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Practical Guide for **Cumulative Impact Assessment and Management** in Latin America and the Caribbean

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List of Acronyms

CETESB	State of São Paulo Environmental Company (Brazil)
CEA	Cumulative Effects Assessment
CIAM or CIA	Cumulative Impact Assessment and Management
CIMF	Cumulative Impact Management Framework
COA	Organic Code on the Environment (Ecuador)
CONAMA	National Council for the Environment (Brazil)
CSO	Civil Society Organizations
DEAT	Department of Environmental Affairs and Tourism (Canada)
ECLAC	Economic Commission for Latin America and the Caribbean
E&S	Environmental and social
EIA	Environmental Impact Assessment
EsIA	Environmental Impact Statement
ESIA	Environmental and Social Impact Assessment
EMT	Environmental Management Tools
ESPS	Environmental and Social Performance Standards
ESSP	IDB Invest Environmental and Social Sustainability Policy
ha	Hectares
HP	Hydroelectric project
IDB	Inter-American Development Bank
IDB Invest	Inter-American Investment Corporation
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
LATAM	Latin America and the Caribbean
MARN	Ministry of Environment and Natural Resources (Guatemala)

MIA	Environmental Impact Declaration (Mexico)
NGO	Non-governmental Organisation
PCB	Polychlorinated biphenyl
PE	Equator Principles
PHAM	Alto Maipo Hydroelectric Project
PNIC	National Infrastructure Plan for Competitiveness
PPP	Policies, Programs and Plans
RCIA	Rapid Cumulative Impact Assessment
RSEIA	Regulation of the Environmental Impact Assessment System (Chile)
RT	Reference Terminology
SDG	UN Sustainable Development Goal
SEA	Environmental Assessment Service of Chile
SEA	Strategic Environmental Assessment
SENACE	National Service of Environmental Certification for Sustainable Investments (Peru)
SERNA	National Ministry of Energy, Natural Resources and Environment (Honduras)
SETENA	National Environmental Technical Secretariat (Costa Rica)
UN	United Nations
VC	Valued Components (VEC)
VEC(s)	Valued Ecosystem Component(s)
VESC	Valued Environmental and Social Component
WCS	Wildlife Conservation Society
WM	World Bank

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PROLOGUE

Cumulative impact assessment and management ("CIAM") is often cited by IDB Invest clients as one of the most difficult challenges both to ensure the environmental and social approval of projects, as well as to meet the requirements for their financing in Latin America and the Caribbean ("LATAM"). This is made even more complicated by the fact that in most of the region's countries there is no clear legal mandate on the need to evaluate cumulative impacts as part of the legal requirements of the environmental impact assessment ("EIA"), nor a uniform established practice that allows professionals in the public and private sectors to carry out these types of assessments in a systematic way. Additionally, there is an even greater and more pressing problem: the absence of effective collaboration frameworks between different stakeholders to manage these types of impacts at the regional level. With the pending need for massive investment in infrastructure in LATAM, in the short and long term, the management of the cumulative impacts of individual investment projects is essential to maintain the future sustainability of the region's complex ecological and social systems.

To meet this need and help private sector proponents, consultants, governments, academics, and civil society representatives to understand what cumulative impacts are and how they can be managed effectively, IDB Invest has prepared this Guide. It presents a practical approach that takes users through a step-by-step process and provides them with useful tips and suggestions. It also contains examples of case studies of CIAM in LATAM.

With this Guide, IDB Invest aims to help its clients, government entities and civil society to promote collaborative approaches for the management of cumulative impacts on valued ecosystem components ("VEC") that represent the interest of a wide range of interested parties who are pursuing a development of "green" infrastructure, maintaining the sustainability of the natural environment and the diverse livelihoods of all those who live in LATAM.

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1. ABOUT THIS GUIDE

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1. ABOUT THIS GUIDE

1.1 Who is this Guide for?

This Practical Guide for Cumulative Impact Assessment and Management in Latin America (the "Guide") is aimed primarily at professionals with an interest in Cumulative Impact Assessment and Management ("CIAM" or "CIA")[1] in Latin America and the Caribbean ("LATAM"). This includes consultants, proponents or projects developers that prepare this type of analysis, lenders that finance infrastructure projects who require them, government officials who review these assessments, academics who have the challenge of training future professionals in CIA, and representatives of civil society interested in determining the cumulative impacts that a group of projects can generate. This document can also help regulatory bodies and decision-makers understand what constitutes an acceptable and reasonable practice when preparing terms of reference, making recommendations for collaborative and regional management, and reviewing the quality of the CIAs. In this sense, the term *professionals*, as used in this Guide, refers to a wide range of participants in the CIA process.

1.2 What is the purpose of this Guide?

The purpose of this Guide is to provide CIA professionals with: i) an overview and clarification of the practice of cumulative impact assessment; ii) suggestions on practical approaches to completing a CIA from the perspective of a project, complying at the same time with legal requirements and international best practices; and iii) an understanding of the challenges involved in carrying out a CIA in the context of LATAM.

1.3 Are the contents of this Guide mandatory?

The Guide **does not** describe the mandatory requirements for carrying out a CIA. Rather, it aims to: i) be generic, applicable for any legislative assessment process and usable by professionals thanks to the provision of information on the CIA process; ii) suggest practical approaches on how to do a CIA; and iii) recommend how to respond to the challenges faced by the CIA processes in LATAM. Any mention or description of a particular case study in this Guide does not imply, in any way, support from IDB Invest for the process followed, nor is it considered a mandatory requirement to be observed, including the decisions derived from such processes.

1.4 What does this Guide not cover?

This Guide, which does not constitute a textbook on CIA, assumes that the user

has basic knowledge of the following: i) fundamentals of environmental impact assessment ("EIA"), including topics such as screening, scoping, identification and assessment of environmental impacts; ii) the use of indicators and analytical techniques; and iii) the identification and prescription of management measures.[2]

This knowledge is important, since many attributes of the CIA are based on those originally developed for the EIA process. Thus, to keep the Guide focused on practical needs, it centers on the main aspects of the CIA process. In this sense, the Guide is not intended to be exhaustive, nor will it cover in detail all the possible situations that may appear during the process of evaluating cumulative impacts.

The scope of this Guide is subject to the following limitations:

> **LEGISLATIVE REQUIREMENTS OF THE CIA IN LATAM**. The Guide is not limited to the requirements of the CIA specified in the local legislation of each country but offers an overview of how the assessment of cumulative impacts in the region is addressed. Thus, the degree of application of the principles described in this Guide may vary from country to country and will depend, to a large extent, on the type of legislation in force. In this sense, the Guide is essentially generic, but

it provides useful information on the way in which a CIA should be carried out under any national legislation of the region.

> **BIOPHYSICAL EFFECTS VERSUS SOCIOECONOMIC EFFECTS:** To date, CIAs have primarily focused on the assessment of the biophysical attributes of a region rather than on its socioeconomic variables. Often, cumulative socioeconomic effects have been included in a separate assessment, using conventional evaluation techniques. However, in practice, this results in shortcomings when addressing the CIA, given that this process requires an integrated approach that considers the complex interactions presented by the environmental and socioeconomic components.

> > **SPECIFIC PROJECT ASSESSMENTS VERSUS REGIONAL PLANNING:** The assessment of cumulative impacts can be carried out for two different purposes: specific assessments of projects (CIA carried out from the perspective of a project) and studies of regional planning (or land-use) at a higher level (regional CIA carried out from the perspective of a planner). This Guide will analyze both approaches, considering that several of the elements used when carrying out assessments from the perspective of the planner (local bodies responsible for planning or environmental control) are simplified when carrying out a CIA from the perspective of a project.

Although the CIAs that are carried out from the perspective of a project should ideally be completed as part of an EIA, in LATAM these analyses are often carried out as a complement to the EIA, mainly because cumulative impact assessments are not normally required in national legislation.

Regional planning studies, or CIAs carried out from the perspective of the planner, are usually undertaken in the context of the Strategic Environmental Assessment ("SEA") when it is necessary to evaluate the impact of several past, present and future human activities in a predefined region, and their relationship with policies, programs and higher-level plans, but without focusing on a specific project.

> **CASE STUDIES:** Although dispersed, there are many examples of CIAs carried out in LATAM. However, these are usually driven to meet the requirements of multilateral organizations such as IDB Invest, the Inter-American Development Bank ("IDB"), the World Bank ("WB"), the International Finance Corporation ("IFC") and private investment banks adhering to the Equator Principles ("EP"). Rather than analysing detailed case studies, the Guide presents examples of projects which demonstrate a specific point or good practice of CIA.

1.5 Organisation of this Guide

This Guide is organized as follows:

> CHAPTER 1: About this Guide

This describes the purpose of the Guide, the target audience, its limitations, and details of what is not included.

> CHAPTER 2: Basic Concepts

This presents the definitions of various concepts that will be used throughout the Guide.

> CHAPTER 3: The Need for Cumulative Impact Assessment and Management in Latin America and the Caribbean

This analyzes why cumulative impact assessments are necessary in Latin America and the Caribbean, the limitations of the "project-by-project" approach of the EIA, and the legal and regulatory framework for CIAs in the region.

> CHAPTER 4: Cumulative Impact Assessment and Management

This presents the basic concepts and definitions of the cumulative impact assessment tool; its main elements; the differences between cumulative impact assessments, environmental impact assessments ("EIA") and strategic environmental assessments ("SEA"); and the tools available for cumulative impact assessments.

> CHAPTER 5: Promotion of Good CIA Practices in LATAM

This summarizes the basic steps for carrying out a CIA, including advice for professionals, and examples of good practices applicable to the Latin American context.

> CHAPTER 6: Challenges of CIA Practice in LATAM

This analyzes the challenges faced by CIA professionals, especially in the LATAM context.

> ANNEXES

The annexes include: i) guidelines for preparing terms of reference for CIA implementation; and ii) a non-exhaustive summary of the regulatory requirements for CIAs in some LATAM countries.

> REFERENCES

This contains details of the documents consulted when creating this Guide.

> FINAL NOTES

This contains details of the bibliographic citations used in this Guide.

This Guide, aimed at consultants, project developers, government officials, academics and people interested in CIAs, is not a textbook, nor does it provide details on the mandatory requirements for carrying out a CIA. Despite being generic, it provides suggestions and practical approaches on how to carry out cumulative impact assessments in the Latin American context.

2. BASIC CONCEPTS

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2. BASIC CONCEPTS

Before starting to talk about cumulative impact assessment and management, it is necessary to agree on some basic concepts that will be used throughout this Guide. For this, it is necessary to begin by understanding what *environment* means, even when, strictly speaking, there is no single definition for this term.

A first approach to the concept of ***environment*** is the traditional definition that relates it to *everything around us*. From this, it can easily be inferred that *environment* not only refers to the purely natural, but also includes a series of other *non-natural* aspects that are part of our surroundings.

Environment, from a more practical perspective, can also be understood as the life-sustaining system in which biotic (living) and abiotic (non-living) factors interact, allowing, conditioning or restricting different forms of life. This meaning, which is in line with the previous one, makes more explicit the fact that, in addition to merely natural factors, the concept of *environment* also includes physical, social, cultural, and economic aspects, among others.

A more anthropocentric meaning of the term states that the ***environment*** is *everything that influences or can be influenced by human beings*. This concept tacitly implies the existence of a subjective evaluation of the interaction or perception experienced by an individual and what surrounds them and limits the broad meaning of the two previous definitions to something more tangible and immediate that relates our surroundings to one or more human activities.

Although not entirely perfect, it is this third and final concept that allows the identification of the environmental alterations that a policy, action or simply an intention to do something can cause and it is the one that, from now on, will be used in this document. **Box No. 1** presents a practical example to better understand this concept.

Box No. 1

Example to better understand the concept of environment

To better understand the difference between the three definitions of *environment,* consider, for example, Ganymede, one of the moons that orbits Jupiter in our Solar System, and try to answer the following question: Is Ganymede part of the *environment*?

The answer seems an obvious yes when the first definition is used, because Ganymede is definitely part of *everything that surrounds us*, regardless of the distance that exists between the Earth and the Jovian moon. However, if the second definition is used, the answer would be a conclusive no because Ganymede does not seem to be part of a *life-sustaining* system, at least not with the information that is possessed to this day.

When the third meaning is used, the answer ceases to be evident and tends rather to be *interpretative*, since the following question should be answered first: Can Ganymede influence or be influenced by human beings? Thus, for the average person, Jupiter's moon is *definitely not* part of the environment since there is almost no possibility of influencing it or being influenced by it. However, for a person working on a Jupiter space exploration program, Ganymede *would* be part of the *environment*.

Starting from any of the three previous definitions, it is easy to deduce that the environment is composed of many elements. Each of these is called ***an environmental component***. Environmental components are characterized by a series of attributes that can be expressed qualitatively or quantitatively through ***indicators or parameters***. The variation of the latter expresses the degree of alteration that the environmental component in question has experienced.

The characteristics of the environmental components do not remain constant over time. Their change is known as ***environmental behavior***. When the environmental behavior has been altered as a result of the deliberate implementation of certain actions, or when its change has been the consequence of the mere intention to carry out some type of action, it is said that an ***environmental effect*** has occurred. If variations in the environmental behavior, i.e. environmental effects, are expressed in qualitative or quantitative terms, and these variations are the final consequence (for a predefined period) of the actions that caused them, the environmental effects are transformed into ***environmental impacts***. Thus, the difference between an ***environmental effect*** and ***impact*** is that the first corresponds to a generic meaning of alteration of the environment's behavior, while the second refers to the quantitative or qualitative assessment of the modifications of this behavior.

Despite this subtlety in the definition, these terms are often used as synonyms. An example to better understand the concepts mentioned above are included in **Box No. 2.**

Box No. 2

Example to better understand the concepts of environmental effect, impact, component, and behavior

Imagine part of a jungle of one squared kilometre through which a river passes, with a person living on its banks. This individual's *environment* will be composed of all those things that can influence him or that he can influence, that is, the trees, the river, the animal and vegetable species he uses for nourishment and clothing, the atmosphere, etc. All these elements of his surroundings constitute an *environmental component* of this individual's *environment*.

The change that this person has been observing over time in terms of variations in the water level, the animal colonies, the plant species, the climate, etc. (all these environmental components) will allow him to characterize the *environmental behavior* of the region where he lives and will allow him, for example, to determine a flooding season and low water season for the river; arrival, nesting and migration seasons for the birds; and periods of flowering and fruiting for the trees.

If, to meet his needs, he decides to dam the river and modify its regime for his own benefit, this person would be causing an *environmental effect* since he would be altering the "normal" conditions of his surroundings. When analysing the environmental repercussions that this action has had and determining, for example, that the results have been "good" in terms of the benefits being achieved, he would be unconsciously converting the effect into an *environmental impact*, a positive one in this case.

Although it is difficult to identify them *a priori*, each of the *environmental components* has a specific function within the environment. Moreover, the variations they experience are intimately related to each other, to the point that any modification of an environmental component can result in an alteration of the set of environmental elements as a whole. This characteristic turns the environment into a ***system***, as it contains a series of elements (environmental components) that interact with each other.

When it has been verified that, over time, the individual changes caused by the

different factors or processes of a system do not produce alterations in its state, it is said that said system is in ***equilibrium***.

An ***ecosystem***, represented by a portion of the environmental system, can be understood, in a general way, as the interrelation between the subset of living environmental factors that make up *biocenosis*, and its non-living surroundings that constitute the *biotope*. The science that studies these relationships is ***ecology***.

The environment is a system made up of environmental factors that are constantly evolving. This process of change, in addition to being continous, is also common, frequent, and to a certain extent *natural*. But then, what number of changes (and of what kind) can occur in the environmental system without causing a breakdown in the environment?

The answer to this question is not easy to find. However, to have a good approach, it is necessary to see the environment as a set of ecosystems that interact with each other and that have a unique characteristic that, at least until now, is only tangibly attributable to our planet: life.

In fact, changing the concentration of the elements required by the ecological equilibrium without this change constituting any danger for the generation or development of life is known as ***pollution. Contamination***, on the other hand, is a degree of (extreme) pollution. Changing the concentration of the elements required by the ecological equilibrium beyond this point endangers the generation or development of life. The limit between pollution and contamination is known as ***the bearing capacity of the environment, load capacity limit, load threshold or limit of environmental elasticity***[3], which, in turn, can be understood as the environment's ability to be polluted without becoming contaminated and to return to the conditions it had before the effect that modified it had been generated. The example in **Box No. 3** allows for a better understanding of the difference between pollution and contamination.

Box No. 3

Example to better understand the difference between pollution and contamination

Imagine a fish tank which is home to a fish. Assume also that it has been decided to gradually add small quantities of salt to the fish tank in regular intervals. At the beginning it will be evident that, despite increasing salinity of the water, the fish will continue to live and "tolerate" the new conditions of its environment. That is, life continues inside the fish tank, even though the initial ecological equilibrium has been altered and a process of pollution has been created in the fish tank. However, as salt levels continues to rise, there will be a point where the fish will be unable to tolerate the excessive salt concentration and will eventually die. A moment before the fish's death, the *bearing capacity of the environment* (of the fish tank) will have been reached and the line between ***pollution and contamination*** will have been determined.

The subtle (but very important) difference between contamination and pollution, marked by the ***environmental bearing*** capacity, is of vital importance to allow the rational "manipulation" of the environment (through its environmental components), to improve the life quality of communities, but without compromising the base resources.

Another concept that needs to be defined is ***sustainable development***[4], which first requires *development* to be defined. For the latter, there is the axiom that, regardless of any political or economic model that is considered, for there to be *development* there must have previously existed some kind of *growth*. In general terms, ***growth*** is nothing more than the accumulation of something that is desired somewhere in a system under analysis. From the perspective of the economy, ***development*** can be understood as the process to identify and carry out actions so that growth occurs in the way that best suits the interests of users. In other words, for *development* to take place, *growth* alone is not enough; it must be controlled and directed so that there are no excesses or defects in the system under analysis. **Box No. 4** presents an example to better understand these concepts.

Box No. 4

Example to understand the concepts of growth and development

One way to better understand the relationship and difference between *growth* and *development* is through the following analogy. Suppose a baker has prepared a batter to make a cake and puts it in an oven without having previously placed it in a tin. The batter, as a result of the heat, will begin to transform and grow in all directions. This *growth* will most likely result in the batter having some excesses and defects in several places: there will be areas where there is more cake than in others, and places where the cake is raw or overcooked. The result of this process does not necessarily benefit the baker or her potential customers since the product obtained in this way will surely be very difficult to market or consume.

Now assume that the baker places the same batter mentioned above in a tin before putting it in the oven. The result, after the required cooking time has elapsed, would be a uniform cake, without excesses nor defects and, therefore, easily marketable or consumable.

The tin, in the second case, would have defined where and how the *dough should grow*, that is, how it should *develop*, to achieve a quality product.

From the above, it can be concluded that *development* is the direction that *growth* must take to achieve certain pre-determined goals. This implies that, before talking about development, it is necessary to have set goals or objectives that can direct human activities that generate growth.

In environmental terms, ***development***, on its own, can be understood as applying human, financial, biological and physical resources to the environment in order to fulfill human needs and improve the standard of living. Note here that there are two implicit things that this meaning relies on: the first, the accumulation of something that, in this case, translates into "*fulfilling human needs;*"; and the second, a tacit determination of the type of growth that is desired and that seeks to "*improve the standard of living*". From an ecological point of view, ***development*** can also be understood as the manipulation of interactions and ecosystem processes in order to fulfill human needs.

Regardless of the perspective when defining *development*, it is easy to infer two things: i) *development* inevitably entails some type of environmental pollution, since it always implies the modification of the environment; and ii) *development*, on its own, does not necessarily entail a rational management of the environment. The above makes clear that the predefined objectives for the type of growth that a system must experience are decisive in determining the type of *development* that it obtains. Thus, for example, if these objectives are compatible with rational environmental management that meets current needs without compromising the capacity of future generations[5], we could speak of ***sustainable*** development, or if the target is the constant maintenance of a given growth rate, we could speak of ***sustained development***.

Sustainable development is a type of *development* where the changes that are made to the environment tend to result in pollution and not contamination.

Since all types of development cause environmental alterations, *sustainable development* seeks a rational manipulation of natural resources, ensuring that the changes made do not exceed the *environmental bearing capacity*. This type of development: i) seeks to increase the well-being of the population without exhausting the base of natural resources that sustain life; ii) provides a space for rational growth; iii) accommodates the manipulation of resources to make them more productive, but without exceeding their *bearing capacity*; and iv) is still conditioned to the capacity that the ecosystems may have to provide raw materials and absorb the effects of human activities. There is no single model of *sustainable development*, since it depends on the environmental conditions of a particular place. For this reason, it is almost impossible to speak of a universal model that leads to *sustainable development*, but rather of *principles* that must be complied with or verified to achieve that condition.

Since resources are finite, a scheme of *sustained development* (which entails constant growth rates) cannot be maintained indefinitely, unless measures are taken to avoid the destruction of the base that makes this growth possible.

The perception, expressed in qualitative or quantitative terms, that an individual has with respect to the environment is called ***environmental quality.*** If this concept is related to that of *sustainable development* and it is kept in mind that for *growth* to become *development* it is necessary to define in advance the goals to be achieved with the growth in question, ***environmental quality*** can also be understood as the proximity between the state that the environment in question is in, and that which has been defined in the ***development*** model to be followed.

One term that will be consistently referred to throughout this Guide is ***Environmental Impact Assessment ("EIA")***. An EIA is nothing more than a set of analytical, participatory, coherent, reproducible and interdisciplinary procedures carried out by a team of specialists in different fields to predict the material changes in the behavior of the environmental components of a territory, through the identification and quantification of the alterations (beneficial and harmful) that could occur in the future as a result of the implementation of (or the intention to implement) an action to be carried out in the present[6].

Every EIA process starts from the determination and analysis of a ***baseline***, which can be understood as the detailed description of the behavioral trend that the attributes or characteristics of the environmental components present in a defined portion of the territory show at a predetermined time. This *baseline* is sometimes referred to as the environmental component to which it refers. Thus, it is common to talk of an ***environmental baseline***, when it includes a large number of environmental components, but it is not unusual to have baselines which are biotic, abiotic, physical, social, economic, cultural, etc.

Although they are intimately related and, therefore, it is common (although not correct) to use these terms as synonyms, it is important to differentiate between the ***Environmental Impact Statement ("EsIA")*** and the EIA process itself: the EsIA is the physical document (the log) that records the EIA process.

For the identification and assessment of the environmental impacts, the EIA must define the area in which the most significant effects on the abiotic, biotic and socioeconomic environmental components

will materialize as a consequence of the project, work or activity, in any of their phases. This region of the territory is known as ***the area of influence***[7]. A vital corollary can be inferred from this definition: the environmental impacts that would occur outside this area of *influence* are either non-existent or non-material.

It is very common to divide the *area of influence* of a project, work, or activity into areas of direct and indirect influence. Thus, the ***area of direct influence*** is the area impacted by the activities of the project, work, or activity under analysis, while the ***area of indirect influence*** can be understood as the part of the territory where impacts come about due to the activities *induced* (and not those carried out) by the project.

A ***Strategic Environmental Assessment*** should be understood as the analytical, participatory, coherent, reproducible and interdisciplinary process carried out by a team of specialists in different fields to predict material changes in the behavior of the environmental components of a territory, through the identification and quantification of the alterations (beneficial and harmful) that could occur in the future as a result of the implementation of plans, programs or projects ("PPP") in the present[8].

Bearing in mind that the term ***environmental management*** can be taken to mean the modification of the environment in an efficient and systematic way through planning, operation, monitoring and continuous improvement to achieve objectives of well-being predefined as positive by the value system adopted by a population, promoting the saving, greater use and sustainability of natural resources[9]; the objective of all environmental assessment processes (whether impact or strategic) is to generate a structured set of measures to eliminate, mitigate, restore or compensate for the potential negative environmental impacts of a proposed action (or PPP), or to maximize its positive impacts. These actions are known as ***environmental management measures.***

If the time that has been allocated for environmental assessment is not sufficient for understanding the dynamics and constant changes of an environmental system, or if the basic information required to reliably carry out a good prediction of impacts and an adequate formulation of management measures is not available at the time of carrying out this process, an ***adaptive environmental management*** approach can be a valid option to eliminate the uncertainty that the lack of information or knowledge of the systems can lead to. This form of environmental management works by continuously monitoring the partial results of the management actions and adjusting them over time through an iterative process of continuous improvement, to counteract the uncertainties that arose during the prediction process and obtain the desired results.

When performing an EIA, it is common to find that several of the impacts identified in the process may become larger or accumulate over time. The effect resulting over time from the interaction between the environmental modifications brought on by the ***same project*** is called ***cumulating impact***. These types of impacts can be synergistic, additive, or even antagonistic, when the resulting effect is greater, equal or lesser, respectively, than the sum of the individual effects considered in isolation.

A ***cumulative impact***, on the other hand, is the ***result from the successive, incremental or combined effects of an***

action or project, added to the effects of other undertakings which are existing, planned or reasonably foreseeable[10]. In other words, it is only the incremental effect, with respect to a spatial and temporal baseline, that a valued ecosystem component[11] ("VEC") undergoes when considering, in addition to those caused by a particular project, the effects of other past, present, and future projects[12].

Note that the difference (subtle, but very important) between ***cumulating*** and ***cumulative*** impacts is the origin of the impacts: in the first case it refers to impacts generated in the environmental components considered in the EIA by ***the same project***; while, in the second, these are ***impacts generated by several projects*** on specific environmental components (VEC).

A ***valued ecosystem component (VEC) or valued component (VC)*** is nothing other than an environmental component (biotic, abiotic, social or cultural) that deserves to be classified as *valuable* or *important* to determine how it will change when exposed to the effects of several projects already carried out, in the process of being implemented or planned to be undertaken in the reasonable future. In other words, a VEC is an environmental or social attribute that is considered *important* for the assessment and management of cumulative impacts and risks[13].

The term ***professionals***, as used in this Guide, refers to a wide range of participants in the CIA process.

These definitions, which may vary depending on the author, will be of vital importance to adequately understand the guidelines suggested in this Guide to evaluate and manage cumulative impacts.

Although there are no universally recognized definitions for the terms used in this Guide, the ones presented here are most commonly accepted when dealing with environmental management tools.

3. THE NEED FOR CUMULATIVE IMPACT ASSESSMENT AND MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN

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3. THE NEED FOR CUMULATIVE IMPACT ASSESSMENT AND MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN

3.1 Factors driving the need for a CIA

The conventional project-based approach used in an environmental impact assessment ("EIA"), which focuses solely on the identification, analysis and management of impacts related to specific projects, has its limitations when it comes to evaluating the impacts of regional and long-term development. Consequently, although the EIA[14] process is essential for the assessment and management of the environmental and social impacts of individual projects, it is also evident that this analysis is often not sufficient to identify and manage the incremental impacts and risks caused by other projects and activities (past, existing, or planned to be implemented in the future). This discrepancy is commonly found in projects financed by IDB Invest in LATAM. However, and to compensate for this deficiency, many countries are already considering the CIA as a desirable and necessary practice in the environmental impact assessment process (see ***Box No. 5***).

Box No. 5

In LATAM, project-by-project EIAs are necessary but not sufficient

In LATAM, there is a marked tendency and emphasis on carrying out project-specific assessments (through the EIA process), rather than an analysis of the global impacts that a group of projects can cause in a particular region. This includes impacts derived from the footprint of the project on its associated environmental components, impacts of other unrelated projects and activities, the presence of culturally different people and the scope of various supply chains necessary to support the development of the project. In many ecologically and culturally sensitive areas of LATAM, such as the Amazon or other island regions, a CIA can provide more adequate environmental and social information to support better decision-making processes to select, prioritize and carry out projects without jeopardising the development and future sustainability of a region.

Although the objective of an EIA is to provide decision makers with an indication of the likelihood of environmental and social consequences of the planned activities, and to offer a set of measures to manage the adverse impacts (or improve the positive ones) of a specific project, the EIA does not consider the aggregate impacts caused by other past or ongoing projects, or those likely to be carried out in the future. Therefore, the EIA only provides a partial, project-focused prediction of how the environment is likely to be in the future.

Cumulative impacts generally refer to changes in the environment's behavior that are the result of ***multiple activities or projects over time, including those caused by the project being evaluated***. However, cumulative impacts are often confused with ***cumulating impacts***, which are generated by a single project, and which may vary with time due to their nature (additive, synergistic, antagonistic, etc.) or the effect of other impacts ***caused by the same project.***

Cumulative impacts may cover different types of effects for different spatial and temporal scales. These may be the result of multiple projects of the same sector within a defined area (several oil wells in the same block, cascading hydroelectric developments in a river basin, etc.), of different types of projects (roads, ports, population center, new cultivation areas, etc.) that exert pressure in the same area (a river basin, a region) or in the same resource (a river, a grassland), either simultaneously or sequentially over time. In all these scenarios, the recipient of the impacts is the same (the river basin or the river), and the total aggregate effect of all the impacts of the project can result in a much more significant final impact than the individual impacts.

