

Environmental Compensation Actions in Costa Rica: Disparity between Commitments and Actions

Fabián Bonilla-Murillo¹ , Juan S. Monrós² , Mahmood Sasa Marín^{1,3} 

¹Clodomiro Picado Institute, University of Costa Rica, San José, Costa Rica

²Research Center for Biodiversity and Tropical Ecology, University of Costa Rica & Biology School, University of Costa Rica, San José, Costa Rica

³Cavanilles Institute of Biodiversity and Evolutive Biology, University of Valencia, Valencia, España

Email: fbonillamurillo@gmail.com, msasamarin@gmail.com, monros@uv.es

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Abstract

Introduction: Environmental compensation is a legal-administrative instrument used by agencies that supervise the environmental impact assessment (EIA) to offset irreversible impacts generated by development projects. The compensation is usually framed in the principle of ecological equivalence, which seeks to equate the losses due to the impact with a net environmental gain obtained by the compensatory actions. **Methods:** We analyzed the records of development projects that have merited an environmental compensation plan registered by the National Environmental Technical Secretariat of Costa Rica (SETENA) between January 2018 and June 2020. **Results:** Seventy-four projects were analyzed; just over 75% of them corresponded to infrastructure projects while the rest concerned exploitation activities of materials and resources. The main impacts that elicited compensation plans were: deforestation and destruction of riverbanks (13%), earthworks (15.5%), poor water management (15.5%), and administrative faults or non-compliance with environmental commitments (62%). The main compensatory measures conducted were: building school infrastructure (20% of the projects), support for environmental education programs (17%), and reforestation programs (>15%), although actions such as the purchase of school supplies, donation of equipment to local communities and the arrangement of roads and causeways were also recorded. In only three projects, the replacement of the impacted habitat was used as compensation for projected damage. **Discussion:** The registered compensatory measures do not endorse the spirit of return on components equivalent to those impacted that generate a net environmental gain and respond only to impacts that had not been considered during the preliminary

evaluation of the project. The compensation plan used in Costa Rica is a sanctioning instrument based on economic valuation and does not guarantee a return equivalent to environmental losses. Therefore, compensation must be integrated in the preliminary evaluations of the projects, identifying these measures in the early stages and separating them from administrative faults.

Keywords

Environmental Compensation, Impacts, Environment, Environmental Evaluation

1. Introduction

Environmental compensation (EC) is an administrative provision that seeks to remedy the losses that result from irreversible impacts to the environment or communities due to production or development projects [1]. EC measures are carried out as a last resort of the so-called mitigation hierarchy [2] when it is impossible to avoid or mitigate impacts or recover the environment affected by them [3]. Thus, the intended objective in EC is that the net losses are null (zero losses) or even better that an environmental gain is generated [4] [5].

EC is usually endorsed by the countries' legal framework that uses this instrument in their environmental management plans [6] [7], standardizing when and who should compensate the environment or communities for the damages [8]. Different factors, such as the estimation of impacts, the level of involvement of government authorities, the role of the developer, and the level of environmental awareness that society has, affect how compensation is carried out and therefore are subject to legal regulations [9].

In addition, the compensatory measures depend significantly on the approach that frames the compensation, be it economic, ecological, or sociocultural [10]. Under the ecological approach, the offset requests ecological equivalence, pursuing to trade-off with environmental components similar to those damaged by the impacts [11]. This approach is preferred by financial agencies such as the Inter-American Development Bank (IDB), the World Bank, the United Nations Organization (UN), among others, as they seek direct compensation for the losses generated by the projects they finance [12] [13]. Under the economic approach, the cost of the impacts is calculated, and the compensatory measures try to achieve economic equivalence. Although there are many ways to compensate under this approach [14] [15], the standard practice is to settle with other environmental or social benefits for a value equivalent to that assessed for the losses [16]. This approach has the advantage of estimating the compensatory measure and is straightforward and relatively easy to implement [16] [17]. However, it has been criticized for reducing environmental components to mere interchangeable goods and not compensating them directly with equivalent elements,

making it challenging to ensure zero net environmental loss [4] [18].

In addition, government agencies supervise the implementation of compensatory measures, generally those responsible for regulating and evaluating the projects' environmental impacts (EIA). In this way, the state guarantees to preserve a quality environment and the production processes that the developer intends to carry out [19] [20].

For Latin American countries, Arbeláez & Sagre [21] point out that it is generally during the planning stage that projects must indicate how they plan to resolve negative impacts on the environment. This plan is part of the requirements to obtain environmental licensing and is designed by the proponent or even by third parties and includes actions aimed at avoiding, mitigating, or compensating for potential damage. However, not all countries have incorporated these procedures adequately, and issues related to impacts on biodiversity and protected areas have often been left out of the EIA system [22]. This situation makes it imperative to assess the effectiveness of compensatory treatments on a case-by-case basis.

