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# Environmental variables in multidimensional poverty measurement

## Practical guide with examples from Latin America and the Caribbean

POVERTY - ENVIRONMENT INITIATIVE

Title: Environmental variables in multidimensional poverty measurement: a practical guide with examples from Latin America and the Caribbean

Poverty-Environment Initiative



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**About this document:**

The UNDP Poverty-Environment Initiative (PEI) and UN Environment Programme seek to support countries to implement policies, instruments, plans and budgets that combine rational environmental management with poverty reduction to contribute to sustainable development. The program also aims to improve capacities at national and local levels to encourage national policies, plans and budgets that are favorable to the poor, as well as inclusive, gender sensitive and sustainable in the use of natural resources. This document has been prepared by the PEI Latin America and the Caribbean team in order to provide strategic and discussion inputs for the main development stakeholders in the region.

# Contents

# LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AF | Alkire-Foster methodology |
| CASEN | Caracterización Socioeconómica Nacional [National Socioeconomic Characterization] (Chile) |
| CBA | Canasta Básica Alimentaria [Basic Food Basket] |
| CONEVAL | Consejo Nacional de Evaluación del Política de Desarrollo Social [National Council for the Evaluation of Social Development Policy] (Mexico) |
| CTMP | Comité Técnico para la Medición de la Pobreza [Technical Committee for Poverty Measurement] (Mexico) |
| DESA | United Nations Department of Economic and Social Affairs |
| EHPM | Encuesta de Hogares de Propósitos Múltiples [Multiple Purpose Household Survey] (El Salvador) |
| FGT | Foster-Greer-Thorbecke poverty index |
| ICV | Índice de Calidad de Vida [Quality of Life Index] |
| HDI | Human Development Index |
| MPI | Multidimensional Poverty Index |
| IVACC | Índice de Vulnerabilidad a Choques Climáticos [Climate Impact Vulnerability Index] (Dominican Republic) |
| LDPS | Ley de Desarrollo y Protección Social [Development and Social Protection Law] (El Salvador) |
| LGDS | Ley General de Desarrollo Social [General Law of Social Development] (Mexico) |
| MINEC | Ministry of Economy (El Salvador) |
| UNEP | United Nations Environment Programme |
| OPHI | Oxford Poverty and Human Development Initiative |
| PEI | Poverty-Environment Initiative |
| GDP | Gross Domestic Product |
| UNDP | United Nations Development Programme |
| SEDESOL | Secretaría de Desarrollo Social [Secretariat of Social Development] (Mexico) |
| UNS | United Nations System |
| STPP | Secretaría Técnica y de Planificación de la Presidencia [Technical and Planning Secretariat of the Presidency] (El Salvador) |
| UNCTAD | United Nations Conference on Trade and Development |

# 1. INTRODUCTION

In September of 2015, the "Transforming our World: The 2030 Agenda for Sustainable Development" (UNGA, 2015) was ratified worldwide, which consists of an action plan in favor of people, the planet and prosperity. This agreement includes 17 Sustainable Development Goals (SDGs) and 169 associated targets. The first objective is to put an end to poverty, in all its forms, and all around the world. One of the indicators for monitoring SDG 1 is the global Multidimensional Poverty Index (MPI).

Given its integrative nature, the 2030 Agenda considers the three dimensions of sustainable development in a balanced way, and thus invites us to rethink the relationship between poverty and the environment. Ensuring environmental sustainability as a basis for a prosperous future implies a challenge for humanity: the need to study and develop new models and tools that can generate simultaneous positive impacts in the areas of poverty reduction and environmental conservation, with the objective of "leaving no one behind," and in a sustainable manner- in other words, without undermining the natural foundations of well-being and livelihoods.

Similarly, the systems and methodologies for measuring poverty have evolved over time. For many years, poverty measurement was based solely on income, based on the implicit idea that poverty was the lack of monetary resources necessary for a person or family to satisfy their basic needs.[1] The Nobel Prize for economics recipient, Amartya Sen (1999), argues that poverty is better defined in the sphere of capabilities, contributing to an understanding of poverty in a multidimensional manner and, thus, changing the systems and methodologies used for its measurement.

Among the precursors of multidimensional poverty measurement is the Unsatisfied Basic Needs method (INDEC, 1984), used in Latin America since the 1980s. The index uses indicators in four areas of people's basic needs (housing, health services, basic education and minimum income). Subsequently, the UNDP Human Development Report of 1996 introduced the Human Poverty Index (HPI), which assesses the situation of countries using a group of indicators that measure average attainment in three basic dimensions of human development: (a) long and healthy lives, measured by life expectancy; (b) knowledge, measured by the adult literacy rate and

[1] An important contribution to the study of monetary poverty, and which was a key input in the development of the Alkire-Foster method for the multidimensional measurement of poverty, was made by Foster, Greer and Thorbecke (FGT, 1984). With the family of FGT indices it could be seen that the population below the poverty line had differences and that the most common monetary poverty index, the percentage of people living in poverty, generated a bias in public policies to prioritize not the poorest, but rather those who were just immediately below the poverty line.

access to primary and secondary education; (c) decent standard of living, measured by per capita GDP (measured in dollars adjusted for purchasing power equivalent).

However, in 2010 the Multidimensional Poverty Index was introduced, based on the Alkire-Foster methodology (ECDPM, 2013). This index incorporates indicators in three basic dimensions: education, health and quality of life (or social well-being). It considers that a household or person is multidimensionally poor if they experience deprivation in 30% or more of the indicators considered.[2]

In addition to this MPI developed by UNDP, which is comparable internationally, the conceptual framework of the Alkire-Foster method (2007) has allowed a number of countries to develop their own multidimensional poverty measurement indices, according to their specific circumstances, in order to obtain a more precise vision and understanding of the characteristics of vulnerability of their populations.

There are currently nine countries in Latin America and the Caribbean that have developed a national MPI (see Annex I for a non-exhaustive summary table of national MPIs in Latin America and the Caribbean and the degree and manner in which they integrate environmental factors), putting the region at the forefront in the development of multidimensional poverty measurement systems. As can be seen below, although the SDGs place the environmental dimension of sustainable development on the same level as the economic and social dimension, only some of these indices specifically take into account indicators or environmental variables. For these reasons, and in view of the growing interest in the region in this area, the Latin American and Caribbean Poverty-Environment Initiative (PEI) team has prepared the present study with the purpose of analyzing the different experiences within the region with regard to integrating environmental variables in multidimensional poverty measurement indices. The document also provides a methodological contribution, in the form of guidelines, that outlines a path for other countries to follow for creating their own MPIs that integrate environmental factors, or for revising their methodologies.

To this end, this document begins by carrying out a conceptual and methodological review of the relationships between poverty and the environment, discussing how to link indicators in this area. Following this, it looks at some representative examples of national MPIs in the region and the way in which environmental factors have been integrated into them (Chile, El Salvador, Mexico, the Dominican Republic and Panama). Finally, the document presents a guide, with a practical proposal for the incorporation of the most relevant environmental variables in poverty measurement systems for each country. This guide consists of a twelve-step proposal, with practical examples.

[2] For more references, see the document by Milorad Kovacevic and Cecilia Calderon (2014). UNDP's Multidimensional Poverty Index: 2014 Specifications. Available at: http://hdr.undp.org/sites/default/files/specifications_for_computation_of_the_mpi_0.pdf

This document, aimed at government authorities and decision makers, as well as representatives of international organizations, academics, students and civil society, concludes with the conclusions drawn in this process, in order to contribute to the debate in this area and generate models that link, in a clear and specific manner, environmental considerations to poverty measurement systems in the region.

## 2. THE LINK BETWEEN POVERTY AND THE ENVIRONMENT

The link between poverty and the environment can be understood from multiple perspectives. One of them is the dependence on natural resources of a large number of people living in poverty. It is estimated that, globally, 70% of people living below the poverty line depend on natural resources for their subsistence, and that ecosystem services and other non-market assets make up between 50% and 90% of the total means of livelihood of families living from exploiting forests and in poor rural areas around the world, the so-called "GDP of the poor" (UNDP-UNEP 2015). The study of these links between poverty and the environment, therefore, seems very relevant and necessary.

Photo 1: Rural family with a livelihood based on natural resources. Tavaí, Paraguay.

Source: Paraguay PEI Project

The Latin America and Caribbean region possesses great natural and cultural wealth, but it is also one of the most unequal regions in the world, and has a considerable dependence on its natural capital (Alkire *et. al.*, 2015). The goods and services from their ecosystems are fundamental

for the population of the region, such as for the provision of water, protection against natural disasters and food production, among others. In fact, most of the inhabitants of rural areas have livelihoods in agriculture, fishing, livestock and forestry, generally exploiting them on a small scale and based on family, peasant and indigenous labor. 81% of the exploitation in the region can be characterized as family farming and employs 60 million people. In addition, they produce most of the domestic consumption products in their countries (in 2012, they accounted for between 27% and 67% of total national food production), and they usually carry out diversified agricultural activities of great importance with respect to environmental conservation. Despite its important role, family farming continues to show high poverty rates that are reflected in multiple dimensions, such as the marginalization of indigenous communities, difficult access to markets, abandonment of the countryside, gender inequality, precariousness of rural work and inequality in income distribution (FAO, 2014). This negatively affects the sustainable occupancy and use of land, plant genetic resources and productive resources, leading to fragile and overexploited areas associated with the most vulnerable populations and, thus, perpetuating a cycle of poverty and inequality.

On the other hand, industries not part of the agricultural sector link poverty and the environment, such as observed in communities whose economic activity is nature or adventure tourism, where the natural environment is a key element for attracting visitors (Ashley and Mitchell, 2009; Zhao and Ritchie, 2007; Briedenhann and Wickens, 2004; McCool and Moisey, 2001). The villages in the Andes mountain range, in the Montebello lagoons in Mexico or on the islands in the Guna Yala district of Panama are just some examples of communities that depend on tourism as a way of life in the Latin American region.

Thus, on the one hand, the degradation of the natural environment puts the livelihoods of a large number of people in poverty at risk; and, on the other hand, as a fundamental means of subsistence, natural resources run the risk of overexploitation. In this case, the relationship is bi-directional. The degradation of the environment implies an obstacle to overcome poverty and poverty can aggravate environmental problems through unsustainable practices of use of natural resources.

This bi-directional relationship between poverty and the environment occurs in other areas as well, such as in the case of lack of access to services that are fundamental to maintaining a certain standard of living, as well as clean drinking water, energy, sanitation, sewage, garbage collection and access to financing or social programs. Not having adequate sanitation systems means that land and water sources become contaminated, with the associated impacts on human health; not having access to alternative energy to substitute solid fuels has impacts on the quality of air in homes and encourages deforestation and ecosystem degradation, and so on.

On the other hand, the risk of natural disasters and climate change have become, in recent years, challenges of increasing importance in the region. In each year between 2000 and 2012, more than 200 million people, most of them from developing countries, were affected by disasters, especially floods and droughts. And between 2008 and 2012, the inhabitants of middle and lower income countries accounted for approximately 97% of the global mortality risk due to

natural disasters. The economic losses suffered by these developing countries are proportionately higher in relation to the size of their economies (UNDP-UNEP, 2015). Latin America and the Caribbean is a region which is very vulnerable to climate change, because, according to the 2017 Global Climate Risk Index, three of the five countries most affected by extreme climate events in the 1996-2015 period are found in the region: Honduras, Haiti and Nicaragua.

Poverty is a key variable in vulnerability to climate change, since poorer populations are less able to respond, recover or adapt to the crises and problems caused by variations in the climate. The lack of access to, and control over, the resources that ensure sustenance, such as agricultural and forest land and water, exacerbates their vulnerability and restricts their ability to adapt to climate change (UNDP-UNEP, 2015). Furthermore, climate change and extreme weather events directly affect food security, reducing production capacity and food supply, which can lead to an increase in prices, affecting, in particular, the poorest populations.

There are also other factors that explain the greater vulnerability to natural disasters and extreme climate events of people living in poverty: the location of their homes on hillsides, areas susceptible to flooding or in remote areas, the lack of resources, such as vehicles and information, as well as their greater dependence on natural resources and environmental services. (B. Sen, 2003; Dash *et. al*., 2007; Masozera, Bailey and Kerchner, 2007; Agola and Awange, 2013; Watmough *et. al.*, 2016). It is estimated that there are 8.4 million people in the Latin America and Caribbean region who live in the path of hurricanes, and 29 million in areas of very low elevation, considered susceptible to flooding.[3]

In this context, the living conditions of the region's population could worsen, even leading to worsening conditions of poverty, if measures are not taken to improve the institutional capacity and the coordination of public policies necessary to generate an integrated and coherent response for the conservation and sustainable use of natural resources. It is clear that this is the only way to maintain the livelihoods of the most vulnerable populations and to meet the Sustainable Development Goals.

In addition to the link between poverty and the environment, arising from the exploitation of the natural environment for livelihood and vulnerability to climate events, there are two other types of associations between poverty and the environment: contamination of the environment, on one side, and the production and consumption of goods and services, on the other. Environmental pollution clearly affects health, one of the fundamental elements of people's well-being. When there is no provision of piped water, rivers and lakes must provide drinking water, but it is also used to wash clothes and dishes, to bathe and to irrigate fields. The contamination of

[3] It is important to emphasize that not all disasters are natural, but are often the product of socially constructed risk conditions, that is, the result of the inadequate management of the environment and development, such as the occupation of river and water course zones, deforestation and environmental degradation, or not building in an manner for the seismic conditions of the area. The risk arises from ignoring the determinants imposed by geography and the environment. See, for example, Maskerey *et. al*. (1993).

these water sources can lead to gastrointestinal diseases that put health at risk, impact family budgets and have repercussions in other areas, such as the ability to work or go to school.

