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ENVIRONMENTAL IMPACTS ON WILD FAUNA CAUSED BY ROADS AND THE EFFECTIVENESS OF MITIGATION MEASURES

Flávio José de Azevedo
Lawyer, Specialist in Civil Procedure and Master in Environment and Regional Development

Abstract: This article aims toto present the environmental impacts on the wild fauna resulting from the roads, as well as the mitigating measures to minimize this problem. Road works, despite their indispensability, compromise the environment, often causing irreversible environmental impacts. Certainly, roads are critical to economic development. Its construction, however, like all anthropic action, causes numerous impacts to the environment, since it modifies the natural habitat of the fauna. Each new construction leads to human flow in previously uninhabited places, making that same habitat vulnerable and, consequently, possibly resulting in loss of species. Environmental impacts are, therefore, one of the most relevant factors regarding the loss of biodiversity worldwide. Thus, for there to be sustainable development, it is necessary to think of urgent measures for environmental preservation. In this vein, it is urgent to take mitigating measures that minimize environmental damage. Common solutions must be found, considering all risks and adapting ways of life to less impactful standards, using appropriate public policies for each case. , so that the economy and the environment can coexist harmoniously and proportionately, enabling sustainable development, so that the resources that are available today are not depleted. There must always be viable measures to protect the fauna, because we also depend on it. It is essential to adopt urgent measures to preserve the environment. Sustainable development is the path to our survival and that of future generations. The ecologically balanced environment is everyone's right, as provided in art. 225 of the Federal Constitution. In this way, it is also everyone's duty to promote environmental preservation.

Keywords: Roads. Environmental impacts. Wild Fauna. Mitigating Measures. Effectiveness. Ecologically balanced environment. Future generations.

INTRODUCTION

The importance of roads for the development of human activities is undeniable. However, roads cause numerous environmental impacts.

Anthropogenic actions that interfere with the environment are often responsible for the extinction of species and the ecological imbalance that, in the end, ends up affecting human beings themselves.

There is no doubt that globalization has brought enormous advances to both developed and developing countries. However, there is innumerable evidence that the issue of pollution and environmental degradation only reached its current levels, not because of globalization, but because of the way it was managed.

In this vein, it is urgent to take mitigating measures to minimize environmental damage.

It is hoped, therefore, that the economy and the environment can coexist in a harmonious and proportional way, enabling sustainable development, so that the resources that are available today are not exhausted.

The guiding question for the idealization of this work was the adoption of viable measures to protect the fauna, because we also depend on it. It is essential to adopt urgent measures to preserve the environment. Sustainable development is the path to our survival and that of future generations.

WHAT IS WILD FAUNA

Fauna is characterized by animals. This name comes from the Roman goddess Fauna, goddess of fertility and the earth.

Animals form one of the most successful living groups, as their innumerable ingenious adaptations enable their existence in the most diverse environments where there is life.

Changes that occurred over millions of years of evolution (BARBOSA; VIANA; RANGEL, 2014).

Fauna is the set of animal species that live in a given area (forest, country, ecosystem). The fauna of a region can be very diverse, considering the existing environmental conditions. The Brazilian fauna, for example, is very rich in animal species, since the country has a wide variety of ecosystems (BARSANO, 2019).

Thus, wild fauna is the set of animals that live in freedom, outside captivity, as established in art. 1 of Law No. 5.197/67. "The determining criterion of this classification is related to whether the species develops its natural life in freedom or outside captivity" (FIORILLO, 2017, p. 258).

Complements Sirvinskas (2017, p. 634):

> Fauna is an environmental good and integrates the ecologically balanced environment provided for in art. 225 of CF. It is a diffuse good. This good is neither public nor private. It is in common use by the people. Fauna belongs to the community. It is good that must be protected for present and future generations.
>
> It should be noted, however, that the fauna protection law placed wild animals as State property (art. 1 of Law n. 5.197/67). The State, in turn, would be represented by the Public Power of the Union. Thus, all wild animals would be part of the private domain of the Public Power. Furthermore, the State cannot use, enjoy and dispose of these environmental goods, which are unavailable. With the advent of the Federal Constitution, fauna became very diffuse in the environment.

However, anthropic actions, such as building roads, for example, which interfere with the environment are often responsible for the extinction of species and the ecological imbalance that, in the end, affect man himself.

