Evidence-based Policy Design in Colombia:

An Empirical Study of Environmental Interventions and Outcomes in Latin America

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Laura Chen is a graduate student and researcher in Public Policy at UC-Berkeley. Her policy interests include methodology, international development, sustainability, and social policy. She is a strong advocate for community-led development, from the process of design to the evaluation of key indicators for success. Prior to her academic career at the Goldman School, she worked in capacity-building and internal strategy for the World Resources Institute (Washington, DC), as a management consultant for Huron Consulting Group (Chicago, IL), and as a Programs Director for Amaanah Refugee Services (Houston, TX). She holds a degree in Marketing from the University of Texas, Austin and studied Arabic Language and Literature at the University of Alexandria, Egypt. A lover of languages, she speaks English, Mandarin, Arabic (MSA, Egyptian and Jordanian dialects), and conversational Spanish.

Jackson Lee is a graduate student at Goldman School of Public Policy at the University of California, Berkeley. His primary policy focus is international development with an emphasis on grassroots and community lead change. His previous work includes roles at an international humanitarian organization, a nonprofit contractor on a USAID education project in Afghanistan, and a funder for locally led NGOs. He holds a BA in Public Policy and Spanish from Duke University.

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ABBREVIATIONS AND KEY TERMS

Absolute Gaps: There is no evidence on the impacts of a particular policy upon the population of interest

3ie: International Initiative for Impact Evaluation

DNP: Departamento Nacional de Planeación, the National Planning Department of Colombia

DIME: Development Impact Evaluation

Disaster Management Outcomes: Outcomes in this category reflect the capabilities (pre and post) of communities, states and individuals to eliminate the negative shocks of hazardous events not to compromise the long-term development prospects

EGM: Evidence Gap Map, an evidence-based method of policy analysis created by 3ie

Economic Outcomes: Outcomes in this category reflect changes in economic indicators at individual and community level such as household income through interventions that improve agriculture productivity, cash transfers, incentives, etc.

Environmental Outcomes: Outcomes related to greenhouse gas emissions, including proxies such as forest condition and coverage, as well as more direct measures of emissions

GHG: Greenhouse gases

GSPP: Goldman School of Public Policy, University of California - Berkeley

J-PAL: The Abdul Latif Jameel Poverty Action Lab

LATAM: Latin American, referring to countries in the Latin American region

PICOS: Population, interventions, comparators, outcomes, and study design. Typically used as a studies screener for inclusion and exclusion criteria.

ToC: Theory of Change

RESUMEN EJECUTIVO (En Español)

Estudiantes de posgrado del *Goldman School of Public Policy* (Escuela de Política Pública Goldman o GSPP) en colaboración con el Departamento Nacional de Planeación (DNP) de Colombia, desarrollaron un *Evidence Gap Map* (Mapa de Brechas de Evidencia o EGM), con el objetivo de apoyar a la nueva administración en el desarrollo de políticas públicas basadas en evidencia. El propósito de este EGM es informar a la nueva administración acerca de políticas relevantes del sector ambiental y aumentar la transparencia y responsabilidad gubernamental durante el periodo de transición.

Los EGM representan una colección visual de evidencia, capaz de ilustrar los efectos de los programas gubernamentales y otras intervenciones, que hayan sido implementados dentro de un área temática específica. De una manera gráfica, los EGM permiten presentar una cantidad significativa de evidencia, estos incluyen típicamente tanto revisiones sistemáticas como evaluaciones de impacto y se encuentran estructurados en torno a un marco de intervenciones, (identificadas durante el proceso de desarrollo), y variables de resultado observadas en estudios relevantes. El análisis y desarrollo del EGM se realizó utilizando la metodología del *International Initiative for Impact Evaluation- 3ie* (Iniciativa Internacional para Evaluaciones de Impacto), la cual se constituye como una organización internacional no gubernamental que promueve políticas y programas de desarrollo basados en evidencia.

La estructura del EGM se encuentra soportada en: la Teoría De Cambio (*Theory of Change*), la literatura académica y las diferentes consultas que se llevaron a cabo de manera regular con líderes del DNP. Con el objetivo de crear el EGM, nuestro equipo realizó en primer lugar una búsqueda sistemática de evidencia y en segundo lugar utilizó una herramienta de inclusión de estudios. Inicialmente identificamos 54 estudios con intervenciones enfocadas en la región de América Latina. Todos los estudios que fueron identificados pertenecen al sector ambiental y fueron publicados después del año 2000.

Utilizamos la herramienta de inclusión, también conocida como PICOS (población, intervenciones, comparadores, resultados, y diseños de estudio) para filtrar la literatura, reduciendo la muestra final a un total de 36 documentos, los cuales aparecen en la visualización del EGM. Nos enfocamos específicamente en intervenciones relacionadas con programas de subsidio, cambios de comportamiento y/o conocimiento, arreglos institucionales, programas de incentivos y gestiones relacionadas a la protección de áreas ambientales. Nos enfocamos en resultados de carácter económico, ambiental y de gestión de desastres y emergencias.

Resultados Principales

Nuestro EGM presenta hallazgos importantes para diferentes actores, como investigadores y tomadores de decisiones. El análisis de nuestros resultados presenta una base concreta de evidencia que nos permite corroborar y validar los vínculos causales desarrollados en nuestra Teoría de Cambio. Asimismo, este EGM permite identificar la falta de evidencia y estudios realizados en áreas específicas. En cuanto a los resultados observados, el EGM nos ayudó a visualizar una gran cantidad de estudios acerca de intervenciones relacionadas con el establecimiento y gestión de zonas ambientales protegidas. También pudimos observar una cantidad abundante de estudios relacionados con intervenciones asociadas a arreglos institucionales (particularmente en el área de capacitación de gestión de desastres y emergencias). Este resultado en particular se preveía desde el inicio del ejercicio, debido a la prioridad política que los legisladores y políticos de Colombia le han dado a esta área, así como el alto nivel de riesgo que existe en el país en cuanto a riesgos ambientales. La mayoría de los estudios introducidos en nuestro EGM son estudios de evaluación de impacto, con una minoría de estudios cualitativos y revisiones sistemáticas.

Adicionalmente, este mapa revela la poca evidencia que existe en intervenciones asociadas a incentivos, participación de la comunidad local en temas relacionados a recursos naturales y pago directo para servicios de ecosistema. También observamos poca o ningún tipo

de evidencia en intervenciones relacionadas con la reducción de carbono, rendimiento agrícola, gases de efecto de invernadero, y manejo de tierra de manera sostenible.

A pesar de que el enfoque de este mapa está limitado a ciertos estudios en el tema ambiental, el EGM que se presenta en este reporte y sus resultados proveen una herramienta práctica para el DNP durante el proceso de planificación y desarrollo de políticas públicas. Estos resultados representan una oportunidad para mejorar prácticas ambientales en Colombia y aumentar la transparencia y responsabilidad gubernamental durante el desarrollo de políticas.

EXECUTIVE SUMMARY (In English)

In light of the upcoming presidential election of 2018, the Departamento Nacional de Planeación of Colombia (DNP, or National Planning Department) partnered with graduate students from the Goldman School of Public Policy (GSPP) to develop an Evidence Gap Map (EGM). The purpose of the EGM is to inform the incoming administration of policy priorities for the presidential transition of 2018 and to increase government transparency and accountability.

Evidence Gap Maps are visual collections of evidence-based outcomes that illustrate the effects of programs and policies within a particular thematic area. Using a graphical display to present systematic reviews, impact evaluations, and other relevant studies. EGMs are structured around a framework based on identified interventions and observed outcomes. The analysis was conducted using 3ie methodology. 3ie, the International Initiative for Impact Evaluation, acts as international grant-making non-government organization that promotes evidence-informed development policies and programmes.

The framework for the EGM was informed by our developed Theory of Change, academic literature, and regular consultations with key stakeholders in the DNP. Using a systematic search and a screening tool, we identified 54 studies with interventions done in the Latin American region pertaining broadly to the environmental sector. We narrowed down to 36 studies by focusing on impact evaluations, systematic reviews, and case studies that followed our developed PICOS (population, interventions, comparators, outcomes, and study design) criteria. We focused on interventions related to subsidies, knowledge and/or behavioral changes, institutional arrangements, incentives, and area management and protection and identified observed environmental, economic, and disaster management outcomes.

Main findings

Our developed EGM has important findings for researchers and policymakers in Colombia. Results from the analysis formed an evidence base that validated some of the causal links in the theory of change while demonstrating a lack of evidence in others. We observed a heavy focus on interventions targeting bio-diverse area protection and management and interventions related to government subsidies which includes investment grants and conditional cash transfer (CCT). We also observed a large number of studies of interventions related to institutional arrangements, particularly as they referred to disaster management capabilities. This is not surprising, given policymakers' interest in these issues and Colombia's increased risk of earthquakes and volcanic eruptions. The majority of studies focused on the Latin American region and most studies identified were impact evaluation studies.

This map also reveals fewer evidence in interventions related to incentives, community involvement for natural resource management, and payment for ecosystem services. We also observed absolute gaps where no evidence was found. Little to no evidence was observed for interventions that had an outcome in carbon storage and sequestration, yield, sustainable land management and conservation, and greenhouse gas emissions.