Many governments and professionals recognize that the environmental and social impacts that are of greatest concern in any region or country tend to be cumulative in nature and are often the result of the impact of several projects or activities in the same region. The acceptance of this basic concept is the main driving force behind the increased use of CIAs internationally.

Among the factors that drive the need for CIAs, the following can be named:

> Many countries have established regulations and policies that require the assessment of cumulative impacts.

- 112 countries (such as Canada, the United States, England, European countries, Australia, and New Zealand, among others), located on all the inhabited continents and of all the main legal traditions, already refer to CIAs in their environmental legislation. This means that, in practical terms, around 60% of all nations in the world have national laws that require a CIA[15].

- Eleven multilateral agreements ratified by 99 countries refer to CIAs, including the Escazú Agreement (2021), which requires the parties to make public "a *description of the main environmental impacts of the project or activity and, as appropriate, the cumulative environmental impact*".

- Nine multilateral banks, including IDB Invest, the World Bank, the Inter-American Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, and the International Finance Corporation (IFC), require this type of assessment for the projects they finance.

- Most countries fall into at least one of the above categories.

- The rapid growth of many LATAM countries requires significant investments in infrastructure, some of which are likely to intersect areas of high environmental and social sensitivity[16]. For this reason, managing growth, creating spaces for future projects, and addressing sustainability issues are becoming increasingly important.

- Increasingly, Civil Society Organizations ("CSOs") and Non-Governmental Organizations ("NGOs") place cumulative impacts at the forefront of their development concerns.

- Multilateral banks, such as IDB Invest, have explicitly introduced the CIA requirement into their environmental and social management frameworks and performance standards. Therefore, every sponsor must perform and submit a CIA as part of the requirements for financing of their projects to be considered.

- IDB Invest's Environmental and Social Sustainability Policy ("ESSP") incorporates a CIA as part of the evaluation of the potential risks and impacts of a project.

In conclusion, CIAs have become one of the essential tools for sponsors and regulators to evaluate the impacts of projects and programs at the regional or national level, using a variety of evaluation tools (see **Figure No. 1**).

Figure No. 1

The family of environmental impact assessment tools

Source: Author's own work

3.2 Example of cumulative impacts in LATAM - the Amazon

A special case that demonstrates the need for CIAs in LATAM is the Amazon Region, where the association between infrastructure development and forest loss and degradation is well established. There, an increasing number of infrastructure projects carried out and proposed (dams, hydroelectric plants, waterways, highways and access roads, and their associated facilities), extractive activities on an industrial scale (mining and hydrocarbon activity that require roads, pipelines, and port

facilities to move basic products to regional and international markets), and artisanal extractive enterprises (small-scale mining that also requires access infrastructure), have contributed -and will undoubtedly continue to contribute- to greater degradation of the region.

Despite decades of struggle against unregulated mining, illegal mining (of valuable minerals produced throughout the rainforest) persists and is expanding to become a powerful engine of destruction and contamination in the Amazon Region. Although mining has always been a regional activity, its current proliferation is not comparable to any other period in its history.

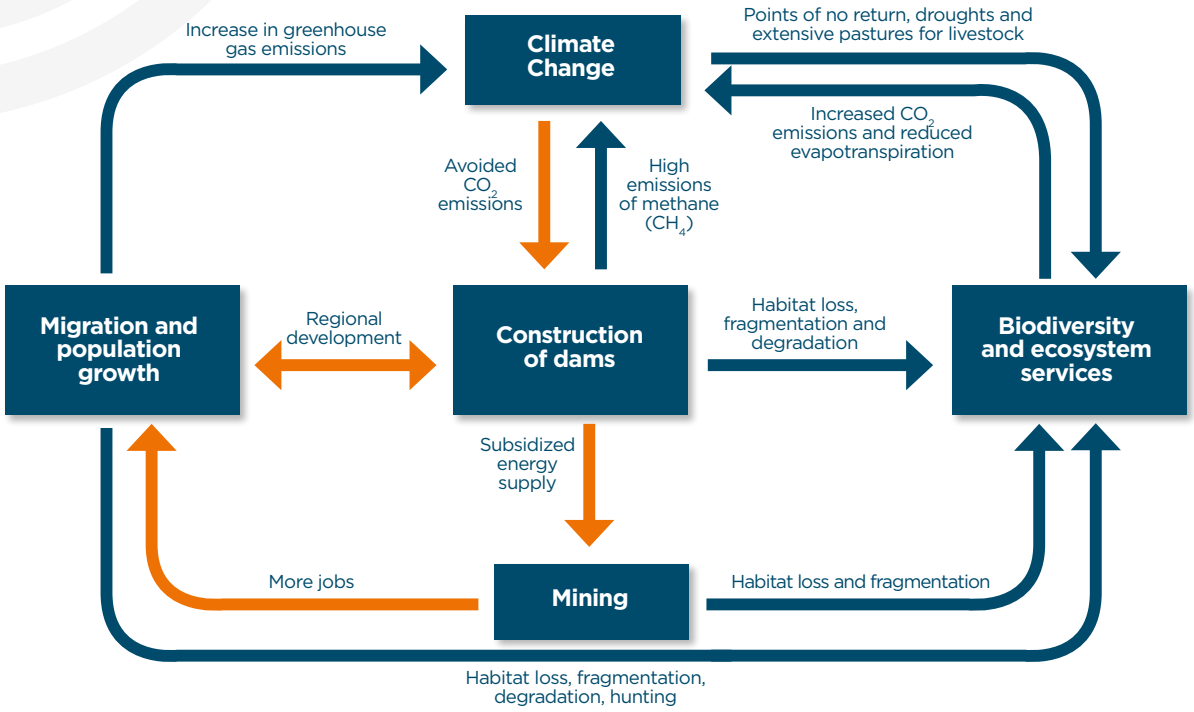
Infrastructure investments and extractive industries interact and reinforce each other to produce environmental and social impacts (many of which affect local indigenous communities) on a large scale that urgently require a CIA process.

It is evident that there is no other LATAM region where the need for a CIA is as urgent as here, because the effects of human intervention in the Amazon are not the result of a single project, but of the interaction of numerous actions that have had, are having and will continue to have incremental impacts. The loss of animal and plant species, many of them still unknown to science, is only one of the many negative consequences of Amazonian deforestation which affects indigenous and coastal communities, as well as urban populations, and even the health of the planet.

The Amazon plays a fundamental role in regulating the Earth's climate. The loss of its forests contributes to the increase in regional and global temperature, to the intensification of extreme weather events, and to the spread of disease vectors[17]. Climatic conditions are significant drivers of emerging infectious diseases. **Figure No. 2** presents a conceptual representation of the cumulative impacts in the Amazon.

Figure No. 2

Simplified model of cumulative impacts in the Amazon



Source: Adapted from Lees et al. 2016

3.3 Regulatory requirements for CIAs in LATAM

The need to carry out CIAs in the legal and regulatory frameworks of the LATAM countries does not necessarily offer a binary yes/no answer. Often, this depends on: i) the degree of discretion that the competent authority has; ii) how this requirement is defined or demanded in the legal provisions; iii) if the requirement is made by reference to other legal bodies (for example, it establishes the need to follow guidelines or procedures that are defined in other separate documents); or iv) if the requirement is implicit, usually referring to the fact that the proponent must comply with all other applicable laws. Beyond these legal ambiguities, there may be an additional complication: the lack of an established practice to guide professionals in preparing cumulative impact assessments.

The review of the regulatory requirements for CIAs in LATAM presented in this Guide (see Annex 2) considered the following topics:

- Requirements and procedures for preparing and presenting a CIA.
- Monitoring of cumulative impacts during the execution of the project.
- Monitoring of regional trends and risks in a temporal and spatial context when the CIA is carried out by a regulatory body (e.g. land use planning).
- Type and quality of information accessible to local stakeholders on the possible cumulative impacts associated with a group of projects (proposed, in progress and yet to be implemented) to be used in the informed community participation process.

Although some LATAM legislative texts include definitions of synergistic impacts[18] (which are often mistakenly treated as a definition of cumulative impacts), there are much fewer that refer to them in the substantive and procedural texts of the laws. Without additional information about implementation in practice, it is difficult to determine to what extent a CIA is required on an *ad hoc* basis in the terms of reference for the development of specific EIAs. However, the increasing use of online application portals, such as Peru's Single Environmental Certification Window, constitutes an important effort to reach a certain level of standardization.

The examination of the use of CIAs in the region is also complicated by the fact that EIAs for large-scale projects usually include cumulative impact analysis to meet the requirements of lenders (which seek to include international best practices in such projects), instead of doing so because of the country's legal requirement. A random check of court rulings addressing CIAs in some countries was useful, but it includes nuanced information that goes far beyond the scope of a concise synopsis, including legal opinions on how regulatory bodies should perform their functions.

An analysis included in an EIA that focuses solely on the identification, analysis and management of impacts related to specific projects is not sufficient for identifying and managing the incremental impacts and risks caused by other projects and activities (past, existing, or planned to be carried out in the future).

4. CUMULATIVE IMPACT ASSESSMENT AND MANAGEMENT

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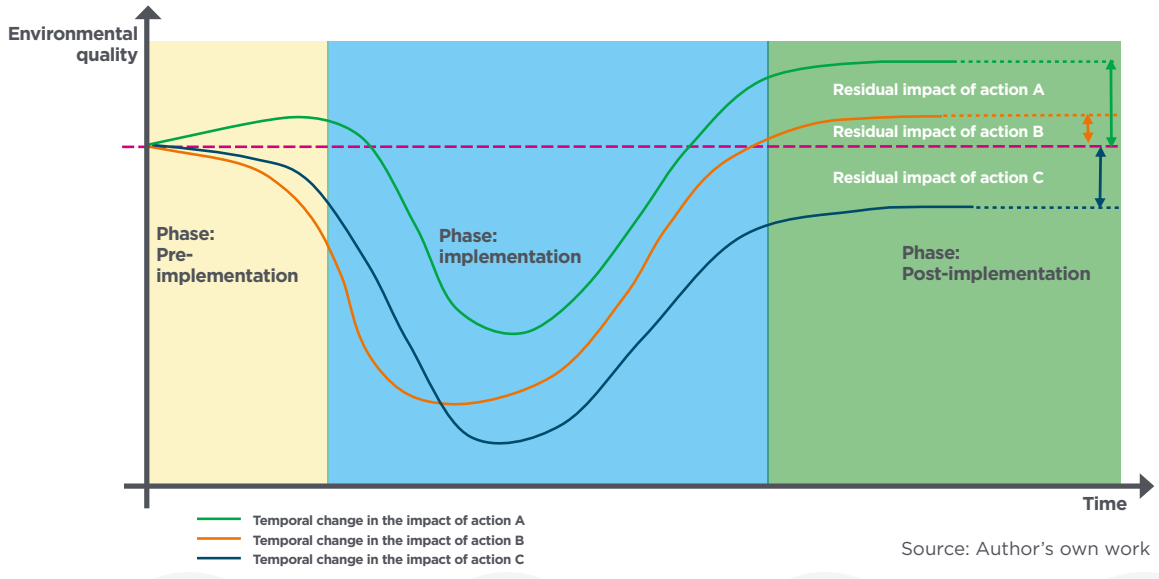
4. CUMULATIVE IMPACT ASSESSMENT AND MANAGEMENT

Before getting into what Cumulative Impact Assessment and Management ("CIAM") means, it is important to recall some aspects that, although more linked to the Environmental Impact Assessment ("EIA") process, will allow defining the starting assumptions of this analysis. Therefore, one of the first things to keep in mind is that an action's impact over time is not constant and tends to vary depending on the stages or phases in which such action is carried out.

Taking the above into account, if environmental quality is plotted on the y-axis and elapsed time on the x-axis, and if the temporal space is divided to mark three stages that correspond to the pre-implementation phase (when the decision to carry out the proposed action has been taken and preparations are being made to implement it), the implementation phase (when the action is being carried out) and the post-implementation phase (when the action has been carried out and the objectives pursued begin to be achieved), the impact generated by said action will tend to behave as presented in **Figure No. 3**.

Figure No. 3

Variation of impact as a function of time



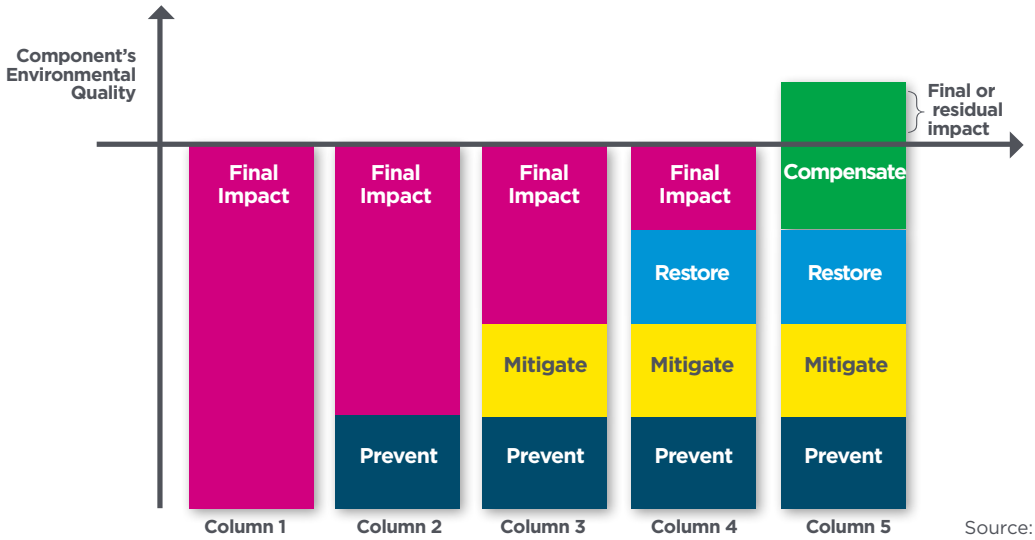
Source: Author's own work

Almost without exception, just decision to carry out an action (pre-implementation phase) will begin to cause certain effects in the environment (especially of a social nature), which can be positive, as in the case of action A, or negative, as in the case of actions B and C (see **Figure No. 3**). As the action is implemented, its (usually negative) repercussions tend to be accentuated (implementation phase) to a point where they begin to be less intense (more or less in the middle of the implementation phase) and then to stabilize in the post-implementation phase, eventually generating positive final distortions, as in the case of actions A and B, or negative, as in the case of action C. These stabilized final distortions are also known as ***residual impacts*** or ***ecological footprints*** of an action.

A second concept is what is known as the ***mitigation hierarchy***. This was developed to encourage the actions (project) that may affect an environmental component to incorporate, within their planning and implementation process, management measures to ***prevent, minimize, restore, or compensate for*** their potential negative impacts, so that the final result of their implementation is, in environmental terms, positive or the least negative. To this end, it is important to bear in mind that: i) ***preventing*** seeks to stop impacts from occurring; ii) ***minimizing*** or ***mitigating*** pursues the reduction of the duration, intensity, or extent of an impact; iii) ***restoring*** has the objective of ensuring that a place or environmental component affected by an impact recovers the conditions it had before said impact occurred; and iv) ***compensating*** aims to preserve areas equivalent to those affected by the actions implemented, when the measures to prevent, mitigate or restore the impact failed to generate a positive aggregate impact. This, graphically, can be better understood as follows (see **Figure No. 4**).

Figure No. 4

Mitigation hierarchy



Source: The Biodiversity Consultancy

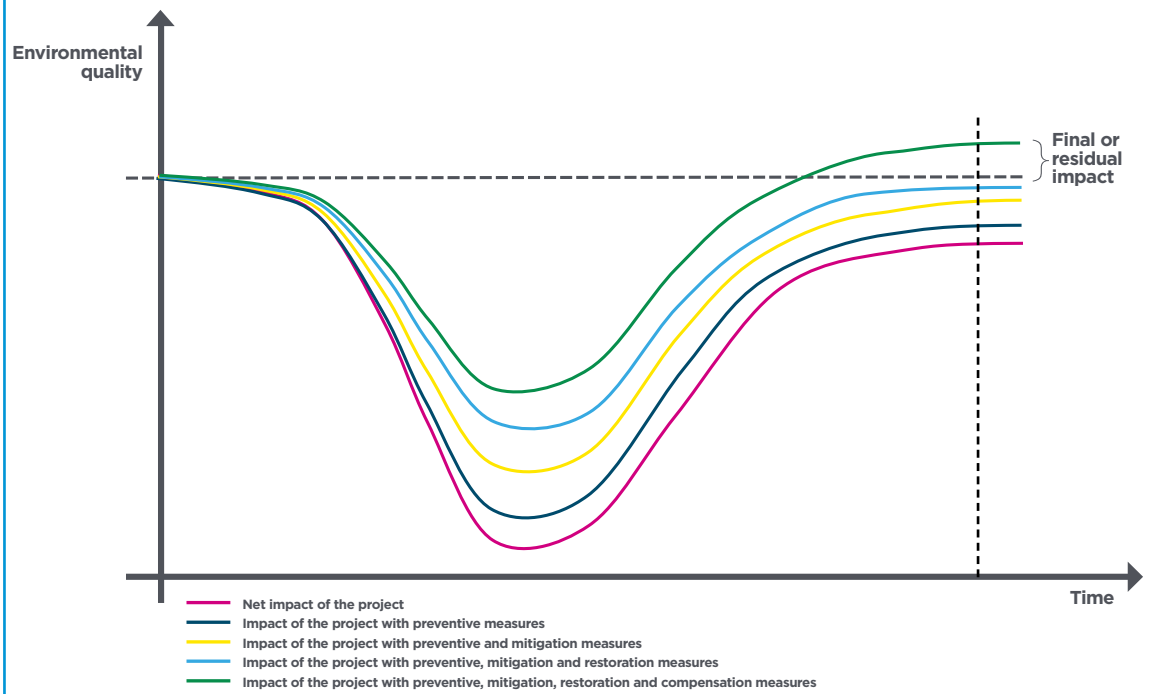
The first column of Figure No. 4 represents the final impact of a set of actions on the environment without any management measure having been applied alongside it. The second shows the impact of the same actions, but after having implemented measures to prevent unwanted impacts from occurring. As can be seen, the final impact (the red portion of Column 2) is less than what the actions would have caused without the adoption of any management measures (Column 1).

The third column represents the final or residual impact (in red) when measures have been applied to both ***prevent*** undesired impacts from occurring, as well as ***mitigation*** measures, to make the impacts less intense. If ***restoration*** measures are applied in addition to the above-described measures, the residual impact becomes even less (Column 4). Finally, if, in addition to all the measures that have been taken previously, ***compensation*** measures are applied (Column 5), it is very likely that the residual impact will become null or even positive.

If the mitigation hierarchy is incorporated into the way the impacts of a project usually occur over time, a graph like the one shown in **Figure No. 5** can be generated. This shows how, when systematically applying the management measures, the intensity of these impacts varies over time.

Figure No. 5

Application of the mitigation hierarchy in the same project over time



Source: Author's own work

4.1 What are cumulative impacts?

Cumulative Impact Assessment and Management[19] ("CIAM" or "CIA") has been a key element of good EIA practices for more than 40 years. The International Financial Corporation (IFC, 2013) defines cumulative impacts as "*those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones*."[20] For practical reasons, the identification and management of cumulative impacts is limited to effects that are generally recognized as significant, based on the concerns of the scientific community or affected communities.

However, when a CIA is carried out from the perspective of a concrete project, it can be understood as the *incremental effect that any past, ongoing, or future project or action can have on the environmental components that will be affected by such project*.[21] In other words, a CIA carried out from the perspective of a specific project aims to identify and manage the incremental effects caused by other projects or actions (past, present, and future) that can exacerbate the environmental and social conditions that the project in question will cause.

Just like impacts within the framework of an EIA process, cumulative effects have characteristics like those dealt with in a common environmental assessment: they can be direct, indirect, additive, interactive, synergistic, temporary, permanent or reversible.

The potential effect of reactions between the impacts (whether those of an individual project or those of other projects in the area) is also an important factor to consider since the resulting effect can be more adverse than the individual impact. For example, the construction of two large adjacent projects during periods of time that overlap can have many interactive impacts, such as changes in land use and operational noise. The interaction between specific impacts of the project is the result of the direct and indirect impacts of the project, while the interaction of the impacts of several projects is cumulative.[22]

The impacts derived from these interactions can be long-term and continue during the operation phase of the projects. The relationship between the different impacts is complex and it is often difficult to distinguish between the impacts, especially indirect and induced ones that relate to the project, and the cumulative ones due to the project in combination with other projects and activities. **Table No. 1** shows the nature and scale of the different types of impact: direct, indirect, and cumulative.

Tablae No. 1

Relationship between types of impact

Parameter \ Type of Impact	Direct	Indirect	Cumulative
Cause	Due to project activities.	Due to project activities but occur later or farther away than direct impacts.	Caused by project activities in combination with those of other projects and actions.
Time period	Present.	Present and future.	Past, present, and future.
Scope or effect	Inside and very close to project boundaries.	Within and near the geographic area where projects can influence direct changes.	Multiple areas: each valued environmental component has its own range within which its condition may be affected.

Source: Author's own work

Interactions due to various environmental problems or threats, such as fragmentation and climate change, must also be considered. Whilst these two factors can directly affect the habitat of the species, their indirect effect on the interactions of the species can have implications for the structure and functioning of the communities of the species. Changes in the distribution area due to both climate change and fragmentation can alter the composition and structure of ecological food networks, ultimately affecting the survival of the species. **Table No. 2** shows four types of impacts depending on their nature (additive or interactive) depending on whether it is a single action or multiple actions.

Table No. 2

Types of impacts according to the process

Number of Actions	Types of Impacts According to the Process			
	Additive Process		Interactive Process	
	Type of Impact	Example	Type of Impact	Example
One action	**TYPE 1** Repeated additive effects of a single proposed project.	The construction of a new road through a protected area, which gives rise to continuous drainage of salt from the road into nearby vegetation.	**TYPE 2** Stressors from a single source that interact with the receiving biota to have a net "interactive" (not linear) effect.	Organic compounds, including polychlorinated biphenyl ("PCB"), which cause biomagnification in the food chains and lead to disproportionate toxicity in birds of prey and large mammals.
Multiple actions	**TYPE 3** Effects derived from multiple sources (projects, point sources, or general effects associated with development) that affect environmental resources in an additive way.	Agricultural irrigation, domestic activities, consumption, and industrial refrigeration, which contribute to the depletion of an aquifer.	**TYPE 4** Effects derived from multiple sources that affect environmental resources in an interactive or synergistic way.	Spillage of nutrients and warm water into a river which combine to cause an algal bloom and the consequent loss of dissolved oxygen, which is greater than the additive effects of each contaminant.

Source: Author's own work

In this context, some examples of cumulative impacts include the following:

- Increased pressure on the survival of an indicator species in an ecosystem, due to different sectoral projects.
- A reduction in the population of wild animals caused by improvements in access to remote areas, with the consequent increase in hunting and accidents, all aggravated by the expansion of the agricultural frontier.
- Deforestation caused by the construction of multiple projects and by external workers entering sensitive areas.
- The generation of secondary social impacts (such as immigration or the increase in traffic congestion and accidents on the roads), due to the increase in vehicular traffic induced by the activities of the different projects.
- The fragmentation of the landscape that limits the permanence and persistence of populations of sensitive species, resulting from roads, transmission lines or other linear projects under construction or in operation in the same region.
- The blocking of migratory routes or wildlife movements (biological corridors) by the construction of linear infrastructure or adjacent wind projects.
- The blocking of the migration of fish due to cascading hydroelectric development projects in the same basin.
- The degradation of air and water quality, due to the existence of multiple industries in the same area or in urban areas.
- The reduction in volume of surface water or groundwater in a river basin, due to its extraction for multiple agriculture, urban development, or industrial projects.
- The loss of mangrove forests due to multiple shrimp crop developments or the construction of linear projections that interrupt the interaction between freshwater and seawater.

4.2 What is a CIA?

Cumulative Impact Assessment and Management ("CIAM" or "CIA") is the process through which the possible risks and environmental and social impacts of a proposed project are analyzed, in a context that incorporates, over time, the possible aggregate impacts of other human activities (projects), natural factors or external social or environmental stressors, carried out in the past, being carried out in the present and with a reasonable probability of being carried out in the future, in order to propose measures to prevent, reduce, restore or mitigate said incremental impacts and risks.

Perhaps a better definition is *the evaluation of the incremental effect, with respect to a spatial and temporal baseline, of an environmental system component deemed valuable (or important) when considering, in addition to the effects caused by a particular action (project), the effects caused by past actions (projects), as well as those that are result of present actions (projects), and those that will surely be generated by actions (projects) reasonably expected for the future.*[23]

This definition, however, raises the following questions: What is the spatial and temporal baseline from which we start? What scales should be used? What actions should

be considered in the analysis? What does actions reasonably expected for the future mean? How can the parts of the environment to be considered be established? Why carry out a CIA?

The answers to these questions are not unique. However, to answer them, it is necessary to start from some basic elements that the definition itself suggests:

- A CIA requires at least two sets of actions or two different projects. This means that ***a cumulative impact analysis cannot be carried out to evaluate the effects of an individual project***, since this evaluation, by definition, is already covered by the EIA process. Although it may seem a semantic issue, it is not surprising that the identification of ***cumulating*** impacts (which become more intense with the course of time) of the ***same project*** that is done in the EIA process is confused with an analysis of ***cumulative*** impacts that includes the incremental ***effects generated by other projects***.

- For a CIA, it is essential to determine the effects caused by other actions (projects). That means each of the projects to be analyzed must have some type of environmental analysis with details on its impacts and, where possible, the type of management measures that will be adopted. This would make it possible to deduce its residual impact (ecological footprint).

- The temporal variable is fundamental in a CIA. This adds additional complexity because, as discussed before, the impacts generated by a project are, unfortunately, not constant over time.

- It is necessary to define a temporal and physical space to delimit the scope of the analysis.

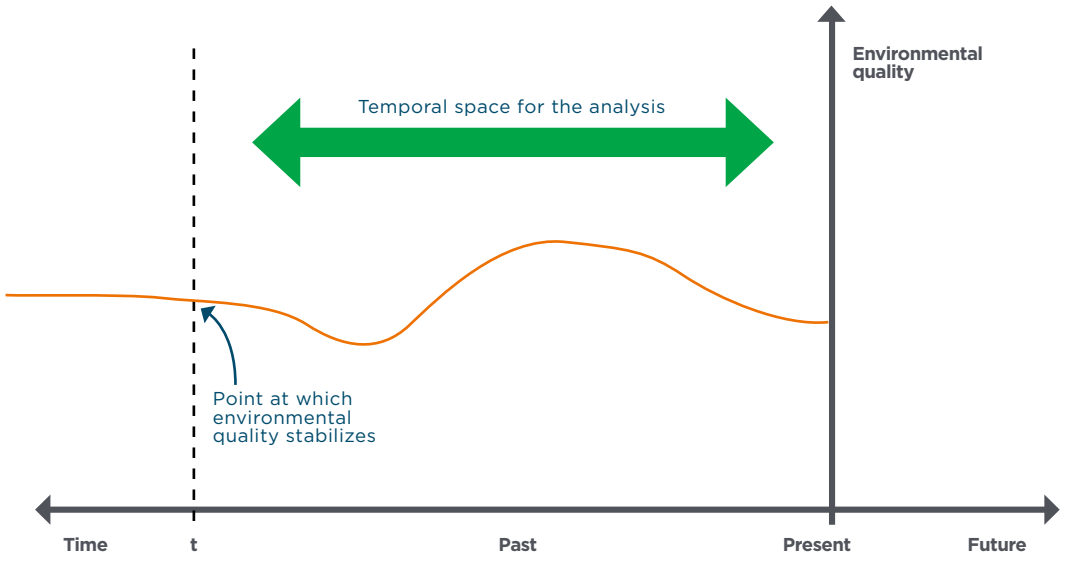
- The timeline should be broad enough to include a portion that corresponds to the past, the present and the future.

Of the three groups of projects to be considered in a CIA, the only one that is obvious is the one that corresponds to the projects that are being carried out in the ***present***, but how to know which projects carried out in the ***past*** should be included? And which ***future*** projects should be considered in the analysis?

One of the best ways to determine which past projects to consider in a CIA comes from analyzing the behavior of the environmental components. Thus, keeping in mind that a CIA is based on the behavior of the VECs, starting from the present, the temporal boundary must extend into the past until a relatively stable VEC behavior in terms of quality is found (see **Figure No. 6**). This point in time will denote the absence of actions that are disturbing it, and all the effects of the actions that were carried out before it will have been translated into a constant environmental quality. All projects that have been implemented from this point in time onwards must be considered in the CIA, at least in a first approximation, as will be seen later in this document.

Figure No. 6

Determining the past timeline in a CIA



Source: Author's own work

To determine how far into the future the analysis should be extended, and which future projects should be considered, there are some recommendations to follow. The future time scale of analysis will depend on the planning timeline and the expected useful life of the projects to be considered, among other aspects.

A project (or set of actions) can be considered as *reasonably expected to be carried out in the future* when, among other indications, it is known that:

> Its sponsor or representative has requested the environmental authority for authorization to initiate the relevant environmental licensing process.

> It is included in the inventory of priority initiatives that the authorities plan to carry out in the coming years - perhaps within the current period of government.