ENVIRONMENTAL IMPACTS CAUSED BY ROADS ON WILD FAUNA

According to Barsano (2019), the damage caused by roads can be divided into physical (erosion, alteration of hydrology, noise pollution), chemical (dispersion of pollutants) and biological (fragmentation, barrier effect, fire outbreaks, introduction of exotic species, increase in hunting and deforestation, attraction of species, roadkill).

In this sense, explain Assis and Furlan (2014, p. 461):

> Roads generate direct effects (fauna mortality due to roadkill, pollution) and indirect effects (loss and fragmentation of habitats, microclimate changes, facilitation of invasions by exotic species) that influence the permeability of the landscape to biota flows, restricting the movement of animals and isolating populations of organisms. Roads also change water and air quality and affect human communities. (ASSIS; FURLAN, 2014, p. 461).

For Spellerberg (2002), the effects of roads on fauna have been divided into: barrier effect; border effect; soil and water contamination; physical deployment and traffic; noise emission; and garbage disposal.

According to the author on the screen, the barrier effect deals with the loss of habitats and the generation of new living space for other animals, the creation of fragments with smaller areas and a greater proportion of edges, scaring away some species and attracting others. It can reduce populations to unviable levels of species per fragment. According to Lauxen (2012), it causes a decrease in movement in the environment, reducing gene flow and possibly increasing inbreeding.

The edge effect is the change in the composition of the edge of roads, causing climatic, chemical and biological changes. The climatic effects involve changes in

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environmental factors, as the zone of influence of the edges presents greater exposure to winds, high temperatures, low humidity and high solar radiation. Biological effects cause changes in the abundance and distribution of species caused by abiotic factors near the edges, such as, for example, the increase in the density of individuals due to the greater primary productivity caused by high levels of solar radiation (LIMA-RIBEIRO, 2008).

Roads contaminate water and soil through metals such as Pb, Ni, Cd and Zn released by vehicle engines and tires; These metals can reach a distance of up to 30 m from the road in soils, 40 to 120 m in plants and up to 48 m in animals. Erosion and sediment carry-over in aquatic habitats are observed in the construction phase and directly influence the turbidity of the springs, causing disturbances in these ecosystems. Sediments can reach sensitive areas at a distance of up to 89 m from the road (SPELLERBERG, 2002).

Physical implantation and traffic: roads pave the way for colonization and agricultural expansion in forest areas, causing a decrease in animal populations through the fragmentation of spaces, hunting and the dispersal of exotic species (SPELLERBERG, 2002).

The emission of noise generates changes in the behavior of fauna, especially birds. Their communication is affected, with consequences for their courtship behavior and reproductive success (HALFWERK et al., 2011). Depending on traffic intensity, effects on birds can be observed for up to 2.8 km (SPELLERBERG, 2002). Amphibians can alter their vocalization patterns as a result of high levels of noise caused by traffic, with eventual reproductive consequences (CUNNINGTON; FAHRIG, 2010).

Garbage disposal, in addition to contaminating the habitat with bottles and cans, can become a trap for small mammals, snakes and lizards. On the other hand, it can also serve as a shelter for these same groups, as well as for birds. Garbage can cause the death of animals when dispersed on roads, as it attracts species that seek food, often resulting in pedestrians being run over (SPELLERBERG, 2002).

Thus, specifically for wild fauna, it is understood that there are two main impacts: the loss of species due to roadkill and the barrier effect, as can be seen in Figure 1.

For wild animals, crossing a road is often a matter of survival, as this is when they can be run over.

