An evaluation of the economic viability of environmental offsets in the saltworks industry

**Uma avaliação da viabilidade econômica de compensações ambientais na indústria salineira**

**INTRODUCTION**

The extraction of sea salt is an activity developed over 500 years in the north coast of Brazil (TRINDADE & ALBUQUERQUE, 2005; VITA et al., 2007; COSTA et al., 2013; DINIZ et al., 2015), which makes it an important productive sector, responsible for the generation of more than 70 thousand direct and indirect jobs (SIESAL, 2016). Despite the economic and social importance, salt extraction depends on the occupation of large areas on the banks of estuaries and bays of arid and semi-arid regions (DAVIS, 2000;
terms the values associated with sustaining life, valuation, and which seeks to translate in economic remuneration based on the precepts of ecological Offsets” (EO), an economic instrument of but the agreement traces the way to further action. enough to reach the agreed temperature objectives, climate action plans (NDCs). Thus, these are not yet countries have submitted comprehensive national agreed in 2015 to reduce greenhouse gas emissions from Paris climate agreement, countries such as Brazil growth from environmental degradation. Similarly, production, and to commit to decouple economic goals, it is expected to progressively improve, by 2030, the efficiency of global resources in consumption and production, and to commit to decouple economic growth from environmental degradation. Similarly, from Paris climate agreement, countries such as Brazil agreed in 2015 to reduce greenhouse gas emissions by 2025, including by reforesting degraded areas. As a contribution to the objectives of the agreement, countries have submitted comprehensive national climate action plans (NDCs). Thus, these are not yet enough to reach the agreed temperature objectives, but the agreement traces the way to further action.

From this perspective, a sustainable measure is to adopt the so-called “Environmental Offsets” (EO), an economic instrument of remuneration based on the precepts of ecological valuation, and which seeks to translate in economic terms the values associated with sustaining life, goods and services provided natural ecosystems (BORN & TALOCCHI, 2002, CAMPHORA & MAY, 2006). The EO has been used successfully in several countries of the European Union and the United States of America, where it is used as a complement to measurerenvention and mitigate environmental impacts (IUCN, 2004).

In Brazil, the EO instrument was created through Law 9.985/2000, which established the National System of Nature Conservation Units (NSCU), regulated by Decree no. 6.848/2009, can be understood as a way to compensate for environmental damages considered inevitable and irreversible, acting as an equivalent substitution of an environmental patrimony that will be lost, altered or de-characterized (SÁNCHEZ, 2008). In practice, when a enterprise has the potential to generate environmental damage that can not be avoided, it is converted into a financial value by way of offsets, which will be allocated to the Caixa Econômica Federal Environmental Compensation Fund, possible from Law 13.668/2018), created to receive the EO resources and intended to Conservation Units (BECHARA, 2009).

In this context, COELHO & LINHARES (2006) studying environmental offsets to the urban arborization of Vitória – ES, Brazil, for cases where the construction and/or reform of property, imply in removal or relocation of trees in vegetative and health good conditions, calculate this EO on the basis of the costs of producing seedlings, planting, annual pruning, annual phytosanitary treatment and removal, plus a rate of up to 50% of the total value, which takes into account the environmental value of each specimen according to its nature. Thus, according to these authors, the EO was applied in 12 cases, in which the tree remotion was inevitable, resulting in 25 tree remotions and demonstrated to be an efficient tool for the management of urban trees, pointing out the importance of including the tree component in the implementation of new construction projects in the city.

In view of exposed; although, it is likely that the recovery of PPAs currently occupied by the saltworks industry will promote significant environmental benefits in the form of ecological services (BARBIER, 2007), it is feared that the aforementioned benefits will not suffice in the face of the costs resulting from the loss of productive area of the salt flats, which could even lead some companies to bankruptcy, with social repercussions such as income reduction and unemployment of the local population.

Given the uncertainties, risks involved, seeking to reconcile the maintenance of ecological services produced by coastal ecosystems and the economic
and social benefits produced by salt production, thus, the objective of this research, was to evaluate the economic viability of Environmental Offsets as an alternative to the unoccupied PPAs in the saltworks.

**MATERIALS AND METHODS**

*Characterization of the study area*

The study was carried out on the north coast of Brazil, in the region known as White Coast between the coordinates 4°54'24” south latitude and the meridians 37°18’08” and 37°02’12” west longitude. This locality comprises the estuaries of the Apodi-Mossoró, Piranhas-Açu and Galinhos Guamaré rivers, which together produce more than 95% of Brazilian salt (Diniz & Vasconcelos, 2017).

