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ENVIRONMENTAL COMPENSATION: MEANS FOR REPAIRING DAMAGE CAUSED BY USAGE OF THE AREA AND PROTECTED NATURAL RESOURCES

COMPENSAÇÕES AMBIENTAIS: MEIOS DE REPARAÇÃO DOS DANOS PELO USO DE ÁREA E RECURSOS NATURAIS PROTEGIDOS

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Abstract

This research aims to identify and describe the legally established environmental compensations to which persons and legal entities are subjected to due to use of specially protected areas and natural resources for the development of economic activities within the Brazilian territory. The methodology used for the research was a qualitative approach using bibliographical and

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vol. 12, nº 2. ISSN 2317-7721
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documentary data, such as articles and standards stipulated in Brazilian environmental laws. Through this study, considering the current environmental standards, it is possible to identify the compensations provided for by the law of the National System of Conservation Unit no. 9985/2000; the environmental compensations for the use of permanent preservation areas, removal of threatened flora species, suppression of native vegetation encountered in the Atlantic Forest biome, as well as intervention in natural cavities. All these compensations were instituted by standards that regulate the use and protection of such natural resources - it remains to be verified whether such obligations have been fulfilled by users of these resources and whether the Public Power has been monitoring their compliance by exercising its supervisory power.

Keywords: specially protected areas and vegetation; natural resources; environmental balance; environmental regulations.

Resumo

Esta pesquisa tem como objetivo identificar e descrever as compensações ambientais estabelecidas legalmente às quais pessoas físicas e pessoas jurídicas estão sujeitas devido ao uso de áreas especialmente protegidas e recursos naturais para o desenvolvimento de atividades econômicas no território brasileiro. A metodologia utilizada para a pesquisa foi uma abordagem qualitativa, utilizando dados bibliográficos e documentais, como artigos e normas estipuladas nas leis ambientais brasileiras. Por meio deste estudo, considerando as normas ambientais vigentes, é possível identificar as compensações previstas na lei da Unidade do Sistema Nacional de Conservação no. 9985/2000; compensações ambientais pelo uso de áreas de preservação permanente, remoção de espécies ameaçadas da flora, supressão da vegetação nativa encontrada no bioma Mata Atlântica, bem como intervenção em cavidades naturais. Todas essas compensações foram instituídas por normas que regulam o uso e a proteção desses recursos naturais - resta verificar se essas obrigações foram cumpridas pelos usuários desses recursos e se o Poder Público vem monitorando sua conformidade exercendo seu poder de supervisão.

Palavras-chave: áreas especialmente protegidas e vegetação; recursos naturais; equilíbrio ambiental; regulamentos ambientais.

INTRODUCTION

vol. 12, nº 2. ISSN 2317-7721
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The Federal Constitution of 1988, in its article 170, assures that everyone has free exercise of any economic activity, regardless of the authorization of public entities. However, it makes reservations in cases provided for by law, and the preservation and protection of the environment should be observed by all, especially those who use natural resources for their activity.

The defense of the environment refers to that which is advocated by article 225 of the Constitution, when it establishes that the Government and the community have the duty to defend and preserve the environment for present and future generations. It is for this purpose that entrepreneurs who use natural resources in the development of their economic activities must undertake activities that at least ensure environmental balance.

Natural resources are assets of the community, and therefore, their use follows its own regulations, with legal delimitation of what is or cannot be exploited economically, respecting the specific requirements.

To use specially protected areas and natural resources, it is necessary to obtain express authorization from the environmental agency linked to the National Environment System, as well as fulfil the obligation to repair any environmental damages incurred. Environmental compensation is one way of promoting this reparation, contributing to the balanced use of the environment, and sustaining economic activity.

In this context, this research sought to identify all forms of compensation instituted when it is necessary to use specially protected natural resources aiming at the development of economic activity.

METHODS

This study is based on Brazilian federal environmental law standards for protected natural resources. To acquire the data used, the websites of the Federal Executive and Senate were used.

The methodology used in the studies was bibliographic, in exploratory and explanatory modalities, with a qualitative approach of the environmental compensations instituted in the Brazilian territory for individuals or legal entities that exploit natural resources in the implementation or development of their activities.