Air pollution is a known cause of respiratory diseases and is common in large cities, but also in rural areas, where cooking inside the home is often done with solid fuels, such as firewood or charcoal, and without adequate smoke ventilation. The improper management of waste attracts disease-carrying pests such as rodents, and chemicals and other types of hazardous waste can also put people's health at risk. The effects of pollution on health often affect the poorest populations, while the wealthier population is able to find ways to avoid or mitigate these effects.

Finally, the production and consumption of goods and services also implies associations between poverty and the environment, although they are often not as explicit or direct as the ones mentioned above. A concrete example is the generation of electricity, which could be thought of in terms of whether or not it uses fossil fuels for generation and the effect this has on the price that the final consumer must pay. In fact, many countries have subsidies for low-income populations, while in others they look for alternatives, such as the installation of solar panels in rural areas. In addition, electricity generation can establish links between poverty and the environment when hydroelectric plants are built which substantially modify the natural environment and displace populations from their communities. Similar examples could be given for the oil production industry or for public transportation, but, in fact, it is difficult to imagine an industry that has no effect, at least indirectly, both on the environment and on the welfare of the less privileged population.

The adequate integration of environmental, economic and social policies should improve human welfare and social equality, while significantly reducing environmental risks and scarcity of natural resources. Sustainable development aims to offer long-term social benefits through short-term activities aimed at mitigating environmental risks and taking advantage of the potential of environmentally sustainable development that includes, for example: the efficient use of natural resources to reduce the environmental footprint and promote economic development and social welfare; the reduction and mitigation of emissions and pollution; the increased use of renewable energies; the reduction of environmental vulnerabilities and their effects on health; and the maintenance of environmental goods and services that contribute to the security of the population whose livelihoods and well-being depend on ecosystem services, among others (UNDP - UNDESA - UNEP, 2015).

# 3. LINKING POVERTY AND ENVIRONMENT INDICATORS

## 3.1 Why multidimensional poverty measurement?

There are several reasons to encourage the multidimensional measurement of poverty. According to Alkire *et. al.* (2015), there are normative, empirical and policy motives. All of them make sense with respect to the link between poverty and the environment. The policy motives

refer precisely to the alignment of actions, policies and programs. Furthermore, a multidimensional poverty measurement is a powerful tool for focusing, monitoring and evaluating social programs. The empirical motive is the link between different dimensions and, more importantly, a view of development that goes beyond just the simple growth of the Gross Domestic Product. Both inequality and poverty, as well as environmental degradation, have been overlooked by policies focused on increasing national income, without taking into account its distribution or negative impacts on the environment.

Finally, the normative motives fall more in the domain of the ethical and philosophical. In this case, it is also very important that all stakeholders understand that a healthy and balanced environment is a key factor for human well-being, that there are different conceptions of what poverty is and that, in many of them, pollution and the deterioration of ecosystems are relevant factors. After all, multidimensional poverty measurements try to better reflect reality- a reality in which the environment is an inseparable and essential part.

## 3.2. Requirements for developing a multidimensional poverty index.

On a national level, the development of a multidimensional poverty index will require volition, consensus, data and metrics. Volition refers to the interest among authorities to adopt a multidimensional poverty measurement. This interest should be reflected in certain commitments, which include human, technical and financial resources, for example, to carry out studies or to train the people who will perform the calculations.

In addition to volition, there must be a certain consensus among the different stakeholders. In order to give a multidimensional poverty index legitimacy, it is very important that there is a participatory process involving the different stakeholders, as well as involving academic institutions, public opinion and civil society. If the measurement of poverty is undertaken with transparency and accountability, in a democratic and participatory process, the results will be more readily accepted. On the contrary, poverty measurements that only seek to promote government actions, undertaken without transparency and dialogue, will be quickly criticized and the results questioned.

Finally, multidimensional poverty measurement requires data, such as surveys, censuses and administrative records. In fact, micro-data is needed, that is, databases at the level of the individual or household, in order to properly identify the population living in poverty. A metric is also needed, such as indicators, thresholds and an aggregated methodology. This document is based on the Alkire-Foster methodology (2007) for the elaboration of multidimensional poverty indices, but there are other alternatives.

## 3.3 Linking environmental indicators to poverty measurements

Incorporating environmental indicators in multidimensional poverty measurements is a step towards sustainable development. Multidimensional poverty indices have allowed for public policies to become increasingly holistic, focusing on other aspects of well-being beyond just income. Incorporating environmental indicators in multidimensional poverty measurements makes visible the link between poverty and the quality of the environment, facilitating the articulation of social policies with elements of environmental protection.

The incorporation of environmental variables in multidimensional poverty measurement systems seems a natural next step on the path toward the multidimensional analysis of the dynamic phenomenon of poverty, since, as we have seen, there is a direct and undeniable relationship between them, which often goes hand-in-hand. In addition, in the current context of climate variability, it is necessary to work in an integrated manner to maximize the efficiency of public resources, prevent the loss of assets and relapses into poverty, as well as to generate social protection networks, especially for the poorest populations. The question of environmental vulnerability must be incorporated into national prevention and planning systems, a path that various countries in the region, as we shall see below, are beginning to explore.

This section discusses the types of data and the options that exist with respect to the metrics used to calculate multidimensional poverty indices with environmental indicators. Three fundamental questions will be addressed.

- What can be linked?
- What is desirable to link?
- How to do so?

In the previous section, different aspects of the links between poverty and the environment were elucidated. However, not all of these associations can be reflected in a multidimensional poverty index. To answer the first question, the compatibility between social and environmental variables will be examined. The second question requires an analysis of the different types of environmental variables that can be incorporated into multidimensional poverty measurements. The answer to the third question is based on two important options of information sources for environmental indicators: household surveys and other sources.

This part of the analysis, and the answer to the three questions above, is primarily based on the document by Géraldine Thiry, Sabina Alkire and Judith Schleicher (2017) on the incorporation of the environment and natural resources in the analysis of multidimensional poverty, elaborated in the framework of the PEI.

## 3.4 Compatibility between environmental and social indicators for the measurement of poverty

According to Thiry, Alkire and Schleicher (2017), in order to link environmental variables with Alkire-Foster type multidimensional poverty measurements, the indicators must be compatible in three areas: conceptually, representationally and computationally.

Conceptual compatibility refers to the fact that environmental variables are linked to human privation, that is, to deficiencies, such as the reduction or loss of capacities or functions that people experience. The preservation of the environment is an end in itself, and its value is relevant to all of humanity. However, for some environmental indicators, there are no methods or conventions to establish a clear and measurable association with the well-being or privations of a particular individual. The preservation of biodiversity, for example, is very important for human well-being in terms of agricultural production capacity, food security and scientific research. It is said that a tree in Peru hosts more species of ants than found in all of England, but it is very difficult to translate this fact into an indicator of the well-being of a particular individual. What would be the indicator of a person's well-being in Peru, or elsewhere in the world? What would be the threshold to determine whether this person lives in privation or not?

Environmental indicators also have to be compatible in terms of their representativeness. That is, they have to refer to the same population and the same time period. Environmental information often does not have the same geographical or temporal representation as the surveys, censuses or administrative records used for calculating population statistics. For example, if the population information is representative at the province level, but the environmental information is representative of watersheds, it is very likely that a basin comprises more than one province, or that a province contains more than one basin, and the data is not necessarily compatible.

When the environmental and population data come from the same source, this problem is solved for the most part. When they come from different sources, the problem of compatibility can be mitigated when the population and environmental data is sufficiently geographically defined, for example, in the case of geo-referenced housing systems.

Finally, computational compatibility refers to the existence of a criterion to transform the environmental variables into binary indicators of privation. In other words, thresholds should be created to identify who experiences (or does not experience) privation with respect to a given environmental indicator. For example, there are contaminant thresholds to determine air quality, but you may need to be more specific to transform this into a multidimensional poverty indicator. How many days of air quality above this threshold are necessary to determine a privation of clean air? Over what time period? In the year of the survey? Which pollutants: ozone, suspended particles or others?

That is why, to obtain compatibility between representativity and computability, environmental information has to be accurate at the individual or household level, and when that

is not possible, one should contain criteria and assumptions that are as precise and clear as possible.

## 3.5 Types of environmental variables and indicators compatible with poverty measurements

After an extensive review, Thiry, Alkire and Schleicher (2017) came up with a classification of three types of environmental data that can be incorporated into multidimensional poverty measurements: livelihoods, environmental health and vulnerability.

- Livelihoods

The term livelihood refers to the resources that nature provides for people's subsistence. The authors subdivide livelihood into three types: material means, institutional means and capabilities.

Material means can be direct, such as food or wood for the construction of houses, or indirect, such as the income that is received from selling these products in the market. By institutional means, the authors refer to the forms or norms of social organization related to the management of the environment and natural resources. For example, land tenure or forest management. Capabilities, on the other hand, constitute the knowledge and experience that people have concerning the management and sustainable use of resources.

- Environmental health

A second group of variables is related to environmental health, that is, the environmental factors that affect the health of people. In this case as well, there are three subdivisions. Factors within the home that impact health comprise the first group of indicators, such as wood or charcoal smoke from cooking. The second subdivision includes factors in the workplace, such as exposure to toxic substances in industry or mining. The third category includes the external factors that affect health, as in the case of air or water pollution.

- Environmental vulnerability

Finally, aspects related to environmental vulnerability make up the third group of environmental variables. In this case, risk exposure, response capacity and risk mitigation (or, in the case of climate change, adaptation capacity) are included. Exposure is the likelihood of a natural phenomenon occurring, such as in a region that is subject to tropical cyclones.

Preparation and response capacity refers to the extent to which a system can deal with a risk or extreme climate event without long-term losses, while the ability to mitigate risks or, depending on the case, adapt to climate change, refers to the way a system can adapt to prevent

risks from becoming disasters. In the case of tropical cyclones, examples of preparation and response capacity would be advance planning to evacuate people from risk areas, early warning systems or the installation of temporary shelters, among others. On the other hand, reinforcing houses with more resistant materials or relocating houses that are in flood zones would be examples of risk mitigation and improvements in adaptation capacity.

In each case, and depending on national characteristics and priorities, each country should decide from among these indicators which of them it wishes to incorporate into its national multidimensional poverty index. To date, experience has shown that it is very likely that, initially, what is considered is currently available information, or whatever information is easiest to obtain. As will be seen below, some of the initiatives developed in Latin America and the Caribbean have begun by using available information, although, on other occasions, they have decided to generate new information and even new indices and tools.

## 3.6 Options for incorporating environmental variables in poverty measurements

Broadly speaking, Thiry, Alkire and Schleicher (2017) identify two major options for linking environmental variables with multidimensional poverty measurement. The first option is the use of environmental indicators in household surveys that are used to estimate multidimensional poverty. The second one is the use environmental data from other sources, other than household surveys, that can be integrated with population information. In both cases, the primary objective is to create environmental indicators that are incorporated into multidimensional poverty indices.[4]

Option 1: Creation of environmental indicators with the same statistical tool used to calculate poverty.

This option offers the enormous advantage of ensuring representation compatibility. The units of analysis, whether individuals or households, report both socioeconomic and environmental information.

Some of the household surveys already contain information on indicators that may be considered environmental. For example, the Multidimensional Poverty Index calculated by UNDP for 101 countries includes a cooking fuel indicator as part of the standard of living calculation. Households are considered deficient in fuel that cook with solid fuels, such as firewood or coal, which emit smoke and particles that are harmful to human health. This is why Thiry, Alkire and Schleicher also consider it an indicator linked to the environment.

[4] The authors consider a third option, which would be to analyze environmental indicators in parallel with the multidimensional measurement, that is, an association that does not fully integrate environmental indicators into the poverty index. This document aims to summarize integration experiences in the region, thus, no case studies are presented to illustrate the parallel study of poverty and environmental indicators, but it is important to consider this alternative.

Other surveys have recently adopted questions related to the environment in their household surveys, with the intention of aggregating other variables in their multidimensional poverty measurements. This is the case of Chile, El Salvador, the Dominican Republic and Panama, which will be discussed below.

Option 2: Use of environmental data from other sources.

In this case, the different sources of information should have a parity mechanism (matching, association), in order to cross-check environmental and population information. As the environmental information is georeferenced, the parity methods using geographic coordinates is the most viable option.

However, one of the main problems with this is that the surveys generally do not make household information at the geographical coordinate level public, in order to protect the confidentiality of the participants. The most logical solution, in this case, is for the statistical institutions in charge of the surveys to conduct the cross-check of the different sources of information. Otherwise, information can only be matched at aggregated geographic levels, such as locality or municipality.

The Dominican Republic has begun linking administrative records with environmental information in its National System of Beneficiaries (SIUBEN). In doing so, the Dominican Republic was able to modify its household survey to include a module on "risk of natural phenomena and environmental pollution," which served to gather the necessary information for the development of the Climate Impact Vulnerability Index (IVACC), which will be described below.

## 4. MEASURING MULTIDIMENSIONAL POVERTY IN LATIN AMERICA

The adoption of multidimensional poverty measurements has spread incrementally throughout the world, and the Latin American region is no exception. In fact, countries like Mexico and Colombia are pioneers in establishing national multidimensional poverty indices. Annex 1 provides relevant examples of multidimensional poverty measurements in the region and how they incorporate environmental data. Some of the countries include indicators associated with the environment, such as cooking fuel use and access to piped water in homes, as well as access to sanitation services and/or sewage. In fact, these three indicators were considered environmental privations in the 2011 Human Development Report (Klugman, 2011). This is the case in countries such as Colombia, Ecuador and Mexico. However, of this group of countries, only Ecuador makes the association of these indicators with the environment explicit, the others link it to basic household services.

