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Agenda Item 12

EVALUATION OF GEF SUPPORT TO CLIMATE INFORMATION AND EARLY WARNING SYSTEMS

(Prepared by the Independent Evaluation Office of the GEF)

EXECUTIVE SUMMARY

1. The Global Environment Facility (GEF) is a family of funds with 186 member countries dedicated to confronting biodiversity loss, climate change, pollution, and strains on land and ocean health. Its grants, blended financing, and policy support help developing countries address their biggest environmental priorities and adhere to international environmental conventions. Over the past three decades, the GEF has provided more than $23 billion and mobilized $129 billion in co-financing for more than 5,000 national and regional projects. The support for adaptation interventions is done mainly through the Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF). Climate Information and Early Warning Systems (CIEWS) are noted in the GEF programming strategy and were one of the eminent four priority themes in the LDCF and SCCF strategy for 2022–2026. Globally, there is a growing recognition of the significance of CIEWS, which have become integral to climate change adaptation. The expansion of CIEWS, when integrated with disaster risk reduction and management, has demonstrated effectiveness in lowering mortality rates in regions affected by significant disasters. CIEWS play a crucial role in diminishing vulnerability to climate change impacts and fostering climate change resilience. Moreover, investments in CIEWS consistently reveal a robust benefit-to-cost ratio, showcasing their potential to not only safeguard lives but also protect valuable assets.

2. This evaluation aims to understand how projects funded by the GEF Trust Fund, LDCF, and SCCF have incorporated CIEWS into their programming strategies. Additionally, it seeks to provide evidence on the performance of these interventions through an assessment of their relevance, results, and sustainability. The overarching objective is to inform future GEF programming on CIEWS by offering valuable insights into successful areas and identifying aspects that require additional focus for achieving sustainable outcomes.

Key Findings and Conclusions

3. **GEF support for climate information and early warning systems demonstrated a strong alignment with the GEF Trust Fund and LDCF/SCCF strategies and remained highly relevant to the distinctive circumstances and challenges in various contexts.** GEF projects were responsive to the demands of beneficiary countries and were driven by the recognition of the need for climate information and early warning systems. These needs were shaped by geography, climate-related hazards, and specific national requests. Additionally, there was a high alignment between projects and the global distribution of climate-related hazards, particularly in Africa.

4. **GEF projects have faced challenges in effectively transitioning from their primary focus on supporting early warning systems to fully integrating early action measures within disaster events.** While GEF projects have improved the generation of climate information and early warnings, there is evidence indicating a lack of systematic knowledge transfer for appropriate responses in disasters. Furthermore, limited attention has been dedicated to fostering community-level risk awareness and building the capacity for appropriate responses among the population. The success of translating warnings into actions depends on, among other factors,

comprehensive national and local plans, coupled with communication infrastructure and knowledge for effective response.

5. **GEF projects performed strongly in terms of effectiveness, but the long-term sustainability of their outcomes remains uncertain.** Although GEF projects have encountered challenges, particularly in the realms of communication and preparedness activities, they have collectively achieved success in fulfilling objectives across various CIEWS domains, notably in facilitating warning services through infrastructure development and capacity building. Nevertheless, sustaining funding and resources for the main outcomes generated by GEF projects is not guaranteed in the long term since often the costs of operation and maintenance of CIEWS can be challenging, especially for LDCs.

6. **There are noteworthy successes of effectively incorporating CIEWS components into existing systems, leveraging technologies, and enhancing the results of other interventions.** GEF projects consistently integrated and capitalized on pre-existing services and platforms. Through synergies with established services, CIEWS interventions targeted the mitigation of gaps within the climate information value chain. This approach sought to broaden information accessibility and stimulated user adoption and application of climate information services. Moreover, GEF projects have shown a substantial catalytic potential. They have established a robust foundation for continuing the impacts initiated by these projects, which often are being financed by other climate funds and involve larger-scale interventions and greater financial resources, enhancing their transformative capacity.

7. **Notable progress has been made in the development of infrastructure and capacity building for CIEWS, although the critical "last mile" challenge persists.** While GEF projects have successfully enhanced forecasting capabilities, including strengthening the institutional capacity of the meteorological offices in LDCs in their ability to use CIEWS, there remains a need to transform this knowledge into actionable and accessible information. GEF projects have not consistently accounted for the challenges in project implementation at the "last mile" of service delivery, particularly in the distribution of climate information and warnings to local communities often marginalized by disaster risk reduction strategies. These communities require special consideration and focused attention to ensure that they are not inadvertently left behind.

Recommendations

8. **GEF projects should shift their focus from solely providing early warning information to fostering early actions during disaster events.** GEF projects ought to prioritize data usability and ensure that both national and local plans are in place. This involves establishing effective communication systems and providing the necessary knowledge of how to respond once the warning is issued. To overcome the “last mile” challenge, GEF projects must prioritize community engagement, capacity building, and the development of tailored communication strategies to address the specific needs and challenges of remote and vulnerable communities.

9. **The GEF Secretariat, STAP, and GEF Agencies should continue aligning indicators with established good practices.** It is advisable for GEF projects to adopt the most fitting indicators in line with WMO guidelines that are informed by international good practices, and lessons learned from past experiences. These indicators would effectively measure the success of CIEWS interventions, serve as a roadmap for future interventions and provide information to global results frameworks. Furthermore, for effective monitoring, it is suggested to set minimum standards for measuring and tracking CIEWS components at the project level. In alignment with the ongoing efforts to streamline and simplify the GEF results framework, this approach emphasizes repurposing existing indicators at the project level rather than introducing new ones. The overarching goal is to enhance the quality of measurement and tracking of the application of CIEWS components, ensuring that interventions are well-informed and impactful.

10. **The GEF Secretariat and GEF Agencies should continue to explore strategies to enhance the financial sustainability of CIEWS components.** The significant costs associated with the operation and maintenance of CIEWS initiatives require a tailored approach to secure long-term financing to enable their continued success beyond the project's completion. Recognizing the complexities of engaging the private sector and acknowledging their potential role, particularly in LDCs, GEF projects are encouraged to support creating an enabling environment for the private sector in developing innovative adaptation solutions derived from CIEWS. This is especially important considering the multiple applications and increasing advantages that CIEWS offers to several sectors, including transportation, agriculture, tourism, finance, and insurance.

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ABBREVIATIONS

CIEWS	Climate Information and Early Warning Systems
CIF	Climate Investment Funds
COP	conference of the parties
CREWS	Climate Risk and Early Warning Systems
ECA	Europe and Central Asia
EW4All	Early Warnings for All
EWS	Early Warning Systems
FAO	United Nations Food and Agriculture Organization
GCF	Green Climate Fund
GEF	Global Environment Facility
GEF IEO	Global Environment Facility Independent Evaluation Office
GEF TF	Global Environment Facility Trust Fund
GFDRR	Global Facility for Disaster Reduction and Recovery
IFRC	International Federation of Red Cross
ITU	International Telecommunication Union
LAC	Latin America and the Caribbean
LDC	least developed country
LDCF	Least Developed Countries Fund
MHEWS	Multi-Hazard Early Warning System(s)
SCCF	Special Climate Change Fund
SIDS	small island developing states
SOFF	Systematic Observations Financing Facility
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

1. INTRODUCTION

1. The importance of both climate information and early warning systems (CIEWS) has been increasingly emphasized globally and has become an integral component of climate change adaptation. The UN Secretary-General recently highlighted this importance, stating, "Early warning systems are one of the most effective risk reduction and climate adaptation measures for reducing disaster deaths and economic losses" (UNDRR 2023a). The scaling-up of CIEWS combined with disaster risk reduction and management has been shown to reduce the number of deaths in areas affected by major disasters.[1]

2. CIEWS are vital in reducing vulnerability to the impacts of climate change and building climate change resilience. Investments in CIEWS have been consistently shown to have a solid benefit-to-cost ratio and the potential to save both lives and assets. The financial savings of CIEWS have tended to reach at least ten times the cost of their investment (GCA 2019). Early warning, for example, given 24 hours before a disaster event or hazard, can reduce damage by 30 percent. Investing $800 million in early warning systems in developing countries would reduce losses by between $3 billion and $16 billion annually (UNDRR 2022). The Global Commission on Adaptation found that investing $1.8 trillion globally in five priority areas, with CIEWS being one of the priority areas, could generate $7.1 trillion in total net benefits over ten years (2020 to 2030; GCA 2019).