> It is part of the political speech of the region's highest authorities where it will be implemented.

> It has the financing necessary for its implementation.

> The authorities have submitted a credit request to a financial institution, perhaps international, to finance it.

> There is strong support from society for the project in question.

> A procurement timetable has been prepared for acquisition of goods and services that will be required to implement it.

These factors, which are not the only ones to consider but which are a good starting point, are not mutually exclusive. On the contrary, the more that apply, the higher the probability (although never absolute) that the project in question will be carried out in the future.

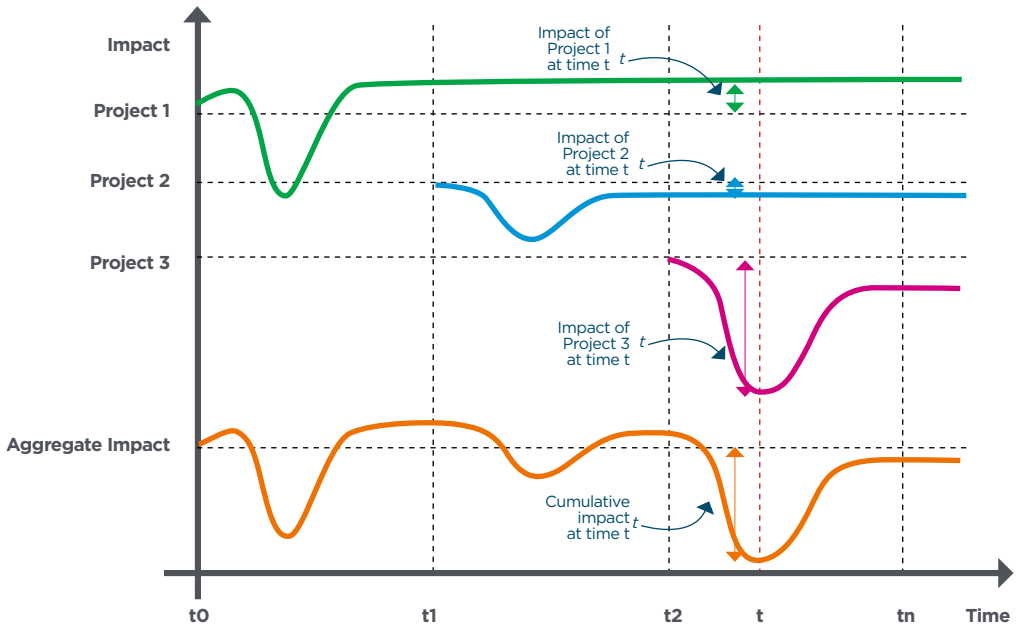
The incorporation of the temporal variable in the CIA constitutes an additional complexity to the analysis because, as shown before, the impacts generated by the projects are not constant over time. Therefore, the CIA will depend on when and how the projects to be considered are carried out. Although in the case of past projects this does not represent a major drawback (since it should already be known when and how they were implemented, and what impacts they generated), the analysis becomes a real challenge when it comes to projects to be carried out in the future.

This is because it is usually not certain when they will be carried out, in what form and, in some cases, what impacts they will generate (since the type of management measures that will be adopted are unknown).

To clarify the above, assume that there are three projects that will be carried out at three different points in the future (t0, t1 and t2) and that their impacts, as analized before, tend to stabilized over time once their implementation stage ends (see **Figure No. 7**). If the same time scale is maintained for the graphs, and different colors are assigned to show the individual impact of each project (in this case green for Project 1, blue for Project 2 and red for Project 3), the aggregate or cumulative impact that would result when considering the individual impacts would be represented by the violet curve.

Figure No. 7

Aggregation of Cumulative Impacts



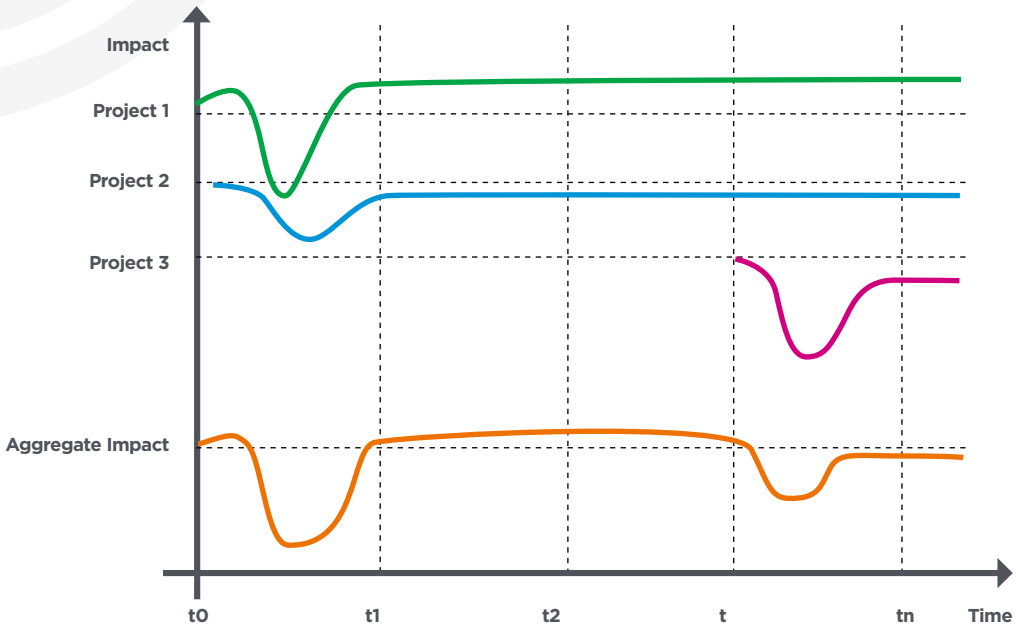
Source: Author's own work

Thus, for any time t, the cumulative impact (violet line) will be the result of adding the impact generated by Project 1 at time t (green line) with that of Project 2 (blue line) and that of Project 3 (red line).

But what would happen if two of the projects were carried out almost simultaneously? Applying the same procedure, the resulting graph would be the one shown in **Figure No. 8**

Figure No. 8

Aggregation of impacts of projects running simultaneously



Source: Author's own work

Figure No. 8 shows that the analysis of the cumulative effects of projects that are being carried out at the same time (present projects) is perhaps one of the most complex tasks in the CIA process. This is because it is precisely during the construction or implementation phase of the projects when the greatest number of undesired incremental impacts are generated. The aggregate effect of these may eventually exceed the bearing capacity of the environment and generate significant impacts as a result (many of them irreversible).

Even though analysing the incremental impacts caused by present projects that are to be considered in the CIA is complex, the process has a great advantage: there is a very high probability of having environmental impact studies for each of the projects to be analyzed, and that these studies are available to the public. The latter is because the environmental legislation of most of the LATAM countries stipulates this.

When analizing the two previous graphs, we can see that from time tn, the effects of the three projects under consideration become asymptotic and tend to stabilize. Consequently, the cumulative impact also tends to be constant because the algebraic sum of several constants is also a constant. That is, starting from tn, it would be enough to add the ecological footprint of each of the projects in question to obtain the total cumulative impact of the set of projects analyzed.

Two other important conclusions that can be drawn from the previous graphs are the following: i) when looking at a time scale that comprises more than the pre-implementation and implementation phases of a project, the effects of such project can be assimilated as "momentary" distortions (even though they can sometimes last several years) of the impact it generates, since the latter tend to stabilize immediately after the completion of the post-implementation phase of the such project; and ii) given the above, unless several projects are to be implemented at the same time or almost simultaneously (in which case it could be interesting to know if the total effect exceeds the bearing capacity of the environment) the combined residual effect, as the analysis times are lengthened, will be equal to the algebraic sum of their individual ecological footprints.

As will be seen later in this document, the answers to the other questions will greatly depend on whether the CIA is carried out from the perspective of a particular project or if this analysis is carried out from the perspective of a planning entity, usually public.

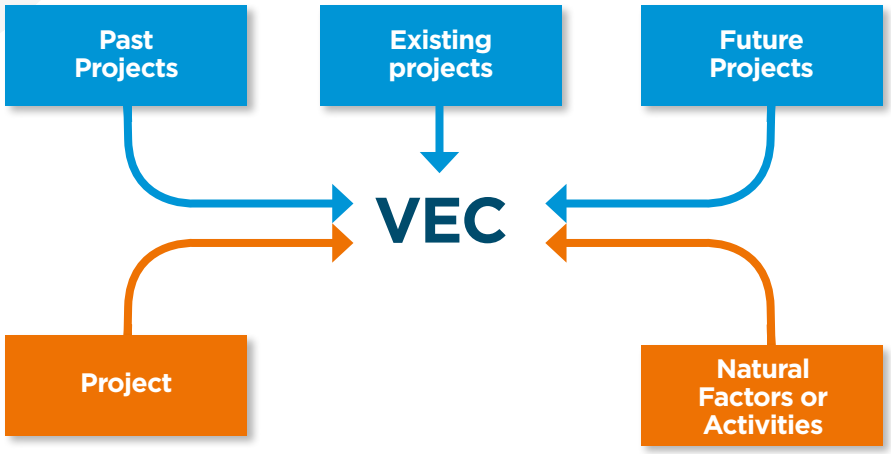
4.3 What are VECs?

Valued ecosystem components[24] ("VECs") are environmental and social attributes that are considered important in the assessment of cumulative impacts and risks.[25] VECs can be many things: physical characteristics, habitats, wild species and populations (for example, biodiversity), ecosystem services (such as fishing, drinking water, flood protection, etc.), natural processes (for example, water and nutrient cycles, microclimates), social conditions (for example, health, economy, food security) or cultural aspects (for example, archaeological sites, sacred places, spiritual or traditional ceremonies).

VECs are the focus of a CIA, as they are the final receptors of the cumulative impacts. VECs should be selected based on consultation processes with different stakeholders. **Figure No. 9** shows how VECs can be affected by the cumulative impacts of projects, activities, or natural stressors.

Figure No. 9

Cumulative impacts on a VEC



Source: Author's own work

4.4 Objectives of a CIA

In general, the intention when carrying out a CIA is to identify the *aggregated* impacts and risks on *predefined* VECs and in *pre-established physical* and *temporal spaces* that may be caused by *projects that have been abandoned, are being constructed, are ongoing or planned to be carried out in the near future*, in order to verify that these impacts and risks *do not exceed the bearing capacity of the chosen VECs* and ensure that their sustainability is not compromised.

A CIA aims for a ***management plan, called a cumulative impact mitigation plan*** (or simply a ***mitigation plan***, or ***cumulative impact management plan***) to be generated, which has characteristics similar to the management plan that is produced through the EIA process.

There are two approaches to carrying out a CIA and, depending on these, two particular objectives:

i) The ***Planner*** (usually a state body that is responsible for territorial planning, resource management, investment planning, environmental control, etc.), which seeks to *determine how several actions (projects) will affect a VEC or a group of them in a pre-established area* for a defined physical space and timeline; and

ii) The ***Developer*** of a project (usually a private, public, or mixed body in charge of carrying out the project in question), which aims to determine *how other actions (projects) may exacerbate future environmental conditions related to its undertaking*.

Among others, some goals that a planner would need to achieve by carrying out a CIA include:

- Ensuring the availability of resources (raw materials, labor, services) in a given region.
- Achieving good (rational) management of resources.
- Having better control of the environmental quality of VECs.
- Preventing the occurrence of environmental contamination processes.
- Avoiding conflicts caused by the demand for resources.
- Optimizing spatial planning processes.
- Prioritizing investments based on their potential residual impact.

Similarly, a project developer would use the CIA process to seek the following:

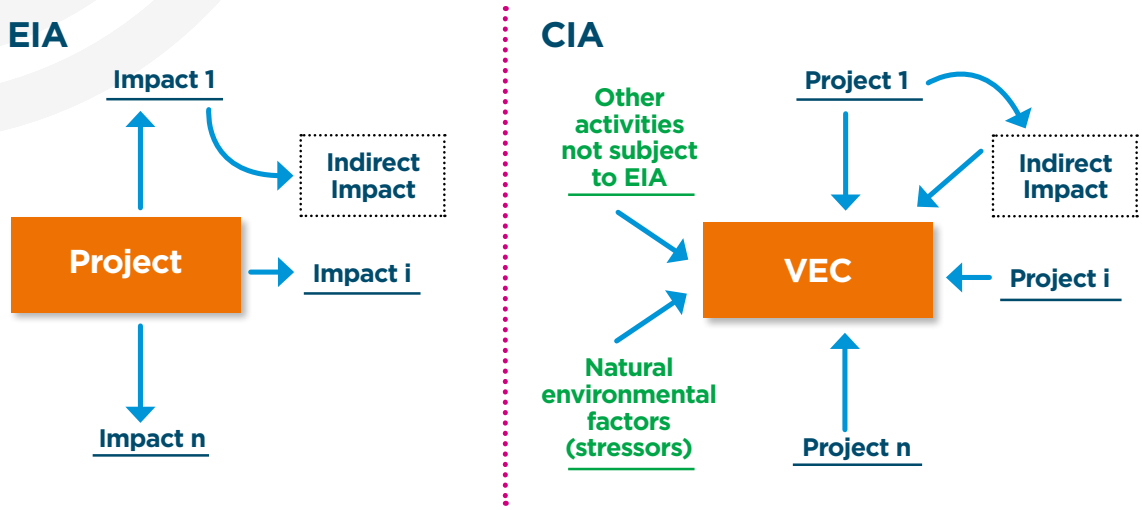
- Ensuring the availability of resources (raw materials, labor, services) so that its undertaking is not threatened by the lack of them.
- Preventing possible conflicts, especially social ones, due to interference that other ventures may bring about.
- Ensuring the availability of services (including ecosystem services) so that its activity is not compromised.
- Guaranteeing that the compensation offsets to be established are conserved and that they are not threatened by the activities of other ventures.
- Preventing the undertaking from being "blamed" for impacts that it has not caused.

4.5 The CIA versus the EIA

Given that a CIA focuses on the VECs and considers the aggregate impacts caused by different projects, the analysis goes far beyond that carried out at the level of an EIA (which focuses on a single project or on "the project"). However, they share many conceptual elements, such as the identification, assessment, and management of these effects. These two perspectives are presented in **Figure No. 10**.

Figure No. 10

Differences between the EIA and the CIA



Source: Adapted from IFC (2013)

4.6 Relationship between CIA and SEA

A CIA can be incorporated as part of the EIA process or, alternatively, carried out as a complement to it. In any case, a CIA should be structured in such a way that each VEC is evaluated separately.

Sometimes, it is necessary to carry out regional impact assessments to identify the effects that various projects or actions can have on a certain portion of the territory. The identification, assessment and management of such impacts is normally carried out within the framework of a **Strategic Environmental Assessment** ("SEA") process.[26] The SEA focuses on the assessment of government policies, programs, and plans ("PPP") rather than that of individual projects. While a CIA is oriented to VECs, the SEA seeks to identify and manage the impacts generated by the PPPs on all the environmental components that, materially, are susceptible to being modified by the actions foreseen in the PPPs or their alternatives.

4.7 Rapid Cumulative Impact Assessment (RCIA) versus full CIA

This is one of the first decision to be made when trying to carry out a cumulative impact assessment process: Should a rapid CIA ("RCIA") or a complete CIA be carried out?

The IFC defines the RCIA as "*a desk review that, in consultation with the affected communities and other stakeholders, enables the developer to determine whether its activities are likely to significantly affect the viability or sustainability of selected VECs*". This procedure is usually proposed for emerging markets (such as those in LATAM) where: i) it may not be possible

to carry out a detailed CIA due to the lack of baseline data available; ii) there is no certainty of future project development; iii) there is a lack of territorial planning schemes that go beyond project-level approvals; and iv) there is limited institutional and governance capacity to manage cumulative impacts. All these factors pose a challenge when it comes to ensuring an effective CIA process.

Essentially, an RCIA is the same as a complete CIA and uses the same methodology. However, the procedure is carried out at a more general level, with less detailed information (often secondary) and in shorter periods than those required for a complete CIA. A RCIA is typically conducted at the beginning of the CIA process to identify VECs, potential projects to be considered in the analysis, key cumulative impacts, and initial management actions. Depending on the intention to carry out an RCIA, the initial information available and how this analysis process will be used, an RCIA can easily evolve into a CIA (see Annex 3 of IFC, 2013).

When considering the need for an RCIA versus a complete CIA, it is recommended that the following questions are answered.

- What is the objective of a CIA? Should it be carried out at a high level to identify possible cumulative risks and impacts as part of the early assessment of the project? If the answers to these two questions are yes, then the RCIA must be chosen.
- Are there gaps in reference information on VECs? If so, an RCIA can help identify what information is required to carry out a complete CIA.
- How much time is available? Is a high-level environmental and social risk assessment necessary in the short term for an investment decision to be made for a project? If the answers are yes, it will be best to choose an RCIA and try to complete the CIA later.

In summary, an RCIA is usually carried out at the beginning of a project's assessment process to determine the significance of the cumulative impacts that may occur. Depending on the level of information and the objectives sought, the RCIA can lead to a more detailed and complete CIA if a deeper analysis of the cumulative impacts analyzed is justified.

A CIA analyzes the incremental effect that a VEC undergoes with respect to a spatial and temporal baseline when it includes, in addition to those caused by a particular action (project), the effects caused by past actions (projects), as well as those that are being produced by present actions (projects), and those that are likely to occur due to actions (projects) reasonably expected to be carried out in the future.

5. PROMOTION OF GOOD CIA PRACTICES IN LATAM

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5. PROMOTION OF GOOD CIA PRACTICES IN LATAM

5.1 CIA planning

When starting a CIA, many professionals face the following questions: Where do we start? Should the VECs be chosen first or are the projects to be included in the CIA selected before that? At what point in the process should the temporal and spatial boundaries be defined? Should the scope of the analysis be defined in conjunction with the definition of the VEC and the projects, or as a linear step-by-step process?

To begin with, it is important to understand that the CIA is carried out, to a large extent, at the project level, first examining the effects that such project can cause on the VEC, and then adding the incremental impacts generated by other past, present, and future projects in combination with external stressors. Secondly, it should be kept in mind that the CIA focuses on determining, assessing, and managing the impacts for each VEC, one by one. Finally, identifying all other past, present, and future projects and activities within the spatial boundaries of each VEC and defining the temporal boundaries of the CIA is vital.

The IFC guidance (2013) indicates that these steps should be performed sequentially in the first phase relating to the scope. However, it is recommended to start with a preliminary election of the VECs to then determine their spatial and temporal boundaries, and the inclusion of other projects and activities in relation to those spatial boundaries. Next, the external stressors should be identified and, finally, the status and trend of each VEC shall be assessed. This process is described in more detail in this Guide.

However, since these stages are interrelated, the entire analysis is carried out, in practice, as an iterative process and by successive approaches: the geographical and temporal boundaries depend on the VECs and the projects that are included in the analysis and this determination also depend on the extent of the impacts of the projects in each VEC. Each iteration reduces the analysis until the final VECs, projects and geographical and temporal boundaries are set.

Since the CIA process is constantly evolving, there is no single accepted practice worldwide. However, in the last decade, the guide developed by the IFC (2013) has been considered as a good starting point for this type of assessment.

Despite their methodological limitations, it is important that, during the process of identifying cumulative environmental and social impacts and risks, project sponsors and consultants consider the following:

- The activities planned in their project can result in added impacts to each VEC.
- Other existing or future projects can also produce incremental negative impacts on top of those caused by their own project.
- To the extent possible, their project's contribution to these aggregate impacts should be prevented or minimized.
- The implementation of other projects may jeopardize the viability of their project if the cumulative impacts result in a significant impact on the ecosystem services on which their project would depend.

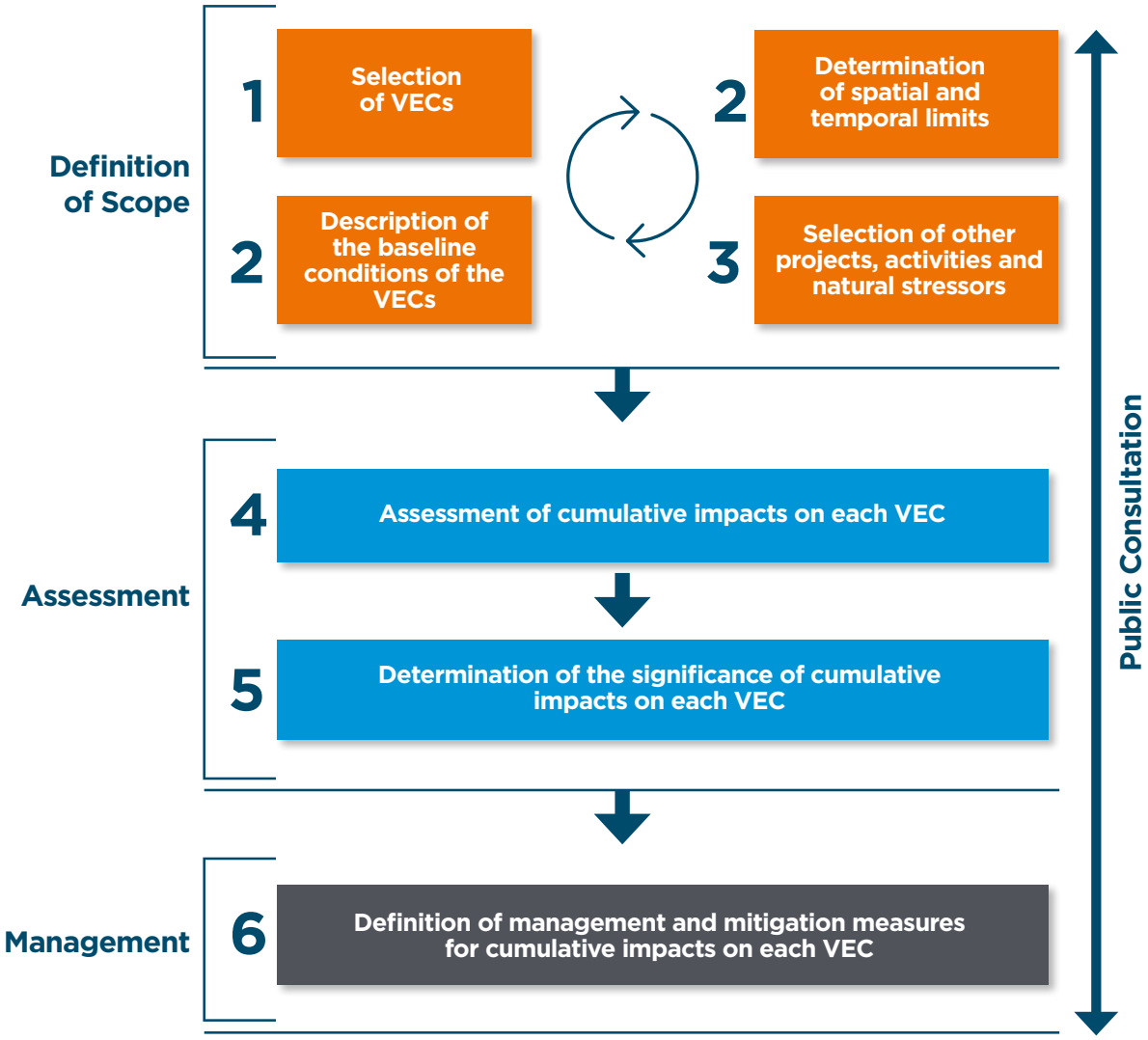
The IFC Guide proposes a six-step interative process for conduction a CIA (see **Figure No. 11**):

- Selection of VECs, temporal and spatial boundaries, and other projects, activities and external stressors. This can be done in parallel (steps 1 and 2).
- Determination of the (current) baseline status of the selected VECs (step 3).
- Assessment of the cumulative impacts of the project examined with other projects and activities and external stressors (step 4).
- Determination of the expected cumulative impacts for the viability or sustainability of each affected VEC (step 5).
- Design and application of management measures to mitigate the cumulative impacts on each affected VEC (step 6).

This methodological proposal is applicable both to a CIA that is carried out from the perspective of a planner, as well as for a cumulative impact assessment process that is carried out from the perspective of a particular project.

Figure No. 11

CIA methodology according to IFC guidelines



Source: Author's own work based on IFC Guide

5.2 Definition of scope: The first step in the CIA process

The first step in the CIA process is to define its scope of action. This involves carrying out the following tasks: i) selecting the VECs; ii) defining the spatial and temporal boundaries of the CIA; iii) identifying other projects, activities and external stressors that could contribute to the cumulative impacts in each VEC; and iv) collecting baseline information on the status and condition of each VEC. These initial tasks must be carried out simultaneously, considering that the CIA focuses on the analysis of the VECs.

5.3 Selection of VECs

VECs are components of natural and human surroundings that the project proponent, the public and community, indigenous populations (where appropriate), scientists and other technical specialists, and government agencies involved in the environmental assessment process, among others, consider having scientific, ecological, economic, social, cultural, archaeological, historical or another type of importance or value.[27]

Choosing the VEC is perhaps the most important step of the CIA process, as it identifies the environmental and social components considered key by stakeholders. However, it is also perhaps one of the most difficult steps in the process.

When the CIA is carried out from the perspective of the planner, VECs must be selected after undertaking a consultation processes with the different stakeholders. When the process is carried out from the perspective of a project, VECs are a subset of the environmental and social components affected by such project (determined by the EIA)[28].

5.4 How to select VECs

For many LATAM stakeholders, the concept of a VEC can be new, so time must be dedicated to adequately explain what it represents and how it is used in the CIA process.

To start the process, the main environmental and social ("E&S") risks and impacts that the project under examination is likely to cause must be defined, before generating a preliminary list of other projects and activities that will be considered in the analysis. This can be done by reviewing the information available from different sources, including existing thematic data, other EIA studies and previous baseline studies that may be available.

VECs are central to the CIA process and, as far as possible, they should be selected to include a fair representation of environmental and social components. For the CIA to be effective, it is recommended to choose no more than a handful of VECs (usually between 6 and 8), as evaluating a larger number will not necessarily add value to the analysis but can increase both the time and cost of the assessment. It is important that the selected VECs reflect both their susceptibility to be affected by the projects that will be included in the analysis, as well as the concerns of the stakeholders. One must always remember that, ***if a VEC is not affected by the project being examined, it should not be included in the CIA***.

It is necessary to identify stakeholders

or "key actors" that may have a specific interest in the upcoming process for input as to the determination of the scope of the CIA. Once this has been done, their opinion on the VECs to be included in the CIA should be sought via workshops, meetings, or discussion groups. This also involves providing these groups with a conceptual explanation of what a CIA is, how they may be affected, first by the project and then by other projects and activities to be considered, and how the resulting cumulative impacts are evaluated and managed.

When carrying out a CIA from the perspective of a project, key actors should have been identified and their concerns noted during the EIA process. However, additional consultations may be necessary, especially when the CIA process is carried out a long period (usually years) after the EIA, and when, beyond the level of the project, these groups must be aware of the aggregate impacts that other projects or activities can have on the VECs.

When selecting VECs, it is important to bear in mind that they should not only be important for stakeholders, but that they should also be likely to be *materially*[29] impacted by any of the projects or activities included in the analysis. Sometimes, impacts (noise, water contamination, traffic, etc.) are mistakenly identified as VECs. A tip to avoid this is to remember that a VEC is, ultimately, an environmental or social component that concerns stakeholders[30].

Examples of common VECs[31] include:

- Air quality and climatic conditions.
- Water and sediment quality
- Flow regime of bodies of water and sediment dynamics.
- Terrestrial/terrain habitats that may be sensitive due to their location or availability.
- Coastal, riverside, aquatic and marine ecosystems due to their location or availability.
- Key economic activities and livelihoods that depend on water and land and are affected by the project area (e.g. fishing, irrigation, agricultural products and water supply).
- Heritage or intangible cultural and spiritual values.

Box No. 6 presents some practical advice for selecting valued components in the CIA.

Box No. 6

Practical tips for selecting VECs

1. Existing EIAs are a useful reference point for identifying VECs most susceptible to project risks and impacts.
2. If a VEC is not affected by the project, it should not be included in the CIA.
3. If a past, present, or future project does not affect a selected VEC, such project should not to be included in the CIA either.
4. Public consultation is always necessary when selecting VECs. If this was not done during the EIA process, if a long time has passed since the EIA was carried out, or if the consultation process was not adequate, a new round of consultations should be undertaken.
5. When conducting a public consultation on the selection of VECs, it is important to explain: i) what VECs are; ii) how they are selected; iii) what they represent in the CIA process; iv) how the CIA is carried out; v) what the CIA information process is; vi) what the timing of the process is; and vii) what the expected results of the CIA are.
6. The selection of VECs must be supported by the professional criteria of the team[32] in charge of the CIA.
7. For the sake of practicality, timing, and ease of CIA assessment, no more than a handful of VECs should be selected (typically between 6 and 8).
8. The selected VECs should include a balanced combination of environmental and social components.
9. VECs must be selected based on predetermined criteria to determine their relevance and significance.
10. The preliminary list of VECs is likely to contain more components than can be reviewed within the CIA budget and the time available.
11. Whenever possible, the condition, status, indicators, bearing capacity limit and historical thresholds and trends of each VEC should be available or determined and described before initiating the CIA.
12. The selected indicators should allow for changes in the VEC's behavior to be measured and determined.
13. Sometimes, a selected component may be better represented by another VEC whose measurement or evaluation is easier to perform.
14. Often, there may not be enough information available to fully assess the status of a VEC. In such cases, it should be decided whether to invest time and resources in collecting additional baseline data on that component or to select another VEC that is similar to the previous one, but for which there is more information.
15. The justification for the final selection of VECs must be documented.