While limited in scope, this EGM and report should serve as a practical tool for the DNP during the preliminary steps of the policy planning process. These results should yield not just improvements environmental outcomes for Colombia, but lasting impacts for the globally interconnected natural world.

INTRODUCTION

This report presents the development of an Evidence Gap Map within the environmental interventions in Latin America (LATAM), identifies major relevant areas that evidence suggest policymakers should prioritize, and finally, offers policy recommendations based on identified research findings.

Background on the Departamento Nacional de Planeación (DNP)

The Departamento Nacional de Planeación of Colombia (DNP, or National Planning Department) partnered with graduate students from the Goldman School of Public Policy (GSPP) to develop an Evidence Gap Map. The purpose of the Evidence Gap Map is to inform the incoming administration of policy priorities for the presidential transition of 2018 and to increase government transparency and accountability. The DNP is an administrative department that belongs to the executive branch of the government and directly reports to the President of the Republic of Colombia. The DNP is in charge of developing, leading, and coordinating services that directly and adequately inform decision-making in Colombia. The main goal of the DNP is to provide technical assistance to promote strategic implementation and development of policies and initiatives across the social, economic and environmental sector.

Overview of Evidence Gap Maps (EGMs)

Evidence Gap Maps (EGMs) are visual collections of evidence-based outcomes that illustrate the effects of programs and policies within a particular thematic area. Using a graphical display to present systematic reviews, impact evaluations, and other relevant studies. EGMs are structured around a framework based on identified interventions and observed outcomes. These maps are a powerful tool for policymakers, as they highlight the availability and characteristics of existing evidence in an accessible and straightforward way. Please note that as of the writing of this report [May, 2018], no international accepted definition or methodology has been established

for EGMs. Therefore, this report uses the International Initiative for Impact Evaluation (3ie) methodology to development the EGM, as 3ie is a leading organization in this field and has created a methodology widely used in standard practice.

Report Structure

This report is structured in the following way:

- Introduction: presents the key stakeholders and overview of evidence gap maps;
- Project Objectives: presents the project goals and motivation;
- Methodology: presents the search strategy, defines the population criteria, introduces the categories of studies introduced, and addresses the limitations of the approach;
- Theory of Change: introduces the theory of change, its assumptions, and defines all identified interventions and outcomes;
- Findings: introduces the evidence gap map and summarizes key observed trends, gaps and major takeaways from the analysis;
- Policy Recommendations: discusses key recommendations based on analysis above;
- Conclusions: concludes and discusses the overarching implications for policy, program implementation, and research.

PROJECT OBJECTIVES

Goals

The goals of this report are to:

- Identify existing studies within the environmental sector, prioritizing on systematic reviews, impact evaluations in the LATAM region, and relevant case studies within the country of Colombia;
- Describe the methodology used in the analysis;
- Define the criteria used to categorizing the data;
- Present the EGM developed in the environmental sector;
- Analyze the types of interventions and outcomes observed for each study using the 3ie methodology for EGMs;
- Provide policy recommendations within the environmental sector for policymakers in Colombia, as based on the evidence of identified studies.

Motivation

This fall, Colombia will transition to a new presidential administration. In 2015, Colombia made the commitment to introduce evidence-based policy making and implementation to reduce wasteful spending and increase policy effectiveness. In partnership with multiple local and international organizations, the national government of Colombia has prioritized conducting regular assessments of implemented programs. According to the DNP, over 3,000 documents (including evaluations and systematic reviews) chronicle government program efforts and impacts.

However, accessing these files can be very challenging among local policy makers, government representatives, and academics. In the absence of access of information about program operations, outcomes, evaluations, and systematic reviews to demonstrate success, well-established programs are too often discontinued or deprioritized during the transition period to a new administration. This lack of continuance can result in 1) shortage of accountability within

Colombia's policy-making agencies, 2) lost opportunities for citizens who may benefit from these programs, and 3) misalignment of national spending to national priorities.

The use of evidence to inform policy and budget decisions, as well as to guide the implementation of programs in Colombia, can provide an important way to reduce wasteful spending, strengthen institutional accountability, and expand innovative programs. Increasing access to national program operations and outcomes, completed program evaluations, and systematic reviews among policy makers and academics in Colombia will increase transparency, accountability, and empirically sound policy design.

METHODOLOGY

The analysis was conducted using 3ie methodology. 3ie, the International Initiative for Impact Evaluation, acts as international grant-making non-government organization that promotes evidence-informed development policies and programmes. The organization works to provide products and services to improve the quality and transparency of impact evaluations.

3ie Evidence Gap Maps (EGMs) are typically presented using an interactive online platform. However, the EGM presented in this report will be presented in a Microsoft Excel worksheet. This format allows users to work with an offline version and allows for the DNP to develop the design and template that best suits their needs.

Following the 3ie methodology, the EGM analysis and framework matrix was structured around relevant interventions and outcomes associated with the environmental sector in Colombia. The framework was informed by our developed Theory of Change, existing academic literature, and regular consultations with key stakeholders in the DNP. We introduced systematic reviews, impact evaluations, and other relevant studies into the framework according to our findings. This allowed us to identify absolute gaps where no evidence exist.

1. Search Strategy

To identify existing studies within the environmental sector, the Goldman team collaborated with DNP to compile a starting list of repositories and journals of relevant sources. Repositories and sites used during the screening stage included: 3ie, J-PAL, DIME, World Bank, The Cochrane Collaboration (The Cochrane Registry of Trials), Fedesarrollo (Repositorio Institucional), Inter-American Development Bank, the Colombia Ministry of Agriculture (Planeación), the DNP (Programas), and academic thesis from the Universidad de los Andes in Colombia. We used keywords related to the environmental sector (such as “environment”, “disaster management”, “greenhouse gas emissions”, “agricultural interventions”, “agricultural

subsidies", "land management", etc.) in both English and Spanish for our initial screening stage. For our initial screening stage all collected studies focused on the environmental sector, prioritizing on systematic reviews, impact evaluations, and relevant case studies. At the start of the screening process, the GSPP team identified 54 studies pertaining broadly to environmental interventions. Using the developed PICOS (population, interventions, comparators, outcomes, study design; see Appendix 1) all studies were fully assessed to determine which ones would be included in the EGM. At this stage 18 were excluded. The final result yielded 36 studies that were included into the EGM.

2. Population

The population of interest were the communities of both rural and urban areas located in the LATAM region. The studies we included focused on the impacts to these communities with specific environmental interventions. All studies were primarily identified within the context of the Latin American region. There were no exclusions based on gender, race, age, or socioeconomic status.

3. Comparisons

Most of the studies we identified used a comparison group to measure interventions causal effects (see Study Types section below). We included studies that were:

- **Impact evaluations,** which comprised the majority of studies reviewed
- **Systematic reviews**, and
- Some **case studies**, with no comparison analysis, which were included when they were identified as relevant within the Colombian environmental context and provided relevant findings and/or policy recommendations

4. Study Types

Following 3ie methodology, we included impact evaluations and systematic reviews from the LATAM region in our EGM. Additionally, we also included a limited number of case studies

performed in Colombia that we considered to be relevant. Impact evaluations are defined as evaluations that measure the causal change that occurs from a program or intervention. Proper analysis of an intervention requires a counterfactual to determine what the outcomes would have been in the absence of an intervention; these can be conducted through an experimental or quasi-experimental study design. Systematic reviews are a compilation of studies that are reliable and replicable. A systematic review has a clear inclusion and exclusion criteria. Studies populated in the EGM include the following study types:

- Randomized Controlled Trial (RCT)
- Regression Discontinuity Design (RDD)
- Cross-sectional or panel studies with an intervention and comparison group using methods to control for selection bias and confounding (such as propensity score matching (PSM) or other matching methods, instrumental variable estimation, difference-in-differences (DID), or a fixed or random effects model with an interaction term between time and intervention used for baseline)
- Controls before and after study using appropriate methods to control for selection bias and confounding (as just described for cross-sectional or panel studies with an intervention and comparison group)
- Studies explicitly described as systematic reviews
- Qualitative studies conducted in Colombia that provided relevant findings and/or policy recommendations
- Other studies that were relevant for the government of Colombia but do not qualify in any of the studies

5. Limitations and Key Facts

The following limitations are important to consider:

A. **Study Scope:** This EGM covers the very broad category of interventions and outcomes in the environmental sector. This represents a very general area, and therefore the inclusion and consideration of all possible interventions throughout all aspects of the environment was not possible. Within the environmental scope, we focused on studies' ***relevance*** and ***feasibility***.

B. **Study Types:** We identified a number of systematic reviews. However, it is important to note that systematic reviews, as a comprehensive aggregate review of recently published impact evaluations, must be updated with new studies regularly to remain a reliable source of evidence for decision making. For the EGM to be truly effective, the DNP must do regular upkeep and introduce new studies, systematic reviews, and additional published relevant research.

C. **Data Access:** It is important to note that some studies included in the systematic reviews may have also been included as separate studies. However, due to data access limitations, we were unable to point to these studies as we do not have the data disaggregated in a way that would allow us to determine that.