In this context, the study began with the Constitution, specifically in the following Federal laws: No. 9,985, 2000, which regulates art. 225, § 1, items I, II, III and VII, and establishes the

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

National System of Nature Conservation Units (SNUC) and other measures; No. 11,428, 2006, which deals with the use and protection of the native vegetation of the Atlantic Forest Biome; No. 12,651 of 2012, which provides for the protection of native vegetation in general; Federal Decree No. 99,556 of 1990, as amended by Decree No. 6,640 of 2008, which provides for the protection of the natural underground cavities of the national territory.

RESULTS

The general rule of the Brazilian legal system does not tolerate environmental damage to the community and determines the preservation of the environment. However, exceptionally, some changes in the environment have been foreseen and are considered tolerable by law, even though they cause damage. Bechara (2007) classifies this damage as legally irrelevant and legally relevant.

Irrelevant tolerable damages are those that, despite having impacts, do not violate the Law and are not compensated, and therefore, not indemnifiable. On the other hand, the relevant tolerable damages are those that, despite the impacts, are authorized by law, but with mitigating and compensatory measures.

Basically, there are two obligations for those who cause legally relevant environmental damage: forest replacement and environmental compensation, without prejudice to mitigation measures. In this study, some environmental compensations instituted for application in the Brazilian territory were identified: compensation provided for in Law No. 9,985, of 2000, of the National System of Conservation Units; compensation for interventions in permanent preservation areas, provided for in CONAMA Resolution No. 369 of 2006; compensation for cutting or suppression of endangered species, provided for in Law No. 12,651 of 2012; compensation provided for in Law No. 11,428 of 2006, due to the suppression of native vegetation inserted in the Atlantic Forest Biome; and compensation for intervention in underground cavities, called speleological compensation, provided for in Federal Decree No. 99,556 of 1990, as amended by Federal Decree No. 6,640 of 2008.

For each authorized intervention, depending on the area and vegetation to be affected, the legislation requires a form of compensation, as will be explained below.

ENVIRONMENTAL COMPENSATION PROVIDED FOR IN NATIONAL PROTECTED AREA LAW

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

According to Machado (2013, p. 932), environmental compensation is an attempt to ecologically balance the environment, which is everyone's right and is essential to a healthy quality of life. For this, the Constitution, according to art. 225, paragraph 1, item IV, determines that the Government requires "in accordance with the law, an environmental impact study is required for the installation of work or activity potentially causing significant environmental degradation, which will be publicized." This study will determine the degree of impact and will be used by the environmental agency to decide on the incidence or not of environmental compensation.

To this end, Law No. 9,985 of 2000 provided, in its article 36, for environmental compensation in the face of the installation and operation of enterprises that cause a significant environmental impact. In this case, the entrepreneur is required to support the establishment and maintenance of conservation units of the Integral Protection Group, consisting of an Ecological Station, Biological Reserve, National Park, Natural Monument and Wildlife Refuge.

Also foreseen is the possibility of benefiting Sustainable Conservation Units, if the project affects them, such as Areas of Environmental Protection of Material Ecological Interest, National Forest, Extractive Reserve, Fauna Reserve, Sustainable Development Reserve, Private Reserve. Natural Heritage, and a specific conservation unit or its buffer zone.

Apparently, the legislators understood that it is best to protect privileged resource areas by requiring environmental compensation because these are units that need more restrictions and should deserve greater protection.

The guidelines for the implementation of the provisions of the Law were embodied in Federal Decree No. 4,340 of 22, 2002. Among them is the determination that the degree regarding impact is fundamental for the calculation of the value of environmental compensation, as follows:

> Art. 31. For the purposes of regulating the environmental compensation referred to in art. 36 of Law No. 9,985 of 2000, the Brazilian Institute of Environment and Renewable Natural Resources - IBAMA will establish the degree of impact from a previous environmental impact study and its report - EIA / RIMA, at which time it will exclusively consider negative environmental impacts on the environment.
> §1 The impact caused will be considered only once in the calculation.
> §2 The calculation shall contain the indicators of the impact generated by the enterprise and the characteristics of the environment to be impacted.