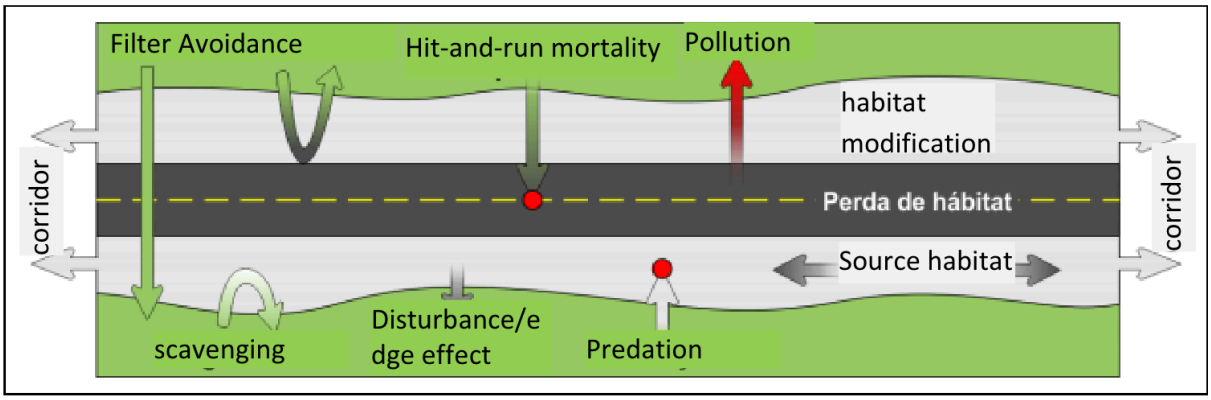


Figure 1 - Schematic representation of the ecological impacts of roads.

Source: Lauxen (2012, p. 46).

The conduct of avoiding the road makes it impossible for the animals to collide with vehicles, however, it limits them to one side of the road, causing damage to the gene flow of populations and to processes such as migration and dispersion, in the search for resources and/or other areas, especially medium and large animals, consequently causing problems regarding isolation and loss of genetic variability, which may cause local and regional extinctions (BAGER et al., 2016).

In this sense, explain Santos and Silva (2015, p. 84):

> In addition to the insufficient amount of food present in the new fragments and necessary for the survival of the species, the lack of sexual partners can generate a high rate of inbreeding. Reproduction between species that present a high degree of kinship reduces the genetic variability of the population, making it vulnerable to extinction due to adverse factors such as diseases. Therefore, there is a need to guarantee the fauna the possibility of crossing the barriers safely in order to guarantee the necessary resources for survival, avoiding its extinction.

The images shown in Figures 2, 3, and 4 show the loss of species due to roadkill and the barrier effect on the Raposo Tavares highway, which cause major impacts on the regional fauna.

Figure 2 - Record of running over and death of a wild animal.

Source: Fonseca (2016).

Figure 3 - Adult capybaras and calves run over on the road.

Source: Fonseca (2016).

Figure 4 - Concrete barrier divides the lanes of Raposo Tavares Highway (SP-270).

Source: Fonseca (2016).

The urbanization process impairs the distribution of fauna and movement patterns, directly helping to biotic homogenization and characterizing a relevant threat to biodiversity. Birds, in particular, have been extensively studied as indicators of anthropic disturbances, they are particularly valuable in assessing these impacts (MORELLI et al., 2014).

Under the socioeconomic aspect, they can result in modifications in the use and value of the land, attraction of human populations and alterations in the productive standards. Environmentally, its effects are manifested in different ways, some more visible, such as the running over of animals, and others underlying, such as fragmentation and changes in habitat characteristics. The perception of the magnitude of these impacts leads to the need to establish urgent and effective mitigating measures.

PROPER ROAD PLANNING AS MITIGATION MEASURES

Transport infrastructure affects the structure of ecosystems – the dynamics of ecosystem function – and has direct effects on ecosystem components, including its species composition. Clearly, the construction of transport lines results in the direct destruction and removal of existing ecosystems and the reconfiguration of local landforms (COFFIN, 2007).

For Trombulak and Frissell (2000), if a broad view of the ecological effects of roads reveals a multiplicity of effects, it also suggests that it is unlikely that the consequences of roads will be completely mitigated or remedied. Therefore, it is critical to keep the remaining portions roadless or mostly roadless in order to preserve the landscape in its natural state. Due to the increasing rarity of roadless areas, especially roadless watersheds, conservation efforts cannot rely entirely on protecting existing natural areas. But neither can conservation efforts rely entirely on tenuous and unexamined assumptions about the ability of site- and species-specific mitigation and remediation measures to reduce the ecological consequences of existing and proposed roads..

