

Administrative Environmental Embargoes Based on Remote Sensing and Procedural Safeguards: Between Ecological Protection and Due Process of Law within the Framework of Brazilian Draft Bill No. 2564/2025

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Abstract

The purpose of this paper is to examine the constitutional and administrative-law implications of Brazilian Draft Bill No. 2564/2025, which proposes to regulate precautionary administrative measures in environmental enforcement and to restrict environmental embargoes based exclusively on remote sensing. The research problem consists in determining whether the requirement of prior notification and the prohibition of embargoes grounded solely on remote detection strengthen procedural safeguards or unduly reduce the effectiveness of ecological protection. The research hypothesis is that, although due process of law and procedural safeguards constitute essential limits on administrative police powers, the proposed restriction may weaken preventive and precautionary environmental governance when interpreted as an obstacle to immediate action against imminent or continuing environmental harm. The research adopts the hypothetico-deductive method. The methodological procedures include documentary analysis of the draft legislation, normative interpretation of Brazilian environmental legislation, and critical examination of the doctrinal debate concerning remote sensing, administrative embargoes, proportionality, precaution, and environmental constitutionalism. The preliminary results indicate that the core issue does not lie in the use of remote sensing as an evidentiary tool, but in the legal definition of the conditions under which precautionary administrative measures may be immediately imposed. The study therefore argues that environmental enforcement must reconcile technological effectiveness, ecological urgency, reasoned administrative decisions, and procedural safeguards, without transforming due process into a barrier to the State's con-

stitutional duty to prevent environmental degradation.

Keywords

Remote Sensing, Environmental Embargoes, Due Process of Law, Procedural Safeguards, Ecological Protection, Environmental Enforcement, Environmental Constitutionalism

1. Introduction

Before addressing the role of complexity, it is necessary to examine how the increasing use of remote sensing technologies in environmental enforcement has reshaped the capacity of public authorities to identify, monitor, and respond to ecological damage. Satellite images, georeferenced data, and digital monitoring systems have become relevant instruments for detecting deforestation, illegal suppression of vegetation, degradation of protected areas, and other environmental violations. In a country with continental dimensions, such as Brazil, these technological mechanisms have contributed to expanding the State's capacity to monitor territories that are difficult to inspect through traditional field operations. However, the legal use of remote sensing in environmental administrative proceedings raises a complex constitutional question: how should technological efficiency in ecological protection be reconciled with due process of law and procedural safeguards in the exercise of environmental police powers?

This debate gained particular relevance with Brazilian Draft Bill No. 2564/2025, which proposes to amend Law No. 9605/1998 in order to regulate precautionary administrative measures in environmental enforcement. The Draft Bill No. 2564/2025 seeks to add Article 72-A to the Environmental Crimes Law, establishing that, once environmental damage is verified, the inspection agent may adopt precautionary administrative measures to avoid the imminent aggravation of the damage, to interrupt its occurrence, and to safeguard environmental recovery. At the same time, the proposal states that such precautionary measures may not be used as an anticipation of the administrative sanctions provided for in Article 72 of Law No. 9605/1998. More specifically, the Draft legislation prohibits the imposition of an environmental embargo based exclusively on remote detection of an infraction resulting from suppression of vegetation, ensuring prior notification of the alleged offender so that explanations may be presented within a reasonable period before the measure is imposed.

The research problem therefore consists in determining whether the requirement of prior notification and the prohibition of environmental embargoes grounded solely on remote sensing strengthen procedural safeguards or, conversely, unduly reduce the effectiveness of ecological protection. The problem is not limited to the technical accuracy of satellite images or digital monitoring tools. Rather, it concerns the constitutional status of administrative environmental en-

forcement when technological evidence is used as the sole basis for measures that may immediately restrict property, economic activity, access to credit, and the lawful use of rural areas. In this regard, the debate requires a distinction between the admissibility of remote sensing as evidence and the legitimacy of imposing precautionary administrative measures without prior adversarial participation.

The objective of the investigation is to analyze the constitutional and administrative-law implications of Brazilian Draft Bill No. 2564/2025, with particular attention to the legal nature of environmental embargoes, the limits of environmental police powers, and the relationship between ecological urgency and procedural safeguards. More specifically, the study aims to examine whether the proposed Article 72-A establishes a legitimate balance between environmental protection and due process of law or whether it creates a normative obstacle to the immediate prevention of environmental harm. It also seeks to assess the extent to which remote sensing may serve as a sufficient evidentiary basis for administrative measures that produce severe legal and economic effects before the full development of an administrative proceeding.

The research hypothesis is that due process of law constitutes essential constitutional limits on the exercise of administrative police powers, including in environmental matters. Nevertheless, the proposed restriction may weaken preventive and precautionary environmental governance if interpreted as an absolute barrier to immediate administrative action in cases of imminent, ongoing, or aggravated environmental damage. Thus, the hypothesis adopted is not that remote sensing should be disregarded, nor that procedural guarantees should be suppressed. Rather, it is that environmental enforcement must be structured through a constitutionally adequate model capable of distinguishing between urgent precautionary measures, which may be justified by ecological risk, and administrative sanctions, which require prior or subsequent procedural guarantees compatible with the severity of the measure imposed.