The environmental impact was conceptualized by CONAMA, Resolution No. 01, 1986, in its article 1:

> Any change in the physical, chemical and biological properties of the environment caused by any form of matter or energy resulting from human

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

> activities that directly or indirectly affect: the health, safety and welfare of the population; social and economic activities; the biota; the aesthetic and sanitary conditions of the environment; and the quality of environmental resources.

From this normative concept, it is concluded that, for the characterization of impact, a simple alteration of the environment is not enough; that is, the damage must affect the health, safety and well-being of the community.

Resolution 237, 1997, of the National Environmental Council (CONAMA), which regulates the environmental licensing aspects established in the National Environmental Policy, defined that environmental studies are those which instrumentalize the impact assessment, and to guide the environmental impact analyses of environmental licensing procedures. Therefore, by identifying the significant environmental damage to the installation and operation of the project to be implemented, the environmental compensation provided for in the National Law on Conservation Units is established.

Compensation, by legal guidance, should benefit Integral Protection Units, but the standard does not include proximity to the impacted area criteria. With this, it left room for the environmental agency to define, according to its analysis, which Conservation Unit will benefit. However, when it comes to promoting environmental balance, Conservation Units should be privileged, at least, those belonging to the same municipality in which the impacting activity is intended to be implemented.

According to Almeida *et al*. (2017), environmental compensation resources from installation and activities with significant environmental impacts have been applied to the same biomes that suffer the impacts, obeying the principle of functional connection. However, these have also been applied in municipalities other than the project site, concluding that the application of the spatial connection principle in the use of the resources of this compensation modality has not been effective.

COMPENSATION PROVIDED FOR IN THE NATIONAL FOREST POLICY ACT

Federal Law No. 12,651, 2012, repealed Federal Law No. 4,771, 1965, and provides for the protection of native vegetation and forests of the national territory, recognizing that they are of use to the lands they cover and are property of common interest to all the inhabitants of Brazil. This reaffirms the right to exercise the use of property with the limitations established by law.

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

The Law in question, in addition to providing for the protection of vegetation in general, determines the protection of areas of permanent preservation, covered or not by vegetation, as well as endangered flora species, establishing special criteria for cutting when authorized.

COMPENSATION FOR INTERVENTIONS IN PERMANENT PRESERVATION AREAS

The area of permanent preservation is described by Federal Law No. 12,651 of 2012, Forest Policy Law - LPF, which establishes:

> A protected area, whether covered by native vegetation, with the environmental function of preserving water resources, the landscape, geological stability and biodiversity, facilitating the gene flow of fauna and flora, protecting the soil and ensuring the well-being of human populations.

Areas of permanent preservation, unlike legal reserve areas, are defined by the Environmental Authority, and characterized as follows:

> Art. 4 - Permanent Preservation Area, in rural or urban areas, is considered for the purposes of this Law:
> I - The marginal ranges of any natural watercourse from the edge of the regular waterbed up to a minimum width of:
> a) thirty (30) meters, for watercourses less than ten (10) meters wide;
> b) fifty (50) meters for watercourses that are ten (10) to fifty (50) meters wide;
> c) one hundred (100) meters for watercourses that are from fifty (50) to two hundred (200) meters wide;
> d) two hundred (200) meters for watercourses that are from two hundred (200) to six hundred (600) meters wide;
> e) five hundred (500) meters for watercourses that have a width greater than six hundred (600) meters;
> II - The areas around the lakes and natural lagoons, with a minimum width of:
> a) one hundred (100) meters, in rural areas, except for the body of water with up to twenty (20) hectares, whose marginal range will be fifty (50) meters;
> b) thirty (30) meters in urban areas;
> III - The areas around the artificial water reservoirs, in the range defined in the environmental license of the enterprise, observing the provisions of §§ 1 and 2;
> IV -The areas around the springs and karst springs, whatever their topographic situation, within a minimum radius of fifty (50) meters;
> V - Slopes or parts thereof with slopes greater than 45 °, equivalent to one hundred percent (100%) on the highest slope line;
> VI - The sandbanks that are dune maintainers or mangrove stabilizers;
> VII - the mangroves, in all their extension;
> VIII - The borders of plateaus or buttes up to the relief rupture line, in a range of no less than one hundred (100) meters in horizontal projections;
> IX - At the top of hills, low mountains, high mountains and mountain chains with a minimum height of one hundred (100) meters and an average slope

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

> greater than 25 °, the areas delimited from the level curve corresponding to two thirds (2/3) of the minimum height of the elevation always in relation to the base, which is defined by the horizontal plane determined by the adjacent plain or reflecting pool or on undulating reliefs, by the elevation of the saddle point closest to the elevation;
> X - Areas at altitudes greater than one thousand eight hundred (1,800) meters, whatever the vegetation;
> XI - the trails.

