IEU LEARNING PAPER

03/2025

EVIDENCE REVIEW ON FOREST CONSERVATION – AN EVIDENCE GAP MAP

Monika Bertzky, Mariana Bonfils, Nathalie Doswald, Fernanda de Leon, Francisca Piperno, Martin Prowse, Sasha Murat

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First Edition

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Citation
The suggested citation for this paper is:
Monika Bertzky, Mariana Bonfils, Nathalie Doswald, Fernanda de Leon, Francisca Piperno, Martin Prowse, Sasha Murat (2025). Evidence Review on Forest Conservation - an Evidence Gap Map. IEU learning paper (March). Songdo, South Korea: Independent Evaluation Unit, Green Climate Fund.

Credits
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Layout and design: Ewnetu Kefale
Cover photo: Flickr, ©pixella

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Printed on eco-friendly paper

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About this IEU Learning Paper

This paper presents an updated evidence gap map of forest conservation interventions in developing countries based on evidence published from 1990 to 2024. The evidence base has increased and filled evidence gaps, in particular on the role of forest policies in halting deforestation and the role of market-based instruments such as certification and credit mechanisms in achieving not only forest conservation but also supporting livelihoods. The bulk of the evidence base remains focused on protected areas, community-based forest management and payments for ecosystem services, where the majority of outcomes relate to forest cover and livelihoods.

ACKNOWLEDGEMENTS

We would like to thank members of the advisory group who have helped to steer the direction of this evidence review, especially Ben Vickers (former Land Use, Forests and Ecosystems Senior Sector Specialist), Beom-Sik Yoo (Ramsar Convention) and Lucia De Strasser (Convention on the Protection and Use of Transboundary Watercourses and International Lakes). The authors would also like to thank Diego Martino from Asesoramiento Ambiental Estratégico for his comments.

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ABSTRACT

This paper presents an updated evidence gap map of forest conservation interventions in developing countries based on evidence published from 1990 to 2024. The evidence gap map (EGM) updates a previous review completed by the Independent Evaluation Unit from 1990 to 2018. A theory of change was used to refine the EGM framework of intervention and outcomes. Interventions were classified under the four different policy instrument types – regulatory, economic, informational and voluntary – and the outcome areas were expanded. Compared to the 2019 EGM, the evidence base has expanded, helping to address key evidence gaps, especially concerning the role of forest policies in halting deforestation and the contribution of market-based instruments such as certification and credit mechanisms in both conserving forests and supporting livelihoods. There are also emerging studies on the role of the private sector, such as supply chain initiatives and corporate social responsibility, in supporting conservation. However, as with the previous EGM, most of the available evidence focuses on protected areas, community-based forest management and payments for ecosystem services, with the majority of outcomes concerning forest cover and livelihoods. The findings also indicate that a critical mass of evidence now exists for conducting meta-analyses on certain combinations of forest conservation interventions and outcomes. While recent systematic reviews have concentrated on protected areas and payments for ecosystem services, this learning paper suggests that land tenure interventions, including those that allow community-based management and environmental certification, represent good candidates for future meta-analysis.

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ABBREVIATIONS

AF	Adaptation Fund
CFM	Community-based Forest Management
COP	Conference of the Parties
EGM	Evidence Gap Map
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GHG	Greenhouse Gas
ICDP	Integrated Conservation and Development Project
LAC	Latin America and the Caribbean
NbS	Nature-based Solutions
PA	Protected Area
PAP	Proposal Approval Process
PES	Payment for Ecosystem Services
PICOs	Population, Intervention, Comparator and Outcomes
RBP	Results-based Payment
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SAP	Simplified Approval Process
SFM	Sustainable Forest Management
ToC	Theory of Change
UNFCCC	United Nations Framework Convention on Climate Change

I. BACKGROUND

A. PROBLEM STATEMENT

Forests provide important resources for local communities, especially in developing countries, and play a critical role in carbon storage and sequestration, biodiversity, regulation of regional and microclimates, and the maintenance of water cycles and air quality (Psistaki and others, 2024; Xofis and others, 2023). Indeed, land-use change contributes up to 20 per cent of annual global greenhouse gas emissions (GHGs), with deforestation responsible for 45 per cent of total agriculture, forestry and other land use emissions (IPCC, 2019, 2023). However, as forests are often shared resources, their tenure arrangements are often opaque or poorly understood. This makes them vulnerable to the tragedy of the commons, where the benefits of forest resource use accrue to a limited number of users while everyone shares the associated costs. The world has lost over 178 million ha of forest since 1990. Africa had the largest annual rate of net forest loss for 2010–2020, followed by South America (FAO, 2020; Secretariat of the Convention on Biological Diversity, 2024).

Growing awareness of the many public benefits forests provide has sparked numerous initiatives aimed at their protection and restoration. On the global stage, multilateral efforts to elevate forest conservation have been growing since the United Nations Conference on the Human Environment in Stockholm in 1972 (Abraham, 2022). Prominent global initiatives include REDD+ efforts launched in the early 2000s, the Bonn Challenge launched in 2011 to restore 350 million hectares degraded forest lands by 2030, the New York Declaration on Forests in 2014, and the Paris Agreement in 2015, which aims to reduce emissions and limit global warming. Meanwhile, corporate sustainability pledges through the Tropical Forest Alliance and initiatives like the Trillion Trees campaign reflect increasing private-sector engagement (Busch & Ferretti-Gallon, 2023).

Governments have used a variety of approaches to conserve forests – ranging from national forest policies, protected areas, community-based forest management, to financial incentives such as payments for ecosystem services, jurisdictional approaches and certification – as illustrated by the papers cited in the following paragraphs.

A broad body of research on the effectiveness of these approaches across different contexts has grown steadily since the 1990s. Recent and prominent examples include evidence gap maps (EGMs) such as Pirard and others (2019) *Effectiveness of Forest Conservation Interventions: An Evidence Gap Map* published by the IEU, and *Land-use change and forestry programmes in low-and middle-income countries: an evidence gap map update* by Parrao and others (2024).

Additionally, hundreds of primary studies have been catalogued through systematic reviews, including those by Ma and others (2020), Di Girolami and others (2023) and Montero-de-Oliveira and others (2023). The increasing interest in researching forest conservation is also reflected in meta-analyses, such as those by Wehkamp and others (2018), Snilsveit and others (2019), Börner and others (2020), and Busch and Ferretti-Gallon (2023).

Beyond forest conservation, a 2024 EGM by Marion and colleagues charts the broader evidence base on climate change and biodiversity interventions in developing countries that includes a systematic review of land management practices.

Gaining an understanding of existing literature and evidence gaps is essential to ensure funding is directed towards effective and scalable climate solutions. This is particularly important for

developing countries where resources for forest conservation may be limited, and alternative land uses may be more economically appealing to stakeholders in the short term.

B. THE RATIONAL FOR THIS EVIDENCE GAP MAP

Conserving forests and reducing forest degradation and deforestation are embedded in multiple multilateral environmental agreements and global commitments. Forest conservation is included in the Convention on Biological Diversity to achieve the goals and targets of the Kunming-Montreal Global Biodiversity Framework. Further, the United Nations Convention to Combat Desertification also engages with land-use changes, including deforestation and degradation.

Most importantly, Article 5 of the Paris Agreement outlines how Parties to the United Nations Framework Convention on Climate Change (UNFCCC) should take action to conserve and enhance, as appropriate, sinks and reservoirs of GHGs, including forests.[1] Further, Article 5 outlines how Parties should implement and support, including through results-based payments, the existing framework as set out in related guidance and decisions already agreed under the Convention in terms of policy approaches and positive incentives for activities relating to:

- reducing emissions from deforestation and forest degradation
- the role of conservation
- sustainable management of forests and enhancement of forest carbon stocks in developing countries
- alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests.[2]

At the same time, Article 5 outlines how Parties should implement and support Convention guidance and decisions reaffirming the importance of incentivizing, as appropriate, non-carbon benefits associated with such approaches. Within the UNFCCC, the REDD+ mechanism has been particularly important.

The significance of forests was illustrated at COP29 in Baku, Azerbaijan, with the launch of the Model Forest Act Initiative,[3] alongside substantial progress on Article 6.4 of the Paris Agreement, one of the flexibility channels through which climate commitments can be achieved.[4] Further, there are strong signals that the climate, biodiversity and desertification benefits of forests are now coalescing within the UNFCCC. Both the UNFCCC and the CBD are negotiating a Tropical Forest Forever Facility, which proposes to use satellite monitoring for results-based payments with the intention of launching the facility at COP30 in Belém, Brazil.

All four multilateral climate finance funds – the Adaptation Fund (AF), Climate Investment Funds (CIF), Global Environment Facility, and Green Climate Fund (GCF) – have forestry-related programmes/projects. These differ in scale and scope. As of late 2024, the AF has two forestry projects totalling USD 5.06 million in grant funding covering the theme of strengthening the land-based adaptation capacity of communities, livelihoods, and ecological security. The Climate

[1] Paris Agreement, Article 5
[2] Paris Agreement, Article 5
[3] Due to the lack of legal expertise focused specifically on forests, the Model Forest Act offers forest legislators, activists and advocates a set of legal blueprints that can be tailored to specific country contexts and communities. The initiative also includes resources to improve implementation of forest conservation measures as well as enforcement mechanisms. See https://lpr.adb.org/program/mofai
[4] COP29 saw agreement on the principles for Article 6.4, covering among other areas credibility, baselines, data sources, additionality as well as non-permanence and reversals. Furthermore, COP29 saw agreement on associated standards, including on MRV, accounting, renewals of crediting periods, reversals and notifications (time), leakage (space). Importantly, the standards also included provisions for robust environmental and social safeguards, human rights and the rights of Indigenous Peoples.

Investment Fund established the Forest Investment Program in 2009 to provide funding for countries to reduce deforestation, curb forest degradation, support sustainable forest management, and promote forest carbon stocks. The Forest Investment Program's portfolio includes 53 projects with USD598 million in approved funding covering a range of project types.[5] In 2010, the Climate Investment Fund also established the Dedicated Grant Mechanism to enhance the role of Indigenous peoples and local communities in protecting the forests that they depend on. Many Global Environment Facility projects operate through a landscape-based approach to enhance sustainable forest management tools.[6] Over the years, the Global Environment Facility has supported 640 sustainable forest management projects with a value of over USD 3.7 billion. The portfolio covers a wide diversity of geographies, implementing agencies, focal areas, and financial values.

The GCF aims to support a paradigm shift towards low-emission and climate resilience development pathways in the context of sustainable development.[7] This overarching aim translates into GCF programming in the forest and land-use sector through:

- Forest Protection – Countries recognizing the role of forests for mitigation and adaptation in their nationally determined contributions need to reflect this pathway in strategic planning instruments at national and local levels
- Forest Restoration – Restoring forested landscapes relies on international and national catalysts for reforestation and on traditional and indigenous communities' buy-in and leadership
- Sustainable Forest Management – Improving forests and forestry management can help increase carbon sequestration and storage, grow resilience, and maintain economic productivity

As of late 2024, and with a focus on mitigation results, the GCF has provided USD 1.66 billion in financing for forests and land use through projects and results-based payment modalities. This support spans 74 projects, including those implemented under the GCF's REDD+ modality.

GCF's REDD+ window was approved in October 2017 and initially allocated USD 500 million to operationalize REDD+ results-based payments and test their procedural and technical elements.[8] Eight projects were approved – seven in Latin America and the Caribbean (LAC) and one in Indonesia - through three internationally accredited entities: the United Nations Development Programme, the Food and Agriculture Organization of the United Nations (FAO), and the United Nations Environment Programme.[9] The eight selected countries reinvested REDD+ proceeds in activities aligned with their nationally determined contributions, REDD+ strategies, or low-carbon

[5] These include landscape approaches, sustainable forest management, capacity building/institutional strengthening and governance reform, Indigenous peoples/local communities, forest monitoring/measurement, reporting, and verification, and agroforestry.
[6] Projects include a focus on protected area establishment and management, integrated landscapes planning and management, forest restoration, certification of timber and non-timber forest products, payment for ecosystem services schemes, financial mechanisms related to carbon, development and testing of policy frameworks to slow the drivers of undesirable land-use change, and work with local communities to develop alternative livelihoods to reduce pressure on forests.
[7] Governing Instrument, 2011
[8] IEU Special Study on REDD+ results based-payment projects in LAC, August 2024
[9] By September 2017, 25 countries had submitted their Forest Reference Levels (FRL) of which the UNFCCC Secretariat had assessed 12.

development plans.[10] In this sense, REDD+ RBPs rewarded countries for prior certified reductions in deforestation and degradation.[11]

In July 2024, the GCF Board approved the principles for mainstreaming REDD+ results-based payments into GCF's regular project and programme activity cycle. It also agreed, on an exceptional basis, to extend the pilot programme on REDD+ results-based payments to a broader group of countries.

C. STUDY OBJECTIVES AND RESEARCH QUESTIONS

To support the learning mandate of the GCF-IEU, this review aims to produce an EGM of the available literature, answering the following overarching question:

What is the evidence base on the effectiveness of selected forest conservation interventions in developing countries?

EGMs illustrate the evidence base by mapping the number of existing studies in specific intervention/outcome categories, typically presented in a matrix. They identify gaps, such as areas where the number of studies, evaluations or syntheses is low and, conversely, highlight 'saturated' cells, thus enabling a systematic review that includes potential meta-analysis on identical intervention-outcome combinations. EGMs facilitate evidence-driven decisions by making information easily accessible. They can also present different study designs using different shapes or colours, allowing for easy interpretation and understanding.[12]

The effectiveness of forest conservation initiatives is defined, first and foremost. by the objectives set for each initiative. Objectives typically address forest cover and biodiversity. Climate change mitigation and adaptation have increasingly become key additional forest conservation objectives, pursued through mechanisms such as REDD+ and nature-based solutions. These outcomes can be tracked by indicators such as changes in forest cover, canopy, biodiversity health, carbon storage capacity, reduced incidence of landslides, and improved water security (Pokharel and others, 2007; ITTO, 2016). Moreover, the success of conservation programmes is increasingly evaluated not only by environmental outcomes but also by their effectiveness in addressing local social and economic needs. Indicators here include income, employment, food security and education (Egan & Estrada-Bustillo, 2011). To evaluate the effectiveness of interventions, study designs should be able to compare similar sites with and without the intervention or before and after it occurs. The evidence review in this learning paper considers all these factors, as outlined in Table 1.