The region is dominated by the oscillations of the Intertropical Convergence Zone, corresponding to the zone of collision between the humid air masses of the northern hemisphere and the southern hemisphere, responsible for the rainy and dry seasons (Rocha et al., 2011), where the rainy season (EMPARN, 2011). The climate of this region is semiarid, type BSw’hi dry and very hot (according to the classification of Köppen), whose rainfall the annual average (<1,250 mm/year) is less than the potential evapotranspiration of the region (1,500 - 1,600 mm/year), being ideal for the production of sea salt in solar saltworks (Rocha et al., 2011).

The main sea currents bordering the study area are the Brazil Current, which accompanies the coast from Rio Grande do Norte (RN) to Rio Grande do Sul, north-south direction, with an average temperature of 22 °C and the Equatorial Current from Rio Grande do Norte to Amapá, with an east-west direction and an average temperature of 25 °C. These currents influence the climate around the Brazilian coast. The local tide is semi-diurnal, where the average level (Z0) established is 139 cm above the RN (Reduction Level) with averages of prey of syllable of 234 cm above the RN, average of prearms of quadrature of 221 cm, average of low-seas of sizia of 43 cm below the RN and average of the low seas of squares of 56 cm (Silveira et al., 2000).

*Survey of productive areas and PPA occupancy*

For the study, only the saltworks industries that are installed in PPA were considered, with a total of 27 solar saltworks with productive areas in mangrove, apicuns and dunes. The evaluated saltworks agreed to participate in the study by assigning the random acronyms in order to preserve their trade names. The data related to the productive areas of each saline, as well as the respective PPAs occupied were obtained from the “Joint report on the environmental technical evaluation of the salt flats in the State of Rio Grande do Norte, Brazil” prepared by the Technical-Scientific- (GT-SAL, 2017), composed of representatives of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) and the Institute of Sustainable Development and Environment of Rio Grande do Norte (IDEMA) (Table 1).

*Determination of environmental offsets*

In order to determine the value of environmental compensation, the criteria for assessment of non-mitigaFble environmental impacts established by Decree n° 6848/2009 (Equation 1).

\[
EO = VR \times ID
\]

(1)

Where:

\(EO\) = Value of Environmental Offsets;

\(ID\) = Impact Degree;

\(VR\) = Sum of the investments needed to implement the project.

In turn, the ID is the result of the sum of the estimated values for the enterprise, regarding Impact on Biodiversity (ISB), Commitment of Priority Area (CPA) and Influence on Conservation Units (ICU) and should not be higher than 0.50% (Equation 2).

\[
ID = ISB + CPA + ICU
\]

(2)

Where:

\(ID\) = Impact Degree;

\(ISB\) = Impact on Biodiversity;

\(CPA\) = Commitment of Priority Area;

\(ICU\) = Influence on Conservation Units.

The ISB counts the impacts of the enterprise directly on biodiversity in its area of direct and indirect influence, while the CPA accounts for the
The values adopted for each index used in the calculation of the Saltworks Impact Degree, as well as their respective justifications, are listed in table 2. In cases where there were doubts as to the most appropriate attribute to fit the project, it was decided to attribute of higher value, always based on the precautionary principle. These indices are established by Decree n° 6848/2009, which assigns a range of values to each specific index. Thus, when opting for a value within this predetermined range, we must justify why we chose it.

The values were defined for each index used in the calculation of environmental compensation, followed by calculating the ISB (Equation 3) and CAP (Equation 4).

\[
\text{ISB} = \frac{\text{MI} \times \text{BI} \times (\text{CI} + \text{TI})}{140} \quad (3)
\]

\[
\text{CAP} = \frac{\text{MI} \times \text{ICAP} \times \text{TI}}{70} \quad (4)
\]

In relation to Influence in Conservation Units (IUC), 0 (zero) was adopted, the projects are not located in the vicinity of conservation units or in their buffer zone.

As for the sum of the investments needed to implement the project (VR) for the projects in this study, the direct comparative method of market data was used, reaching the amount of US$ 10,309.28 per hectare in each saltwork evaluated.