According to the aforementioned authors, the design, management and restoration of roads need to be more carefully adjusted to meet the range of ecological processes and terrestrial and aquatic species that may be affected. Deliberate monitoring is needed to ensure that projects have robust ecological benefits and minimal adverse effects, and that they are cost-effective relative to their actual benefits. Of course, these assessments require time and money that are generally unavailable. Most of the funds used to remediate troubled roads are earmarked for actual field operations and are not available to support such evaluation and monitoring. A tiny fraction of the specialists who build roads or "restore" them are trained to recognize and address the full spectrum of ecological issues. Furthermore,. Caro et al. (2014) point out four important measures to be observed regarding proper road planning, namely:

- First: consultations between infrastructure engineers and natural resource managers should start early, allowing the identification of less controversial and more viable alternative routes, minimizing harmful impacts on the environment. Key tools in conservation planning include geographic mapping of the distribution of threatened plants and animals and their key resources and decision structures; exceptional phenomena such as wildlife migrations should be central to the design of large infrastructure projects.

- Second, each proposed road project must require careful, case-by-case examination and arbitration. For example, in Oeste Paulista, as already mentioned, there is a large flow of wild animals and any road that stops or reduces the movement of animals must be very well planned.
- Third, effective enforcement is needed to control the speed and volume of traffic. It is naive to assume that roads and railways will not lead to wildlife collisions, this will lead to pressure for fences, which must be analyzed whether they are beneficial or harmful to wildlife in each location, so it is essential that infrastructure planners work with biologists to avoid migration routes and dispersal corridors.
- Fourth: Strict national and international policies need to be put in place to condition aid for infrastructure development on prior analysis of the real long-term costs of these projects. Honest application of the law is fundamental to "good legal practice" and must be an unbreakable condition of any aid and development package. These specific proposals differ from more general solutions in that they will have a greater chance of success because economic and conservation objectives are usually reconciled at the national level or in consultation with local stakeholders.

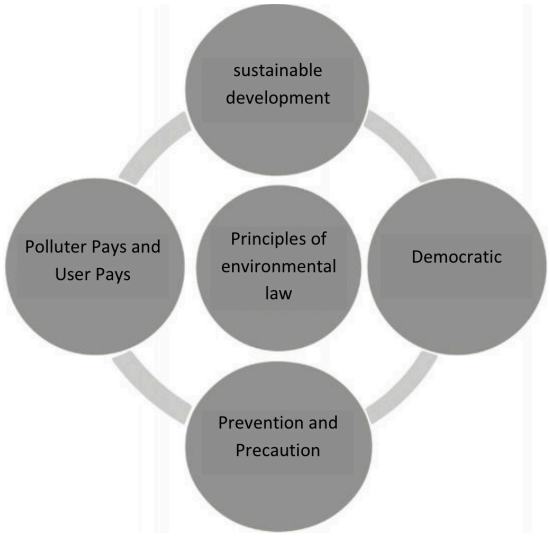
PRINCIPLES AS FOUNDATIONS FOR IMPLEMENTING MITIGATION MEASURES FOR ENVIRONMENTAL IMPACTS

According to Giacomelli and Eltz (2018), the general principles of law emerged as guidelines for legal norms, being guidelines for the interpretation and application of legal regulations in the most diverse branches in which they affect. For Environmental Law, principles are not only rules for interpreting or valuing norms, but are also conceptualized as precepts of a normative nature directly responsible for achieving the purposes proposed by environmental legislation. The principles can be expressed in legal norms or derive from the legal understanding on the protection of the environment, varying from author to author, as they are doctrinal constructions, however, they mainly consist of integrating the environmental legal system.

For the aforementioned authors, currently, Law is consolidated through several sources, each one representing the essence of the application of legal norms in the pursuit of the ideal of justice. And it is in this context that the principles emerge as guiding elements of the entire legal system.

The principles can be expressed in legal norms or derived from the legal understanding on the protection of the environment. They vary from author to author, as they are doctrinal constructions. Among the most commented principles, those presented in Figure 18 stand out.

Flowchart with the interrelated principles of Environmental Law



Source:Giacomelli and Eltz (2018).

Principle of sustainable development

The principle in question has the essence of supporting the fundamental bases of production and reproduction of human beings, as well as their activities, equitably ensuring an adequate relationship between people and their environment, so that future generations can also enjoy the same resources that are enjoyed today. "That is to say, the principle of sustainable development aims to share the performance of the economy with the preservation of the environment" (GUERRA; GUERRA, 2014, p. 113).

According to Trennepohl (2020), the guidelines for sustainable development reflect the need to conserve the environment, observing the scientific principles and natural laws that govern the maintenance of ecosystem balance, the need to make development strategies compatible with the protection of the environment, the adoption of measures to prevent damage and situations of environmental risk and international cooperation.