[10] The process for selecting countries and allocating payments was as follows. The GCF Secretariat and the independent Technical Advisory Panel (iTAP) assessed financing proposals based on a scorecard, compliance with GCF policies and technical criteria. They included an incentive for full alignment and non-carbon benefits. The payable emission reductions ('GCF ERs volume') were calculated by dividing the total score obtained by the maximum possible score (48 points) and multiplying this by the emission reductions offered by a country. An additional 2.5 per cent of the resulting value was included in the final payment for any country that showed: full alignment and non-carbon benefits.

[11] The IEU completed an evaluation of the GCF's REDD+ modality in June 2024. Rather than evaluating individual projects, the study synthesized common lessons from a portfolio of REDD+ RBP projects in LAC, drawing on the perspectives of a diverse range of stakeholders associated with these projects. It found that the approval process of the REDD+ RBP projects improved over time through using refined templates. While the ex-post requirement to invest REDD+ RBP proceeds went beyond the requirements of the Warsaw Framework, it did not restrict access to funding but it did introduce delays. IAEs acted as conduits to the Fund, using their technical expertise and working with local partners through framework agreements. The study highlighted the importance of national structures for the devolution of resources, the value of flexibility in allocating funds, and that long-term benefits were embedded through institutional innovations, such as new instruments (Colombia and Paraguay), enhanced monitoring, reporting and valuation systems MRV (Costa Rica), and strengthened governance structures (Chile).

[12] Additional characteristics of the intervention or study, such as geographical region, population sub-group or study design can be applied as filters within the map.

Table 1. Scope of the evidence review

Population	Forest ecosystems in developing countries
Interventions	Policies, programmes or projects that conserve or protect forest ecosystems directly or indirectly
Comparator	Comparable forest ecosystems at sites without the implementation of a forest conservation intervention or measuring before and after the intervention
Outcomes	Direct environmental benefits resulting from forest conservation, along with any indirect resource effects and socioeconomic effects

Source: Authors

D. FINDINGS FROM PREVIOUS REVIEWS ON FOREST CONSERVATION

This evidence review builds on three previous EGMs related to forest conservation. First, Puri and others (2016), in their report *"Examining the Evidence Base for Forest Conservation Interventions"* published by 3ie in New Delhi, analysed the effectiveness of forest conservation strategies in low- and middle-income countries over the period from 1990 to 2015. Their comprehensive review included 110 impact evaluations and eight systematic reviews. They found that the majority of evidence was focused on three key conservation interventions: protected areas, decentralized or community-based forest management, and payment for ecosystem services (PES). These interventions were primarily assessed in terms of their impact on forest cover, levels of forest degradation, and socioeconomic outcomes such as income and poverty reduction. They found that most of the evaluations employed quasi-experimental methods to estimate the causal effects of these conservation efforts.

Second, Pirard and others (2019), in their report *"Effectiveness of Forest Conservation Interventions: An Evidence Gap Map,"* published by the GCF in Songdo, South Korea, expanded on the work of Puri and others (2016) by extending the evidence review through to 2018. They incorporated 120 additional studies for 2016–2018, alongside 68 studies from the original Puri review that met their inclusion criteria. Their analysis revealed that significant gaps remain in the evidence base for many combinations of forest conservation interventions and outcomes. The most frequently studied interventions continued to be protected areas, decentralized or CFM, and PES. The key outcomes most examined remained forest cover and livelihood impacts. Although quasi-experimental methods were widely used, many studies lacked comparators or relied primarily on survey data, limiting the strength of the evidence base.

Third, Parrao and others (2024), in their report *"Land-Use Change and Forestry Programmes in Low- and Middle-Income Countries: An Evidence Gap Map Update,"* published by 3ie in New Delhi, broadened the scope beyond traditional forest conservation interventions to examine a wider range of land-use and forestry programmes. Covering 2000–2023, the study synthesized findings from 596 studies. Among the most frequently evaluated interventions were protected areas, decentralized or CFM, PES, and agricultural extension and training programmes, together accounting for 58 per cent of the evidence base. In terms of outcomes, forest cover and income were the most commonly assessed, representing 49 per cent of all outcomes studied. The authors found the research landscape continues to be dominated by quasi-experimental methods, with a strong reliance on matching techniques. Notably, about one-third of the studies incorporated geospatial data into their analyses.

The evidence base across the three EGMs shows how measuring forest cover in well-defined protected areas is relatively straightforward due to the abundance of remote-sensing data, eliminating the need for fieldwork and time-consuming primary data collection. In contrast, assessing biodiversity and socioeconomic factors requires specialized field methods, long-term commitment, and a broader set of skills to apply high-quality experimental or quasi-experimental approaches effectively.

As is characteristic of EGMs, the description of the evidence base is at a relatively general level. To examine the effectiveness of interventions, it is necessary to look at the current landscape of systematic reviews. Parrao and others (2024) analyse medium-high confidence systematic reviews. They report findings from two SRs on protected areas, which show broadly positive outcomes, particularly for the protection of habitat in tropical forested areas (Geldin and others, 2013; Pullin and others, 2013).

With regards to PES, an incentive-based mechanism where landowners and resource users are financially compensated for maintaining or enhancing ecosystem services, two systematic reviews indicate approaches based on payment for environmental services (PES) could reduce deforestation but that these findings should be treated with caution due to the quality of the evidence (Sami and others, 2015 and Snilstveit and others, 2019). Only one systematic review was found that looked at community-based forest management and found that the quality of the studies meant that meta-analyses were not possible but that it seemed community-based forest management had a positive effect on reducing deforestation (Sami and others, 2015).[13]

This updated evidence gap map of forest conservation interventions in developing countries will help to assess whether key forest policies, the use of improved technology such as cookstoves, or private-sector mechanisms are proving effective in terms of environmental and social outcomes (Pirard and others, 2019; Parrao and others, 2024).

II. METHODS

A. OVERALL METHODOLOGICAL APPROACH

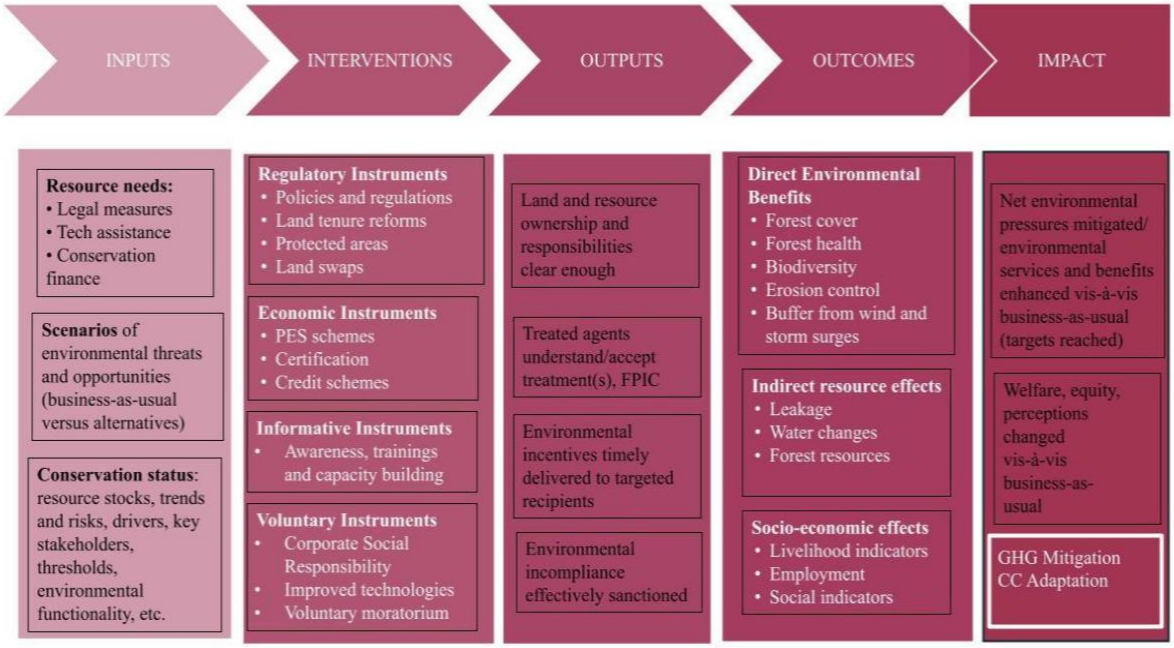
The development of the EGM involved a rigorous approach to identify, assess, and visualize gaps in research evidence through three main phases, as described in full in the approach paper for this review (Bertzky, Doswald & Prowse, 2024). First, the evidence review team developed the scope of the study (see Table 1) and the framework for analysis. A theory of change (ToC) was used to explain how the activities undertaken by an intervention – such as a project, programme or policy – contribute to a chain of results that lead to the intended or observed impacts. In parallel, the review applied the Population, Intervention, Comparator and Outcomes (PICOs) approach alongside the ToC. Second, a set of search steps was developed containing requirements, eligibility criteria, and coding procedures. Finally, the articles found were screened for eligibility and then coded into the online EGM framework through Evidence for Policy and Practice Information Reviewer 4.

[13] On PES, see the recent GCF-IEU evidence review on market-based approaches to mitigation and adaptation (Beavor, A. and others, 2024).

B. THEORY OF CHANGE

The ToC broadly sets out the reasoning, linking inputs and assumptions to outcomes and impacts at varied scales in space and time. Forest conservation covers a diversity of types and scales of intervention, ranging from small integrated community conservation projects to large-scale national strategies, including for REDD+ and protected area networks. The review identifies and synthesizes the available evidence on deliberate interventions aimed at advancing forest conservation, specifically in non-Annex I countries. The ToC underpinning the review is Börner and others (2020), who proposed a framework for assessing the effectiveness of forest conservation based on theoretical impact channels, economic and institutional requirements for effectiveness, and trade-offs arising from leakage, spillover effects, and behavioural responses. This ToC serves as the basis for the review, with modifications made to the categories of interventions and outcomes. In particular, while Börner and others (2020) classified interventions into three categories – enabling measures, incentives and disincentives – these categories, while relatively intuitive, do not fully capture the range of instruments policymakers use. For this EGM, a more suitable classification is drawn from Bengtsson and others (2010), which organizes interventions by policy instrument type: regulatory, economic, informative and voluntary.

Figure 1. Theory of Change for the effectiveness of forest conservation



Source: Authors

Note: This ToC was adapted from Börner and others (2020). The elements retained for the EGM framework are shown in white.

C. CRITERIA FOR INCLUSION AND EXCLUSION OF STUDIES

This evidence review expanded the scope of the study illustrated in Table 1 into a full set of Population, Intervention, Comparator and Outcomes (PICOS) to derive the inclusion and exclusion criteria for studies. The PICOs are described below.

1. Population

The EGM includes:

- Developing countries. The review refers to developing countries in this context as non-Annex I countries as defined by the Kyoto Protocol.
- The review included studies conducted at different units of observation, including households, communities, firms, districts, regions,[14] and countries.
- The review focused on forest ecosystems targeted by a forest conservation intervention, including terrestrial forest ecosystems, mangroves, and agroforests.

2. Interventions

Forest conservation interventions were drawn from those used by Pirard and others (2019) and reclassified into the following policy instruments:

- **Regulatory Instruments**: These involve creating laws, regulations, or rules that set obligations or restrictions on behaviour. For example, enforcing environmental standards or protected areas through legal requirements.
- **Economic Instruments**: These include using government financial mechanisms such as taxes, subsidies, and incentives to influence behaviour. For instance, carbon markets encourage businesses to reduce emissions, while payments for ecosystem services incentivize forest protection.
- **Informational Instruments**: These aim at educating and informing the public or specific groups about an issue, such as public awareness campaigns on environmental protection. The goal is to influence behaviour through information dissemination.
- **Voluntary Instruments**: These include establishing non-binding agreements or partnerships between government, businesses, and other stakeholders to achieve policy objectives. Examples include voluntary environmental agreements or corporate social responsibility initiatives.

Appendix 1 shows the alignment of these categories with the coding used in the previous EGM forest conservation. There are two differences between this evidence review and the study by Pirard and others (2019). First, the IEU study classifies most community-based forest management under land tenure reforms, as the approach generally arose through changes in forest laws where the rights to manage, use and sometimes own forest had been given to the community (Larson and others, 2010; Tol, 2010). Second, it includes credit schemes and market mechanisms, such as the carbon market or biodiversity credits. Appendix 2 provides definitions of the EGM's interventions.

3. Comparison

This review included studies that evaluate comparable populations – whether forest ecosystems, human populations or firms – at sites without the implementation of a forest conservation intervention or by measuring conditions before and after the intervention.

[14] The term "regions" in the context of the review refers to subnational units, such as the Brazilian Pantanal, and international units, such as the Amazon rainforest.

4. OUTCOMES

The definitions of the outcomes in the 2019 EGM were reviewed to assess their suitability for the present EGM. Outcomes are not part of the inclusion/exclusion criteria for the study.[15] As shown in the ToC, the team suggests distinguishing outcomes according to whether they are direct environmental benefits, indirect resource effects, or socioeconomic effects, as detailed in Appendix 3. Each of these can be experienced directly by citizens as a result of forest conservation interventions.