3. The GEF addresses the effects of climate change in its programming strategies. The impacts of climate change are also implicitly addressed by the GEF in several ways. GEF programming directions lay out strategies for achieving global environmental benefits under each GEF focal area for a four-year period. From 2010 onwards, the GEF Secretariat developed four-year programming strategies on adaptation to climate change for the Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF), coinciding with GEF replenishment periods. For CIEWS to be incorporated within country-priorities as an integral part of climate resilience strategies, strengthening CIEWS has therefore become a commonly deployed intervention for the LDCF and by several SCCF, Global Environment Facility Trust Fund (GEF TF), and multitrust (MTF) projects.

4. CIEWS are noted in the GEF programming strategy on adaptation to climate change and are one of the eminent four priority themes in the LDCF and SCCF strategy for 2022–2026. Also, both the GEF-7 and GEF-8 replenishment programming directions note that investments to support flood and drought CIEWS will be made under the international waters focal area to support the focal area's third objective: *Enhance water security in freshwater ecosystems*. Project interventions have included investments in automated weather stations and their operations and maintenance, agro-hydromet and hydrometeorological forecasting, institutional capacity building, and last-mile technologies (streamlining and efficiency technologies).

[1] Cyclone Amphan in Bangladesh (2020), floods in Sri Lanka (2017), and droughts in Kenya (2010), among others.

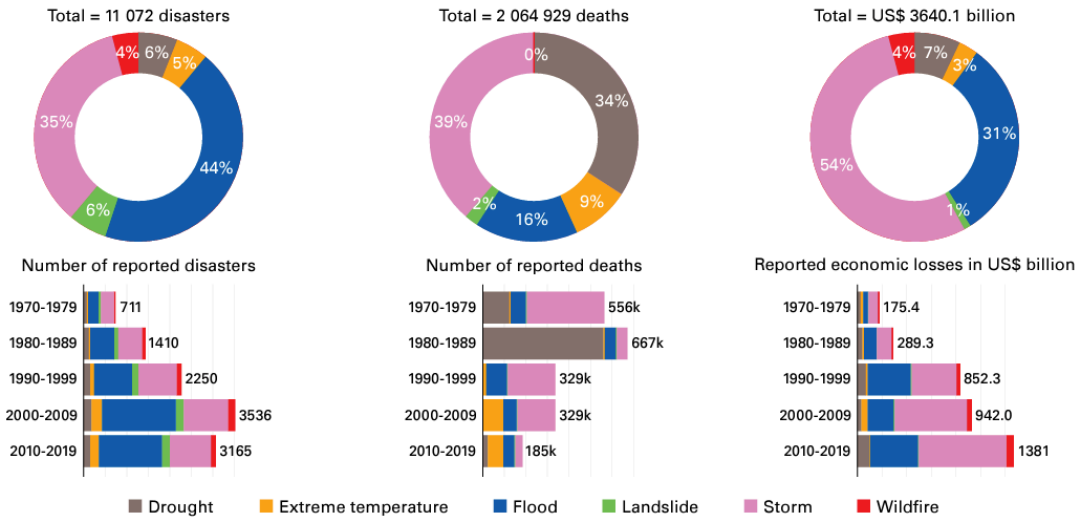
5. This evaluation identifies both strengths and areas requiring increased attention in GEF projects featuring CIEWS interventions. By examining GEF relevance, results, and sustainability, the evaluation provides evidence on the performance of GEF interventions addressing environmental aspects related to CIEWS. With CIEWS designated as one of the four priority themes for the LDCF and SCCF, and its recognition as a priority theme in the GEF Programming Strategy on Adaptation to Climate Change from July 2022 to June 2026 (GEF 2022), the evaluation aims to inform future GEF programming on CIEWS by offering insights into areas of success and those requiring additional focus for sustainable outcomes.

2. BACKGROUND

2.1 Context

6. During 2015–2021, it was estimated that 1 billion people were affected by disasters, and 300,000 people went missing or were lost. Annual reported losses averaged $330 billion. In 2021 alone, 38 million new internally displaced people were recorded, 60 percent of whom were displaced due to climate-related disasters (Ijjasz et al. 2022). Out of all the global disasters, deaths, and economic losses attributed to various factors, seventy-nine percent were linked to weather, water, and climate-related hazards worldwide. These incidents accounted for 56 percent of the total reported deaths and contributed to 75 percent of the economic losses associated with disasters during that period (Figure 1; WMO 2020). Floods globally have affected at least 1.4 billion people between 2000 and 2019 (UNDRR 2023b), while drought impacted at least 1.6 billion people during the same period (UNDRR 2023b). Given these implications, hydrometeorological impacts and disaster events are a critical consideration for CIEWS.

Figure 1: Number of disasters, deaths, and economic losses globally (1970–2019)



Source: WMO 2020.

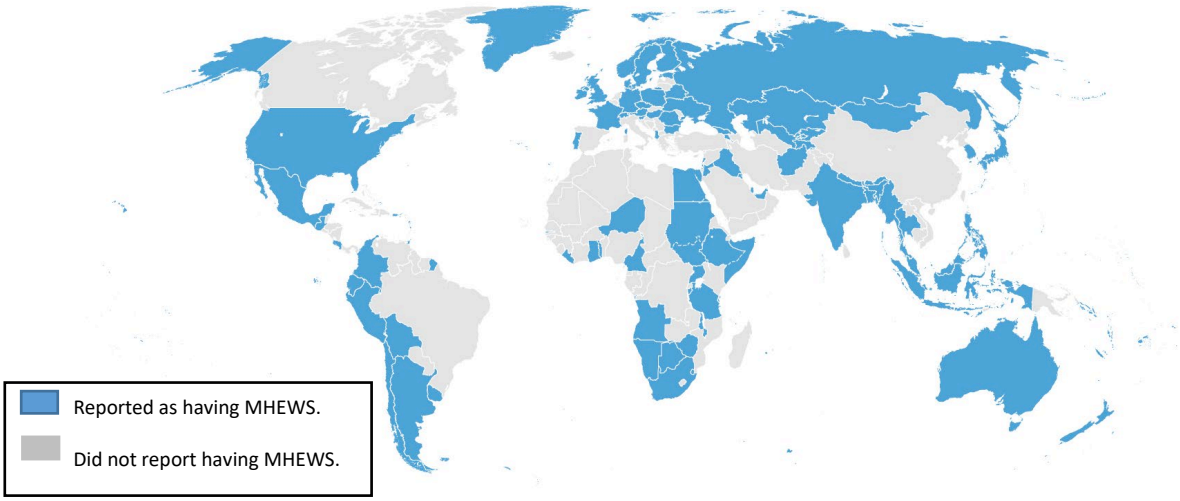
7. For this coming decade, these trends are likely to escalate. The World Meteorological Organization (WMO) predicts that global temperatures will reach record levels between 2023 and 2027 due to heat-trapping greenhouse gases and an El Niño event. The chances of the annual average near-surface global temperature rising more than 1.5°C above pre-industrial levels are at 66 percent (WMO 2023a). Additionally, the WMO predicts that at least one of the next five years will be the warmest on record (WMO 2023a).