The study adopts the hypothetico-deductive method. It begins with the hypothesis that the constitutional controversy cannot be resolved by giving absolute priority either to environmental protection or to due process of law. From this premise, the research tests whether the normative design proposed by Draft Bill No. 2564/2025 offers a proportional solution to the conflict between ecological effectiveness and procedural legality. The methodological procedures include documentary analysis of the legislative text, normative interpretation of Brazilian environmental legislation, and critical examination of the doctrinal debate concerning remote sensing, administrative embargoes, proportionality, precaution, environmental constitutionalism, and administrative sanctioning law. The analysis also considers the distinction between precautionary administrative measures and administrative sanctions, since this distinction is decisive for determining the intensity and timing of procedural safeguards.

The preliminary results indicate that the central legal issue does not lie in the use of remote sensing as an environmental monitoring or evidentiary tool. Re-

remote sensing is compatible with constitutional environmental protection and may significantly enhance State action against deforestation and ecological degradation. The decisive question concerns the legal conditions under which an environmental embargo may be imposed immediately when remote detection is the only evidentiary basis. A constitutionally adequate interpretation must therefore avoid two extremes: on the one hand, turning technological environmental enforcement into a mechanism of automatic administrative restriction without individualized reasoning or procedural safeguards; on the other hand, transforming due process of law into a formal barrier that prevents timely State action against environmental harm.

Therefore, the investigation argues that the legislative text should be analyzed through a framework of constitutional balancing. Environmental governance requires technological effectiveness, rapid response capacity, and precautionary tools capable of preventing the continuation or aggravation of ecological harm. Nevertheless, the Rule of Law requires reasoned administrative decisions, proportionality, legality, and procedural safeguards for individuals and legal entities affected by restrictive State measures. The constitutional challenge is not to choose between ecological protection and due process of law, but to construct an administrative model in which both operate as mutually reinforcing requirements of legitimate environmental enforcement.

For the purposes of this study, constitutional balancing is conducted through a four-part analytical test. First, urgency requires concrete indications that environmental harm is imminent, ongoing, or likely to worsen before the ordinary administrative proceeding can be completed. Second, proportionality requires the measure to be suitable and necessary, as well as a reasonable correspondence between the scope and duration of the embargo and the ecological risk to be prevented. Third, evidentiary sufficiency requires technically reliable remote data capable of identifying the affected area, the temporal proximity of the detected event, the continuity or currentness of the harmful conduct, and the risk of aggravation. Fourth, procedural safeguards require an individualized and reasoned decision, prompt notification, access to the supporting evidence, an effective opportunity to contest the measure, and rapid administrative review. Immediate action is constitutionally legitimate only when these criteria, considered together, demonstrate that delay would materially compromise ecological protection.

2. Constitutional Ecological Protection, Environmental Police Powers and Remote Sensing

The constitutional analysis of administrative environmental embargoes based on remote sensing must begin with the legal status conferred on environmental protection by the Brazilian Federal Constitution of 1988. The protection of the environment is not only a programmatic directive, nor a sectoral administrative policy subject to unrestricted legislative discretion. It is part of the constitutional structure of the Brazilian Rule of Law, since Article 225 establishes the right to an eco-

logically balanced environment as a fundamental right of both individuals and the community, while also imposing duties of protection on the State and society (Brasil, 1988). In this regard, Sarlet and Fensterseifer (2020, p. 45) state that the constitutionalization of environmental protection by the Federal Constitution of 1988, especially Article 225, conferred centrality upon ecological values, principles, and rights within the Brazilian legal system. They also maintain that the constitutional status of the fundamental right to an ecologically balanced environment places ecological values at the “heart” of the legal system, influencing all branches of law and limiting other rights, principles, interests, and legal positions when necessary.

This legal framework is decisive for understanding the legitimacy of environmental police powers. If environmental protection is simultaneously a State objective and a fundamental right, public authorities are not merely authorized to act against environmental degradation; they are constitutionally required to do so. Thus, Sarlet and Fensterseifer (2020, p. 45) argue that the objective and duties of environmental protection bind all State powers—Legislative, Executive, and Judiciary—to act according to this constitutional normative guideline, within the framework of a Democratic, Social, and Ecological Rule of Law. This means that environmental enforcement, including monitoring, inspection, administrative precautionary measures, and sanctions, must be interpreted as institutional instruments for fulfilling a constitutional duty rather than as optional administrative choices.

Brasil (2023, p. 6) also emphasizes that Articles 225 and 5, paragraph 2, of the Federal Constitution of 1988 recognize the environment as a fundamental right held by both individuals and the community, while also establishing environmental protection as a fundamental objective and task of the Brazilian Socio-Environmental Rule of Law. As a result, the State is under a constitutional duty to adopt legislative and administrative measures capable of ensuring the effective protection and enjoyment of this fundamental right. This approach is particularly relevant to the debate on Draft Bill No. 2564/2025, since any legislative restriction on precautionary administrative measures must be assessed not only taking into account the procedural safeguards granted to the alleged offender, but also in view of the State’s constitutional duty to prevent ecological degradation.

