

70

Presentation date: October, 2021
Date of acceptance: December, 2021
Publication date: January, 2022

SYSTEM OF PAYMENTS

FOR ECOSYSTEM SERVICES WITHIN THE FRAMEWORK OF CLIMATE CHANGE MITIGATION POLICIES: A LEGAL-DOCUMENTARY ANALYSIS

SISTEMA DE PAGOS POR SERVICIOS ECOSISTÉMICOS EN EL MARCO DE LAS POLÍTICAS DE MITIGACIÓN DEL CAMBIO CLIMÁTICO: UN ANÁLISIS JURÍDICO-DOCUMENTAL

Rolando Medina Peña¹

E-mail: rolandormp74@gmail.com

ORCID: <https://orcid.org/0000-0001-7530-5552>

Josemanuel Luna Nemecio²

E-mail: josmaluna2@gmail.com

ORCID: <https://orcid.org/0000-0002-6850-3443>

¹ Universidad Metropolitana. Ecuador. Centro Universitario CIFE. México.

² Centro Universitario CIFE. México.

Suggested citation (APA, 7th edition)

Medina Peña, R., & Luna Nemecio, J. (2022). System of payments for ecosystem services within the framework of climate change mitigation policies: a legal-documentary analysis. *Revista Universidad y Sociedad*, 14(1), 689-700.

ABSTRACT

The interaction between subjective public rights and public interest in the sustainable management of dry forest ecosystem services, from an analysis of the real convergence of Environmental Law and Administrative Law, justifies the need for consolidated legislation that has strategic and tactical legal techniques capable of updating and unifying the administrative interpretation in the regulation of the use and occupation of forest land, always based on the reliability of the positive results of several experiences acquired in the conservation and restoration of dry forests. We assume the Environmental Impact Assessment (EIA) within the work as a guideline for sustainable development and within the framework of climate change mitigation policies, whose objective is to determine behaviors incompatible with the sustainable management of dry forest ecosystem services and the responsibility of the promoter through the obligation of a study of the degree of scientific uncertainty.

Keywords: Forests, ecosystem, administrative law, right to environmental quality, right to control natural resources, public law, environment.

RESUMEN

La interacción entre los derechos subjetivos públicos y el interés público en materia de manejo sostenible de los servicios ecosistémicos boscosos secos, desde un análisis de la convergencia real del Derecho Ambiental y el Derecho Administrativo, justifica la necesidad de una legislación consolidada que cuente con técnicas jurídicas estratégicas y tácticas capaces de actualizar y unificar la interpretación administrativa en la regulación del uso y ocupación del suelo forestal, siempre basándose en la confiabilidad de los resultados positivos de varias experiencias adquiridas en la conservación y restauración de los bosques secos. Asumimos la Evaluación de impacto ambiental (EIA) dentro del trabajo como una directriz del desarrollo sostenible y en el marco de las políticas de mitigación del cambio climático, cuyo objetivo es determinar las conductas incompatibles con el manejo sostenible de los servicios ecosistémicos boscosos secos y la responsabilidad del promotor a través de la obligación de un estudio del grado de incertidumbre científica.

Palabras clave: Bosques, ecosistema, derecho administrativo, derecho a la calidad ambiental, derecho al control de los recursos naturales, derecho público, medio ambiente.

INTRODUCTION

The concern of the international community for the issue of environmental protection and sustainable development has grown significantly in recent years, according to Luna-Nemecio (2019), considerations. These elements originate the rebirth of the theoretical-methodological research work, which leads to a critical analysis of sustainable development (Kahle, et al., 2018), where the issue of ecosystem services is inserted, by constituting, according to Palavecinos, et al. (2016), cognitive systems, which will determine the orientation of positive or negative attitudes regarding the conservation of nature.

The issue of payment systems for ecosystem services in forests is closely related to the framework of climate change mitigation policies, having to configure protection of these services with rigorous objective and justification, the need to assess environmental impacts, and other options to carry out a certain valuation of these services, as recommended by Gavito, et al. (2017), referring to the need to establish new development models, where the sustainable use of ecosystems and their renewable resources should prevail.

The epistemic and methodological principles sustained by integrating the concept of "ecosystem" indicate that a theoretical-legal construction on the protection of dry forest ecosystems must also synthesize the norms of Environmental Law and Administrative Law. In this order, they must also be based on the institutional and cultural framework influencing the management of ecosystems, as well as the payment for environmental or ecosystem services and the behavior of social actors.

In this sense, the subject of this study consists of addressing the deficiencies, inconsistencies, and structural criticisms of the systems of payments for ecosystem services in dry forest ecosystems, within the framework of climate change mitigation policies. This research is based on legal-documentary analysis, taking as a basis the elements collected in the legal sciences, specifically in the interrelation among rights: administrative, environmental quality, control of natural resources and public law, in consequences with what reflected by Food and Agriculture Organization (2016), that forests are a primary solution to climate change disasters and to mitigate their effects.

The existing problem and that will be addressed, lies in the lack of foundation of the legal protection of the dry forest ecosystem services, by natural persons (human person exercising law) and legal persons (the act of constitution), where it will be based on the results of practical experiences related to the correct use of technical instruments for forest conservation and restoration.