The GCF's assessment of forest conservation interventions primarily focuses on how effectively they contribute to climate goals. Accordingly, the review focuses predominantly on the reduction or sequestration of carbon dioxide or other GHGs through the conservation of forests that would otherwise have been degraded or deforested. It also examines the contribution of forests to climate change adaptation.

Climate mitigation and adaptation may be considered as outcomes or impacts, depending on whether the actions were specifically designed for these purposes or whether the effects emerge indirectly through cascading or systemic processes. The review includes climate adaptation outcomes within natural systems, such as erosion control, buffering against wind and storms, and reduced flooding, as well as within human systems, including improved livelihoods.

5. STUDY DESIGN

The review includes quantitative or mixed-methods studies published as peer-review articles or grey literature,[16] including the following methodological approaches:

- Impact evaluation approaches, which assess the impact of an intervention using counterfactual analysis using experimental and quasi-experimental approaches
- Correlation analyses, such as using cross-sectional data, panel data or time series
- Systematic reviews of quantitative evidence studies.

The studies have been grouped into three categories:

- Tier 1 category studies using experimental and quasi-experimental designs
- Tier 2 category studies using non-causal methods but with comparators
- Tier 3 category studies without clearly defined comparators but with qualitative context

6. EXCLUSION CRITERIA

Table 2 summarizes the exclusion criteria used in this review. Furthermore, the review excludes book chapters, theses and all documents in languages other than English and Spanish.

[15] The 2019 EGM included GHG emissions, biodiversity, forest condition, forest conservation, forest protection, forest cover, reduced deforestation, livelihoods, and employment. The 2019 EGM also included the quality of certain impacts, such as the cost-effectiveness of the intervention – measured as positive outcomes relative to costs – and leakage in relation to the previously listed outcomes happening outside the intervention's boundaries. The 2019 EGM stated the list of outcomes was not closed and other social outcomes, such as participation, equity, were also considered

[16] Research and reports produced outside of traditional academic or commercial publishing channels.

Table 2. Summary of PICO framework and inclusion/exclusion criteria

	INCLUDE	EXCLUDE
Population	• Developing countries as defined by the Kyoto Protocol. • Range of scales including households, communities, firms, districts, regions, and countries. • Forest ecosystems targeted by a forest conservation intervention, including terrestrial forest ecosystems, mangroves, and agroforests	• Non-forest ecosystems • Areas not targeted by a forest conservation intervention • Countries listed in Annex I of the Kyoto Protocol
Interventions	1. Regulatory Instruments 1.1. Forest policies 1.2. Land tenure reforms 1.3. Protected Areas 1.4. Land Swaps 1.5. Compliance 2. Informative Instruments 2.1. Awareness and capacity-building 3. Voluntary Instruments 3.1. Corporate social responsibility 3.2. Voluntary use of improved technology 3.3. Voluntary moratorium 4. Economic Instruments 4.1. Payment for Ecosystem Services schemes 4.2. Environmental certification 4.3. Credit schemes and market mechanisms	Interventions not primarily aiming at forest conservation, including: • Integrated Conservation and Development Projects (ICDPs) that do not identify conservation as the primary objective • Interventions lacking clear boundaries for the population affected • Interventions primarily aiming to address threats to biodiversity, such as wildlife trade, poaching
Comparator	• Comparable populations, such as forest ecosystems, local households, communities, and companies at sites without the implementation of forest conservation interventions • Same populations at sites prior to the implementation of forest conservation interventions (before/after comparators) • Comparable populations subject to other forest conservation interventions	• Different ecosystems • Households, communities or companies in areas where non-forest interventions are implemented that could bias the comparison.
Outcomes	1. Direct environmental benefits 1.1. Forest cover 1.2. Forest health 1.3. Biodiversity 1.4. Erosion control 1.5. Buffer against wind and storm surges	None

	INCLUDE	EXCLUDE
	2. Indirect resource effects 2.1. Availability of other forest resources 2.2. Leakage 2.3. Water effects 3. Socioeconomic effects 3.1. Livelihood 3.2. Employment 3.3. Social effects 4. Impact 4.1. GHG mitigation 4.2. Adaptation	
Study	Quantitative or mixed-methods studies published as peer-reviewed articles or as grey literature, including the following methodological approaches: • Impact evaluation approach, which assesses the impact of an intervention using counterfactual analysis, including experimental and quasi-experimental approaches • Correlation analyses, such as using cross-sectional data, panel data or time series • Systematic reviews of quantitative evidence studies	• Process-based evaluation reports, such as evaluation reports based on milestone indicators, stakeholder-based evidence and qualitative information • Prospective and predictive analysis based on modelling • Cost-benefit and cost-effectiveness analysis

Note: The criteria in Table 2 were based on and adjusted from Puri and others (2019).

D. SEARCHING FOR EVIDENCE

This section details the search methods used on academic and other databases, websites and wider search methods, such as citation tracking. The review team developed a series of steps, which included a list of databases to be searched and additional sources such as organizational websites and databases that retrieve reports and other grey literature. The steps also included a list of selected articles provided by the advisory group.

1. SEARCH STEPS

The review covered both peer-reviewed and grey literature. The forest conservation EGM developed by Pirard and others (2019) covered the period 1990 to 31 August 2018. This review builds on that evidence by identifying additional literature published between 2018 and November 2024. Test search strings were developed on the earlier study and refined to ensure a comprehensive but manageable set for use in academic databases. Simplified search strings were developed for broader databases and websites. Searches were performed in both English and Spanish.

Selected bibliographic details were downloaded into Zotero, and all duplicates were removed. Furthermore, backward citation searches were used to find all cited references within published meta-analyses.

2. SEARCH DATABASES AND REPOSITORIES

Table 3 presents the number of records retrieved from each source during the rigorous search of academic databases, grey-literature databases and websites.

Table 3. Number of papers found in databases or websites by searches performed

DATABASE	HITS
Scopus	3,582
Environmental Evidence Library	206
3ie	45
World Bank e-library	112
Center for International Forestry Research and the World Agroforestry Centre (CIFOR-ICRAF)	728
Mangroves for the future	0
Mangrove Alliance	25
Ecologic Institute	2
The Nature Conservancy	0
Earth-Eval	0
Global Environmental Facility	18
Center for Effective Global Action Research Publications	1
Global Forest Resources Assessments	1
Total	4,720

In addition, the advisory committee contributed 32 articles, bringing the total number of records found to 4752.

3. SEARCH STRING

As described in Appendix 4, the search terms were classified according to different sets:

- Population
- Outcome
- Interventions
- Methods

Test search strings indicated that adding the methods set constrained the results excessively, and this set of search strings was excluded. The three remaining sets of searches were combined with the Boolean operator OR. An exclusion for non-developing countries was used as the fourth set. Table 4 provides an example search string used in the Scopus database.

Table 4. Search String used in Scopus

Population TITLE-ABS-KEY= (Forest* OR mangrove* OR rainforest*) AND ("forest protection" OR "forest restoration" OR "forest conservation" OR "reforestation" OR "sustainable forest management") AND TITLE-ABS-KEY= ("developing countr*" OR communit* OR village* OR communit* OR district* OR sector* OR "low income countr*" OR "middle income countr*")
Intervention OR TITLE-ABS-KEY= (Conservation OR protection OR management) AND ("protected area" OR "national park"; OR "indigenous territory" OR "indigenous reserve" OR "nature reserve" OR "forest reserve" OR sanctuary OR "conservation corridor" OR "extractive reserve") OR ("community-based management" OR "community-conserved area") OR ("payment for environmental services" OR payment for ecosystem services" OR PES OR "direct payment" OR; "incentive-based conservation" OR subsid*) OR ("indigenous land demarcation" OR "local land demarcation" OR "Rural Environmental Registry" OR certification) OR ("agricultural yield" OR "sustainable agriculture" OR "capacity-building" OR "cooking stoves" OR "fuelwood substitution" OR "land-use zoning" OR "nontimber forest product" OR "land tenure" OR titling OR "law enforcement" OR "rule of law" OR "deforestation-free supply chain" OR zero-deforestation supply chain" OR "zero-deforestation commitment" OR "tax concession" OR "land swap" OR "moratorium" OR "environmental awareness")
Outcomes OR TITLE-ABS-KEY= ("greenhouse gases emissions" OR "GHG emissions" OR "carbon stock enhancement" OR "forest condition" OR "forest cover" OR "reduced deforestation" OR (adaptation AND flooding) OR (adaptation AND drought) OR "disaster-risk reduction" OR "soil stabilisation" OR "erosion control" OR livelihood* OR employment OR (adaptation AND buffer) OR (Adaptation AND "storm surges") OR coastal protection OR leakage OR ("water quality" OR "water quantity" OR "surface runoff" OR "groundwater recharge" OR "water availability") OR income OR "poverty reduction" OR "food security" OR health OR education OR equity OR participation OR social OR knowledge OR "behaviour change"
Exclusion AND NOT TITLE-ABS-KEY= (US OR USA OR "United states" OR "North America*" OR Alabama OR Alaska OR Arizona OR Arkansas OR California OR Colorado OR Connecticut OR Delaware OR Florida OR Hawaii OR Idaho OR Illinois OR Indiana OR Iowa OR Kansas OR Kentucky OR Louisiana OR Maine OR Maryland OR Massachusetts OR Michigan OR Minnesota OR Mississippi OR Missouri OR Montana OR Nebraska OR Nevada OR "New Hampshire" OR "New Jersey" OR "New Mexico" OR "New York" OR "North Carolina" OR "North Dakota" Ohio OR Oklahoma OR Oregon OR Pennsylvania OR "Rhode Island" OR "South Carolina" "South Dakota" OR Tennessee OR Texas Utah OR Vermont OR Virginia OR Washington OR "West Virginia" OR Wisconsin OR Wyoming OR Canad* OR UK OR England OR Scotland OR Wales OR Ireland OR Irish OR Spain OR France OR Greece OR Ital* OR Portug* OR German* OR Switzerland OR Swiss OR "New Zeal*" OR Australia* OR Israel* OR Belgi* OR Netherland* OR "Dutch" OR Luxemb* OR Denmark OR Norway OR Sweden OR Finland OR Iceland* OR Poland OR Austria* OR Malta OR Hungar* OR Czech OR Slovak* OR Latvia OR Lithuania OR Estonia OR Russia* OR Romania* OR Bulgaria* OR Serbia OR Croatia OR Japan* OR Korea* OR "Hong Kong" OR Singapore OR Saudi Arabia OR Qatar OR Emirates)

For broader databases and websites, only the population and intervention list were used, together with country filters where available.

E. DATA COLLECTION AND ANALYSIS

This section describes the process of screening studies for eligibility and coding the included studies to populate the EGM and analyse the data.

1. SCREENING OF STUDIES

After combining search outputs from the different sources, uploading them into Zotero and removing duplicates, the full screening process was undertaken in EPPI Reviewer 4 through a stepwise process. The primary inclusion and exclusion criteria were applied to:

a) the article title and abstract
b) the full text of each of the articles.

The team applied a conservative approach during the first phase of screening, ensuring that an article was **included** if there was uncertainty about it meeting the required criteria.

The team tested for reviewer bias at the start of the selection process of the second step with a Kappa analysis (CEE, 2013). Three team members reviewed a common sample of 100 abstracts. Agreement on article inclusion or exclusion was assessed using the Kappa statistic,[17] which ranges from +1 (perfect agreement) to −1 (strong disagreement). According to Fleiss's rule of thumb, Kappa values below 0.40 are "poor," values from 0.40 to 0.75 are "intermediate to good," and values above 0.75 are "excellent" (Fleiss et al., 2003). The percentage agreement was 86 per cent with a free-marginal Kappa of 0.72, indicating a very good level of agreement between the three reviewers.

2. DATA EXTRACTION, MANAGEMENT AND ANALYSIS

The list of articles included in Pirard and others (2019) was also uploaded into EPPI Reviewer 4 to make a combined reference list from 1990-2024. Data extracted from the study included:

1. Bibliographical data
    + Full title of the paper
    + Authors
    + Year
    + Publication Type
    + Language
2. Descriptive data
    + Country and Region
    + Population / Scale of intervention
    + Intervention category, type and description
    + Outcome category, type and indicators
    + Outcome indicators
3. Methodological information
    + Study type and tier category[18]

[17] Online Kappa Calculator

[18] Three tier categories reflect the quality of the study. Tier 1 includes studies that apply impact evaluation approaches. Tier 2 consists of correlation analyses that include a comparator. Tier 3 comprises studies without clearly defined comparators but which offer valuable qualitative insights into the effectiveness of forestry-related interventions, including systematic reviews and meta-analyses.