5.5 Establishing spatial boundaries in the CIA

Once the initial list of valued components has been selected, it is necessary to establish the spatial and temporal boundaries of the CIA. Generally, the spatial boundary of each VEC can be determined in four ways (see **Table No. 3**):

Table No. 3

Ways to establish the spatial boundaries of VECs

Based on VEC. Establishes appropriate spatial boundaries for each VEC considering primarily its geographic range and project area of influence (AOI) for the VEC. For example, spatial boundaries for a migratory species may consider seasonal migration trajectories, regardless of the jurisdictional limits.	**Based on the project activity.** Considers the distribution of physical activities in the vicinity of the project (e.g. mining or the exploitation of forest resources where they may constitute the main land use).
Based on the ecosystem. This approach is based on knowledge of the ecosystem and the place the VEC occupies within it. For example, ecological boundaries, such as a watershed, may define the geographical range of a VEC (e.g., a population of a fish species). It may be best suited for regional approaches.	**Based on administrative or political boundaries.** Considers administrative, political, or other boundaries created by humans as spatial boundaries. Useful for socioeconomic and cultural VECs. For example, provincial, municipal, or statistical spatial boundaries (e.g., census sections or health units), or a traditional territory of an indigenous people.

Source: Canada Impact Assessment Agency[33]

When doing this, it is usual to obtain different spatial boundaries for each VEC; some will overlap, while others will not. The use of a geographic information system is extremely useful in this process. The extension of the spatial boundary of each VEC must also consider the area of influence of the project in question and the boundaries of other projects that may lead to cumulative impacts.

It is not recommended to select the spatial boundary of a specific VEC based on the boundary of a specific project, since this may not be extensive enough to assess the cumulative impacts of other projects.

When the boundaries of VECs have a similar extent, it is common to establish a single spatial boundary for the CIA. For example, when a large area of the project extends over several hundred kilometres and includes all the spatial boundaries of the different VECs, it can be classified as a single spatial boundary. However, whenever possible, it is recommended to set spatial boundaries for each VEC instead of having a single global boundary.

Whatever the choice, the form and criteria used in the selection of the spatial boundaries of VECs must be documented.

5.6 Establishing temporal boundaries in the CIA

The delimitation of the past time limit for a CIA should be based on an analysis of the past trend of the VEC and how it has been affected by previous projects. The availability of informati on is fundamental when selecting this limit: before the start of the project in question, it is important to consider which projects carried out in the past may have affected (or be affecting) the selected VECs, since this will influence the current baseline conditions. Therefore, it is prudent to adopt a conservative approach when selecting the past limits and considering the impacts on the baseline conditions of the VECs before starting the project.

The future limit of the CIA is equally difficult to establish. The scope of the time limit is usually determined by the knowledge of when future plans and projects will be implemented. However, this will become more uncertain the further in the future these dates are.

The selection of future time limits can be supported by the review of: i) existing government land use or development plans; ii) project records for the review of the EIA; iii) information in the public domain (newspapers, websites, public media); and iv) consultation processes carried out for other projects.

In LATAM, a temporal boundary of more than 10 years can be difficult to justify. **Box No. 7** presents some practical tips for selecting spatial and temporal boundaries in the CIA. **Box No. 8, Box No. 9** and **Figure No. 12** present two case studies on how VECs were selected.

Box No. 7

Practical tips for choosing spatial and temporal boundaries

Spatial boundary

1. Separate spatial boundaries should be established for each VEC.
2. It is possible, although in practice it does not occur frequently, to use a single spatial boundary, if it contains the spatial boundaries of all VECs.
3. The spatial boundaries of each VEC will also determine which projects and activities should be included in the CIA.
4. Scale effects (different detail of information possessed) will influence the determination of the extent of spatial boundaries and may lead to overestimation or underestimation of the extent of cumulative impacts.
5. It is wise to adopt a conservative approach when identifying the spatial boundaries, considering that the large areas for analysis can complicate the CIA.
6. The spatial boundary should consider the trend, status, and condition of the VEC at the time of the assessment.
7. The final selection of spatial boundaries is made via an iterative process.

Temporal boundary

1. It is necessary to set time limits (past and future) for the CIA.
2. Setting the past time limit can be difficult when going back to a pre-development scenario. In this sense, it may be more practical to consider those past projects that may have affected each of the selected VECs and use as the past limit the timeline in which this effect began to be seen.
3. There are several sources that can be considered when drawing up future time limits: i) existing government land-use or development plans; ii) project records for the revision of the EIA; iii) information in the public domain (newspapers, websites, public media); and iv) consultation processes carried out for other projects.
4. In LATAM, a time point more than 10 years in the future can be difficult to justify due to the lack of information on future projects and on the ability to predict their impacts with certainty.
5. The justification of the temporal and spatial boundaries in the CIA must be documented.

Box No. 8

Case Study Example - Selection of VECs in the Alto Maipo Hydroelectric Project in Chile

Alto Maipo Hydroelectric Project, Chile

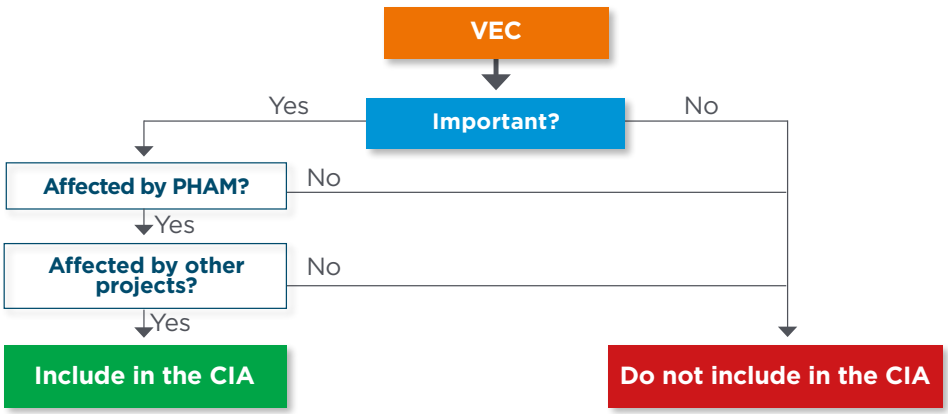
The Alto Maipo Hydroelectric Project ("PHAM"), which comprises two run-of-the-river power plants (531 MW) and their corresponding transmission lines (17 km), was approved by the Chilean environmental authorities on the basis of two EIAs. At the time of its approval, other projects were already in operation in one of the river basins of its area of influence and others were expected to be developed in the future. In conformance with the rules of the financial institutions supporting the project, a CIA had to be carried out.

The process used an innovative methodology for identifying VECs. The EIA had already been completed and approved by the Environmental Assessment Service ("Chilean SEA") and extensive consultations had been carried out with all relevant stakeholders. During this process, meetings were accurately recorded, and these logs were maintained. They were then analyzed to identify the concerns that the key actors considered most important. These concerns were then grouped by topics (environmental, social, economic) and subsequently prioritized according to the frequency with which they were mentioned in the records.

The CIA identified thirteen points of concern[34], which were subsequently examined by means of a flowchart (see Figure 6). At the end, four VECs were selected to be included in the CIA.

Figure No. 12

VEC Selection Process in the PHAM



Source: Author's own work

Box No. 9

Case Study Example - VEC Selection

Brumadinho - Vale Brazil

On 25 January 2019, a tailings dam failed at Vale SA Corrego de Faijao Iron Mine, 9km east of Brumadinho, Mina Gerais, Brazil. Approximately 11 million cubic metres of sludge was suddenly released, causing a 10m high wave that reached the Paraopeba River, located about 300km downstream. More than 250 people died because of the incident.

An ex-post environmental impact assessment was prepared to determine the severity of the incident. The regulatory authorities also requested a CIA to be carried out to quantify the impacts of the dam breaking, together with the impacts of the repair and compensation activities completed by Vale in response to the incident, and those of other projects and activities in the affected area.

The CIA initially selected 28 VECs: 7 physical, 4 ecological and 17 socio-economic and cultural. This set was further refined, using the following criteria to characterize each VEC in terms of its sensitivity: i) the impact of the tailings dam breaking; ii) the impact of emergency response actions and compensation efforts; iii) the impact of other projects and activities in the region; iv) the degree of sensitivity and vulnerability of the VECs in the Paraopeba river basin; and v) the VECs that were raised as concerns by the interested parties who were consulted.

After carrying out a matrix analysis, the following four VECs were selected for analysis in the CIA: i) surface waters; ii) terrestrial biodiversity (sub-component - native vegetation); iii) aquatic biodiversity (sub-component - fish); and iv) quality of life.

5.7 Selection of projects and activities for the CIA

Once the initial set of VECs and their spatial and temporal boundaries have been established, the next step is to select other projects or activities that can result in cumulative impacts on the selected VECs.

The identification of future projects and activities will inevitably be complicated by the availability of information and the certainty in predicting the cumulative impacts on the chosen VECs. To this end, local, regional, and national development plans are an excellent source of information to begin with, as well as any available information from the EIAs of projects that have undergone the environmental licensing process.

The evaluation of future activities must consider projects whose implementation is reasonably foreseeable within the time limits established in the CIA. When selecting projects to be included in the CIA, a simple rule applies: if the project does not result in cumulative impacts on a VEC, it should not be included in the CIA.

Box No. 10 presents some advice for selecting other projects and activities for inclusion in the CIA.

Box No. 10

Practical tips for selecting other projects and activities to be included in the CIA.

Selection of projects

1. If the project in question does not affect a specific VEC within the spatial boundary defined for the CIA, it should not be included in the analysis.
2. The limit for the inclusion of projects in the CIA must be determined considering the area of influence of the projects that affect the VEC.
3. The identification of future projects and activities can be assisted by means of public announcements or government development plans.
4. The list of projects whose EIAs have been submitted to the environmental approval or licensing process is an excellent source of information, since in many of the LATAM countries these records are public, as well as some EIAs.
5. Another potential very good source of information is websites of other possible projects that may be developed in the project area.
6. It is very important to consult press articles and other references published in the media on the development of future projects.

Box No. 10

7. Although some project sponsors (public or private) may be reluctant to disclose information about their projects (sometimes for reasons of confidentiality or ownership, or simply because they do not want to share it), the information related to those projects will undoubtedly strengthen the CIA process.
8. Information on projects planned for a date further in the future will always lead to a greater degree of uncertainty. Therefore, it is necessary to clearly explain how this uncertainty will be addressed in the CIA.
9. Only projects that have a reasonable probability of being carried out in the future and that may cause incremental impacts on the selected VECs should be included in the analysis.
10. When there are several projects of the same type within a given area (for example, an industrial complex), it may be easier to group them and consider them as a single project entity.

Selection of natural stressors

1. Assessing the significance of natural stressors should be based primarily on existing information.
2. The assessment of recurrent natural disasters (hurricanes, El Niño and La Niña heat fluctuations, etc.) can provide useful information on how to address the impact of these events in future scenarios.
3. Weather reports and reviews can provide additional information for the process of determining the impact of external stressors.
4. The impacts of climate change should be considered as a natural stressor.
5. The situation of climate change contained in the reports of the Intergovernmental Panel on Climate Change ("IPCC") may be useful in determining whether this phenomenon is a stressor.

Box No. 11 presents a case study showing how the types of projects for consideration in a CIA can be grouped.

Box No. 11

Selection of projects for the CIA - Puerto de Pecém, Brazil

The port of Pecém is located about 50km from Fortaleza, the capital of the state of Ceará, in north-east Brazil. In 2018, the port of Pecém handled 17 million tonnes of cargo. Due to the growth of the national and international economy and the demand of the related market, Pecém expects to increase the yield to 45 million tonnes in 2030. Consequently, a CIA was carried out to assess the environmental and social risks of port expansion for a group of VECs.

31 companies and 10 service providers operate in the port of Pecém. Due to the large number of individual projects and the difficulty of evaluating the impacts of all projects and activities, the decision was made to amalgamate existing and proposed projects for the future into industrial groups as follows:

i) steel and steelmaking plants; ii) cement plants; iii) thermal power plants, including coal and natural gas plants; iv) wind power plants; v) grain silos and food production facilities; vi) service providers; vii) storage terminal service providers; viii) bulk loading facilities; and ix) granite suppliers and distributors.

The cumulative impacts of the activities of the industrial cluster were assessed for three VECs (air quality, public health, and terrestrial biodiversity) and were analyzed for two future time scenarios: until 2030, an average term based on the United Nations Agenda for Sustainable Development Goals ("SDGs"); and until 2050, based on the Long-Term Development Strategy of the state of Ceará.

Although it was not possible to evaluate the contribution of individual projects to the cumulative impacts in each VEC, the CIA evaluated the significance of the overall cumulative impact in each VEC and defined a series of management, coordination and collaboration actions required, as well as a list of individual mitigation measures that should be adopted for all port facilities to reduce the cumulative impact.

5.8 Identifying natural stressors and other factors affecting VECs

In addition to human projects and activities, natural stressors and external factors, such as hurricanes, storm surges, floods, droughts, volcanic eruptions, earthquakes and other natural events that may affect the state of the VECs must also be identified and characterized in the CIA. The impacts of natural stressors can amplify the magnitude or scope of the cumulative impact generated by past, present and future projects and activities, and should be considered as additional to the impacts generated by those projects and activities.

One question that is often raised by professionals in charge of CIA is how to deal with climate change and determine whether it is a natural stressor. Although climate change is caused by human activities, this phenomenon can amplify the effects of other natural stressors and affect the state of, or make more susceptible, a VEC to cumulative impacts. For this reason, climate change should be considered a natural stressor rather than a human activity that causes impacts additional to those of the project.

5.9 Determining the baseline conditions of the selected VECs

Once the VECs have been selected, baseline information should be collected to assess their current situation, past trends, and future potential behavior (see **Table No. 12**). This may include information on their load capacity and their thresholds (or assimilative capacity), if available. Since this information is often not readily available, some trend-based interpretation may be necessary.

Box No. 12

Practical tips for determining the baseline conditions in each VEC

1. Reference information on the selected VECs should be available in the project EIA as well as in the project EIAs to be included in the analysis.
2. Government publications may also have reference information for some VECs.
3. Information on the status of the VEC can also be requested from interested parties during the consultation.
4. Since it may be difficult to establish the thresholds or bearing capacities of a VEC, it is advisable to adopt a conservative approach and apply the precautionary principle: *Where there are threats of serious or irreversible damage, a lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation*[36].
5. If the baseline status of a VEC is not available when performing a CIA, it may be necessary to collect additional baseline data to evaluate it. This will of course translate into an increase in the time and resources to be allocated to the CIA.

To determine the cumulative impact on each VEC, it is important to evaluate how its past trends and states have been affected by projects or actions already implemented, and how they may be affected by other present and future projects or activities. If a VEC has been significantly affected by past activities, it will be more likely to be impacted by present and future effects. This will determine the level of significance of the cumulative impact and the extent of mitigation measures required.

The process begins with the collection of information (primary or secondary) to determine the status of each VEC. This will depend on factors such as: i) the type of information needed; ii) the availability of the information; iii) the resources available to produce the required information, if it is not easily accessible; iv) the timetable for carrying out the CIA; and v) the difficulty of obtaining or producing the baseline information. Once this information has been obtained, past, present, and expected future trends of the state of the VEC must be evaluated.

Indicators are parameters used to measure and report on the status and trend of a VEC and must be clearly identified at the beginning of the impact assessment process to focus and facilitate the analysis of the interactions between the project examined, the other projects and activities to be considered, and the selected VEC. The selection of indicators must consider the following: i) their relevance; ii) their ease of measurement; iii) their potential change because of the project; and iv) their ability to reflect changes in the status of the VEC[37]. Indicators should not be identified until the list of VECs to be included in the CIA has been finalized.

5.10 Cumulative impact assessment

Once the background analysis phase of each VEC has been completed, the next step is to identify and assess the potential cumulative environmental and social impacts and risks due to past, current, and future projects and activities.[38]

The evaluation of the cumulative impacts in each VEC uses the same approach, or a similar one, as that used in the prediction of impacts of the traditional EIA, with the difference that the cumulative impacts are evaluated for each VEC, one by one. As in the EIA process, the criteria for characterising impact are usually magnitude, spatial or geographical extension, frequency, duration, reversibility, uncertainty and probability, among others.

Unfortunately, ***there is no single tool to perform a CIA***. A thorough analysis usually requires a combination of tools, each with its own characteristics and intended for different situations and stages (for example, scope analysis versus impact analysis, regional versus local, policy versus project, and the selection of mitigation and management measures). The optimal combination of tools depends, among other factors, on the nature of the problem, the type of VECs, the purpose of the analysis, access to data and their quality, the availability of resources, the preferences of the community and the type of impacts to be addressed.

The tools commonly used in the EIA are also applicable to the CIA. These include:

- **Questionnaires, interviews, and expert panels:** As with the EIA process, these are ideal resources to collect a wide range of information on past, present, and future projects, as well as to identify the VECs to be included in the analysis. This methodology, based mainly on surveys which are usually prepared with the help of one or more checklists, relies heavily on the opinions of the group of experts carrying out the CIA.

- **Checklists:** These are useful for identifying possible cumulative effects, by providing topics or issues of interest on which the projects and the VECs to be considered in the CIA can be identified. These types of lists can be the same that are used for the EIA process (to identify the susceptible environmental components),or be more specific depending on the perspective (of the planner or the project) from which the CIA is carried out, among other factors.

- **Networks, diagrams, and graphs:** These are convenient for establishing the cause-and-effect relationships that can lead to cumulative effects, not only of the first degree, but of a higher degree.

- **Bearing capacity analysis:** These identify the bearing capacity (or load capacity) of each VEC under analysis and compare it with the maximum or minimum legal thresholds, in order to ensure that the modifications induced in the environment by the accumulation of past, present, and future projects are within the permitted limits. This methodology, which provides mechanisms to control the incremental use of unused capacity, is the one most used by the environmental authorities in charge of controlling contamination.

- **Matrices:** These provide a format that is easy to use and understand, and are used to represent, tabulate, organize and quantify the interactions between projects and VECs. The difference with respect to the cause-effect matrices used in the EIA processes is that, in this case, the rows correspond to the VECs (generally identified through other methodologies) and the columns to the past, present (including the project under analysis, if the CIA is being done from the perspective of a particular project), and future projects.

- **Modelling:** This is a very powerful technique to quantify (mathematically or physically) the incremental cause-and-effect relationships that several projects can generate, resulting in cumulative impacts.

- **Trend analysis:** This method is generally used to assess the state of the VEC over time, develop projections based on past events and determine, with a pre-established degree of confidence, the conditions that said VEC may have in the future. It also helps to determine changes in the incidence or intensity of some factors over time.

- **Mapping overlay (Geographic Information Systems - GIS):** Just like the cartographic methods or systems used in the EIA process, these incorporate the information collected into a georeferenced coordinate system and, through a process of image overlaying, establish territorial regions to express the cumulative effects of the projects under analysis.

Whatever the methodology used to determine the cumulative impacts, it must meet the following minimum requirements:

- For a good evaluation of the temporal accumulation of effects, the time scale and observation frequencies according to the recurrence of the main disturbances and the dynamics of the eventual recovery of the environment must be considered. For example, in the case of forests, it is advisable to consider the time involved in secondary succession, which is usually measured in decades.

- The geographic scale of the disturbance to set the physical boundaries of the study must be considered. Likewise, flows across those boundaries should be analyzed.

- The link between actions, VECs and impacts must be explicitly incorporated to allow effects to be identified.

Since none of the available methodologies can meet all the requirements described above, a good CIA usually uses a combination of them. It is also common to make use of *ad hoc* methods that can be structured and adapted to the specific circumstances of the CIA process. In these cases, the methodology must be described beforehand, detailing its features (starting assumptions and, above all, its limitations), otherwise it will be very difficult to establish whether the results of the CIA process are sufficiently robust to allow a good cumulative impact mitigation plan to be based on it.

Table No. 4 contains a short description[39] of the most commonly used methodologies in a CIA

Table No. 4

Method	Comments
Geographic Information Systems	Powerful computer mapping and spatial information tool for capturing, visualising, and analysing digital data. Map overlays can be used to identify areas where the effects are likely to be greatest.
Network analysis	Network and system diagrams are useful for mapping and identifying cause-and-effect relationships (to the nth degree), which result in cumulative effects.
Biogeographic analysis	Landscape analysis emphazises the ecological pattern, structure, and process within a defined spatial unit.
Interactive matrices	These deal with the analysis of additive and interactive effects of several multi-project configurations.
Ecological modelling	These are numerical methods that model the behavior of ecosystems to extrapolate them over time.
Land quality assessment	Planning tool to assess the environmental quality of the land and establish use thresholds.
Interviews	Stakeholder interviews are used to gather information on the cumulative effects of past and present actions.
Checklists	These include a list of possible cumulative impacts from a list of common or likely effects.
Trend analysis	Identifies the historical, current, and future trends of a resource.
Load capacity analysis	Identifies thresholds as constraints to development. In the ecological context, load capacity is defined as the threshold below which ecosystem functions can be maintained.

Source: DEAT (2004)[40]

Whatever methodology is used for the CIA, certain steps are recommended when assessing the cumulative impacts (see **Box No. 13**) on the selected VECs.

Box No. 13

Assessment of cumulative impacts on VECs

1. The CIA analysis is aimed at predicting the future behavior, state, and condition of each VEC due to the incremental impacts of past, present, and future projects and activities, including the impacts generated by natural stressors.
2. There is a wide range of EIA tools that can be used to assess cumulative impacts.
3. The cumulative impacts are assessed in each VEC, one by one and not in conjunction.
4. When carrying out the CIA, the following questions must be answered: i) Are there other projects or activities in the defined project area that affect the VEC?; ii) Do the effects of the project overlap or increase the effects on the VEC?; iii) Do the effects of the project have the potential to affect the long-term sustainability of the VEC?; and iv) Are there other activities or stressors that exert impacts on the VEC (climate change, influx of workers, natural events such as floods, earthquakes, etc.)?
5. Qualitative techniques may be more appropriate to assess cumulative impacts on socioeconomic and cultural VECs.
6. Choosing an appropriate indicator that can measure changes in the condition of VECs due to cumulative impacts is key.
7. Comparative scenarios are useful tools for assessing the cumulative impacts on each VEC, as they can be created for a wide range of starting conditions.
8. The only significant impact to consider in a CIA is the cumulative impact in each VEC[41].

In practical terms, of the group of available methodologies, perhaps the most used in LATAM for a CIA are the following: i) network diagrams or graphs; ii) bearing capacity analysis; iii) cartographic systems; and iv) matrix analysis. Except for the matrix analyses, which will be described later in this Guide when looking at how to carry out a CIA from the project perspective, a more detailed description of the methodologies is included below.

5.10.1 Network diagrams or graphs

Network diagrams or graphs are very useful methodologies for establishing the cause- effect relationships that can lead to first-degree and higher-degree cumulative effects. Like most methods, to build a network of cumulative impacts, the starting point is a list of past, present, and future projects, and another that contains the VECs.

For this, the main interventions of the project in question (Base Project) are listed in a column called *Actions*, if the analysis starts from the perspective of a particular project, and the past, present, and future projects to be considered in the CIA are added to this list. If the analysis is done from the *planner's* perspective, only the projects are listed. This list does not need to be polished since the same methodology will do it later. It is advisable, however, that the list not be very extensive because, as the number of actions grows, the visualisation and subsequent interpretation of the graph is greatly compromized.

Similarly, the environmental components that, in a first instance, are deemed to be affected by the *actions* are listed. These can be selected from a predefined checklist (Leopold method[42], for example) or from an *ad hoc* list. Once the actions are placed in one column and the components in another, connectors are drawn if the proposed action may affect the environmental quality of the component in question. A visual aid that is often used to represent the degree of impairment is the use of connectors of different thicknesses: the thicker the line, the greater the impact.

Then, actions and environmental components that are not joined by a connector are discarded. This results in a set of actions with the potential to cause changes in the environmental components, and a list of components vulnerable to the actions detailed above. At this point the environmental components are transformed into *primary* VECs.

Once this is done, a second list of environmental components is placed next to the *primary* VECs, and it is determined if there is any type of interaction between each VEC and new list of components. Components with no interactions are then removed and the remaining ones, except for the *primary* VECs, become *secondary* VECs. To determine the tertiary VECs, this process is done once more by removing the primary VECs from the column. This process is repeated until the cumulative impacts to the *nth* degree are obtained.

Once the VECs have been determined to the *nth* degree, the network is simplified as far as possible so that the results are easy to understand. For this, the *star network method*[43] can be used, taking into account that: i) there can be no connectors between the starting actions, since this would mean that there is an overlap or redundancy of projects, in which case only the most important project should be considered; ii) there can be no connectors that go from the VECs to the actions, since the aim is to determine how the projects affect the VECs and not vice versa; iii) circular interactions should be avoided where one VEC affects other VECs and these, either directly or indirectly, affect the first one, since this would create a vicious circle that would generate a cumulative impact that tends to infinity; and iv) it may not be feasible to simplify the network to ensure that there are no crosses between the connectors.

The way to visualize this methodology is reflected in **Box No. 14**.

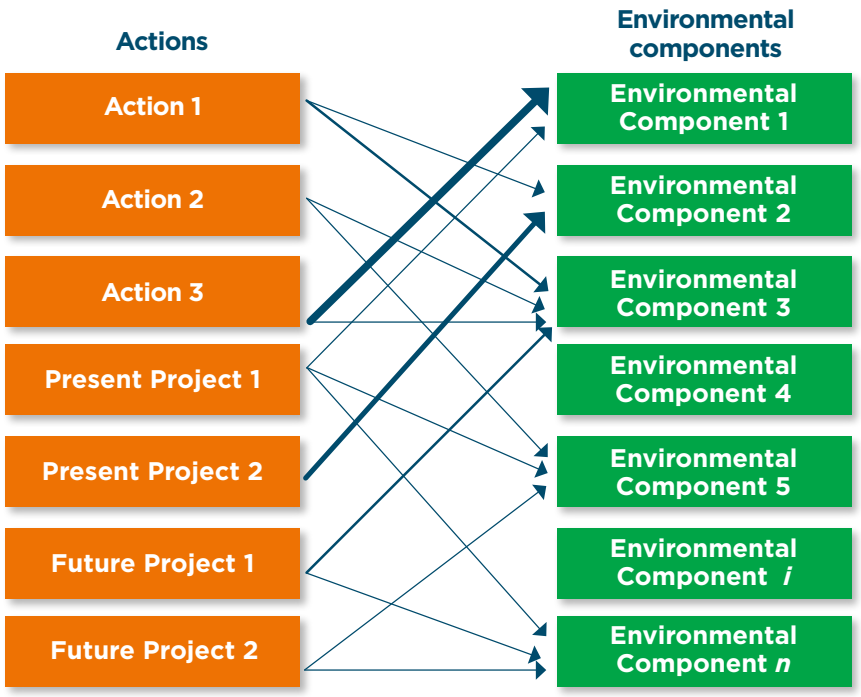
Box No. 14

Guide for using the network diagram or graph method.

Assume that a preliminary list of environmental components to be considered in the CIA has been identified. Suppose also that the Actions *Action 1, Action 2 and Action 3* of the Project are determined to have the greatest potential to cause changes in the pre-selected environmental components, and the projects *Present Project 1, Present Project 2, Future Project 1, and Future Project 2* are to be included in the CIA. With these data, the respective columns are produced, and the actions and components are joined with connectors as applicable (see **Figure No. 13**), using thicker lines to denote greater impact.