Ecosystem or environmental services were clearly defined by United Nations (2005), as the benefits that people obtain from ecosystems are essential for human well-being. The very inexistence of strategic legal techniques and concrete tactics, at the primary level, which should integrate consolidated legislation as a model for the protection of forest ecosystem services, is one of the needs that today presents the subject at a legal level, where they are limited only to the Traditional protection control, an aspect to be overcome for the sake of truly sustainable development, considering the tribute for the enjoyment and use of ecosystems, also suffering from contributions to the surrounding communities, to support their local development, according to the authors Medina, et al. (2017).

In this perspective, the approach from the legal doctrine of the complexity of the protection of ecosystem services has had little development, even though the idea is of common acceptance for the authors Rodríguez & Páez (2012); of an Environmental Law that urgently requires even the assistance of other sciences that contribute to the knowledge of the environment, justification of the seriousness of the problem and its solutions that the legislator would legally translate.

Concerning this topic, no similar studies are known that contemplate the integral relationship among the rights: administrative, environmental quality, control of natural resources, and public law, however, if there are works of theoretical review and exemplification of cases practical, especially in our American continent. As a transcendent step, it is necessary to refer to the birth of public subjective rights together with private subjective rights supported by granted titles, where its origin is based on the verification by the Food and Agriculture Organization (2016), of the transfer of forest management rights to local communities and the promotion of integrated land use.

Within this framework, progress has been made in the region, the planning of public policies directed to the planning of forestry activities, which makes it possible to develop more national programs for the protection, conservation, recovery, and sustainable use of forests, which allow mitigating the enormous complexity and scope of the crisis of degradation of natural habitat areas, warning about the need to incorporate into state policies based on legal regulations, elements such as the optimization of restoration and cost-effective management that minimize risk and identify the urgency of intervention.

Indeed, countries such as Mexico, Chile, Argentina, Colombia, and Ecuador, just to mention some of the Latin American regions, have their recognition through legal norms for environmental protection and specifically of

their wooded areas; However, these standards always tend to place parameters and concepts that are not always precise and punctual, so it is certainly a first step in the advancement of this issue, but it is also not enough to achieve a result that collaborates with sustainable development, since it lacks procedures that contemplate the experiences and evaluations obtained from the praxis.

The resulting analysis leads us to the need to address, contribute and guide decision-making around the approach to the subject by professionals and organizations and serve as a reference for future research in the area, based on the fact that administrative law must synthesize, in its often casuistic norms, the specific principles of an ecological nature of environmental law on a foundation that also accounts for the incidental institutional, economic and cultural frameworks and even private law, determining factors in the production and distribution of material and immaterial benefits, where payment for environmental services would have a place, therefore it would make possible more objective public decisions to resolve conflicts.

Following the above, this conceptual study focused on the following goals: 1) Explain the status, trends, and threats in dry forest ecosystem services and their repercussions for human communities; 2) Analyze the normative and conceptual structure of the principles of environmental law that sustain international instruments and national laws for the protection of biological diversity; 3) Propose specific strategic and tactical legal techniques, at the primary level, which should integrate consolidated legislation as a model for the protection of forest ecosystem services. This will be done to propose a model for the protection of dry forest ecosystem services aiming to correct legal gaps or normative omissions in national legislation and international environmental law (DAI).

MATERIALS AND METHODS

The main axis of the research focuses on the epistemic conception of transdisciplinarity and complexity for the approach not of an object of study but a field of problems, by resorting not only to legal sciences but others such as the forestry, economic, social and political. The research is based on the qualitative paradigm. The depths of the natures of realities are addressed, considering their unitary-dynamic character. From the methodology, we will use the documentary record tool (Centro Universitario CIFE, 2016), for the review, selection, and analysis of bibliography through research criteria for the domain and deepening of the fundamental categories that guide this research.

The documentary review and analysis consists of searching, selecting, organizing, and analyzing a set of written materials to answer one or more questions about a topic (Table 1).

Table 1. Analysis of Categories.

Chart 1: *Analysis of Categories Used in the Study*

Categories		Questions or components
<p>Payments for ecosystem services in forests.</p> <p>The normative and conceptual structure of the principles of environmental law.</p> <p>Legal techniques.</p>		<p>1) Explain the status, trends, and threats in dry forest ecosystem services and their implications for human communities.</p> <p>2) Analyze the normative and conceptual structure of the principles of environmental law that underpin international instruments and national laws for the protection of biological diversity.</p> <p>3) Propose specific strategic and tactical legal techniques, at the primary level, which should integrate consolidated legislation as a model for the protection of forest ecosystem services.</p>

We proceeded by consulting electronic sources and databases such as Scopus, Web of Science, Scielo, Redalyc, Google Academic, Latindex, to obtain scientific articles and texts closely related to the categories studied, in search of research articles that had relation to the proposed categories.

Document Selection Criteria

To select the scientific texts and articles to be used in our work, we consider and detail the following criteria:

1. Articles and books were searched using the following databases: Scopus, Web of Science, Scielo, Redalyc, Google Academic, Latindex, in language: English, Spanish, Portuguese, and Russian.
2. The following essential words “forest, ecosystem, administrative law, right to environmental quality, right to control natural resources, public law, environment” were used together with one or more of the following complimentary words: “ecological law “,” Environmental services. “,” Ecological services “,” native forests “,” climate change. “,” Sustainable development. “ and “constitutional law”.
3. Only articles from indexed journals were selected. In some cases, books from recognized publishers, research centers, or universities were used.
4. The documents had to be within the 2014-2019 period.
5. The documents had to address some element of the established categories.