Here, we evaluate the scope of compensatory measures in the face of irreversible environmental impacts generated by development projects in Costa Rica. This nation enjoys an enormous reputation as a green country by promoting the sustainability of its natural capital [23]. The government also has comprehensive legislation that tries to regulate actions in all dimensions of the environment: forestry, water, biodiversity [24]. However, a recent analysis indicates that the issue of environmental compensation has been treated very superficially in the regulations [25]. The administrative authority in charge of evaluating the environmental impacts of projects and ensuring compensation is the National Environmental Technical Secretariat (SETENA), a department from the Ministry of Environment and Energy of Costa Rica created in 1995 by the Organic Law of Environment 7554 [26].

SETENA uses the General Regulations on Environmental Impact Assessment Procedures of Decree 31849-MINAE-S-MOPT-MAG-MEIC [27] to support its judgments. A preliminary assessment is performed for all projects; the possible impacts are categorized through two documents (D1 and D2). D1 is used for projects that anticipate a moderate to significant impact and involves submitting complementary technical studies (*i.e.*, geological, biological, archaeological) and a record of environmental measures to mitigate the possible effects. Before 2004, the instrument used by SETENA for the same purposes was the FEAP (Preliminary Environmental Assessment Form). In contrast, D2 is a tool for low-impact projects, basically being a sworn statement of the works to be developed and the commitment not to negatively impact the environment, which does not require any additional study.

Based on this initial assessment, SETENA determines whether a project must include a sworn declaration of environmental commitments (DJCA), a predictive environmental management plan (P-PGA), or an environmental impact study (EsIA) (Figure 1), according to the magnitude of the impacts identified a

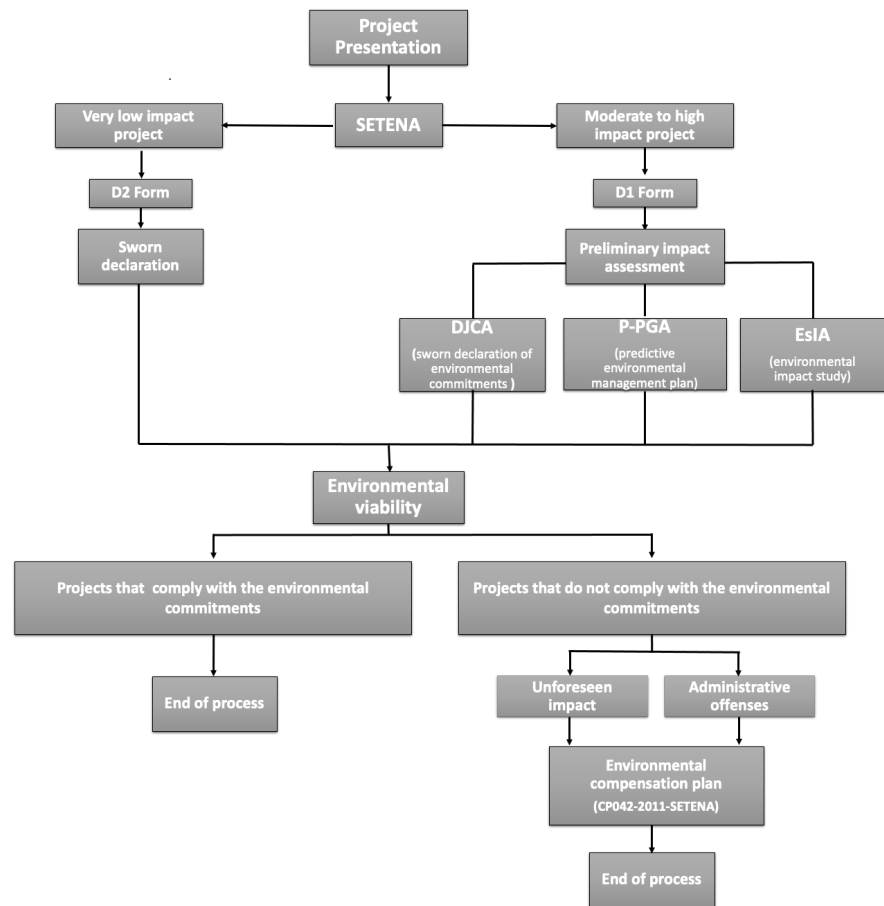


Figure 1. Environmental evaluation and compensation process by SETENA for development and infrastructure projects. See text for elaboration.

priori. Once the EA is approved, SETENA grants the environmental feasibility, the license that authorizes the development of the project or activity. Those projects that do not comply with the ecological commitments acquired during the EsIA (or that generate new impacts not previously contemplated) are sanctioned through compensation measures (Figure 1), whose costs are appraised according to the agreement of the Plenary Commission of SETENA (CP-042-2011-SETENA) [28]. These new measures make up the Compensation Plan, which specifies the actions to defray those impacts that were not contemplated during the environmental evaluation.

Although the procedure described above has been regulated since 2011, no analysis has been carried out on its capacity to offset environmental impacts generated by projects. It is also not entirely clear whether the measures adopted are proportional to the effects incurred. This study presents the first analysis of project files that have merited presenting a Compensation Plan before SETENA.