The Economic Impact caused by the PPA eviction was estimated based on the perpetual flow of revenue losses, using the Net Present Value (NPV), adapted from SILVA & FONTES (2005), and the interest rate was adopted according to the Long Term Rate (TLP) of 7%, in force in the country (Equation 5).

\[
\text{NPV} = \sum_{t=0}^{n} R_t (1 + i)^{-t} - \sum_{t=0}^{n} C_t (1 + i)^{-t} \quad (5)
\]
Where:
Rj = current value of revenues;
Cj = value of revenue after area vacancy;
i = interest rate;
j = period in which revenues or unemployment occur;
n = number of periods or duration of the project.

It was considered that EO was feasible whenever the costs resulting from it were lower than the economic impact caused by the vacancy of the PPAs.

RESULTS AND DISCUSSION
Saltwork productive area versus PPA occupation

The average productive area of the saltwork enterprises was 1,099.50 ha, with a minimum of 69.00 and a maximum of 5,539.90 ha (Table 3). Considering the form of salt exploration and harvest, according to ROCHA et al. (2012) all the evaluated salt was considered industrial and mechanized.

On average, 13.70% of the productive area of the saltworks is installed in PPA, ranging from the minimum value of 1.06% to the maximum of 46.91%. Although, some saltworks occupied large areas of permanent preservation, the vast majority of these occupations do not exceed 10%. In order to understand why the occupation of PPAs by the saltworks it is necessary to emphasize that this occupation, in the great majority of cases, occurred decades and even centuries before the appearance of the PPA concept itself (DINIZ et al., 2015), and that most of the salt flats that are now in use were built in areas along the watercourses that were periodically flooded by the tides, where the formation of sodium chloride naturally occurred (COSTA et al., 2014). In addition, priority was given to the layout of the salt

Table 3 - Saltworks, productive area (ha), occupation of Permanent Preservation Areas - PPA - (ha) and percentage of PPA occupied (%) by saltworks in the region of White Coast, Brazil.

| Saltworks | Productive area (ha) | Occupation of PPA (ha) | Occupation of PPA (%) |
|-----------|----------------------|-----------------------|-----------------------|
| GUA       | 1,663.46             | 80.86                 | 4.86                  |
| FME       | 2,951.78             | 60.37                 | 2.05                  |
| MIR       | 1,668.69             | 188.84                | 11.32                 |
| SLM       | 494.92               | 75.81                 | 15.32                 |
| SVE       | 156.50               | 24.16                 | 15.44                 |
| MBO       | 480.00               | 37.68                 | 7.85                  |
| MAR       | 1,023.21             | 33.62                 | 3.29                  |
| CEA       | 232.25               | 15.57                 | 6.70                  |
| SCA       | 725.92               | 10.16                 | 1.40                  |
| STA       | 1,087.68             | 31.71                 | 2.92                  |
| SVEII     | 69.00                | 5.49                  | 7.96                  |
| RSO       | 153.71               | 14.40                 | 9.37                  |
| SLMII     | 303.37               | 58.58                 | 19.31                 |
| AGS       | 115.25               | 38.73                 | 33.61                 |
| UPU       | 1,842.00             | 38.79                 | 2.11                  |
| PED       | 722.32               | 338.86                | 46.91                 |
| MAL       | 87.03                | 23.69                 | 27.22                 |
| CTA       | 260.25               | 2.76                  | 1.06                  |
| ARA       | 1,000.09             | 249.81                | 24.98                 |
| IMB       | 3,265.62             | 280.57                | 8.59                  |
| UMA       | 565.85               | 64.69                 | 11.43                 |
| SOR       | 5,539.90             | 226.86                | 4.10                  |
| SLP       | 1,318.29             | 166.95                | 12.66                 |
| SLE       | 224.05               | 19.96                 | 8.91                  |
| SAR       | 704.22               | 78.33                 | 11.12                 |
| CAM       | 360.00               | 115.39                | 32.05                 |
| ANE       | 2,671.05             | 1,001.84              | 37.51                 |

*Acronyms randomly assigned to saltworks.
pans as close as possible to the estuary margin, to enable the shipment of salt and the flow of water/sea production, thus providing a technical, logistical and economic justification for the practice.