D. **Possibility of Bias:** Since our EGM have a relatively broad inclusion criteria (see Appendix 1) in terms of study design, some impact evaluation designs may have high risk of bias or might be considered too limited on closer inspection.

E. **Case Studies:** A number of relevant case studies and cost benefit analysis studies were identified and included in the EGM. While 3ie EGMs typically exclude qualitative studies and studies that does not include an intervention, we decided to include relevant ones that we consider the DNP would benefit from knowing.

F. **Language Limitations:** The team had a limited capacity to search in Spanish repositories and sources due to the language barrier. While the goal for this EGM was to develop an inclusive framework with all impact evaluations, systematic reviews, and relevant studies

relevant to Colombia, it is likely that some relevant studies may not be included in this report.

THEORY OF CHANGE (ToC)

We hypothesized that environmental management interventions at the local level lead to a positive outcome in forest coverage and condition, biodiversity, resiliency, disaster mitigation, and household income. This theory represents a description of hypothetical linkages informed by a preliminary assessment of existing research in the environmental management sector. The causal link developed can be visually observed in Figure 1.

The inputs for this causal link included government and financial support, human resources, and infrastructure. These factors represent the ecosystem and framework necessary for interventions to have an optimal implementation. Our theory suggests that interventions at the local level, which includes financial government support (e.g. subsidies such as investment grant and conditional cash transfers, ecosystem services payment), training, establishment of protected areas, community natural resource management, providing disaster management capabilities (e.g. equipment, infrastructure, protocols) leads to a number of positive outputs. These outcomes include an increase in sustainable practices and appropriate technology in the agricultural and environmental sector, which in turns results in an increase in carbon storage and sequestration. Additionally, we predict that a number of interventions result in sustainable land management and conservation, an increase in agricultural yield, and an overall better response in the event of disaster.

In the long term, we expect these investments in local management to yield positive impact in forest coverage and condition, a reduction in overall greenhouse gas (GHG) emissions, and increase in biodiversity and resiliency, better economic outcomes for families, and improved disaster management and mitigation. Our ToC was tested by our developed EGM, as we were

able to evaluate the observed outputs and outcomes of implemented interventions in the environmental management sector.

We have illustrated our ToC within the figure below:

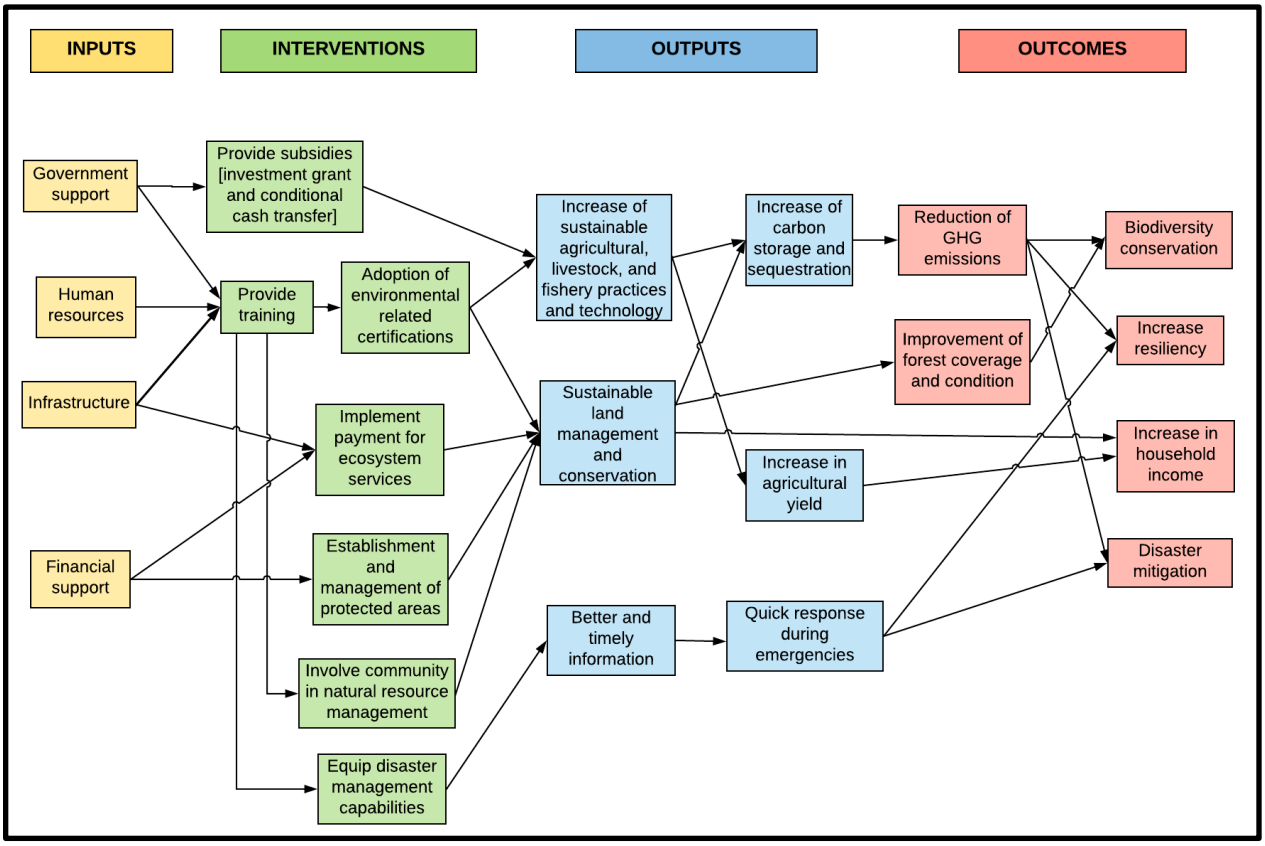


Figure 1. Theory of Change. The Theory of Change highlights the inputs, interventions, outputs, and final outcomes that we will discuss in greater detail below.

Theory of Change Assumptions

Our ToC follows the following assumptions:

1. *Inputs Stage*

    - Government support is granted to continue efforts;
    - Financial capital is available at the time of intervention;
    - Qualified and motivated personnel is available during implement of the intervention.

2. Intervention Stage

- Existing regulatory framework is in good standing;
- Training interventions include training in the following areas: agriculture, livestock, fisheries, and agroforestry;
- There is high participation interest from all stakeholders involved in the intervention;
- An existing infrastructure is available for financial transactions to occur.

3. Output Stage

- Intervention was properly and successfully of implemented;
- Appropriate (site relevant) technologies are introduced for technology implementation interventions;
- Subsidies are successfully allocated;
- Subsidies are sufficient for interventions to be successfully implemented;
- Partnerships among different stakeholders and agencies are successful.

4. Outcomes Stage

- Economic markets are fully functional; and
- There are no negative external forces taking advantage of improved forest conditions.

Theory of Change Definitions

1. *Inputs*

The following table (Table 1) indicates the definitions for the inputs identified in the ToC. These inputs represent the framework and ecosystem in which environmental interventions need to occur in order to observe our hypothesized outcomes.

Table 1. Inputs Definitions used for the Evidence Gap Map

INPUTS	Definition
Government support	Government's commitment to full provide political and institutional support towards the implementations of the interventions
Human resources	Staff required towards implementing to implement the interventions across different government, private and non-profit institutions
Infrastructure	Includes a functioning set of infrastructures (e.g. banks, buildings, telecommunication technologies, transportation, water, electricity, etc...)
Financial support	Allocation of sufficient financial resources that would support the implementation of interventions

2. Interventions and Sub-Interventions

Using our ToC, we identified interventions that lead to a specific outcome indicator. Interventions that were included centered around identified policies undertaken by the Colombian government, an international donor, or comparison country. We decided to limit our scope to a limited number of interventions and sub-interventions to maximize for utility and effectiveness of the EGM. Therefore, we have identified 5 interventions which are a broader categorization of the 8 activity level sub-interventions. List of interventions and sub-interventions are presented in the analysis section of this report.

Tables 2 and 3 indicate the definitions given to identified interventions and sub-interventions observed in the ToC described in Figure 1. Main types of interventions included: (1) subsidies; (2) knowledge and/or behavioral changes; (3) institutional arrangements; (4) incentives; and (5) area protection and management. The definitions for each are illustrated in the following table (Table 2):

Table 2. Interventions Definitions used for the Evidence Gap Map

INTERVENTIONS	Definition
Subsidies	Interventions in this category are developed to encourage investment by the private sector in environment management through funding granted by the government
Knowledge and/or behavioral changes	Interventions in this category are developed to promote sustainable practices technology, information about best practices, management techniques, and enforcement protocol.

Institutional arrangements	Interventions in this category include measures to make institutions in DRM stronger
Incentives	This category includes different interventions that use economic and other in-kind incentives provided to individuals or communities to influence land management behavior
Area protection/ management	Interventions in this category involve actions to establish or expand parks, reserves or other legally protected areas (PAs) in which land or resource use is either fully restricted or regulated. They also include programs with changes to the management regime of a particular area or jurisdiction.