Our goal is to assess whether the measures requested by SETENA in the face of unavoidable impacts effectively correspond to compensatory actions that ensure zero net loss. Based on this analysis, we also wish to formulate recommendations that allow environmental compensation to be framed as an essential in-

strument in a project's environmental management to generate an ecological gain.

2. Methods

We requested the records of projects requiring environmental compensation plans registered in January 2018-July 2020 before the National Environmental Technical Secretariat of Costa Rica (SETENA-DT-ASA-09232020). The inclusion criteria were projects with viability or in the process that presented environmental compensation, whether in protected wild areas or not. The files were exhaustively reviewed, noting the information on the size and type of project, negative impacts, estimation of the value of the effects, and approved compensatory measures. We assessed whether the compensatory actions occurred in protected wild areas or if, on the contrary, they were conducted outside of them. We conducted a descriptive study of the agreed-upon measures based on this information.

3. Results

Between January 2018 and July 2020, SETENA registered 74 projects that required environmental compensation measures. Fifty-four of those projects were initially submitted under the D1 form, five under the D2 form, and 15 submitted under a FEAP. Two of the projects were obtaining environmental viability at the time of this review, while the rest had already been approved. Almost half of the reviewed reports (49.2%) concern infrastructure projects in services, industries, and housing, while 18.3% were constructions in agro-industrial plantations, mainly palm-oil, ornamental plants, and pineapple. The extraction of materials in rivers and pits involved almost a fifth of the projects analyzed (**Figure 2**).

Table 1 shows the project's profiles, including their dimensions, the impacts that required compensation, and the measures SETENA endorsed to compensate

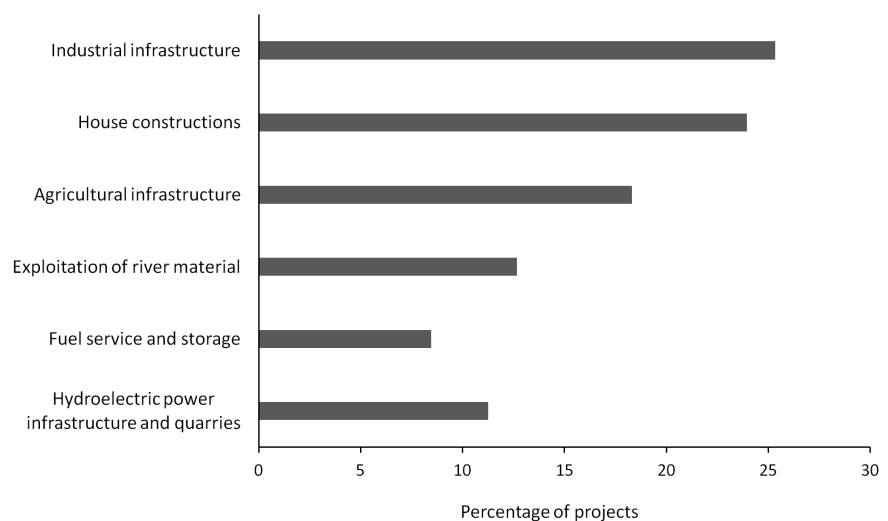


Figure 2. Distribution of projects that required a compensation plan by type of development from January 2018 to June 2020. Source: SETENA.

Table 1. Projects that presented environmental compensation plans in SETENA; Impacts to compensate (1 = administrative failures, 2 = EIA breaches, 3 = deforestation, 4 = land removal, 5 = pollution, 6 = water, 7 = mobilization, 8 impact on fauna); Compensation measures (1 = equipment, 2 = road infrastructure, 3 = school buildings, 4 = school supplies, 5 = reforestation, 6 = food, 7 = cleaning, 8 = environmental education, 9 = compensation by area/habitat, 10 = monitoring, 11 = soil measurements, 12 = others, 13 = gaps, 14 = not specified).