RESULTS AND DISCUSSION

Public subjective rights, which arise from the use of forest ecosystem services, constitute a conflictive construction of regulations because they are based on an economic system that depends on overproduction, or the extent to which it generates excess demand and its corresponding increase of buyers, that is to say, shortage of merchandise. Economic theory, in this situation, is the primary basis for the management, handling, and conservation of forest ecosystem services, because it is aimed at constituting their quantifications and estimates of economic value, in this case, from the criticism of the social cognitive structure that it has assimilated practically all rights as values determined by the circulation of capital, and, to the conceptual models imposed by the Western State in the market sphere.

A first reason for the crisis is derived: the closure of economic growth. The contraction of the global market paralyzes a good part of the installed productive capacity and causes a decrease in the technical productive forces in many communities settled in the forests. We combine this observation with “attempts to assign monetary values to services and environmental losses and attempts to correct macroeconomic accounting [by] the ecological economy”, without neglecting that *“Its contribution and main axis is, rather, the development of physical indicators and indices of (in) sustainability”* (Martínez, 2010, p. 44). Posner (2000), would assert for his part: “it is not

surprising... that the pattern of emergence and extension of property rights in a society is related to the increase in the proportion between the benefits of property rights property and its costs” (p. 41). In terms of the relationship between Environmental Law and Administrative Law, this economic treatment will be extended to the rights of use of forest ecosystem services.

Regarding public forests, Posner (2000), he indicates the following example: *“Much of the land in the western United States is owned and managed by the federal government... The main justification for extensive government ownership of land is aesthetic in nature: the preservation of wilderness areas for the enjoyment of walkers”; however, it is an ecosystem service not incorporated into the concept of economic valorization: “what shall we say about the people who will one day wish to visit the national forests and are willing to pay for this option, no matter how unlikely it is to be realized?”* (p. 87)

In this case, the U.S. Public Administration meets two conditions necessary for the study in question. The first external, to be located in a territory where the excursion is a persistent activity; and the second internal, to have their forests under management plans, conservation, and sustainable management. According to Posner (2000), *“the government limits logging on each area of government land to the number of new trees added since the last logging, to prevent a net reduction in the number of trees on the land”* (p. 86). This is the interest in making economic assessments of scenic beauty services, among others that could be derived, such as watershed protection and greenhouse gas mitigation. In short, the cited author offers an alternative conception to economically value the aesthetic service of forests, an example taken in this work, as a starting point for the elaboration of what today is called payment for environmental services (PES).

Food and Agriculture Organization (2016), has verified the existence of *“transfer of forest management rights to local communities and the promotion of integrated land use”* as the first important step because this is how subjective public rights are born together with private subjective rights supported by entitlements granted. The foregoing constitutes a response following the ecological-economic valorization that contributes to the protection of forest ecosystem services. When Food and Agriculture Organization (2016), points out that *“the lack of recognition of customary agrarian law in written law creates problems”*; it must also be understood in terms of a cultural model of exchange in rural communities other than those regulated, precisely, by positive law.

It should be noted that the necessary community convergence of public subjective rights and private subjective rights in the global scope of forest ecosystem services is functional, which is argued by Sainz (1976) in the following way: *“the concept of interest Public derives from the permanence that the public has over the private, not because it is different, but because it is general. Taken in itself, the concept of public interest coincides with that of the general interest and the common good; it is the common interest of all citizens”* (p. 63). Positive law, in cases of such recognition, turns to the public interest if the call for the attention of the Convention on Biological Diversity (United Nations, 1992) is taken into account, regarding *“the desirability of equitably sharing the benefits derived from the use of traditional knowledge, innovations, and practices relevant to the conservation of biological diversity and the sustainable use of its components”*, that is, the moment in that, according to Food and Agriculture Organization (2016), *“management responsibilities have been transferred from the State to the private sector and small farmers and local communities” constitutes an estimate of the general value of these sectors”*.

On the other hand, *“the eradication of poverty and the reduction of inequality as the main objectives of national economic policies”*; stimulate innovation and communicate the best science-based practices to farmers” in agriculture and forests pointed out by the Food and Agriculture Organization (2016), indicate in themselves the general nature of the public interest Sainz (1976), in this regard I would argue: *“the notion of public interest, being an expression of what private interests have in common, is neither opposed nor superimposed on the latter, but rather, to some extent, the assumes”*.

When environmental services are paid for, it is because it has been recognized that each service has properties and utilities, which must be defined in environmental regulations prior knowledge of the characteristics of the model of a culture in its interaction with the forest ecosystem. We insist on this due to the reiteration of the problem of the recognition of rural communities regarding their customary rights. Environmental regulations (in a generic sense) should not neglect the ecological properties of forests, nor the cognitive structure that warns of behaviors of the beneficiaries of ecosystem services in a particular culture of the universal logical-historical process. The valuation is conditioned by the diversity of forest ecosystem services. The PSA is limited in some way to the urban and rural use of water, this is the interest of protecting the hydrological basins, the storage, and provision of water, as well as the afforestation for the regulation of hydrological flows for these and other purposes. Forests protect the soil, fix

nutrients, and accumulate organic matter and mitigate greenhouse gases, among others.

Therefore, the planning and management plans for forests are aimed at their conservation and maintenance. All human activity will be felt in the utility of environmental services, which are not limited to the extraction of wood. The valorization of ecological-economic change has a different dimension from the classic utilitarianism, although these activities generate the prices of forest ecosystem services are preceded by a high level of ecological awareness and knowledge that is also ready for such services to be provided with quality.