8. Least developed countries (LDCs) and small island developing states (SIDS) are the most acutely affected (GCF 2022), bearing the disproportional burden of disaster-related economic losses relative to their national gross domestic product (Ijjasz et al. 2022). According to recent data, SIDS have lost $153 billion due to weather, climate, and water–related hazards since 1970. This amount is substantial when considering that the average GDP for SIDS is $13.7 billion. Additionally, 1.4 million people in LDCs lost their lives due to similar hazards, accounting for 70 percent of total deaths from natural hazards (WMO 2020).

9. At the same time, regions face disparities in their progress in establishing CIEWS, and special assistance is needed for LDCs, SIDS, and Africa (UNDRR and WMO 2022). To date, one-third of the world's people, mainly in LDCs and SIDS, are not covered by early warning systems (UNDRR 2022). Yet, countries with limited early warning coverage have eight times higher disaster mortality rate than countries with comprehensive coverage. As of 2022, only half of countries globally were protected by multi-hazard early warning systems; numbers are even lower for developing countries, with less than half of the LDCs and only one-third of SIDS having a multi-hazard early warning system (UNDRR 2022). Figure 2 shows the global coverage of reported early warning system coverage by country in March 2022 for the Sendai Framework for Disaster Risk Reduction's target G.[2]

[2] https://sendaimonitor.undrr.org/analytics/global-target/18/8?indicator=34

Figure 2: Global coverage of reported early warning systems (by country, March 2022)

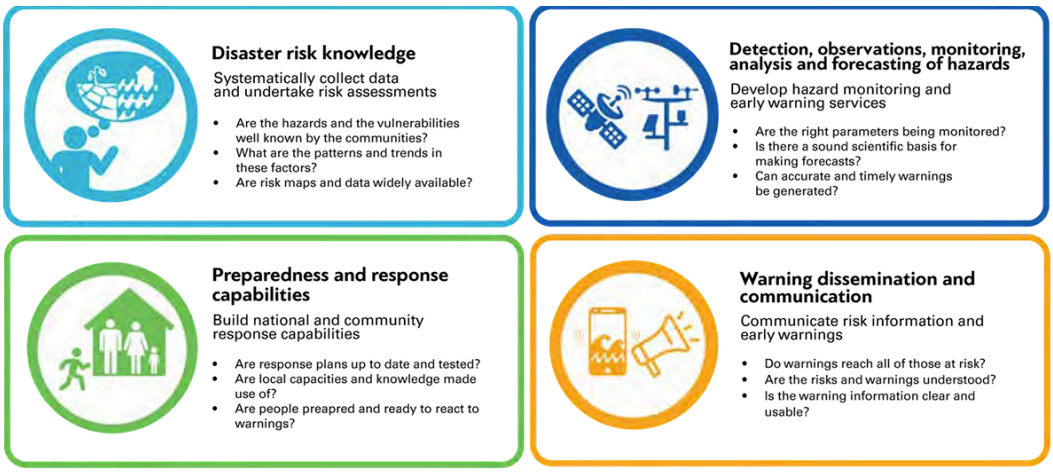


Source: UNDRR 2022.
Note: MHEWS = Multi-Hazard Early Warning System(s)

10. These figures are echoed by the WMO, who found in their State of Climate Services 2020 report that data provided by 138 WMO members show that just 40 percent of them have multi-hazard early warning systems (MHEWSs). One-third of the population in the 73 countries that provided information is not covered by early warnings (WMO 2020).

11. The early warning process includes detection, analysis, prediction, warning dissemination, and response decision making and implementation. These critical elements in early warning systems are true for climate information and early warning. Good practice in climate information and early warning emphasizes four main pillars of an early warning system, which are generally described as: 1) disaster risk knowledge, 2) hazard detection, monitoring, forecasting and analysis, 3) warning dissemination and communication, and 4) preparedness and response capabilities, as shown in Figure 3 (UNDRR 2023a).

Figure 3: The four components of early warning



Source: WMO 2023b.

12. Critical considerations when establishing climate information and early warnings should incorporate:

(a) **Innovation**. Introduce creative solutions to address the problems.

(b) **Efficiency and efficacy**. An effective practice achieves the desired results and has a positive impact within its context (e.g., preparedness). An efficient practice achieves these results with the best use of available resources.

(c) **Sustainability**. The sustainability of CIEWS best refers to their ability to maintain its results for the future or a reasonable period.

(d) **Replicability or transferability**. Good practice can be adapted to new contexts while following the initial guidelines to achieve similar results.

(e) **Involvement of community**. The participation of citizens in disaster preparedness and risk reduction practices through community engagement can lead to enriched early warning good practices. This behavioral change represents a tangible improvement.

(f) **Inclusiveness**. Vulnerable groups often bear a disproportionate burden during climate-related disasters. Involving them in the development of early warning systems ensures that specific vulnerabilities are identified and addressed. This approach includes engaging vulnerable groups, incorporating the elderly, people with disabilities, LGBTQI+ individuals, women, and children.

13. For early warning to be effective, most critically, it must require the direct participation of at-risk communities, facilitate public education and awareness of risks, entail efficient message and warning dissemination, and maintain a constant preparedness for early action. Good practice involves the participation and consideration of vulnerable groups, and emphasis is on inclusivity in the design of any early warning. Multiple studies have identified the issue of

the “last mile,” that is, the connection of CIEWS to end users in local communities, as the biggest challenge to successful CIEWS. The International Federation of Red Cross and Red Crescent Societies (IFRC 2022), for example, highlights that climate information and early warning “cannot simply improve weather, climate and hydrological information, services, and infrastructure.” This poses the danger of relegating individuals to the role of mere users, with their involvement in the system becoming an afterthought. In connecting people as the final point in the system, technological and scientific factors are emphasized. At the same time, it is assumed that all the relevant data, information, and knowledge are housed outside of local communities (Marchezini et al. 2018). To make the “last mile” effective, variations of community-based early warning systems have emerged, for example, community-based, participatory, and people-centered EWS. Participation in early warning repositions involvement of end users in the process. Finally, having preparedness and response plans and capabilities, including at local government level, is vital to ensure that people take appropriate action using early warning information to successfully reduce the impacts of extreme events and prepare for unavoidable impacts before they happen. Preparation and response plans at the local government level are crucial for effectively responding to warnings from regional or national hydrometeorological services (WMO 2023b).

2.2 Evaluation purpose, scope, and objectives

14. The purpose of this evaluation is to provide evidence on the relevance, effectiveness, and sustainability of the portfolio of GEF-supported interventions on CIEWS. The evaluation aimed to identify lessons applicable to the GEF by obtaining evidence-based findings of what works, why, and for whom. The evaluation reviewed projects addressing CIEWS and identified lessons applicable to the GEF, LDCF, and SCCF future programming of CIEWS interventions. Furthermore, this evaluation provides evaluative evidence on the performance and trends of an intervention area that has been elevated in the GEF-8 adaptation strategy to a priority theme. The evaluation excludes early warning for non-climate-related hazards like earthquakes and tsunamis but includes multi-hazard systems. Although intended for use by the GEF and LDCF/SCCF Council, Secretariat, and GEF Agencies, this evaluation will also be relevant to donors, government officials, and practitioners in developing countries.