# Project file	Locality (County, Province)	Impact area surface (m ²)	Impacts to compensate	Compensation measures	Estimated cost (\$)
D1-14285-14	Montes de Oca, San José	117,375	2, 6, 7	2, 4, 11, 12	71,924
D1-1181-10	Santo Domingo, Heredia	3051	1	1	649
D1-9561-12	Barva, Heredia	12,843	2	1	NA
D1-15409-15	Guácima, Alajuela	45,978	3, 4	2, 3, 5, 7	5481
D1-15451-2015	Sarapiquí, Heredia	274,000	3	5, 8, 10	36,415
D1-7304-2012	Heredia, Heredia	15,567	2, 6	3, 5, 8	237
FEAP-736-2001	San Carlos, Alajuela	2 linear kilometers	1	1, 2, 4	NA
D1-21601-2017	Bagaces, Guanacaste	13,577,400	6	9	NA
D1-12279-2014	Siquirres, Limón	3,163,688	6	5, 10, 11	8500
D1-21666-2017	Desamparados, Alajuela	53,662	1, 4	2, 5, 7, 8	9950
D1-22727-2018	Osa, Puntarenas	4149	1, 3	3	791
D1-18211-16	Pérez Zeledón, San José	3015	1, 2	3	364
D1-18517-16	Pococí, Limón	15,600	1	1, 3, 5, 8	2010
D1-21926-2018	Grecia, Alajuela	78,456	1	4	3120
D1-14610-15	Garita, Alajuela	151,343	1	1, 8	8650
D1-863-2007	San Carlos, Alajuela	290,317	3, 8	5	NA
D1-06841	La Unión, Cartago	1978	1	6	791
D1-1429-2011	Barva, Heredia	5300	2, 4, 6	5, 7	949
D1-312-2006	El Coyol, Alajuela	1,470,000	2	13	NA
FEAP-148-1997	Esparza, Puntarenas	2,436,000	2	1, 8	NA
D1-20354-2017	Liberia, Guanacaste	2956	4	5, 11	NA
D1-9661-12	San Francisco, Heredia	NA	NA	5	NA
D1-10845-2013	Osa, Puntarenas	23,836,200	2	4	1978
D1-16604-15	Siquirres, Limón	360,000	1, 2	8, 14	NA
D1-14365-15	Alajuela, Alajuela	45,964	1	8	1519
D1-10656-13	Curridabat, San José	4750	1, 6	10	NA
D1-17272-16	Paraíso, Cartago	1,327,825	3,4,6	5	NA
D1-10967-13	El Roble, Alajuela	120,565	1, 4	5	NA
FEAP-675-01	San Carlos, Alajuela	129,495	1	3, 4, 8	NA
D1-16605-2015	Sandoval, Limón	297,560	1	2	839

Continued

D1-15149-15	Corredores, Puntarenas	1,360,000	1	4, 5, 8	1978
D2-9977-2012	Turrialba, Cartago	1187	2, 6	5	NA
FEAP.227.1996	Belén, Heredia	26,758	2	8, 14	NA
D2-7487-12	Corralillo, Cartago	100	1, 2, 4	3, 8	3223
D1-1586-05	Pococí, Limón	185,000	1, 2	14	NA
FEAP-1668-2005	Quepos, Puntarenas	2 linear kilometers	1, 2	3, 8	498
FEAP-406-2004	San Antonio, Alajuela	4000	1	3, 8	2089
D1-320-2008	Grecia, Alajuela	1372	1	3, 5	475
FEAP-594-03	Pithaya, Puntarenas	444	1, 2	14	NA
D1-7429-12	Santo Domingo, Heredia	101	1	4	791
D1-20602-2017	Bagaces, Guanacaste	951,500	3	5,9	NA
D1-9842-2013	San Ramón, Alajuela	238,359	1, 2	3,8	1647
D1-322-2007	Limón, Limón	NA	1, 2	3	NA
FEAP-0082-1994	San Carlos, Alajuela	2 linear kilometers	1	1, 7	7200
D1-8884-2012	San José, Alajuela	64,726	2	6	NA
D1 9661-13	San Francisco, Heredia	30,440	4	11	NA
D1-11397-2013	Belén, Heredia	10,070	1, 3	1, 5	16,954
D1-0288-2010	Pococí, Limón	2,670,000	1	8, 14	832
D1-5643-2011	San Ramón, Alajuela	75	1	1	NA
D1-489-2008A	Osa, Puntarenas	6500	1	1	396
D1-16604-15	Siquirres, Limón	360,000	1	3	396
D1-17092-16	Guápiles, Pococí, Limón	428	2, 4, 6	3, 5, 7, 11	172,437
FEAP-001-1994	San Carlos, Alajuela	78,779	1	1, 3, 7, 8	NA
FEAP-410-98	Grecia, Alajuela	122,638	1	3	949
D1-7968-2012	Limón, Limón	77,9000	2	2	NA
D1-16887-16	Goicoechea, San José	18,299	2, 4	3	1604
D1-1232-06	Orotina, Alajuela	3000	2	1, 3	2729
D1-1047-2006	Orotina Alajuela	3000	1	3, 5, 8	3164
D1-14288-14	Tárcoles, Puntarenas	4332	1	3	NA
D1-864-2007	Sarapiquí Heredia	2 linear kilometers	4	2, 3	2203
D1-0098-2019	Esparza, Puntarenas	39,765	5, 6	3	1187
D2-0091-2019	Escazú San José	2400	4	5, 8	1503
FEAP-976-2003	Golfito, Puntarenas	183,782	2	1	2242
D1-21961-2020	Rio Cuarto, Alajuela	195,812	1, 2	1	7932
D1-19417-2017	San Carlos, Alajuela	4251	2, 4	5	2930

Continued

D1-17769-16	Coronado, San José	3000	1, 2, 3, 4, 6	14	NA
FEAP 976-2004	Carrizal, Alajuela	ND	4, 6	14	NA
D2-21626-17	Garabito, Puntarenas	5697	1	3	6000
FEAP-105-2001	Pococí, Limón	531,596	2, 8	3, 8	2000
D1-1390-2011	Corredores, Puntarenas	17,334	1	3, 4, 5, 8	2453
D2-232017-2018	Cóbano, Puntarenas.	956	1	3	23,734
D1-16926-2016	Pérez Zeledón, San José	1526	3	3	356
FEAP-0073-1994	San Carlos, Alajuela	NA	NA	NA	NA
FEAP-035-1996	San Ramón, Alajuela	NA	NA	NA	NA

NA: Not available; data not located in the SETENA archives during the time this review was conducted.

for these damages. The extent of the project infrastructure varied: from small-scale constructions (e.g., buildings less than 500 m²) to those considered megaprojects (construction of the Río Piedras Reservoir, projected on more than 900 hectares).