Remote sensing should therefore be understood within the broader constitutional framework of prevention, precaution, and ecological governance. Satellite images, georeferenced data, and digital monitoring systems are not merely technological conveniences used by environmental agencies. They are instruments that expand the State’s capacity to identify environmental damage, detect suppression of vegetation, monitor areas of difficult physical access, and respond more rapidly to ecological risks. From this perspective, remote sensing may be included among the contemporary instruments of environmental police power, especially because environmental police power includes “measures of control and inspection of polluting actions” and other measures aimed at the effectiveness of environ-

mental legislation and environmental rights (Sarlet & Fensterseifer, 2020, pp. 53-54).

Recent international research reinforces this institutional role of remote sensing. Chugg et al. (2021) demonstrate that near-real-time satellite monitoring can augment environmental enforcement by identifying early indications of noncompliance and prioritizing scarce inspection resources. At the same time, Maniadaki et al. (2021) show that the use of remote sensing in environmental law must remain compatible with proportionality, purpose limitation, privacy protection, and adequate institutional safeguards. These contributions support a model in which technological monitoring strengthens the State's informational capacity without automatically determining the restrictive legal consequence to be imposed.

The preventive function of remote sensing becomes even clearer when environmental protection is connected to the precautionary principle. Sarlet and Fensterseifer (2020, pp. 54-55) maintain that, under the precautionary principle, the State must guide its action in order to anticipate and avoid the occurrence of environmental damage. This constitutional orientation is compatible with the use of monitoring and immediate-alert mechanisms capable of detecting serious environmental risks and triggering urgent responses. Although the authors discuss such mechanisms in the broader field of ecological and climate protection, the same reasoning applies to remote sensing in cases of illegal deforestation or suppression of vegetation. Where environmental damage may be ongoing, cumulative, or difficult to reverse, technological detection may serve as a constitutionally relevant basis for administrative action.

The climate dimension reinforces this conclusion. Sarlet and Fensterseifer (2023, p. 45) argue that the climate system should be recognized as a legal good of constitutional status, endowed with special protection under the Federal Constitution of 1988. They also emphasize that the list of State duties under Article 225, paragraph 1, is merely illustrative and remains open to new duties required by comprehensive environmental protection, especially in view of new risks and threats arising from technological development and human intervention in nature (Sarlet & Fensterseifer, 2023, p. 59). This argument is important because remote sensing is itself a technological response to intensified and territorially dispersed forms of environmental degradation. It allows the State to confront deforestation, land-use changes, and ecological harm with greater informational capacity and institutional speed.

However, the constitutional importance of remote sensing does not eliminate the need for legality, proportionality, reasoned administrative decisions, and procedural safeguards. Environmental police power is not equivalent to unrestricted administrative power. It must be exercised through individualized assessment of risk and procedural mechanisms capable of preventing arbitrariness. This concern is reflected in Draft Bill No. 2564/2025, which provides that precautionary administrative measures may not be used as an anticipation of the sanctions set forth in Article 72 of Law No. 9605/1998, under penalty of nullity, and also prohibits the

imposition of an environmental embargo based exclusively on remote detection of vegetation suppression without prior notification and an opportunity for clarification by the affected party (Brazil, Chamber of Deputies, 2025, p. 1). The point is not to transform remote detection into automatic administrative punishment, but to recognize that technological evidence may justify precautionary measures when the situation reveals urgency, risk of aggravation, or continuity of environmental harm.

The distinction between precautionary measures and administrative sanctions is essential in this regard. The justification of the legislative text expressly states that sanctions have a punitive purpose, whereas precautionary administrative measures do not have a punitive nature, but rather a protective or securing function, with urgency as their defining premise (Brazil, Chamber of Deputies, 2025, p. 2). The same justification refers to Administrative Legal Guideline No. 32/2012/PFE/IBAMA to support the distinction between immediate precautionary measures and sanctions imposed after adversarial proceedings and full defense, adding that environmental enforcement is not merely punitive, but also seeks to prevent avoidable environmental harm (Brazil, Chamber of Deputies, 2025, p. 3). Therefore, if the embargo is used as punishment, stronger prior procedural guarantees are required; if it is used as a precautionary measure in the face of ongoing or imminent environmental damage, its legitimacy may depend on urgency, proportionality, reasoned justification, and subsequent adversarial review.

In operational terms, the distinction between a precautionary embargo and a punitive sanction may be identified through four objective indicators. First, timing: the precautionary embargo is adopted before the final determination of administrative liability, whereas the sanction is imposed at the conclusion of the sanctioning proceeding. Second, purpose: the embargo seeks to interrupt, contain, or prevent environmental harm, while the sanction seeks to punish an established violation. Third, evidentiary threshold: the precautionary measure may be supported by qualified preliminary evidence demonstrating urgency and risk, whereas the punitive sanction requires a fuller evidentiary basis compatible with a definitive finding of liability. Fourth, reviewability: the precautionary embargo must remain provisional and subject to prompt technical and administrative reassessment, while the sanction results from a final administrative decision and is subject to the ordinary system of administrative and judicial review.