Because they are specially protected areas, permanent preservation areas have received differentiated treatment and have a specific regime, if intervention is required with regards to activities considered to be of public utility or social interest, as well as those with low impact. In this sense, Federal Law No. 12,651 of 2012 states that:

> Art. 7. Vegetation located in a Permanent Preservation Area shall be maintained by the owner of the area, possessor or occupant of any title, whether natural or legal, whether public or private.
> §1 Having suppression of vegetation located in Permanent Preservation Area, the owner of the area, possessor or occupant in any capacity is obliged to promote the replacement of the vegetation, except for the authorized uses provided for in this Law.
> §2 The obligation provided for in Paragraph 1 is of a real nature and is passed on to the successor in the event of transfer of ownership or ownership of the rural property.
> §3 In the case of unauthorized vegetation suppression carried out after July 22, 2008, the granting of new authorizations for vegetation suppression is prohibited as long as the obligations set forth in paragraph 1 are not fulfilled.
> "
> Art. 8 - The intervention or suppression of native vegetation in a Permanent Preservation Area will only occur in the hypotheses of public utility, social interest or low environmental impact provided for in this Law.
> §1 The suppression of native vegetation that protects springs, dunes and sandbanks can only be authorized in case of public utility.
> §2 The intervention or suppression of native vegetation in Permanent Preservation Area dealt with in items VI and VII of the caput of Art. 4 may be authorized, exceptionally, in places where the ecological function of the mangrove is compromised, for the execution of housing and urbanization works, inserted in projects of land regularization of social interest, in consolidated urban areas occupied by low-income population.
> §3 Authorization by the competent environmental agency is not required for the execution, as a matter of urgency, of national security activities and works of civil defense interest aimed at the prevention and mitigation of accidents in urban areas.
> §4 In no event shall there be any right to regularization of future interventions or suppression of native vegetation other than those provided for in this Law.
> Art. 9 - People and animals are allowed access to Permanent Preservation Areas to obtain water and to carry out activities with low environmental impact.

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

Despite the lack of foreseeing the obligation of environmental compensation, it is implicit in the Federal Constitution, which establishes minimum criteria for the use of the environment, translated mainly by the principles of the right to sustainable development, healthy quality of life and a balanced environment. Therefore, there is no way to conclude otherwise than that compensation is necessary in this case. If that were not enough, CONAMA, through Resolution No. 369, 2006, established the obligation to comply with environmental compensation when environmental intervention in a permanent preservation area is authorized.

This form of compensation for interventions in permanent preservation areas requires a compensation of 01 ha of area for each hectare of intervention:

> Art. 5. - The competent environmental agency shall establish, prior to issuing the authorization for intervention or vegetation suppression in PPA, the ecological measures, mitigating and compensatory, provided for in § 4 of art. 4 of Law no. 4,771, 1965, which must be adopted by the applicant.
> §1 For the enterprises and activities subject to environmental licensing, the mitigating and compensatory ecological measures provided for in this article shall be defined within the scope of said licensing process, without prejudice, where appropriate, to compliance with the provisions of Art. 36 of Law No. 9,985 of July 18, 2000.
> §2 The compensatory measures dealt with in this article consist of the effective recovery or replacement the vegetation in the PPA and should occur in the same sub-basin, and as a priority: I - in the area of influence of the enterprise, or II - in the headwaters of the rivers.

Thus, in principle, as it is a specially protected area, except in cases of low impact, the entrepreneur should compensate the damage to be caused. And, as a matter of logic, if the environmental norm described what would be a low impact intervention, it must be concluded that the other activities, in theory, if implemented in areas of permanent preservation, even if they are named for public utility or social interest, should be considered of significant impact.