The leading causes for presenting the compensation plan include the destruction of riverbanks by logging and deforestation of areas with coverage (13% of the projects), unauthorized earthworks (15.5%), and poor water management (15.5%) (**Table 1**). We also recorded impacts on fauna, waste contamination, and movement in 5.6%, 4.0%, and 2.8% of the projects, respectively. Because some projects registered more than one impact, these combined causes affected just over a third of the total number of projects evaluated (35%) (**Table 1**).

In contrast, almost 80% of the projects registered administrative failures and violations of the measures proposed in their environmental commitments. Among the most frequent administrative offenses are included: expiration of the environmental guarantee, lack of an environmental regent, non-submission of re-gency reports, and starting works without environmental control instruments or authorization by SETENA. The most common violation was the modification of the design and the affected area of the project. SETENA considers these faults as causes to trigger the compensatory actions.

In several cases, an estimate of the economic value of the impacts to be compensated is presented (**Table 1**), with records between \$237 and \$172,437 US dollars. However, no report shows how this valuation is calculated.

Among the compensatory measures registered, the donation of construction materials or the installation of infrastructure for schools (20% of the cases), support for environmental education programs (17% of the projects), and re-forestation programs (>15% of the cases) stand out (**Figure 3**). Other actions used in compensation were: the purchase of equipment or school supplies, the donation of equipment to community associations, and the repair of roads and paths. The records reviewed do not account for the scope of these measures, nor

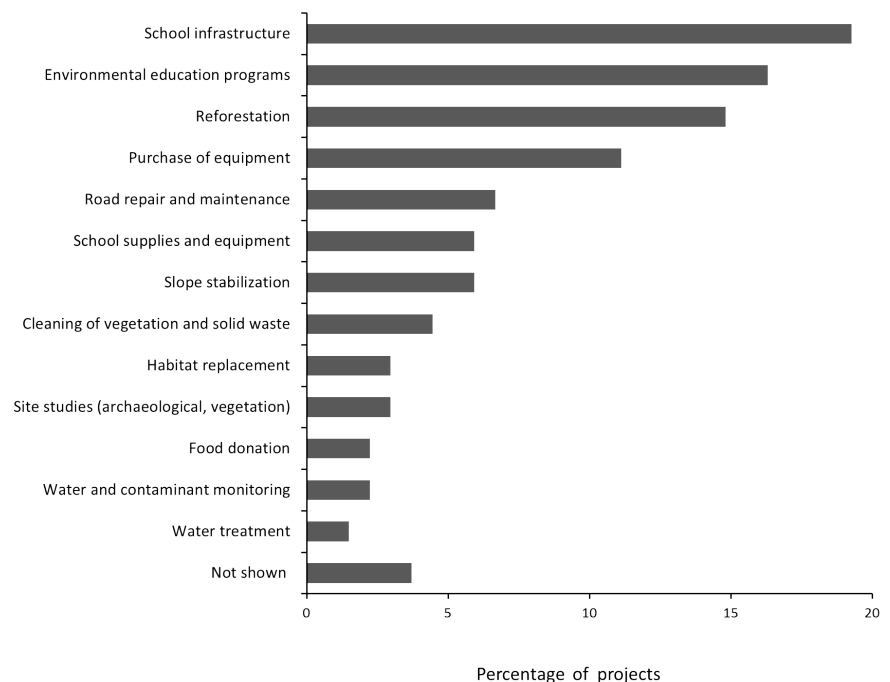


Figure 3. Percentage of compensatory measures registered in the projects from January 2018 to June 2020. Source: SETENA.

is there evidence of evaluation and monitoring of the environmental education and reforestation programs over time. Only a tiny fraction of the cases (<5%) contemplated actions to replace the impacted habitats or measures aimed at its recovery, as well as actions to monitor water and pollutants (**Figure 3**).

Several compensatory actions taken are presented in **Table 2**. Compensatory actions taken were quite varied and included: the acquisition of food and water from community centers, the purchase of foosball tables for the development association, the purchase of school supplies, the establishment of reforestation programs, and the acquisition of land with forest cover to replace impacted areas. Only three projects registered biological monitoring to evaluate the scope of their compensation plan (**Table 2**). In two of the files reviewed, there is no mention of what the Compensation Plan consisted of, nor was information on the economic valuation of the impacts to be compensated included.