2.3 Methodology and evaluation questions

15. Broad evaluation questions set out for the evaluation followed four key questions:

(a) How do GEF-administered trust funds support CIEWS?

(b) How effective are the CIEWS interventions financed by the GEF?

(c) What is the added value of the GEF support in CIEWS interventions?

(d) What are the lessons learned specific to the design and implementation of CIEWS projects supported by GEF-administered trust funds?

16. A set of sub-questions and methods for capturing the answers to these key questions are included in the evaluation matrix (Annex I). These four key evaluation questions are set out as themes in the key findings section of this report.

17. The review considered a portfolio of projects with CIEWS investments included within their components, from the GEF-3 replenishment period onward. The evaluation used various methods, including a portfolio desk review of projects addressing CIEWS, a review of good practices in CIEWS, project site visits, case studies, and key informant interviews. The protocols for reviewing the portfolio's effectiveness were based on good practices established in the literature. Detailed information collection and follow-up probing for information were conducted through the case studies (project visits) and interviews with key informants.

18. The evaluation team selected a portfolio of 55 projects.[3] The selection of the evaluation portfolio was conducted by performing a text search using a taxonomy of keywords related to CIEWS[4] in the project titles, objectives, components, outcomes, and outputs of LDCF, SCCF, and GEF Trust Fund projects from GEF-3 to GEF-7. The evaluation team manually validated the projects for relevance, applying consistent inclusion and exclusion criteria and retaining projects that aligned with the evaluation's scope and objectives. Projects that referred to CIEWS for climate change mitigation purposes and those that did not address hazards due to climate change were excluded. The final evaluation portfolio includes projects focused on adaptation and response to climate hazards, each carefully chosen for their relevance to the evaluation's focus. The evaluation applied a mixed-methods approach using both quantitative and qualitative methods outlined below.

19. **Portfolio review.** A detailed desk review of the selected projects (ongoing and closed) was conducted using a portfolio review protocol (Annex II) to extract data on CIEWS interventions. The review protocol was developed to ensure a consistent approach to the extraction of data on the type of CIEWS intervention, sources of funding, results, types of indicators, replicability, sustainability, gender dimensions, lessons learned, and the added value of the LDCF, SCCF and the GEF TF in CIEWS interventions from project documents. Data analysis allowed the evaluation team to identify trends in CIEWS support.

20. **Literature review of good practices in CIEWS.** A substantial body of academic and practice-based literature on CIEWS exists. Therefore, the evaluation includes a review of good practices and aims to provide useful insights for GEF's future programming. It focuses on identifying the most effective elements in CIEWS for climate change adaptation, with a review of literature from 2019 onward. As noted earlier, the review is limited to climate change

[3] Forty-three projects received financing from LDCF, seven projects from the SCCF, three projects from the GEF Trust Fund and two projects from multi-trust fund initiatives.

[4] The taxonomy of keywords included “early warning,” “EWS,” “climate information,” “climate change information,” “climate service,” “climate change service,” “climate data,” and “forecasting” in the results framework of the project identification form (PIF) or CEO endorsement were included in the portfolio review. Dropped, canceled, and project implementation review–rejected projects were removed.

adaptation and excludes early warning for non-climate-related hazards like earthquakes and tsunamis but includes multi-hazard systems.

21. **Case studies.** To complement the portfolio analysis and to better understand how systems work in practice, four projects in three countries addressing CIEWS were selected as case studies. The purposeful selection of these projects (see Annex III) aimed to reflect a diversity of GEF funds, regions, the scale of CIEWS development, and different implementation stages (e.g., completed or ongoing). Where opportunities existed, an examination of the functioning of CIEWS in the incidence of a disaster event or forecasted impacts was included in the case study. Through these three case studies, the evaluation aimed to understand outcomes in a country context, the mechanisms by which the outcomes were achieved, and the factors contributing to observed outcomes. The case studies include national and regional projects in Costa Rica, Tanzania, and Tonga.[5]

22. **Key informant interviews.** Interviews were conducted with selected stakeholders from the GEF Secretariat, GEF Agencies, STAP, UNFCCC, and relevant project in-country stakeholders. These interviews aimed to triangulate findings from the desk review and case studies.

2.4 Limitations and quality assurance

23. The evaluation has gone through a comprehensive quality assurance process. The draft approach paper and draft evaluation report have been circulated and validated before finalization through a feedback process with the key stakeholders. In addition to GEF IEO management and peer review, the evaluation's designs and methods have been carefully documented, adhering to the principles of independence, impartiality, credibility, and utility.

24. The evaluation encountered three limitations. First, there was a lack of clear identification of CIEWS projects in the evaluation portfolio since climate information and early warning interventions are not tagged in the GEF Portal. To address this limitation, the evaluation team cross-checked the portfolio information downloaded from the GEF Portal with the management information systems of GEF Agencies before conducting any analysis. Additionally, the team considered the inclusion of direct references to CIEWS in project results frameworks as a legitimate threshold for inclusion, as this would capture projects where CIEWS outcomes were explicitly targeted and monitored. A second limitation arose from CIEWS interventions being a part of overarching project activities that were not specifically listed as project objectives. This made it challenging to discern the precise outcomes directly linked to CIEWS

[5] The selected case study projects are: Improve water supply and promote sustainable water practices of end-users and productive sectors by advancing community-based and ecosystem-based measures in rural aqueduct associations (ASADAS) to address projected climate-related hydrological vulnerability in Northern Costa Rica (GEF ID 6945); Strengthen the weather, climate and hydrological monitoring capabilities, early warning systems and available information for responding to extreme weather and planning adaptation to climate change in Tanzania (GEF ID 4991); Enhance basin protection, livelihoods, and integrated water resources management in the Songwe River Basin (SRB) through transboundary cooperation and sustained ecosystem services (GEF ID 9420); and Strengthen early warning, resilient investments, and financial protection of participating countries in Tonga (GEF ID 5814).

components. While this condition did not impact project-level assessments, it posed challenges for attributing specific outcomes to individual CIEWS interventions. Third, the evaluation faced constraints related to data quality and stakeholder engagement, primarily due to inconsistencies in the quality of terminal evaluations. To mitigate these issues, the evaluation employed a combination of semi-structured interviews with key informants, in-depth case studies, and leveraging insights from portfolio reviews and analysis to triangulate and verify all the data gathered.

2.5 Concepts and definitions

25. **Climate Information Services (CIS).** For the purposes of this evaluation, CIS refers to the collection and interpretation of observations of actual (past and present) weather and climate as well as simulations of both past and future periods (forecasting) to provide a credible, relevant, and usable interpretation of weather and climate information (CARE 2023). These can include information access to interpreted targeted climate information that is relevant, reliable, accurate, communicated appropriately, and assists decision making based on anticipating and managing the risks of changing and variable climate.

26. Climate services rely on data generated from national and international databases providing information on temperature, rainfall, wind, soil moisture, and ocean conditions as well as projections and scenarios, and risk and vulnerability analyses. When these data are combined with socioeconomic variables and other non-meteorological data, such as data on agricultural productivity, road and infrastructure plans and mapping, health trends, and human settlements in high-risk zones, the combined information can be customized into climate information services. This climate information can then provide climate services such as projections, trends, economic analysis, and services tailored for specific uses to assist in adaptation to climate variability and climate change, particularly for decision-makers in climate-sensitive sectors (WMO 2022a).

27. The Global Framework for Climate Services (GFCS) sets out the framework for developing and applying climate services to accelerate and coordinate technically and scientifically sound climate information and measures. By doing so it aims to improve climate-related decision-making addressing climate-related risks (WMO 2022a).