We also identified several sub-interventions for each intervention group. Main types of sub-interventions included: (1) Equip disaster management capabilities; (2) Adoption of environmental related certification; (3) Implement Payment for Ecosystem Services (PES); (4) Provide training, (5) Investment grant; (6) Conditional Cash Transfer (CCT); (7) Establishment and management of protected areas; and (8) Involve community in natural resource management. Each of these have been defined as described in the following table (Table 3):

Table 3. Sub-interventions Definitions used for the Evidence Gap Map

SUB-INTERVENTIONS	Major Intervention group	Definition
Equip disaster management capabilities	Institutional arrangements	Programs and policy initiatives intended to build up disaster management capabilities of public institutions (e.g. hiring and placing trained experts, supplying technologies and equipment to adequately respond and predict emergency, providing sufficient financial resources, performing regular trainings and doing regular upkeep and maintenance of infrastructure)
Adoption of environmental related certification	Incentives	Certification schemes promoting sustainable agricultural production or sustainable land management and conservation. To be included studies needed to either (1) assess a program that promotes sustainable agricultural practices, sustainable livestock, agro-forestry, aquaculture, sustainable forest management, watershed management or a sustainable technology (e.g., seeds, fertilizers, irrigation, etc.) or (2) measure effects on an environmental outcome (3) example certifications include rainforest alliance, carbon trust fund, ISO 4001
Implement Payment for Ecosystem Services (PES)	Incentives	Programs where incentives are offered to individuals or communities for managing land to provide environmental services (such as carbon sequestration or water provision). Conditions for receiving incentives may include either full protection, restoration, reforestation and sustainable land management

Provide training	Knowledge and/or behavior change	Formal training strategies through degree programs and technical and vocational training programs. To be included studies needed to either (1) assess a program that promotes sustainable agricultural practices, sustainable livestock, agro-forestry, fisheries, sustainable forest management, watershed management or a sustainable technology (e.g., seeds, fertilizers, irrigation, etc.) or (2) measure effects on an environmental outcome.
Investment grant	Subsidy	Direct subsidy programs designed by governments to encourage private sector investment in the environmental management (e.g. sustainable agricultural practices, agro-forestry, aquaculture, sustainable forest management, watershed management or a sustainable technology)
Conditional Cash Transfer (CCT)	Subsidy	Direct subsidy programs where the recipient is required in environment management and agriculture (e.g. sustainable agriculture practices, sustainable livestock, agro-forestry, aquaculture, sustainable forest management, watershed management or a sustainable technology) in return for being part of a welfare program
Establishment and management of protected areas	Area Protection/ management	Establishing protected areas such as national parks where access and use of resources is either fully restricted or regulated.
Involve community in natural resource management	Area Protection/ management	Interventions establishing, improving or monitoring decentralized forest management. Decentralizing forest management typically involves transferring responsibility for forest management, from central government to other stakeholders (private sector, forest communities and government). Examples include joint forest management, participatory forest management and community-based forest management.

3. Outputs and Sub-Outputs

The outputs and sub-outputs are identified and defined in Tables 4 and 5. The outputs identified included: (1) environmentally sustainable practices; (2) yield; (3) technology adoption; and (4) emergency preparedness. These have been further defined in the following Table (Table 4):

Table 4. Identified outputs and their definitions used for the developed Evidence Gap Map

OUTPUT	Definition
Environmentally Sustainable Practices	An output that indicates a change in behavior or management has occurred and that is recognized as a sustainable practice in agriculture, livestock, land management, and fisheries (e.g. improved soil health, reduced water use, reduction of pollution (fertilizers and pesticides), increase in the development of natural habitats for endangered species, reforestation, increased forest cover and condition etc...)

Increased Yield	Output that are associated with an increased in overall agricultural, livestock, and seafood yield as a result of new practice, education, technology implementation, training etc.. (measured by qt/ ha)
Technology Adoption	Adoption of new technologies as a result of government interventions (subsidies and conditional cash transfers)
Enhanced Emergency preparedness	Increased capabilities to deal with negative impact of disaster or in the case of a regional emergency

From the identified outputs we also identified several sub-outputs. These include: (1) sustainable practices and technologies in agriculture, livestock and fishery; (2) sustainable land management and conservation; (3) information capacity; (4) agricultural yield; (5) carbon storage and sequestration, and (6) emergency response. We have defined these as shown in the Table below (Table 5):

Table 5. Identified sub-outputs and their definitions used for the developed Evidence Gap Map

SUB-OUTPUT	Major Output group	Definition
Sustainable practices and technologies in agriculture, livestock and fishery	Environmental (sustainable practices), technology adoption	Outputs in this category reflect changes achieved through the implementation of sustainable practices in agriculture (promotion of nutrient management and health, minimize water use, reduction of pollution levels, etc..), livestock (proper waste management practices, adoption of low GHG emitting animals, etc…) and fisheries (reduction in overfishing, promoting fishing quotas, sustainable fisheries management, etc...)
Sustainable land management and conservation	Environmental (sustainable practices)	Outputs in this category reflect changes achieved through the implementation of sustainable land management and conservation practices (e.g. improved forest coverage and condition, improved biodiversity, increased carbon sequestration)
Information Capacity	Emergency preparedness	Change in the capabilities of early warning and other information systems to predict disaster as well as effective and efficient communications during emergency situations as a result of personnel training, allocation of proper resources and protocols, and optimal infrastructure.
Agricultural Yield	Yield	Change in overall agricultural yield (including agricultural products such as fruits, vegetables, grains, pulses, timber) as a result of new practice, education, technology implementation, training etc..
Carbon storage and sequestration	Environmental (sustainable practices), technology adoption	Outputs in this category reflect a change in measures of carbon stocks in biomass and above and below ground organic matter as a result of technology adoption, implementation of sustainable practices, change in conservation of land management practices.

Emergency response	Emergency preparedness	Outputs in this category reflect a change in the disaster management response in the event of emergency that is more effective and efficient

4. Outcomes and Sub-Outcomes

Defining our outcomes of interest is particularly important to defining the scope of the environment and disaster management policy evidence search. In both an ex-ante search design and during the search, the team examined the outcomes measured in various interventions in the environmental management sector. Outcomes were categorized under the following categories: (1) environmental; (2) economic; and (3) disaster management. We have defined these as shown in the Table below (Table 6):

Table 6. Identified outcomes and their definitions used for the developed Evidence Gap Map

OUTCOME	Definition
Environmental Outcome	Outcomes in this category reflect changes in natural resource management, biodiversity conservation and GHG emission through various environmental, economic and institutional interventions
Economic Outcome	Outcomes in this category reflect changes in economic indicators at individual and community level such as household income through interventions that improve agriculture productivity, cash transfers, incentives, etc
Disaster management outcomes	Outcomes in this category reflect the capabilities (pre and post) of communities, states and individuals to eliminate the negative shocks of hazardous events not to compromise the long-term development prospects

Finally, from the identified outcomes (in Table 5) we also identified several sub-outcomes. These sub-outcomes include: (1) forest coverage and condition; (2) forest condition; (3) GHG emissions; (4) biodiversity conservation; (5) household income; and (6) resilience to disasters. These have defined these as shown in the Table below (Table 7):

Sub- Outcomes

Table 7. Identified sub-outcomes and their definitions used for the developed Evidence Gap Map

SUB-OUTCOME	Major Outcome group	Definition
Forest coverage and condition	Environmental Outcomes	Any measures of forest cover, including extent of forest maintained, reforested, regeneration, deforested or converted to another land type and characteristics of existing forests, including composition, structure or function of forested land
GHG emissions	Environmental Outcomes	A measure of how much heat trapping gases (e.g. Carbon Dioxide, Methane, Nitrous Oxide and Fluorinated Substance) are released in the atmosphere as a result of human induced economic activity
Biodiversity conservation	Environmental Outcomes	Outcome reflects measures taken to preserve the variety of life in the Latin America region(flora, fauna, micro-organisms and their genes, water ecosystems, terrestrial, and marine ecosystems)
Household income	Economic outcomes	A measure of change in aggregate income of household members in every form of income (salaries, wages, profit, other transitory income, government cash transfer, etc..)
Resilience to disasters	Disaster management outcomes	A measure of countries, communities and individuals ability to absorb and recover from hazards, shocks and stress due to governance structures, risk assessment and management capabilities, knowledge and education, and disaster preparedness

FINDINGS

To illustrate the different findings we observed once the EGM was completed we provide an analysis on multiple different dimensions. We present an analysis on the major gaps in the evidence observed, methodologies used, major geographical regions, types of interventions, and outputs and outcomes observed from identified studies.

Our developed EGM can be observed in Figure 2, this presents all the included impact evaluations, systematic reviews, and qualitative studies with each study mapped according to the intervention(s), output(s), and outcome(s) they covered. Each number represents an individual study (see Appendix 5 for studies key). The color of each number indicate the type of effect; green studies indicated a positive effect, red studies indicated a negative effect, purple studies indicated mixed effects, grey studies indicated no effect, and yellow studies indicate an unknown level of effect. In some instances, we observed different types of effects under the same type for sub-intervention and sub-outcome (i.e. note under the *investment grant* sub-intervention and *sustainable practices in technologies* there are five different studies coded in various colors). We have indicated the type of effect each study claimed using the color coding explained above and have hyperlinked each study with its source for easy access. The effects were coded using the articles arguments and evidence and not our own analysis. For more detailed information on how to read an evidence gap maps please refer to our developed guide (see Appendix 6).