A second group of environmental indicators that has been incorporated in the region is related to solid waste and other types of contaminants. Chile and Costa Rica are cases in point,

although, in the case of Costa Rica, they are linked to health. Finally, there is a third group of variables that has been used in multidimensional poverty measurement, which is related to environmental vulnerability, mainly natural disasters and extreme climate events. El Salvador is an example, as well as the recently adopted MPI of the Dominican Republic and Panama.

In this section, we will look at five cases of national multidimensional poverty measurements, with different examples of incorporation of environmental variables. The first case is Mexico, which, along with Colombia, has served as an example in poverty measurement, and, although its scope in environmental factors is limited, it is representative of what occurs in a number of countries in the region.

The second case is Chile, which recently published the results of its multidimensional poverty measurement, which already includes the aforementioned environmental indicators related to pollution.

The third case, El Salvador, demonstrates the efforts made to incorporate the vulnerability of the population living in poverty to natural disasters and extreme climate events.

Additionally, we analyze the experience of the Dominican Republic, which is an important example of how to associate poverty and the environment in its National System of Beneficiaries (SIUBEN), an entity with the competence and mandate to provide focus for social protection programs, and to create a specific index to complement the existing poverty measurement system (Quality of Life Index - ICV).

Finally, we include the Panama case study, the last country in the region to introduce its Multidimensional Poverty Index (MPI), incorporating a specific dimension called "Environment and sanitation," which specifically incorporates environmental indicators.

## 5. ANALYSIS OF CASE STUDIES IN THE REGION

### A. Mexico

The United Mexican States is located in the northern hemisphere of the American continent. The country has a population of 119.5 million people, according to the 2015 inter-censal survey, and is

considered the second largest economy in Latin America.[5] In addition, the 2016 human development report classifies Mexico, with an HDI of 0.762, in the category of countries with high human development (UNDP, 2017). Despite this, the country still faces considerable challenges. In fact, poverty affects 46.2% of the population and 9.5% live in extreme poverty, according to the official 2014 estimate made by the National Council for the Evaluation of Social Development Policy (CONEVAL), the institution responsible for poverty measurement in Mexico and regulating and coordinating the evaluation of social development policies and programs as well as establishing guidelines and criteria for defining, identifying and measuring poverty (CONEVAL, 2010, 2016).

To combat poverty and inequality, Mexico has implemented a number of social programs, such as *Prospera* (originally called *Progresa* and, later, *Oportunidades*).[6] Over the last 20 years, Mexico has made significant progress in terms of vision and poverty measurement. At the beginning of the 2000s, the Technical Committee for the Measurement of Poverty (CTMP) was created under the Secretariat of Social Development (SEDESOL), which established a method based on household income and includes three different types of monetary poverty: food, capacity and assets (CTMP, 2002).

On January 20, 2004, the Mexican government enacted the General Law of Social Development (LGDS), which recognizes the multiple dimensions of individual rights in society in article 36. Under this law, the National Council for the Evaluation of Social Development Policy was created (CONEVAL, 2010).

After an intense dialogue and deliberation process, between 2006 and 2009, CONEVAL adopted a multidimensional poverty methodology that includes two fundamental spheres: economic well-being and social rights. Economic well-being allows for the measurement of monetary poverty, taking advantage of the experience of the CTMP, but also considering social rights as a sphere of essential needs, many of which are provided by the State. In the area of privation of social rights, these are measured in accordance with Article 36 of the LGDS using six dimensions (CONEVAL, 2010):[7]

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[5] Source: http://www.worldbank.org/en/country/mexico

[6] The *Prospera* program is a conditional cash transfer program that aims to reduce extreme poverty among the Mexican population, improve their capacities, and incorporate mechanisms to exit the program, particularly the productive association. Although it is not within the scope of this document, there are other studies on the incorporation of environmental variables in conditional cash transfer programs, as well as on the articulation of social and environmental policies (UNDP-UNEP, 2015a, 2015b, 2017).

[7] Social cohesion, also included in the LGSD (but not incorporated into the multidimensional poverty index), is measured using four indicators: the Gini index, the degree of social polarization of the state or municipality, the ratio of the population with an income considered as extreme multidimensional poverty, with respect to the population that is not in a situation of multidimensional poverty and is not vulnerable, and the perception of social networks index. (CONEVAL, 2010).

1. deficiencies in education,
2. access to health services,
3. access to social security,
4. quality and basic services for households, and
5. access to food.

### 1) Multidimensional poverty measurement methodology

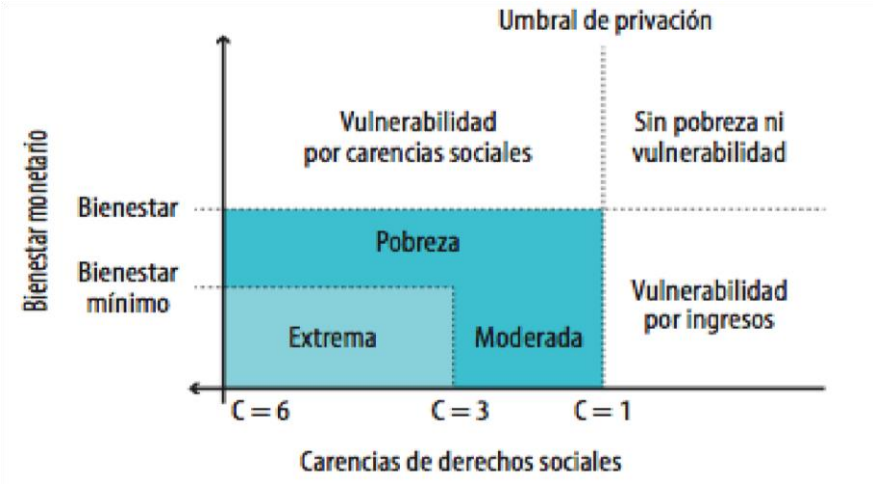
The Mexican poverty measurement methodology follows the two basic steps defined by Sen (1976) as essential for any poverty index: identification and aggregation. Identification of the population living in poverty is achieved in two stages: the definition of monetary poverty lines (well-being and minimum well-being) and multidimensional poverty lines (thresholds for moderate and extreme privation), as shown in Figure 1.

Two monetary poverty lines are defined to identify people with insufficient income: the well-being line and the minimum well-being line, which in other places are known as poverty and extreme poverty lines, respectively. The lines are different for rural and urban areas. Thus, the economic well-being line in 2014 was approximately 6.5 dollars per person per day in urban areas and 4.1 dollars per person per day in rural areas. The minimum well-being line was equivalent to approximately 3.15 and 2.2 dollars per person per day in urban and rural areas, respectively.

To be considered living in poverty, a person must have an income below the minimum well-being line and experience at least one of the six social privations. To be considered living in extreme poverty, the person must have an income below the minimum well-being line and experience at least three of the social privations.[8] People who have incomes below the well-being line, but experience no social privation, are considered vulnerable in terms of income, while those who experience some social privation, but whose income is above the well-being line, are considered vulnerable due to social privation. People who do not experience privations and have incomes above the well-being line are considered not poor and not vulnerable (Figure 1).

[8] For the National Crusade against Hunger, a strategy adopted at the beginning of President Enrique Peña Nieto's administration, hunger was defined as extreme food poverty, that is, when one of the social privations of extreme poverty is the lack of access to food.

Figure 1: Multidimensional poverty measurement in Mexico.




Source: Ortiz E. and Pérez-García M. (2013)

With respect to aggregation, multidimensional poverty measurement in Mexico uses a metric similar to the one proposed in the Alkire-Foster methodology. Once the people living in poverty have been identified, the incidence is measured by the percentage of the population living in poverty, while the degree is determined by the average number of privations of the poor, without considering income. The intensity of poverty is the product of the proportion of the population living in poverty multiplied by their average number of privations.[9] With regard to income, CONEVAL also reports the proportion of people living in poverty and the income gap.

## 2) Social privation and the link to the environment

Of the six social privations mentioned above, the lack of basic services for the household is subdivided, in turn, into four indicators:

- No access to water
- No sewage
- No electricity
- No chimney when using wood or charcoal for cooking

The indicator of homes without a chimney that use firewood or charcoal for cooking is very similar to the cooking fuel indicator in the global Multidimensional Poverty Index. This indicator, as previously mentioned, is considered by CONEVAL as an environmental indicator linked to air

[9] In the original notation of the AF methodology, the incidence is the headcount; the degree is derived by dividing by the number of privations to obtain the proportion of privations of the population living in poverty, which, in the AF notation, is known as intensity. The multiplication of the headcount by intensity is the adjusted headcount, also known as $M_0$.

quality inside the home. The indicators of access to water and sewage could also be considered variables related to health and linked to environmental quality.

Finally, the lack of quality housing is subdivided into residences with:

- Earth floors
- Roofs made with non-resistant materials
- Walls made with non-resistant materials
- Inadequate space for the number of residents (overcrowding)

The indicators of materials for roofs and walls are not environmental indicators, but have the potential to indicate vulnerability to natural disasters and extreme climate events. When there is information about the exposure of houses to certain risks, for example, in areas subject to flooding or landslides, used together with the information on housing materials, it is possible to estimate environmental vulnerability.

## 3) Conclusion

The recognition of the multidimensional nature of poverty is a historic change for countries in Latin America. In fact, Mexico was the first country to undergo the transition from a vision based solely on income poverty to a multidimensional one, taking into account monetary aspects as well as social and territorial ones. Today, the method developed by CONEVAL provides more precise information about the problems and a realistic understanding of poverty conditions in the country.

Although its conception, which stems from a focus on rights, does not include environmental indicators, we can see that some of the indicators related to social rights are linked to the environment, even though this link is not expressly recognized. On the other hand, there is a commitment to not modify the methodology for at least ten years. This would be a good opportunity to start planning additional environmental indicators to be incorporated in the future. Thus, one could contemplate the inclusion of pertinent questions in the household survey, and even begin to study their effects in terms of their association with the other indicators.

## B. Chile

The Republic of Chile is located in the Southern Hemisphere, in the extreme southwestern part of South America. The country has 17.9 million inhabitants [10] and, economically speaking, is considered one of the richest countries in the region, with an average annual GDP growth rate over the last 25 years of approximately 5.5% and a per capita GDP of US$ 15,700 (2013) in current currency, according to the World Bank.[11] In terms of human development, it has a rating of 0.822. The country is also the most advanced on the continent and is classified in the "very high development" category in terms of HDI, ranking 38 among 188 countries (UNDP, 2017). Despite this, poverty, inequality[12] and, above all, vulnerability, continue to be significant challenges for the country.

The first studies on poverty in Chile go back to the 1970s, when a map of extreme poverty was created, based on the Unsatisfied Basic Needs method. In the 1980s, a system for measuring income poverty was adopted (Commission for the Measurement of Poverty, 2014). Between 1987 and 2011, poverty was reduced by at least one third and the extreme poverty rate by no less than one fifth, so that, in 2011, the poverty and extreme poverty rates were 12.1% and 2.6%, respectively, of the total population (Figure 3).

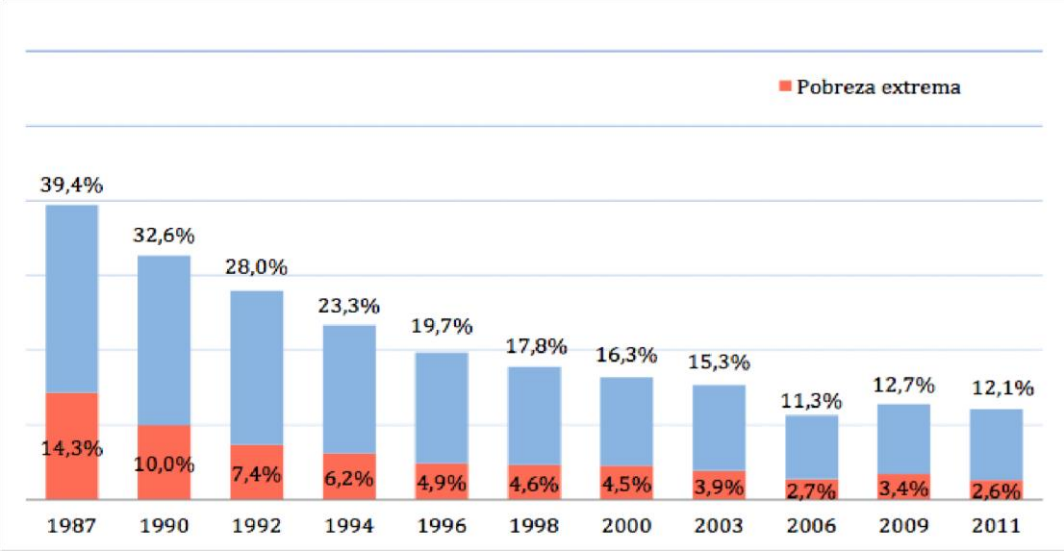
In December of 2012, the Chilean government created the "Presidential Advisory Commission of Experts to Update Poverty and Extreme Poverty Lines," which also took on the task of preparing a proposal to measure poverty in a multidimensional manner (Commission for Poverty Measuring, 2014).