Environmental offsets

The ID calculated for all the enterprises evaluated was 0.83%; however, decree 6.848/2009 set the maximum value for this variable at 0.50%. Difference between the calculated ID and the maximum ID set by the legislation resulted in the loss of US$1,008,950.03 from the value of EO, which in practice implies fewer resources for nature conservation (Table 4). The definition of a maximum limit for the GI is one of the most controversial points of the method of calculation of environmental offsets, and has been questioned by several environmental groups, since in determining a “ceiling” for the impacts of an enterprise, the principle of proportionality between the environmental damage and the corresponding remedial action (ALMEIDA & PINHEIRO, 2011).

It is important to highlight the high weight that is given to the VR of the project in the calculation of the EO, which can sometimes stand out due to the environmental impact caused by it. As an example, we can mention the SMA saltwork, whose PPA occupation is 33.62 ha, but the value referring to EO is higher than that of the ARA saltwork, occupying almost 250 ha, simply because the SMA saltwork has a VR higher.

Economic impact of unemployment of PPA

The economic impact due to the vacancy of the PPA by the saltworks was estimated at US$3,258.88/ha. The total vacancy of PPAs in the saltworks would result in a combined revenue

Table 4 - Reference Value and Environmental Offsets calculated for the saltworks industries of the Brazilian White Coast region based on the Impact Degree (ID).

| Saltworks | Reference value of saltworks (US$) | Environmental Offsets US$ (ID = 0.83%) | Environmental Offsets US$ (ID = 0.50%) |
|-----------|------------------------------------|--------------------------------------|--------------------------------------|
| GUA       | 17,149,072.16                      | 142,337.29                           | 85,745.36                            |
| FME       | 30,430,721.64                      | 252,574.98                           | 152,153.61                           |
| MIR       | 17,202,989.98                      | 142,784.81                           | 86,014.95                            |
| SLM       | 5,102,268.04                       | 42,348.82                            | 25,511.34                            |
| SVE       | 1,613,402.06                       | 13,391.24                            | 8,067.01                             |
| MBO       | 4,961,240.31                       | 41,178.29                            | 24,806.20                            |
| MAR       | 10,575,813.95                      | 87,779.25                            | 52,879.07                            |
| CEA       | 2,400,516.79                       | 19,924.29                            | 12,002.58                            |
| SCA       | 7,503,049.09                       | 62,275.31                            | 37,515.25                            |
| STA       | 11,242,170.54                      | 93,310.02                            | 56,210.85                            |
| SVEII     | 713,178.29                         | 5,919.38                             | 3,565.89                             |
| RSO       | 1,588,733.85                       | 13,186.49                            | 7,943.67                             |
| SLMII     | 3,135,607.24                       | 26,025.54                            | 15,678.03                            |
| AGS       | 1,191,214.47                       | 9,887.08                             | 5,956.07                             |
| UPU       | 19,038,759.68                      | 158,021.70                           | 95,193.79                            |
| PED       | 7,465,839.79                       | 61,966.47                            | 37,329.19                            |
| MAL       | 899,534.88                         | 7,466.14                             | 4,497.67                             |
| CTA       | 2,689,922.48                       | 22,326.36                            | 13,449.61                            |
| ARA       | 10,336,589.15                      | 85,795.83                            | 51,684.24                            |
| IMB       | 33,753,178.29                      | 280,151.38                           | 168,765.89                           |
| UMA       | 5,848,578.81                       | 48,543.20                            | 29,242.89                            |
| SOR       | 57,259,948.32                      | 475,257.57                           | 286,299.74                           |
| SLP       | 13,625,736.43                      | 113,093.61                           | 61,151.93                            |
| SLE       | 2,315,762.27                       | 19,220.83                            | 11,578.81                            |
| SAR       | 7,278.76                           | 60,413.71                            | 36,393.79                            |
| CAM       | 3,720,930.23                       | 30,883.72                            | 18,602.87                            |
| ANE       | 27,607,751.93                      | 593,366.36                           | 35,668.93                            |
| TOTAL     | 306,836,279.07                     | 2,546,741.11                         | 1,553,181.39                         |
loss of US$ 99,744,624.45. The lowest economic impacts were comprised between a minimum of US$ 81,296.02 related to the vacancy of 2.76 ha of PPA by CTA saltwork, and the maximum of US$ 29,509,278.35 related to unemployment of a range of 1,001.84 ha of PPA by ANE saltwork. For all the enterprises evaluated, the value corresponding to EO was several times smaller than the economic impact resulting from the vacancy of the PPA (Table 5).