Fiorillo (2017, p. 66) warns that "environmental resources are not inexhaustible, making it inadmissible for economic activities to develop outside of this fact". Thus, the aim is to balance the economy and the environment. Development is allowed, however, in a sustainable, well-organized way, so that the resources that can currently be enjoyed do not disappear or become ineffective. Therefore, the principle of sustainable development is determined as development that can meet today's needs, without compromising the next generations.

In this vein, explain Giacomelli and Eltz (2018, p. 42):

> The term sustainable development emerged in the late 1970s, having been enshrined in Eco-92, when it was transformed into a principle. This principle seeks to balance environmental protection with economic development, for a better quality of life, considering the conscious use of non-renewable natural resources.

Economic progress is of enormous importance to the nation, however, its realization must be in line with the conservation of the environment. The bipartition "environmental preservation" and "economic development" can be resolved if both parties act appropriately without extreme attitudes. In this sense, Guerra and Guerra (2014, p. 114) state: "This way translates into the principles that govern sustainable development that emerges to reconcile the two aspects mentioned".

The development of humanity does not result in the deterioration of the environment. In reality, deterioration comes from the prevailing kind of development. Thus, environmental problems arise from the inappropriate way of seeking prosperity (BECHARA, 2009).

For Milaré (2020), in the principle of sustainable development, the reciprocity between right and duty is so obvious, since developing and enjoying a fully habitable planet is not just a right, it is the primary duty of people and society.

In this way, sustainable development is the principle that aims at harmony between economic activity and the correct use of natural resources.

Polluter pays and user pays principle

The polluter pays principle is mentioned in inc. VII of art. 4 of Law No. 6.938/81, which provides:

> Art 4 - The National Environmental Policy will aim to:
>
> [...]
>
> VII - the imposition, on the polluter and predator, of the obligation to recover and/or indemnify the damage caused and, on the user, of the contribution for the use

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> of environmental resources for economic purposes. (BRASIL, 1981).

Article 14, § 1, of Law No. 6,938/81 establishes the strict liability of the polluter:

> § 1 - Without preventing the application of the penalties provided for in this article, the polluter is obliged, regardless of the existence of fault, to indemnify or repair the damage caused to the environment and to third parties, affected by its activity. The Public Prosecutor›s Office of the Union and of the States will have legitimacy to propose civil and criminal liability actions for damages caused to the environment. (BRASIL, 1981).

According to Trennepohl (2020), the polluter must bear all the costs of his actions, with the cost of production. The foundation of the principle, therefore, is to remove the burden of the economic cost from the entire community and pass it on to the individual who, in some way, takes advantage of the damage and the implications that the environment will suffer with his undertaking.

For Milaré (2020), the principle is not intended, evidently, to tolerate pollution at a price, nor is it limited only to compensating for the damage caused, but rather, precisely, to avoid the impact on the environment.

According to Fiorillo (2017), this principle does not mean "pay to pollute" or "pollute through payment". Through it, one cannot look for ways to prevent the damage from being repaired, establishing a legality for the polluting action, as if the human being could say "I am polluting, but I am paying". Its meaning is quite different.

The polluter pays principle determines that those who cause environmental damage are held responsible for the consequences of their conduct, repairing the damage caused. Thus, this principle aims to prevent environmental degradation, repressing the action of the one who caused the damage, paying for the repair of the consequences caused to the environment. It is worth mentioning that it is up to the Public Power to apply the penalties provided for in the environmental protection rules (GUERRA; GUERRA, 2014).

For Giacomelli and Eltz (2018), the polluter-pays principle seeks to make the private sector bear the environmental costs arising from the high consumption of natural resources, as a way of compensating for the environmental damage caused. The user-pays principle was recognized by art. 4, second part of item VII, of the National Environmental Policy Law (PNMA).

The authors explain that, based on the idea that environmental goods are everyone's property, the State imputes to those who enjoy these goods for the purpose of profit a pecuniary value for that purpose. However, this does not mean that those who pay for this use will own the natural resources and use them as they see fit: the preservation of the environment is the guideline.

Democratic (or information) principle

For Giacomelli and Eltz (2018), the democratic principle guarantees the population the possibility of participating in public policies for environmental preservation, through some instruments provided for in the legislation.