[10] Source: http://datos.bancomundial.org/pais/chile?view=chart

[11] Source: http://data.worldbank.org/indicator/NY.GDP.PCAP.CD

[12] Chile's GINI index is one of the highest in the region: 50.5

Figure 3: Evolution of poverty and extreme poverty in Chile, 1987 to 2011 (Percentage of households).

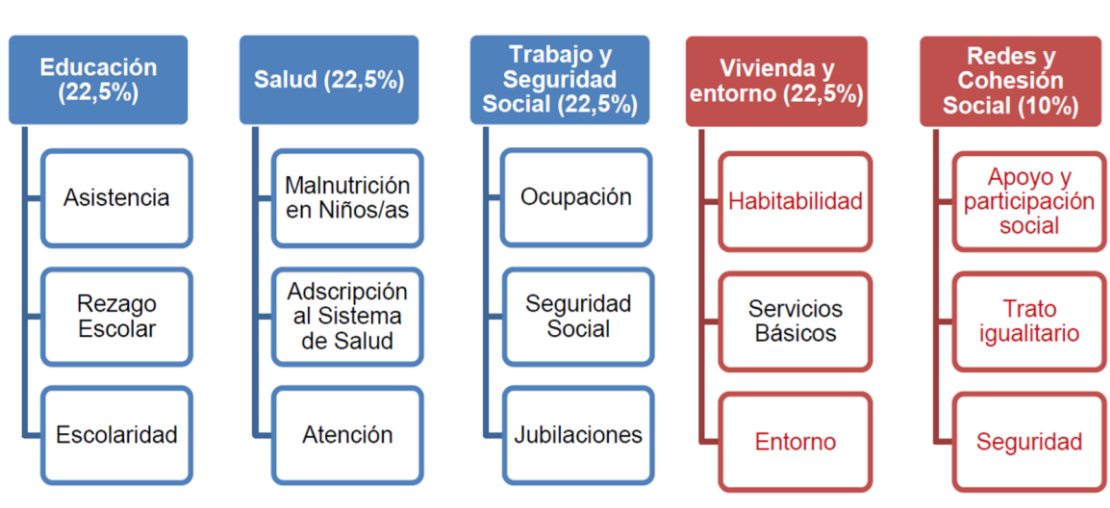



Source: Comisión para la Medición de la Pobreza (2014)

## 1) Multidimensional Poverty Index in Chile

The multidimensional method developed by OPHI (Alkire and Foster, 2007) was selected by the commission of Chilean experts to complement the measurement based on income. Chile used a normative criterion for the selection of dimensions that were essential constituents of well-being. The "voices of the poor" survey conducted by the Foundation for Overcoming Poverty was also used, with the aim of understanding and using the point of view of people living in poverty concerning the well-being dimensions they considered most relevant. Finally, for the selection of the dimensions and indicators for the MPI, an empirical criterion was used, based on the existing data in the National Socioeconomic Characterization survey (CASEN), with the incorporation of new questions and modules in the questionnaires, in order to obtain a multidimensional vision. This process made it possible to obtain, on a national level, a consensus on five dimensions: education, health, labor and social security, housing and the environment, as well as networks and social cohesion (Figure 4).

Figure 4: Indicators and thresholds, selected by factor, for Chile's MPI.




Source: Ministerio de Desarrollo Social de Chile

Each dimension has a weight of 22.5%, except that of networks and social cohesion, which has a weight of 10%. Within the dimensions, each indicator has a weight of 7.5%, except the indicators of the networks and social cohesion dimension, which have a weight of 3.3% each. The poverty threshold that was chosen in Chile is 22.5%, that is, a household must present privations in 22.5% of the total to be considered poor, or the equivalent of one of the first four dimensions.

### 2) The link to the environment: poverty and pollution

Chile's MPI makes explicit the link between poverty and the environment in the "environment" indicator. Thus, for the 2015 CASEN, many questions were added with the potential to report on air pollution, noise pollution, water pollution, visual pollution, presence of garbage in public areas, as well as harmful fauna such as rodents, dogs etc. Figure 6 shows the details of the question in the questionnaire.

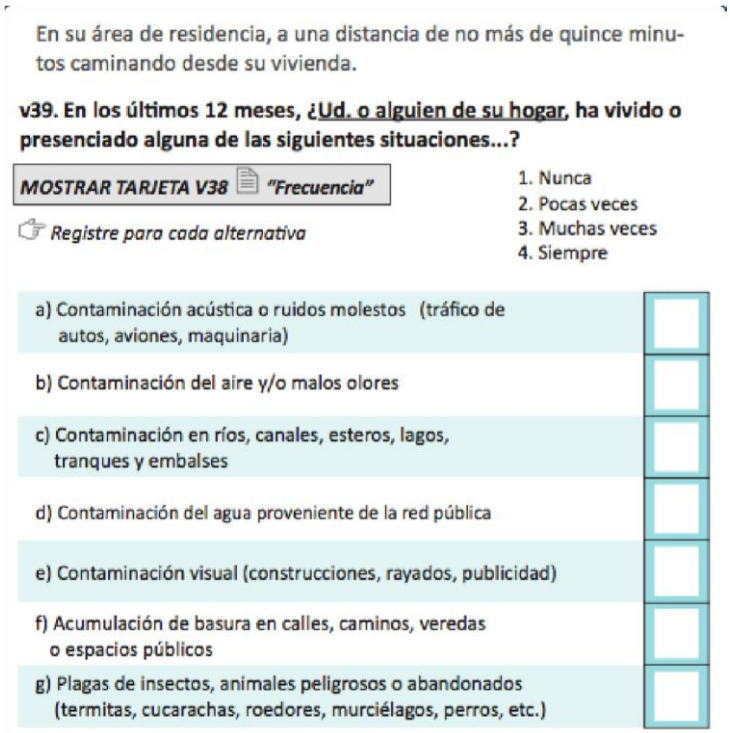
A household is considered deficient in environmental quality if:

(a) Two or more environmental pollution problems are identified that frequently occur in the area of residency; or,

(b) there are no employed family members and the area of residency lacks any of the three basic services (health, education and transportation); or,

(c) the area of residency lacks any of the three basic services (health, education and transportation) and the household has employed members who use public or non-motorized transportation and take, on average, an hour or more to get from their home to their place of work.

Figure 5: Question about environmental quality in CASEN 2015



En su área de residencia, a una distancia de no más de quince minutos caminando desde su vivienda.

**v39. En los últimos 12 meses, ¿Ud. o alguien de su hogar, ha vivido o presenciado alguna de las siguientes situaciones...?**

*MOSTRAR TARJETA V38 "Frecuencia"*

*Registre para cada alternativa*

1. Nunca
2. Pocas veces
3. Muchas veces
4. Siempre

| | |
|---|---|
| a) Contaminación acústica o ruidos molestos (tráfico de autos, aviones, maquinaria) | |
| b) Contaminación del aire y/o malos olores | |
| c) Contaminación en ríos, canales, esteros, lagos, tranques y embalses | |
| d) Contaminación del agua proveniente de la red pública | |
| e) Contaminación visual (construcciones, rayados, publicidad) | |
| f) Acumulación de basura en calles, caminos, veredas o espacios públicos | |
| g) Plagas de insectos, animales peligrosos o abandonados (termitas, cucarachas, roedores, murciélagos, perros, etc.) | |

Source: CASEN 2015 questionnaire

In addition to the environment indicator, the basic services indicator considers the type of sanitation and water services in the household, while the habitability indicator refers to the materials used for roofs and walls. These indicators could be linked to both environmental health and vulnerability to risks. Chile could serve as an example for other countries in the region to estimate or modify their multidimensional poverty measurements.

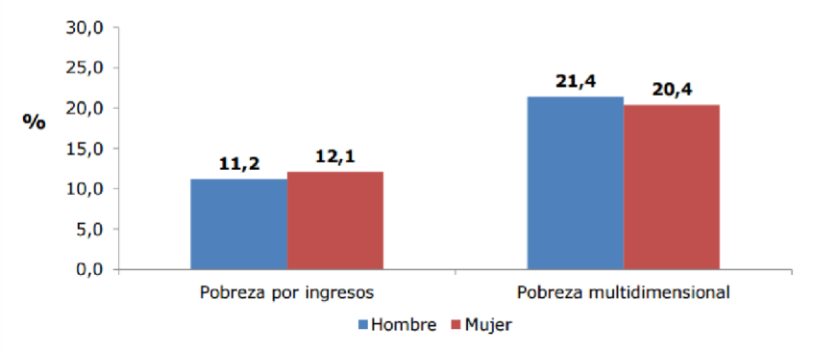
Finally, Chile chose the household as the unit of measurement to calculate multidimensional poverty. In fact, in the country's public policies, the predominant focus is "the household, and the measurement of poverty by income also uses the household as a unit of analysis" (Commission for the Measurement of Poverty, 2014).

In 2015, the percentage of the population living in poverty was 20.9%, although the figure is not comparable with prior calculations, since environment and network indicators are not available for previous years. Without these indicators, the poverty rate would be 19.1%, that is, 1.3% lower than in 2013. In terms of income poverty, this affects 11.7% of the population, with 3.5% living in extreme poverty. The reduction is more pronounced in terms of income, since, in 2009, the income poverty rate was 25.3%, with 9.9% living in extreme poverty, while, for the same year, multidimensional poverty was reported at 27.5%.

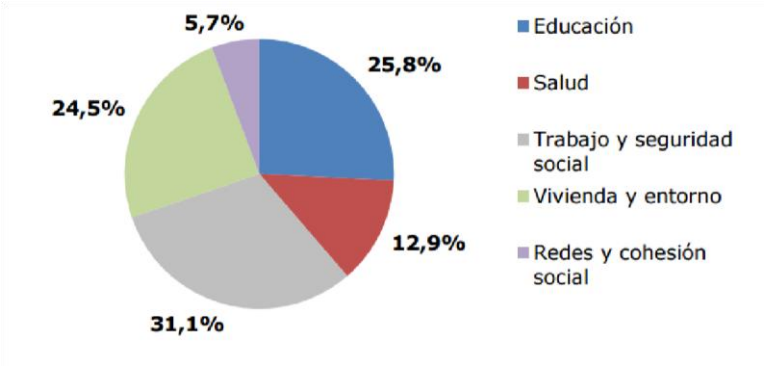
Figure 6: Analysis of CASEN 2015.

Percentage of people living in poverty (disaggregated by sex):

by income or multidimensional measurement




Breakdown of the different poverty dimensions in Chile




Source: Ministerio de Desarrollo Social, Chile. Encuesta CAEN, 2015

## 3) Conclusion

Chile's experience in measuring poverty is exemplary for the region. In this case, they decided to keep the measurements of monetary and multidimensional poverty separate, contrary to what occurs in Mexico, where both were integrated. Moreover, Chile has endeavored to incorporate novel aspects in their multidimensional measurement, not only environmental variables, but also public safety and discrimination ones.

The household survey questionnaire included a question about different types of contaminants, however, environmental privation may or may not be due to pollution sources near the home, as it could also be due to other causes, such as lack of equipment services, distance

from the workplace or unemployment. For public policy purposes, for example, knowing the disaggregation of the causes of privation within the environment indicator is very important.

## C. El Salvador

The Republic of El Salvador is a Central American country with an estimated population of 6,520,675 inhabitants (2016), and is considered a country of medium human development, ranked in 117th place in 2015, with an index of 0.680 (Ministry of Economy *et. al.*, 2014; UNDP, 2017). The country suffered from an authoritarian regime, followed by a ten-year civil war, between 1979 and 1992, which left an estimated 75,000 people dead and 8,000 missing. Despite the incipient capacity of the State in the postwar period, and impacts such as the 2008-2009 financial crisis, the Millennium Development Goals were achieved, reducing the 13.4% of the population living below the poverty line of USD 1.25 per day in 2001 to 5.5% of the population in 2012.

Nevertheless, in 2012 poverty was estimated at around 40% of the population, measured using the national poverty line (Government of the Republic of El Salvador and the United Nations System in El Salvador, 2014). With the technical assistance of UNDP and financial support from the Grand Duchy of Luxembourg, the Government of El Salvador developed a new multidimensional poverty measurement that complements the measurement of monetary poverty. To this end, the Multiple Purpose Household Survey (EHPM)[13] was reviewed and 20 indicators were defined in five dimensions of human welfare, including exposure to environmental damage and risks. In fact, for the 2014 survey, a Module for Multidimensional Poverty Measurement was created with additional questions to estimate all the selected indicators. In the 2016 survey, the additional module questions were incorporated into the body of the survey.

### 1) From income poverty to multidimensional poverty

In El Salvador, the methodology for measuring income poverty is based on the costs of certain basic goods and services. The threshold for measuring poverty is the Basic Food Basket (CBA). The UNDP analysis found that this method had three main limitations: 1) an outdated basic food basket, 2) volatility in poverty figures due to abrupt changes in food prices, and 3) decoupling

[13] This survey is a statistical instrument used by the country to provide information on the socioeconomic situation of Salvadoran households. More information can be found on the website of the Statistics and Census Bureau of the Ministry of Economy: http://www.digestyc.gob.sv/index.php/temas/des/ehpm.html

from social policies. The recommendation was to adopt a multidimensional approach for the measurement of poverty (UNDP, 2012).

Based on a series of interviews and consultations with focus groups, UNDP carried out on-site research in 20 communities considered to be living in poverty between August and September of 2012. The results were published in the report *La Pobreza en El Salvador* [Poverty in El Salvador], reflecting the perspective of the poor (UNDP, 2014). This participatory process initially came up with eight dimensions: income, housing, food, leisure, work, health, citizen security and education. Among the privations identified for homes was exposure to environmental degradation and risks such as rain, floods, landslides or avalanches and watercourses.