28. **Early Warning Systems (EWS).** EWS provides timely and effective information that enables those exposed to hazards to take action, avoid or reduce risk, and prepare an effective response (UNDRR 2004). Each of these agendas recognizes the centrality of resilience and support for building resilience by facilitating decision making based on obtaining reliable information on how risks can be reduced for human and natural systems (Flood et al. 2021). The United Nations Office for Disaster Risk Reduction (UNDRR) defines early warning systems as “the provision of timely and effective information, through identified institutions, that allows individuals exposed to hazards to take action to avoid or reduce their risk and prepare for effective response.” In LDCF/SCCF strategy documents, EWS is often discussed in combination with forecasting. For this evaluation, forecasting or providing timely information to improve decision making for avoiding damage and losses can be considered a vital element of an EWS.

29. **Climate Information and Early Warning Systems (CIEWS).** Formal definitions for CIEWS, and associated terms, have yet to be provided in GEF documents. However, recently, climate information and early warning systems have been considered together, including in the review of the evaluation portfolio of projects related to early warning and climate information services for the purposes of climate change adaptation. Climate and weather information dissemination has become synonymous with early warning systems for responding to the hazards and impacts caused by climate change and both are referred to in this report under the umbrella of CIEWS. Similarly, funds focused on climate change, such as the Green Climate Fund (GCF), consider these as combined rather than as separate systems for specific disasters. Therefore, this evaluation, does not specifically delineate between climate information systems and early warning systems. Instead, it is understood that climate information and early warning are integrated in good practices for climate change adaptation.

3. GEF Support to CIEWS

3.1 GEF programming strategies for adaptation

30. GEF programming directions lay out strategies for achieving global environmental benefits under each GEF focal area for four years. Starting from 2010, the GEF Secretariat has developed four-year programming strategies specifically focused on adaptation to climate change for the LDCF and the SCCF, coinciding with GEF replenishment periods. CIEWS are noted in all the adaptation strategies and have been elevated to one of the four priority themes in the strategy for 2022–2026. While less common, CIEWS have also been included in some past GEF programming strategies related to climate. In LDCF/SCCF strategy documents, CIEWS are often discussed in conjunction with forecasting. For the purposes of this evaluation, forecasting, or "the provision of timely information to improve the management in the emergency phase," (Merz et al. 2020) can be considered a vital element of an EWS. Below is an overview of discussions of CIEWS in GEF strategies.[6]

31. Climate information and early warnings have been included in LDCF and SCCF adaptation strategies from 2010 until 2026 (Table 1).

[6] Discussion excludes examples of CIEWS projects presented as part of the general narrative of strategies.

Table 1: CIEWS in LDCF/SCCF adaptation strategies 2010-2026

2010–2013 LDCF/SCCF adaptation strategy	• The **first GEF programming strategy for adaptation covering 2010 to 2013** (GEF 2010) included "improving the monitoring of diseases and vectors affected by climate change, and related forecasting and early-warning system, and in this context improving disease control and prevention" listed as one of nine programming priorities for the SCCF. • CIEWS are also mentioned as an example of LDCF interventions under both the categories of disaster risk management and natural resources management and as an example of SCCF interventions under disaster preparedness and risk management. • Early warning and forecasting are listed as the fifth largest sector where urgent and immediate adaptation projects were needed, based on identification in the National Adaptation Programmes of Action (NAPA). • Additionally, under Objective CCA-2 – Increasing Adaptive Capacity, a specific output (2.2.1) was included on "Systems in place to disseminate timely risk information."
2014–2018 LDCF/SCCF adaptation strategy	• In the **GEF programming strategy for adaptation covering July 2014 to June 2018** (GEF 2014), CIEWS are included in the results framework for LDCF SCCF programming. • CIEWS are listed under Objective 2: "Strengthen institutional and technical capacities for effective climate change adaptation" for *Outcome 2.3: Access to improved climate information and early-warning systems enhanced at regional, national, sub-national and local levels*. An indicator for the number of early warning systems established or strengthened is also included in the results framework, with a baseline of 30 in 24 countries and a target to support all LDCs. Further, a specific indicator measuring the "Number of people (percentage of whom are female)/ geographical area with access to improved climate information services" was included in the revised results framework of the LDCF and SCCF. • CIEWS are noted under discussions of coastal-zone management and climate information services, as well as in a discussion of LDCF financing needs. • As with the previous policy, CIEWS related to the monitoring of diseases and vectors affected by climate change is listed as one of nine programming priorities for the SCCF. • The strategy also notes that 16 percent of the NAPA thematic priorities are categorized as Early Warning and Disaster Risk, showing that the sectoral distribution of LDCF and SCCF investments was closely aligned with country demand as well as the mandate of the funds. • More specifically, the strategy reported a more than $40 million regional initiative aimed at strengthening hydrometeorological services and early-warning systems in nine LDCs in Sub-Saharan Africa. • The strategy reports that the GEF Adaptation Program has provided considerable support towards weather and climate monitoring, data collection, and early warning systems, comprising 12 percent and 6 percent of all LDCF and SCCF investments, respectively.
2018–2022 LDCF/SCCF adaptation strategy	• In the **GEF programming strategy on adaptation to climate change covering July 2018 to June 2022** (GEF 2018), CIEWS are mentioned twice: 1) in a discussion of mainstreaming adaptation across GEF themes, as an

	example of the type of LDCF activity that might be seen in multitrust fund (MTF) projects, and 2) in the discussion of enhanced private sector engagement as an opportunity for transforming markets for adaptation technologies and innovations with private sector partners. • In the LDCF/SCCF Results Framework, "Vulnerability to climatic hazards reduced through new or improved early warning systems" is considered as Output 1.1.3 in seeking to "Reduce vulnerability and increase resilience through innovation and technology transfer for climate change adaptation." • The 2018–2022 programming period follows the adoption of the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development. Adopted at the UN Summit in January 2016, SDG 13 (take urgent action to combat climate change and its impacts) comprises a specific target (13.3), mentioning the goal to "improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning." According to the strategy, the GEF adaptation program is well aligned and capable of contributing to SDG 13 and delivering groundwork for other goals.
2022–2026 LDCF/SCCF adaptation strategy	• In the **GEF programming strategy on adaptation to climate change covering July 2022 to June 2026** (GEF 2022), the most prominent inclusion of CIEWS is as one of four themes in the programming architecture. Under this theme both LDCF and SCCF will support EWS and climate information systems "with a focus on bridging climate information value chain gaps, expanding access to early warning systems, and striving for greater user uptake and application of climate information services." • In the global context section of the strategy, CIEWS are noted as contributing to reduced risk and informed decision making by communities, along with other interventions. A sub-indicator on CIEWS is included in the results framework for the period: "number of direct beneficiaries from the new or improved climate information services including early warning systems (sex-disaggregated)." • CIEWS are also mentioned in Priority Area 1 for the SCCF: Supporting the Adaptation Needs of SIDS, as one area where SCCF has a successful track record. • The strategy mentions that since the creation of the LDCF, it has supported a wide range of sectoral priorities, with climate information services (53 percent) as the third with the highest participation just behind water (55 percent) and agriculture and food security (67 percent). The SCCF's sectoral distribution shows climate information services (37 percent) as the second most active, just behind water (43 percent).