It is important to emphasize that the vacancy of the PPA by the evaluated saltworks will influence not only the production of sea salt, but all the socioeconomic factors inherent in the salt industry, since the perpetual flow of the loss of revenue reaches a relevant amount, even surpassing the Gross Domestic Product of Rio Grande do Norte State in 2017. In addition, the reduction, proportional to the productive area of saltworks, in the collection of Tax on Circulation of Goods and Services (TCGS), should be considered, and this reduction should be understood as a measure of the social and environmental cost of PPA unemployment, with a reduction in employment, as well as the benefits of tax collection.

From a more detailed analysis, it is observed that lower TCGS tax collection will also result in a lower allocation of resources to environmental actions, since according to LOPES et al. (2012), of the 25% of TCGS collected and distributed among municipalities, 0.5% will be allocated to conservation units and other protected areas.

Since the settlement of PPAs by saltworks in the White Coast region will cause economic and social damages (BEZERRA et al., 2012), and conversely, the permanent environmental damages resulting from this occupation are not subject to mitigation, since they provided soil salinization in these areas; and therefore, prevented the growth of mangrove vegetation in these areas, EO has shown

| Saltworks | Economic Impact (US$) | Environmental Offsets (US$) |
|-----------|-----------------------|----------------------------|
| GUA       | 2,387,892.21          | 85,966.92                  |
| FME       | 1,780,214.10          | 152,546.77                 |
| MIR       | 5,576,670.36          | 86,237.20                  |
| SLM       | 2,238,759.68          | 25,557.26                  |
| SVE       | 713,473.61            | 8,087.86                   |
| MBO       | 1,112,735.32          | 24,806.20                  |
| MAR       | 992,838.68            | 52,362.27                  |
| SCA       | 459,800.66            | 112,002.58                 |
| STA       | 300,036.91            | 37,515.24                  |
| SVEII     | 936,434.11            | 56,210.85                  |
| RSO       | 162,126.24            | 3,565.89                   |
| SLMII     | 425,249.17            | 7,943.66                   |
| AGS       | 1,143,742.89          | 15,678.03                  |
| UPU       | 1,148,098.93          | 95,193.79                  |
| PED       | 10,006,939.83         | 37,329.19                  |
| MAL       | 699,593.94            | 4,497.67                   |
| CTA       | 81,506.09             | 13,449.51                  |
| ARA       | 7,377,187.15          | 51,684.23                  |
| IMB       | 8,285,566.63          | 168,765.89                 |
| UMA       | 1,910,372.83          | 29,242.89                  |
| SOR       | 5,699,446.28          | 286,299.74                 |
| SLP       | 4,930,233.55          | 68,128.68                  |
| SLE       | 589,442.59            | 11,578.81                  |
| SAR       | 2,313,178.29          | 36,393.79                  |
| CAM       | 36,393.79             | 18,604.65                  |
| ANE       | 29,585,529.71         | 138,038.76                 |

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Table 5 - Economic Impact (US$) resulting from the vacancy of the PPA by the Environmental Offsets (US$) estimate.
to be economically feasible, since its total value, considering the 27 saltworks evaluated, was about 60 times smaller than the economic impacts resulting from the vacancy of the PPA. Another point that deserves to be mentioned for the decision making regarding EO or vacating the PPA relates to the real environmental gains of the retreat of these areas by the saltworks, because according to COSTA et al. (2013) the soil of the areas where the salt is installed is not suitable for the development of vascular vegetation, especially the mangrove, which does not tolerate the high salt content present in the soil. It would; therefore, be unlikely that, once they were unoccupied, these areas would once again recover and perform their ecosystem functions.

In this way, in addition to representing a lower economic cost, EO gives the possibility that an environmental area equivalent to degraded area can be improved to reach the best result in terms of ecosystem services (HEYES & MORRISON-SAUNDERS, 2012), especially in cases of application of resources in Conservation Unit, ensuring positive results for the environment (EPA, 2006). The EO has been praised as a tool to provide a more flexible and economical approach to development, while achieving better environmental results (TEN et al., 2004). It has also been suggested that the EO could guarantee to the enterprises greater speed to obtain licensing for operation (ICMM, 2005).

However, BECHARA (2009) argued that EO can not be understood as an “authorization to pollute”, but rather must be taken as an instrument capable of compatible development and environmental protection. Corroborating this statement, MEISTER & SALVIATI (2009) believe that a public policy or even private initiative that considers only economic factors will not solve socio-environmental problems, requiring an integrated action by the three spheres of government.