The transfer of forest management rights to local communities, as we corroborate in the projects and organizations discussed, contributes to the conservation and sustainable use of forest biodiversity, to raise awareness about the role of forests in the sequestration of carbon reserves, among others, so it could be thought of paying these communities for environmental services where the intervention of the Public Administration would be essential. The aforementioned organizations provide objective signals of a possible functioning of the payment system for forest ecosystem services because they seek investment alternatives aimed at the maintenance and conservation of forests.

From the point of view of production, the acquisition, particularly of diffuse ownership of the dry forest, establishes a competitive equilibrium in which the owners maximize their profit by spending, or investing in its sustainable management, a variable introduced by the pro-undivided principle, starting from of the additive ratio that this requires between the anthropological time of felling and the time of regeneration; Price (P) equals Marginal Cost (CMg) of production and consumers pay a price for the good produced equal to the marginal valuation of the good. The formula 1 is derived:

$$P = CMg = G \text{ (gaining)} \quad (F1)$$

Here, the *pro indiviso* principle continues to locate the profit in an autonomous abstract concept concerning the tangible, material, and useable thing (firewood and wood), since sustainable management (conservation and maintenance) is the basis of the valuation of change of those things, therefore never excessive in the sense of serious danger, or damage. In case of damage, we suggest integrating this rule into the following methodological proposal for the valuation of environmental damage (Barrantes y Di Mare, 2016:5-6), which in mathematical terms, the damage would be expressed by $[(DA)]_j$, which is given

by the area between the curves f_1 and f_2 from the start t_0 , so that (Formula 2):

$$DA_j \int_{t_0}^x [f_1(t) - f_2(t)] dt \quad (F2)$$

Where: DA: is the damage caused to natural resource j ; $f_1(t)$: explains the behavior of the natural resource (or environmental factor) without the presence of the particular economic activity (that is, before the damage); $f_2(t)$: explains the behavior of the natural resource once the economic activity comes into operation (that is, after the damage); t : time and x : time that the effect on factor j lasts.

Now, the *pro indiviso* principle, guide of the anthropo-ecological rationality proposed in this research, leads to a unit of measurement or homogeneous anthropological time scale, consisting first of all in the time of the economic activity that caused the environmental damage and, second, the time spent in the activity that seeks to restore natural resources or forest ecosystem services taken as an example (firewood and wood). In this order, the additive ratio of this anthropological time and the total time in which the forest regenerates are established, equivalent to the time that the impact lasts in the factor j , which in principle will always be larger and will never be confused with the time of restoration, from which the forest begins to regenerate itself. It follows that both condition the gain, and the total regeneration time of the forest will be less if the anthropological time is shorter.

Ecological restoration, is the reestablishment of the structure, productivity, and diversity of the species originally present in the forest. Over time, ecological processes and functions will coincide with those of the original forest. Therefore, sustainable management based on scientific and technological information will predetermine that time, which is longer.

However, as previously stated, the indivisible qualitative property of the dry forest as a geographical unit reveals the correlation between anthropological time and population density and the expansion of deforestation areas. This indicates that the homogeneous character attributable to anthropological time only operates as an instrument, valid within the additive rules because that correlation constitutes a non-homogeneous dynamic structural system, nor reducible to quantity. Consequently, the ecological valuation corpus proposed so far integrates the quantitative into the unity of *logos* and *ethos* to focus on the entitlements granted by the Public Administration, where public subjective rights are articulated together with private subjective rights.

The appreciation of the change is expressed in the price and its determinations reside in investments, expenses in protection technology, conservation, repair, ordering, and the same intensity of the material and spiritual activity, hence the mediation of the additive formula between the anthropological time and the forest regeneration time. According to Rosen (1985), "*expressed in mathematical terms... the individual is willing to exchange one good for an additional quantity of another, which is called the marginal ratio of substitution. Therefore, an efficient allocation of resources requires that the marginal relations of substitution be equal for all consumers*", that is, in this change, the marginal valuation of the good is carried out indicating the price formula

On the other hand, following Posner (2000), the development of the benefits of property rights, as we said, is related to the proportion of their costs, a starting budget to enter, now, the conceptual bases of a new and differentiated criterion that serves the measurement of social costs and benefits, that is, the problem of externalities or optimal intergenerational allocation of exhaustible resources. The problems of externalities then indicate to the current generations that enjoy their property rights, the responsibility to protect the interests of future generations. In any case, property titles generate an intergenerational obligation. The aforementioned additive rule proposal, between the anthropological time and the total regeneration time depending on the use of the forest and its conservation, or restoration, is an example of such a commitment; But now it is a matter of combining a certain different economic analysis with the approach of marginal substitution relations since the externalities are referred to a non-existent market.

In another order, the economic analysis has been extended to the repair of damages for breach of contract, fundamentally in matters of restitution and consequential damage. These modes of indirect performance of the benefits, according to Polinsky (1989), guarantee optimal compliance but warns that, if it is about encouraging the optimal degree of confidence in the fulfillment of contractual obligations, it is best to simply resort to the restitution of the good or its monetary value. However, from the point of view of Environmental Law, what is significant is the compensation for the pure ecological damage that, as a rule, is not regulated by the Civil Codes. Administrative responsibility, in these cases, appears with the border of the contract outsider, that is, when there is a transgression of the patrimonial ownership of an extra-contractual third party. It can be understood, in the analysis of the contracts that we will propose later, the relationship between a violation of individual ownership and collective ownership

and, therefore, the constitution of an administrative responsibility parallel to civil liability.