Therefore, Brasil (2023, pp. 14-15) argues that the principle of ecological non-regression, together with the principles of prevention and precaution, must guide public action in environmental matters, since the right to a healthy and balanced environment must be ensured for both present and future generations. This reasoning may be transposed to the discussion of the proposal: a legislative restriction on embargoes based exclusively on remote detection cannot be examined only as a procedural guarantee. It must also be evaluated according to whether it reduces the effectiveness of preventive environmental governance.

The structural dimension of environmental protection further supports this interpretation. [Bambirra and Brasil \(2021, p. 2\)](#) observe that the right to an ecologically balanced environment is often neglected and that the State should ensure preventive means for environmental preservation, since the reparation of ecological damage is usually uncertain and therefore requires effective environmental protection policies. They also argue that environmental violations and degradation result from structural failures of the State and of the responsible institutions, requiring flexible structural measures to guarantee the right to an ecologically balanced environment for present and future generations ([Bambirra & Brasil, 2021, p. 17](#)). From this perspective, remote sensing is not only an evidentiary technique; it is part of the institutional infrastructure necessary to overcome structural deficits in environmental enforcement.

Accordingly, the constitutional reading of remote sensing must avoid two opposite distortions. The first would be to treat remote detection as sufficient in every case for imposing restrictive administrative measures, regardless of justification, proportionality, urgency, or the possibility of administrative review. The second would be to require prior adversarial proceedings in all situations, even when ecological harm is ongoing, imminent, or likely to become irreversible. Both extremes are constitutionally inadequate. The first risks converting environmental police power into automated restriction; the second risks transforming due process into a formal obstacle to the State's duty of ecological protection, which derives from the constitutional status of environmental protection, the precautionary principle, and the principle of ecological non-regression ([Sarlet & Fensterseifer, 2020; Brasil, 2023](#)).

Hence, the most constitutionally adequate approach is one of integration. Remote sensing should be recognized as a legitimate and necessary instrument of environmental police power, especially in a country marked by extensive territory, recurrent deforestation, and structural enforcement limitations. At the same time, its use must be accompanied by reasoned administrative decisions, technical consistency, proportionality, clear identification of the area affected, and procedural opportunities for clarification and review, as required by the distinction between precautionary administrative measures and administrative sanctions under the legislative proposal ([Brazil, Chamber of Deputies, 2025](#)). Ecological protection and due process of law should not be treated as mutually exclusive constitutional values. Properly understood, both operate as conditions for legitimate environmental enforcement under the Federal Constitution of 1988, particularly in view of the structural deficits that affect the effective protection of the right to an ecologically balanced environment ([Bambirra & Brasil, 2021](#)).

3. Administrative Environmental Embargoes, Evidentiary Sufficiency and Procedural Safeguards under Draft Bill No. 2564/2025

The Brazilian Draft Bill No. 2564/2025 places the debate on remote sensing within

the broader legal regime of precautionary administrative measures in environmental enforcement. The proposed Article 72-A authorizes the inspection agent, once environmental damage has been verified, to adopt precautionary administrative measures to prevent the imminent aggravation of the damage, interrupt its occurrence, and safeguard environmental recovery. At the same time, the proposal states that such measures may not be used as an anticipation of the administrative sanctions provided for in Article 72 of Law No. 9605/1998. It also prohibits the imposition of an embargo based exclusively on remote detection of an infraction arising from vegetation suppression, ensuring prior notification of the alleged offender and the possibility of providing explanations within a reasonable period before the measure is imposed (Brazil, Chamber of Deputies, 2025, p. 1).

The draft legislation therefore seeks to regulate a sensitive point of environmental administrative law: the distinction between precautionary measures and sanctions. Its justification expressly states that sanctions are aimed at punishing unlawful conduct, whereas precautionary administrative measures do not have a punitive nature, but rather a protective function, with urgency as their defining premise (Brazil, Chamber of Deputies, 2025, p. 2). This distinction is decisive because the legal legitimacy of an environmental embargo depends on its function in the concrete case. If it is imposed to interrupt an ongoing risk or avoid the aggravation of environmental damage, it operates as a precautionary measure. If, however, it is used as a definitive response to an unlawful act, it assumes the character of an administrative sanction and requires a different procedural intensity.

Administrative precautionary measures may be understood as concrete measures adopted by competent public agents, in the exercise of the administrative function, usually in relation to determined individuals or legal entities, due to situations of risk and with the provisional purpose of minimizing or preventing damage to legally protected interests (Cabral, 2021, pp. 41-42; Tonon Neto, 2025, p. 14). This definition is particularly important for remote sensing because satellite images, georeferenced data, drones, and digital monitoring systems do not determine, by themselves, the legal nature of the administrative response. Their relevance depends on whether the evidence supports an urgent, provisional, and protective action or whether it is being used as an automatic substitute for the administrative determination of liability.

The legal regime of administrative precautionary measures requires more than factual detection. It requires legal authorization, connection with the effectiveness of administrative action, and observance of constitutional safeguards. In this regard, the requirements of precautionary administrative measures include *periculum in mora*, *fumus boni iuris*, motivation, proportionality, adversarial proceedings, full defense, and respect for constitutional limits (Tonon Neto, 2025, pp. 32-33). Thus, remote sensing may form part of the evidentiary basis for an environmental embargo, but it cannot dispense with reasoned administrative justification, individualized assessment of risk, and proportionality. The decisive issue is not whether the evidence was produced remotely, but whether it demonstrates,

in the concrete case, urgency, current risk, continuity of harm, or imminent aggravation capable of justifying a restrictive measure before the ordinary development of the administrative proceeding.