+ Comparator
+ Analysis method

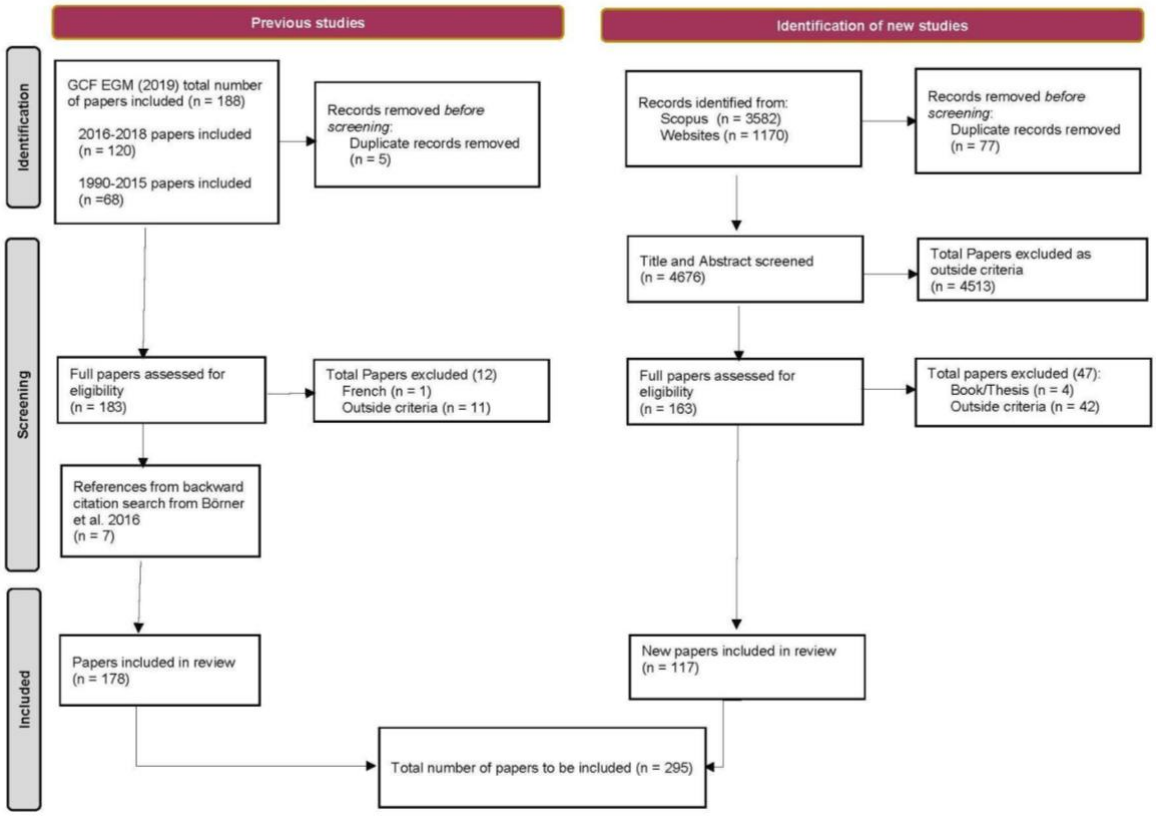
All data were extracted into Excel to allow for data analysis and graphics design, and the data on interventions/outcomes and tiers were entered into EPPI Reviewer 4 to allow for online visualization of the EGM.

III. SEARCH RESULTS AND DESCRIPTIVE STATISTICS

A. SEARCH AND SCREENING

The initial search yielded 4,676 articles after duplicates were removed. As illustrated in Figure 2, the screening process added 117 articles for the 2018-2024 search. The previous forest conservation EGM (Pirard and others 2019) compiled studies from 1990 to 2018 with a total of 188 papers – 120 from 2016-2018 and 68 of 122 from 1990-2015 in a previous study by 3ie (Puri and others 2016). Five duplicate records were removed from these earlier lists. The full papers were assessed for eligibility, resulting in 171 included articles. A backward citation search was conducted on a systematic review by Börner and others (2016), resulting in seven additional articles being included. This brought the total number of included articles from 1990-2018 to 178 articles. Thus, the EGM contains a total of 295 articles.

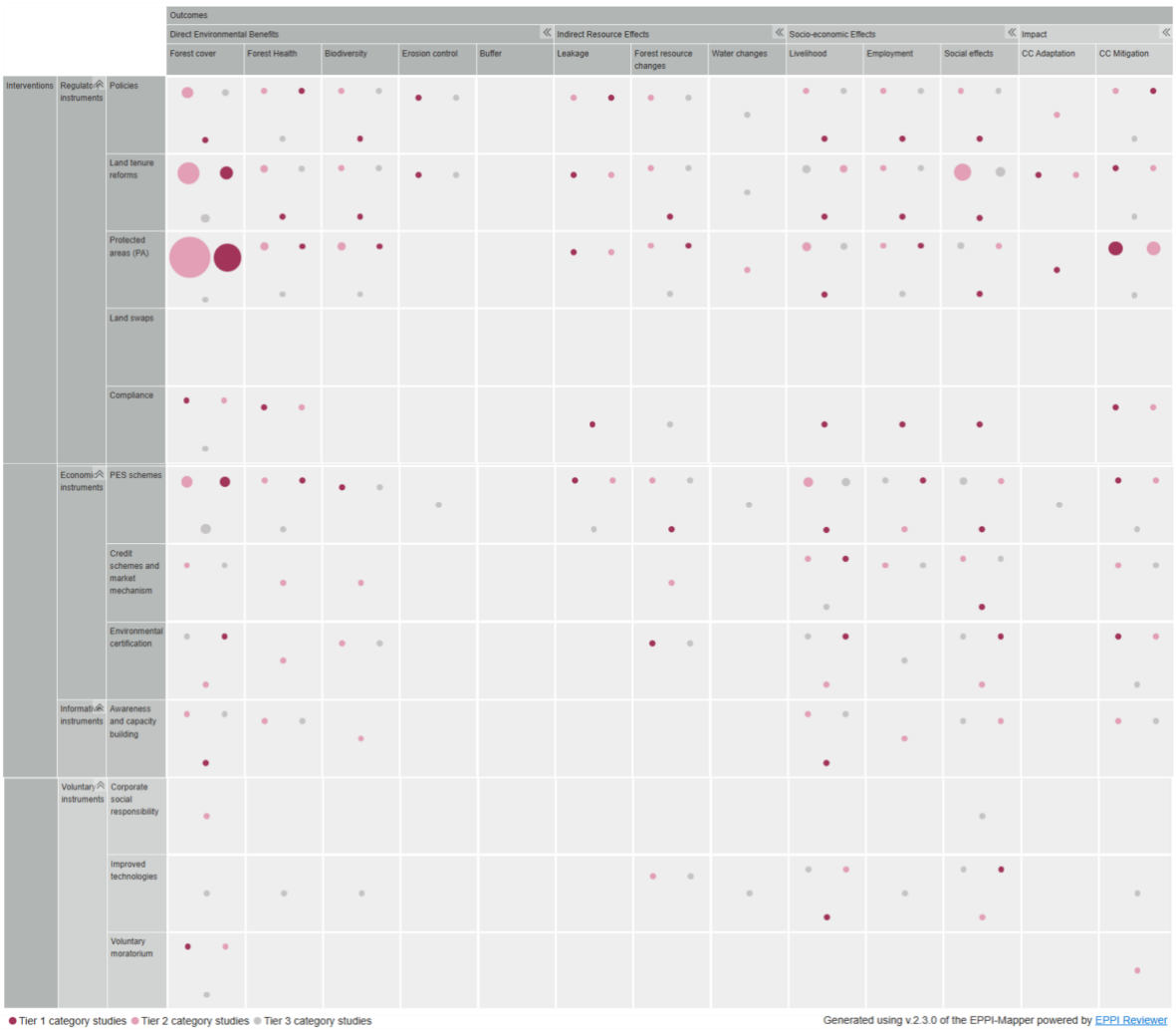
Figure 2. Overview of search results



B. CHARACTERISTICS OF THE EVIDENCE BASE

The EGM produced by the coding of the screened studies can be viewed online. Figure 3 shows a snapshot of the EGM, with different colours indicating the different tier categories. The following section describes the characteristics of the evidence base included in the EGM. It is important to note that some articles examined multiple interventions and their outcomes. As a result, the total number of intervention or outcome categories exceeds the number of articles. While 295 articles were catalogued, the total number of intervention or outcome combinations was 325.[19]

Figure 3. Evidence gap map on the effectiveness of forest conservation in developing countries



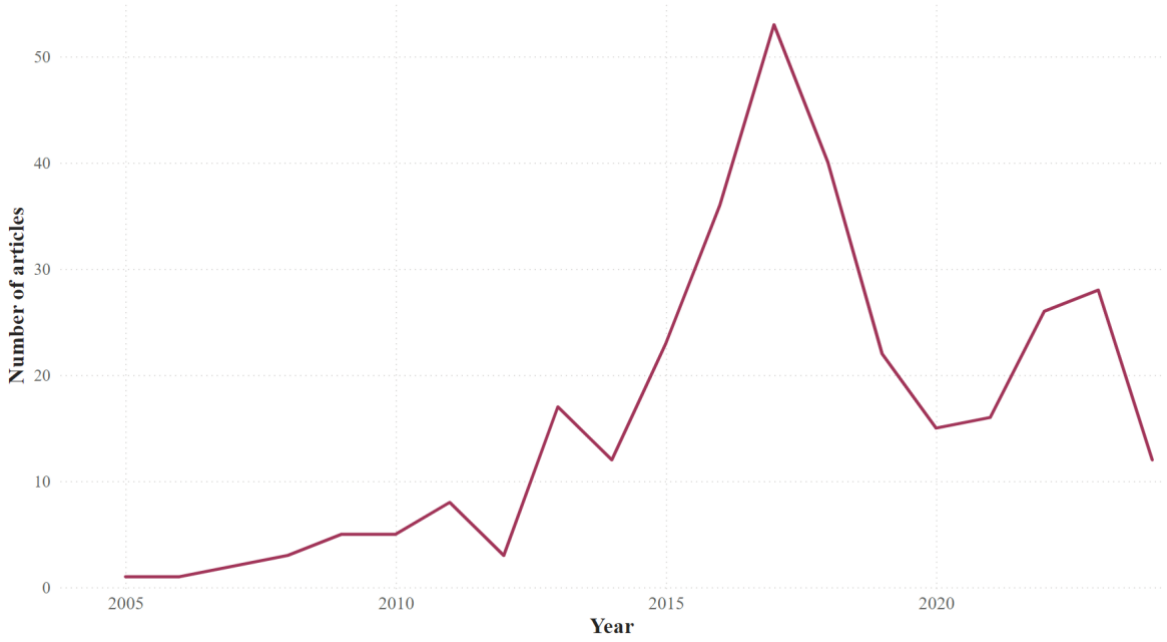
Source: Authors

1. PUBLICATION TREND OVER TIME

Publications on the topic of forest conservation effectiveness gradually increased from 2005, reaching a peak in 2017 before declining in 2020, as detailed in Figure 4. A second peak in 2023 shows renewed interest in the topic, although numbers fell again in 2024.

[19] We use the term "studies" when discussing, for example, the number of findings of a particular intervention or outcome category, and "article" when referring to the actual number of articles containing the different studies. In some cases, the number of "studies" on a particular intervention or outcome is the same as the number of "articles".

Figure 4. Publication trend over time

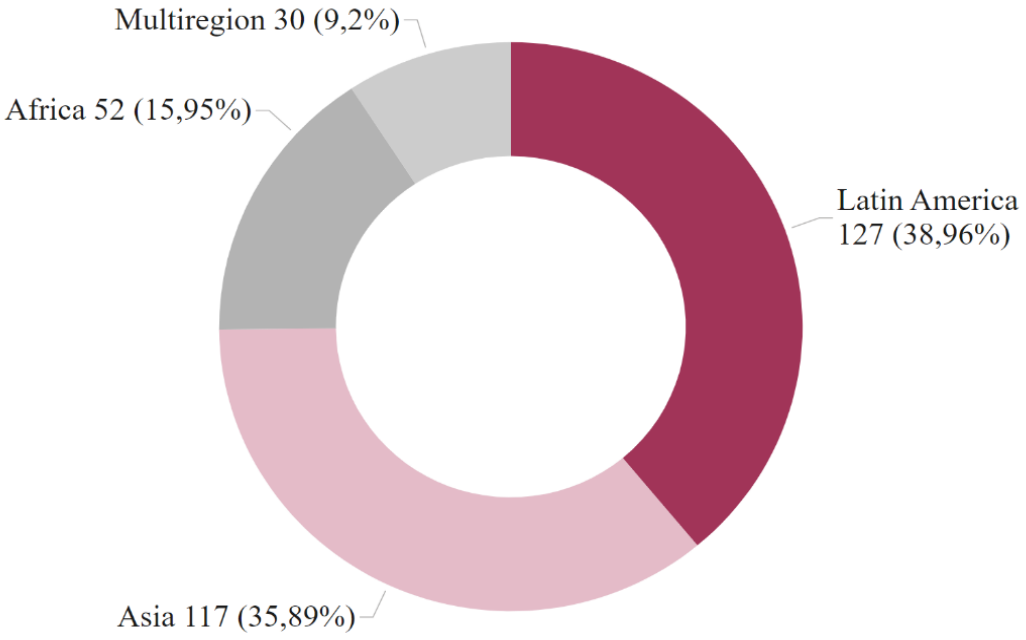


Source: Authors

2. GEOGRAPHICS DISTRIBUTION

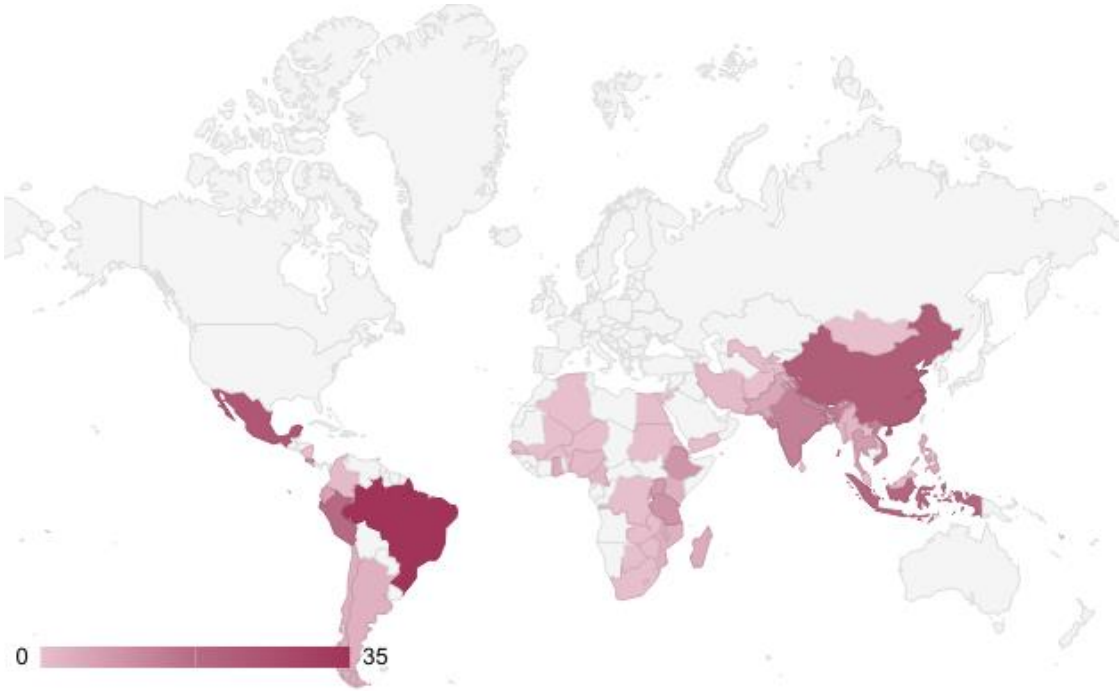
The data presented in Figure 5 reveals LAC as the region most studied, followed closely by Asia. Figure 6 illustrates how forest conservation interventions have been studied in 30 developing countries, with the highest concentration in Brazil, Mexico, Indonesia and China. Notable gaps remain in Africa, particularly among countries in the Congo Basin.