3.2 Characteristics of the evaluation portfolio of CIEWS

32. The evaluation portfolio includes a variety of CIEWS projects, distributed across different GEF funding cycles. Specifically, there are 3 projects from GEF-3, 7 from GEF-4, 26 from GEF-5, 12 from GEF-6, and 7 from GEF-7. Among these, 27 projects are currently ongoing, while 28 have been completed. Out of the 28 completed projects, a significant majority of 26 have undergone terminal evaluations, providing valuable insights into their outcomes and impacts.

Each GEF replenishment period has seen an important allocation of funds dedicated to CIEWS. Notably, GEF-5 stands out in terms of support, as the majority of projects in the CIEWS evaluation portfolio were funded by the LDCF (78 percent), and the largest share of LDCF projects and funding was approved during GEF-5. Figures 4 and 5 illustrate the distribution of CIEWS projects and LDCF project funding by GEF replenishment period. However, there was a funding constraint in GEF-6 and GEF-7, which resulted in slower approvals compared to GEF-5. The data show a strong positive correlation between the number of CIEWS projects and LDCF projects by GEF replenishment period (0.88), and a very strong positive correlation between the funding of CIEWS projects and LDCF projects by GEF replenishment period (0.94). This highlights the significance of the LDCF in supporting CIEWS interventions.

Figure 4: CIEWS projects' distribution over the GEF replenishment periods

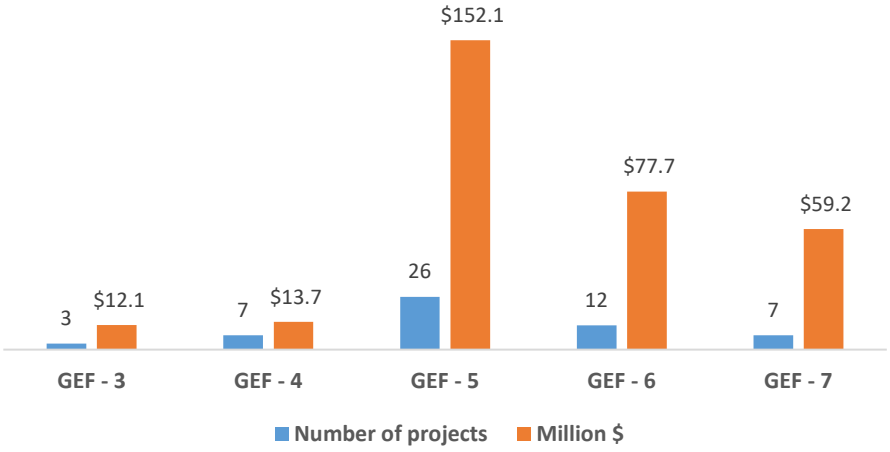
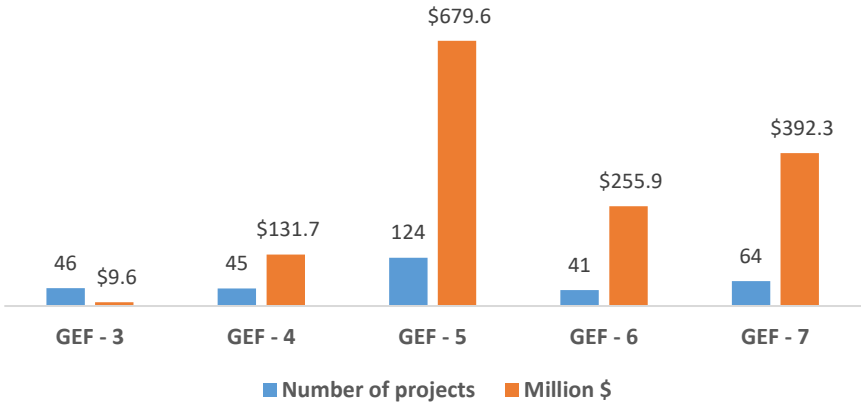
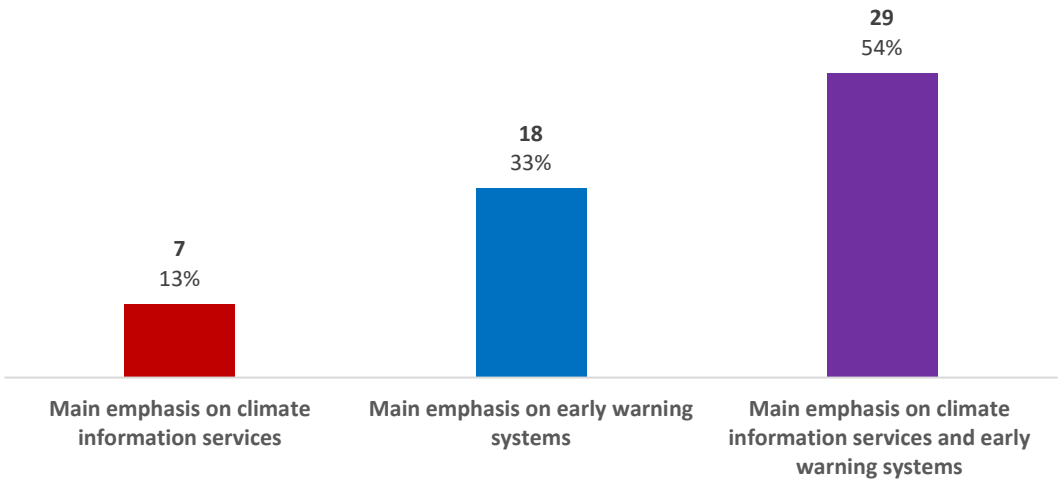


Figure 5: Distribution of LDCF projects over the GEF replenishment periods



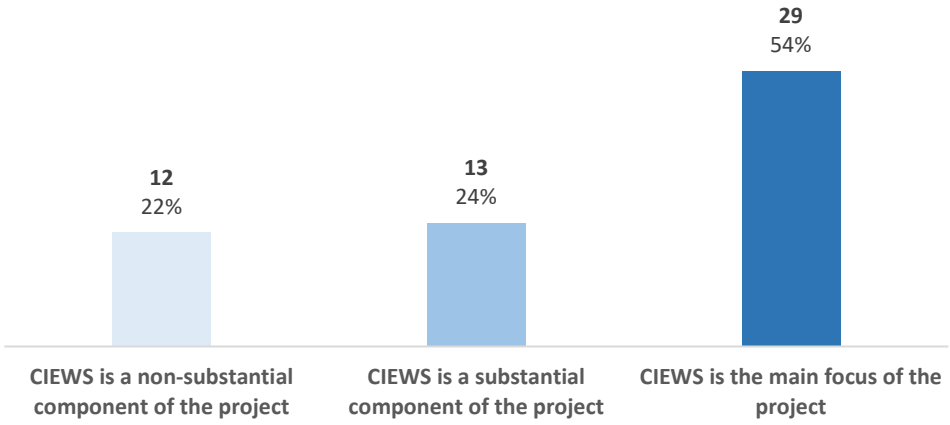
33. It is imperative to emphasize the significance and thematic approach of CIEWS, along with its evolution across GEF replenishment periods within the projects in the evaluation portfolio. As illustrated in Figure 6, seven projects highlighted their involvement in climate information services, contributing 13 percent to the overall portfolio. Eighteen projects focused on supporting early warning systems, constituting 33 percent of the portfolio. Furthermore, the evaluation team identified 29 projects, comprising a substantial 54 percent of the portfolio, in which early warning systems and climate information services were integrated as joint interventions. This integrated approach underscores the consistent strategy of GEF-funded projects to leverage the synergistic benefits of climate information services for enhancing the development of early warning systems.