This principle ensures citizen participation in protecting the environment, since each and every service improves when effectively charged by consumers. And with the environment and its preservation it does not happen otherwise (TRENNEPOHL, 2020).

Democratic participation has its constitutional seat in art. 225, § 1, VI, which states that to ensure the effectiveness of this right (to an ecologically balanced environment), it is incumbent upon the Government: "[...] VI – to promote environmental education at all levels of education and awareness for the preservation of the environment" (BRASIL, 1988).

Therefore, in order to ensure the democratic principle, citizens can take advantage of various forms of participation available to them, as guaranteed by the Federal Constitution.

Principle of prevention and precaution

The principle of prevention, as well as that of precaution, aims to protect and preserve the environment through defense measures that must be taken to achieve this purpose. However, the doctrine presents them differently.

For Trennepohl (2020), the principle of prevention is one in which the difficulty or impossibility of environmental repair is previously verified, that is, once the environmental damage has been accomplished, its repair is always uncertain or excessively costly. The main reason for this principle is the need for immediate cessation of some potentially polluting activities, due to the harmful results for the environment. This possibility of the result is what characterizes the principle of prevention.

According to that author, the precautionary principle applies to those cases in which the danger is abstract, from a state of potential danger, in which there are evidences that lead to consider a certain dangerous activity.

Guerra and Guerra (2014) distinguish them as follows: the precautionary principle is the one that establishes that one should not intervene in the environment before being sure that these will not be adverse to the environment; whereas the precautionary principle applies to environmental impacts that are already known and have a history of information about them. That is, while the former applies to impacts that are unknown; the second corresponds to the applicability of impacts that are already known. Thus, the basic distinction between the two boils down to one corresponding to a concrete danger (in the case of prevention) and the other to an abstract danger (in the case of precaution).

For Milaré (2020), the principle of prevention is distinguished from the principle of precaution because prevention has a broader concept than precaution and, in turn, precaution is the attitude or anticipatory measure directed preferably to concrete cases.

Still according to the understanding of Milaré (2020), the principle of prevention is fundamental in Environmental Law, concerning the priority that must be given to measures that prevent the birth of attacks on the environment, in order to reduce or eliminate the causes of actions susceptible of change its quality.

In this context, Giacomelli and Eltz (2018, p. 27-28) defend:

> One of the most important concepts in relation to sustainability and preservation of the environment is also one of the most controversial principles of Environmental Law, the precautionary principle, which deals with unknown risks in a given technology or innovation. With a very clear division between the application of this principle between the United States of America (weak conception) and the European Union (strong conception), this principle is a watershed in the implementation of technologies of genetically modified organisms and in human genetic manipulation for the treatment of diseases, for example, these concepts being: The concept of precaution is often confused with the concept of prevention, which deals with the management of risks known to the scientific community from the prohibition of practices or the obligation of technologies to mitigate these risks through accident prevention resources. Both principles are developments of principle 2 of the Rio Convention, which determines the prohibition of activities that cause damage to the environment within its borders or beyond them.

Thus, it can be said that the principle of prevention aims to avoid harmful interventions to the planet that may previously be known. The precautionary principle, on the other hand, aims to prevent those actions possibly harmful to the environment about which science has no knowledge and whose consequences, therefore, cannot be specified.

FEASIBILITY OF MITIGATION MEASURES

According to the words of Trennepohl (2020, p. 75), "the planet is, therefore, experiencing the decay of the 'Developmentalist State', when it finds its limits in the environmental issue with depleted resources". Therefore, it is urgent that measures be taken in order to implement sustainable development.

According to the author in question, the path is to find common solutions, investigating the risks of modern society, adapting the way of life, consumption and services, to less risky and polluting standards, adopting the correct public policies.

It is stressed that any measure to be taken must undergo a feasibility analysis.

In this vein, Santos e Silva (2015, p. 84) teach:

> The choice of locations for the implementation of structural interventions to mitigate environmental impacts on fauna must be carried out by a specialized team. Teams of biologists are assigned to investigate and determine the critical points that require the implementation of these measures, through continuous monitoring and evaluation of the landscape around the highway, the points with the highest incidence of animal crossings are identified [...].