In the matter of repairs and compensation for emerging damage, the economic analysis of the contracts is directed to the quantification of the damage suffered by the creditor, but the pure ecological damage overcomes it, the definition of which is not capable of implying with exactitude different types of reparation as it happens in the Civil Codes. The civil restitution implied by the fact that the debtor returns to the creditor the benefits that the latter conferred upon him or the compensation of his losses due to the breach of the contractual obligation, does not appear with all clarity in the case of the determination of the causal link between the polluting subject and the pure ecological damage.

In summary, it is essential to establish a relationship that implies the feasibility of the marginal relationship of dry forest harvesting contemplated in the additive rule between the anthropological time and the total time of regeneration, the formula "obligation for the present, right for the future" in the face of the asymmetric intertemporal externality, the market where consumers or beneficiaries would be willing to pay for forest environmental services (PSAF), finally, the compensation of pure ecological damage and its correlation with strict liability based on risk theory. All this following the obligation to avoid or prevent serious or irreparable damage to forests.

Environmental Law as model construction

Environmental Law regulates the management and use of forests, mainly from how technological knowledge guides the references of good practices of agroforestry or forestry models. Thus, it is updated with several elements of ecological diagnosis made by specialists; then it builds the forest policy to assume them as part of the problem of deterioration of ecosystem services.

In effect, this technological knowledge makes it possible for Environmental Law to regulate forest policy by moving it from a model of mere commercial exchange and exploitation to a combination of instruments of conservation or integrated management of the territory based on the declaration of natural protected areas with a vision of multiple variables, including climate change, deforestation and the balance of the hydrological cycle.

Therefore, the model also consolidates the organization around a set of processes: provision of forest technical services, productive diversification, research, development, and transfer of technology, equipment and training for forest planning, quality, opportunity and competitiveness, integration of the forest productive chain, adequate

financing for the needs of forest management projects, such as forestry models that serve to make sustainable management planning.

Such an organization necessarily involves an interaction between the owners or private sectors and the public service. The result is a model of balanced, integrated, and sustainable forest management, defined as an instrument that forms part of the public administration's policy on sustainable development and involves the concerted decision-making of the beneficiaries, precisely for the orderly occupation of the territory, in accordance with the ecological characteristics of the forest ecosystems.

In this way, good practices in agroforestry or forestry models are guided by technological knowledge and it should be required that both the process of I+D and the basis of political management of science, which also involves the collaboration of academia. Thus, this specialized branch on management and science policy aims to evaluate technologies so that the Public Administration allocates resources and promotes certain designs in favor of the administered or citizens.

The forest management as an instrument of the Public Administration policy presents, in terms of economic benefits, certain problems about the optimal model of the FSPE; because it is a procedure that falls on the externalities or environmental impacts whose values are not collected by the market prices. Added to this is the challenge of the committee of experts selected by said Administration, in the evaluation of projects related to I+D, where there is no generalized agreement on the success in the medium and long term regarding the cost-benefit pair.

The analysis of environmental impacts formulates and evaluates, through a model, political options to carry out a certain valuation of the forest ecosystem services, which must become an instrument of the environmental management itself, including the risk and associated costs, a question that goes through the need to establish the relationship between intrinsic values and instrumental values as a basis for conservation.

The choice of this model takes into account the characteristics of the beneficiaries of forest ecosystem services. Its management will be evaluated, therefore, the adoption of the best option of a project must be compatible with the integration between the volitive and the normative. In this sense, the environmental impact assessment (EIA) is a technical reflection on the complex nature of the environment.

The principle of sustainable development

It implies projects oriented not only towards greater quantitative economic growth, because it is also necessary to incorporate the territorial diffusion of growth, under forest management plans to sustain the fair distribution of benefits. Sustainability here is the viability in time of a productive model marked by its exchanges with the dry forest ecosystem.

Special attention is given to the norms and instruments of planning, management, execution, and supervision of projects in the forest territory, to mitigate negative environmental impacts, for example, that proposed by Escobar, (1996): *“silvopastoral systems are a tool for the sustainable development of livestock, where simultaneously in a determined and ordered space the trees grow associated with livestock, in spatial or sequential arrangements in time, interacting economically and ecologically”*.

Sustainable development points to these systems as a characteristic productive model of forest management in connection with agriculture and livestock, based on land management, without over-exploitation of natural resources. It corrects the abandonment of pastures and encourages a system of land use, where trees grow in association with agricultural cultivation and livestock, as the case may be, and also avoids the replacement of native species by others of rapid growth.

For this reason, a systemic approach is used, where the usual compartmentalization of the academic world is not a priority. There is a clear intention to criticize the customary work of the bulk of economists, who continue to parcel out their object with excessive rigor. This requires considering the environmental impacts of production within forest ecosystems and the relevance of certain projects for the integration of considerations that have no monetary value in the traditional market, an issue discussed below. From an economic point of view, the issue is to provide the necessary incentive, in particular, to promote sustainable development.

An EIA of economic behavior in terms of sustainable development, therefore, requires comprehensive monitoring of the capacity of forest ecosystems to absorb exploitation. Its principles can be applied to forest land use planning that promotes synergies between the various beneficiaries involved in the management and the possibility of taking charge of mitigating the inevitable effects. The determination of such capacity calls for the collection of information to describe the particularities. According to Alvarado & Herrera (1998), *“the correct use of the land requires knowledge of the intrinsic characteristics of the ecosystem, as well as the needs or possible uses by the users”*

(p. 9). In this sense, it should be noted that forests are fragile, threatened by inappropriate economic practices. It is urgent to promote studies on endemic species that may disappear under pressure from rural communities.