This caution is also necessary because administrative precautionary measures may produce significant practical effects. If the anticipation of the practical effects of a final punitive decision is treated as a precautionary measure, there is a risk that the measure may operate as an anticipated sanction. Such an interpretation is incompatible with due process of law, which also applies to administrative proceedings (Tonon Neto, 2025, pp. 26-27). The Draft Bill directly reflects this concern by stating that precautionary administrative measures may not be used as instruments for anticipating sanctions, under penalty of nullity of the proceeding (Brazil, Chamber of Deputies, 2025, pp. 1-2).

At the same time, environmental administrative responsibility cannot be understood through a merely punitive lens. It is primarily oriented toward the prevention of environmental damage, while civil liability seeks reparation or compensation and criminal liability is directed toward punishment. The administrative sphere is especially relevant because the Executive branch is closer to the damaging event and usually has specialized environmental technical staff, which may enable faster and more effective responses in environmental protection (Fonseca & Ruschel, 2021, p. 406). This preventive orientation supports the use of remote sensing as an instrument capable of expanding the State's capacity to identify environmental harm and respond to ecological risks in a timely manner.

However, the preventive function of administrative environmental enforcement does not authorize automatic restrictions. Embargoes and suspensions may appear both as administrative sanctions and as precautionary administrative measures. As precautionary measures, they may be adopted by inspection agents at the time of the infraction notice and may produce immediate effects, since acts of administrative police power are not conditioned on prior judicial authorization. Nevertheless, because embargoes and suspensions have immediate effects and are among the most severe measures in the administrative environmental sphere, their adoption requires caution and guiding criteria (Fonseca & Ruschel, 2021, pp. 407-408). This reasoning is central to the legislative proposal: the legal problem does not lie in the use of remote sensing itself, but in the possibility of imposing a highly restrictive administrative measure without sufficient justification, proportionality, and procedural control.

The procedural moment in which the measure is adopted also matters. Administrative measures of embargo or suspension are adopted at the initial stage of the administrative infraction proceeding, usually by the inspection agent, while administrative sanctions are imposed at the end of the proceeding by the competent environmental authority. Measures adopted during inspection must be assessed in the administrative judgment and may either be confirmed as sanctions or reviewed (Fonseca & Ruschel, 2021, pp. 409-410). This structure allows an interpretation that reconciles environmental urgency with procedural guarantees: an em-

bargo may be immediate when the legal requirements of precaution are present, but it must remain subject to review, technical verification, and adversarial control.

The specific legal nature of the environmental embargo confirms this need for differentiation. The embargo of works, activities, and their respective areas is provided for as a precautionary measure in Article 101, item II, paragraph 4, and Article 108 of Decree No. 6514/2008, while it is also provided for as a sanction in Article 72, item VII and paragraph 7, of Law No. 9605/1998 and Articles 15, 15-A, 15-B, 16, paragraph 2, 16-A, 17 and 18 of Decree No. 6514/2008 (Tonon Neto, 2025, p. 72). As a precautionary measure, the embargo is imposed under summary cognition, at the beginning or during the administrative inspection proceeding, with the purpose of preventing the continuation of a given action or activity (Tonon Neto, 2025, pp. 72-73). However, the precautionary embargo cannot be conceived as an automatic consequence of the mere verification of an apparent administrative irregularity (Tonon Neto, 2025, p. 73).

This requirement of non-automatic application is directly related to evidentiary sufficiency. The precautionary embargo presupposes the need to avoid the consummation or perpetuation of an unlawful situation or the aggravation of the practical result of the conduct considered unlawful by the inspection authority. It also requires that the action to be prevented represent an imminent risk to the environment or to human health and that it be related to current conduct, contemporaneous with the inspection (Tonon Neto, 2025, p. 73). Therefore, remote sensing evidence should not be treated as legally irrelevant, but neither should it be treated as automatically sufficient. It must be connected to a reasoned administrative finding capable of identifying the affected area, the current or imminent risk, the continuity of harm, and the necessity of the embargo (Brazil, Chamber of Deputies, 2025).

Accordingly, before an immediate embargo based on remote sensing may be considered lawful, the administrative record should contain, at a minimum: precise geospatial delimitation of the affected area; reliable identification of the date or period in which the environmental alteration occurred; evidence of temporal proximity between the detected event and the administrative intervention; indications that the harmful conduct is ongoing or continues to produce effects; demonstration of a concrete risk that the damage may be aggravated if the authority postpones action; and a technically reasoned connection between the remote evidence, the area subject to restriction, and the necessity of the embargo. These minimum elements do not require a definitive determination of liability, but they must be sufficiently consistent to justify an exceptional and immediately restrictive measure.

The evidentiary assessment must also address the technical and legal vulnerabilities of satellite-derived information. Zhang et al. (2024) identify challenges involving the authenticity, accuracy, interpretation, attribution, and admissibility of satellite evidence, while York et al. (2023) emphasize the justice and ethical impli-

cations of conservation remote sensing. Applied to immediate embargoes, these concerns require the administrative authority to preserve source metadata, explain the analytical method used, identify relevant margins of error, and establish a traceable connection between the image, the location, the time of detection, and the regulated conduct.