Figure No. 13

Step 1 for graphing: Interaction between actions and environmental components



Source: Author's own work

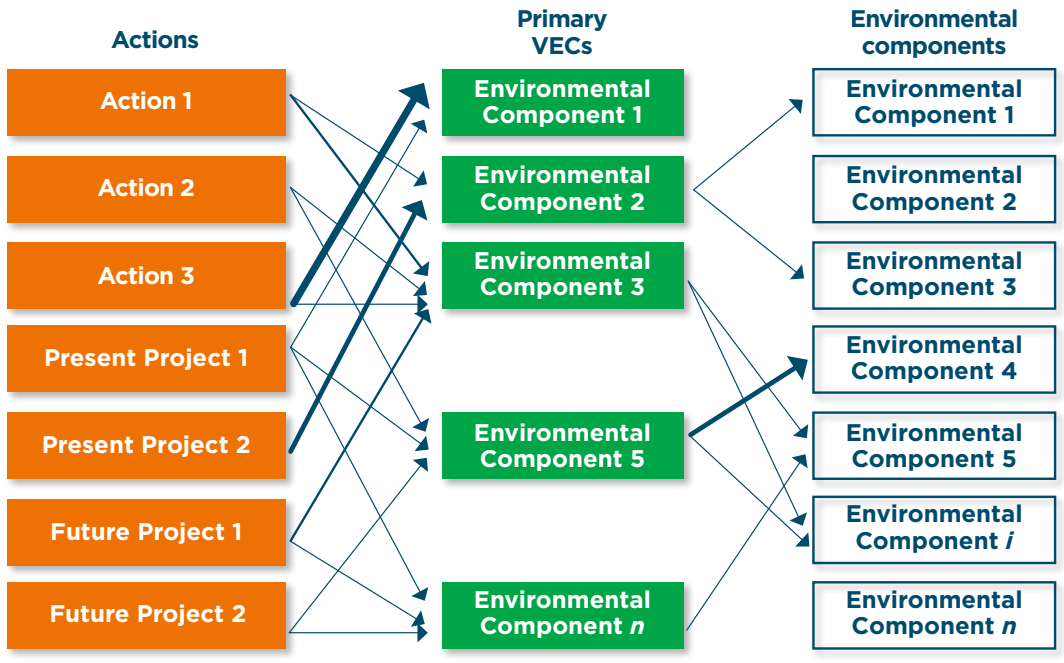
Box No. 14

Note that *Environmental Component 4* has no connector that relates it to the proposed actions. This means that this component is not a *primary VEC* and must be removed from this column. However, it does not necessarily mean that *Environmental Component 4* cannot be considered a secondary VEC or one of a greater (*nth*) degree.

Continuing with the process, a new column is added with all the environmental components initially identified and the previous process is repeated. Take care not to produce circular references; in other words, do not add a component that connects directly or indirectly (through other components) with itself (see **Figure No. 14**).

Figure No. 14

Determining primary and secondary VECs



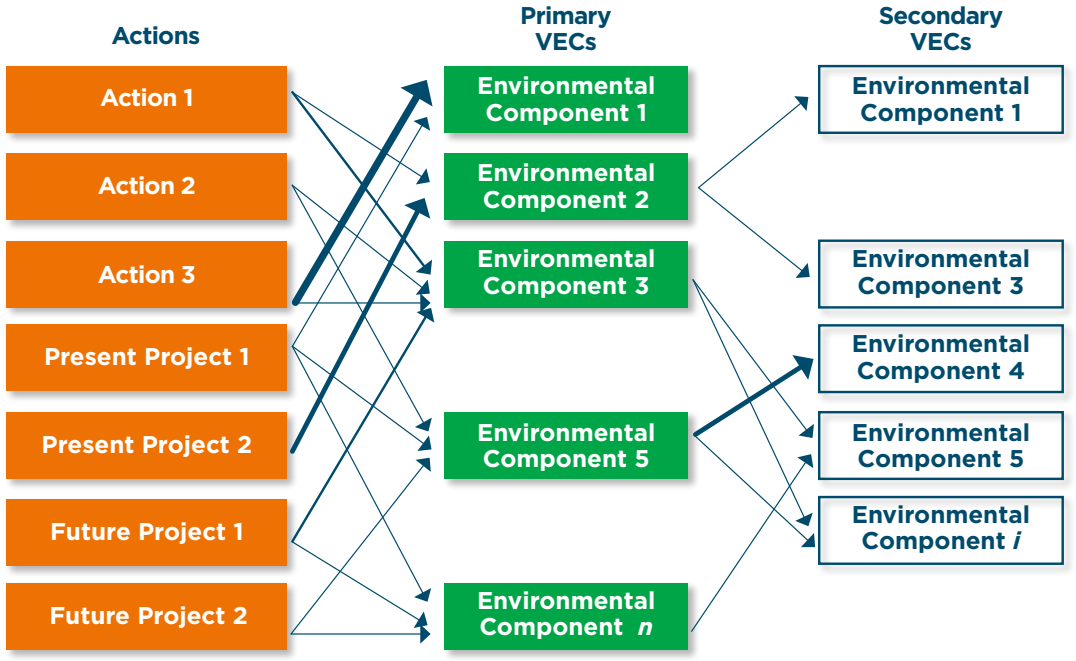
Source: Author's own work

Box No. 14

Next, any components that have not been affected by an interaction in the previous instance are deleted. In this example, Environmental Component 4 and Environmental Component i (see **Figure No. 15**).

Figure No. 15

Determining final primary and secondary VECs



Source: Author's own work

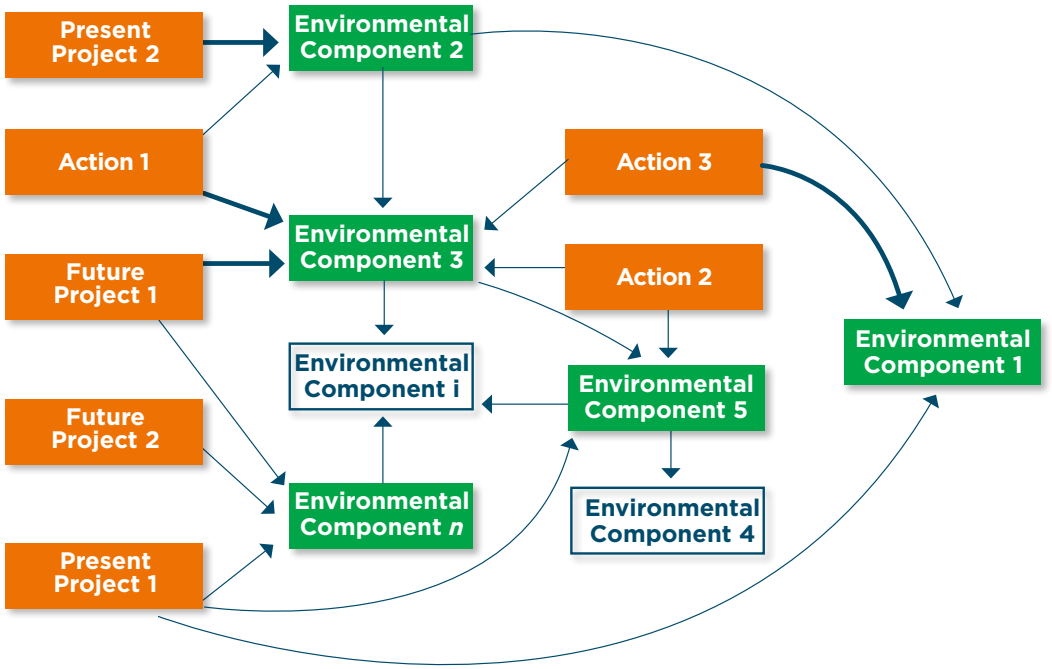
Finally, the graph is simplified, eliminating circular references (see **Figure No. 16**).

Box No. 14

Finally, the graph is simplified, eliminating circular references (see **Figure No. 16**).

Figure No. 16

Simplification of the network for greater understanding



Source: Author's own work

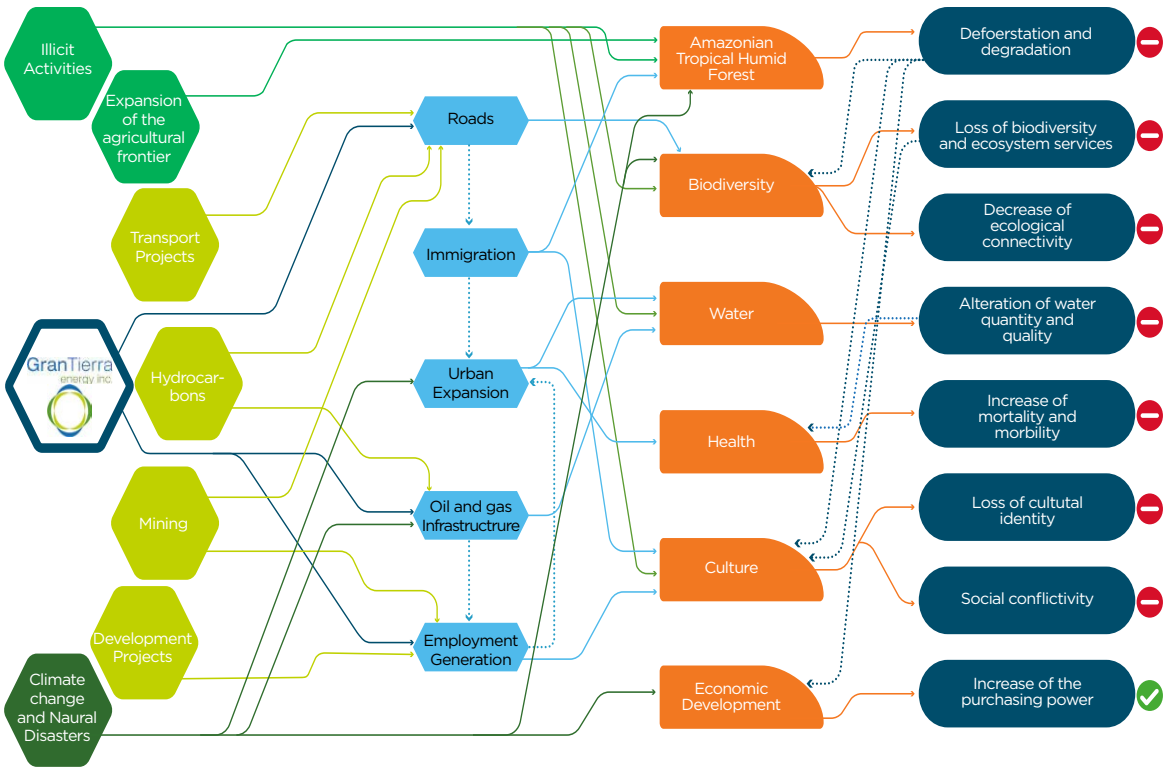
The simplified figure shows the actions in orange, the primary VECs in green (all those that experienced a direct change caused by an action), and the secondary VECs in white (all those that were affected by a primary VEC).

The VECs that are most susceptible to accumulate effects are those with more arrows pointing to them. In this example, the most susceptible is *Environmental Component 3. Next are Environmental Component 5, Environmental Component n and Environmental Component 1 with the same severity.*

Figure No. 17 and **Figure No. 18** present two case studies on the use of network diagrams to evaluate cumulative impacts.

Figure No. 17

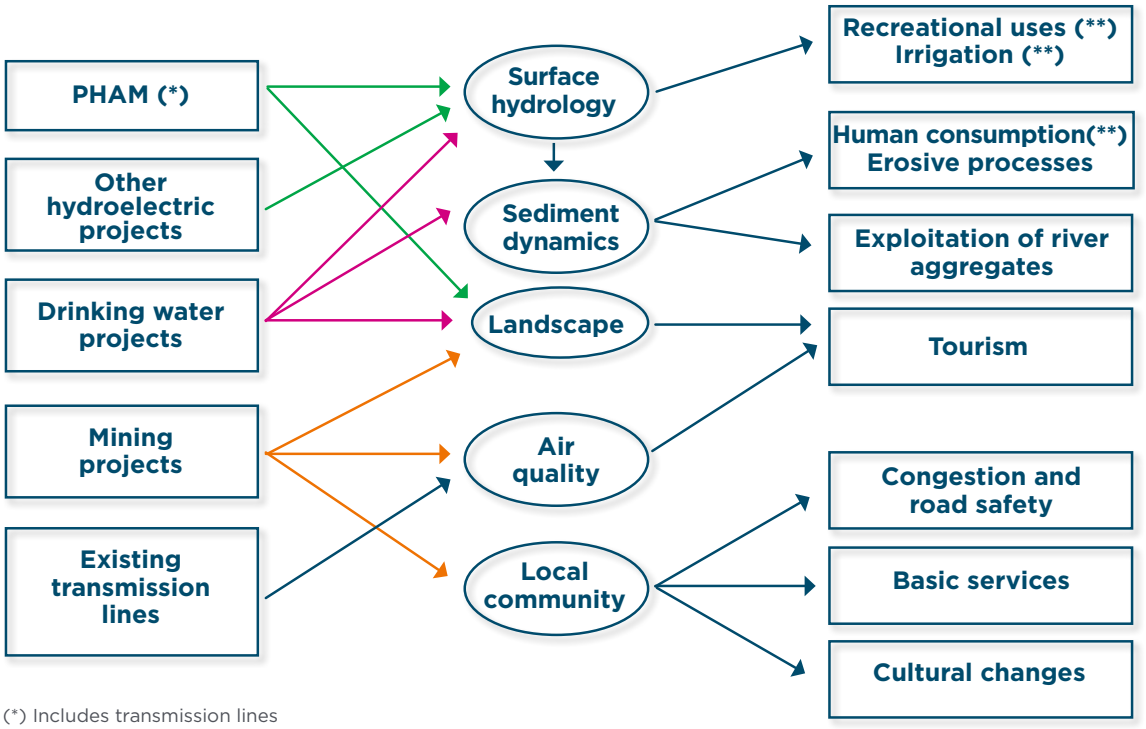
Examples of CIA network diagrams – Oil and gas project



Source: Adapted from oil and gas project

Figure No. 18

Example of CIA network diagram – Alto Maipo Project



(*) Includes transmission lines
(**) Other uses of water

Source: Adapted from the PHAM Cumulative Impacts Study

5.10.2 Analysis of the bearing capacity

To apply this methodology, you must know in advance the legal bearing capacity of each of the VECs that will be considered in the CIA. Remember that this legal limit provides a buffer or safety factor beyond the actual limit that each environmental component has for being polluted without becoming contaminated. Then, using any impact prediction methodology, the incremental impact that each of the projects under analysis could cause for each VEC is determined to calculate, by simple addition (that is, assuming that there are no synergistic impacts), the cumulative impact. This final impact is compared with the legal limit and decisions are made regarding the appropriateness or otherwise of carrying out the proposed project, any of the present or future projects, or, if necessary, of putting into effect an environmental remediation plan for past projects.

The easiest way to understand this method is, perhaps, through the following example (see **Box No. 15**).

Box No. 15

Guide to using the assimilative capacity analysis method.

Suppose that a cumulative impact analysis is needed to determine the impact the following projects would have on the VEC Forests: *Base Project, Present Project 1, Present Project 2, Future Project 1, Future Project 2, and Future Project n*. Assume that, to date and as a result of the intervention of all past projects, it has been established that the available forest area in the area under analysis is 600 hectares ("ha").

Carrying out the relevant analyses, it has been established that a minimum forested area of 350 0 hectares in the area being analyzed is necessary to be kept to guarantee the quantity and quality of the environmental services provided by the forest, and the legislation has established an area of 400 hectares as the minimum required limit.

Assume that, after the corresponding environmental analyses, it has been determined that the projects to be considered in the CIA will impact the VEC Forests in the manner indicated in **Table No. 5**, where a negative number indicates a net deforestation of the area and a positive one a reforestation of the site in question:

Table No. 5

Areas to be affected by projects

Project	Area of forestation (ha)
Base Project	-50
Present Project 1	-80
Present Project 2	-40
Future Project 1	-25
Future Project 2	50
Future Project n	-130

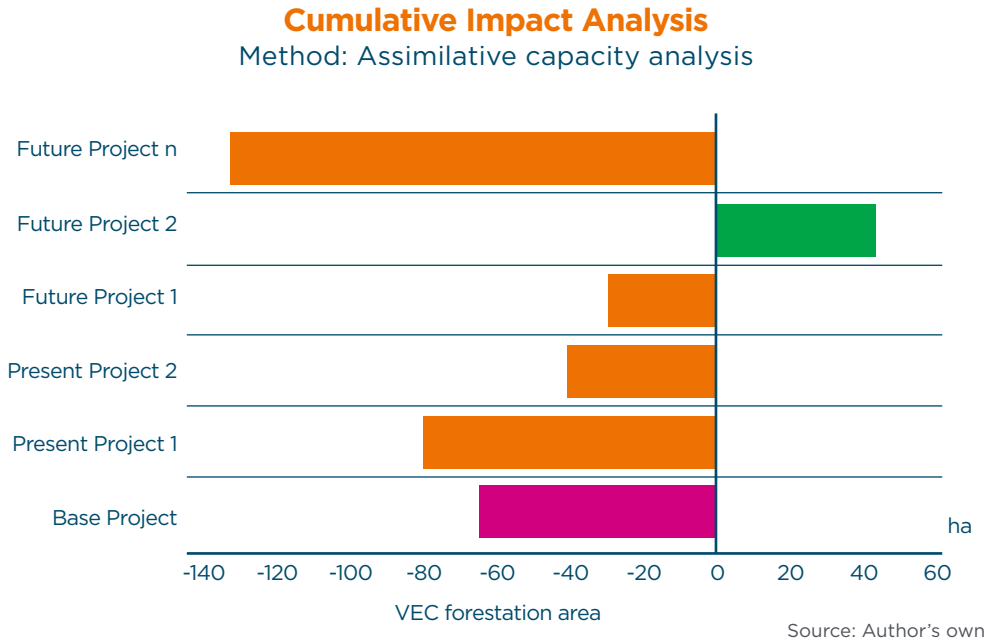
Source: Author's own work

Box No. 15

With these values, a graph like the following could be generated (see **Figure No. 19**).

Figure No. 19

Absolute values of the impact of each project on the VEC Forests



Source: Author's own work

This graph, which reflects the individual *incremental* impacts of each of the selected projects, makes it possible to immediately identify, the projects that would generate negative cumulative impacts (orange and fuchsia) and those that would counteract them (in green). However, for the purposes of greater understanding, it is advisable to work a little more with the values obtained.

Once the *incremental* impacts of each project included in CIA are known, a table can be created recording the *Current Impact* of the VEC due to past projects (in blue), as well as the Set Limit determined by the legislation (in yellow) and the calculated value of the *Cumulative Impact* (in green). If the values obtained are divided by the value of the Set Limit, a column can be obtained with the values of incremental impacts with respect to the legal limit (standardized values). Thus, the resulting table (see **Table No. 6**) would be like the following, where the standardized value of the legal set limit is identical to the unit and the rest of the values are expressed as a multiple of this value:

Box No. 15

Table No. 6

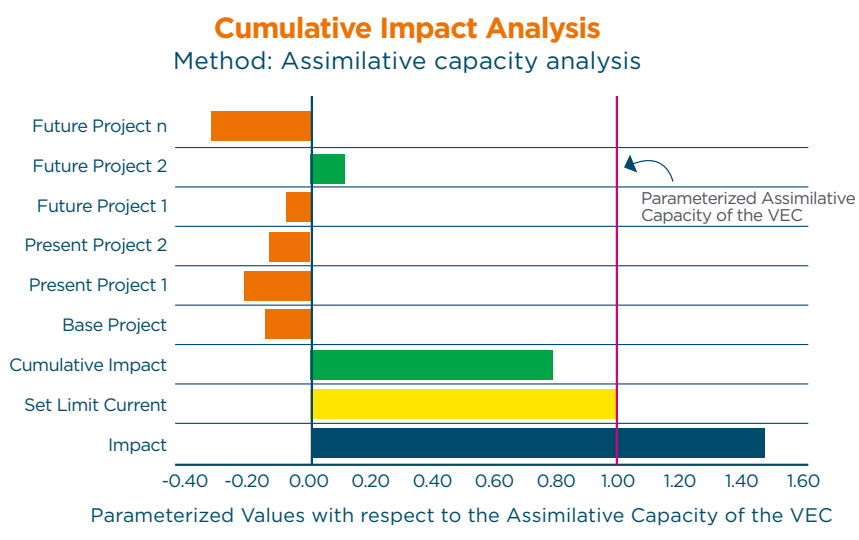
standardized affected areas

Project	Area of forestation (ha)	Standardized Area
Current Impact	600	1.50
Set Limit	400	1.00
Cumulative Impact	325	0.81
Base Project	-50	-0.13
Present Project 1	-80	-0.20
Present Project 2	-40	-0.10
Future Project 1	-25	-0.06
Future Project 2	50	0.13
Future Project n	-130	-0.33

Source: Author's own work

Just as before, a graph as shown in **Figure No. 20** can be generated.

Figure No. 20



Source: Author's own work

Box No. 15

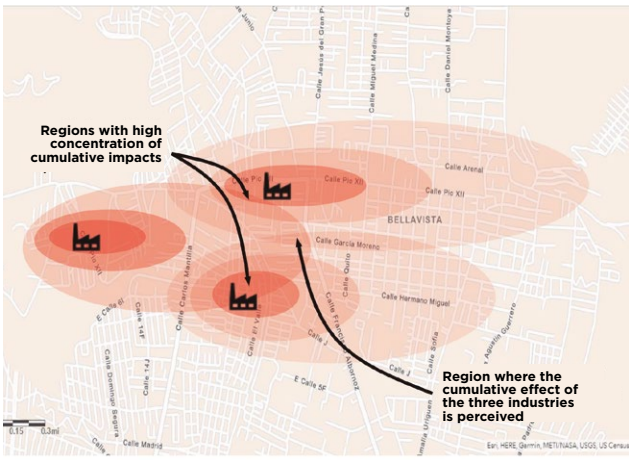
As can be seen, having the values in a graphical and standardized way makes it easy to conclude, for example, that the cumulative impact that would result from carrying out all the projects considered would be 20% below the legal minimum limit, meaning that doing so would not be legally viable. However, the graph also shows that if the *Future Project n* is not implemented (which has a negative incremental impact of approximately 30%), the environmental authority could well autorize the other projects. Likewise, the diagram obtained would allow the environmental authority to establish an order of priority for carrying out the projects: first the *Future Project 2, which has a positive impact, then, in order, Future Project 1, Present Project 2, the Base Project, and Present Project 1,* which have increasingly negative effects.

5.10.3 Mapping methods or systems (transparency methods)

As with how they are used in the EIA process, cartographic methods can be used to determine, spatially, the aggregate impacts that various projects can have on a particular VEC. For this, impact maps of each project considered in the analysis for the VEC in question are prepared and then, through a map algebra process, they are combined to generate an aggregate impact map relating to that VEC, as outlined in **Figure No. 21**.

Figure No. 21

Estimation of total impact using the mapping method



Source: Author's own work

A map generated in this way allows for the spatial identification of the points where the incidence of the incremental impacts of each of the analyzed projects become critical for the VEC under analysis. This procedure should be repeated for each VEC that is considered in the CIA.

5.11 Determining the significance of cumulative impacts

The significance of a cumulative impact is represented by a measure of the scope of the change in state of a specific VEC and its tolerance to said change, that is, if this variation is reversible or a threshold condition is exceeded (bearing capacity). The assessment of the significance of the cumulative impacts must be carried out for each VEC, evaluating the scope or severity of the change in state of the VEC due to the impact in question.

Table No. 7 and **Figure No. 22** suggest a matrix for ranking the significance of cumulative impacts.

Table No. 7

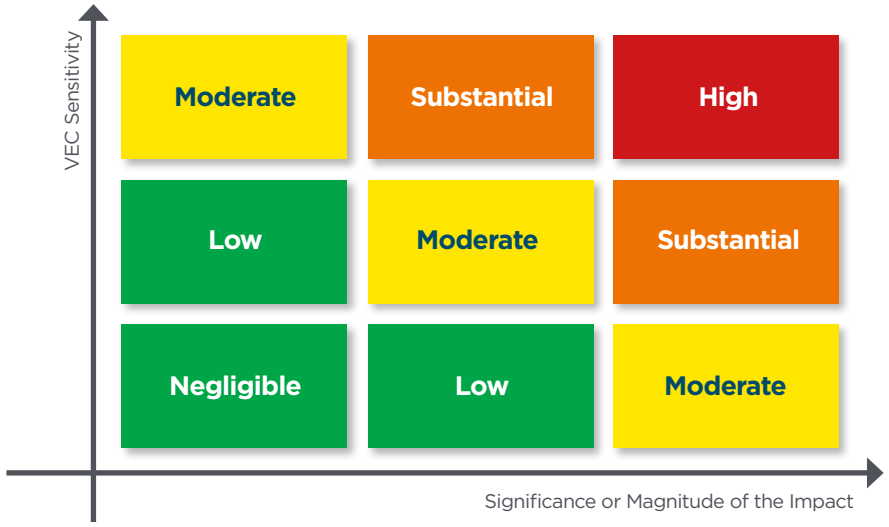
Determining the significance of the impact

Significance of impact	Description
Insignificant	VEC would not undergo a noticeable change.
Moderate	VEC would undergo noticeable changes, but within natural variation.
Substantial	The VEC would undergo changes beyond natural variation, but within its tolerance or resilience range.
High	The VEC would undergo changes that exceed its range of tolerance and resilience, resulting in an irreversible deterioration.

Source: Author's own work

Figure No. 22

Matrix for determining the significance in the CIA



Source: Author's own work

5.12 Managing cumulative impacts

The last of the six steps that the CIA process must follow is to propose management strategies in the form of a cumulative impact management plan that describes all the measures necessary to address the most significant impacts on the selected VECs.

A cumulative impact management plan consists of two parts. First, as in the EIA, is the preparation of a mitigation plan for the project's contribution to cumulative impacts. This is under the direct control of the project sponsor. Secondly comes a cumulative impact management plan for incremental impacts on VECs that are outside the control of the project. This requires the involvement of multiple parties. A good CIA requires environmental authorities (or another government body) to take the initiative, together with the sponsors of the projects contained in the CIA and civil society, to work together to implement collaborative management actions and minimize the cumulative impacts.

To do this effectively, it is recommended to assign a "champion" who assumes overall responsibility for implementing the cumulative impact management plan. **Box No. 16** contains some advice for managing cumulative impacts. **Box No. 17** provides a case study on collaborative efforts to manage cumulative impacts in the Amazon Region.

Box No. 16

Practical tips for the effective management of cumulative impacts

1. Adopt a multi-level approach to managing cumulative impacts in each VEC.
2. Prepare a mitigation plan to minimize the project's contribution to the cumulative impacts identified in the CIA.
3. Adopt a collaborative approach to develop a management plan to manage (beyond the project level) the incremental impacts caused by other projects, actions, or stressors in the selected VECs. This will require the participation of government agencies, project proponents and civil society.
4. Identify a leader or "champion" who directs the management of the cumulative impacts. Ideally, this "champion" is a government body responsible for the management of the VEC, but other government bodies and even civil society can also participate, depending on the nature of the VEC.
5. Monitoring and follow-up of the CIA mitigation plan is vital to evaluate its effectiveness and assess the status and trend of each VEC.

Box No. 17

Strengthening the CIA in Peru through the support of the Wildlife Conservation Society[44]

Despite the legal requirements, the practice of carrying out a CIA has not become established as an environmental management tool in Peru. Some CIAs have been carried out mainly as a requirement of international banks, or as an initiative of some projects. Currently, there is a consensus among environmental authorities on the need to apply a CIA in Peru, especially in fragile territories such as the Amazon, the Andean (Sierra) and the Coastal regions. This need is even more critical given the accelerated infrastructure investment programs that are being carried out and planned in the country. The Wildlife Conservation Society ("WCS") has supported the implementation of CIA in Peru and has proposed an Action Plan consisting of 5 main steps:

> Establish criteria to define the need for a CIA in the Environmental Assessment.

Box No. 17

> Prepare the Terms or Reference ("TOR") for the CIA in the detailed EIAs and in some semi-detailed ones.

> Develop CIA pilots in Peru.

> Design and disseminate a technical manual for CIAs in Peru.

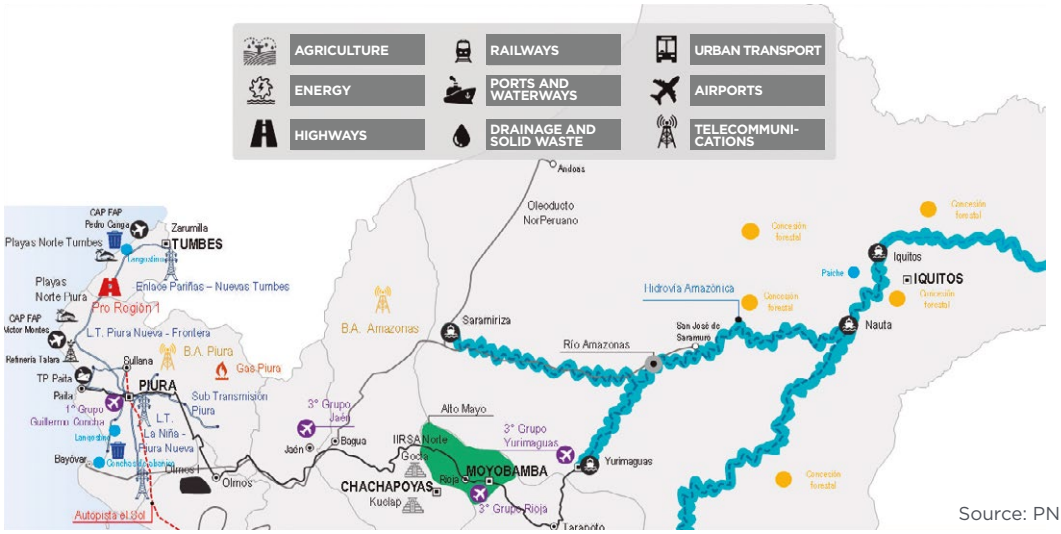
> Establish an education and training program for CIAs.