A technical advisory council was created, led by the Technical and Planning Secretariat of the Presidency (STPP) and the Ministry of Economy (MINEC), which also received support from institutions such as University of Oxford's OPHI initiative and Mexico's National Council for the Evaluation of Social Development Policy. This process resulted in a new Development and Social Protection Law (LDPS), published on September 4, 2014 in the Official Gazette, which establishes that the measurement of poverty be multidimensional, focused on rights, comprehensive and technically rigorous, in addition to being public, transparent and adhering to the best international practices.[14]

With this conceptual, legal and inter-institutional framework, the new measurement of poverty uses the household as the unit of analysis and is based on five dimensions and twenty indicators, as shown in Figure 7: 1) education, 2) housing conditions, 3) work and social security, 4) health, basic services and food security, and 5) habitat quality, which are aligned with the Five-Year Development Plan 2014-2019, which is based on the principle of quality of life. (STPP and MINEC-DIGESTYC, 2015).

For a household to be considered poor, a poverty threshold *k* of 0.35 was determined, that is, privation in 35% of the dimensions. As each dimension has a weight of 20% in the multidimensional poverty index, and each dimension has four indicators, each indicator has a weight of 5% in the total of the MPI. Therefore, a household is considered poor if it experiences privation in seven or more indicators.

[14] The law can be found at: http://www.asamblea.gob.sv/eparlamento/indicelegislativo/buscador-de-documentos-legislativos/ley-de-desarrollo-y-protecion-social

Figure 7: Multidimensional poverty measurement in El Salvador.


Source: STPP and MINEC-DIGESTYC (2015)

The result of the multidimensional measurement reveals that 35.2% of the population is multidimensionally poor, which represents 606,000 homes, in which 2.6 million people reside. Despite the fact that the percentage is similar to that of income poverty, 31.9%, only 17.7% of the population experiences both types of poverty: 17.5% is poor when measured multidimensionally, but not by income, and 14.2% lives in monetary poverty, but not multidimensional poverty.

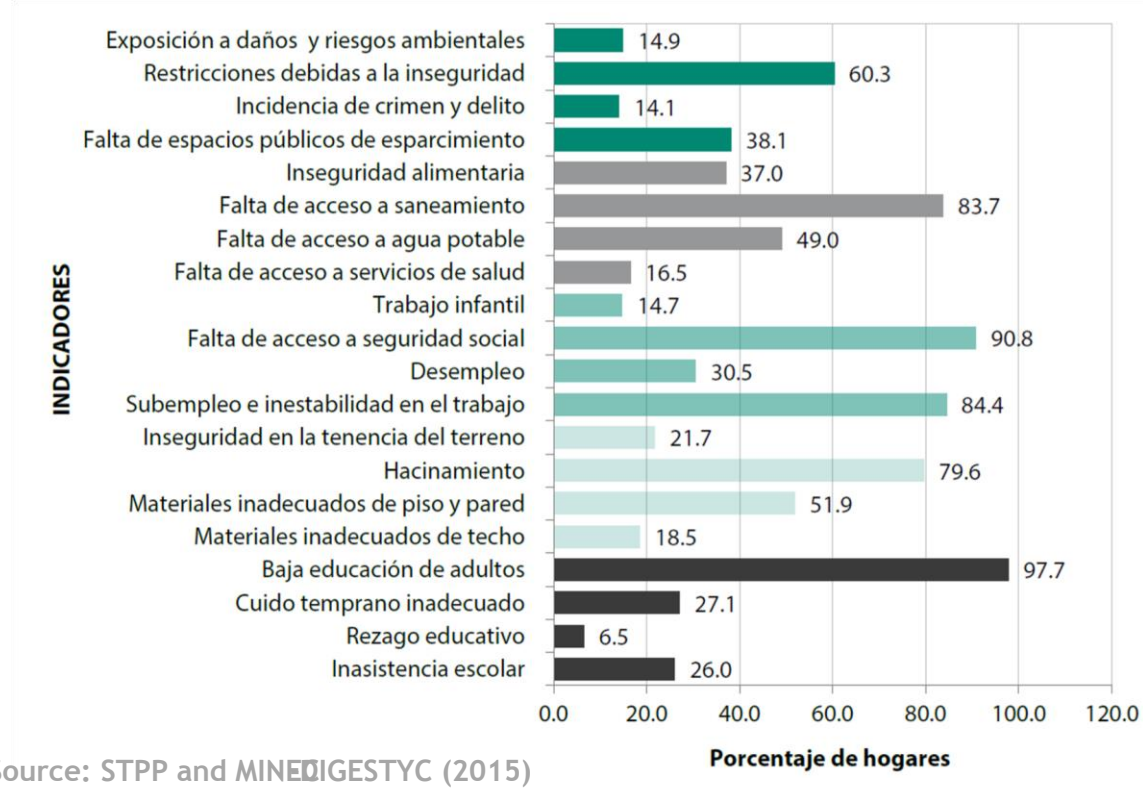
## 2) Linking poverty and disaster risk to the environment

Although it was not originally contemplated in the LDPS, the inclusion of the habitat quality dimension resulted from the on-site study carried out by the UNDP team to gather the opinions of the population living in poverty. This dimension includes four indicators: 1) lack of public spaces for leisure, 2) incidence of crime, 3) restrictions due to insecurity, and 4) exposure to environmental degradation and risk.

The definition of the environmental risk exposure indicator refers to households that have been damaged by natural phenomena, or present at high risk of suffering them. The indicator threshold determines that a household be considered in privation with respect to this indicator if, in the last year, it suffered damages due to floods, landslides, avalanches or watercourses, or if there is a risk of damage from erosion (STPP and MINEC-DIGESTYC, 2015).

7.7% of Salvadoran households reported a privation in the environmental degradation and

Figure 8: Percentage of households in multidimensional poverty by type of privation




Source: STPP and MINED-DIGESTYC (2015)

risk indicator in 2014. Of the 20 indicators, it is one of the four that reports a lower percentage. Paradoxically, the indicator with the highest percentage of privation is inadequate adult education (80.6%) and the lowest is inadequate educational in general for school age children and adolescents (3%). On the other hand, the percentage of poor households that report privation with respect to exposure to environmental degradation and risks is 14.9%. Figure 8 shows the percentages for households living in multidimensional poverty, thus, the percentages do not reflect the incidences among the population in general, but only the incidences among people living in poverty. These are called adjusted incidences according to AF methodology.

To incorporate the dimension of habitat quality in its multidimensional poverty measurement system, El Salvador, like the Dominican Republic, included new questions in the household surveys that provide new information on the phenomenon of poverty.

## 3) Conclusions

The example of El Salvador is part of a new wave of multidimensional poverty measurements that have begun to incorporate dimensions and indicators related to the environment, as well as incorporating other important dimensions, such as citizen security. In this sense, an important aspect that serves as an example of good practice is the fieldwork carried out by UNDP in El Salvador, as well as the work carried out with the support of the Poverty-Environment initiative in the Dominican Republic. This participatory exercise led to the

incorporation of new dimensions; among them, the dimension of habitat quality, a category containing innovative indicators.

With an MPI that incorporates environmental indicators, the government of El Salvador understands that it will be impossible to eradicate poverty without taking into account vulnerability to natural disasters and extreme climate events. No doubt, this will lead to social programs and other kinds of interventions for the population living in poverty to begin to incorporate aspects aimed at reducing exposure to disaster risk and increasing the resilience of households.

The government recognizes that they still have challenges ahead of them, one of which is to guarantee the frequency of the measurement, which, according to the LDPS, must be every two years. Another challenge is the focus, particularly on a regional scale. To this end, it is important to improve administrative records, in particular the national registry of beneficiaries.

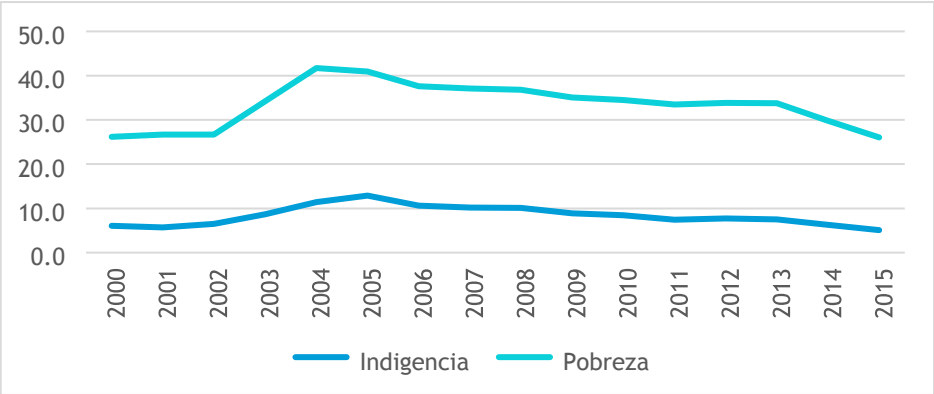
## D. The Dominican Republic

The Dominican Republic is a middle income country located in the Caribbean with an estimated population of 10,648,791 (2016).[15] It has an open and dynamic economy that has enjoyed an annual average growth rate of 4.8% over the last 15 years, even reaching 7.6% in 2014 and 7% in 2015, according to preliminary figures. The accelerated economic growth has contributed to poverty reduction, including one of the Millennium Development Goals to reduce poverty by 50%, which the Dominican Republic was able to comply with, as the rate of extreme poverty was reduced from 10.8% to 5.1%, according to figures from the National Social Indicators System (SISDOM)[16] of the Dominican Republic. Despite this, poverty and extreme poverty stand at the same levels as the year 2000, after a considerable increase due to the economic crisis of 2003, when the economy contracted 0.3% in real terms.

Figure 9: Percentage of the population living in monetary poverty and extreme monetary poverty in the Dominican Republic.

[15] World Bank, based on the Population Division of the United Nations, available at: https://datos.bancomundial.org/pais/republica-dominicana

[16] The data can be found at: http://economia.gob.do/mepyd/despacho/unidad-asesora-deanalisis-economico-y-social/sisdom/sisdom-2015/




Source: SIUBEN

The Dominican Republic has transformed its society and economy from the dependence on agriculture, mainly sugarcane, to a service economy based on tourism. However, the eradication of monetary poverty is not the only social challenge that persists. The last SDG report pointed out that there are also challenges in terms of malnutrition, employment, social security, access to drinking water and sanitation, education and health. In addition to these challenges, there is the problem of environmental degradation, as well as the island's exposure to extreme climate events, which have increased in severity and frequency as a result of climate change. One of the main motivations for the Dominican Republic to incorporate environmental variables in its multidimensional poverty measurements is precisely the issue of vulnerability to climate events.

The direct antecedent of its MPI is the quality of life index (ICV) as a system for measuring poverty and identifying beneficiaries of social programs. In addition to this index, they have incorporated another level of analysis related to environmental vulnerability with the innovative Climate Change Adaptation and Vulnerability Index (IVACC).

Climate Change Adaptation and Vulnerability Index (IVACC)

In order to reduce the vulnerability of poor rural households, which are particularly vulnerable to extreme climate events, the *Programa Nacional Sombrilla* [National Umbrella Program] was developed between 2012 and 2014, with the support of UNDP and UNEP, aimed at integrating poverty, environment and climate change variables in development planning. To achieve this, the Program worked on the integration of climate change adaptation policies with social protection strategies, and the Climate Change Adaptation and Vulnerability Index (IVACC) methodology was particularly important to achieve this end. The IVACC index calculates the probability of a household being affected by hurricanes, storms and floods, using three variables: i) characteristics of the home (walls and roof), ii) household income and iii) proximity of the home to risk sources (river, stream or ravine).

The IVACC index is used in conjunction with the SIUBEN database to: a) identify the population with a high environmental disaster risk; b) focus interventions at regional and population levels, prioritizing poor households located in high-risk areas; c) develop public policies to promote greater resilience to the effects of hydro-meteorological events.

The IVACC index was the first global climate vulnerability index focused on households and has been an important input for the development of the country's multidimensional poverty index.