The distinction between embargo and suspension further refines the analysis. Embargo is more closely associated with the installation of undertakings, such as the opening of roads, the installation of gas stations, vegetation suppression, and similar works, whereas suspension of activities is directed toward undertakings already in operation that offer imminent danger to public health or serious risk of environmental damage (Fonseca & Ruschel, 2021, p. 411). In cases of vegetation suppression detected by remote sensing, this distinction is relevant because the embargo usually concerns a spatially identifiable area. The administrative authority must therefore demonstrate the connection between the detected environmental interference and the area subject to restriction, avoiding measures that are broader than necessary or insufficiently connected to the evidence obtained.

Proportionality is another indispensable criterion. The principles of prevention and precaution must be analyzed together with the administrative-law principle of proportionality when embargoes or suspensions are applied. These measures are designed to prevent known damage and to anticipate uncertain or unknown damage, but their application requires an assessment of both the seriousness of the potential harm to be avoided and the consequences produced by the precautionary measure itself (Fonseca & Ruschel, 2021, pp. 412-413). Thus, the administrative authority must assess not only the ecological risk but also the burden imposed on the alleged offender. This requirement prevents remote sensing from being converted into a mechanism of automatic restriction and requires a proportional relationship between the evidence, the scope of the embargo, and the environmental purpose pursued.

Leonelli (2021) contributes to this balance by framing the precautionary principle as an internal limit on regulatory discretion and by emphasizing the role of judicial review in determining whether risk-based measures are insufficiently protective or disproportionately restrictive. Within the framework of Draft Bill No. 2564/2025, this approach supports scrutiny of both administrative inaction and excessive intervention: the authority must demonstrate that the embargo responds to a credible ecological risk, is suitable and necessary for its protective purpose, and rests on an evidentiary record capable of effective administrative and judicial review.

The criteria for the application of embargoes and suspensions also reveal the need for caution in legislative and administrative design. Many state laws treat the absence of an environmental license, or the exercise of an activity in disagreement with the license obtained, as sufficient grounds for embargo, while suspension generally requires risk or danger to the environment or public health. The criteria for suspension appear more reasonable because they require the configuration of

some consequence, whereas the absence of an environmental license does not always imply such risk (Fonseca & Ruschel, 2021, pp. 422-423). This reasoning may be applied to remote sensing: the detection of vegetation suppression is relevant, but the restrictive measure must still be justified by the concrete risk, the continuity of the harmful conduct, and the need for immediate intervention.

The technological dimension of this debate reinforces the same conclusion. Technology must operate in combination with human intelligence because technological processes are also subject to failures and the interpretation of legal norms remains dependent on human knowledge. Artificial intelligence, drones, mapping tools, and other technological mechanisms may assist technical agents and increase the efficiency and effectiveness of environmental procedures (Vilaça et al., 2021, p. 33). Nevertheless, complete reliance on machines to the detriment of human intelligence may be dangerous, especially because the ability of artificial intelligence to predict catastrophic events and the level of failures in equipment remain uncertain (Vilaça et al., 2021, pp. 33-34). Applied to remote sensing, this means that technological evidence should strengthen environmental enforcement, but it must remain subject to expert assessment, legal reasoning, and procedural review.

The argument may also be situated within the broader scholarly dialogue already represented in the reference base of this study. Constitutional environmental protection and precaution establish the normative duty to act; the analysis of structural institutional failures explains the need for effective enforcement capacity; the legal theory of administrative precautionary measures defines the limits of provisional intervention; studies on embargoes and suspensions identify the criteria of urgency, risk, and proportionality; and the discussion of technological instruments emphasizes both their contribution to administrative effectiveness and the continuing need for qualified human assessment. Read together, these approaches support an integrated model in which remote sensing strengthens environmental enforcement without replacing legal reasoning, individualized motivation, or procedural control (Sarlet & Fensterseifer, 2020; Bambirra & Brasil, 2021; Cabral, 2021; Fonseca & Ruschel, 2021; Tonon Neto, 2025; Vilaça et al., 2021).

The Draft Bill No. 2564/2025 must also be analyzed from the perspective of the principle of ecological non-regression, understood as a prohibition of ecological backsliding, and the duty of progressivity in environmental matters. This principle is relevant to the assessment of the legislative proposal that affects environmental protection, since constitutional provisions concerning the right to an ecologically balanced environment must be understood as forming a hard normative core that cannot be suppressed or reduced by legislators, administrative authorities, or courts in concrete cases. The principle of ecological non-regression and the duty of progressivity also operate as hermeneutic parameters when courts examine normative or administrative acts that reduce the level of environmental protection (Brasil & Vasconcelos, 2022, p. 26). This perspective prevents the discussion from being reduced to a simple opposition between technology and due

process of law.