COMPENSATION FOR CUTTING OR SUPPRESSION OF ENDANGERED SPECIES OF FLORA

Federal Law No. 12,651 of 2012 authorizes the suppression of vegetation that shelters species of endangered flora, provided the compensatory and mitigating measures that ensure their conservation are adopted, as follows:

> Art. 27. In areas subject to alternative land use, the suppression of vegetation that houses species of endangered flora, fauna, or migratory species, according to an official list published by the Federal or state or municipal SISNAMA agencies, will depend on the adoption of compensatory measures and mitigators that ensure the conservation of the species.

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

The official list of endangered species in the Brazilian territory was published by the Ministry of Environment (ME) and is registered in Ordinance no. 443, of 2014. However, a form of environmental compensation has not yet been regulated by a Federal norm, but this does not prevent the environmental agencies from instituting the Ordinance when endangered flora species are encountered in areas subject to alternative soil use.

COMPENSATION PROVIDED FOR IN THE FEDERAL ATLANTIC FOREST LAW

The specific standard that takes care of the Atlantic Forest is Federal Law No. 11,428, 2006, regulated by Federal Decree No. 6,660, 2008, even though it was recognized as a national patrimony by the 1988 Constitution, in its art. 225. The special treatment in the formalization of infra-constitutional instruments established that the use of the vegetation included in this biome must obey the conditions that ensure the preservation of the environment, even when the use of natural resources occurs.

In principle, intervention in primary and secondary native vegetation in the middle and advanced stages of regeneration is not allowed, but the standard exceptionally authorized the analysis of intervention by the competent body when it comes to the execution of works, projects or activities. public utility, scientific research and preservation practices, provided that environmental compensation is provided.

To analyse the request for intervention in primary vegetation, when the intervention is authorized, it is still necessary to fulfil some requirements for the decision, such as the preparation of the Environmental Impact Study (EIA), the Environmental Impact Report (RIMA), the proof of technical and locational inexistence and, indicated by the tenderer, in detail, the high relevance and the national interest for the suppression.

In order to authorize the suppression of secondary vegetation at an advanced stage of regeneration, it should be noted whether this suppression is an exceptional situation characterized by the following circumstances: execution of public works, activities or projects; scientific research and conservation practices; for implementation of mining enterprises; and in the urban perimeters, approved until the date of the Federal Law nº 11.428 of 2006, for subdivision or building. In addition to these conditions, the enterprises must ensure the preservation of native vegetation at an

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

advanced stage of regeneration in at least fifty percent (50%) of the total area covered and comply with the Municipal Master Plan and other applicable urban and environmental standards.

In this case, it is also the entrepreneur's obligation to prove the absence of a technical and locational alternative for the mining and public utility venture; submit EIA / RIMA; and indicate in detail the high relevance and national interest for deletion, if it is of public utility.

Cutting, suppression and exploitation of secondary vegetation in the middle stage of regeneration of the Atlantic Forest biome are only authorized in exceptional cases, when necessary for the execution of public works, activities or projects, scientific research and preservation practices. There is also the possibility of meeting the social interest, provided for by the Atlantic Forest Law, in its art. 3, item VIII.

Suppression is also possible in areas with vegetation in the middle stage of regeneration in the Atlantic Forest biome and its disjunctions, for the installation of mining enterprises and when necessary for small farmers and traditional populations in the exercise of agricultural, livestock or forestry activities that are essential for subsistence, except for the areas of permanent preservation, and, when applicable, after the registration of the legal reserve pursuant to Federal Law No. 12,651 of 2012.

This intervention in urban perimeters is also allowed if approved until the effective date of Federal Law no. 11,428, 2006 (art. 31, item I) for subdivision or building, provided that the project guarantees the preservation of at least 30% (thirty percent) of the total area covered by native vegetation. In the urban perimeter delimited after this date, a minimum of 50% (fifty percent) of the total area covered by vegetation must be maintained, obeying the municipal master plan and other applicable norms.

For the deliberation of the request to intervene in the mentioned cases, it is also the applicant's obligation to prove the inexistence of a technical and locational alternative for the mining venture, of public utility or social interest; submit EIA / RIMA, and indicate in detail the high relevance and national interest for the suppression.

For the area of secondary vegetation at an early stage of regeneration of the Atlantic Forest biome, logging, suppression and exploitation may be authorized provided that the federation unit has more than five percent (5%) of the original area of this vegetation, according to data from the National Institute for Space Research - INPE (Table 1).