## 1) Multidimensional poverty in the Dominican Republic

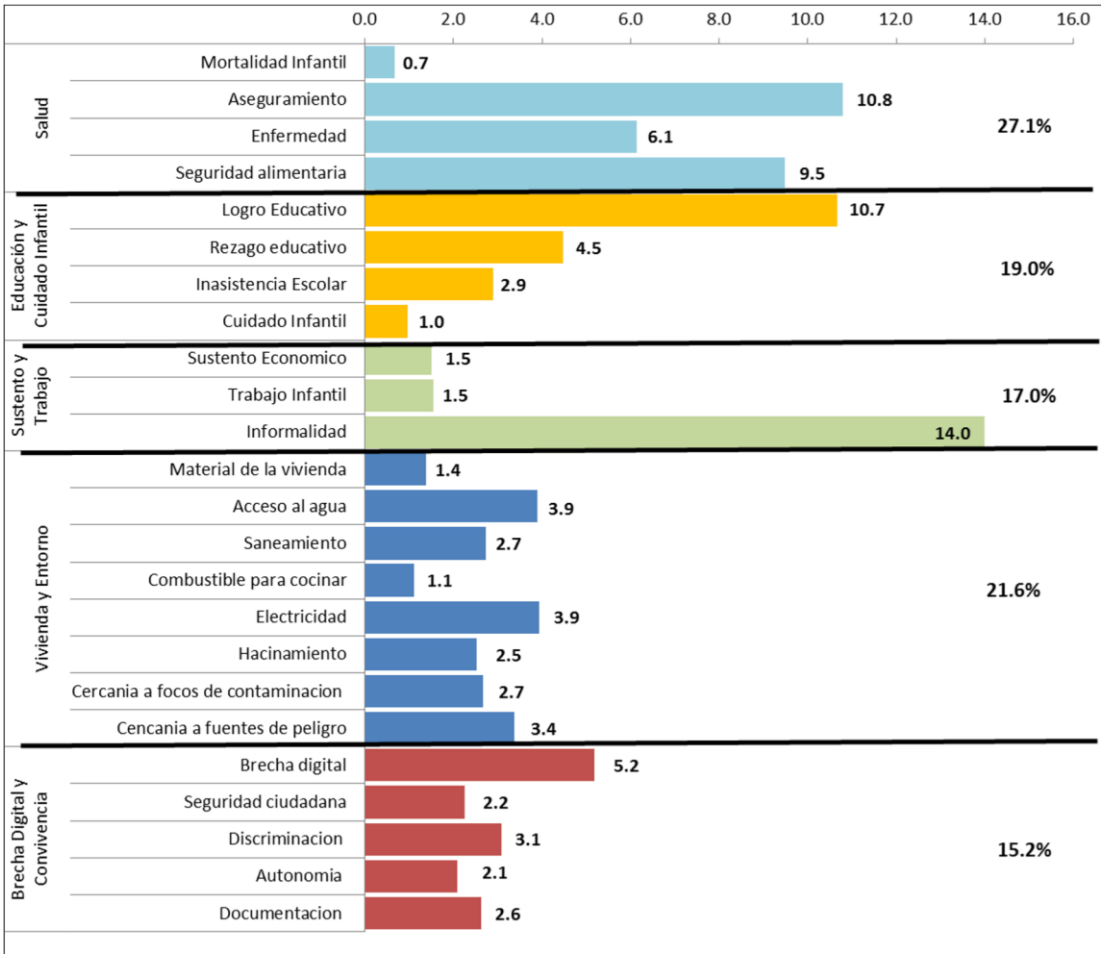
Multidimensional poverty measurement in the Dominican Republic adheres to the Alkire-Foster methodology (2007), like the other examples presented in this document. The MPI is a project that began in June of 2014, with the participation of Vice President Margarita Cedeño de Fernández, at the second annual meeting of the Multidimensional Poverty Peer Network (MPPN). That same year, the debate on possible dimensions and indicators began and, in 2015, the survey form was drawn up with the technical assistance of OPHI, and the survey was begun. During 2016, the survey was analyzed, the dimensions and indicators were created and, in June of 2017, the MPI was presented, containing five dimensions and twenty-four indicators.

For the selection of the dimensions, a participatory and comprehensive process was carried out, which included national and international technical meetings, as well as the objectives and targets of the National Development Strategy 2030 and the results of the "*Mi Mundo 2030*" [My World 2030] survey, which identifies the priorities of civic and social rights. The dimensions and their corresponding indicators in the MPI-DR are:

1) Health: infant mortality, health care, illness, food
2) Education and child care: access to education, educational deficiencies, school attendance, child care
3) Livelihood and work: providing for the home, child labor, informality
4) Household and environment: housing, drinking water, sanitation, fuels, electricity, overcrowding, proximity to pollution sources, proximity to sources of danger
5) Digital divide and coexistence: digital divide, citizen security, discrimination, participation and documentation

Each dimension has a weight of 20% in the measurement total, and the indicators within each dimension have the same weight, being 5% in the dimensions of health and education and child care; 6.66% in the livelihood and work dimension; 2.5% in the housing and environment dimension; and 4% in the digital divide and coexistence dimension. For a person to be identified as poor, they must experience privations in 33% of the total MPI. With respect to the incidence numbers, the percentage of the population living in multidimensional poverty is 19.1% at the metropolitan level, although it increases to 32.3% for the rest of the urban population, and to 38.5% for people in rural areas.

Figure 10: Percentage contribution of each indicator to the MPI, national total




Source: Vice-Presidency of the Republic

The indicator that most accounts for total poverty is informality, at 14%, although the health dimension accounts for the highest percentage, at 27.1%, between the four indicators within it. The adjusted privation rate, that is, only considering the population living in multidimensional poverty, is highest for access to education (36.8%) followed by health care (34.2%) and informality (34%). The lowest adjusted privation rate is found in the indicators of infant mortality, child care, providing for the home and child labor, at 2.1%, 2.9%, 3.4% and 3.6%, respectively.

## 2) The link to the environment

The link to the environment can be observed in the household and environment dimension. In addition to the cooking fuel indicator, which has been revised in other cases, this dimension in the Dominican Republic's MPI has two indicators that explicitly associate the relationship between poverty and the environment: proximity to pollution sources and exposure to environmental risks. The thresholds to determine who is considered to experience privation in these indicators are defined as follows:

- Proximity to pollution sources: Households close to any source of contamination in urban areas, with the exception of proximity to pork and poultry farms in rural areas.
- Proximity to sources of danger: Households within 0.5km of a source of environmental risk (river, gully, ravine, lagoon, watercourse, sea coast, erosion or landslide area, dry or diverted riverbed).

At the national level, 16.8% of households in multidimensional poverty are close to a pollution source. However, this percentage drops to 12.3% in the metropolitan area and increases to 21.7% in urban areas. In rural areas, the percentage of households living in poverty that are close to a pollution source is 13.7%, although pork and poultry farms in rural areas are not included in the calculation of the indicator threshold.

In the case of proximity to sources of danger, the rate of adjusted privation is higher than that of proximity to pollution sources, attaining 21.4% of households living in multidimensional poverty, although, once again, the metropolitan area has a lower incidence: 11.8%. On the other hand, both urban and rural areas have higher percentages of privation, at 23.9% and 23.4%, respectively. That is, almost one in four multidimensionally poor households, outside the metropolitan area, is close to a source of environmental danger.

The household and environment dimension is second in the contribution to the total MPI, at 21.6% at the national level. Of this percentage, 2.7% corresponds to the proximity to pollution sources and 3.4% to proximity to sources of environmental danger. In the metropolitan area, both indicators account for 3% to total poverty, though in urban areas the proximity to pollution sources indicator accounts for 3.4% and the environmental hazard indicator for 3.8%. Finally, in rural areas, the proximity to pollution sources indicator accounts for only 1.7%, but the proximity to sources of environmental danger remains at 3.2%.

## 3) Conclusion

The Dominican Republic has demonstrated innovation in its vision of linking poverty and the environment in its social indicators. In the case of the IVACC index, not only is the link between poverty and the environment established and made explicit, but it is also a fundamental tool to provide focus for social programs and the national registry of beneficiaries. By doing so, interventions aimed at the population living in poverty also take on an environmental perspective, at least in terms of vulnerability.

In the MPI, two indicators are used that demonstrate the poverty-environment relationship in two different ways: exposure to pollution sources and exposure to environmental dangers. With the geographical disaggregation of the metropolitan area, urban areas and rural areas, differentiated policies can be developed to reduce the socio-environmental privations within the MPI.

The incorporation of environmental indicators is only one of the innovations included in the MPI of the Dominican Republic. Child labor, digital divide, citizen security, autonomy, discrimination, social inclusion and documentation are indicators that are not commonly found in multidimensional poverty indices, but that will certainly become so in the future.

Finally, it is worth noting the effort made by the Dominican Republic to link household surveys and poverty measurement systems with environmental vulnerability. In addition to differentiating the impacts of sources of environmental contamination and danger on households (questions 16 and 20), the 2016 household survey used by the Dominican Republic also includes, in section V, "Risk from environmental problems and pollution" questions regarding abandonment of households (refugees) due to natural disasters (question 18), and the duration of the event (question 19), and, although these questions have not been included as indicators in the MPI, their inclusion in the household survey and the subsequent data may encourage their inclusion in future MPIs of countries vulnerable to natural disasters and climate change, as the abandonment of the home due to extreme events could serve as a proxy to analyze the environmental vulnerability of households, and the duration can help to measure the intensity.

## E. Panama

Panama is a country located in the southernmost part of Central America, with an estimated population of 4,058,372 inhabitants (CGR and INEC, 2016). It is among the High Human Development countries and is also one of the most unequal countries in the world. According to the MEF, in 2015 "the 10% of the richest families in Panama had 37.3 times more income than the 10% of the poorest families in the country. This level of inequality is higher than it was in 2014, when it was determined that 10% of the richest population had 33.9 times more than the poorest 10%" (MEF, 2015).

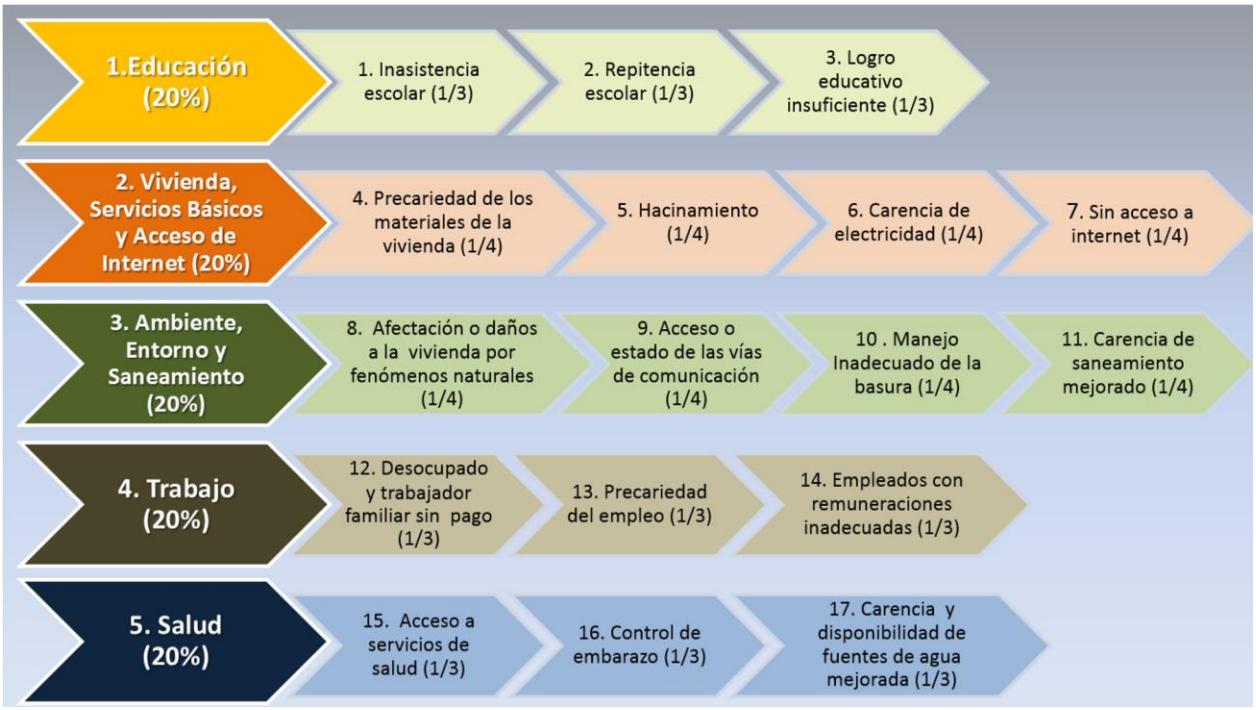
Panama has been one of the most dynamic economies in Latin America over the last years, with an average annual growth of 7.4% between 2006 and 2016. The economic outlook continues to be positive, supported by positive growth, thanks to the revenues from the Inter-oceanic Panama Canal, which was expanded and is part of a broad range of investments in infrastructure and service projects.

Since 2009, Panama has used monetary poverty as a poverty measurement system, considering a poverty line for consumption and, since 2017, in a complementary manner, it has developed a Multidimensional Poverty Index based on the Alkire-Foster methodology. In May of 2016, the government of Panama, under the technical coordination of the Ministry of Social Development (MIDES), approved the design and calculation of the MPI, carrying out the entire process in record time to have it ready in June of 2017 (MEF, 2017).

## 1) Multidimensional poverty measurement methodology

The Panamanian MPI is measured using the Multiple Purpose Survey (EPM), conducted by the National Institute of Statistics and Census (INEC) every year during the month of March, with representation at the national, provincial and indigenous district level, as well as representing rural and urban areas. After studies, consultations in the provinces and districts, and their subsequent analysis, it was determined that the Panamanian MPI include five dimensions and seventeen indicators, which represent the main privations of households and the population in Panama. The process received support from OPHI, UNDP and the World Bank.

Figure 11: Dimensions and indicators of the Panamanian MPI.




The five dimensions and their corresponding indicators are:

1) Education and child care: school attendance, failure rate at school and access to education.
2) Housing, basic services and Internet access: inadequate housing materials, excess of inhabitants per household (overcrowding), lack of electricity and no Internet access.
3) Environment and sanitation: home damage due to natural phenomena, access to roads, inadequate waste management, lack of improved sanitation.
4) Work: unemployment and family labor, precarious employment, non-compliance with labor rights.
5) Health: access to health services, birth control, lack of availability of adequate water sources.

Each dimension has the same weight of 20%, and within, each indicator also has the same proportional weight; one third for dimensions that have three indicators and one quarter for dimensions that have four indicators. The poverty threshold is 20%, that is, for a household to be considered living in poverty it must experience privation in 30% of the total, that is, one and a half dimensions, or between five and six indicators.