4. Discussion

Although compensatory measures are contemplated in Costa Rican regulations and a mechanism has been established to implement them, our analysis reveals certain inconsistencies in how environmental offsets are interpreted and how irreversible negative impacts are reimbursed.

Between 2018 and 2020, 74 projects required environmental compensation before SETENA. However, it is impossible to determine what proportion of the total number of projects this number represents. This is because the requests for compensation plans occur late in the project development process; consequently,

Table 2. Types of compensatory measures found in the project records at SETENA.

Compensatory actions	Items
Equipment donation	Blowers, truck parts, table football, collection centers, fans, air conditioning systems, furniture, lighting lamps, electronics, teaching materials, uniforms, piping systems, awnings, speakers, generators, fuel
Other construction	Paved trails, streets, paths, sidewalk signs, bus stops, information kiosks, telephone exchanges.
School infrastructure	Recycling stations and plants, money, painting, construction (classrooms, offices, and walls), garden benches and tables, cleaning green areas, furniture, awnings, alarm systems, infrastructure maintenance, and remodeling
School Supplies	Computers, tablets, biomechanical fitness machines, notebooks, uniforms, environmental awareness workshops, tree donations, dance, and music programs
Reforestation	Donation and planting of trees, reforestation plans, and programs, remediation plans, cutting of vegetation and weeds, installation of grass, irrigation systems, enrichment of secondary forests
Food supplies	Purchase of milk, diapers, meat, chicken, and bottled water
Cleaning supplies	Cleaning of the riverbed, purchase of cleaning supplies, waste collection, garden maintenance, removal of mud and stagnant water, cleaning of road patrols.
Environmental education	Socio-environmental education programs, talks, workshops, training (recycling, waste management, water resources), sponsorships, environmental management plans and water treatment, educational materials.
Habitat substitution	Acquisition of land and farms with similar types of forests.
Resource monitoring	Annual monitoring of water (quality and rate of infiltration and contaminants), flora, fauna
Soil management	Rainwater collection system for irrigation, post-closure mitigation measures (removal of sediment traps, waste disposal, and soil recovery), soil reformation plans, slope stabilization, implementation of mitigation measures (collection of stormwater, sediments, crossing barriers, retention ponds, and structures for runoff), soil waterproofing, filling and soil compaction.
Others	Feasibility studies and vehicular access, archaeological evaluations, research and evaluation of agrochemicals, affidavits of environmental measures, legal support in environmental complaints, wastewater treatment lagoons

there is a gap between the initial appraisal of the project and the assignment of compensatory measures. For instance, SETENA registered 4830 new projects during the study period [29], although only five required compensation were in-

cluded in our review. In the future, other projects may have to comply with that requirement as the project develops. Evidence is that most of the cases included in our review correspond to projects that entered SETENA before 2018. Still, it was during the study period that compensatory actions were requested.

The preliminary evaluation (and therefore the category of studies to which the project is assigned) does not necessarily determine whether or not a project will merit compensatory measures. Thus, five projects initially registered as D2 required compensation plans, although this category is assigned to projects with minimal and reversible impacts [27].

The regulations detailing the method for determining when a project requires compensation can be confusing. The General Regulation of Environmental Impact Assessment Procedures (EIA) of Decree 31849-MINAE-S-MOPT-MAG-MEIC explicitly distinguishes between negative environmental impacts and environmental damage. Thus, a negative impact is “evaluated in an *ex-ante* process, for which prevention, mitigation, and compensation aspects can be considered to reduce its environmental scope”. In contrast, environmental damage is considered “a negative environmental impact, not foreseen, controlled, or planned in an Environmental Impact Assessment process (evaluated *ex-ante*), produced directly or indirectly by an activity, work or project, on all or any other component of the environment. For this damage, no prevention, mitigation or compensation measure was foreseen, and that implies an alteration assessed as having a high Significance of Environmental Impact (SIA)” (article 3, paragraph 28). The compensation plan then arises to respond to environmental damage; it is requested after granting the environmental license.

To add to the confusion, two different definitions of environmental damage are recognized in the laws. One is stated in the Decree 31849-MINAE-S-MOPT-MAG-MEIC mentioned before. The other definition is contemplated in the regulations of the Biodiversity Law 34433 (article 3 subsection c) “Environmental damage: It is the result of the alteration or destruction, intentional or not, or a product of negative impacts of some human activity or natural origin, which affects, interrupts or destroys the components of ecosystems, altering their function and structure reversibly or irreversibly” [30]. Therefore, in Decree 31849, the environmental damage is recognized after the execution of the project, whereas in the Biodiversity Law, the damage is identified from the beginning. This second definition does not seem to be considered by SETENA since most observed compensation plans are carried out after environmental viability and are not planned at the project formulation stage.

A consequence of the conceptual differences is that two types of environmental damage are recognized. On the one hand, there are adverse and irreversible modifications to environmental components (for example, removal of forest cover, earthworks, sedimentation, floods, **Table 1**). On the other hand, damages can also violate the rules and verdicts regulated by SETENA, including administrative infractions (**Table 1**). Both types of injuries elicit similar compensatory

measures (**Table 2**) despite their conceptual differences.