			Output								Outcome					
			Environmental (Sustainable Practices)			Yield	Technology Adoption		Emergency preparedness		Environmental			Economic	Disaster management	
			Sustainable practices and technologies in agriculture, livestock and fishery	Sustainable land management and conservation	Carbon storage and sequestration	Agricultural Yield	Carbon storage and sequestration	Sustainable practices and technologies in agriculture, livestock and fishery	Information Capacity	Emergency Response	Forest Coverage and condition	GHG emissions	Biodiversity Conservation	Household income	Resilience to disaster	Disaster mitigation
Interventions	Incentives	Adoption of new practises and technologies	15 | 16 | 20 | 30	15 | 16 | 20 | 30		16 | 31		15 | 16 | 20 | 30		28	20 | 28	28	20	10 | 11 | 15 | 20	10 | 11	10 | 11
		Implement Payment for Ecosystem Services (PES)	37		37		37	37			22 | 37	37		37		
	Institutional arrangements	Equip disaster management capabilities	7 | 18 | 26 | 33	7 | 18 | 33				7 | 18 | 26 | 33	3 | 4 | 5 | 27 | 38	2 | 3 | 4 | 5 | 14 | 27 | 28 | 29 | 38	7 | 18 | 28 | 29 | 33	28 | 29	18	7	4 | 5 | 27 | 38	2 | 3 | 4 | 5 | 27 | 38
	Knowledge and/or behavior change*	Provide Training	7 | 20 | 26 | 35	7 | 20	8	8	8	7 | 20 | 26 | 35	4 | 27	4 | 27	7 | 20		8 | 20 | 35	7 | 20 | 34	4 | 27 | 34	4 | 27
	Subsidy	Investment grant	6 | 7 | 23 | 24 | 37	6 | 7	37		37	6 | 7 | 23 | 24 | 37	3 | 5 | 6	2 | 3 | 5	7 | 23 | 24 | 37	37	6 | 24	7 | 34 | 37	5 | 6 | 34	2 | 3 | 5
		Conditional Cash Transfer (CCT)	6 | 30	6 | 30 | 39	8	8	8	6 | 30	6	29	29 | 39	29	6 | 8	34	6 | 34	
	Area Protection/ Management	Establishment and management of protected areas	7 | 18 | 19 | 23 | 24 | 25 | 33	7 | 18 | 21 | 33		31 | 32		7 | 18 | 19 | 23 | 24 | 25 | 33			7 | 18 | 19 | 21 | 22 | 23 | 24 | 25 | 33		12 | 18 | 19 | 24 | 25	7 | 32	32	32
		Involve community in natural resource management	9 | 17 | 19 | 26	9 | 21				9 | 17 | 19 | 26		2	17 | 19 | 21 | 22	17	17 | 19	17		2

Figure 2. Evidence Gap Map of the Environmental Sector in Latin America. This map presents all the included impact evaluations, systematic reviews, and qualitative studies with each study mapped according to the intervention(s), output(s) and outcome(s) they covered.

1. Main Results on Methodologies and Year of study

The identified studies employ different research tools to assess the effect of environmental interventions on various outcomes. While the scientific tools are very diverse ranging from qualitative to experimental quantitative studies, we have categorized them according to the following major categories.

Table 8. Major categories of study design and their definitions

STUDY DESIGN	Definition
Impact evaluation	Assessment of how the intervention being evaluated affects outcomes, whether the effects are intended are unintended. The effects of the interventions are usually compared against counterfactual of what those outcomes would have been in the absence of the intervention.
Cost Benefit analysis	Assessment of strength and weaknesses of environment related interventions to select the best alternative
Systematic review	A summary of the results of the available studies on environmental interventions
Case study	A research method involving a detailed examination of an intervention to learn best practices and understand contextual conditions
Mixed Methods	A research method involving more than one of the above discussed designs

Using definitions from Table 8, Figure 3 (see below) represent the break down of the studies coded. As can be seen from the graph, studies which involve different techniques of impact evaluation constitute a larger share (43%) of the total number of studies fully coded (n=36). The types of impact evaluation studies used include a mix of experimental designs such as Randomized Controlled Trials (RCT) and quasi-experimental designs such as propensity score matching (PSM) and difference-in-difference. Impact evaluation studies are expensive to implement compared to other study types. Hence, the larger share of impact evaluation in this EGM might come as a surprise. However, this is mainly due to the team's priority focus of finding impact evaluation studies within the Latin America region. Case studies, which compare environmental initiatives within Colombia and across other countries, come second in terms of the methodologies applied accounting for a quarter of the studies.

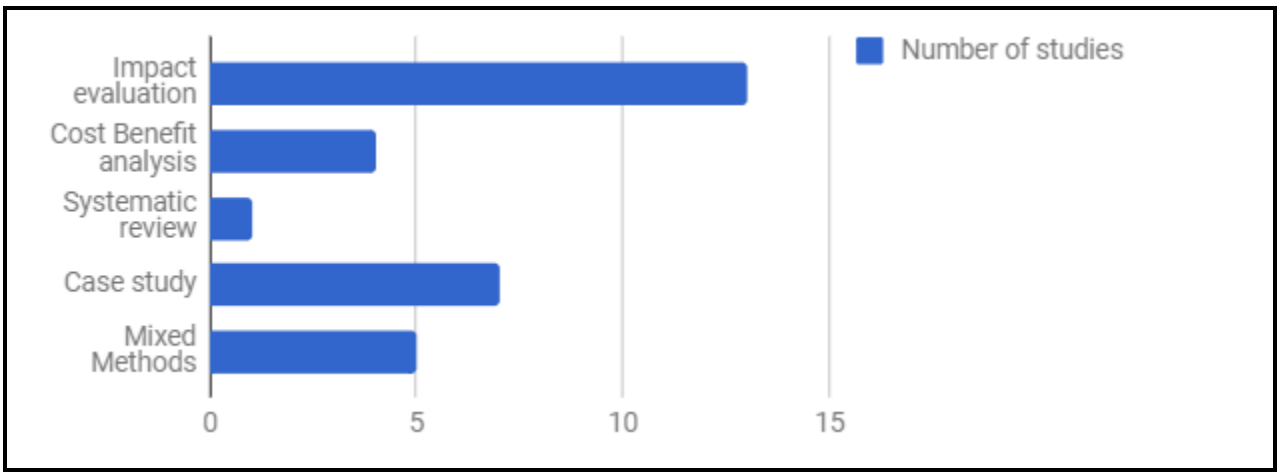


Figure 3. Analysis of research designs used in the identified studies

In terms of timeline of studies, most of them can be categorized as recent as can be shown in Figure 4 (see below). Studies which were conducted after 2010 account for around 70% of the total number of studies identified. One interesting insight from the figure below is the increase in the use of impact evaluation as a study design. Among the studies coded in this EGM, impact evaluation was non-existent prior to 2005, however this changed after 2005. This can be partially attributed to the establishment of research centers such as J-PAL and 3ie (2003 and 2008 respectively), which are authors of some the studies in this EGM, and growing interest from Latin American governments to support evidence based decision making using impact evaluation.[1]

[1] Alzua, Maria Laura H. D. (2013). *Impact Evaluation for Policy Making: A close look at Latin American Countries with weaker research capacities (pp 5)*