Figure 6: Emphasis on CIEWS interventions



34. Concerning the specific interventions related to CIEWS within projects, Figure 7 provides a detailed breakdown. In 29 projects, constituting 54 percent of the total projects reviewed, CIEWS interventions were the primary focus. For 13 projects, accounting for 24 percent of the projects reviewed, CIEWS featured as a substantial component. In the case of 12 projects, making up 22 percent of the portfolio, while the CIEWS-related intervention was not considered substantial, it was still a relevant aspect that deserves consideration within the portfolio. The portfolio review indicated that, from these projects, the average CIEWS component ranges from 15 percent to 35 percent in terms of the specific funding allocated.

Figure 7: Magnitude of CIEWS interventions

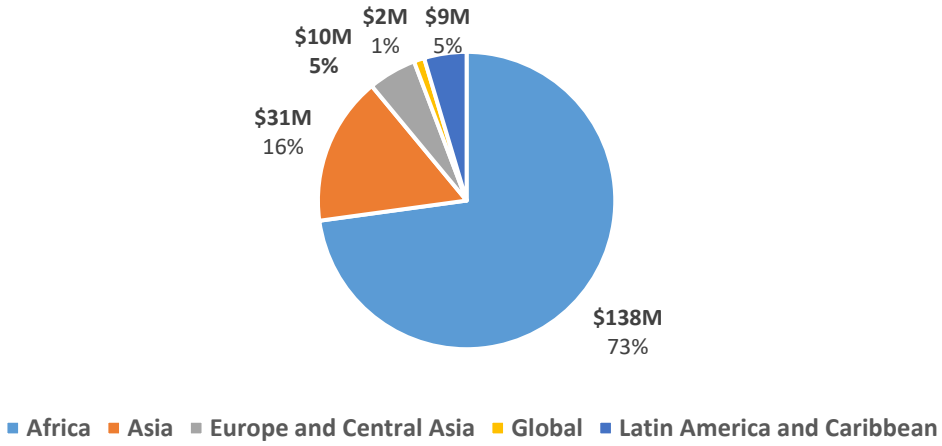


35. For the CIEWS evaluation portfolio of projects, GEF project financing[7] through its different funds totaled $314.8 million. The average grant size stood at $5.7 million, while the median grant size was $5.2 million, showing a standard deviation from the mean of $2.9 million. The largest grant made was $17.8 million[8], and the smallest grant was $0.9 million.[9]

36. In the distribution of the number of projects by region, Africa was the most prominent region, representing 71 percent of the entire evaluation portfolio reviewed for the evaluation. Asia accounted for 16 percent, Europe and Central Asia for seven percent, and Latin America and the Caribbean for four percent of the portfolio's composition. In terms of GEF financing, the portfolio mirrored a similar trend, as depicted in Figure 8.

[7] GEF project financing refers to a grant or concessional financing provided from any GEF-managed trust fund to support the implementation of any full-size project, medium-size project, enabling activity or program. This excludes financing, Agency fees, and project preparation grants.
[8] Building Resilience of Health Systems in Pacific Island LDCs to Climate Change (GEF ID 8018).
[9] Strengthening of The Gambia's Climate Change Early Warning Systems (GEF ID 3728).

Figure 8: Geographic distribution of LDCF, SCCF and GEF Trust Fund financing in the evaluation portfolio



37. There has been a noticeable shift toward financing CIEWS regional projects, which began during GEF-4. By the onset of GEF-6, regional projects accounted for 25 percent of the total projects approved during that replenishment period (Table 2). This strategic shift aligns with the international practice of recognizing the transboundary-nature of risks and climate-related disasters.[10]

Table 2: CIEWS multi-country projects over the GEF replenishment periods

Period	# of multi-country projects	% of multi-country projects by replenishment period
GEF-3	0	0
GEF-4	1	14%
GEF-5	3	12%
GEF-6	3	25%

38. In terms of funding sources for the CIEWS evaluation portfolio, the breakdown is as follows: 78 percent (43 projects) received financing from the LDCF, while another 13 percent (7 projects) found support from the SCCF. Approximately 4 percent (three projects) were financed by the GEF Trust Fund, and an additional 4 percent (two projects) constituted multi-trust fund initiatives. The breakdown of the evaluation portfolio by Agency share of projects and funding is depicted in Figures 9 and 10. Among the seven Agencies represented in the evaluation portfolio, the United Nations Development Programme (UNDP) has the largest share of projects, with 32

[10] See World Adaptation Science Programme, UNEP Policy Brief #2: Transboundary climate risk and adaptation.

out of 55 projects, representing 58 percent of the total. The World Bank serves as the GEF Agency for eight projects, constituting 15 percent of the portfolio. In comparison, the United Nations Environment Programme (UNEP) and the African Development Bank (AfDB) each act as the GEF Agency for five projects, contributing 9 percent to the portfolio.

Figure 9: Number of projects by Agency

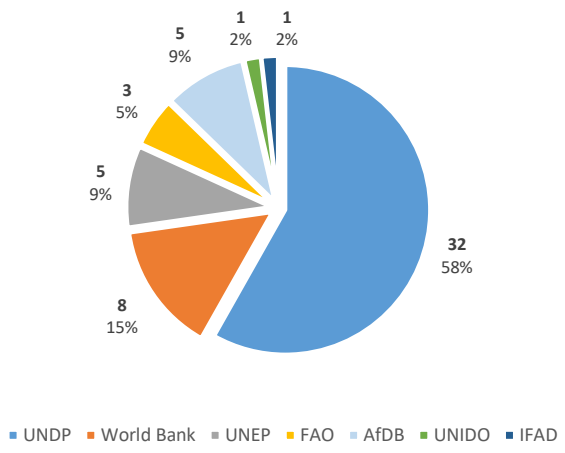
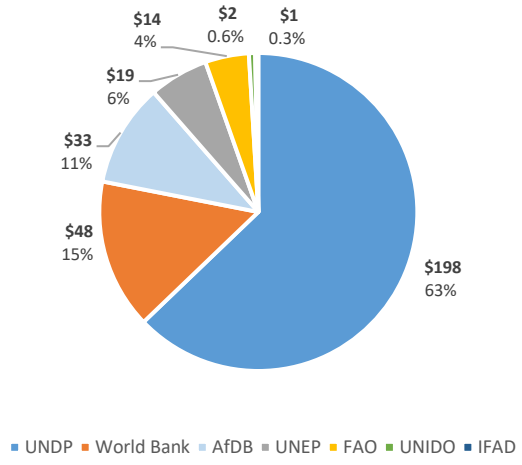


Figure 10: Funding amount by Agency ($ million)



39. Cofinancing pertains to additional financing beyond GEF project financing that supports the implementation of a GEF-financed project or program, facilitating the achievement of its objectives. Table 3 delineates the levels of GEF project financing in relation to cofinancing levels for the projects in the evaluation portfolio. The table illustrates a consistent trend, with GEF financing consistently hovering around 20 percent in later GEF replenishment periods, albeit with minor fluctuations during the earlier replenishment periods. In summary, the GEF cofinancing ratio remained at 7/40, indicating that GEF financing constituted 17.5 percent of the total project portfolio funding. It is essential to note that these data reflect the expected cofinancing at the project CEO endorsement or approval stage and do not represent the actual materialized cofinancing at project completion.