The explanation for this situation seems to be found in the regulations in place. The payment of sanctions as an objective of the compensation is endorsed by article 99 of the Organic Law of the Environment 7554 [26], which specifies in subsection i: “Alternatives of compensation of the sanction, such as receiving official educational courses on environmental matters; in addition, working on communal works in the area of the environment” as penalties that can be imposed on individuals or public officials, for actions or omissions that violate the norms of that law or other environmental protection provisions. Nonetheless, the same article indicates in subsection g the need of “Imposition of compensatory or stabilizing obligations of the environment or biological diversity” to compensate for environmental damages. SETENA seems to favor sanction compensation alternatives over mechanisms to compensate for impacts at the level of components of the environment and diversity. Consequently, the Compensation Plan regulated in Costa Rica is more of a sanctioning instrument, which in most cases imposes penalties to correct violations of the regulations.

A fundamental aspect of compensation is to achieve a net environmental gain [11] [31], which is attained when the offset is not less than the cost of the impact. Net gain can be established on the surface area of the habitat of interest, species composition, structure, ecosystem function, or use by people [11]. When administrative sanctions replace compensation, there is a danger of not guaranteeing an equivalent return of environmental losses. This situation was evidenced in many of the compensatory actions extracted from the project records. Thus, the environmental gain does not seem to be a goal to follow in the compensatory measures endorsed by SETENA.

Following regulation CP-042-2011-SETENA [28], the environmental compensation measures practiced in Costa Rica are based on an economic approach [10], where the monetary value of the impacts is estimated, and the suggested compensation should have an equivalent cost. To ensure economic equivalence, SETENA’s plenary commission indicates that the financial estimate for the damages must be carried out by a suitable professional facilitated by the developer. In proven environmental damage, SETENA could request support from SINAC (the administrative authority for natural resources and conservation areas) or the Environmental Court, both MINAE agencies, to assess that impact. Even in very complex situations, SETENA is empowered to carry out specialized outsourcing [28], which, as stipulated, should be paid for by the developer [25]. None of this was evidenced in the cases reviewed. Instead, usually, the developer proposes the Compensation Plan, based on an approximate economic valuation made by him, and submits it to SETENA for approval. One of the drawbacks of this procedure is that the developer is responsible for identifying the possible negative impacts, estimating the monetary costs associated with them, and proposing the compensation measures equivalent to that expense (paragraph a, point 2 of regulation CP042-2011) [28]. In addition, there is no clarity on how

this economic valuation is done, nor on how SETENA determines if that value is proportional to the estimated cost of the impacts (or infractions) that originated the sanction. In other words, it is not clear whether proportionality is established in economic matters that represent the desired value-value balance [32].

A monetary deposit must be consigned as an environmental guarantee to ensure that the developer complies with the environmental measures when executing the project. The objective of this guarantee is to protect the application of correction or compensation measures for environmental damage, and its amount is appraised by SETENA, generally for 1% of the value of the project (article 21, Organic Law of the Environment 7554) [26]. For the developer to recover his deposit, he must present the environmental compensation plan, so it is in his interest to minimize the costs associated with unforeseen impacts or non-compliance. However, there is no evidence that SETENA has claimed the environmental guarantee in any analyzed cases, even though several did not specify compensatory measures. Thus, the role of SETENA seems to be relegated to the regulation of procedures and not to guarantee that the negative impacts are effectively compensated, or to seek an environmental gain.

Under the principle of the environmental hierarchy, compensatory measures must be carried out if the mitigation is not sufficient, focusing on tangible components of the environment, such as biodiversity or natural habitat [13]. Although measures such as those recorded in **Table 2** benefit communities or public institutions and are socially acceptable, they do not compensate for the affected environmental components. In addition, these measures have the drawback of being temporary, while compensation for environmental elements should involve actions with more lasting results.

Compensatory alternatives based on contributions to specific environmental education activities also do not guarantee compensation proportional to losses, especially since there is no greater detail or follow-up evidence to verify whether these actions have materialized and their scope. Similarly, there is no evidence that the reforestation efforts mentioned in many files as compensation measures are sustained over time, nor if actions beyond planting are included (e.g., care and monitoring of planted trees, weed cleaning, protection, etc.). Thus, there is no guarantee that these actions meet the environmental gain requirement expected from the compensation [11].

The non-proportionality shown between the compensation measures and the impacts recorded in **Table 1** may have legal consequences under Costa Rican law. On the one hand, article 50 of the Costa Rican Political Constitution [33] establishes the right to a healthy environment, which would not be ensured by resorting to the measures observed. On the other hand, the scarce legislation on compensation has resulted in jurisprudential pronouncements that recognize the responsibility for environmental damage, regardless of whether a norm establishes it. For example, the general principles of Environmental Law should be oriented towards preserving nature to allow sustainable development, even when there is not enough legislation [34].