Figure 5. Evidence base on forest conservation effectiveness in developing countries by region



Source: Authors

Figure 6. Map of the evidence base on forest conservation effectiveness in developing countries

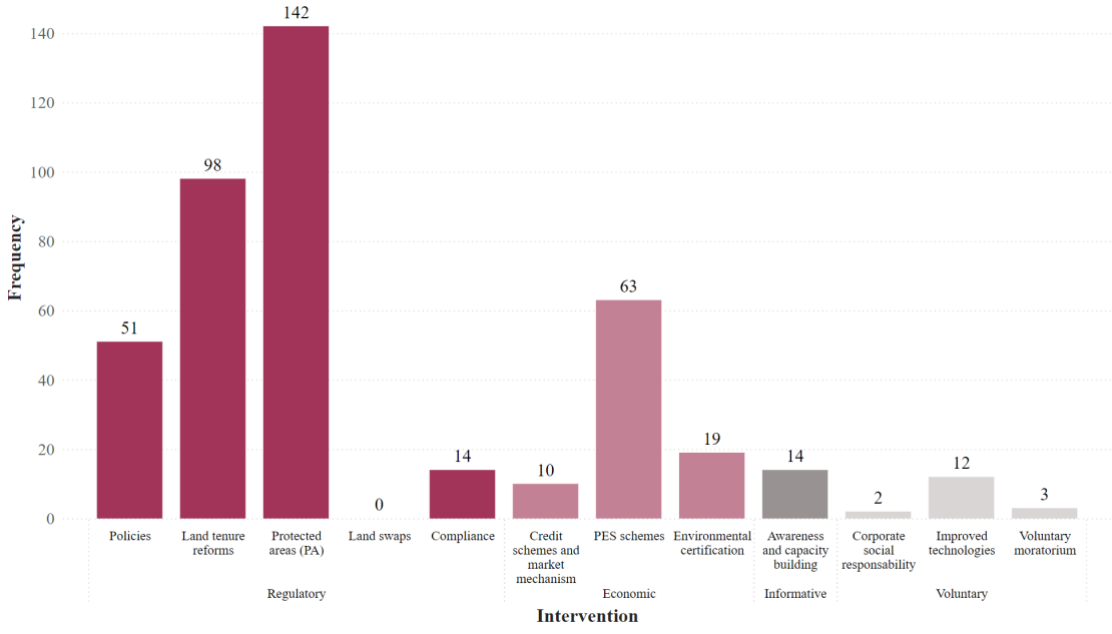


Source: Authors

3. INTERVENTIONS

When looking at broad intervention categories, regulatory instruments have the greatest amount of evidence, with 68 per cent of studies mapped onto this intervention type, followed by economic instruments at 24 per cent. Voluntary and information instruments offered the fewest number of studies, at approximately 4 per cent each. Figure 7 shows the number of studies within each broad intervention category.

Figure 7. Forest conservation interventions studied in the literature included in the EGM



Source: Authors

a. Regulatory instruments

Protected areas

As Figure 7 explains, protected areas were the most frequently studied regulatory instrument, a finding that has not changed since Pirard and others (2019). Within the articles on protected areas, an additional systematic review was found dating from 2020 (Ma and others, 2020), which was not included by Parrao and others (2024). As shown in Figure 3, studies on protected areas cover all outcome topics except buffering against wind and storm surges and erosion control and focus particularly on forest cover and mitigation.

Land tenure

Figure 7 indicates that land tenure reforms were the second most frequently studied intervention type, a finding that differs from Pirard and others (2019). As described earlier, the review team categorized community-based forest management interventions within the land tenure category because the intervention tends to occur through changes in land tenure. One example of this is the study by Anup and others (2018), which evaluated the implementation of these community forestry interventions in Nepal through the 1993 Forest Act and the 1995 Forest Rules. In contrast, Pirard and others (2019) treated them and land tenure as separate, while Parrao and others (2024) included them under the broader category of "area protection and management". Taking these differences in categorization into consideration, the findings of this review concur with the two previous studies in terms of the availability of evidence.

Figure 3 shows that land tenure studies also cover all outcome categories except buffering against wind and storms, with a majority of studies looking at the impact on forest cover and social outcomes. This finding is similar to those found by both Pirard and others (2019) and Parrao and others (2024), who also found forest coverage and social effects as common outcome areas.

Policies

Figure 7 also notes that the review found 51 articles evaluating policies.[20] As mentioned in the methods section, the category of policies includes strategic planning documents, programmes and legislation other than those related to land tenure or protected areas. As seen in**Error! Reference source not found.**, policies cover all outcome types except buffers.

Looking into the included literature, it is evident that legislative interventions include the revision or reforms of forest law, such as the study by Ainembabazi and others (2014), which examines evidence from Uganda's forest policy reforms. Another example is the application of land-use zoning, as illustrated by Bruggeman and others (2018), who examine the impact of land-use zoning on forest cover changes in Bhutan. A further example is law enforcement, as shown in the study by Amad and others (2022), which analyses trends in deforestation as a response to management regimes and policy intervention in the Hindu Kush Himalaya of Pakistan.

A variety of forest policy programmes or projects were included in the EGM, ranging from subnational projects, such as the evaluation of Pakistan's Ten Billion Tree Tsunami Project in Khyber Pakhtunkhwa Province (Aleem and others, 2024), to national policy programmes, as illustrated by the evaluation of the impact of Ghana's forest-related policies (Andoh and others, 2018).

Pirard and others (2019) found very few policy studies. Two factors can explain the difference in findings. The first is the classification approach. Pirard and others (2019) included one category on "improvement of the rule of law" and another on "mix of REDD+ projects and forest management policy". In the absence of a broader policy category, relevant studies may have been excluded. The

[20] In some cases, the number of studies matches the number of articles, in which case we choose to refer to the articles.

second factor is publication timing, as 65 per cent of articles classified as policy were published in 2018 or after.

Interestingly, Parrao and others (2024) also found 51 studies relating to policy. However, given that five studies in this review were published in 2024 and the scope of their study was broader, it is unlikely that the exact same set of studies appears in this review's EGM.

Land swaps

Land swaps remain a distinct gap in the literature, a finding that remains unchanged since the publication of Pirard and others (2019).

Compliance

Figure 7 shows that compliance interventions have been examined in 14 articles, half of which were published after 2018. As outlined in Appendix 2, the compliance category includes not only law enforcement through fines but also intragovernmental regulations to curb deforestation – an area categorized separately by Pirard and others (2019). The limited number of studies on intragovernmental deforestation-curbing regulations noted by Pirard and others (2019) no longer holds. In fact, several studies have since been published on the blacklisting of municipalities in Brazil (Assunção & Rocha 2019; Knoch and others 2019; Moz-Christofoletti and others 2022). Parrao and others (2024) include only one similar compliance intervention, referred to as "monitoring and enforcement", which does not align with that presented in this review.

b. Economic instruments

Payment for Ecosystem Services

Among economic instruments, PES schemes account for the greatest volume of evidence, with 63 studies across 59 articles, 23 of which have been published since 2018. As**Error! Reference source not found.** illustrates, PES covers all outcome categories except buffers and are slightly more numerous for forest cover and livelihoods.

As described in section D, both Pirard and others (2019) and Parrao and others (2024) find numerous studies on PES. We have catalogued one new systematic review on PES by Montero-de-Oliveira and others (2023), as listed in Appendix 5.

Environmental Certification

The findings in Figure 7 indicate that environmental certification is the second most studied topic within economic instruments, with 19 studies reported across 18 articles. Half of these articles were published after 2018, showing an increased level of interest in this topic since the publication of Pirard and others (2019). However, the coverage of outcome categories is more limited, as shown in **Error! Reference source not found.**, particularly regarding indirect resource effects, erosion control and buffering capacity.

Parrao and others (2024) report 60 studies on certification. However, their scope includes agricultural production and sustainable land management or conservation, which is considerably broader than the scope of this review. This review identifies one additional systematic review on certification published by Di Girolami and others (2023), as outlined in Appendix 5.

Credit schemes

The review identified 10 articles on credit schemes, representing a new category compared to the study by both Pirard and others (2019) and Parrao and others (2024), which means that no comparison can be made. Figure 3 shows socioeconomic effects as the outcome category most associated with credit schemes, with only five articles additionally addressing environmental outcomes.

c. Information instruments

Capacity-building and awareness-raising interventions were found in 14 articles, 10 of which were published after 2018, indicating a marked increase in the literature since Pirard and others (2019). Parrao and others (2024) identified 14 studies on the provision of formal technical and vocational training and 17 studies on information services to promote sustainable practices and technology. However, their review adopts a broader scope, including agricultural practices and sustainable land management. As shown in Figure 2, capacity-building outcomes in the EGM focus mainly on socioeconomic effects and forest cover.

d. Voluntary instruments

Improved technologies

Within voluntary instruments, the assessment of the effectiveness of improved technologies was the most frequently addressed, with 12 articles identified, as shown in Figure 7. In this EGM, a diverse range of improved technologies were applied voluntarily, including agroforestry, silvicultural practices, improved firewood cooking stoves, alternative energy schemes such as biogas, and alternative livelihoods such as beekeeping. As expected, socioeconomic effects were evaluated most frequently.

Three additional articles under this category were identified following the report by Pirard and others (2019). While that report also had a category on improved technologies that included the same types of technologies, the authors found only three studies, despite much of the report's literature overlapping with literature in this review. The categorization in their EGM was likely stricter as they only included Tier 1 and Tier 2 categories.

Corporate Social Responsibility

The corporate social responsibility category included only two studies and, therefore, remains a gap in the literature, as noted by Pirard and others (2019). The two studies are also very different. Chamberland-Fontaine and others (2022) looked at, among other things, how corporate funding supports mangrove restoration and protection. In contrast, Anderson and others (2019) examined the effects of private forest concessions in the Amazon, including those managed by companies with corporate social responsibility commitments.

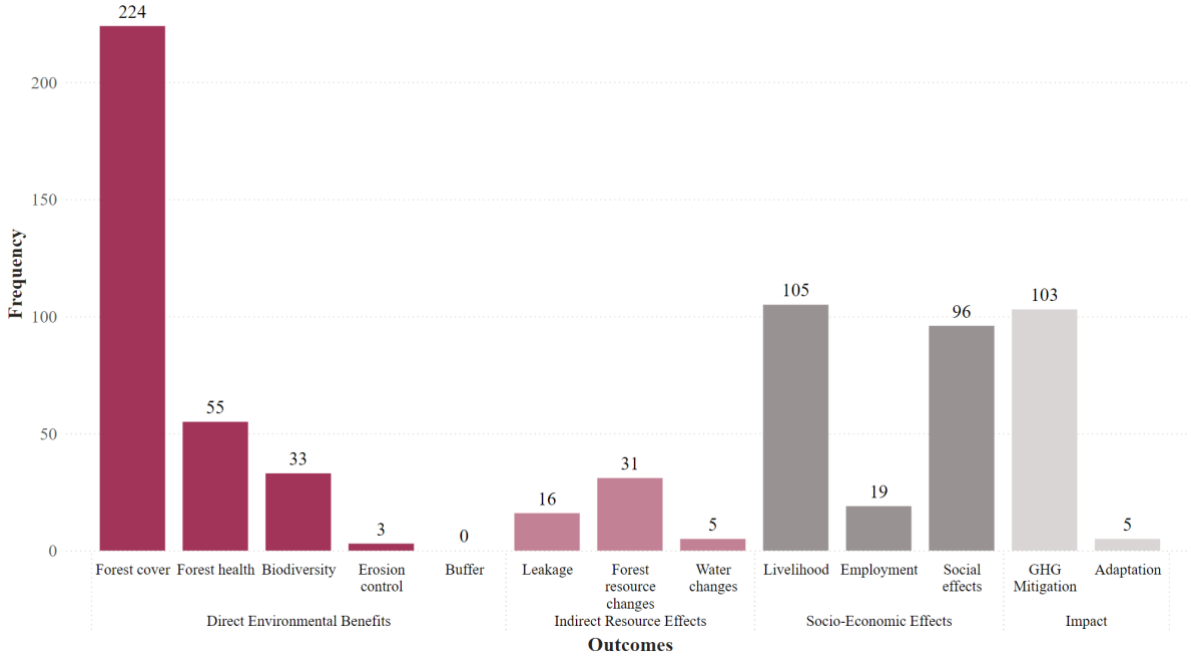
Voluntary moratoriums

Since the publication of Pirard and others (2019) EGM, there has been limited research on voluntary moratoriums aimed at forest conservation, as illustrated in Figure 7. Only three notably diverse studies have been identified: Börner and others (2020), a meta-analysis that incorporated two studies on voluntary conservation efforts; Jung and Polasky (2018), which focused on the Responsible Soy Project; and Brandt and others (2015), which explored traditional practices in China, including voluntary bans on logging.