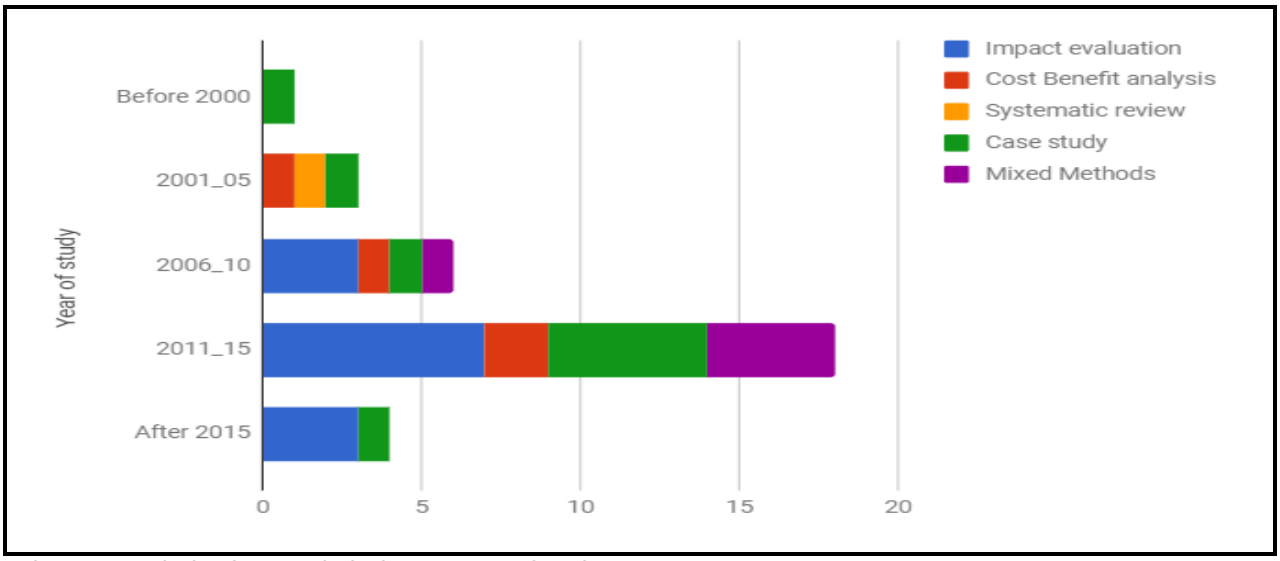
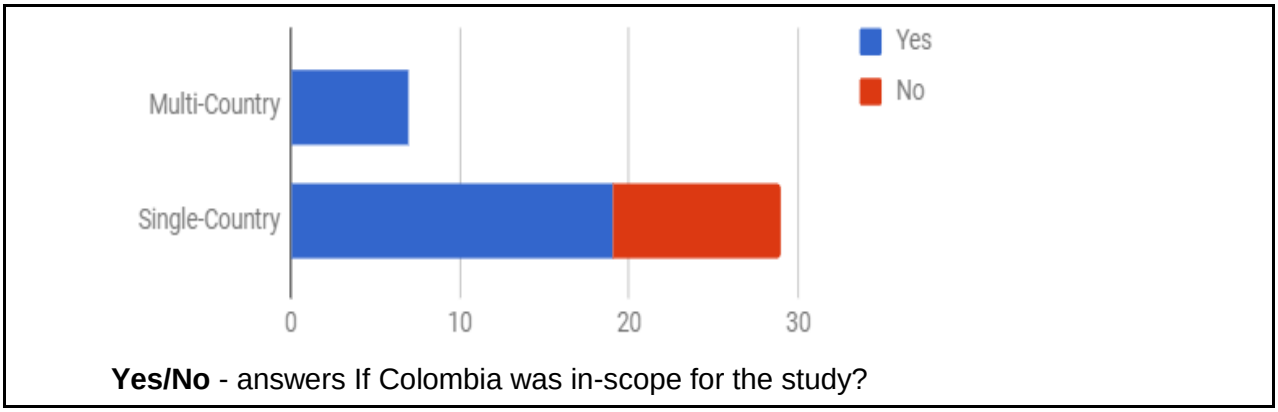


Figure 4. Analysis of research designs vs year of study

2. Geographic Analyses of the Studies

The geographical coverage of the EGM is diverse with studies from developing countries in Sub-Saharan Africa, East Asia and South Asia included. However, a majority of studies are from Latin American countries especially from Colombia as can be witnessed in Figure 5 (see below). A single country study where the entirety of it was conducted in Colombia or cross-country studies which Colombia is in scope are about 70% of the total. In addition, studies from other Latin American countries were also a focus for this EGM. Focusing on those countries will improve prioritization best interventions from neighboring countries which have close social and economic connections to Colombia and ensure better external validity for impact evaluation studies.



Yes/No - answers If Colombia was in-scope for the study?

Figure 5. Analysis of identified studies by geographical location

3. Analysis on Interventions, Outputs, and Outcomes

The distribution of studies across interventions is relatively even. There is a large number of studies of interventions related to Area protection and management, particularly as they refer to establishment and management of protected areas. They account for 32% of the studies in the developed EGM. There is also a heavy focus on interventions regarding institutional arrangement especially disaster management agencies. Interventions related to subsidy program by the government are heavily reflected in the EGM. On the other hand, there are fewer observed interventions related to knowledge and behavioral change which includes providing educational and vocational training. Figure 6 (see below) summarizes the distribution of studies across major interventions.

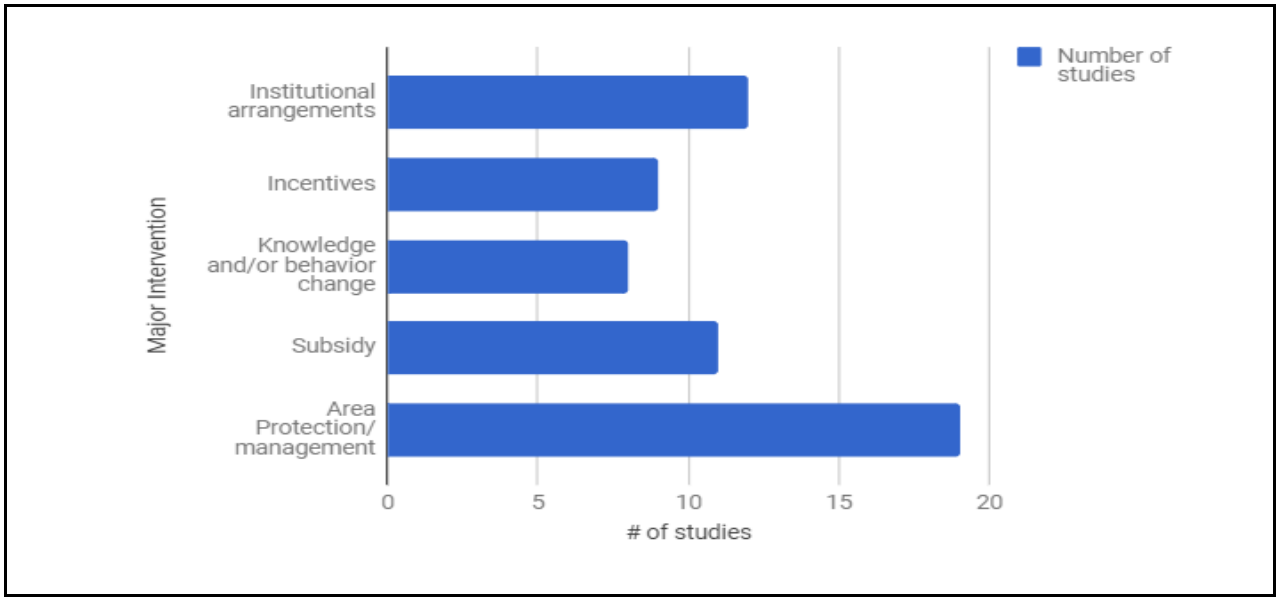


Figure 6. Distribution of studies coded across the major intervention areas

Similar to Figure 6, studies were also grouped into an observed output and outcome. In addition to grouping them, the policy team also worked to identify the stated effect of the intervention on the outputs and outcomes. This is shown in Figures 7 and 8 (note that unlike the figure above, the y-axis here is presented at a subcategory level, i.e. sub-output and sub-outcome)

Figure 7. Distribution of studies coded across sub-output level along with the stated effect

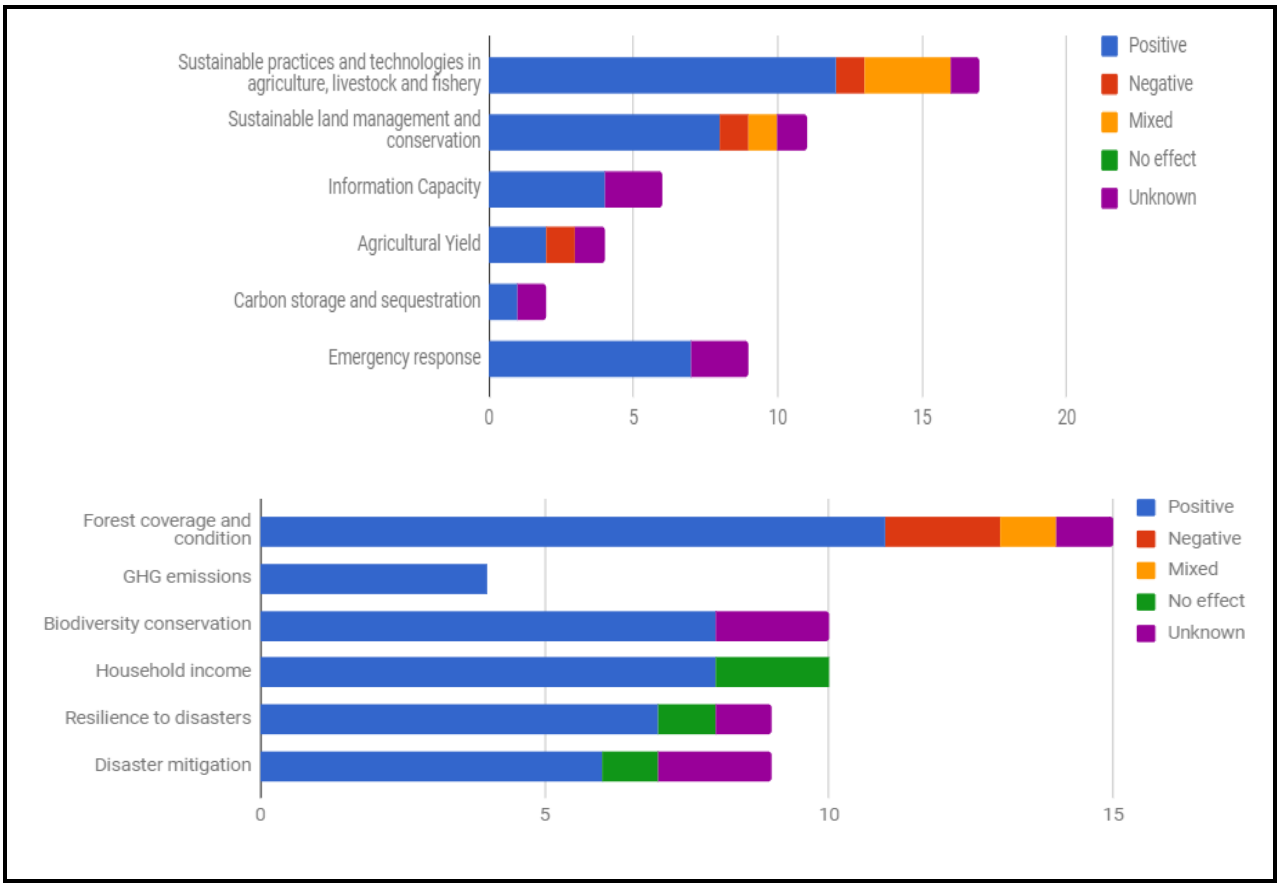


Figure 8. Distribution of studies coded across sub-output level along with the stated effect

4. Major Evidence Gaps

The EGM also reveals absolute gaps where no evidence was found. We observe very little or no evidence for interventions that had an outcome in carbon storage and sequestration, yield, sustainable land management or conservation, and greenhouse gas emissions.