Many of the natural resources that serve as a basis for economic activities depend in some way on ecological systems which in turn produce a variety of services and the reckless use of these resources can irreversibly reduce their carrying capacity and of resilience, affecting along the chain, the own economic development. Thus, economic activities need to be designed to provide the right incentives to protect the resilience of natural systems (SANTOS & SILVA, 2012). In this context, the MILLENNIUM ECOSYSTEM ASSESSMENT (2005) defines ecological services, or environmental services, as the benefits that man obtains from ecosystems.

It is known that the areas of PPAs occupied by salinas were originally composed of mangroves and apicunas, ecosystems recognized by directly and indirectly providing innumerable ecological services, such as fishing, carbon fixation, protection against erosion, among others (SCHAEFFER-NOVELLI et al., 2012). Knowing the importance of the mangroves and apicunas of the region and being of common census that the occupation of these areas can negatively affect these ecosystems, it is indispensable that the resources coming from the EO are directed to the creation and maintenance of Conservation Units in areas (ALMEIDA & PINHEIRO, 2011). This is the first step in reducing the burden on the environment and the community, thus establishing a reconciliation between environmental protection and economic development.

Thus, it is essential to highlight the significant difference between Environmental Offsets (article 36 of Law 9.985/2000) and “financial compensation”, since in the first the entrepreneur becomes responsible for promoting actions that result in improvement of environmental quality (MOTA, 2015). In this regard, SÁNCHEZ (2008) warns that, for the ecological effectiveness of Environmental Offsets, the resources generated, should be used to create or maintain Conservation Units in the region of influence of the enterprises, in order to socially distribute the impacts (positive and negative) of the project, preventing or minimizing tensions between companies and local populations. Communities do not realize the gains from ecosystem services if the resource invested takes place in an area more than 200 km away (IUCN, 2012).

It is noteworthy; although, the evaluation of government policies must be stimulated, since it generates knowledge of the implemented policies
results, which allows the rulers to use this information to improve the conception or implementation of actions, to base decisions and to promote the provision of information. In this sense, the indicators are instruments that allow identifying and measuring the results of an intervention, as well as understanding the causes and effects of the results obtained from a theoretical conception (RAMOS & SCHABBACH, 2012). Within the context of public policy evaluation, the primary purpose of the indicator is to measurably translate a certain aspect of a government action, allowing it to evaluate its results and, from there, reorient the actions, which suggested their indispensability to qualify environmental offsets (BANCO MUNDIAL, 2004).

In addition, these indicators make it possible to adapt such compensation to new global environmental agreements and policies, such as 2030 Agenda, specifically in the objectives and goals of SDG8, SDG9, SDG13, SDG15 that address: promoting sustainable economic growth; promote sustainable and inclusive industrialization; take urgent action to combat climate change and its impacts, protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt reverse land degradation and biodiversity loss (ONU, 2015).

Therefore, it appears, it can be said that EO is an alternative to vacating PPA by the saltwork sector. In addition, environmental offsets can be an important mechanism for financing Conservation Units in Rio Grande do Norte State, since the state has only seven Conservation Units, and only the Sustainable Development Reserve of Ponta do Tubarão covers coastal ecosystems (CNIP, 2018), and thus ensures that environmental compensation does not deviate from its true purpose, which is to counterbalance environmental losses, and not to generate financial resources (BECHARA, 2009).

CONCLUSION

Environmental Offsets is an economically viable and more attractive alternative to the vacancy of PPAs by the saltworks industry and can also provide environmental gains as a result of the financing of Conservation Units in the areas of influence of the enterprises.

There is evidence of the need to improve the current method used to estimate the value of Environmental Offsets, since, when setting a maximum compensation limit, the reality of the environmental impacts caused by the projects is not reflected, and the collection of resources for the creation and maintenance of Brazilian Conservation Units.

Thus, future studies should establish method enlargement capable of economically valuing permanent preservation areas based on their ecosystem services, since in some offsets adopted, until then, only one service is valued, while in others there is a combination of several of them. Moreover, such methods may help to communicate and understand the importance of these ecosystems, as well as foster financial sustainability strategies and public policies.

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DECLARATION OF CONFLICT OF INTERESTS

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHORS’ CONTRIBUTIONS

The authors contributed equally to the manuscript.

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