Additionally, the WCS has developed some pilot evaluations of the National Infrastructure Plan for Competitiveness[45] (Plan Nacional de Infraestructura para la Competitividad, "PNIC") to determine how and to what extent the projects contained in this plan impact the socio-ecological systems of the areas where they would be developed.

The area selected for the pilot study was PNIC North Zone 1 (see **Figure No. 23**), since it includes Peru transversally and covers the three natural regions (sub-zones): coast (Tumbes and Piura), mountains (Cajamarca) and rainforest (Amazon, San Martín and Loreto). The evaluation proposes a series of recommendations to ensure the sustainability of infrastructure programs in the country, including more explicit territorial approaches, the design and application of early warning systems for infrastructure proposals, the strengthening of land use plans and the strengthening of the capacities of national and regional agencies, as well as a program to monitor the key elements of natural capital in each region.

Figure No. 23

PNIC area of study



Source: PNIC

5.13 Use of adaptive management in a CIA

To address the uncertainties that cumulative impact management can present, it is advisable to adopt an adaptive management approach, especially when it comes to the implementation of effective regional mitigation and management plans, to explore opportunities for collaboration in the management of impacts, and to propose viable coordination mechanisms.

The adoption of surveillance and monitoring programs is of the utmost importance when it comes to determining the overall effectiveness of the management measures proposed to mitigate cumulative impacts (see **Table No. 18** and **Figure No. 24**).

Box No. 18

Use of adaptive management to deal with uncertainty in the CIA

Many times, cumulative impact assessment and, even more so, management, is limited by the high degree of uncertainty represented by the potential environmental and social impacts of the projects to be considered in the analysis. This uncertainty can be caused by:

- The high technical complexity of the projects.
- The possibility that projects generate large ecological footprints.
- The sheer number of natural and human ecosystems to be considered.
- The various areas of influence of each of the projects.
- The long planning, implementation and operation times foreseen for each project.
- The need for long periods of stabilization required by projects to reach their final ecological footprint.

Uncertainty can also be exacerbated by:

- Natural environmental variability (climate, fires, earthquakes, avalanches, volcanoes, streamflow, genetic composition of species, animal movements).
- The presence of unstable ecosystems (for example, after a project has been carried out).
- Human impact through global climate change, new technologies and population growth.
- Lack of knowledge about most aspects of ecosystems that are being managed.
- Variations in social and political objectives: variable budgets, political orientations and changing demands for environmental quality and aesthetic values.

Adaptive management is a planned and systematic process that is adopted to continuously improve environmental management practices. This process, which is based on the monitoring and evaluation of partial results, is continuously strengthened as it is applied and provides the necessary flexibility to identify and apply new management measures or to modify existing ones over time based on

Box No. 18

these partial results. Thus, this form of environmental management:

- Plays a key role in the implementation of the CIA's mitigation and management plans.
- Provides a framework for decision-making and stakeholder participation.
- Is useful when managing cumulative impacts, especially when there is a high number of uncertainties.

In essence, adaptive management:

- Deals with the uncertainties of natural and human systems.
- Improves knowledge about the operation of these systems to achieve management objectives.
- Relies on supervision (ongoing monitoring and evaluation) to understand and improve decision-making.

The basic components of an adaptive management plan are:

- Baseline.
- Institutional commitment (human resources, budget).
- Clear objectives.
- Installed capacity.
- Indicators and thresholds.
- Control and monitoring.
- Decision-making mechanism.
- List of options for mitigation measures.
- Stakeholder participation.

Figure No. 24

Adaptive Management Scheme in CIAs

Source: Author's own work

5.14 Cumulative impact management plan

Cumulative impact management plans, as well as the management plans developed in the EIA, also have the basic function of establishing a system that guarantees compliance with the mitigation measures that are formulated in the CIA. These plans, in terms of content and form, make no distinction with respect to who has carried out the evaluation of cumulative impacts (whether the *planner* or the *developer*) and tend to include the same requirements.

As in the case of the EIA, the management plans that are formulated as a result of the CIA are usually presented in a matrix form where the

management measures are listed in the rows of the matrix, and the columns generally correspond to the following fields: i) mitigation measure, that is, what is intended to be done; ii) incremental impact that is addressed, in other words, what the measure is taken for; iii) VEC it acts upon, to identify which elements of the environment will be affected by the measure; iv) expected effect, or the intended outcome when applying the measure; v) who is responsible for the execution, or who must implement the measure; vi) who is responsible for control, that is, who will verify that the measure was carried out in the planned way; vii) time of implementation of the measure, or when the measure should be carried out; viii) frequency of implementation, or how often the measure should be carried out; ix) management indicator, to know if the management system was efficient in the implementation of the measure; x) success indicator, to evaluate the effectiveness of the measure carried out; xi) estimated cost; and xii) comments.

Of all these monitoring parameters, there are some that have characteristics or implications other than the management plans produced in the EIA. For example: in the EIA the person *responsible for implementing the measure* is usually someone related to the project under study, whereas in the case of the CIA this may include the sponsors of the projects being considered in the analysis, a government authority or a group of civil society (NGO, CSO); the *person responsible for controlling or verifying that the measure was implemented in the planned way* tends to be an authority; the estimated cost of the measure, which in the EIA is incorporated into the budget of the project analyzed, in most cases has to be financed by the sponsors of the projects being considered in the analysis in the case of the CIA; and the comments generally refer to agreements that the authority must reach to ensure the implementation of the mitigation plan.

That said, it is important to keep the following in mind:

- The plan for cumulative impact management almost always includes actions that must be taken by the sponsors of the projects considered in the analysis (some of which may be abandoned and not have an "owner"), by civil society or by the competent authorities.
- The plan requires coordination between public and private actors and strict control when being implemented, to avoid discrepancies and ensure that the desired objectives are achieved.
- For this plan to be implemented successfully, strong institutions are required to enforce it and, above all, to monitor it.
- Usually, it is the sponsors or owners of the projects included in the CIA who must finance the implementation of the management plan.
- The implementation of a cumulative impact management plan may require the approval of new laws, policies or regulations, or the signing of agreements.
- Regardless of who carried out the CIA, the implementation of the corresponding management plan will always (or almost always) require the intervention and monitoring of the authorities.

5.15 Methodological simplification when the CIA is carried out from the perspective of the developer or a specific project

The majority of cumulative impact analyses for private sector projects are carried out from the perspective of the *developer* or a particular *project*. This is mainly due to two factors: i) much of the legislation in force in LATAM countries does not explicitly require a CIA as part of the environmental licensing process and therefore it is simply not carried out; and ii) access to financing resources provided by multilateral development banks (IDB Invest, IFC, etc.) and commercial banks affiliated with the Equator Principles require these studies.

A CIA that is carried out from the perspective of a *project* starts with knowing the impact that the group of actions envisaged in such project will cause in the environment, in other words: an EIA. If this environmental assessment process was properly carried out,[46] it should have included the following:

1. A good delimitation of the areas of direct and indirect influence of the *project*.
2. An adequate definition of the timing of the *project's* development phases (pre-construction, construction, operation and maintenance and abandonment).
3. The evaluation of all the relevant actions of the *project*, with the potential to cause some type of environmental impact.
4. An in-depth analysis of all the environmental components likely to be materially affected by the actions of the *project*.
5. A good baseline which sheds light on the behavior of the environmental components to be affected.
6. A solid analysis of environmental impacts.
7. A series of measures to prevent, mitigate, restore, and compensate for unwanted effects, and to stimulate the changes sought (environmental and social management plan).

Of these minimum requirements, the most important for the CIA process are the first, second, fourth and fifth, whose analysis is detailed below.

The area of influence of a project (composed of the area of direct influence and the area of indirect influence) is, by definition, the portion of the territory where the impacts of the actions to be carried out will manifest. This means that outside this area, the influence of the project in question cannot be perceived. In this sense, if any impact caused by a project's actions were detected outside its area of influence, this would mean that such area of influence was poorly determined and that it should be expanded to include the place that is experiencing some environmental modification caused by the project in question.

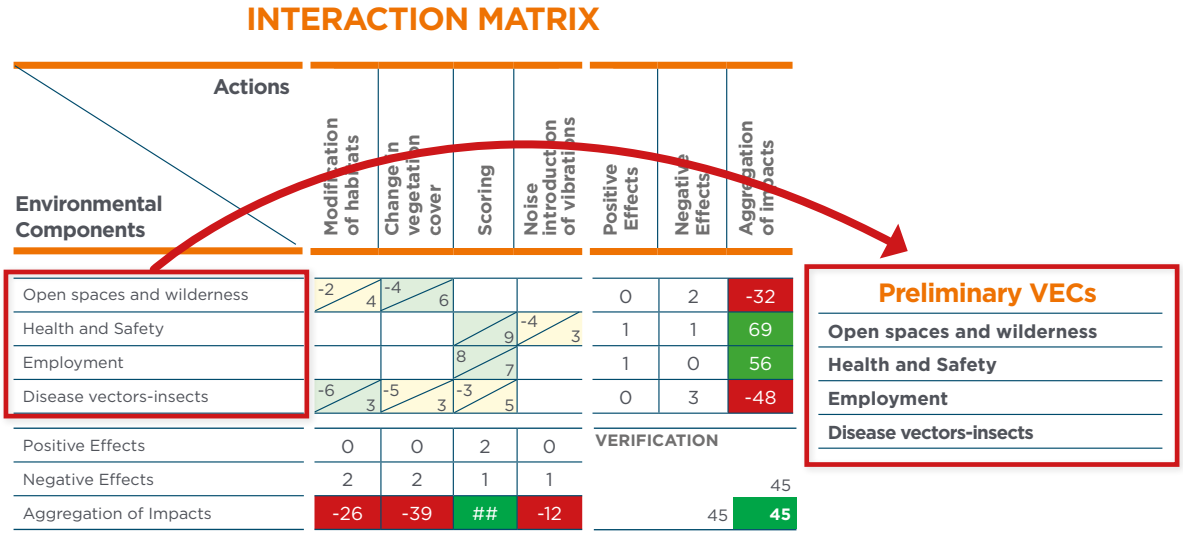
Recalling that the fundamental purpose of a CIA that is carried out from the perspective of a project is to determine how other actions (projects) could exacerbate the future environmental conditions of those in which it will be developed, ***a good delimitation of the areas of direct and indirect influence of the project*** (requirement No. 1 which the EIA has to comply with) is vital, since it automatically becomes the preliminary spatial limit[47] for the CIA being carried out from the perspective of a project.

An adequate definition of the timing of the project's development phases (requirement No. 2 that the EIA must comply with), on the other hand, helps to ascertain the time interval from the present (date on which the pre-construction phase of the project begins) to the date on which it is expected that the project will have fulfilled its useful life (date of abandonment). However, to obtain the timeline of the CIA, the period between the pre-construction and abandonment phases of the project must be added to the portion corresponding to the past temporal space, which is determined as previously explained in this document.

The consideration and in-depth analysis of all the environmental components likely to be materially affected by the actions of the project (requirement no. 4 that the EIA must comply with) means that, if the environmental assessment was well carried out, it is not appropriate to add other environmental components to the study of cumulative impacts. The need to include other components is a sign that the EIA was not well performed, is incomplete and therefore needs to be updated. This is reflected in the fact that, for CIA purposes, only the environmental components (or a subset of them) included in the EIA can be transformed in the preliminary VECs, as shown in **Figure No. 25**.

Figure No. 25

Transforming environmental components into preliminary VECs



Source: Author's own work

Carrying out a CIA from the perspective of a project ***should not*** require a separate public consultation, since it is understood that it: i) must have already been carried out as part of the EIA process; and ii) must have served to determine the environmental components to be affected by the project in question. However, holding meetings with the community to refine the list of preliminary VECs (environmental components of the EIA) is highly recommended.

If the EIA of the project in question has a ***good baseline which sheds light on the state of the behavior of the environmental components to be affected*** (requirement No. 5 which the EIA has to comply with), it is expected that the effects of past projects (in abandonment or in operation) are already considered when determining the "current" status of the VECs, so it is not necessary to add more time to reflect the "past" condition to the CIA. However, two situations must be considered: i) although the EIA may have captured the effects of past actions or projects on the environmental components considered, it is unlikely that it has identified the origin of this effect (which may be necessary when structuring the cumulative impact management plan); and ii) in practice, it is common to find a time lapse (sometimes of several years) between an EIA being carried out, being approved and the decision to implement the project in question. In these cases, and for the purposes of the CIA, it may be decided to update the baseline contained in the EIA to reflect the "current state" of the VECs.

That said, when the CIA is carried out from the perspective of a *project*, the determination of the spatial and temporal boundaries, and the identification of the preliminary VECs and their condition, are almost entirely defined in the EIA should this process has been properly carried out.

What follows, then, is to determine which past projects (abandoned or in

operation and *whose effects have not been considered in the baseline included in the EIA*, otherwise there would be a duplication of effects), and present projects (currently being implemented or about to be) are *materially* influencing or may influence the environmental quality of each selected VEC. Next, projects with a reasonable probability of being carried out in the future and that could also have some impact on the environmental quality of the VECs under analysis must be identified.

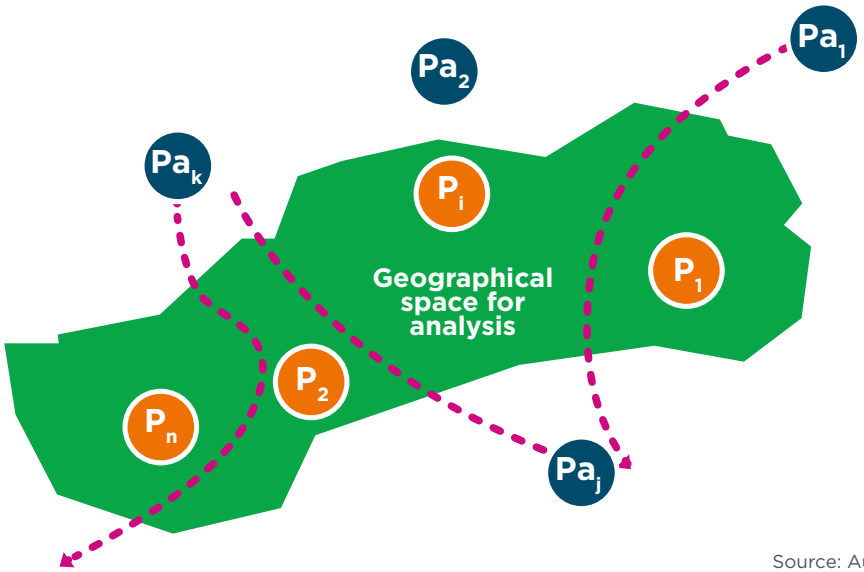
For this, a list is drawn up of the projects which have been abandoned, are in operation, being carried out or reasonably expected to be carried out in the future, and that are physically located ***within*** the area of influence of the *project* (now *geographical space* for the CIA). As a rule of thumb, the likelihood that a project may contribute to the accumulation of impacts is higher the closer it is to the *project*.

To this list, other projects (past, present, or future) that are ***located or will be located near the chosen area*** must be added, provided that there is ***some type of flow*** (of materials, supplies, products, biomass, etc.) that originates in these projects and that intersect the chosen area, or vice versa.

Figure No. 26 shows, schematically and in green, the ***geographical space*** under analysis. Projects P_1, P_2, P_i and P_n that are within this area become automatic candidates to be included in the cumulative impact analysis. Projects Pa_1, Pa_2, Pa_k and Pa_j are also potential candidates because they are very close to the study area. However, a detailed analysis shows that the project Pa_2 does not generate any flow (marked with dotted lines in red) that intersects the area under analysis, so it should not be included in the list of potential projects to be considered in the CIA.

Figure No. 26

Determining the projects to initially be considered in the CIA



Source: Author's own work

A great source of information for past and present projects are their EIAs or the corresponding environmental monitoring reports, if available. However, accessing them is also not an easy task: it is very common that old projects (and the older the projects, the more pronounced this situation) do not have an EIA, and that monitoring reports, if they exist, are scarce, are not accessible or simply do not include information relevant to the analysis. In these cases, the professional judgement of the team in charge of the CIA must be sufficient and, most probably, time and resources must be assigned to make rapid environmental analyses of the projects on the list and determine if these are, in fact, generating or may generate some type of disturbance in the VECs already identified, and if these effects were already considered in the EIA of the *project*.

If the determination of past and present actions is difficult, it can be a bit more complicated to identify future actions or, rather, actions that would *reasonably* occur in the future. In fact, although in theory this information could be available from the same source as the list of past and present projects, in practice, the *developer* may have restricted access to this information. Reasons for this include:

- Legal reservations to disclose information about a project to potential competitors;
- Being careful to not disclose information relating to a project until certain milestones have been achieved in its formulation process;
- Political advantages to restricting information;
- Possible social repercussions (e.g. speculation) that could arise when an announcement is made regarding the intention to carry out a project; and
- Possibility of losing financing.

To determine the VECs and the final projects that are to be included in the CIA, it is advisable to use the preliminary lists of VECs and the past, present, and future projects that were initially identified through the previous steps to build a matrix where the VECs are placed in the rows and the projects in the columns (see **Table No. 8** and **Table No. 9**)

Once the above has been done, an "x" is used to mark any relevant VEC-Project interaction boxes when the project considered may have some material impact on the VEC with which it interacts. The nature of the interaction must be established in advance by the CIA group to eliminate projects where the possibility of affecting a predetermined VEC is considered as *marginal, low or negligible.*

Table No. 8

Projects to be discarded in the CIA process

Projects affecting VECs / VEC	Within the area under analysis				Outside the area under analysis			
	Project 1	Project 2	Project i	Project n	Project 1	Project 2	Project k	Project m
Mineral resources	x	x			x			
Soils		x						x
Geomorphology			x		x			
Unique physical factors								
Continental water		x						x
Sea water			x		x			
Ground water	x							x
Water quality								
Water temperature				x	x			
Water recharge			x					
Quality of gases and particles								
Floods	x		x		x			x
Erosion								
Sedimentation and precipitation	x		x		x			x
Solution		x		x	x			x
Compaction soil and settlement								
Stability		x			x			x

Source: Author's own work

Table No. 9

VECs to be discarded in the CIA process

Projects affecting VECs / VEC	Within the area under analysis				Outside the area under analysis			
	Project 1	Project 2	Project i	Project n	Project 1	Project 2	Project k	Project m
Mineral resources	x	x			x			
Soils		x						x
Geomorphology			x		x			
Unique physical factors								
Continental water		x						x
Sea water			x		x			
Ground water	x							x
Water quality								
Water temperature				x	x			
Water recharge			x					
Quality of gases and particles								
Floods	x		x		x			x
Erosion								
Sedimentation and precipitation	x		x		x			x
Solution		x		x	x			x
Compaction soil and settlement								
Stability		x			x			x

Source: Author's own work

For example, *Project 2* and *Project k* (highlighted in yellow) in **Table No. 8**, which are outside the area under analysis, but close to it, should be excluded from the analysis since they have no interaction with any of the identified VECs. Similarly, the VECs *singular physical factors, water quality, quality of gases and particles, erosion, and compaction and soil settlement* (also highlighted in yellow in **Table No. 9**) should also be eliminated from the CIA process since they are not likely to be *materially* affected by the projects under analysis. VECs and projects that have not been eliminated through this refinement process will be considered as definitive.

Once the list of past, present and future projects with the potential to contribute to the accumulation of impacts in the selected VECs has been refined, the next step is to carry out the cumulative impact assessment in the strict sense, using any methodology,[48] and to prepare the corresponding environmental mitigation plan. This concludes the analysis.

5.16 Páez-Zamora Matrix Methodology for CIAs

Like the matrix methods used in the EIA process, the Páez-Zamora matrix methodology for the CIA begins with a list of VECs and a record of past, present and future projects that may be modified or have the potential to modify each of the selected environmental components, which are arranged in rows and columns, respectively, of a matrix. Each cell of this matrix, which records an interaction between the project and a VEC under analysis, can be graded according to its magnitude and significance, as proposed by the original Leopold method, or as indicated by the Conesa[49] method.

Once the VECs and the projects have been identified, the next steps are similar to those set forth in the Leopold-Páez[50] matrix methodology, with subtle variations that allow better visualization of the results and an approach to the analysis if this is done from the perspective of a particular *project*. Thus, the steps for the development of a CIA matrix are as follows:

1. **Delimitation of the area to be evaluated.** If the analysis is carried out from the perspective of a *project*, the starting area is equal to the area of influence of that project. If the analysis is done by the *planner*, this area will need to be determined as described earlier in this Guide.

2. **Identification of the VECs.** If the CIA is done from the perspective of a project, the environmental components that were used in its EIA are adopted directly as preliminary VECs. If the CIA is done from the perspective of a *planner*, a list of VECs must be drawn up, as previously described in this Guide.

3. **Identification of past, present, and future projects to be considered in the CIA.** Regardless of the perspective from which the CIA is carried out, it is necessary to create a list of past (abandoned or in operation), present (ongoing), and future (to be implemented) projects that have the potential to have incremental impacts on the selected VECs. If the CIA is done from the perspective of a *project*, the effects of past and present projects that have already been considered in the EIA should not be included (but the names of these projects should be kept in mind). The *project* must be included in the list of projects to be considered and the results of its prior environmental analysis must be transferred without changes to the CIA, except for a correction of scales.

4. **Transformation of the overall results (aggregation of impacts) that each environmental component obtained in the EIA process into new values of magnitude and significance for each VEC.** Regardless of how the impact assessment was carried out as part of the EIA process, it will be necessary to transform the total impact value of the project on the chosen VECs to values of magnitude and significance, using the same criteria that were used during the EIA process.

5. **Determining the magnitude and significance of the interactions between the projects and the selected VECs.** This step is undertaken in the same way as when performing a matrix analysis using the Leopold-Páez methodology.[51]

6. **Aggregation of results.** This step is like the matrix analysis with the Leopold-Páez methodology.

7. **Graph of the contributions of each project analyzed to the cumulative impact.** To visualize the contributions to the incremental impacts that each project under analysis would make, it is advisable to produce a bar chart to express the impact values.

   If the CIA is done from the perspective of a project, the values of the partial cumulative impact generated by each project can be divided by the impact (direct or incremental) of the project to obtain a standardized impact and know how significant the incremental impacts are compared to what the project in question would produce. These results can also be plotted.

   Likewise, if it is assumed, as previously analyzed, that the incremental impact of a project in its post-implementation phase becomes asymptotic and tends to a constant, and the dates on which the analyzed projects would enter that stage are known, a graph of the temporal variation of the cumulative impact can be created.

8. **Preparation of the Environmental Mitigation Plan.** This plan is prepared in a manner like that usually done for the EIA.

The best way to understand how the Páez-Zamora matrix methodology for a CIA operates is through the example summarized below, which is developed from a project (see **Box No. 19**).

Box No. 19

Example of how to use the Páez-Zamora method

1. **Delimitation of the area to be evaluated.** Suppose this has already been done and the area to be evaluated has been defined.
2. **Identification of the VECs.** Assume that the EIA for the *project* has already been completed and that, because of this analysis, the results that are reflected in the following matrix were generated (see **Figure No. 27**)

Figure No. 27

Results matrix from the project EIA

ENVIRONMENTAL ASSESSMENT MATRIX
LEOPOLD-PÁEZ METHOD

Environmental Factors \ Actions to be carried out	Modification of habitats	Change in vegetation cover	Scoring	Noise and introduction of vibrations	Positive effects on the Environmental Factor	Negative effects on the Environmental	Total impact on the Environmental
Open spaces and Wilderness	-2 / 4	-4 / 6			0	2	-32
Health and Safety			9 / 9	-4 / 3	1	1	69
Employment			8 / 7		1	0	56
Disease vectors-insects	-6 / 3	-5 / 3	-3 / 5		0	3	-48
Positive impacts due to the Action	0	0	2	0	VERIFICATION		
Negative impacts due to the Action	2	2	1	1			
Total impact due to the Action	-26	-39	122	-12			45

Source: Author's own work

The VECs to be used in the CIA are those shown in **Table No. 10**. These correspond to the Environmental Factors or Components that were used in the EIA of the *Project*. Remember that in the case of a CIA that is carried out from the perspective of a *Planner*, the list of VECs must be generated.

Box No. 19

Table No. 10

VECs to be considered in the CIA, obtained from the EIA of the Base Project

VEC
Open Spaces and wilderness
Health and safety
Employment
Disease vectors-insects

Source: Author's own work

Table No. 11

List of projects to be considered in the CIA

Projects to be considered in the CIA
Past Project 1
Present Project 1
Future Project 1
Future Project 2

Source: Author's own work

3. **Identification of past, present, and future projects to be considered in the CIA.** Suppose that, following the procedures suggested in this document, in addition to the project, the following list of projects was generated, all of which have the potential to affect at least one of the previously selected VECs (see **Table No. 11**).

Box No. 19

With the list of VECs and projects, the following matrix is built (see **Figure No. 28**).

Figure No. 28

Cumulative Impact Matrix (not assessed)

CUMULATIVE IMPACT MATRIX

PÁEZ ZAMORA METHOD

Environmental Factors \ Projects	Base Project EIA	Past Project 1	Present Project 1	Future Project 1	Future Project 2	Positive effects on the Environmental Factor	Negative effects on the Environmental Factor	Total impact on the Environmental
Open spaces and wilderness								
Health and Safety								
Employment								
Disease vectors-insects								
Positive effects due to the Project						Total		
Negative effects due to the Project								
Total effects due to the Project								

Source: Author's own work

Note that the *project* appears in the first column and the other projects in the following columns. This will not happen when the CIA is carried out from the perspective of a planner.

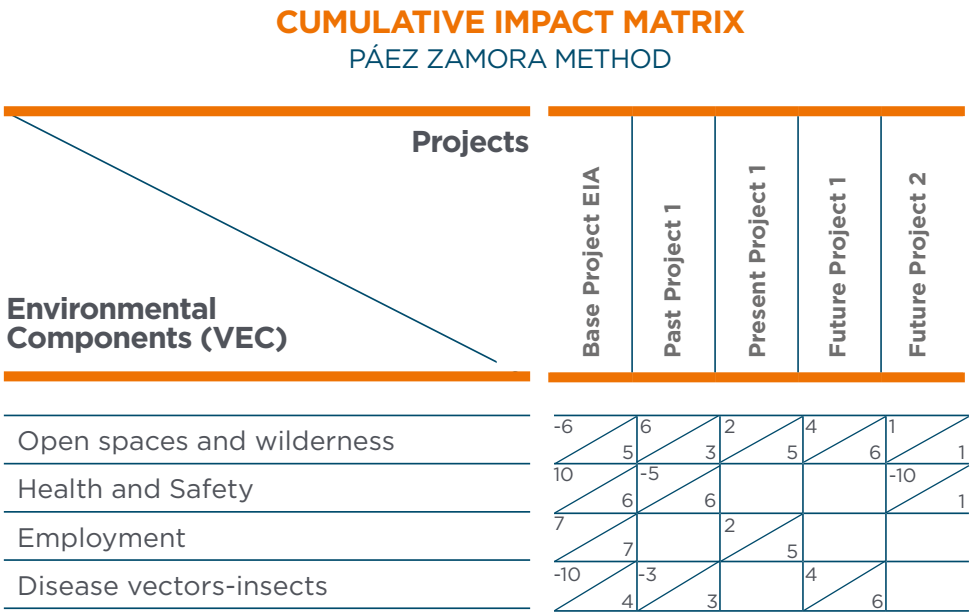
4. Transformation of the overall results (aggregation of impacts) that each environmental component obtained in the EIA process into new values of magnitude and significance for each VEC. Suppose that this has already been done and that it has been possible to translate the total effect of the project on each selected VEC (see column No.1 of **Figure No. 28**).

Box No. 19

5. **Determining the magnitude and significance of the interactions between the selected projects and the VECs.** For this, it is necessary to proceed in the same way as for the Leopold-Páez matrix analysis, until a matrix like the following is obtained (see **Figure No. 29**):

Figure No. 29

Cumulative Impact Matrix (assessed)



Source: Author's own work

Note that the equivalent values of *magnitude, importance* and *sign* of the Base Project are calculated from the results of its EIA, if the CIA is carried out from that perspective. If the CIA is done from the perspective of a planner, these values must be assigned as suggested by the Leopold-Páez method.

Box No. 19

6. **Aggregation of results**. Proceed in a similar way as proposed in the Leopold-Páez method, until obtaining a matrix as shown in **Figure No. 30**, where the individual and aggregate impacts can be associated with a certain color to highlight them. In this case: green for positive impacts; red for negative impacts with high magnitude and importance; yellow for negative impacts of low magnitude and importance; and orange for other impacts.