4. Outcomes

Across the broad outcome categories, this review's EGM shows that direct environmental benefits were the most frequently studied, accounting for 46 per cent. Socioeconomic effects followed, examined in 27 per cent of cases. Indirect resource effects were addressed in only 8 per cent of studies. Impact was measured in 19 per cent of studies, particularly in relation to climate change mitigation. Figure 8 presents the number of outcomes per intervention studied.

Figure 8. Forest conservation outcomes studied in the literature included in the EGM



Source: Authors

a. Direct environmental benefits

Forest cover

As illustrated in Figure 8, forest cover was the most studied outcome, accounting for 224 of 325 studies. As reported in all three previous EGMs, the use of remote-sensing data makes this outcome relatively easy to study (Puri and others, 2016; Pirard and others, 2019; Parrao and others, 2024).

Forest health

While forest health was studied in 55 interventions across 54 articles, Pirard and others (2019) did not include this as an outcome. In contrast, the review by Parrao and others (2024) did, identifying forest conditions as an outcome in 41 studies. Since that review's publication, five new articles have been published. The difference in the number of articles can be attributed to the different intervention categories used, as outlined in Appendix 1.

Biodiversity

As Figure 8 illustrates, 33 articles examined the impacts of forest conservation interventions on biodiversity – eight times more than the four studies reported by Pirard and others (2019). In addition to the increase in the number of papers since 2018, this review's EGM coded 19 articles published before 2018. The difference reflects variations in how biodiversity was coded and study tiers reported in the previous EGM (see Pirard and others, 2019).

Erosion control

Only three articles discussed erosion control as an outcome of forest conservation initiatives. These articles each cover a different intervention: community-based conservation (Lambini & Nguyen, 2022), PES (Burivalova and others, 2019) and agroforestry practices (Robiglio & Reyes, 2016). Neither Pirard and others (2019) nor Parrao and others (2024) included erosion control in their outcomes.

Buffer

Buffers are a clear gap in the literature, as demonstrated in Figure 8. This outcome category is highlighted for the first time since neither Pirard and others (2019), nor Parrao and others (2024) included it in their EGMs.

b. Indirect resource effects

Leakage

Leakage was examined as a potential outcome in 16 articles, as shown in Figure 8. Interest in this topic has increased since the work of Pirard and others (2019), with seven additional studies identified. A clear trend has emerged in the study of leakage as an outcome linked to regulatory instruments and PES. In contrast, the remaining economic instrument interventions, along with all informative and voluntary instruments, remain significant gaps in the literature, as outlined in Figure 3.

Forest resource change

Error! Reference source not found. shows that forest resource change was identified as an outcome in 31 articles and covered most intervention types listed in**Error! Reference source not found.**. The most commonly cited indicator was the use or access to firewood, timber and non-timber forest products. This outcome did not appear in the EGMs by Pirard and others (2019) or Parrao and others (2024), so a comparison is not feasible.

Water change

Water change is also a new outcome to emerge since Pirard and others (2019). Only five articles described changes in water quantity or quality resulting from forest conservation interventions, including one systematic review by Burlinova and others in 2019. This limited number of studies indicates a clear gap in the literature on the relationship between forest interventions and water-related outcomes.

c. Socioeconomic effects

Livelihood

Livelihoods were the most common socioeconomic outcome reported in the literature, and, as Figure 3 explains, they covered all studied interventions except corporate social responsibility and voluntary moratoriums. Income was the most common indicator for livelihoods. This finding is similar to Pirard and others (2019) and Parrao and others (2024).

Employment

As can be seen from Figure 8, 19 studies across 18 articles reported employment as an outcome and covered all studied interventions except corporate social responsibility and voluntary moratorium, as outlined in **Error! Reference source not found.**. Twelve of these articles were published after 2018, showing an increase in interest in this topic. Pirard and others (2019) report only two studies in their EGM, potentially due to their classification system. Parrao and others (2024) did not look at employment.

Social effects

Social outcomes were described in 96 studies and, in most cases, in qualitative terms, such as empowerment or awareness.**Error! Reference source not found.** shows that social effects were reported in all studied interventions except voluntary moratoriums. Nearly half of those studies were published after 2018, showing an increase in the frequency of this topic since the 2019 study by Pirard and others.

d. Impact

GHG mitigation

Figure 8 indicates that GHG mitigation was reported as an outcome or impact in 95 articles covering 103 studies and included all studied interventions except CSR. About a third of these articles were published after 2019, further demonstrating the increased interest in the topic after the publication of the study by Pirard and others.

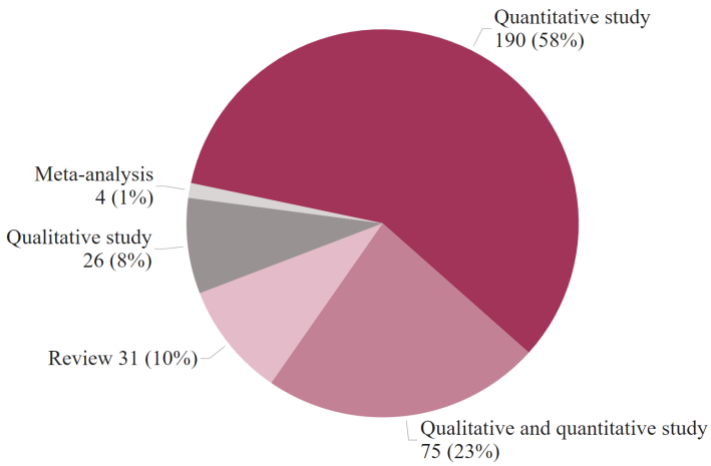
Adaptation

As indicated in Figure 8, articles rarely mentioned adaptation as a potential impact of forest conservation. The five articles that mentioned adaptation were published after 2017, which is consistent with the emergence of interest in this topic (Doswald and others, 2020). This gap in the literature is identified for the first time in this IEU evidence review, as neither Pirard and others (2019) nor Parrao and others (2024) included it in their EGMs.

5. STUDY DESIGN

As shown in Figure 9, of the five types of study design categorised in the EGM, quantitative and mixed methods form over three-quarters of included studies. When assessed by tier, Tier 1 studies account for 31 per cent of the total, while Tier 2 and Tier 3 represent 48 per cent and 21 per cent, respectively.

Figure 9. Types of studies in the EGM

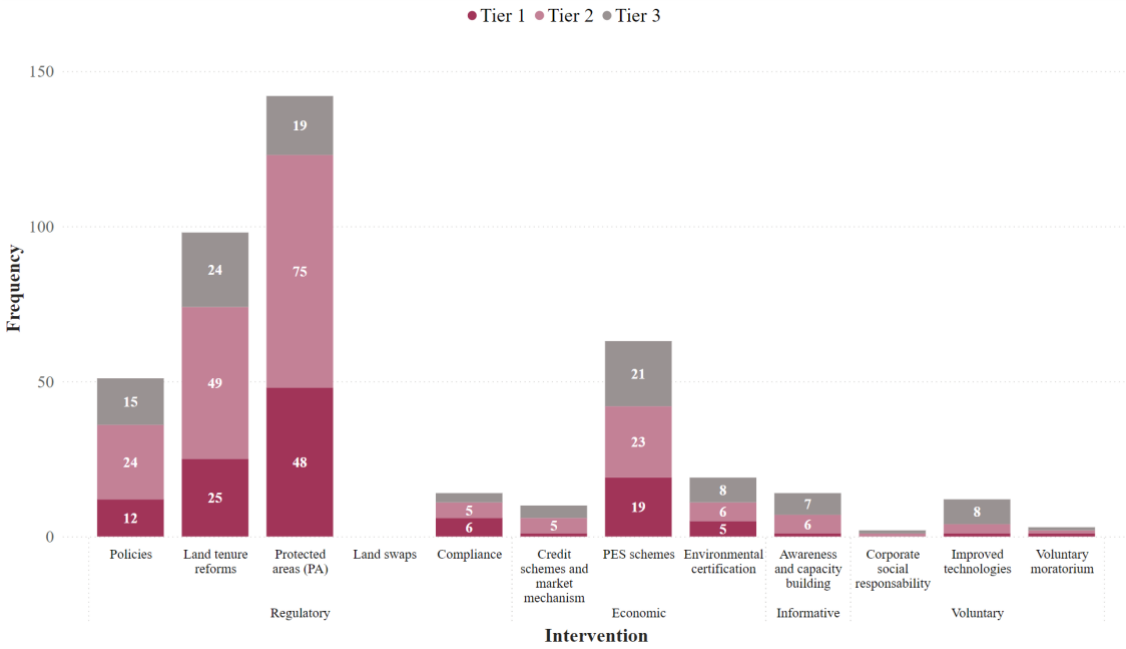


Source: Authors

a. Intervention by tier

Figure 10 shows the breakdown of interventions by tier. The highest relative proportion of Tier 1 studies compared to Tier 2 and Tier 3 for each intervention are compliance with 42 per cent (6 articles out 14), PA with 33 per cent (48 out of 142) and PES with 30 per cent (19 out 63). At the same time, the lowest are awareness and capacity-building (1 out of 14) and improved technologies (1 out of 12). The first three interventions are commonly evaluated using area-based analyses – such as Black and others (2022), who compared deforestation rates inside and outside protected areas in Cambodia. In contrast, the latter two rely on qualitative studies exploring socioeconomic impacts, as in Adulcharoen and others (2020) on the local impacts of community-based mangrove restoration.

Figure 10. Forest conservation interventions by tier studied in the literature included in the EGM

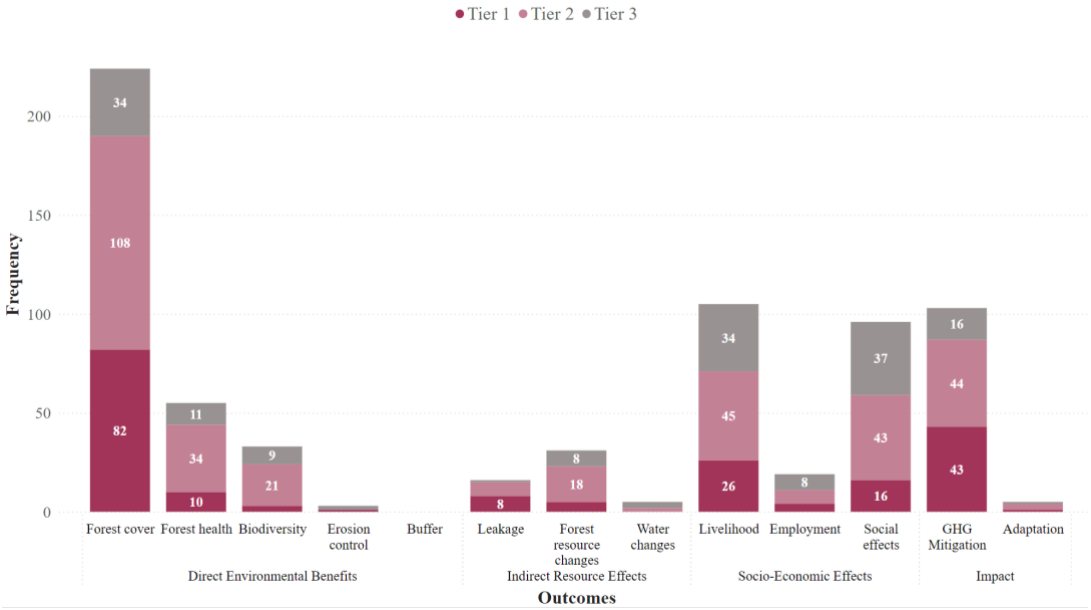


Source: Authors

b. Outcomes by tier

Figure 11 presents the studied outcomes by tier. The highest relative proportion of Tier 1 studies compared to Tier 2 and Tier 3 for each outcome are leakage with 50 per cent (8 articles out of 16), GHG mitigation with 42 per cent (43 articles out of 103) and forest cover with 36 per cent (82 out of 226). These outcomes tend to have solid indicators such as percentage change in forest cover and carbon stock. In contrast, livelihoods and social effects are more often examined in Tier 3 studies, often without clear indicators. Nevertheless, 24 per cent of Tier 1 studies also include livelihood outcomes, usually measured by income.

Figure 11. Forest conservation outcomes studied in the literature included in the EGM



Source: Authors

C. Gap Analysis

1. Geographic distribution

As shown in Figure 6, the developing countries with extensive forest resources, such as China, Brazil, Indonesia, Peru, and Mexico, are well represented within the studies included in the EGM. Brazil, with 496 million hectares of forest resources, ranks second globally. China ranks fifth, containing 220 million hectares, which is equivalent to 5 per cent of forest cover worldwide (FAO, 2020). In comparison, Mexico has 65 million hectares of forest cover (Hannah Ritchie (2021)).[21]

African countries, including the Democratic Republic of Congo, the Republic of Congo, Gabon and many West African nations, are underrepresented in the evidence base despite Africa containing the world's second-largest expanse of tropical forests (Eba'a Atyi and others, 2022). According to the FAO's most recent Forest Resources Assessment, the Democratic Republic of Congo alone has 126 million hectares of forest (Hannah Ritchie (2021)).

This review's findings are similar to those of Pirard and others (2019), who also observed a limited number of studies in Africa and a preponderance of studies in Latin America and Asia. One notable difference is that Pirard and others (2019) identified India as having the largest number of studies, whereas this review ranked India sixth, alongside Costa Rica and Vietnam.