In general terms, the EIA enables a better economic valuation of the ecosystem services that are intended to be consumed in the projects, by stimulating the efficient use of them. The fact of valuing these services integrally constitutes a tool for the management of the dry forest ecosystem and to promote sustainable development. Dry forest conservation is a sustainable development problem. This requires control activities, management planning, developing monitoring mechanisms within the framework of the ecosystem approach, and effective legal regulation of a new way of relating to the ecosystem, which also includes a consensual course to conserve biodiversity and the restoration of viable populations of species.

Sustainable development also addresses the vulnerability of communities to logging roads and trails within the dry forest. For the moment, we propose that it is of the first order to measure the rates of erosion on these roads through management plans for the use of forests and wooded pastures, especially due to damage to drinking water intakes due to sedimentation of the basins. Such is the case of the need to stimulate endemic plantations on abandoned roads through FSPEs, i.e., paying for the greenhouse gas sink and preventing the decomposition and transformation of waste logs into methane gas that returns to the atmosphere. The sale of environmental services is now an international strategy and Costa Rica is the leader.

The circumstance applied to dry forest ecosystems

It refers to the phenomena of physical, chemical, biological, social, etc., that surround the forest ecosystems, object of study in particular, but that does not belong properly to their essence, and that logically, will depend as much on their qualitative and quantitative condition as on external spatial and temporal factors.

The knowledge of the circumstance points out the scientific and technical relativism that dominates the environmental matter, makes that an activity considered positive today appears, in the future, by the own scientific advances or by new circumstances as an activity of significant negative effects. Global policies are indispensable because the changes that tend to order the Environmental Law take a transboundary character, given that deforestation and degradation generate ecological alterations capable of exceeding the limits of the national space and the time in which they are produced.

The circumstances, because of the desertification advance, may advise the adoption of combined reforestation and natural regeneration management projects to ensure the persistence of the vegetal space. Social phenomena, on the other hand, often indicate the need to strengthen institutions aimed at managing the design, execution, and operation of investments, or at the beneficiaries' organizational structure. The fact that they are social and natural phenomena that surround forest ecosystems, guides the creation of an optimal system of environmental information and monitoring together with programs of control, evaluation, and correction of activities.

In this sense, the uncertainties born from dissimilar interactions between physical, chemical, biological, and social phenomena, among others, are typical of the circumstance, to which the precautionary principle is directed in the field of EIA, that is, there could be various impacts whose consequences would not be determined exactly, but would advise not to hesitate before the alleged risk.

Flexibility, as a characteristic of the unitary model of the organization of the modalities in which forest ecosystem services are expressed, is fundamental in the world of changing circumstances, since the decisions taken by the public administration and the communities, even in the case of not having full certainty, must be adapted to the new needs and protection criteria that arise. A solution will be all the more flexible, the more advanced that model is at the time of its implementation, which will allow modifications to be introduced, according to the changes in such services.

The interactions of certain social phenomena, such as logging and extensive agriculture without forest management planning, could alter the conservation status of a species and the probability that it will continue to exist in the present or shortly, in the event of a decrease in the volume of the current population, hence the normative improvement around projects, based on knowledge of the natural way in which forest ecosystem services are organized, without which it is impossible to determine, even if the uncertainty is not always cleared up, significant negative impacts.

Indeed, improving the quality of regulations increases the credibility and predictability of the Public Administration, which is necessary to create confidence in the beneficiaries of forest ecosystem services, including market agents; because it would be a regulatory model with a better disposition for economic analysis in the process of forming the PSAF, the EIA, the penalty for faults and the collection of taxes, among others. We add the creation of environmental information mechanisms that favor the effective application of the law, by handling various

issues, for example, reproductive biology, populations of threatened species, total biomass, or organic matter of a forest, among others.

a) Tactical legal techniques

Promote, within the framework of externalities markets or PSAF, consultation between investors or industrialists, small-scale landowners, and other regional actors. A consolidated legislation would implement the following techniques that would generate commitments:

- Design of an FSPP scheme that includes: quantification of the supply and the REDD project that should be implemented; methods to support the choice and design of the specific REDD project; an analysis of implementation costs; and guidelines to ensure that local communities also achieve benefits.
- Other strategies and mechanisms for payment for ecosystem services for forest conservation, without prejudice to guidelines on the benefits that communities should enjoy.
- Creation of a mechanism that is fed by financial sources capable of recognizing incentives to reestablish the concept of supply and demand for environmental services and goods within a cycle based on restoration and reforestation.

b) Tactical legal techniques

Sejenovich (2014), warns us that there is "*recognition of the justice and desirability of considering environmental costs*". However, he adds, "*the determination of environmental costs has not been sufficiently elaborated*". He proposes "an Input-Output Matrix of Intersectoral Relations of Resources and Environmental Services" to "analyze how this particular 'factory' is managed and operated". This method encompasses a human ecological order as opposed to the traditional way of doing economic theory. But this implies an ecological reconstruction of both public subjective rights and public administration and the improvement of legal procedures. In this way, the very conception of the environment changes. Potentiality cannot be measured in a single resource since it would have a partial and wrong vision of the ecosystem, that is, the resolution method is structured around ecological knowledge, which assumes information capacity.