According to the Brasília Environmental Institute (IBRAM) (BARSANO, 2019), the effectiveness of the mitigating measures adopted must be determined through a post-implementation monitoring program, aiming at corrective, supplementary measures or alteration of the mitigating measures.

For Lauxen (2012), post-construction monitoring is essential for evaluating the effectiveness of the measures adopted, detecting possible necessary adjustments and consolidating a knowledge base that will help future decision-making.

Thus, with the proper adoption of mitigating measures, traffic safety will be much greater, both for humans and for wildlife.

With regard to waste from animal carcasses which, as reported by the Public Prosecutor's Office, was disposed of along the road's right of way or in landfills unsuitable for receiving such waste, the conduct is environmentally inappropriate, as it is characterized as of great environmental impact, with a clear polluting capacity and also with a high risk to public health.

Disposal close to the highway's right of way or in domestic garbage landfills does not fit into any of the appropriate forms, as such areas are not suitable for receiving such waste. The defendants end up admitting free aggression to the environment, when they should dispense with greater rigidity in environmental protection, as declared by GAEMA (FONSECA, 2016).

Thus, animal disposal sites are potential sources of soil, surface and groundwater contamination.

Furthermore, waste, if not controlled, produces a high and negative environmental impact. It is essential, therefore, to manage waste correctly, when possible, minimizing pressure on natural resources as well as to avoid environmental degradation (BELTRÃO, 2014).

Determines art. 3 of Resolution No. 358 of the National Council for the Environment (CONAMA):

> Art. 3rd. It is up to health service waste generators and the legal guardian, referred to in art. 1 of this resolution, the management of waste from generation to final disposal, in order to meet environmental and public health and occupational health requirements, without prejudice to the joint liability of all those, individuals and legal entities that, directly or indirectly, cause or may cause environmental degradation, especially transporters and operators of treatment and final disposal facilities, under the terms of Law No. 6938, of August 31, 1981. (CONSELHO NACIONAL DO MEIO AMBIENTE, 2005).

Regarding the specific and environmentally appropriate destination, there are studies that indicate measures such as: autoclaving, incineration, sanitary landfill built within pre-established norms that guarantee the quality of the environment and that does not harm the air, composting and animal cemetery (BELTRÃO, 2014).

In this way, animal waste must be properly disposed of in appropriate places, avoiding the risk of contamination of the soil, groundwater, fauna and flora, as well as avoiding putting human health at risk. .

In addition, it is emphasized that the importance of biodiversity in the environment provides numerous benefits, which go beyond economic and social interests and which, although apparently insignificant, tend to be exhausted in a development that does not prioritize the sustainability of productive activities and anthropic actions (BARBOSA; VIANA, 2014). Sustainable development is "one that meets the needs of the present without compromising the ability of future generations to meet their own needs" (OLIVEIRA, 2017, p. 103).

With this, the harmonious and proportional coexistence between the economy and the environment is sought, enabling development in a sustainable, planned way, so that the currently existing resources do not run out or become useless. It means to say that economic development is fundamental for the country, however, this must be carried out in accordance with environmental preservation. According to Guerra e Guerra (2014, p. 113-114), "the dichotomy 'preserving the environment' and 'fostering economic development' is solvable if the parties proceed correctly without extremism".

FINAL CONSIDERATIONS

This manuscript aimed to address the issue of environmental impacts on wildlife caused by roads and the effectiveness of mitigating measures, due to the importance of understanding the very important aspects of this topic for the conservation of biodiversity.

It was found that human actions that influence the environment can lead to the extinction of wild fauna species, as well as interfere with the ecological balance, harming current and future generations.

Due to these impacts, ecosystems have been significantly altered, requiring measures that are actually observed regarding proper planning on the roads. To this end, it is essential that national and international policies are truly put into practice, as well as there must be a careful examination of road projects and inspection needs to be effective.

Common solutions must be found, considering all the risks and adapting ways of life to less impactful standards, using appropriate public policies for each case.

There are many measures to reduce the impacts caused by roads, however, they should be analyzed according to their feasibility to minimize the direct impacts of roads on different groups of fauna.

In view of the above, it was observed that it is necessary for the environment and economic development to have a harmonious, well-planned relationship, aiming to maintain

the currently existing resources so that they do not run out. And the legal system is the guarantor of the balance between these aspects, and the mitigating measures must be studied in advance and not forced to be implemented.

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