2. Interventions

a. Regulatory instruments

Regulatory instruments, particularly protected areas, land tenure reform and policies, emerged as the most frequently studied intervention. These interventions are relatively easier to study because they often involve formal legal documents and can be evaluated by linking the timing of regulatory changes to observable changes in forest cover using remote-sensing data, as seen in the work of Andrew and others (2023). However, other regulatory tools, such as using compliance methods to enforce forest regulations, are limited, as monitoring enforcement and actual adherence are often complex and data-scarce (FAO & ITTO, 2010).

Land swaps remain underexplored, likely because they are relatively rare, as noted by Pirard and others in 2019. They have been discussed as a potential approach for conserving forests in Indonesia, particularly within the context of the country's rapidly expanding oil palm industry (WRI, 2013). Nevertheless, the findings of this review indicate that such interventions have not been widely evaluated.

b. Economic instruments

Economic tools, particularly credit schemes, are underrepresented in the evidence base. Within the review's EGM, relevant studies largely focused on the voluntary carbon market, where private entities purchase credits to offset emissions, and on REDD+ initiatives, which provide financial rewards for verified emissions reductions. It is noteworthy that relatively few studies address voluntary carbon market projects. For instance, West and others (2023) evaluated 26 voluntary carbon offset projects in the Verra Project database to assess their success in reducing deforestation. The limited appearance of such projects in peer-reviewed and grey literature raises questions about the broader visibility and validation of their outcomes. No studies were found on biodiversity credit markets. This absence is unsurprising, as biodiversity credits only recently emerged as a major

[21] The remaining ranking in terms of the five countries with the largest forest resources belong to developed countries, with Russia in first place, Canada in third and the USA in fourth place.

theme in international policy conversations, particularly during the Convention on Biological Diversity COP15 in the context of the Kunming-Montreal Global Biodiversity Framework (Waterford and others, 2024).

In contrast, environmental certification schemes, such as those of the Forest Stewardship Council, have been established for some time and are now emerging topics in the literature, with a notable increase since the work of Pirard and others (2019). They represent a growing attempt by the private sector to leverage market-based mechanisms for forest conservation, similar to public sector approaches such as PES. Interest in these certification schemes has grown in line with rising consumer demand for sustainable products and increased efforts by companies to demonstrate environmental responsibility across global supply chains (McKinsey & Company and NielsenIQ, 2023). Notably, these recent studies are also starting to explore not only whether certification helps reduce deforestation but also how it influences broader social and ecological outcomes, as seen in the work by Burivalova and others in 2019 and Mitiku and others in 2018.

c. Voluntary instruments

Voluntary initiatives, particularly those led by the private sector, such as corporate social responsibility programmes and voluntary moratoriums on deforestation, represent another area with significant evidence gaps. These interventions are particularly challenging to study, as companies often withhold full details of their offset projects due to proprietary concerns or fears of being accused of greenwashing. Further, data availability for traceability and transparency in supply chains for forest products is unreliable, making it difficult to access data for evaluations (Fripp and others, 2023).

Within the "improved technologies" category, the primary interventions identified were the adoption of agroforestry practices. These practices are seen as a promising way to reconcile forest conservation with local livelihoods. However, the evidence base for their effectiveness in reducing deforestation at scale remains limited, given the relative paucity of articles on the topic.

3. Outcomes

a. Direct environmental benefits

As in previous EGMs, changes in forest cover remain the most commonly studied outcome in the literature (Pirard and others, 2019; Parrao and others, 2024). In comparison, forest health and biodiversity were less widely studied despite their critical role in determining conservation outcomes, as emphasized by the Secretariat of the Convention on Biological Diversity in 2024. Measuring biodiversity and forest health is challenging due to the sheer complexity and scale of these concepts, as well as the difficulty in establishing a universal, comprehensive metric. Biodiversity encompasses various levels of biological complexity, from genetic diversity to ecosystem integrity. Forest health is similarly multifaceted, encompassing factors like tree species diversity, the presence of deadwood, and the overall resilience of the ecosystem (Noss, 1999). While remote sensing cannot directly measure biodiversity, it can provide proxy data and indirect indicators. Increasingly, it is also being used to measure forest health (Torres and others, 2021).

The remaining direct environmental benefit outcomes were sparsely represented in the literature. In particular, the review did not identify any studies that specifically examined the benefits of forest conservation interventions in enhancing natural buffers against environmental hazards. This gap may stem either from limitations in the search terminology used or from the way the topic is framed in existing research. For example, although some studies document the role of mangrove forests in protecting coastal communities from tsunamis, such as Dahdouh-Guebas and others (2005) and Kathiresan and Rajendran (2005), they focus on the presence and ecological functions of existing

mangrove ecosystems, rather than evaluating the effectiveness of specific actions aimed at maintaining or enhancing those protective functions. As a result, the direct link between conservation interventions and buffer benefits remains underexplored.

b. Indirect resource effects

Indirect resource outcome effects were the least studied outcome group, representing a clear gap in the evidence base. These types of outcomes are often not considered traditional core objectives of conservation initiatives, which may partly explain their limited coverage. Nevertheless, they are critical to understanding the broader impacts of forest conservation. For instance, leakage is a well-recognized risk, particularly in the context of forest-based GHG mitigation projects (Schwarze and others, 2002). Despite its significance, leakage was addressed in only a small number of studies in this EGM. This may be because leakage is difficult to detect and even harder to establish and attribute causality. Similarly, the conservation of forests can inadvertently restrict local communities' access to forest resources, posing social and livelihood risks – issues that were also underrepresented in the reviewed literature.

The connection between forest conservation interventions and their impacts on the water cycle remains underexplored in the literature. Forests play a crucial role in regulating hydrological processes, influencing precipitation patterns, groundwater recharge, and surface water flows (Ellison and others, 2017). Conservation actions that preserve or restore forest cover are expected to yield significant water-related benefits, such as improved watershed stability and enhanced water quality. However, despite the ecological importance of these services, few studies have rigorously evaluated the direct effects of conservation initiatives on water cycle outcomes. Much of the existing research focuses on broader ecosystem services without identifying or quantifying specific hydrological changes linked to these interventions (Sudmeier and others, 2021). As a result, the potential co-benefits – or unintended consequences – of forest conservation for water security remain largely speculative, revealing a notable gap in the evidence base and an important area for future investigation.

c. Socioeconomic effects

Socioeconomic outcomes were relatively well represented in the literature, echoing patterns observed in previous EGMs (Pirard and others, 2019; Parreño and others, 2024), particularly regarding livelihoods and broader social impacts. However, many of these studies lacked analytical rigour. References to improvements in livelihoods or well-being were often made without specifying clear indicators, standardized metrics, or causal pathways. This vagueness makes it difficult to assess the true extent or nature of socioeconomic changes resulting from conservation interventions. One exception relates to income, which appeared more frequently as a tangible indicator of livelihood impacts. Several studies tracked changes in household income levels to assess the socioeconomic effects of forest conservation initiatives. Nonetheless, even among these, challenges related to attribution and variations in measurement approaches were common, as seen in studies by Sims in 2010 and Okumu and Muchapondwa in 2020.

Employment effects, in particular – including impacts on job creation, labour displacement, or income diversification – were rarely addressed in the reviewed literature. This represents a critical gap, especially given that employment opportunities are often cited as a key reason for promoting conservation initiatives among local communities.

d. Impact

The apparent lack of studies explicitly examining the role of forest conservation in climate change adaptation is striking. However, this may reflect a gap in discourse rather than a true absence of

activity. In recent years, approaches such as ecosystem-based adaptation and nature-based solutions (NbS) have gained prominence in describing conservation, restoration, and sustainable use interventions aimed at addressing societal challenges, including adaptation to climate change. As Doswald and others (2020) highlighted in their EGM on climate change adaptation in low- and middle-income countries, NbS were among the most frequently studied intervention types. However, NbS is an expansive and heterogeneous category. The specific forms of forest conservation included in this review may be either less typically implemented as NbS or are not explicitly identified as such in published research. Moreover, a recurring challenge is that many studies assess the ecosystem's protective functions – such as the existence of mangroves mitigating tsunami impacts – without evaluating the effectiveness of active conservation or restoration interventions. This conflation between the condition of the ecosystem and the intervention's impact suggests a need for clearer distinctions and more consistent classifications across research on nature-based adaptation strategies.

In contrast, GHG mitigation outcomes are more readily associated with measurable changes in forest cover and have attracted substantial research attention, partly driven by significant funding flows towards initiatives such as REDD+. It is notable, however, that while many studies reported GHG mitigation benefits, relatively few were categorized under the specific intervention type of credit scheme. This reflects a broader complexity highlighted by Pirard and others (2019), who argued that REDD+ initiatives often operate as a policy mix, blending multiple instruments and intervention types rather than fitting neatly into a single category. As a result, attributing observed GHG outcomes to a specific mechanism, such as credit generation, remains difficult and complicates efforts to map the evidence base along discrete intervention types.

IV. CONCLUSIONS AND IMPLICATIONS

This evidence gap map on the effectiveness of forest conservation interventions highlights several key trends and gaps in current scientific research.

Regulatory instruments, particularly protected areas and forest policies, were the most frequently studied intervention type. This is unsurprising given their central role in government-led conservation efforts. An emerging trend in the research is the growing recognition of land tenure security as a critical factor in implementing successful forest conservation. The increasing number of scientific papers addressing this issue in recent years reflects a broader shift in acknowledging that secure land rights can incentivize sustainable forest management. Communities and individuals with secure tenure are more likely to invest in long-term conservation practices, reducing deforestation and degradation. This growing body of evidence supports the need for policies that strengthen land tenure as a precondition for effective forest conservation strategies.

The evidence base shows that the effectiveness of PES has become a well-established area of research. PES represents a shift from traditional conservation models to a market-based approach (Snilsveit and others, 2019). This aligns with economic theories that emphasize incentives and efficiency, making it an appealing area of study for researchers interested in environmental economics and policy design, as highlighted by Jack and others in 2008. The topic has been widely researched, with numerous systematic reviews and meta-analyses that look at several outcome areas, as detailed in Appendix 5.

The EGM suggests that scientific research on credit schemes and corporate social responsibility in conservation is likely to increase in the coming years. Many of the papers addressing these topics are relatively recent, aligning with the substantial international attention given to biodiversity

finance mechanisms. The development of biodiversity credit schemes and the increasing focus on the private sector's role in addressing the biodiversity finance gap indicate that corporate involvement in conservation efforts is becoming more prominent. As companies face rising expectations to contribute to sustainability, further research will be crucial in assessing the effectiveness of these financial mechanisms across several dimensions and ensuring they lead to meaningful conservation outcomes.

Quantitative studies on forest conservation interventions primarily focus on specific, measurable outcomes, such as forest cover, but there is an ongoing challenge in determining appropriate indicators for other important benefits. While economic indicators such as income generation are frequently studied, other aspects such as biodiversity conservation and non-monetary livelihood improvements remain difficult to quantify. This continued difficulty in measurement highlights the need for improved methodologies that can capture the full range of forest conservation benefits beyond commonly assessed metrics. Expanding the scope of measurable indicators would provide a more comprehensive understanding of how conservation interventions impact both ecosystems and human well-being.

One of the most striking findings is that adaptation remains underrepresented in research despite its growing importance in the face of unavoidable climate change impacts. While mitigation efforts continue to dominate, there is a notable lack of studies examining how forests contribute to adaptation, particularly within natural systems through erosion control, soil stability, and their role as buffers against storm surges. Given the increasing frequency and intensity of extreme weather events, this evidence gap limits the ability of policymakers to effectively integrate forest conservation into climate adaptation strategies.

A. SUGGESTIONS FOR POLICY AND PROGRAMMING

The completion of this evidence review is timely, contributing to the run-up to COP30 in Belém, Brazil, and supporting ongoing global efforts to protect biodiversity, combat desertification, and advance climate goals, both within the GCF and more broadly across the environmental finance landscape.

The Paris Agreement committed parties to support and implement "policy approaches and positive incentives for activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries".[22] As an operating entity of the financial mechanism of the UNFCCC and the Paris Agreement, the GCF plays a key role in helping developing countries meet their mitigation targets. It does so by supporting projects focused on forests and land-use. One of the GCF's paradigm-shifting strategies to protect forest ecosystems includes "devising equitable, sustainable and transparent financial mechanisms to invest in forest conservation." According to the GCF Strategic Plan 2024-2027, the Fund aims to support developing countries in conserving, restoring, or sustainably managing between 120 and 190 million hectares of terrestrial and marine areas.

This evidence review builds on the IEU's previous evidence gap map that examined evidence on forest conservation interventions in low- and middle-income countries from early 2016 to mid-2018. It shows how, compared to the previous EGM, the evidence base has increased and filled evidence gaps, in particular on the role of forest policies in halting deforestation and the role of market-based instruments such as certification and credit mechanisms in achieving not only forest conservation but also supporting livelihoods. There is considerable potential here for GCF programming to learn

[22] Paris Agreement (UNFCCC, December 12, 2015), https://unfccc.int/sites/default/files/english_paris_agreement.pdf, 2.

from the evidence base. There are also emerging studies on the role of the private sector, such as supply chain initiatives and corporate social responsibility, in supporting conservation.

B. SUGGESTIONS FOR FUTURE EVALUATIVE WORK

To address some of the persistent gaps in the literature, future research should prioritize the role of the private sector in forest conservation, particularly through voluntary instruments.

Many forestry conservation outcomes remain unexplored, requiring continued research to examine the effectiveness of forest conservation in preserving biodiversity and supporting climate change adaptation. It is also important to strengthen the evidence base on forest conservation's indirect effects, including leakage, restricted resource access, and water changes.

Given the evidence-based landscape described in this report, including the identification of remaining gaps in the EGM's evidence-rich intervention and outcome categories, the authors propose conducting a meta-analysis for two interventions: land tenure and environmental certification. The analysis would examine three key outcomes – forest cover, livelihoods and GHG mitigation – and generate overall effect size effects for each intervention. This meta-analysis would complement the systematic reviews by Di Girolami and others (2023), which explored these topics in depth.