The ecological rationality that we have been following, we propose it as an anthropological emergency to go to that awareness, establishing links between the projects; because these are expressions of the essential factual support in the analysis of both private and public interests and the pretension, on the part of the Public Administration, of reaching a fair balance between methods of economic valorization and what is called public interest and public

service. The link between projects is a way of considering the production and application of knowledge not only of the beneficiaries of forest ecosystem services but also of specialists, students, teachers, promoters, and implementers. Its ecological content must be decoded because it is knowledge applied within the communities and has forms of control that are conscious of the fact that the ecosystems are defended in this area. This constitutes a historical process of realization of its diverse objectives of the scientific-technological base in the territories and particular ecological conditioning at the level of its norms.

Collective and concerted management, like that of these types of projects, makes it possible to organize the activity of the beneficiaries on the objective basis of the ecological reality that affects them. The fact that they touch on the themes of specialists and draw up geographical and demographic premises reveals the irregular nature of the development of these communities. The projects, from the territorial ordering, openly declare the competition of the market and, as long as it is a question of suitable exploitation of the resources, that is to say, it corresponds first of all to the techniques that directly use market prices.

We take these projects as a model, to synthesize and propose the following principles that join the general principle *pro indiviso*, intending to inspire forest laws on the protection of forest ecosystem services:

- a) The sustainable management of the dry forest according to the knowledge of the interactions among physical, biological, political, socio-cultural, economic, and patrimonial factors.
- b) Forest planning within a framework of orderly occupation and sustainable use of the territory, according to the ecological characteristics of the dry forest.
- c) Agro-ecological production, certification, evaluation, valorization, and commercialization.
- d) The conservation and protection of forest ecosystem services and an adequate balance between the different public administrations in territorial development.

In the order of payment for ecosystem services (Sejenovich, 2014) specifies that the analysis of *“the relationship between costs and income from product sales to know if there is a balance, or if there is a surplus”*, is essential if one wants to use it to improve knowledge of the resources or the operation of new products or new services. The knowledge, precisely, must be focused on issues of territorial planning and regulation of forest management according to the needs of the beneficiaries of forest ecosystem services.

A balance is established between the economic compatibility of management, the need for spatial planning, and the possibilities of payment for ecosystem services. If there is, according to Sejenovich (2014), *“a deficit, that is, if the costs exceed the benefits, it must be determined whether the State will subsidize it”*. In accordance with the above principles, there must be a close link between economic assessment, territorial planning, and the effectiveness of the public administration. In this sense, we warn that economic assessment should be considered only as a means and its success depends strongly on having adequate political and institutional conditions.

Therefore, beyond the limitations, gaps, or defective treatment of national forest legislation in all senses, problems commonly addressed by academic debate (of unquestionable significance), which has an extensive bibliography, land management is the cardinal instrument for an effective policy on sustainable forest management and, specifically, regulation and protection of ecosystem services. The analysis of the legislation is not lost if we take into account that the activities of management and exploitation of natural resources are granted rights, whose execution complies with healthy environmental management instruments. We add the interposition of claims and complaints before the Public Administration, as well as the administrative contentious route and the judicial action. The institutional and environmental normative framework must establish a close link between the economic valuation, the territorial ordering, and the effectiveness of the Public Administration as a principle of agreement of decisions of the social, technical, political, and economic actors.

The documentary study presented determined the need for consolidated legislation on individual responsibility, both of the State and the private sector, which systematizes, updates and unifies the administrative interpretation of public interest in matters of forest ownership and its sustainable use as ecosystems of indisputable reference in matters of ecological complexity. It is important to consider systemic approaches that include indicators, whether environmental or sustainable development, which, when unified, can respond to sustainability problems, where if forests are managed sustainably, they will affect the resilience of ecosystems and societies (Organization of the United Nations for Food and Agriculture, 2016).

More and more legal norms are approved for the protection of the goods that integrate the environment, determining that they do not contemplate the experiences of conservation of the woodlands applied by other sciences, such as the forest, environmental and agricultural sciences. This consolidated legislation, valued in the investigation, can make viable a public arbitration that counteracts

the injury of individual patrimonial interests affected by the environmental damage, through an interaction between the public subjective rights and the public interest in the matter of sustainable management of the forest ecosystem services, that leads, in addition, to payment for environmental services in the cases of protection and conservation. This position coincides with that assumed by Sejenovich (2014), when he warns us that there is *“recognition of the justice and convenience of considering environmental costs”*. However, he adds, *“the determination of environmental costs has not been sufficiently elaborated”*.

Protected forests are legal objects introduced voluntarily or not into subjective public rights by coexisting with public arbitration, in accordance with public service and national wealth promotion. On one hand, ownership and public service, on the other, the object of public subjective rights due to the interaction between the private and public sectors in matters of ecological management within the interrelationship Environmental Law-Administrative Law. This could constitute a basis for the Public Administration and the private sector to stimulate, together, the PSAF.

Therefore, the consolidated legislation should specify the projects that can be subject to EIA. Hence, it is a strategic specification on how to organize the exposure of the best project alternative from the issues concerning each of the environmental indicators; and a requirement of certain skills, which both the Public Administration and the promoters must possess, in order to anticipate negative and positive impacts. In this sense, it is shared with Gavito, et al. (2017), who recommend the participation of the technical and scientific force and society as a whole, to support the improvement of public policies and thus minimize environmental degradation.