Our analysis also warns of confusion between the concept of environmental compensation and environmental mitigation, both in the regulations and institutional framework. Thus, measures such as: cleaning the riverbed, stabilizing slopes, monitoring surface waters, establishing recycling stations, wildlife crossings, sedimentation traps, and waste disposal systems (**Table 2**) are actions aimed at reducing the adverse effects of the projects, but not to compensate for them. One possible reason for this confusion is how these concepts are specified in Costa Rican regulations. The Regulation of Decree 31849-MINAE-S-MOPT-MAG-MEIC cited above defines Mitigation Measures as “those actions aimed at reducing significant negative environmental and social impacts caused by the execution and operation of an activity, work or project and that must apply to the total AP of the activity, work or project and depending on its magnitude, may apply to its direct or indirect area of influence.” This statement details the nature of the measures, also specifying where they should be applied. In contrast, the same article sets Compensation Measures such as: “actions that compensate society or nature, or a part of them, for adverse environmental impacts, for cumulative negative effects, caused by the execution and operation of an activity, work or project. In this case, the definition is very general. It does not specify the nature of the actions that can be carried out to compensate for these negative impacts or whether these compensations can be exercised on aspects unrelated to the adverse effects. Consequently, the possibility of other types of compensation is left open, thus causing confusion between measures.

In conclusion, although all the measures registered here are positive actions for the environment or sectors of society affected by development projects, it is clear that the bulk of them do not endorse the spirit of return on components equivalent to those impacted. Many of the contemplated compensatory measures try to atone for infractions of an administrative nature, which explains their inconsistency with natural environment elements. This is a consequence of treating compensatory measures as sanction alternatives. Therefore, neither the current regulations nor their application by SETENA ensure the environmental benefit or gain in compensation measures, which contradicts the essence of environmental compensation.

How to reverse this situation?

We believe that several aspects should lay the groundwork for how to proceed in the event of negative impacts on the environment from development and production projects. First, compensation (and any other level in the mitigation hierarchy) should be considered from the earliest stages of the environmental impact assessment process. In the case of Costa Rica, if a project requires an environmental impact study (EsIA), compensation should be considered one of its possible outcomes, as it is done in other countries (Australia [35], United States of America [11] Canada, [36]). The study must then clearly indicate the foreseeable impacts, including if these can be avoided, mitigated, or if the environment once impacted can be rehabilitated or restored. If the expected impacts persist,

an environmental compensation plan should be presented to account for them. The actions to be followed, both mitigation and compensation, would constitute the environmental commitments that the developer would acquire to make his project environmentally viable. SETENA must have sufficient technical criteria to anticipate the impacts of works and projects and be able to evaluate the containment, mitigation, or compensation plans proposed as environmental commitments. Once the environmental effects and the possible solutions submitted in the environmental obligations have been evaluated, the environmental viability would be granted. Following this strategy, SETENA should identify most of the impacts to be compensated at the planning stage.

In large-scale projects, SETENA must guarantee inspections in the field that corroborate and follow up on the commitments made by the developer. Two types of problems could arise from these inspections and their corresponding reports. The first being, the emergence of impacts not contemplated in the EsIA would result in new mitigation or compensation actions. These could be handled as a supplement to the developer's previously acquired environmental commitments. The second being, SETENA's inspections could show non-compliance with measures previously contemplated in the environmental commitments or administrative non-compliance with some of the project's requirements. In both cases, it would be an explicit violation of the previously acquired environmental duty, which should generate a warning to the detriment of the developer. Here there is the alternative of an economic sanction or the execution of the environmental guarantee of the project, previously established for it. Using this deposit more frequently would possibly considerably reduce the number of projects that do not meet their environmental commitments.

If faults that generate compensation actions are identified during the field inspections, these should be recorded as an addendum to the compensation plan proposed during the first evaluation stage. Ideally, these measures should be based on ecological equivalence, proportionality, and net profit that constitute the spirit of environmental compensation [15] [37]. When the breaches are administrative, it is clear that an economic sanction applies, along with a warning or even the cessation of the project's operation. These actions should be sanctioned and valued separately from environmental compensation.

Other aspects would improve the treatment of environmental compensation in the country. If the strategy of economically assessing negative impacts continues, this assessment should be carried out by an expert appointed and assigned by SETENA, and paid for by the developer. In this way, the transparency of the process is favored, and compensatory measures are prevented from being proposed unilaterally [25]. The economic valuation needs to be regulated with a calculation methodology free of ambiguities so that the expert opinion has an established and objective roadmap [17].

In the economic approach, the implementation of some strategies that have been successful in other countries could be contemplated in Costa Rica. An ex-

ample of this is the use of environmental banks or biodiversity banks [38] [39] [40]. Once the project's negative impacts have been characterized, these mechanisms seek compensation through an economic investment to a cumulative fund destined to be applied in areas or tasks to conserve the environment. In this way, it is possible to maximize the environmental gain by better designing environmentally fair compensations.

Many of the compensations made in the reviewed projects aim for social assistance. However, we emphasize that adverse environmental impacts are compensated with compensatory measures on those environmental components affected (equivalence) and in the same amount (proportionality).

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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