The results show that 19.1% of the population is multidimensionally poor in Panama, which amounts to 777,752 people. However, this percentage is not homogeneous throughout the country, as in Los Santos only 4.2% of the population is multidimensionally poor, while in the districts the incidence is much higher: 93.4% in Ngäbe Buglé, 91.4% in Guna Yala and 70.8% in Embera. In absolute terms, the Ngäbe Buglé district has the largest number of people living in poverty (191,634), accounting for 24.6% of the population living in poverty in Panama. The three indicators that figure highest in total poverty are: inadequate access to education (12.4%), precarious employment (11.9%) and inadequate waste management (8.4%).

### 2) Social privation and the link to the environment

The link between poverty and the environment is very explicit in the Panamanian MPI. One dimension, in fact, is called "Environment and sanitation." Two of the four indicators in this dimension are environmental. On the one hand, inadequate waste management results in environmental pollution and creates health risks. While damage to homes caused by natural phenomena is similar to indicators that other countries are adopting, such as El Salvador and the Dominican Republic. The thresholds for these indicators are defined as follows:

- Damage to homes by natural phenomena: a home that has suffered damages caused by floods, landslides, tidal flooding, strong winds, drought or other natural phenomena is considered in a situation of privation.
- Inadequate waste management: in urban areas, the inhabitants of a household are considered in a situation of privation if waste is incinerated or disposed of in a vacant lot, river, stream, lake or the sea, or simply buried. In rural areas, the same criteria apply, with the exception of burying waste.

Inadequate waste management is the indicator with the highest incidence: 13.9% of the population is multidimensionally poor and experiences this privation. In the case of damage to homes due to natural phenomena, the incidence is only 3.3%. As mentioned above, inadequate waste management is one of the indicators that contributes the most to total poverty in Panama (8.4%), while the damage to homes indicator accounts for 2.0%.

Figure 12: Percentage of the population living in poverty and in privation with respect to the environment and sanitation dimension


Source: MEF (2017)

In the Emberá, Ngäbe Buglé and Guna Yala indigenous districts, where the incidence of poverty is much higher than in the rest of the country, inadequate waste management accounts for 11%, 9.4% and 8.4%, respectively. However, in the Darién, Veraguas, Panamá Oeste, Chiriqui, Herrera and Los Santos areas, inadequate waste management is the third indicator with the greatest contribution to poverty, attaining 11.9% in Los Santos. In Coclé, it is the fourth indicator, accounting for 10.6%, and only in Panama and Colón is inadequate waste management not among the five main indicators.

### 3) Conclusion

In addition to having developed its MPI is a record time, Panama has demonstrated innovation in a number of important ways. Among them is considering Internet access among the basic services for households and including it as an indicator. Another novel indicator is access to roads, which was considered important, based on the consultations that were carried out throughout the country. The incorporation of environmental variables is also an effort worthy of recognition, principally because one of the dimensions is the environment, and three indicators were included.

Moreover, one of the advantages of the Panamanian MPI is that it is representative at the provincial and district level. For most provinces and districts, inadequate waste management is a relevant indicator. Furthermore, it would be expected that the state strengthen its policies on the collection and management of solid waste, including the separation of waste for recycling.

Finally, the indicator of home damage due to natural phenomena, although not one of the indicators with the highest incidence, is very relevant in the context of climate change. Panama is fortunate not to be in the hurricane belt, but it does have very high levels of annual precipitation and periods of increasingly recurrent drought, so it will be important to monitor the evolution of

this indicator in the coming years, especially considering that the survey to calculate the MPI is conducted annually. Finally, this indicator also helps to raise awareness on the issue, contributing to a more resilient society.

## 6. STEPS TO APPLY THE ALKIRE-FOSTER POVERTY MEASUREMENT METHODOLOGY WITH ENVIRONMENTAL VARIABLES

In this document, we have discussed the theoretical aspects of incorporating environmental variables in multidimensional poverty measurements, and five case studies have been analyzed that demonstrate different and practical ways of approaching this task. In this section, we present our adaptation of the steps to create a multidimensional poverty index, for which OPHI recommends the application of the Alkire-Foster methodology (2007)[17] and, in conjunction, the incorporation of environmental variables.

### Step zero: map available information

This is an additional step, prior to the standard twelve steps for the creation of an MPI. It is probably something that has to be done at any rate, even if one is not considering incorporating environmental variables in the multidimensional poverty measurement. However, since the compatibility of the information on environmental and social variables is key to successfully measuring poverty with environmental associations, it is important to review part of what was discussed in section 3. To this end, the mapping of environmental information should consider:

i. Conceptual, representational and computational compatibility.

ii. Type of association of environmental information: livelihoods, environmental health or vulnerability.

   a. If environmental information is linked to livelihoods, it will be necessary to determine if this refers to material means, institutional means or capabilities.

   b. If the environmental information is linked to environmental health, it will be important to identify if it refers to aspects within the home, the workplace or the external environment.

   c. If environmental information is linked to vulnerability, it will be necessary to distinguish between exposure, capacity to cope and adaptation capacity.

[17] The original English version of the twelve steps can be found on the OPHI website: http://www.ophi.org.uk/research/multidimensional-poverty/how-to-apply-alkire-foster/. The OPHI portal has a series of educational resources available, free to the public, at: http://www.ophi.org.uk/resources/online-training-portal/.

iii. Information source: household survey, georeferenced information etc.

In the case of Mexico, for example, information on the presence of a chimney inside houses that use wood or charcoal for cooking is linked to environmental health. In the case of Chile, the sources of contamination are external, but are also linked to environmental health. For El Salvador, the link is to vulnerability, mainly due to exposure to natural disasters and extreme climate events. The Dominican Republic and Panama have indicators related to both environmental health and vulnerability to climate events. In all five cases, the information source is the household survey.

### Step 1: select dimensions

There are at least five different ways to select the dimensions that will be part of a multidimensional poverty index:

i. Participatory, deliberative exercises, such as the one that was carried out in El Salvador at the initiative of UNDP and which led to the incorporation of housing quality and the exposure to environmental degradation and risk indicator. In Panama, a consultation process was also carried out in all the provinces and districts. Similar alternatives are surveys on people's views on poverty, such as the Voices of the Poor project (Narayan *et. al.*, 2000).

ii. A list that has garnered a certain degree of legitimacy through public consensus. Good examples of this are the Sustainable Development Goals or national development plans. In the case of Mexico, the dimensions are underscored by the General Law of Social Development.

iii. Consensus from a panel. Chile created the Presidential Advisory Commission of Experts to undertake the challenge of developing a multidimensional poverty measurement, based on studies, empirical evidence and expert opinions, among other inputs. In the Dominican Republic, an inter-institutional consensus was also achieved, with the participation of government agencies, international organizations and the University of Oxford.

iv. Implicit or explicit assumptions about what people value or should value. Sometimes these assumptions are based on theories about well-being and adhere to some convention or school of thought. Sometimes, they are informed assumptions on the part of the researcher or authority.

v. Consensus on the database of available information with the required characteristics.

The above options are not mutually exclusive. That is, following one procedure does not imply that another cannot also be followed in a complementary manner. In fact, these procedures often overlap, follow an order, or are performed in parallel. In the end, everyone should consider the available information, the sources of statistical information and their frequency, representativeness etc.

### Step 2: select the unit of analysis

The unit of analysis is commonly the individual or household, but it could also be a community or region, including institutions such as schools or clinics, although a poverty measurement using this type of unit of analysis would have very unique characteristics. Nonetheless, being open to the possibility of using units of analysis other than the individual or household may provide a window of opportunity. Clearly, this is a question that requires further investigation. Of the cases studied, only Mexico uses the individual as the unit of analysis, while the rest of the countries studies use the household.

### Step 3: select the indicators

Indicators are chosen for each dimension according to the principles of accuracy and economy. The principle of accuracy refers to the capacity of the indicator to describe the phenomenon in question and provide inputs for public policies. The principle of economy implies that simplicity is preferred over complexity, so if you have several indicators that describe the same phenomenon, one will have to be selected for the index. In other words, indicator redundancy should be minimized. There are statistical tests that can help in this regard, such as the one that was used in Panama.

Mexico's environmental indicator, within the basic household services dimension, is whether households that use firewood or coal have a chimney. In the case of Chile, the dimension is housing and environment, within which there is an indicator for environment. This indicator has three components, of which only one is environmental: the presence of some type of contamination. In the case of El Salvador, the indicator is exposure to environmental degradation and risk, within the housing quality dimension. In the Dominican Republic, there are proximity to pollution sources and proximity to sources of danger indicators within the housing and environment dimension. In the case of Panama, the damage to homes due to natural phenomena and inadequate waste management indicators are within the environment and sanitation dimension.

### Step 4: establish thresholds for indicators

The threshold is the limit of privation for each indicator. This step establishes the first cut-off point in the methodology. Each person can be identified with the presence or absence of privation in each indicator. For example, if the dimension is education: How many years of schooling do you have?, '6 years or more' could identify the absence of privation, while '0-5 years' could identify the presence of privation in the indicator. Poverty thresholds can be tested to determine their robustness, or measurements may employ multiple sets of thresholds to determine different types of poverty. Common examples of this are monetary poverty lines, where one level is generally established for moderate poverty and another for extreme poverty.

In the case of the Mexican indicator, the threshold is binary. Households that cook with wood or charcoal are deemed in privation or not by the absence or presence of a chimney. The threshold for the indicator in Chile is a bit more complex. It includes seven causes of contamination and the threshold requires that the household report the frequency of two of them as "always" (see Figure 6). Panama considers waste management inadequate in urban areas if waste is incinerated or burned, deposited in a vacant lot, river, stream, lake or the sea, or if the waste is buried. In rural areas they apply the same criteria, with the exception of burying waste.

In the case of El Salvador, the threshold of the environmental indicator is whether, in the last year, the home suffered damage due to flood, landslide, avalanche or watercourse, and if it is exposed to risk of erosion damage. In Panama, this same indicator does not include exposure to landslides, while the Dominican Republic only considers proximity to sources of danger up to half a kilometer away.

### Step 5: apply privation thresholds

In this step, the indicator becomes binary, that is, it has a value of one if the person or household experiences privation, and a value of zero if they do not. To illustrate the process, let's assume there are three people: Maria, Carla and Sandra. Let's assume there are three indicators similar to those we saw in the cases analyzed above, using the Mexican parameters for pollution in the household, the Chilean one for pollution in the environment and the Salvadoran one for vulnerability.

| Individual | Contamination in the home (CH) | Contamination in the environment (CE) | Vulnerability (V) |
|---|---|---|---|
| Maria | Cooks with wood without a chimney | Frequently there is waste and annoying noise | Her home suffered flood damage two years ago |
| Carla | Cooks with gas | There is always garbage, pests (rodents) and smoke | Her home was damaged in a recent earthquake |
| Sandra | Cooks with charcoal without a chimney | The tap water is always dirty | Her home is in a ravine |

Thus, Maria experiences contamination privation in her home because she does not have a chimney and cooks with wood, but she does not experience any of the other two privations because, although there is often garbage and noise, the frequency reported is not "always." Her home also suffered flood damage, but it was more than a year ago.

Carla, on the other hand, cooks with gas, so there is no privation with regard to contamination in the home, but there is privation with regard to the environment, since there is "always" garbage, pests (rodents etc.) and smoke near her house. She does not experience

privation with regard to environmental vulnerability because, even though her house suffered damages in a recent earthquake, damages caused by earthquakes are not considered in the indicator.

Finally, Sandra cooks with charcoal and does not have a chimney, so there is privation with regard to air pollution inside the home. Although her tap water is dirty, the contamination in the environment threshold determines the presence of two sources of contamination to be considered experiencing privation. However, her home is situated in the lower part of a ravine, so it is at risk of landslide from erosion. When applying the privation thresholds, the privation matrix is as follows:

| Individual | Contamination in the home (CH) | Contamination in the environment CE) | Vulnerability (V) |
|---|---|---|---|
| Maria | 1 | 0 | 0 |
| Carla | 0 | 1 | 0 |
| Sandra | 1 | 0 | 1 |

### Step 6: adjust the weights

It is often assumed that the dimensions have the same weight in a multidimensional poverty index and, similarly, that the indicators have the same weight within each dimension. This is how the weights are assigned, for example, in El Salvador, where each dimension has a weight of 20% and each indicator a weight of 5%. In Panama, each dimension also has a weight of 20%, but three of the dimensions have three indicators and two have four indicators, so some indicators have a weight of 6.6% and others 5%. Something similar occurs in the Dominican Republic index, where the five dimensions have the same weight (20%), but within them it depends on the number of indicators. The case of Chile is different, since there are four dimensions that have a weight of 22.5% and another one with a weight of 10%. In the case of Mexico, income implicitly has a weight of 50%.

There is no golden rule for assigning weights to dimensions and indicators.[18] However, there are two requirements that must be met. The first is that all dimensions and all indicators must have a positive weight. A weight of zero completely voids the dimension or the indicator. A negative relative weight would imply that it is a privation that, in the aggregate, reduces poverty,

[18] For more references on the methods to assign relative weight to dimensions and indicators, consult Alkire *et. al.* (2015). You can also find more information at:
http://www.ophi.org.uk/resources/ophi-working-papers/#ophiwp26
http://www.ophi.org.uk/weighting-in-multidimensional-poverty-measures-26-27-may-2008/

which is a contradiction. The second requirement is that the relative weights of all dimensions and indicators must add up to one, if we are considering proportions, or 100%, if referring to percentages.