With the documentary research presented, it was determined that the interaction between subjective public rights and the public interest in the sustainable management of dry forest ecosystem services should have the EIA because it is a technical-administrative instrument that reaches a consensus between the public administration and the community on the need to suspend any project, productive activity, or the valuation of the change of things, without the need for unequivocal scientific evidence in the face of a danger of substantial reduction or loss of biological diversity. The limitations of the study arise from the broad field of the subject, where various sciences interact as a whole, in addition to the fact that on the subject of EIA there are various experiences in countries, which are impossible to address all, constituting the basis for other works.

CONCLUSIONS

The anthropo-ecological rationality that we propose makes the principles of Environmental Law its own, as an expression of the hard Law in national matters related to the administrative interpretation of the public interest, essential for the legal protection of dry forest ecosystem services. This is the foundation of the collective incidence rights that, from the recognition of the limits of the forest property relations, justify both the compensation of the pure ecological damage and the interaction between the private and public sectors in matters of sustainable development.

The EIA is, then, a guideline for sustainable development and administrative sanctioning law, because it is based on the principles of precaution and prevention to determine both the assumptions that identify behaviors incompatible with the sustainable management of dry forest ecosystem services and the responsibility of the developer through the obligation of a study of the degree of scientific uncertainty.

Thus, it is justified the idea of assuming the reliability of the positive results of the mentioned experiences acquired in the conservation and restoration of dry forests for their integration, through the strategic and tactical legal techniques analyzed above, to a model of protection of dry forest ecosystem services capable of correcting the legal gaps or normative omissions of the national legislations and the DAI.

REFERENCES

- Alvarado, Á., & Herrera, B. (1998). Clasificación de tierras para uso forestal y la estimación de su capacidad productiva. Academia Nacional de Ciencias de Costa Rica.
- Barrantes, G., & Di Mare, M.I. (2016). Metodología para la evaluación económica de daños ambientales en Costa Rica. <https://silو.tips/download/metodologia-para-la-evaluacion-economica-de-daos-ambientales-en-costa-rica>
- Centro Universitario CIFE. (2016). Metodología del registro documental para la búsqueda y organización de la información científica. CIFE.
- Escobar, M. (1996). Sistemas Agroforestales. Evento: Experiencias de participación comunitaria en el aprovechamiento y manejo sostenible de los ecosistemas boscosos. Una contribución metodológica para el desarrollo sostenible. Minambiente.

- Food and Agriculture Organization. (2016). El Estado de los bosques del mundo 2016. Los bosques y la agricultura: desafíos y oportunidades en relación con el uso de la tierra. FAO. <http://www.fao.org/publications/sofo/2016/es/>
- Gavito, M. E., Van der Wal, H., Aldasoro, E. M., Ayala-Orozco, B., Bullén, A. A., Cach-Pérez, M., Casas-Fernández, A., Fuentes, A., González-Esquivel, C., Jaramillo-López, P., Martínez, P., Masera-Cerruti, O., Pascual, F., D Pérez-Salicrup, D. R., Robles, R., Ruiz-Mercado, I., & Villanueva, G. (2017). Ecología, tecnología e innovación para la sustentabilidad: retos y perspectivas en México. *Revista mexicana de biodiversidad*, 88, 150-160. DOI: <https://doi.org/10.1016/j.rmb.2017.09.001>
- Kahle, J., Risch, K., Wanke, A., & Lang, D. (2018). Strategic Networking for Sustainability: Lessons Learned from Two Case Studies in Higher Education. *Sustainability*, 10(12).
- Luna-Nemecio, J. (2019). La importancia de la Educación para lograr el Desarrollo Social Sostenible. *Ecociencia International Journal*, 1(1), 6-11.
- Martínez, J. (2010). El ecologismo de los pobres. Conflictos ambientales y lenguajes de valoración. Editorial Icaria.
- Medina Peña, R., Domínguez Junco, O., & Medina de la Rosa, R. E. (2017). Fundamentos jurídico-metodológicos para un sistema de pagos por servicios ecosistémicos en bosques del Ecuador. *Revista Científica Agroecosistemas*, 5(1), 109-117.
- Polinsky, A. M. (1989). *An Introduction to Law and Economics*. Wolters Kluwer.
- Palavecinos, M., Amérigo, M., Ulloa, J., & Muñoz, J. (2016). Preocupación y conducta ecológica responsable en estudiantes universitarios: estudio comparativo entre estudiantes chilenos y españoles. *Psychosocial Intervention*, 25(3), 143-148.
- Posner, R. (2000). *El análisis económico del derecho*. Fondo de Cultura Económica.
- Rodríguez, G. A., & Páez, I. A. (2012). *Temas de derecho ambiental: una mirada desde lo público*. Editorial Universidad del Rosario.
- Rosen, H. (1985). *Manual de Hacienda Pública*. Editorial Ariel Economía.
- Sainz, F. (1976). Reducción de la discrecionalidad. El interés público como concepto jurídico. *Revista Española de Derecho Administrativo*, (8), 63-94.
- Sejenovich, H. (2014). *Economía, Ecología y Derecho*. In, R. Brañes, *La fundación del derecho ambiental en América Latina*. (pp. 103-135). PNUMA.
- United Nations. (1992). *Convenio sobre la diversidad biológica*. <https://www.cbd.int/doc/legal/cbd-es.pdf>
- United Nations. (2005). *Millennium Ecosystem Assessment Report*. <https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/1918/661.pdf?sequence=1&isAllowed=y>