Disaster management capabilities

The trends in studies targeting disaster management capabilities through interventions show significant outcomes in information capacity and emergency response. There was a number of qualitative studies observed in this category, but the majority of interventions related to disaster management capacities observed a positive outcome in emergency preparedness, particularly emergency response. A limited number of outcomes related to forest coverage and condition,

greenhouse gas emissions, and resilience to disaster were observed from interventions in this category. Only a few outcomes related to biodiversity conservation and household income were observed with interventions of this type.

Investment grants

The trends in studies targeting subsidies in the form of investment grants show a great number of positive outcomes in sustainable practices and technologies, as well as forest coverage and condition. A number of qualitative studies also showed emergency preparedness outcomes through investment grants. A limited number of outcomes related to agricultural yield, sustainable land management and conservation, and carbon storage and sequestration were observed from investment grant interventions.

Establishment and management of protected areas

The trends in studies targeting the establishment and management of protected areas show that a significant number of interventions had mixed outcomes related to sustainable practices, forest coverage and condition, and biodiversity conservation. Some agricultural negative outcome effects were found in interventions related to the establishment and management of areas. This is a clear outcome as limiting agricultural land to protect areas and develop sustainable practices will result in reduced agricultural yield as less land is being used for agricultural production. Lastly, positive biodiversity conservation outcomes were observed with intervention studies focusing in the establishment and management of protected areas.

POLICY RECOMMENDATIONS

Based on the findings above, the Goldman team recommends that the DNP prioritize policies centered around: (a) disaster management capabilities, (b) investment grants in sustainable practices and technologies and forest coverage, and (c) community involvement of natural resource management. While not comprehensive in addressing the plethora of issues under the purview of natural resource management, there exists a pattern of evidence demonstrating impact from localized interventions. Trainings for local governments, organizational partners, and the general population on how to best manage resources has also shown to lead to positive behavior changes in the management and use of these resources. Specifically, training should ensure that these actors are aware of best practices and understand the environment-specific reasons why certain management and use practices affect resource outcomes in the way they do.

The evidence base for the impact of Colombia's protected forest areas on biodiversity is comparatively small and offers no clear pathway for addressing this vital aspect of forest health. Further research can be completed in this area for the purposes of finding whether there exist sub-interventions within the protection of forests that are making a difference in maintaining or increasing the diversity of species.

CONCLUSION

In preparation for the 2018 elections and the establishment of new development priorities, the National Planning Department of Colombia asked the team from Goldman School of Public Policy to develop an Evidence Gap Map. The Goldman team tasked itself with creating an EGM for Colombia's efforts in environmental and disaster management for the purposes of informing relevant policy making in this area. Working in tandem with DNP and under the advisement of an EGM specialist, the team followed 3ie methodology in designing a search strategy, defining the project scope, and developing a theory of change.

Results from the research formed an evidence base that validated some of the causal links in the theory of change while demonstrating a lack of evidence in others. In particular, we observed a considerable level of evidence in interventions related to disaster management capabilities, investment grants (as subsidies), and the establishment and management of protected areas. This provides the DNP with a useable evidence base for structuring future policy aimed focusing in those spheres. In terms of gaps, there is limited evidence on the interventions impacting the carbon levels, affecting yield, impacting land conservation and reducing greenhouse gas emissions.

The DNP has asked the Goldman team for preliminary policy recommendations informed by trends in the EGM. One clear evidence pathway exists in the finding that transitions to localized natural resource management, broadly defined, have shown to be effective. From this the team has proposed that tailored interventions at the local level should be a priority for policies aimed at protecting and managing Colombia's treasured natural resources. The evidence base for effective techniques to reduce the carbon footprint, increase product yield, and reduce GHG emissions in Colombia is comparatively smaller. This suggests that further effort should be put into impact evaluations in this area if policy makers are seeking Colombia-specific trends in these policy issues.

While limited in scope, this EGM and report should serve as a practical tool for the DNP during the preliminary steps of the policy planning process. Environmental management policy in particular stands to become obscured in the prioritization of efforts that are of higher political importance. Effective policy in this area is unique, however, in that it creates lasting impact in an arena that outlasts administrations. By its nature, increased efficacy in this pursuit yields not just improvements environmental outcomes for Colombia but lasting impact for the globally interconnected natural world.

APPENDIX

Appendix 1: PICOS Inclusion and Exclusion Criteria

The following document was utilized to identify studies. The population, interventions, comparisons, outcomes, and study types (otherwise known as PICOS) served as a study screener and defined the scope of our evidence gap map during its developmental stage.

POPULATION

To be included, studies had to be focused on the environmental sector. In terms of geographic region, studies were primarily identified in the Latin American region, within both the rural and urban population.

INTERVENTION

Table A1.1 indicates the interventions that were included for the EGM. These are further divided into subcategories that are detailed in the *Theory of Change* section.

Table A1.1. Interventions Definitions used for the Evidence Gap Map

INTERVENTIONS	Definition
Subsidy	Interventions in this category are developed to encourage investment by the private sector in environment management through funding granted by the government
Knowledge and/or behavior change	Interventions in this category are developed to promote sustainable practices technology, information about best practices, management techniques, and enforcement protocol.
Institutional arrangements	Interventions in this category include measures to make institutions in DRM stronger
Incentives	This category includes different interventions that use economic and other in-kind incentives provided to individuals or communities to influence land management behavior
Area Protection/ management	Interventions in this category involve actions to establish or expand parks, reserves or other legally protected areas (PAs) in which land or resource use is either fully restricted or regulated. They also include programs with changes to the management regime of a particular area or jurisdiction.

COMPARISONS

Most studies identified used a comparison group to measure interventions causal effects (see *Study Types* section in pg. 17)

- Impact evaluations were the majority of studies reviewed

- Some case studies, with no comparison analysis, were included when they were identified as relevant within the Colombian environmental context and provided relevant findings and/or policy recommendations

OUTPUTS

Table A1.2 indicates the interventions that were included for the EGM. These are further divided into subcategories that are detailed in the *Theory of Change* section.

Table A1.2. Identified outputs and their definitions used for the developed Evidence Gap Map

OUTPUT	Definition
Environmental (Sustainable Practices)	An output that indicates a change in behavior or management has occurred and that is recognized as a sustainable practice in agriculture, livestock, land management, and fisheries (e.g. improved soil health, reduced water use, reduction of pollution (fertilizers and pesticides), increase in the development of natural habitats for endangered species, reforestation, increased forest cover and condition etc...)
Yield	Output that are associated with an increased in overall agricultural, livestock, and seafood yield as a result of new practice, education, technology implementation, training etc.. (measured by qt/ ha)
Technology Adoption	Adoption of new technologies as a result of government interventions (subsidies and conditional cash transfers)
Emergency preparedness	Increased capabilities to deal with negative impact of disaster or in the case of a regional emergency

STUDY TYPES

For the EGM, we included impact evaluations, systematic reviews, and relevant case studies. We specifically included:

- Randomized Controlled Trial (RCT)
- Regression Discontinuity Design (RDD)
- Cross-sectional or panel studies with an intervention and comparison group using methods to control for selection bias and confounding (such as propensity score matching (PSM) or other matching methods, instrumental variable estimation, difference-in-differences (DID), or a fixed or random effects model with an interaction term between time and intervention used for baseline)
- Controls before and after study using appropriate methods to control for selection bias and confounding (as just described for cross-sectional or panel studies with an intervention and comparison group)

- Studies explicitly described as systematic reviews
- Qualitative studies conducted in Colombia that provided relevant findings and/or policy recommendations
- Other studies that were relevant for the government of Colombia but do not qualify in any of the studies

Time Period
Publications were only included if they were published from 2000 onwards

Language
Studies were published in both Spanish and English

Appendix 2: Coding Sheet

Table A2.1. Used coding sheet

ID	***Description***
Source #	Each study assigned unique Id
Title	Full name of the paper
Sector	Studies categorized into environment, agriculture, and disaster management
Author	Author of the study
URL	URL for the study
Year	Year of study
Summary of results	A summary of the main findings from the paper
Region	Geographic region of the study identified
Method	If the study is RCT, risk analysis, comparative study, etc..
Type of study	Impact evaluation vs systematic review
Language	English vs Spanish
Identified by	GSPP Policy team member who coded the study
1,2,3,4,5	Code proxy for Positive, Mixed, Negative, No and Unknown effect *(see appendix 3 for details)*

Appendix 3: Definition of Effect for the studies coded

The following table presents the coding proxy used in the developed EGM to code for the effects observed in studies.