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

According to the protection criteria established by the Atlantic Forest Law, in addition to the measures and evidences described, those who deforest primary or secondary native vegetation, at an advanced or middle stage of regeneration, of the Atlantic Forest biome have the duty to compensate or, in its impossibility, have the obligation to replace the vegetation. The legal provision describing the obligation to comply with environmental compensation is Federal Law no. 11,428, 2006, art. 17 complemented by art. 32, *in verbis*:

> Art. 17. The cutting or suppression of primary or secondary vegetation in the middle or advanced stages of regeneration of the Atlantic Forest Biome, authorized by this Law, is subject to environmental compensation, in the form of the destination of an area equivalent to the extent of deforested area, with the same ecological characteristics, in the same watershed, whenever possible in the same river basin, and, in the cases provided for in articles 30 and 31, both of this Law, in areas located in the same Municipality or metropolitan region. ( )
> Art. 32. The suppression of secondary vegetation in the advanced and medium regeneration stage for mining purposes will only be allowed with the:
> (....)
> II - adoption of a compensatory measure that includes the recovery of an area equivalent to the project area, with the same ecological characteristics, in the same watershed and whenever possible in the same water basin, regardless of the provisions of art. 36 of Law No. 9,985 of July 18, 2000.

Table 1. Federative units and their remaining areas of the Atlantic Forest biome, Brazil, 2019

UF	Área UF (hm²)	Total Natural (hm²)	% Total Natural
AL	2,777,724	140.659	9.2%
BA	56,473,404	2,004,746	11,1%
CE	14,892,047	64,064	7.4%
ES	4,609,503	483,087	10.5%
GO	34,011,087	30,172	2.5%
MG	58,651,979	2,829,026	10,2%
MS	35,714,473	712,374	11.2%

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

PB	5,646,963	54,982	9,2%
PE	9,815,022	198,346	11,7%
PI	25,157,775	901,787	33,9%
PR	19,930,768	2,322,682	11,8%
RJ	4,377,783	820,164	18,7%
RN	5,281,123	12,041	3,4%
RS	26,876,641	1,092,336	7,9%
SC	9,573,618	2,189,122	22,9%
SE	2,191,508	69,901	6,9%
SP	24,822,624	2,344,483	13,7%
Total	340,804,043	16,269,972	12,4%

Fonte: INPE and SOS Mata Atlântica (2017-2018).

It is emphasized in the article that environmental compensation is a condition for the required intervention, since, if authorized, its form and the location of the vegetation replanting must at least be established in advance. Intervention is not allowed without the establishment of minimum criteria for compliance with forest compensation, either by allocating an area equivalent to the extent of the deforested area, with the same ecological characteristics, in the same river basin, or for the recovery of an area equivalent to the venture area.

The Atlantic Forest Law provides for environmental compensation for the impact caused to vegetation in the middle and advanced stages of regeneration, when intervention is allowed. For vegetation at an early stage of regeneration, the standard provides for intervention but does not require compensation.

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

COMPENSATION FOR INTERVENTION IN UNDERGROUND CAVITIES (SPELEOLOGICAL COMPENSATION)

The first rule to provide for the protection of cavities was provided for in the 1988 Constitution in its Art. 20, Item X, which states that the underground natural cavities and the archaeological and prehistoric sites are assets of the Union and constitute a Brazilian cultural heritage. This stipulation first appeared in a Resolution of the National Council of the Environment (CONAMA) no. 5 of 1987, which was repealed by CONAMA Resolution no. 347, 2004.

Currently, the Brazilian cavities are governed by Federal Decree No. 99,556 of 1990, amended by Federal Decree No. 6,640 of 2008, pursuant to Art. 20, Item V, and Art. 216 of the Federal Constitution

Brazilian natural underground cavities are defined by Federal Decree No. 99.556 of 1990, in its sole paragraph:

> A natural underground cavity is any human-accessible underground space, with or without an identified opening, popularly known as a cave, cavern, grotto, hollow, lair, pit or hole, including its environment, mineral and water content, fauna and flora found there and the rocky body where they are inserted, as long as they were formed by natural processes, regardless of their dimensions or type of nesting rock.