### Step 7: count the number of privations for each person

Once the relative weights of the dimensions and indicators have been determined, the number of privations for each person must be counted. Using the illustrative example above, let's assume that it was decided that contamination in the home has a weight of 50%, while contamination in the environment and vulnerability each have a weight of 25%. The sum of the privations can be seen in the last column.

| Individual | Contamination in the home (CH) | Contamination in the environment (CE) | Vulnerability (V) | Total |
|---|---|---|---|---|
| Maria | 0.5 | 0 | 0 | 0.5 |
| Carla | 0 | 0.25 | 0 | 0.25 |
| Sandra | 0.5 | 0 | 0.25 | 0.75 |

### Step 8: establish the poverty threshold, *cutoff k.*

The poverty threshold is the percentage or number of privations that a person or household must experience to be considered poor. In the case of Chile, for example, the poverty threshold is 22.5%, or privation in one of the first four dimensions. In the case of El Salvador, the poverty line is 35% privation, equivalent to seven of the twenty indicators. In Panama it is 30% and in the Dominican Republic it is 33.3%. In the case of Mexico, the methodology is a little different. For a person to be considered living in poverty, they must have an income below the well-being line and have at least one social privation. Although the Mexican index does not make the percentages explicit, if income implicitly has a relative weight of 50%, this means that the poverty line for Mexico is, implicitly, greater than 50%. In this case, if a person experiences privation in the six social indicators, but does not have an income below the well-being line, they are not considered poor.[19]

[19] The Alkire-Foster methodology is based, to a large extent, on the counting approach of Tony Atkinson (2003). This approach demonstrates two extremes, in terms of counting. When only one dimension or indicator is required to be considered living in poverty, it is called union. However, when it is required that the person experience privation in all dimensions to be considered living in poverty, it is called intersection. The cutoff "k" is, generally, an intermediate threshold between union and intersection.

### Step 9: apply the poverty threshold, *cutoff k.*

Let us suppose, for the example, that it has been determined that the poverty threshold is 1/3, or 33% privation. If the indicators had the same weight, the three people in our example would have to be considered poor. But, with relative weights, Carla has a 25% privation count, so she cannot be considered poor.

| Adjusted matrix | | | | | | | |
|---|---|---|---|---|---|---|---|
| Individual | Total | Poor | | Individual | Contamination in the home (CH) | Contamination in the environment (CE) | **Vulnerability (V)** |
| Maria | 0.5 | Yes | | **M** | 0.5 | 0 | 0 |
| Carla | 0.25 | No | | **C** | 0 | 0 | 0 |
| Sandra | 0.75 | Yes | | **S** | 0.5 | 0 | 0.25 |

The privations of the non-poor are substituted by zeros in the adjusted matrix, to center the analysis on the poor and on the dimensions in privation. Thus, in the adjusted matrix, Carla does not experience any privation.

### Step 10: calculate the incidence, *H*

The number of poor people is divided by the total population, also known as the percentage of the multidimensionally poor. In Mexico, it is 46.2%, in Chile, 20.9%, in Panama, 9.1% and in El Salvador, 35.2%. These figures are not comparable to each other, as their dimensions, indicators and thresholds are different. National poverty measurements serve, mainly, to provide a portrait of the country, and the ability to compare the results over time. There are other measurements that are intended to allow for international comparisons, such as the UNDP Global MPI, calculated for more than 100 countries and reported annually in the Human Development Report.

In the example, when $k$ = 1/3, the incidence is simply the proportion of people who are poor, Maria and Sandra, $H$ = 2/3 = 66.6%. The incidence $H$ is a useful measurement, very easy to understand, and probably the one that is most often used. However, it does not increase if the poor suffer more privation, nor can it be disaggregated by dimension to analyze how poverty differs between groups. For this, there are two other indicators in the Alkire-Foster methodology.

### Step 11: calculate the average poverty gap or intensity, *A*

The intensity *A* is the weighted sum of the privations of the poor among the total number of poor people. From the adjusted matrix we add 0.5 + 0.5 + 0.25 to arrive at a figure of 1.25, which is divided by the number of poor people, 2 in this case. Thus, the intensity of poverty is 0.625 or, as a fraction, 5/8.

### Step 12: calculate the adjusted incidence, $M_0$.

The adjusted incidence, according to the Alkire-Foster methodology, is what the multidimensional poverty index is. Quite simply, $M_0$ is calculated as the weighted sum of the privations of the poor, among the total population.

In our example it would be: (0.5 + 0.5 + 0.25) / 3 = 5/12 = 0.416. Intuitively, the adjusted incidence is the product of the incidence by intensity, that is, it can also be calculated as *H* times *A*, which, in the example, would be *HA* = (2/3) x (5/8) = 5/12 or, in decimals, 0.416.

## 7. CONCLUSIONS

Multidimensional poverty measurements contribute to a deeper and more precise analysis of a population, in an exercise of transparency and accountability, which allows for the elaboration of more coherent and effective public policies, thus contributing to the efficiency of public actions to reduce poverty. It also offers empirical evidence about an immense set of variables, at a population and territorial level, their privations and the associations between different phenomena. Additionally, the elaboration process, if carried out in a participatory manner, strengthens dialogue and social consensus at the national level.

Latin America and the Caribbean have demonstrated strong leadership in the development of MPIs, with Mexico and Colombia as pioneers in the adoption of national multidimensional poverty measurements, while progressively incorporating the environmental dimension in these methodologies and measurements. Although the case studies are limited in the region, there are already concrete examples of integrating environmental considerations in multidimensional poverty measurement systems. Proof of this are the advances in Chile, Panama and the Dominican Republic in this regard.

The above examples show that the incorporation of environmental dimensions and indicators in multidimensional poverty measurement systems is not only possible, but also necessary. All countries that are in the process of developing their national multidimensional poverty indices have the opportunity to draw on these experiences to incorporate relevant environmental indicators into their respective methodologies.

For countries that already have national MPIs, but have not incorporated the environmental dimension, it is time to think about the future. When the time comes to review methods, it should be seen as an opportunity to integrate the environmental dimension in a more systematic and explicit manner, drawing on these experiences. In the case of Mexico, for example, which has had an MPI since 2008, the indicators can only be modified every 10 years, so the time to make changes is quickly approaching.

The analysis of the case studies demonstrates that some environmental indicators have been widely accepted, either explicitly as environmental indicators or as related to household conditions, such as access to clean drinking water or improved sanitation or the use of fossil fuels for cooking, while others, such as access to adequate waste management, appear to be progressively incorporated into measurements in the region.

Additionally, this process encourages the study and introduction of new environmental indicators related to natural disasters and extreme climate events. This is the case of the Dominican Republic, whose household survey already includes questions related to proximity to pollution and danger sources, abandonment of the home due to severe natural phenomena and

the duration. This opens the door to their incorporation in future MPIs of countries vulnerable to natural disasters and climate change and to a deeper understanding of the associations between prevention and early warning systems, social protection and environmental vulnerability.

However, there is still a long road ahead. To date, for example, there has not been a multidimensional poverty measurement that incorporates variables or environmental indicators with respect to livelihoods, even though it has been observed that one of the closest links between poverty and the environment is the high degree of dependence of the population living in poverty on natural resources, ecosystems and the environmental services they provide. Integrating this link into multidimensional poverty measurement systems in a coherent manner may be a methodological challenge.

Livelihoods, as a central theme in the link between poverty and the environment, is a fertile ground for government intervention via different strategies for a sustainable way out of poverty. To this end, the work that the Poverty-Environment Initiative is carrying out in Latin America in the area of social protection and the environment is a good starting point for the identification of indicators and variables that can be incorporated into multidimensional poverty measurements, as part of the goal of developing more coherent public policies (PEI, 2017). It is an area that merits further study.

Another area that merits further investigation is environmental health in the home and workplace. Employment in the areas of garbage collection, mining, maintenance of sewage systems, certain types of industries and workshops, to name just a few, expose workers to toxic substances and pollutants that are detrimental to health. As these indicators are made visible, it will be easier to take measures to prevent or mitigate these risks. Incorporating environmental indicators into the livelihood dimension is one way to make this link visible.

With respect to incorporating environmental variables into multidimensional poverty measurements, especially when the information comes from a source other than household surveys, much remains to be explored in the region and the rest of the world. The use of georeferenced environmental indicators looks promising, although some administrative battles will surely have to be fought to merge different databases and, at the same time, guarantee the confidentiality of statistical information.

In methodological terms, most of the cases reviewed in this document use information from household surveys that were modified, at some point, to provide the necessary information to estimate all their multidimensional poverty indicators: in Mexico, they created the Socioeconomic Conditions Module of the Household Income and Expenditure Survey for the 2008 index and, since then, it has been the data source used for the measurements carried out by CONEVAL; in Chile, the National Socioeconomic Characterization Survey was modified, which allowed for the incorporation of the environment indicator, and in El Salvador and Panama, a similar situation occurred with the Multiple Purpose Household Survey; and, in the Dominican Republic, a module called "Risk of natural phenomena and environmental pollution" was added to

the household survey. Thus, the experience in the region is strengthened by the modification or adaptation of household surveys, or other similar questionnaires.

The process of adapting household surveys for the elaboration of the various national MPIs has also led to the inclusion of new non-environmental variables in the surveys, contributing dimensions that, until recently, had not been taken into account in multidimensional analyses. Thus, new indicators, such as access to the Internet, public spaces for leisure, the incidence of crime, restrictions due to inadequate security or poor access to or state of means of communication have become multidimensional poverty indicators in different countries, contributing to the generation of accurate data in these new areas, allowing for more insight in the analysis of the phenomenon of multidimensional poverty, as well as allowing for the elaboration of public policies that are better coordinated and more comprehensive and precise.

Finally, in the region, national registries of beneficiaries have recently been developed, such as SIUBEN in the Dominican Republic and RUP-CENISS in Honduras. These systems offer enormous potential for monitoring socioeconomic indicators and could be used to incorporate environmental variables that make the links more explicit between beneficiaries of social programs, their environment and environmental management. There is also considerable potential for the association of public policies with components of environmental sustainability, especially in the interventions aimed at the population living in poverty.

Multidimensional poverty measurement facilitates the adoption of holistic perspectives for the solution of contemporary problems. A multidimensional vision is fundamental to break silos and overcome fragmented and disjointed strategies to increase the effectiveness and efficiency of government actions.

This holistic vision is aligned with the 2030 Agenda for Sustainable Development, which requires the development of better tools for planning, instrumentation, monitoring and evaluation for its advancement. In order to achieve the SDGs, it is essential that, in the paradigm shift that accompanies the adoption of multidimensional poverty measurements, the environmental dimension be integrated in a coherent and systematic way.

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## 8. ANNEX 1. TABLE OF NATIONAL PMIs IN LATIN AMERICA AND THE CARIBBEAN AND INTEGRATION OF THE ENVIRONMENTAL DIMENSION

| Country | Integration of environmental dimensions | Environmental variables included |
|---|---|---|
| **Chile** | Yes | Chile's MPI has recently been updated to specifically include environmental variables that have already been incorporated in the CASEN survey:<br>• Air pollution<br>• Noise pollution<br>• Water pollution<br>• Visual pollution<br>• Waste in public areas<br>• Pests (rodents etc.) |
| **Colombia** | Not specifically | The Colombian MPI incorporates some indicators in the dimension "Public services for households" and "Housing conditions" that could be considered environmental. |
| **Costa Rica** | Not specifically | The Costa Rican MPI incorporates "Health" within the dimension and includes indicators for water, waste and health services. |
| **Ecuador** | Yes | The Ecuadorean MPI has a dimension called "Habitat, housing and healthy environment" in which 3 indicators are included: access to water sources, sewage disposal systems and overcrowding. |
| **El Salvador** | Yes | Under the "Environment" dimension of El Salvador's MPI there is a module for exposure to environmental damage and risk: "the home is in a situation of privation if, in the last year, it has suffered damages due to flood, landslide, avalanche or watercourse, or if it is at risk of damage due to erosion." |

| | | |
|---|---|---|
| **Honduras** | Not specifically | The MPI of Honduras contains the dimensions of health, education, work and housing. Currently, the health dimension incorporates indicators for access to an adequate water system, access to adequate sanitation and the type of fuel used for cooking. |
| **Mexico** | Not specifically | Within the dimension "Basic services for the household" the Mexican MPI incorporates indicators such as the use of firewood or coal and presence of a chimney (related to pollution and health), as well as access to water and basic health services. |
| **Panama** | Yes | The Panamanian MPI contains 5 dimensions of equal weight: education, housing, basic services and access to Internet, environment and sanitation and work and health, each with a weight of 20%. The "Environment and sanitation" dimension includes 4 specific indicators: damage to homes due to natural phenomena, access to or condition of roads, inadequate waste management and lack of improved sanitation. Other indicators traditionally considered "environmental," such as housing materials and access to improved water sources are considered under the dimensions of housing and health. |
| **Dominican Republic** | There is an explicit link between poverty and the environment within the "housing and environment" dimension. | Within the dimension "Housing and environment" of the MPI of the Dominican Republic there are indicators referring to electricity and type of cooking fuel, overcrowding, water and sanitation and housing materials. It also introduces indicators of a more novel nature: proximity to any type of pollution source (with a distinction between the urban and rural areas) and the proximity to sources of environmental risk (stream, ravine, lagoon, watercourse, sea coast, landslide or erosion zone, dry or deviated river bed). |

European Union


Norwegian Ministry of Foreign Affairs


Spanish Ministry of Foreign Affairs and Cooperation


Swedish International Development Cooperation


UK Department for International Development