Table A3.1. Definition of how effect was identified from the studies coded

Effect: The effects are coded by the articles' arguments and not our own analysis given the evidence available		
Effect	**Code proxy**	**Definition**
Positive	1	The author asserts that a positive relationship was observed
Negative	2	The author asserts that a negative relationship was observed
Mixed	3	The author asserts that both positive and negative relationships were observed
No effect	4	The author asserts that the inputs / intervention areas had no effect
Unknown	5	The author asserts that the effect remains unknown despite the research conducted

Appendix 4: Coding Cheat Sheet

To code the identified studies at least one type of intervention, output and outcome, and one type of sub-intervention, sub-output, and sub-outcome from tables A2.1 through A2.3 was selected. Note that some studies were categorized under multiple categories for intervention, output, and outcome.

Table A4. 1. Each identified study included at least one intervention and sub-intervention to be included in the EGM

	Intervention	**Sub-Intervention**
1	Subsidy	Investment Grant
		Conditional Cash Transfer
2	Knowledge and/or behavior change	Provide Training
3	Institutional arrangements	Equip disaster management capabilities
4	Incentives	Adoption of environmentally related certification
		Implement Payment for Ecosystem Services (PES)
5	Area Protection and/or management	Establishment and management of protected areas
		Involve community in natural resource management

Table A4. 2. Each identified study included at least one output and sub-output to be included in the EGM

	Output	**Sub-output**
1	Environmental (Sustainable Practices)	Sustainable practices and technologies in agriculture, livestock and fishery
		Sustainable land management and conservation
		Carbon storage and sequestration
2	Yield	Agricultural Yield
3	Technology Adoption	Carbon storage and sequestration
		Sustainable practices and technologies in agriculture, livestock and fishery
4	Emergency preparedness	Emergency response
		Information Capacity

Table A4. 3. Each identified study included at least one outcome and sub-outcome to be included in the EGM

	Outcome	**Sub-outcome**
1	Environmental Outcome	Forest coverage and condition
		GHG emissions
		Biodiversity conservation
2	Economic outcomes	Household income
3	Disaster management outcomes	Resilience to disasters
		Disaster mitigation

Appendix 5: Studies used to populate the EGM.

Table A5. 1. Studies key. Each identified study included in the EGM was assigned a number. Note all studies titles have been hyperlinked for easy access.

Study Number	Title (hyperlinked)
2	Participación y capital social como ejes de desarrollo comunitario sostenible
3	IDRL Colombia: A Study on Legal Preparedness for International Disaster Assistance in Colombia
4	Analysis of Disaster Risk Management in Colombia
5	Project Performance Assessment Report: Colombia Disaster Risk Management Development Policy Loan (IBRD-76180) June 27, 2017
6	Instrumentos económicos para la gestión ambiental urbana
7	Medio ambiente y desarrollo económico: priorización de la inversión ambiental con criterios económicos
8	Valoración de los beneficios económicos provistos por el sistema de parques nacionales naturales: una aplicación del análisis de transferencia de beneficios
9	Implementation Completion and Results Report for National Protected Areas Conservation Trust Fund Project
10	Implementation Completion and Results Report for Colombia - Sustainable Development Investment Project
11	Implementation Completion and Results Report for Integrated National Adaptation Project
12	Implementation Completion and Results Report for Andean Region Conservation and Sustainable Use of Biodiversity Project
14	Earthquake Vulnerability Reduction Program in Colombia: A Probabilistic Cost-benefit Analysis
15	Is Eco-Certification a Win–Win for Developing Country Agriculture? Organic Coffee Certification in Colombia
16	Impact Evaluation of UTZ Certified Coffee Program in Colombia
17	Development as a conservation tool: Evaluating ecological, economic, attitudinal, and behavioral outcomes
18	Effectiveness of Terrestrial Protected Areas in Reducing Biodiversity and Habitat Loss
19	Community Managed Forests and Forest Protected Areas: An Assessment of their Conservation Effectiveness across the Tropics
20	Responding to Globalization: Impacts of Certification on Colombian Small-Scale Coffee Growers
21	Strict versus mixed-use protected areas: Guatemala's Maya Biosphere Reserve

22	Conserving Forests: Mandates, Management or Money?
23	The effects of protected area systems on ecosystem restoration: a quasi-experimental design to estimate the impact of Costa Rica's protected area system on forest regrowth
24	Protected Areas and Avoided Deforestation: A Statistical Evaluation
25	A spatial econometric approach to spillover effects between protected areas and deforestation in the Brazilian Amazon
26	Assessing Environmental Management Capacity: Towards a Common Framework
27	Building Resilience: Integrating Climate and Disaster Risk into Development
28	Economics of Climate Change in Latin America and the Caribbean: Paradoxes and Challenges of Sustainable Development
29	Beneficiary Satisfaction Surveys: Emergency operations 2012 Jamaica and Dominican Republic Pan-American Disaster Response Unit
30	Final performance evaluation of the BIOREDD+ (biodiversity - reduced emissions from deforestation and forest degradation) : climate change component
31	Biodiversity reduced emissions from deforestation and forest degradation program: BIOREDD+final report
32	Indicadores de biodiversidad relacionados con las caracteristicas del paisaje
33	Near real-time alert systems for community-based MRV in Colombia: connecting national forest monitoring with cars and communities in Caqueta
34	Household Risk Strategies and Conditional Cash Transfers in Nicaragua
35	Protecting Fisheries through Enforcement and Informational Campaigns in Chile
37	Testing the Effectiveness of Payments for Ecosystem Services to Enhance Conservation in Uganda
38	Insurance Against Cognitive Droughts: The Psychology of Water Scarcity and Insurance
39	The Ecological Footprint of Poverty Alleviation: Evidence from Mexico's Oportunidades Program

Appendix 6: Guide on how to read an evidence gap map

How to Read the Evidence Gap Map

As mentioned, the Evidence Gap Map is a visual representation of the intersection of interventions, outcomes, and final outputs. The interventions are traditionally as rows, and the outcomes and outputs are traditionally expressed in columns. Though there is no agreed-upon method of creating the Evidence Gap Map, we have used other Evidence Gap Maps from 3ie to inform and guide our design.

We first define the terms intervention, output, and outcome as used by Monitoring and Evaluation firms.

Defining the Terms: Intervention, Output, and Outcome

For our purposes, an intervention is "a specific activity or set of activities intended to bring about change in some aspect(s) of the status of the target population (e.g., HIV risk reduction, improving the quality of service delivery)." Outputs are defined as "the results of program/intervention activities; the direct products or deliverables of program/intervention activities, such as the number of HIV counseling sessions completed, the number of people served, the number of condoms distributed". Finally, we use and understand outcomes as "short-term and medium-term effect of an intervention's outputs, such as change in knowledge, attitudes, beliefs, behaviors".

Interventions

We identified five main types of interventions, which include:

1. Use of Subsidies;
2. Knowledge and/or Behavioral Changes;
3. Institutional Arrangements;
4. Incentives; and
5. Area Protection and Management

The sub-interventions listed under broad intervention categories are:

1. Equip Disaster Management Capabilities;
2. Adopt Environmentally Related Certifications;
3. Implement Payment for Ecosystem Services;
4. Provide Training;
5. Utilize and Investment Grant;
6. Implement Conditional Cash Transfers;
7. Establish and Manage Protected Areas; and
8. Involve the Local Community in Natural Resource Management

Each intervention is an umbrella for sub-interventions, which illustrate the type of change in greater granularity. The breakdown of intervention to corresponding sub-intervention is shown in greater detail in the table below (attach table).

Outputs

We identified four main types of outputs, which include:

1. Environmentally Sustainable Practices;

2. Increased Yield;
3. Adoption of Technology; and
4. Enhanced Emergency Preparedness

The sub-outputs listed under broad output categories are:

1. Sustainable Practices and Technologies in Agriculture, Livestock, and Fishery;
2. Sustainable Land Management and Conservation;
3. Information Capacity;
4. Agricultural Yield;
5. Carbon Storage and Sequestration; and
6. Emergency Response

Each output is an umbrella for sub-outputs, which illustrate the type of change in greater granularity. The breakdown of output to corresponding sub-output is shown in greater detail in the table below (attach table).

Outcomes

Finally, we identified four main types of outcomes, which include:

1. Environmental outcomes
2. Economic outcomes
3. Disaster Management outcomes

The sub-outcomes listed under broad output categories are:

1. Forest Coverage
2. Forest Condition
3. GHG Emissions
4. Biodiversity Conservation
5. Household Income
6. Resiliency to Natural Disasters
7. Disaster Mitigation

Each outcome is an umbrella for sub-outcomes, which illustrate the type of change in greater granularity.

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