Figure No. 30

Calculations in the cumulative impact matrix

CUMULATIVE IMPACT MATRIX
PÁEZ ZAMORA METHOD

Environmental Factors \ Projects	Base Project EIA	Past Project 1	Present Project 1	Future Project 1	Future Project 2	Positive effects on the Environmental Factor	Negative effects on the Environmental	Total impact on the Environmental
Open spaces and wilderness	-2 / 4	6 / 3	2 / 5	4 / 6	1 / 1	4	1	23
Health and Safety	10 / 6	-5 / 6			-10 / 1	1	2	20
Employment	7 / 7		2 / 5			2	0	59
Disease vectors-insects	-10 / 4	-3 / 3		4 / 6		1	2	-25
Positive effects due to the Project	2	1	2	2	1			
Negative effects due to the Project	2	2	0	0	1			
Total effects due to the Project	39	-21	20	48	-9			

Juan Carlos Páez Zamora 2012

Source: Author's own work

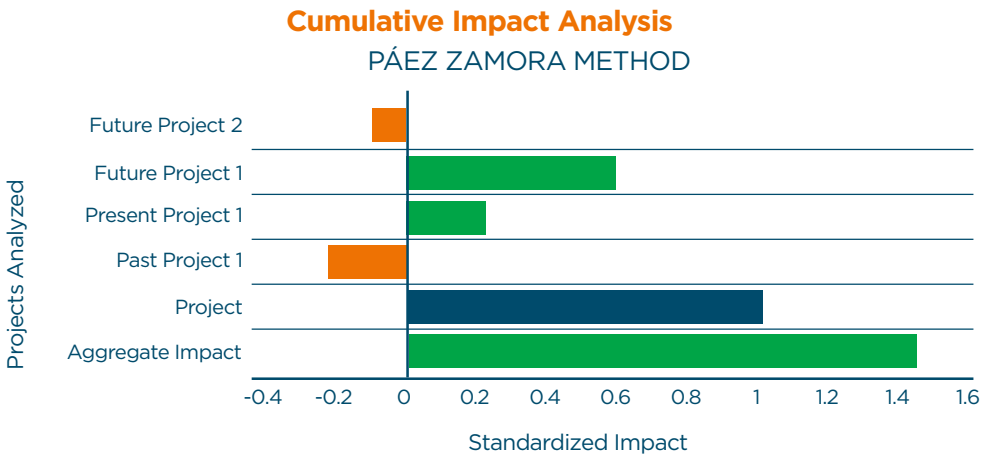
7. **Graph of the contributions of each project analyzed to the cumulative impact.** This graph can be made directly by taking the projects included in the analysis and comparing the values of total effects derived from each project. In the case of a CIA from the perspective of a project, it is advisable to divide

Box No. 19

each of the Total Impacts Due to the *Project by the Total Impact* due to the Base Project. With this, the standardized impact of the Base Project will be equal to the unit and all other impacts will be a percentage of this value (see **Figure No. 31**). Thus, these new magnitudes can be plotted in a bar chart, where the contribution to the cumulative impact of each project will result in several times the impact of the Base Project. For the example in question the resulting graph is as follows:

Figure No. 31

Graph of the cumulative impact with respect to the impact of the base project



Source: Author's own work

The graph above demonstrates, for example, that the total cumulative impact when considering *Past Project 1* (-25%), *Present Project 1* (24%), *Future Project 1* (56%) and *Future Project 2* (-11%) is approximately equal to 45% of the direct effect generated by the Base Project and that this is positive (see Aggregate Impact bar); similarly, it can be asserted that the contribution of *Past Project 1* is negative, approximately 25% with respect to the impact generated by the Base Project.

Box No. 19

Starting from a fixed time scale (using an example of 8 years), taking as a reference the year in which the Base Project will become operational and having known how much later than this the analyzed projects will become operational, the following table can be drawn up (see **Figure No. 32**)

Figure No. 32

Cumulative impact throughout the analyzed period

PÁEZ ZAMORA METHOD

Projects	Aggregate Impact	Standardized Impact	Year in which the Project will become operational	Year 0		Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Year 7		Year 8	
Base Project EIA	39	1,00	0,0																		
Past Project 1	-21	-0,54	1,5																		
Present Project 1	20	0,51	3,0																		
Future Project 1	48	1,23	2,5																		
Future Project 2	-9	-0,23	6,0																		
STANDARDIZED CUMULATIVE IMPACT				1,00	1,00	1,00	0,46	1,69	1,69	2,20	2,20	2,20	2,20	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97

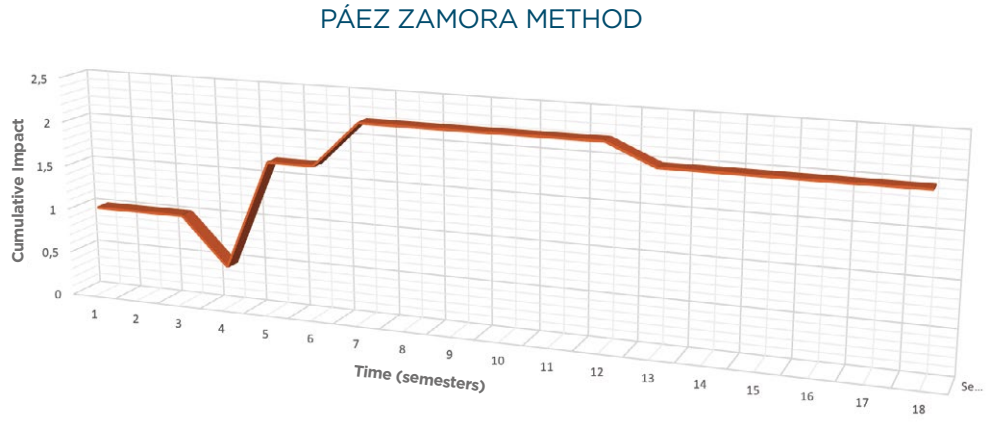
Source: Author's own work

With the values of the standardized total cumulative impact, it is possible to construct a graph to see the change of this impact as a function of time (see **Figure No. 33**).

Box No. 19

Figure No. 33

Change in the standardized cumulative impact over the analysis period



Source: Author's own work

8. **Preparation of the Environmental Mitigation Plan**. This plan is prepared in a manner like that usually used for the EIA.

It is important to bear in mind the following observations on the use of matrix methods in the CIA process:

> It is essential to carefully define: i) the spatial boundaries associated with each VEC and its indicators; ii) the time phases and specific actions associated with the proposed project; and iii) the rating scales of the impacts that will be used in the matrix analysis.

> It is very common for a CIA process to require more than one matrix analysis for cumulative effects. In this sense, it is customary to prepare preliminary matrices that are fine-tuned according to the time and physical scales of each VEC and are adjusted to the extent that the list of projects to be considered can also vary over time.

> The interpretation of the results of

the CIA process must be carried out carefully, due to the biases that can arise when introducing a specific methodology for phenomena that occur spatially. However, the analysis of cumulative impacts through a matrix methodology generally produces qualitative results that allow a good basis for decision-making.

> Assuming that the team in charge of the CIA is maintained and that the qualification parameters have not changed, when separate matrices are made for each stage of analysis and the values are standardized so that they are comparable, the interaction matrices can be useful to outline the evolution of the cumulative impacts over time.

> The results generated using matrices provide very valuable information that can be used to assign impact indicators for each project analyzed and for each of the VECs considered.

> The matrix methodologies for the CIA have the same limitations as those used to carry out an EIA. Therefore, it is very important to keep them in mind.

In particular, the use of the Páez-Zamora method:

> Is based on the pre-existence of an EIA, built on a good baseline and a solid analysis of environmental impacts, using a matrix methodology for the effect. If this is not the case, transforming the results of the EIA into a matrix system can be burdensome and require time and resources, which are not always available.

> Requires that the evaluation criteria to qualify the cause-effect interactions that were used in the EIA be maintained throughout the CIA.

> Assumes that the incremental effect (ecological footprint) of a project will be constant and permanent after it has entered the post-implementation phase (operation and maintenance).

The CIA is an iterative process that starts from the selection of the VECs, the temporal and spatial boundaries,and other projects, activities, and external stressors; continues with the determination of the incremental impacts generated by the projects and actions on the selected VECs; and ends with the formulation, execution and control of management measures to prevent, mitigate, restore or compensate for the cumulative impacts identified.

6. CHALLENGES OF CIA PRACTICE IN LATAM

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6. CHALLENGES OF CIA PRACTICE IN LATAM

Despite being in use in developed countries for several decades, CIAs remain one of the most challenging and least understood tools of the set of environmental impact assessment tools in LATAM countries, where unclear regulatory frameworks, modest or deficient governance mechanisms, weak institutions, limited or unreliable availability of information and absence of methodological guidelines that promote an effective practice of CIA, among other aspects, are noted.

In practice, there are many challenges faced by people interested in carrying out a CIA. These are described below.

6.1 Sources of information

The lack of access to reliable sources of information is a common situation throughout LATAM. However, the scarcity of reference data or its reliability should not be considered an obstacle to carrying out a good CIA, given that use of adaptive management strategies can be an option to address the uncertainties that this represents. Even in the absence of reliable quantitative data, the CIA, based on qualitative criteria, can be useful to determine the need for regional monitoring programs or to guide decision-making.

The first source of information for a CIA should be the EIA of the project in question, as this should contain very good information on environmental and social components, which will undoubtedly be very useful for assessing the status of the VECs selected for the CIA. In LATAM, this information can be obtained from the public records of EIAs maintained by the environmental authorities of each country, or through sectoral government institutions. Unfortunately, this task may not be easy, as many EIAs are often not published in full on websites maintained by local environmental authorities. However, if these projects are funded by an international financial institution, such as IDB Invest, it is likely that their EIAs will be available on the website of those institutions.

A second source of useful information may be the baseline studies carried out by NGOs or CSOs that may publish information on some VECs, or the publications of research carried out by academic institutions on specific environmental components.

Although the information required for characterizing the behavior of the VECs can be obtained from various sources (EIA, NGO or CSO publications, research, government planning publications, etc.), it is likely that the extent (level of detail) of this information is not consistent ocross sources or with what is required for the CIA.

It should be noted that access to the information required to carry out a CIA may be limited by the following:

- Legal, commercial, or financial limitations that prevent proponents from disclosing information about their project to prevent it from being used by their competitors.
- Care taken to not disclose information related to a project until certain milestones have been reached in its approval process.
- Political advantages to not making project information public.
- Possible social repercussions (especially speculation) that could arise when the intention to carry out a project is made known.
- Possibility of losing funding for the project.

These circumstances make access to detailed information on future projects limited. One way to counteract this situation and obtain the information sought may be to conduct interviews with private sector proponents or government agencies that are carrying out projects in the region. If this latter is not possible, an alternative way to continue with the CIA process could be to consider "generic" impacts that each project to be analyzed could result in depending on its type.

Whatever the source of information, all the data used for the characterization of VECs in the CIA must be validated in terms of their rigor, accuracy, usefulness, reliability, and reasonableness. Where appropriate and depending on the deficiencies of the information collected, the generation of additional primary reference data may well be required.

6.2 Consultation of CIA stakeholders

Consultation with relevant stakeholders (key actors) is an essential and integral component of the CIA and an important process that is often overlooked. Contact with key actors should start as soon as possible in the process and continue throughout the implementation of the CIA, and subsequently when cumulative impact management measures are implemented.

The first and perhaps most important objective in ensuring effective consultation with key actors, is the selection of VECs to be included in the CIA. This must be done by the team in charge of the assessment, through the definition of the scope of the analysis and the result of the identification and mapping exercise of the relevant interested parties.

Once the scope has been defined and the key actors mapped, a series of meetings and discussion groups will be required to assess the interest and determine the form of stakeholder participation in the CIA. It is very important that, during the initial phase of determining the scope of the study, the concepts (especially what a VEC means), the reason for carrying out a CIA, the methodology to be used, the role and contribution of stakeholders, and the expected results of the cumulative impact assessment process are explained to the key actors.

The consultation on the VECs must be inclusive and carried out through a variety of standard means of participation, including meetings in municipalities or communal houses, discussion groups, and interviews with key sources. The most important consideration in this process is

to explain to key actors the purpose of the CIA and how it differs from the EIA.

It is common for some key actors to prioritize certain VECs over others. However, the final selection of VECs should not consider specific interests, even when an interested party insists on the inclusion of a VEC (or a group of them) in the CIA. It is desirable that key actors reach a consensus on which representative environmental and social VECs should be selected. However, in cases where this is not possible, it will be the team in charge of undertaking the CIA who will have to make a final decision on which VECs to include in the process. All decisions regarding the inclusion or exclusion of VECs during stakeholder consultations must be documented.

Although consultation with key actors (when carried out) is usually limited to the initial selection of VECs, this process should be maintained throughout the entire CIA process, including the phases of developing management measures to minimize cumulative impacts and (most importantly) the implementation and monitoring of the cumulative impact management plan.

It is very important that all key actors are properly informed throughout the CIA process. In this regard, it is appropriate to develop an information access mechanism that allows stakeholders to be aware of the progress of CIA, which is culturally appropriate,[52] flexible and effective enough to reach the most vulnerable populations. When conditions permit, the consultation process can use data portals, a website, or social networks. Less technological means, such as municipal meetings, distribution of brochures, pamphlets, messages, etc., can also be used.

The choice of information exchange mechanism is unique for each CIA, depending, among other factors, on access to technology, the availability of internet connection, and the ease of exchange of physical or digital information.

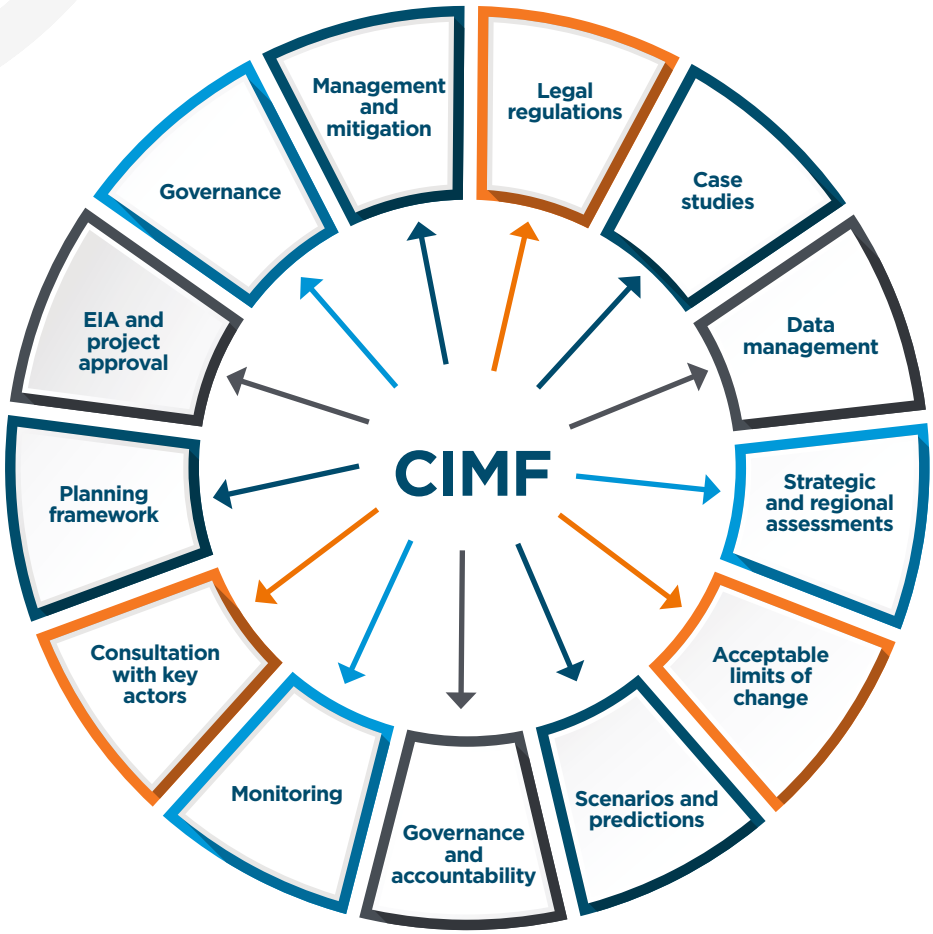
6.3 Management of and responsibility for cumulative impacts

A complex situation that many proponents face when trying to define the most appropriate form of cumulative impact management is how to address the incremental impacts derived from other projects in operation, being carried out or planned to be executed in the future, since this task, by definition, transcends the scope of inference of their project.

One of the ways to manage the cumulative impacts between multiple project proponents, government institutions, civil society representatives and other stakeholders, is through a cumulative impact management framework ("CIMF"). This instrument incorporates numerous measures on how cooperative efforts can be put in place to manage cumulative impacts across multiple project proponents, agencies, or actors. **Figure No. 34** shows an example of a cumulative impact management framework.

Figure No. 34

Example cumulative impact assessment and management framework



Source: Author's own work

By participating in a CIMF with defined governance responsibilities and a collaborative approach to the management objectives of the specific VECs, the responsibility can be shared among all participants, including working together to reduce conflicting mandates and responsibilities in relation to management of cumulative impacts. For a CIMF to be effective, the following must be considered:

- Choose a leader or "champion" who is responsible for the CIMF. This may be a ministry or other government entity responsible for one or a group of projects considered in the CIA, or for monitoring one or more of the selected key VECs.
- Decide on the corporate governance structure that regulates the functioning

of the framework: representation, frequency, and number of meetings, how decisions are made (hopefully by consensus), among other aspects.

- Establish a common data and information system accessible to all.
- Identify gaps in information and ways to manage those gaps.
- Identify financial mechanisms that support the management framework.
- Define control and monitoring initiatives.
- Decide the ideal thresholds or management scenarios to minimize adverse impacts on the status of the selected VECs.

6.4 A two-tier model for managing cumulative impacts

There are two ways to manage cumulative impacts: according to the level of control and the level of responsibility. The first is at the project level, where the individual proponent has full control over the management of its contribution to the cumulative impacts on the VECs. This involves the following activities:

- Identifying the effects of the project on the VECs used in the CIA.
- Determining the scope and significance of the cumulative impacts related to the project in the selected VECs.
- Prescribing internal management measures to minimize the project's contribution to the cumulative impacts.
- Identifying the extent of potential participation in collaborative management measures for cumulative impacts together with other development proponents or those actors responsible for other activities that contribute to the cumulative impacts on the VECs.

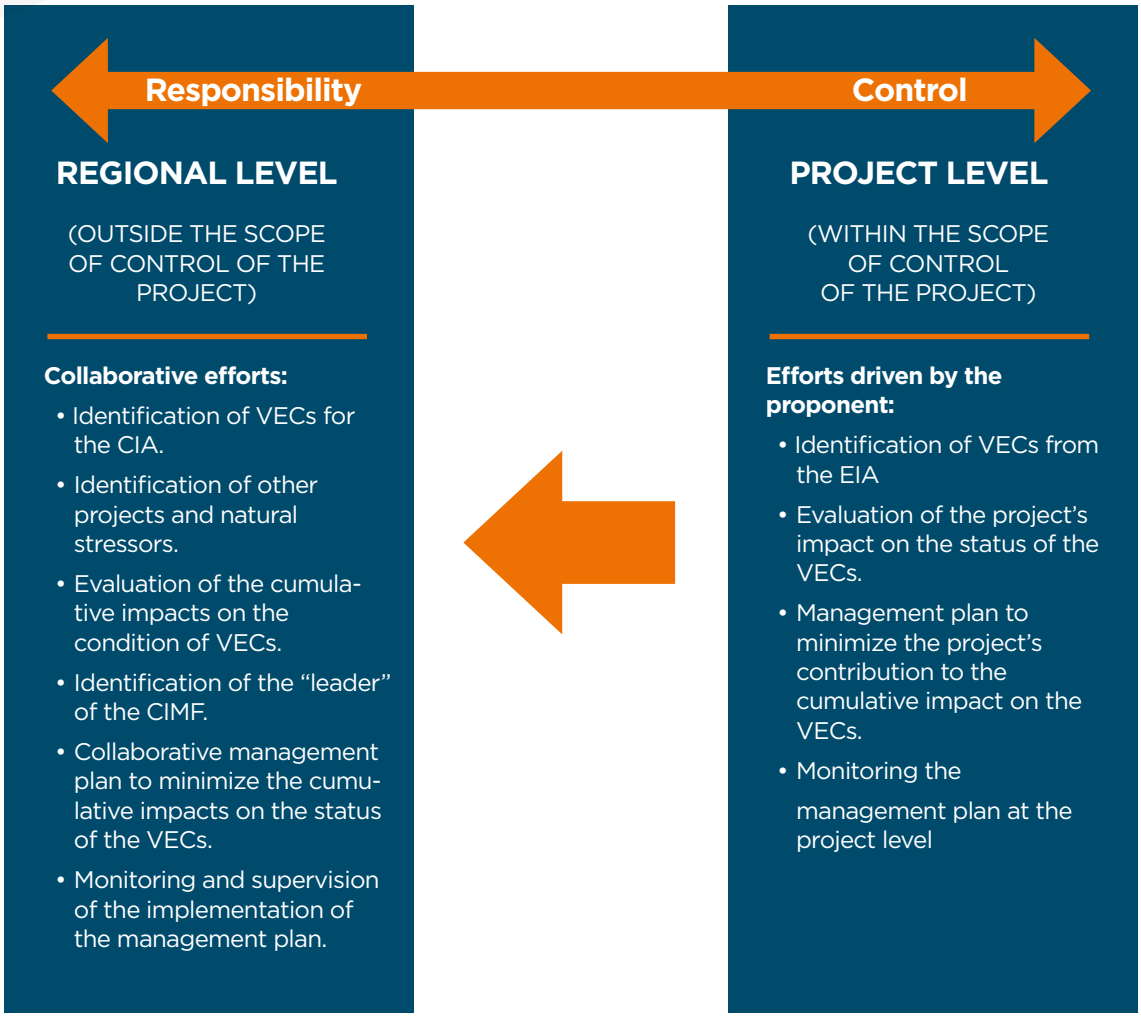
The second level goes beyond the project level. In this case, the sponsors of the other projects included in the CIA must take responsibility for the management of the contribution of their projects to the cumulative impacts on the VECs. This requires:

- The determination of the composition, governance, responsibility, and functionality of the CIMF members.
- The determination of cooperative mitigation and management measures to minimize cumulative impacts on VECs.
- The identification of data gaps to understand the extent of cumulative impacts on VECs.
- The determination of the needs for continuous monitoring and collection of reference data on the trends and status of VECs.
- The development of cooperative funding efforts for collaborative management mechanisms.

This two-tier responsibility for managing cumulative impacts is shown in **Figure No. 35**.

Figure No. 35

Two-tier approach to cumulative impact management based on control and responsibility



Source: Adaptation from IFC 2013

6.5 Private sector challenges in the CIA

Some of the main challenges that private sector proponents face when managing their contribution to cumulative impacts in combination with those of other proponents and actors include:

- Mental schemes that confuse cumulative impacts with residual environmental and social impacts at the project level.
- Modest (or no) large-scale comprehensive inter-institutional coordination; unclear organizational mandates; uncollaborative institutional attitudes and incentives; rigid organizational culture that is resistant to change; and logistical challenges, such as access to or availability of shared information systems.
- Promotion of private business interests over the common good.
- Stakeholders having biased perceptions regarding the different priorities and acceptable thresholds in the VECs.
- Complexity of understanding cumulative impacts on natural and human systems.
- Lack of a higher-level overall planning framework, e.g. land use plans or strategic environmental assessment.
- Lack of implementation, monitoring and control of CIA management plans.

Approval of the project in question will probably require its proponent to mitigate the contribution of such project to the cumulative impacts on a particular VEC. Depending on the management framework adopted, the significance of the cumulative impacts on a particular VEC and the condition of the VEC, additional mitigation responsibilities may also be assigned beyond the project level. Sometimes, a project proponent's participation in a collaboration framework that allows an adequate management of the cumulative impacts may well be a condition that the corresponding environmental licensing process requires. In this sense, the proponent is advised to share that responsibility, instead of taking the risk of being held fully responsible for doing so.

Below are some of the advantages that private sector proponents may have when carrying out a CIA:

- Ensuring the availability of resources (raw materials, labor, services) so that the project is not threatened by the lack of the above.
- Preventing possible conflicts, especially social conflicts, arising from their project.
- Ensuring the availability of ecosystem services so that project activities are not threatened.
- Ensuring compliance with all permits and other government requirements for the operation of the project.
- Ensuring that the compensation areas are maintained and are not threatened by other projects and activities.
- Avoiding the "fault of the project" due to impacts that the proponents are not responsible for.

6.6 Government challenges in the CIAA

LATAM governments also face numerous challenges in taking responsibility for managing cumulative impacts:

- "Bottom-up" development planning, i.e. project by project.
- Modest or non-existent general frameworks of land use planning or strategic environment assessment of the highest level on how individual projects are regulated and managed within a regional context of land use planning.
- Government management in "silos" and with little interaction or collaboration with other government bodies.
- Conflicts in government jurisdictional mandates that undermine collaborative planning efforts.
- High turnover and maintenance of key management personnel, which prevents adequate (and continuous) management of complex resources.
- Continuous changes (usually with the change of governmental administration) of the personnel in charge of decision-making, which hinders long-term planning between consecutive administrations.

Recognizing these challenges, governments should consider the following when committing to a cumulative impact management framework:

- Ensuring that the availability of resources (raw materials, labor, services) in a region is not compromised.
- Promoting inter-institutional coordination and avoiding conflicts of interest on management responsibilities.
- Achieving good (rational) management of resources.
- Prioritizing the maintenance of the status of the VECs so that their viability is not threatened.
- Preventing environmental contamination above the established thresholds.
- Avoiding social and user conflicts due to the demand for resources.
- Optimizing land use planning processes.
- Prioritizing investments based on their potential residual impact.
- Ensuring the implementation of cumulative impact management plans, making sure they are controlled and monitored to achieve the desired objectives (to avoid the deterioration of the VECs).
- Ensuring that the compensation conditions are maintained and are not threatened by other projects and activities.
- Avoid the "fault of the project" due to impacts that the proponents are not responsible for.

6.7 Control and monitoring in the CIA

The lack of monitoring and follow-up of cumulative impact mitigation plans is a common problem in the CIA process, especially when establishing

who is responsible for monitoring efforts and how monitoring data can be used to improve management decisions and actions. Therefore, it is always advisable to strive for a collaborative monitoring effort that is funded, that is implemented by all participants in the CIMF and that provides for the inclusion of an independent monitoring agency, where possible.

A cumulative impact monitoring plan must consider a periodic review of the following:

- The threshold conditions for the selected VECs.
- The indicators to measure the status of the VECs.
- The status of the condition of each VEC in relation to those thresholds.
- The effectiveness of the collaborative management measures being applied.

The CIA must be updated periodically to include unforeseen impacts, determine the effectiveness of the cumulative impact management framework, and correct the CIMF based on the effectiveness of the proposed management measures and the results that are obtained.

The prevalence in LATAM of unclear regulatory frameworks, modest or deficient governance mechanisms, weak institutions, limited or unreliable availability of information and the absence of methodological guidelines to promote effective CIA practice, among other things, should not discourage the realization of cumulative impact assessments, much less the management of such impacts.

7. REFERENCES

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8. ANNEXES

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ANNEX 1
Terms of Reference Guide for Cumulative Impact Assessment and Management

As a key component of the Environmental Impact Assessment ("EIA") process for the project, the Consultant will carry out a Cumulative Impact Assessment ("CIA") at the same time as updating the EIA, focusing on the identified Environmental and Social Valued Components ("VEC") that may be affected by the project and by other past, present, and foreseeable development activities that will be carried out in the future within or near the project area.

The purpose of this task will be to give the project sponsor (the "Client") recommendations on measures to be taken in the scope of action of such project, as well as at a regional level, to minimize the incremental negative impacts and maximize the associated positive impacts. The CIA must follow an analysis process like that proposed in the IDB Invest Practical Guide for the Assessment of Cumulative Impacts in Latin America.

In addition to the activities that it deems necessary to fulfill the objectives of this consultancy, the Consultant must carry out the following:

1. Do a preliminary identification of VECs. Based on the above thematic data and studies, the Consultant shall identify a number of valued environmental and social components that may be affected by the project and other projects and activities.

   Prioritzed VECs (no more than 6 to 8), which must be the result of a consultation process with stakeholders, may include, among others, the following: changes in water quality and sediments; changes in flow regime and sediment dynamics; modifications or conversion of coastal, riverside, aquatic and marine ecosystems; and disruption of economic activities and livelihoods (e.g. fishing, irrigation agriculture, agricultural products and water supply).

   The study will describe the nature of the impacts: it will assess the scale and significance of changes in the status of VECs in the long term, defining, as far as possible, clear quantitative and qualitative indicators (for example, percentage of loss, ecologically feasible, level of change acceptable to stakeholders and productivity threshold), load capacity

and thresholds and historical trends of VECs.

2. Conduct site visits and consultations to prioritize VECs. Guided by the results of prior analysis, the Consultant must visit the project site, as well as the sites of other projects and interventions that may affect the behavior of the selected VECs. During the site visits, the consultant will carry out consultations with key actors (local communities, representatives of government agents, sponsors of other projects, NGOs, CSOs, academia, etc.). Based on the results of the field visits, they will update and refine the results and conclusions of the theoretical study.