Accordingly, the adequate interpretation of Draft Bill No. 2564/2025 is not one that excludes remote sensing from environmental enforcement, but one that regulates the legal consequences that may derive from it. Remote sensing should be recognized as a legitimate evidentiary and monitoring tool, especially in cases involving deforestation, vegetation suppression, and territorially dispersed ecological harm. At the same time, the embargo must be supported by a reasoned administrative decision that demonstrates the connection between the remote evidence, the affected area, the current or imminent risk, and the necessity of the measure. The measure should not operate as an anticipated sanction, nor should due process be transformed into a formal barrier to urgent ecological protection. The proper balance lies in treating remote sensing as a qualified technical indication that may justify precautionary administrative action when combined with urgency, proportionality, individualized reasoning, and procedural safeguards compatible with the concrete risk involved (Brazil, Chamber of Deputies, 2025).

The strongest counterargument in favor of prior notification is that remote sensing may involve interpretive errors, temporal mismatches, imprecise delimitation, or an insufficient connection between the detected alteration and the person identified as responsible. Because an embargo may severely restrict property use, economic activity, access to credit, and the operation of rural undertakings, a prior opportunity to provide explanations can prevent erroneous or disproportionate administrative restrictions. This objection is persuasive in ordinary cases and supports prior notification as the general rule. Nevertheless, it should not operate as an absolute requirement when technically reliable evidence demonstrates imminent, ongoing, or rapidly aggravating environmental harm, since the delay necessary for prior participation may permit irreversible damage. In these limited high-risk situations, immediate action remains justified only if it is exceptional, narrowly tailored, expressly reasoned, followed by prompt notification, and subject to expedited administrative review.

In practical terms, the proposed interpretation requires environmental enforcement agencies to document the constitutional balancing test in each immediate embargo, clearly recording the evidence of urgency, the minimum remote-sensing elements, the proportionality of the territorial and temporal scope of the measure, and the reasons why prior notification would compromise ecological protection. Agencies should also establish rapid post-embargo review procedures, provide regulated parties with access to the technical evidence and an effective channel for correction or clarification, and reassess the measure as soon as new information is produced. For regulated parties, this model increases predictability by identifying the factual and legal grounds that must support immediate intervention. For judicial scrutiny, it provides objective parameters to distinguish a legitimate precautionary response from an automated, excessive, or prematurely punitive restriction.

A comparative enforcement perspective further indicates that legitimacy de-

depends on the fairness, transparency, and accountability of regulatory implementation. [Hervé Espejo and Inostroza Skaric \(2025\)](#) argue that environmental justice must extend to enforcement law and policy, rather than remaining confined to planning and licensing decisions. Accordingly, agencies applying remote-sensing evidence should adopt consistent standards, provide accessible reasons and effective review mechanisms, and avoid enforcement patterns that impose disproportionate burdens without adequate evidentiary justification.

4. Concluding Comments

From this analysis, it follows that the research examined the constitutional and administrative-law implications of Brazilian Draft Bill No. 2564/2025, especially with regard to the regulation of precautionary administrative measures in environmental enforcement and the proposed restriction on environmental embargoes based exclusively on remote sensing. More specifically, the study sought to analyze the legal nature of environmental embargoes, the limits of environmental police powers, the evidentiary role of remote sensing, and the relationship between ecological urgency and procedural safeguards.

The research problem consisted in determining whether the requirement of prior notification and the prohibition of environmental embargoes grounded solely on remote detection strengthen due process of law and procedural safeguards or, conversely, unduly reduce the effectiveness of ecological protection. The analysis demonstrated that the problem cannot be properly resolved through an abstract opposition between technological environmental enforcement and the rights of the alleged offender. The core legal issue does not lie in the admissibility of remote sensing as evidence, but in the definition of the legal conditions under which a restrictive precautionary administrative measure may be immediately imposed.

The hypothesis was therefore confirmed in qualified terms. Due process of law, legality, proportionality, and reasoned administrative decision-making constitute essential constitutional limits on the exercise of environmental police powers. However, the proposed restriction may weaken preventive and precautionary environmental governance if it is interpreted as an absolute barrier to immediate administrative action in cases of imminent, ongoing, or aggravated environmental harm. Thus, the hypothesis is confirmed considering as procedural safeguards cannot neutralize the State's constitutional duty to prevent ecological degradation. This conclusion is consistent with the constitutional understanding that environmental protection imposes binding duties on public authorities and requires preventive action against structural ecological degradation ([Sarlet & Fensterseifer, 2020, 2023](#); [Brasil, 2023](#); [Bambirra & Brasil, 2021](#)).

The study also confirmed that remote sensing should not be treated either as legally irrelevant or as automatically sufficient. Satellite images, georeferenced data, drones, mapping tools, and digital monitoring systems may operate as legitimate technical and evidentiary instruments for environmental enforcement, par-

ticularly in cases of deforestation, vegetation suppression, and territorially dispersed ecological harm. Nevertheless, technological evidence must be accompanied by individualized administrative reasoning, technical consistency, proportionality, clear identification of the affected area, and procedural opportunities for clarification and review. Remote sensing may therefore justify precautionary administrative action only when connected to urgency, current risk, continuity of harm, or imminent aggravation. It also corresponds to the view that technological instruments may strengthen administrative effectiveness only when combined with qualified human assessment, technical verification, and legal control (Vilaça et al., 2021).