These underground cavities are made up of geological, archaeological and paleontological sites, and host endemic and endangered species. They are also water reservoirs that enable the development of leisure activities and ecotourism for the scenic beauty and their unique relief forms. According to Marra (2001), there are several benefits brought by underground cavities, such as ecological, touristic, scientific and cultural ones.

One of the forming elements of limestone or karst caves is water. Lino and Allieve (1980) point out that these caves stand out for the profusion and beauty of speleothems and for their greater biological diversity. Ganem (2009) points out that flora and fauna are another peculiar aspect of cave ecosystems and their distribution is related to physical factors and nutrient availability.

According to research conducted on the website of the National Caves Registry of Brazil, there are currently 7,914 caves registered in the country. This Register was created by the Brazilian Speleology Society (SBE), with the purpose of compiling all available information about caves, being an important tool for research in various areas and for studies and projects for the preservation of caves and the environment.

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

The current Resolution also deals with the area of influence of the speleological heritage, which includes the biotic and abiotic elements, superficial and underground, necessary to maintain the ecological balance and the physical integrity of the cave environment.

The area of influence over the speleological heritage is defined by the competent environmental agency, through specific studies at the expense of the entrepreneur, but the standard established as the area of influence, until the competent environmental agency defines it, the horizontal projection of the cave plus a surrounding area of 250m in a convex polygonal shape.

Despite the importance of speleological heritage, cave intervention is possible, depending on its degree of relevance, which is disciplined in MMA Normative Instruction no. 2, 2009. If there is a possibility of intervention in caves, there occurs an environmental compensation stipulated by the amendment of Federal Decree No. 99,556 of 1990, which occurred with Federal Decree No. 6,640 of 2008.

The caves, according to the norm, are classified according to their degree of relevance, which can be maximum, high, medium or low, depending on their ecological, biological, geological, hydrological, paleontological, scenic, historical-cultural and socioeconomic attributes.

The underground natural cavities of maximum relevance, as expressed in Federal Decree no. 6,640, of 2008, in its Art. 2, § 4, are those that have at least one of the following attributes: unique or rare genesis; unique morphology; remarkable dimensions in extent; area or volume; unique speleothems; geographic isolation; essential shelter for the preservation of genetically viable populations of endangered animal species on official lists; habitat essential for the preservation of genetically viable populations of endemic or relict troglobitic species; rare troglobitic habitat; unique ecological interactions; cavity testimony; or outstanding historical, cultural or religious relevance.

The underground natural cavity with high degree of relevance is one whose attributes are considered locally and regionally accented; or locally accentuated and regionally significant. It is of medium relevance those whose attributes are considered accentuated in its location, low in the regional focus; or significant in both.

An underground natural cavity with a low degree of relevance is one with attributes that stand out significantly in their place of origin, but regionally they are not of equal importance, or are of little local and regional prominence.

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

The natural cavity with the maximum degree of relevance, as well as its area of influence, cannot be subject to irreversible negative impacts, so it can only be used under conditions that ensure its physical integrity and the maintenance of its ecological balance, in accordance with which determines art. 3 of Federal Decree No. 6,640 of 2008.

Unlike the most relevant cavities, the high, medium and low relevance cavities can be subject to irreversible negative impacts, provided they are subject to environmental licensing.

For the use of caves of high relevance, the compensatory measure must ensure the preservation of two “reference cavities”, that is, with the same degree of relevance, of the same lithology and attributes like those of the one impacted.

The standard also admits and authorizes the environmental agency to define, in agreement with the entrepreneur, other forms of compensation, if there are no other representative cavities in the enterprise area that can be preserved in the form of “reference cavities”.

For the use of caves of medium relevance, the compensation will be the adoption of measures that contribute to the conservation and proper use of the Brazilian speleological heritage, especially the underground natural cavities with maximum and high relevance, defined by the competent environmental agency.

In order to comply with Federal Decree no. 6,640, of 2008, in its art. 4, § 3, which deals with the possibility of establishing another form of compensation, if there are no representative cavities in the enterprise area that can be preserved in the form of “reference cavities”, the Chico Mendes Institute for Biodiversity Conservation (ICMBIO) issued Normative Instruction no. 30 of 2012 stipulating administrative and technical procedures for the implementation of the said speleological compensation

For low relevant characterized cavities, when the irreversible impacts on these underground natural cavities occur, the standard did not foresee or establish the obligation to comply with other environmental preservation or compensation measures.