3. Establish the spatial and temporal boundaries of the CIA. The Consultant, based on the secondary information and that obtained from its field visit, will establish the spatial and temporal boundaries of the CIA depending on how they affect the state of the selected VECs throughout the life cycle of the project. The CIA shall explain the basis for the determination of the spatial and temporal boundaries considering the following:

   a. The spatial (geographical) context should consider administrative, ecological, physiographic (e.g. basins) and transboundary limits and any other relevant characteristics. Since there may be different spatial contexts for each VEC, the use of a geographic information system is recommended.

   b. The temporal boundary will be unique. For this, the Consultant must analyze the possibility of extending backwards to a scenario prior to development, to current conditions and to the future as realistically as possible. An appropriate time span in LATAM is no more than 10 to 20 years.

4. Determine the scope and scale of past, existing, or planned developments and activities that may cause or have caused cumulative impacts on the selected VECs, as well as determining the same for the project. The Consultant shall identify the types and intensity of cumulative impacts that have influenced or may influence the status of the selected VECs. The evaluation of future activities must consider any projects which can be reasonably expected to be carried out within the time limits established for the CIA.

5. Identify natural stressors and other factors that may affect the status of VECs. The Consultant, in addition to previous developments and activities, must identify and characterize the natural stressors and drivers (climate change and other natural events) that affect the condition of the VECs.

6. Evaluate cumulative impacts on VECs. With the prioritized VECs, the Consultant must identify and evaluate the potential environmental and social aggregate impacts and risks, in addition to any other potential additive, compensatory, antagonistic, or synergistic effects, to describe whether the impacts and risks associated with the project interact with each other and how they do so.

   For each VEC, the prediction of the impacts will use criteria such as the scope, frequency, duration, magnitude, reversibility, uncertainty, and probability of impacts. This involves evaluating the cumulative impact on each VEC, one by one; estimating the effect of the project on the expected changes in the status or condition of the VECs, including the effects of the predicted mitigation; and determining the cumulative impact of all other developments, activities, and external stressors on each VEC within the established time limit. To this end, the Consultant must answer the following questions:

a. Are there other projects or activities in the defined project area that affect the VECs?

b. Do the effects of the project overlap or increase the effects on the VECs?

c. Can the effects of the project affect the long-term sustainability of the VECs?

d. Are there other activities or stressors that exert impacts on VECs (climate change, labor influx, natural events such as floods, earthquakes, etc.)?

7. Determine the significance of cumulative impacts. The Consultant must define adequate indicators and thresholds to determine the acceptable changes in the conditions or status of the VECs; describe the magnitude and significance of said impacts and risks in the context of past, present and future actions to determine if they could affect the sustainability of the VEC in question; and identify the consequences and the benefits of carrying out the project in the manner and timeframe proposed for this purpose.

The significance of the impact must be determined according to the VEC's bearing capacity, whether determined by its limit threshold, by an established legal directive or policy, or by a qualitative assessment based on the opinion of the team in charge of the CIA. In any case, the criteria used to determine the significance of the cumulative impacts must be defensible.

The project's contribution to the cumulative impacts in the selected VECs must be qualified (usually as insignificant, moderate, substantial and high, or through a predefined value scale), taking into account whether the project: i) has a measurable effect on the VEC; ii) acts in conjunction with the effects of past, present or future projects, activities and external stressors; and iii) together with other projects, activities and external stressors, modifies the status of the VECs to an unacceptable level or exceeds the pre-established legal threshold.

8. Identification of management measures. The Consultant must propose strategies for managing the identified impacts and express these in a cumulative impact management plan that describes the measures needed to tackle the significant impacts on the VECs and that considers the following:

a. The management measures that other projects should incorporate in their EIA and Environmental Management Plans to manage their contribution to the cumulative impacts identified.

b. Management measures that extend beyond individual projects and that would require cooperative management between multiple government agencies, projects, NGOs, CSOs, and other actors.

c. Where applicable, suggestions for changes to institutional and legal frameworks, guidelines and directives for capacity development, and the form of intersectoral cooperation.

d. When necessary, adaptive management recommendations to manage the uncertainties inherent to the CIA process.

ANNEX 2
Regulatory Requirements for CIA by Country (April 2022)

Country	Mandate for the CIA?	Legal text and summary of requirements
Argentina	No	CIA requirements are not found in any relevant national or provincial law
Belize	Yes, explicitly.	Environmental Impact Assessment Regulations (1995): 5(d) The minimum requirements of an EIA include an assessment of the likely or potential "direct and indirect, cumulative, short- and long-term effects". 26(1)(a) Any selection must include a consideration of "...**any cumulative environmental effects** that may result from the project taking into consideration other proposed projects or projects that have been or will be carried out".
Bolivia	It explicitly mentions cumulative impacts, but, strictly speaking, refers to "cumulating" impacts.	Supreme Decree No. 24.176 - Regulation of the Environmental Law. Environmental Prevention and Control Regulations (1995): Article 25 - The identification of impacts must include at least... (a) Identification, inventory, quantitative and qualitative assessment of the project's effect... on environmental and socioeconomic aspects of the project's area of influence: Positive and negative effects, direct and indirect effects... and **cumulative and synergistic effects will be distinguished**.
Brazil	Federal law specifically mentions the "cumulative and synergistic properties" of impacts. However, the text refers more to "cumulating" impacts. São Paulo's state law is more explicit in requiring an impact assessment considering the effects of other existing projects in the region.	Federal law **Resolução CONAMA** 1/86 (Art. 6) establishes that the EsIA will develop minimum technical studies, including of the environmental impacts of the project and its alternatives, "through the identification, prediction of the magnitude and interpretation of the significance of the likely relevant impacts, differentiating: the positive and negative impacts (beneficial and adverse), direct and indirect, immediate and medium and long term, temporary and permanent; their degree of reversibility; **their cumulative and synergistic properties**; the distribution of social burdens and benefits". The regulations vary at the state level. For example, the above provisions are repeated verbatim in **Law No. 1532** (1982) of the State of Amazonas. In the State of São Paulo, the Manual para Elaboração o Estudos Ambientais com AIA published by the CETESB establishes that "when applicable" the sponsors must "carry out an assessment of the cumulative and synergistic impacts considering the existing projects in the region".

Country	Mandate for the CIA?	Legal text and summary of requirements
Chile	Implicit, according to the Environmental Assessment Service (Chilean SEA)[53], but not clear to the proponent.	The *Guía para la descripción del área de influencia: Área de influencia en el Sistema de Evaluación de Impacto Ambiental* [Guidance for the description of the area of influence: Area of influence on the Environmental Impact Assessment System] (Chilean SEA, 2017) (p. 10) argues that the **Law on Environmental Bases No. 19.300**, Art. 2(l) that describes the area of influence implicitly makes clear the inclusion of the CIA analysis, noting that "*a Baseline is the detailed description of a project or activity's area of influence, prior to its implementation*" implies this, and citing the definition of area of influence of **Reglamento N°40 del Sistema de Evaluación de Impacto Ambiental** [Regulation No. 40 of the Environmental Impact Assessment System] (RSEIA) Art. 2(a).
Colombia	Necessary for integrated environmental licences; also for monitoring and control	**Decree 1076 of 2015** (Consolidated Regulation), Art. 2.2.2.2.3.8.6. prescribes the minimum information required in the application for integrated environmental licences that incorporate all the necessary accessory permits, which must include: a) *Identification of each of the environmental impacts* ...at the time of integration, as well as the **cumulative environmental impacts** on each of the natural resources used by the projects; b) T*he new integrated environmental management plan*, which takes into account the measures aimed at preventing, mitigating, correcting or compensating for the present environmental impacts, the **cumulative** and other impacts of the projects, works or activities to be integrated; as well as the monitoring and follow-up program and the integrated contingency plan; (Monitoring and control included in Art. 2.2.2.3.9.1.).

Country	Mandate for the CIA?	Legal text and summary of requirements
Costa Rica	Yes, for projects with moderate and high impact It also covers the CIA for government planning purposes	**Decree No. 31849 - Reglamento General de Procedimientos de Evaluación de Impacto Ambiental** [General Regulation of Environmental Impact Assessment Procedures] (and its amendment from 2013): Art. 9(5) (*Environmental Assessment Documents - Documentation to be attached to D1*, necessary for projects with moderate and high impact) must include: "**The basic matrix for identifying cumulative environmental impacts** that would be generated duly completed (D1)." (from a list of 6 types of documentation required). The proponent must swear that the information in the basic matrix is accurate, current and true under penalty of law. • Article 12 addresses *Accumulation* (defining it as the progressive increase in the manifestation of an effect over time) • Article 68 deals with CIA by SETENA and other centralized and decentralized state authorities on development trends in river basins. CIA in the context of regulatory planning: Decree No. 32.967/ MINAE (EIA Manual, Part III, land use planning): 5.13 Procedure for applying the Environmental Fragility Index to regulatory plans already drawn up and to other types of spatial planning: 5.13.2 In *geographical areas in which there is already significant anthropogenic land use*, as part of the integration of the environmental variable, **a Basic Evaluation of Cumulative Effects will be included**. It should determine the condition of land use/overuse considering the IFA data as a basis and, in addition, the conditions of environmental load capacity for the following topics... (list of media/ topics) 5.13.3 The information generated as a result **of the cumulative effects analysis** shall be summarized in the form of a land use/ overuse map. (Map content specified).
Dominican Republic	General regulation names cumulative impacts, but, strictly speaking, refers more to "cumulating" effects. Yes, specifically for small-scale mining projects.	**Resolution No. 5/02 - Reglamento del Sistema de Permisos y Licencias Ambientales [Regulation of the System for Environmental Permits and Licences]**. (2002) Art. 19 stipulates that: "The final report of the Environmental Impact Study must include at least: (f) Identification, description and assessment of the potential impacts of the project, **including indirect, cumulative and synergistic impacts.**" **La Norma Ambiental para la Explotación de la Minería No Metálica** [The Environmental Standard for the Exploitation of Non-Metallic Mining] (2004) states that: "6.2. When an Environmental Impact Study is required (Chapter V, Law 64-00), it must comply with at least the following criteria: .... g) The synergistic and cumulative effects, as well as possible conflicts of use, will be identified and assessed. h) In the case of small mining projects, the **cumulative effects of the same with other similar projects** in the area where the operation is proposed must be analyzed."

Country	Mandate for the CIA?	Legal text and summary of requirements
Ecuador	Yes, explicitly, but mandatory only for the Competent Environmental Authority. únicamente para para la Autoridad Ambiental Competente.	**Decree No. 752 - Reglamento del Código Orgánico del Ambiente** [Regulation of the Organic Code of the Environment] (COA). (2019) Art. 512: **Activities with cumulative environmental impact:** "The Competent Environmental Authority, in coordination with sectoral institutions, will identify and evaluate the environmental impacts generated by projects, works or activities that may have cumulative effects, for which it will prepare environmental quality studies or monitoring of the resources in question" (to adopt policies, regulations and decisions on EIA).
El Salvador	No. The CIA is only addressed in a tangential way in the context of wastewater and sewage.	CIA is not mentioned in the Ley de *Ordenamiento y Desarrollo Territorial* [Land Management and Development Act], which sets out the procedural requirements of the EsIA. The *Reglamento Especial de Aguas Residuales y Manejo de Lodos Residuales* [Special Regulations on Wastewater and Waste Sludge Management], Art. 4, requires owners of sanitary landfills to carry out a cumulative analysis of the total volume of waste to avoid exceeding the maximum load.
Guatemala	A CIA is required only at the discretion of the Ministerio de Ambiente y Recursos Naturales [Ministry of Environment and Natural Resources] (MARN)	**Acuerdo Gubernativo Número 137-2016: Reglamento de Evaluación, Control y Seguimiento Ambiental** [Governmental Agreement Number 137-2016: Environmental Assessment, Control and Monitoring Regulations] (2016) CIA is included in the list of tools that make up a complete application: Art. 5 "Complementary environmental tools: The following are considered complementary environmental tools: a) Environmental risk assessment; b) Social impact assessment; c) Cumulative impact assessment; and d) Environmental management plan. The specific terms of reference, contents and technical procedures for the development of each of them will be determined by the MARN".
Guyana	Yes, if activities can cause cumulative impacts.	Law No. 11 of 1996 Environmental Protection Law, Art. 17(1): "Where an activity on its own does not have a significant effect on the environment, but the same or similar activities are carried out by any person anywhere and, *cumulatively, are likely to significantly affect the environment*, the Agency **shall require that an assessment of the environmental impact of** the **cumulative effects** of such activities by such persons be carried out."

Country	Mandate for the CIA?	Legal text and summary of requirements
Honduras	Yes, if the Manual of Standardized Procedures requires it	**Reglamento del Sistema Nacional de Evaluación de Impacto Ambiental** [Regulation of the National Environmental Impact Assessment System] (2015, amended by Agreement No. 5-2019) Art. 37: "As part of the Environmental Impact Assessment Study (Estudio de Evaluación de Impacto Ambiental, EsEIA) or Environmental Audit Study (Estudio de Auditoría Ambiental, EAA), the responsible consulting team must use at least one assessment of environmental impacts in accordance with a standardized procedure established by the Ministry of the Environment in the Manual de Evaluación y Control Ambiental [Environmental Assessment and Control Manual]. This aims to have a standardized framework to recognize the dimension and conditions of environmental impacts, including **cumulative impacts**, in order to have a harmonized and standardized template that facilitates the review and comparison of studies. The **Environmental Assessment and Control** Manual states: "It is important to note that tools relating to Strategic Environmental Assessment and Cumulative Effects Assessment are not included, since they will be covered in detail in a separate Manual, that is, a Technical Manual of Strategic Environmental Assessment to be prepared by the Secretariat of Natural Resources and Environment (SERNA). However, it has not been possible to access this manual.
Jamaica	There are no references to a CIA.	The CIA analysis is not mentioned in the Natural Resources Conservation (Permits and Licences) Regulation] 1996 (and its 2015 amendment), in the Law on Authority for the Conservation of Natural Resources 1991 or in other relevant laws reviewed.
Mexico	Yes, if a project requires an EsIA study in regional mode	**Reglamento de la Ley General del Equilibrio Ecológico y la Protección al Ambiente en Materia de Impacto Ambiental** [Regulation of the General Law on Ecological Balance and Environmental Protection in Matters of Environmental Impact] (2000) Art. 13: "The environmental impact statement [EsIA document], in *its regional modality*[54], must contain the following information: I. General project data... III. Link to planning tools and applicable legal ordinances; IV. Description of the regional environmental system and indication of the development and deterioration trends of the region; V. Identification, description and **evaluation of the environmental, cumulative and residual impacts of the regional environmental system**; VI. Strategies for the prevention and mitigation of the environmental, cumulative and residual impacts of the regional environmental system..." A CIA is also necessary for modifications of the project, even when online information is presented through the electronic platform Sistema para el Ingreso, Evaluación y Resolución de Manifestaciones de *Impacto Ambiental y Trámites* [System for the Entry, Evaluation and Resolution of Demonstrations of Environmental Impact and Procedures] (MIA-E) for project applications.

Country	Mandate for the CIA?	Legal text and summary of requirements
Nicaragua	No	An implicit mandate for a CIA was repealed by Decree No. 20-2017.
Panamá	It seems implicit for Category III projects, but refers more to "cumulating" impacts. In addition, the requirement is subject to the discretion of the government agency	**Decree No. 123 regulates the process of environmental impact assessment.** (2009) Article 15 provides a **detailed list of the contents of the EsIA documents**, but does not explicitly list the different types of impacts (direct, indirect, cumulative). Article 18 states that the Authority may recategorize projects if they meet certain criteria, for example, producing cumulative or synergistic impacts. Article 24 defines the EsIA studies for Category III (high impact) as an "Analysis document applicable to the projects, works or activities included in the exhaustive list provided for in Article 16 of the Regulation, whose implementation may result in negative environmental impacts that are indirect, cumulative and/or synergistic and of quantitative and/or qualitative significance, which therefore merit a deeper analysis for their evaluation and the identification and implementation of corresponding mitigation measures."
Paraguay	It explicitly mentions cumulative impacts, but, strictly speaking, refers to "cumulating" impacts	Law No. 294/93 - Evaluación del impacto ambiental [Environmental Impact Assessment] (1993) Article 3 stipulates that: "All environmental impact assessments must contain, as a minimum: … d) The analyses necessary to determine the possible impacts and risks of the works or activities during each stage of their implementation and after their completion; their positive and negative, direct and indirect, permanent or temporary, reversible or irreversible, continuous or discontinuous, regular or irregular, **cumulative or synergistic** effects, in the short, medium or long term (No updates or modifications have been found).

Country	Mandate for the CIA?	Legal text and summary of requirements
Peru	Required for certain sectors.	**Supreme Decree No. 040-2014-EM Reglamento de protección y gestión ambiental para las actividades de minería, beneficio, labores generales, transporte y almacenamiento** [Environmental Protection and Management Regulations for Mining, Benefit, General Work, Transport and Storage Activities] (2014) (as amended by DS No. 005- 2020-EM). Art. 42: In environmental studies, the identification and assessment of the potential environmental and social impacts of the mining project must include: b) In the assessment of the potential impacts, recognized or generally accepted methodologies will be used ...for mining activity, The methodology used *must allow the authority and stakeholders* to have a clear understanding of the incidence of the mining project in their environment, considering the physical, chemical, biological and socio-economic aspects involved, as well as the cumulative, synergistic and other impacts that could be generated by the concurrence with other sources, if applicable and determined in the specific terms of reference. Art. 49 (Plan de Vigilancia Ambiental, [Environmental Surveillance Plan]): The Environmental Surveillance Program includes the monitoring of effluents, emissions and environmental quality, which must consider: ... e) In addition, the environmental monitoring plan should include the monitoring of other impacts, **including the monitoring of cumulative impacts, among others**. Article 132.1 of DS 005-2020-EM establishes that the cumulative impacts for the soil analysis component for new mining areas must be analyzed considering all the consecutive Sustainability Technical Reports (Informes Técnicos Sustentatorios, ITS), which includes the sum of occupied areas, removed volumes, lost plant cover, simultaneous work with other Environmental Management Tools (Instrumentos de Gestión Ambiental, IGA), among others. Supreme Decree No. 039-2014-EM - **Reglamento para la protección ambiental en las actividades de hidrocarburos** [Regulations for environmental protection in hydrocarbon activities], in its Art. 55, requires the assessment of the accumulation of residual products of a proposed project over time: "*The Guidelines for the application of the principle of indivisibility in the SENACE [National Service of Environmental Certification for Sustainable Investments] environmental impact assessment* establish that the EsIAs carried out by third parties for investment projects in Infrastructure and new or modified Natural and Productive Resources must consider the technical criteria of SENACE for the CIA.

Country	Mandate for the CIA?	Legal text and summary of requirements
Trinidad and Tobago	Mentions the need for an assessment of the potential effects and hazards of the proposed activity, without mentioning cumulative impacts. In addition, this requirement is at the discretion of the preparer and of the authority.	The Standard on Environmental Authorisation Certificate (2001 and amendments) defines "effects" including cumulative and synergistic effects. Art. 10. "An EIA required by the Authority under section 35(4) of the (Environmental Management Act)... may, where appropriate, include the following information: (a) a non-technical summary of the assessment findings including key issues, a brief assessment of the **potential effects** and hazards of the proposed activity and the measures... to address the conclusions [of the EsIA]; (e) an identification and assessment of the **main effects** that the activity may have on the components of the environment ; (j) a description of the proposed program for monitoring the actual impacts and **effects** of mitigation measures at the different phases of the activity".
Uruguay	It is explicitly mentioned, but, strictly speaking, it refers to "cumulating" impacts.	**Decree No. 349/005 - Reglamento de Evaluación de Impacto Ambiental y Autorizaciones Ambientales [Environmental Impact Assessment and Environmental Authorisations Regulation]** (2005) on the Application for Prior Environmental Authorisation Art.12 (Content of the Environmental Impact Study). The document containing the results of the Environmental Impact Study *must contain* at least the following parts: Part II (Identification and assessment of impacts): in which both negative and positive environmental impacts will be identified and evaluated, and the following aspects will be considered: a) Forecasting direct and indirect, simple and **cumulative** impacts; as well as the evaluating the risks deriving from the environmental situation resulting from the implementation of the project.
Venezuela	No	No references to CIA can be found in the relevant legislation.

9. END NOTES

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9. END NOTES

[1] This Guide uses the term Cumulative Impact Assessment and Management ("CIAM"). In some countries, such as Canada, the term Cumulative Effects Assessment ("CEA") is used. Although, as will be seen later in this document, effects and impacts have a subtle distinction, for practical purposes, a CIA and a CEA encompass the same process.

[2] As will be explained later in this document, management measures, in a broad sense, include actions to prevent, minimize (or mitigate), restore, or compensate for unwanted cumulative impacts, as well as to improve the positive impacts.

[3] This meaning is based on considering the environment as a spring that deforms when an external load (an action) is applied. If this load is less than a load limit (the assimilative capacity), the spring will deform, but, once the load disappears, it will return to its initial form (pollution). However, if the load is greater than the limit, the spring will deform, but, when the load ceases, it will not be able to recover its original state and will experience a residual deformation (contamination), until an external load of equal or greater intensity, but opposite to the initial one, can restore its primitive form. However, if the applied load is greater than the spring's breaking limit, the spring will probably collapse, which in the analogy would mean that a permanent and irreversible environmental effect would have occurred.

[4] Sfeir-Junis. R: Conceptos de Desarrollo Sostenible. [Concepts of Sustainable Development] World Bank Workshop, Quito, Ecuador, 1997.

[5] Definition widely accepted by several authors.

[6] Páez Zamora, J.C. Elementos de Gestión Ambiental [Elements of Environmental Management], CreateSpace, 2009.

[7] Adapted from the Guía para la Identificación y Caracterización de Impactos Ambientales [Guide for the Identification and Characterisation of Environmental Impacts]. Ministerio del Ambiente del Perú [Ministry of the Environment of Peru]

[8] Adapted from the Guía de Evaluación Ambiental Estratégica [Strategic Environmental Assessment Guide]. Economic Commission for Latin America and the Caribbean ("ECLAC").

[9] Adapted from Estudio de Casos de Manejo Ambiental: Desarrollo Integrado de un Área en los Trópicos Húmedos - Selva Central del Perú [Environmental Management Case Study: Integrated Development of an Area in the Wet Tropics - Central Jungle of Peru], Organization of American States, 1987

[10] IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013).

[11] These are also known as Valued Ecosystem Components, Valuable Ecosystem Components, or simply as Value Components ("VC").

[12] Páez Zamora, J.C. Elementos de Gestión Ambiental [Elements of Environmental Management], CreateSpace, 2009.

[13] Definition according to the IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2015). Note that VECs may also be referred to as valued environmental and social components ("VESC") or valued components (VC). VECs are increasingly being used in the practice of CIA.

[14] In this Guide, the EIA is used as a process that includes an environmental impact assessment, as well as an environmental and social impact assessment (called "ESIA").

[15] Nelson, R. 2022. El potencial latente de los conceptos de efectos acumulativos en los regímenes nacionales e internacionales de evaluación del impacto ambiental [The latent potential of cumulative effects concepts in national and international environmental impact assessment regimes]. Transnational Environmental Law. In print.

[16] The 21st century will undoubtedly witness an unprecedented expansion of roads, with at least 25 million kilometers of new roads expected to be built by 2050. 90% of them will be built in developing countries, which support many of the most biodiverse and environmentally important ecosystems on the planet (https://www.global-roadmap.org/)

[17] Lees, A.C., C. A. Peres, P.M. Fearnside, M. Schneider, A. Jansen, and S. Zuanon. 2016. La energía hidroeléctrica y el futuro de la biodiversidad amazónica [Hydroelectric energy and the future of Amazonian biodiversity]. Biodivers Conserv DOI 10.1007/s10531-016-1072-3.

[18] The use of the terms cumulative impacts or synergistic impacts does not appear to be consistent across countries.

[19] Cumulative impact assessment is also referred to as cumulative effect assessment in some jurisdictions (e.g. Canada). In this context, effects and impacts are considered to be the same.

[20] IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013)..

[21] Páez Zamora, J.C. Elementos de Gestión Ambiental [Elements of Environmental Management], CreateSpace, 2009.

[22] Indirect impacts are those that are not a direct result of the project and that often result from actions induced by the project. They are sometimes called second- or third-level impacts, or secondary impacts.

[23] Paez Zamora, J.C. Elementos de Gestión Ambiental, CreateSpace 2009Páez Zamora,

J.C. Elementos de Gestión Ambiental [Elements of Environmental Management], CreateSpace, 2009.

[24] These are also known as Ecosystem Value Components, Valued Ecosystem Components, Valuable Ecosystem Components or, simply, as Value Components ("VC").

[25] Definition according to the IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2015). Note that VECs may also be referred to as valued environmental and social components ("VESC") or valued components ("VC"). The term VEC is the one most used in the practice of CIA.

[26] Gunn, J.H. and B. F. Noble. 2011. Integrating cumulative effects in regional strategic environmental assessment frameworks: lessons from practice. Journal of Environmental Assessment Policy and Management, Vol. 11, No. 03, pp. 267-290 (2009)

[27] Environmental Assessment Office. Government of British Columbia. 2013. Guideline for The Selection of Valued Components and Assessment of Potential Effects. https:// www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/environmental-assessments/guidance-documents/eao-guidance-selection-of-valued-components.pdf

[28] This assumes that a meaningful consultation process with key stakeholders took place during the EIA process.

[29] The definition of materiality and the effect or impact should be defined in the CIA.

[30] Some methodologies, such as matrices or checklists, contain a list of environmental components that can be used to identify VECs.

[31] Note that all these VECs are, strictly speaking, environmental components.

[32] Note that the term team is used, not group, because this involves the group of professionals who will be carrying out the CIA to work together and coordinate their activities to create harmony and achieve the desired objectives in an efficient way. This makes it a team.

[33] https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/assessing-cumulative-environmental-effects-ceaa2012.html

[34] River continuity; biodiversity present in watercourses; flow of watercourses; security in the availability of water for irrigation; surface water quality; recreational uses of watercourses; sediment dynamics; social economic environment; local infrastructure; air quality; cultural and archaeological heritage; climate change; and protected areas or areas of tourist, cultural or heritage interest

[35] Surface hydrology; sediment dynamics; landscape; and local community.

[36] Pinto-Bazurco. J.F. 23 October 2020. Precautionary principle. International Institute for Sustainable Development. https://www.iisd.org/articles/precautionary-principle

[37] Environmental Assessment Office. Government of British Colombia. 2013.

[38] This step should also identify any potential additive, compensatory, masking or synergistic effects and describe whether and how the aggregate impacts of other projects and activities may affect the condition and status of each selected VEC.

[39] Canter, L. (1999) Cumulative Effects Assessment, in: Petts, J. (ed.) Handbook of Environmental Impact Assessment, Volume 1, Environmental Impact Assessment: Process, Methods and Potential, Blackwell Science, Oxford, 405 - 440.

[40] DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism ("DEAT"), Pretoria.

[41] Source: Dr. Bill Ross, Professor Emeritus, University of Calgary, Canada.

[42] This matrix method of evaluation was proposed in 1971 by Luna Leopold in collaboration with other North American researchers to evaluate the environmental impacts of specific projects. The matrix itself is a double entry box in which the rows contain a list of environmental components and the columns contain the actions to be implemented when carrying out a project.

[43] Páez Zamora, J.C. Elementos de Gestión Ambiental [Elements of Environmental Management], CreateSpace, 2009.

[44] Quintero, J. 2022. Evaluación de impactos acumulativos: oportunidades y desafíos para su implementación en el Perú [Evaluation of cumulative impacts: opportunities and challenges for its implementation in Peru]. Wildlife Conservation Society ("WCS"). Lima, Peru

[45] The PNIC has 52 projects that are distributed in all areas of the country

[46] Otherwise, the EIA will need to be supplemented and updated.

[47] On rare occasions this geographical boundary will have to be adjusted.

[48] See section 5.10 of this Guide.

[49] Conesa Fernández V.: Guía Metodológica para la Evaluación de Impacto Ambiental [Methodological Guide for Environmental Impact Assessment], 1997.

[50] This methodology, based on Leopold's proposal, introduces a form of impact aggregation and an analysis that allows the results to be graphically plotted to visually determine how beneficial or harmful the project being analyzed is in environmental terms. For more information, see Páez Zamora, J.C. Elementos de Gestión Ambiental [Elements of Environmental Management], CreateSpace, 2009.

[51] Like the original methodology proposed by Leopold, this methodology requires evaluation of each interaction as follows: i) the magnitude, which is an indication of how much the VEC has been affected; ii) the significance, which reflects how representative such variation is; and iii) the type of effect: whether it is positive or negative.

[52] Considering limitations such as language, accessibility or availability of internet services, among other aspects.

[53] SEA, Aportes técnicos para el desarrollo de una guía para la evaluación de impactos acumulativos en el SEIA [Technical contributions for the development of a guide for cumulative impact assessment in the SEIA], https://www.sea.gob.cl/sites/default/files/imce/archivos/2020/07/informe_final_consultoria_impactos_acumulativos.pdf.

[54] According to Mexican federal regulations, in article 11, EsIAs must be carried out in a regional manner if they fall into one of the 5 categories, including projects that are planned for places where, "due to their interaction with the different regional environmental components, cumulative, synergistic or residual impacts that may cause the destruction, isolation or fragmentation of ecosystems are anticipated".

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