639,70
Espirito Santo	0,5240	214.351,0	408.673,9	194.322,9	IRS	919,49
Mato Grosso	1,0000	432.562,1	0,0	0,0	CRS	111,54
Mato Grosso do Sul	1,0000	339.892,0	0,0	0,0	CRS	474,68
Minas Gerais	1,0000	1.441.573,5	0,0	0,0	CRS	124,2
Paraná	0,8850	705.279,2	797.284,5	92.005,3	DRS	1.625,44
Paraíba	1,0000	12.236,1	0,0	0,0	IRS	1.940,87
Pará	1,0000	778.623,4	0,0	0,0	CRS	100,91
Pernambuco	0,0350	18.290,1	529.451,0	511.160,9	IRS	4.610,64
Rio de Janeiro	0,0160	17.341,3	1.061.389,6	1.044.048,3	DRS	12.421,99
Rio Grande do Sul	1,0000	660.290,7	0,0	0,0	CRS	1.489,40
Santa Catarina	1,0000	665.614,6	0,0	0,0	CRS	717,86
Sergipe	1,0000	18.906,6	0,0	0,0	IRS	6.383,53
São Paulo	0,5320	767.159,7	1.441.573,7	674.414,0	DRS	2.150,63

Table subtitle: Increasing returns to scale - IRS; Constant returns of scale - CRS; Decreasing returns of scale - DRS.

Inefficiency is demonstrated in many situations. The first in the technical efficiency score obtained by each state. And then on the expected value, that is, what should be the output of the forest increase efforts. In addition, it is possible to observe that some states are obtaining decreasing returns of scale - DRS.

CONCLUSIONS

In this way it is possible to conclude that efforts by the state governments to recover vegetation are not enough to reach the goals set by the federal government.

In addition, existing efforts have proved to be inefficient, that is, states need to optimize their strategies for ecologically restoring their environmental liabilities.

Finally, it is important to warn that these data may be even worse, since the data used are self-reported by the states that insert expenditures in the sub-function recovery of degraded areas that do not actually have this destination.

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