DISCUSSION

In this research, five different forms of environmental compensation were identified. Federal Law No. 9,985 of 2000, when creating the National System of Conservation Units, established one of the main forms of environmental compensation, which requires the

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

entrepreneur to support the establishment and maintenance of the Integral Protection Group's protected area, environmental licensing of significant impact projects, supported by an environmental impact study and its report - EIA / RIMA.

In sequence, following the same constitutional orientation of protection and sustainability of natural resources, CONAMA, through Resolution no. 369, of 2006, instituted procedures for the analysis of requests for intervention in permanent preservation areas and established the obligation to comply with environmental compensation when necessary and authorized by environmental intervention in these special areas.

In 2006, Law No. 11,428 – the National Atlantic Forest Policy was created, which emphasizes the importance of the vegetation in that biome, requiring compensation from the entrepreneur when its exploitation is authorized.

In general, endangered flora species are not exploitable, but the new Federal Forest Code provides for this possibility for areas that may have alternative land use, provided that compensatory and mitigating measures are adopted to ensure the conservation of the species. Federal Law No. 12,651 of 2012, in its Art. 27, provides for such measures, but does not establish a way to offset this impact.

The latest official list recognizing endangered flora species was published in 2014 by IBAMA, through Ordinance MMA No. 443, and has been updated.

Natural underground cavities are also subject to special protection because of their importance and because they are a fragile and delicate ecosystem. They are regulated by federal rule, as they are part of the national heritage. The classification of natural cavities influences the type of environmental compensation, which is made according to their degree of relevance (Table 2).

FINAL CONSIDERATIONS

The Brazilian Federal Constitution of 1988 solidified the importance of preserving the environment for present and future generations when it required environmental impact studies for the installation of work or activity that potentially causes significant degradation in the environment. In addition, it determined the protection of flora and fauna, prohibiting practices that endanger the extinction of species, being explicit about the need to create economic development mechanisms with environmental responsibility.

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

Environmental compensation is one of the main instruments to guarantee the conservation and preservation of the natural environment and should be observed by all those who exploit special vegetation and areas for the implementation of their economic activities.

The legal and constitutional protection of the environment and the means put in place to compensate for the permissible use of natural resources in areas with endangered species of flora are in harmony with the constitutional dictates established to ensure a healthy quality of life for all. Now it remains to investigate if these stipulations are being implemented by entrepreneurs and supervised by the Government.

Table 2. Legally instituted environmental compensation

Activity /compensation	What to compensate	The form of environmental compensation	Legal provision
Installation of projects with significant environmental impacts	The significant environmental impact due to the installation and operation of the project.	It depends on the impact assessment and the Environmental Impact Study, since the value of compensation-sharing is fixed proportionally to the environmental impact, after a study that ensures the contradiction and the broad defense	Law no. 9,985 of 1998.

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

Intervention in Permanent Preservation Area	The area with or without native vegetation due to the intervention	Recovery of area equivalent or larger than the required intervention	Law no. 12,651 of 2012.
Cutting down endangered trees	The suppressed individuals	The form of application has not yet been regulated.	Law no. 12,651 of 2012.
Intervention in native vegetation / Atlantic Forest biome / disjunctions	The suppressed native vegetation	Area equivalent or larger than authorized	Federal Law no. 11.428 de 2006.
Intervention in cavities of high or medium relevance	Suppressed caves when considered of high or medium relevance	High relevance: to ensure the preservation of two "reference cavities", with the same degree of relevance, the same lithology and similar attributes as the one impacted. Medium relevance: adoption of measures that contribute to the conservation and proper use of the Brazilian speleological heritage, especially the underground natural cavities with maximum and high relevance, as defined by the competent environmental agency.	Federal Decree no., 99,556 of 1990, altered by Federal Decree no. 6,640 of 2008.

Source: MMA (1990, 1998, 2008, 2012)

vol. 12, nº 2. ISSN 2317-7721
DOI: 10.12957/rdc.2020.48045

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vol. 12, nº 2. ISSN 2317-7721
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