The distinction between precautionary administrative measures and administrative sanctions proved decisive for the development of the research. The environmental embargo may assume different legal functions depending on its purpose, timing, and evidentiary basis. When used to interrupt ongoing harm or prevent the aggravation of environmental damage, it operates as a precautionary measure. When used as a definitive response to unlawful conduct, it assumes a punitive nature and must be subject to the procedural intensity required for administrative sanctions. For this reason, the draft legislation should not be interpreted as excluding remote sensing from environmental enforcement, but as requiring that the legal consequences derived from remote detection be properly justified and procedurally controlled. This functional distinction is supported by the Brazilian administrative-law literature, which associates precautionary measures with urgency, provisional protection, and subsequent review, while punitive sanctions require the procedural guarantees applicable to the final determination of liability (Cabral, 2021; Fonseca & Ruschel, 2021; Tonon Neto, 2025).

Methodologically, the hypothetico-deductive approach proved useful because it allowed the initial hypothesis to be tested against the normative design of Draft Bill No. 2564/2025, the constitutional foundations of ecological protection, the preventive function of environmental administrative responsibility, and the procedural guarantees applicable to restrictive administrative measures. Starting from the premise that neither ecological protection nor due process of law may be treated as absolute, the research demonstrated the need for an integrative model capable of reconciling technological effectiveness, ecological urgency, evidentiary sufficiency, proportionality, and procedural safeguards.

A further result concerns the evidentiary *status* of remote sensing within the most constitutionally adequate interpretation of the draft legislation, which should be understood as one of balance and integration. The proposal may contribute to preventing automatic embargoes and strengthening procedural guarantees if interpreted as a requirement of motivation, technical verification, proportionality, and opportunity for clarification. However, it may generate a risk of insufficient ecological protection if interpreted as a rigid obstacle to urgent precautionary action in situations of ongoing or imminent environmental harm. Therefore, ecological protection and due process of law should not be treated as mutu-

ally exclusive constitutional values. Properly understood, both operate as complementary conditions for legitimate environmental enforcement under the Brazilian constitutional order. This integrative interpretation is also compatible with the principles of prevention, precaution, and ecological non-regression, which require the preservation of effective levels of environmental protection without excluding legality and procedural guarantees (Brasil, 2023; Brasil & Vasconcelos, 2022).

In dialogue with the Brazilian constitutional and administrative-law foundations identified above, the international contributions incorporated into the study reinforce two complementary conclusions. Chugg et al. (2021) and Maniadaki et al. (2021) confirm that remote sensing may improve the early detection of environmental violations and the allocation of limited inspection resources, while its legal use must remain constrained by proportionality, purpose limitation, and institutional safeguards. Zhang et al. (2024) and York et al. (2023) further demonstrate that evidentiary sufficiency cannot be separated from technical traceability, methodological transparency, disclosed margins of uncertainty, and the justice implications of technologically mediated enforcement. Accordingly, remote evidence may support an immediate embargo not because of its technological character alone, but because it provides a reliable, spatially and temporally individualized, technically explainable, and reviewable basis for concluding that environmental harm is ongoing, imminent, or at risk of aggravation.

Leonelli (2021) and Hervé Espejo and Inostroza Skaric (2025) broaden this conclusion from evidentiary reliability to the legitimacy of environmental governance. The precautionary principle supports timely intervention in the presence of credible ecological risk, but it also subjects administrative discretion to scrutiny regarding suitability, necessity, proportionality, and the adequacy of the evidentiary record. Likewise, environmental justice requires consistent enforcement standards, accessible reasons, non-arbitrary implementation, and effective administrative and judicial review. In the Brazilian context, these contributions support a model in which an immediate embargo remains lawful in limited high-risk situations, provided that urgency is specifically demonstrated, the measure is no broader than necessary, and prompt post-embargo review is available to correct technical or legal error.

Accordingly, the Brazilian and international sources converge on a common normative conclusion. The constitutional duty of ecological protection and the preventive function of environmental police powers (Sarlet & Fensterseifer, 2020, 2023; Brasil, 2023; Bamberra & Brasil, 2021) must be operationalized through administrative measures whose purpose, timing, evidentiary basis, proportionality, and reviewability are clearly identified (Cabral, 2021; Fonseca & Ruschel, 2021; Tonon Neto, 2025). At the same time, technological efficiency cannot displace human assessment and procedural accountability (Vilaça et al., 2021). This convergence strengthens the paper's central finding that remote sensing may lawfully support an immediate embargo only when it forms part of a reasoned, technically

verifiable, proportionate, and promptly reviewable administrative decision.

This research is subject to three principal limitations. First, it is doctrinal and normative in nature, relying on legislative, legal, and bibliographical analysis rather than empirical observation of enforcement practices. Second, Draft Bill No. 2564/2025 remains under legislative consideration and may be amended, approved with modifications, or rejected, which may alter the normative premises examined here. Third, the research does not test how environmental agencies or courts apply the proposed criteria in concrete cases, including the technical reliability of different remote-sensing systems, the duration of post-embargo review, or the effects of restrictive measures on regulated parties. These limitations indicate the need for future empirical and case-law research, without diminishing the usefulness of the constitutional and administrative parameters developed in this study.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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