APPENDICES

Appendix 1. INTERVENTION CATEGORIES BY THE 3IE AND IEU EGMS CLASSIFIED BY TOC

Table 5. ***Intervention categories by the 3ie and IEU EGMs organized according to ToC categories***

EGM Categories	Categories used by 3ie 2024 EGM	Categories used by IEU 2019 EGM
Regulatory Instruments	Law and policies related to forests and other land	Improvement based on the rule of law
		Land tenure reforms
	Area protection and management	CFM
		Protected areas
		Intragovernmental deforestation-curbing regulations
		Land swaps
Informative instruments	Training, education and information to promote sustainable practices and technology	Awareness-raising and capacity-building
		Training on local sustainable practices involving local communities
Voluntary instruments		Indirect conservation based on improved technologies, substitution effects or a combination of both
		Zero-deforestation commitments
		Barring non-sustainable providers in value chains
Economic instruments	Incentives	Incentives: PES-like with clear conditionalities
		Environmental Certification

Appendix 2. INTERVENTION TYPE, EXPLANATIONS AND EXAMPLES

Table 6. Description of the intervention types within each intervention category

INTERVENTION TYPE	EXPLANATION (ADJUSTED AND EXTENDED FROM 2019 EGM)
Regulatory Instruments	
Policies	Policies here refer to a set of principles, guidelines, or rules established by the government to guide decision-making and achieve specific forest conservation objectives and, therefore, cover improvements in legislation and strategic policy programmes. Policies are a broad category and can cover all the other regulatory instruments listed below. Indeed, land tenure, protected areas, land swaps and compliance all stem from policies, often in the form of laws or regulations. However, the coding process was exclusive, meaning that the policy category was used only if any of the other instruments were not used or if it was an additional intervention
Land tenure reforms	Land tenure reforms include conservation objectives, such as the transfer of property rights or the consolidation of tenure security, as seen in Indigenous and local land demarcation and tenure enforcement processes. This includes lands tenured to the communities for community-based forest management with or without ownership.
Protected areas (PA)	Various categories defined by the International Union for Conservation of Nature (IUCN) based on the degree of protection or tolerance of human presence and activities within its borders.
Land swaps	Changes in land designation, e.g. moving a concession from a High Conservation Value area to a degraded area or an area without forest cover.
Compliance	Enforcement of law through fines, etc and intragovernmental deforestation-curbing regulations, such as: • Transfers from central to local government based on conservation performance, such as the Brazilian ecological value-added tax, ICMS-Ecológico • Central government publicly exposing high-deforesting municipalities (“blacklisting”) and cutting their access to credits and subsidies while listed
Informative Instruments	
Awareness and capacity-building	Activities aiming to create knowledge and behaviour change, including: • Education and awareness campaigns • Training of communities on sustainable methods, etc.
Voluntary Instruments	

INTERVENTION TYPE	EXPLANATION (ADJUSTED AND EXTENDED FROM 2019 EGM)
Corporate social responsibility	Zero-deforestation commitments, which aim to reap publicity gains through consumer recognition of sustainability
Voluntary use of improved technologies	• Interventions to increase agricultural yields, based on Borlaug's hypothesis of "land sparing" • Improved cooking stoves • Plantations with clear conservation purposes, such as supplying fuelwood • Agroforestry with clear conservation purposes • Alternative livelihoods
Voluntary moratorium	Barring non-sustainable providers in value chains
Economic Instruments	
PES schemes	User-financed PES: Private and non-governmental organization interventions such as Coasean agreements Government-financed PES: Subsidy programmes established by broader public sector institutions or user representatives, often tax-financed
Environmental certification	Environmental certification, with consumer-financed sustainability premiums for forest products, such as timber certified by the Forest Stewardship Council, or for crops certified by the Roundtable on Sustainable Palm Oil
Credit schemes and market mechanism	Credit schemes, including offsets, biodiversity credits, voluntary and compliance carbon market

Appendix 3. OUTCOME DEFINITIONS

Table 7. Description of the outcome types within the outcome categories

Direct environmental benefits	
Biodiversity	Forest conservation supports the maintenance, recovery, and increase of the diversity of species and ecosystems, as well as impacts population sizes and the occurrence of species. Indicators include: • Number of species found in the forest • Population sizes of forest species • Return of species that had previously disappeared • Endemic or endangered species protected
Forest cover	Forest cover is conserved or increased through active conservation, strict protection or natural regeneration. The typical indicator is the area covered by forest.
Forest health	Forest health refers to the condition of forests being resilient to (i) biotic disturbances, such as pests and diseases, and (ii) abiotic disturbances, such as climate change and pollution, while maintaining ecological integrity and capacity to provide essential ecosystem services. These include timber production, carbon sequestration, biodiversity conservation, and supporting livelihoods. Measuring forest health is complex, and indicators can vary by forest type. In tropical forests, a typical indicator of logging impact is the amount of woody debris left behind after timber extraction. Large quantities of woody debris can make forests highly vulnerable to fire and create breeding grounds for insects (FAO 2021).
Erosion control	Forests absorb and slow down rainfall, which reduces the risk of flooding and soil erosion, while root systems stabilize the soil, preventing soil loss or even landslides during heavy storms. Indicators include: • Soil erosion rates • Soil compaction • Root density • Presence of vegetation cover
Buffer against wind and storm surges	Forests act as windshields, dissipating wind energy and thus protecting nearby communities and infrastructure from wind damage. Coastal forests can mitigate wave power and serve as a buffer against storm surges. Indicators include: • Wind speed reduction • Wave height attenuation • Flooding extent • Soil erosion rates
Indirect resource effects	
Availability of other	Forest conservation helps maintain biodiversity, ensuring that various forest resources, such as medicinal plants, timber, and non-timber products, continue to

forest resources	thrive. Continued or enhanced availability of such resources may be seen as an indirect benefit of forest conservation by local people unless there are access restrictions due to strict protection measures. In that case, while the effects on biodiversity are positive, they can be perceived as negative by local resource users. Indicators include: • Population sizes/density of certain species • Time spent looking for certain species/distance to cover before finding certain species • Species returning to forest that were not available anymore • Distance and access to firewood
Leakage	Forest cover loss gets displaced to areas outside of the intervention area (leakage) or gets displaced in time (reversals). The typical indicator would be the size of the area displaced or the time frame.
Water effects	Forests influence the water cycle and resources by maintaining soil moisture, reducing surface run-off, enhancing groundwater recharge, and improving water quality by filtering pollutants and stabilizing streamflow. However, they can sometimes also have negative effects, particularly in areas where invasive species or overgrowth disrupt natural water flows. Additionally, dense forests in certain regions may increase evapotranspiration, potentially reducing local water availability, especially in arid climates. Indicators include: • Groundwater level changes • Water quality indicators • Water availability • Sedimentation and turbidity
Socioeconomic effects	
Livelihood effects	Forest conservation can affect local livelihoods. Livelihoods refer to the means by which a person or community secures the necessities of life, such as food, shelter, and clothing. It includes income-generating activities and access to resources that support an individual or family's well-being. Effects can be positive, such as when forest conservation leads to enhanced food security, or can be negative when access to forest resources gets restricted for the sake of forest conservation. Indicators include: • Income or expenditure • Food security indicators such as dietary diversity • Number and diversity of livelihood activities
Employment	Forest conservation can create new job opportunities. Where forest conservation creates eco-tourism infrastructure, this may open opportunities for local people to be employed as guides. However, forest conservation can also reduce employment opportunities, where strict protection measures are put in place and enforced, restricting local people from using forest resources. Indicators include: • Number of jobs created • Un-/employment rate
Social effects	Forest conservation can have a range of social effects. All social indicators will

	be covered. Examples include: • Education • Equity • Participation • Decision-making • Empowerment • Traditional knowledge and practices • Land rights and tenure • Awareness and training

Appendix 4. SEARCH TERMS

The search terms from the 2019 EGM were used with key additions, which are shown in marron red in Table 8 below.

Table 8. List of search terms used in the literature search

Intervention
Conservation; protection; sustainable management; protected area; national park; indigenous territory; indigenous reserve; nature reserve; community-based management; forest reserve; community-conserved area; conservation corridor; sanctuary; payment(s) for environmental services; payment(s) for ecosystem services; direct payment(s); incentive(s)-based conservation; subsidies; subsidy program; subsidy programme; extractive reserve(s); indigenous land demarcation; local land demarcation; Rural Environmental Registry; certification; agricultural yield(s); sustainable agriculture; capacity-building; cooking stoves; fuelwood substitution; land-use zoning; nontimber forest product(s); land tenure; titling; law enforcement; rule of law; deforestation-free supply chain; zero-deforestation supply chain; zero-deforestation commitment; tax concession; land swap; moratorium; environmental awareness; capacity building; ICDP;
Population
Forest*; mangrove*; rainforest* ; developing countr*; communit*; village*;communit* ; district* ; sector* ; low income countr*; middle income countr*
Outcomes
greenhouse gases emissions; GHG emissions; forest condition; forest cover; reduced deforestation; adaptation; flooding; drought; disaster-risk reduction; soil stabilization; erosion control; livelihoods; employment; carbon stock enhancement; buffer; storm surges; coastal protection; leakage; water quality; water quantity; surface runoff; groundwater recharge; water availability; income; poverty reduction; food security; health; education, equity; participation; social; knowledge; behaviour change;
Methods
empirical evidence; empiric*; impact evaluation; systematic review; statistical analysis ; counterfactual; experiment*; quasi-experimental ; discontinuity design ; discontinuity regression ; regression discontinuity ; fixed effect* ; regression ; difference* in difference* ; double differenc* ; instrumental variable* ; propensity score ; matching ;propensity weight*; time-series ; panel data ;double robust ; random* ; control group ;pipeline approach ; pipeline method ; pipeline comparison ; impact assessment ; econometric analys* ;cross-sectional data ;difference-in-difference

Appendix 5. SYSTEMATIC REVIEWS AND META-ANALYSES IN OUR EGM

Table 9. The existing meta-analyses and systematic reviews found in our EGM

STUDY	TYPE	COVERAGE	INTERVENTIONS
Börner and others, (2016) Emerging Evidence on the Effectiveness of Tropical Forest Conservation. PLoS ONE 11(11): e0159152.	Meta-analysis	• Developing countries • Studies in PLOS One Collection as of March 2016	PA, PES, law enforcement, public disclosure, certification
Savilaakso & Petrokofsky (2017) Certification systems for verifying carbon trading from forestry and other land uses and their effectiveness to deliver non-carbon benefits. CAB Reviews, 12, No. 017	Systematic review	• Worldwide • Studies published between 2000 and 2016	Credit schemes and Environmental certification
Min-Venditti and others (2017) What policies improve forest cover? A systematic review of research from Mesoamerica. Global Environmental Change, 47, 21-27	Systematic review	• Central America and Mexico • Studies published between 1981-2013	Agricultural subsidies, community-based management, forest sector regulation, land tenure, PES, PA
Wehkamp and others, (2018) Governance and deforestation — a meta-analysis in economics.	Meta-analysis	• Worldwide • Studies published between 1994 and 2015	Governance variables
Miller and others, (2018) Protected areas and the sustainable governance of forest resources. Current Opinion in Environmental Sustainability, 32:96–103	Systematic review	Studies published between 2015 and 2018	PA
Snilsveit and others (2019) Incentives for climate mitigation in the land-use sector—PES effects on environmental and socioeconomic outcomes in	Meta-analysis	• Low- and middle-income countries. • Studies published	PES

STUDY	TYPE	COVERAGE	INTERVENTIONS
low- and middle-income countries: A mixed-methods systematic review.		between 1990-2017	
Börner and others (2020) The Effectiveness of Forest Conservation Policies and Programs. Annual Review of Resource Economics, 12:19.1–19.20.	Systematic review with meta-analyses qualities	• Worldwide • Studies published between 2001-2020	PA, PES, decentralized CFM, certification, sustainable use, land tilting and reform, governance, Indigenous protected land, integrated conservation and development project, voluntary conservation
Ma and others (2020) Do Protected Areas Matter? A Systematic Review of the Social and Ecological Impacts of the Establishment of Protected Areas. Int. J. Environ. Res. Public Health, 17, 7259	Systematic review	• Worldwide • Studies published until 2020	PA
Diansyah and others (2021) A Systematic Review on Community Forest Management in Southeast Asia: Current Practices and Impacts on Biodiversity Conservation and Livelihood Quality of Local Communities. Human Ecology Review, 27, 3–21.	Systematic review	Southeast Asia	CFM
Busch & Ferretti-Gallon (2023) What Drives and Stops Deforestation, Reforestation, and Forest Degradation? An Updated Meta-analysis. Review of Environmental Economics and Policy, 17.	Meta-analysis	• Worldwide • Studies published between 1996-2019	PA, enforcement of forest laws, PES, land tenure, community-based forest management and certification of sustainable commodities
Di Girolami and others (2023) Two systematic literature reviews of scientific research on the environmental impacts of forest certifications and	Systematic Review	• Worldwide • Studies published between 2003 and 2018	Forest certifications and community-based forest management

STUDY	TYPE	COVERAGE	INTERVENTIONS
community forest management at a global scale. Forest Policy and Economics, 146, 102864			
Montero-de-Oliveira and others (2023) Under what conditions do payments for environmental services enable forest conservation in the Amazon? A realist synthesis Ecological Economics, 205, 107697	Systematic Review	• Amazon • Studies published until 2021	PES

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Beavor, Andreas, and others (2024). Evidence review on market-based approaches to mitigation and adaptation. IEU learning paper (July). Songdo, South Korea: Independent Evaluation Unit, Green Climate Fund. Available at https://ieu.greenclimate.fund/sites/default/files/document/240725-egm-mbm-report-top-25-07-24-1345.pdf Accessed on 4 June 2025.

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