Table 3: GEF financing and cofinancing in CIEWS projects

GEF replenishment period	GEF financing amount ($ million)	Cofinancing amount ($ million)	GEF financing as % of total financing (GEF + cofinancing in $ million)
GEF-3	$12	$61.2	16.4%
GEF-4	$13.7	$37.8	26.6%
GEF-5	$152	$849.4	15.2%
GEF-6	$77.7	$280.6	21.7%
GEF-7	$59.2	$231.5	20.3%
Total	**$314.8**	**$1,800**	**17.5%**

4. KEY FINDINGS

4.1 Relevance

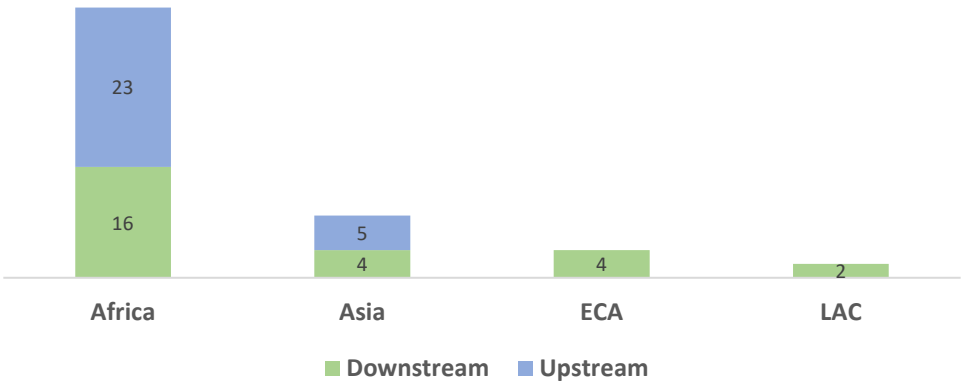
40. **CIEWS projects demonstrate strong alignment with GEF Trust Fund and LDCF/SCCF strategies.** Projects approved in GEF-3 and GEF-4 within the CIEWS evaluation portfolio are in accordance with programmatic documents prioritizing an upstream and transboundary approach. This approach, tailored to the unique contexts of each country, aims to furnish decision-makers and stakeholders with timely and accurate information about climate patterns, trends, and potential hazards. Upstream projects typically involve the deployment of meteorological and climate monitoring stations, satellite observations, climate models, and data analysis techniques. For instance, the project Strengthening Climate Information and Early Warning Systems in Malawi to Support Climate Resilient Development and Adaptation to Climate Change (GEF ID 4994) received support from the LDCF for the procurement and installation of 40 meteorological monitoring stations with telemetry, archiving, and data processing facilities to gather "upstream" data. The project also included training for equipment maintenance and repair, computer infrastructure, and telecommunications. Similarly, the project Strengthening Climate Information and Early Warning Systems in Tanzania for Climate-resilient Development and Adaptation to Climate Change (GEF ID 4991) contributed to improved water management through enhanced equipment, such as automated stations. The installation of automatic weather stations has increased the accuracy, quality, and timeliness of data, especially during the rainy season and other critical times.

41. More recent projects in the CIEWS evaluation portfolio have shifted towards a downstream approach, a transition that is also evident in the most recent GEF and LDCF/SCCF programming documents. This approach revolves around the translation and application of upstream climate information at local levels and in local contexts. The objective of downstream projects is to provide actionable and context-specific information to individuals, communities, and organizations, facilitating the implementation of appropriate response measures and promoting advanced planning to mitigate the impacts of climate hazards and risks. Consequently, this enhances resilience to climate change impacts and supports adaptation efforts. Key features of downstream climate information and early warning systems include tailoring climate information to the specific needs and vulnerabilities of local communities, translating complex climate data into user-friendly formats and languages, and disseminating information through various channels, such as mobile apps, community radio, or local networks, to facilitate planned responses.

42. As an example, the project Climate Resilient and Sustainable Capture Fisheries, Aquaculture Development, and Watershed Management (GEF ID 10411), approved in 2022, serves as an illustration of the downstream application of upstream data. Implemented in Malawi and financed by the LDCF, the project entails the installation of hydrometeorological systems for early warnings. Local communities will take charge of managing these systems, addressing issues such as vandalism, operation and maintenance, low usage, and ensuring timely communication. Apart from collecting data sent to meteorological services for

processing, trained local fishermen will utilize simple and mainstreamed technologies, such as mobile phones, to connect with the national forecast system and receive information about potential extreme weather conditions in the lake area. This system aims to establish and operate a communication and dissemination scheme, informing communities about impending threats and enabling disaster response teams to prepare against climate-related risks. This trend of transitioning over time from the prioritization of upstream approaches to achieving a balance between upstream and downstream activities was identified across different regions (Figure 11). Countries in Africa and some areas in the Asia-Pacific region demonstrated a balanced prioritization of both upstream and downstream activities within the project's focus. In contrast, projects in countries in the ECA and parts of LAC focused on GEF support for downstream activities. The CIEWS evaluation portfolio comprises 29 upstream projects and 26 downstream projects.

Figure 11: Number of projects by approach type



43. **GEF projects focusing on CIEWS were demand-driven by countries' beneficiaries**. Through interviews, project documents, and country case studies, a consensus emerges that the CIEWS components were demand-driven, with key stakeholders recognizing the imperative need for climate information and early warning systems. These needs were closely linked to geographic considerations, climate-related hazards, and the specific requirements of each country. The GEF Secretariat established a broader strategic direction, emphasizing the significance of climate information services and related infrastructure. Furthermore, it allowed flexibility for individual countries and agencies to identify specific activities. This approach often aligned with national priorities, enabling a tailored response to each region's unique circumstances and challenges. For instance, in Tonga, the Pacific Resilience Program (GEF ID 5814) adjusted legislative frameworks, such as legal acts related to disasters, to align with national priorities. Simultaneously, the project provided flexibility to include post-cyclone support following Cyclone Gita in 2018 and much-needed assistance after the cyclone disaster impacts for WASH (water, sanitation, and hygiene) activities, along with strengthening shelters on critical, hard-hit islands. Another example is in Costa Rica (GEF ID 6945), where the project's interventions in the aftermath of Hurricane Otto in 2017 were crucial. The GEF Agency, UNDP,

developed an active response coordinated with the National Emergency Commission (CNE) to articulate actions at the local level that continued throughout the project. One of these interventions was the design and implementation of an early warning system for the five communities most exposed to sudden events (floods, mud avalanches) due to hydrometeorological conditions in the municipality of Upala.[11] Field interviews confirmed that the project interventions were sensitive to the country's economic, social, and environmental conditions of the country, demonstrating high relevance in the design and implementation stage.

44. **The data indicate that CIEWS projects are effectively targeting regions with higher risks due to climate-related hazards**. CIEWS interventions by GEF-supported projects are mapped in Figure 12, and Figure 13 shows the global distribution of climate-related risks elaborated by the World Bank, which calculates vulnerability-weighted mortality risk values for each country across climate-related disasters. A thorough analysis of both maps underscores a strategic alignment between the CIEWS evaluation portfolio and the distribution of climate-related hazards by mortality risk. This alignment is particularly precise in Africa, where CIEWS interventions closely correspond to the risk distribution. Notably, the LDCF has proven to be highly instrumental and appreciated by stakeholders for delivering CIEWS interventions, particularly in fragile and conflict-affected situations.

45. In the three countries where case studies were conducted, the GEF performed well in specifically targeting subnational areas that were highly relevant in terms of hotspots of climate-related risks. In Costa Rica, CIEWS interventions, funded by the SCCF, specifically concentrated on the country's northern region. According to climate change scenarios provided by the WMO, this area faces a concerning outlook in the short term, with an anticipated 15 percent reduction in rainfall by 2030 and a more severe 35 percent decrease by 2050. These extreme conditions are expected to further exacerbate climate conditions, particularly in areas such as the Guanacaste and Alajuela Cantons.

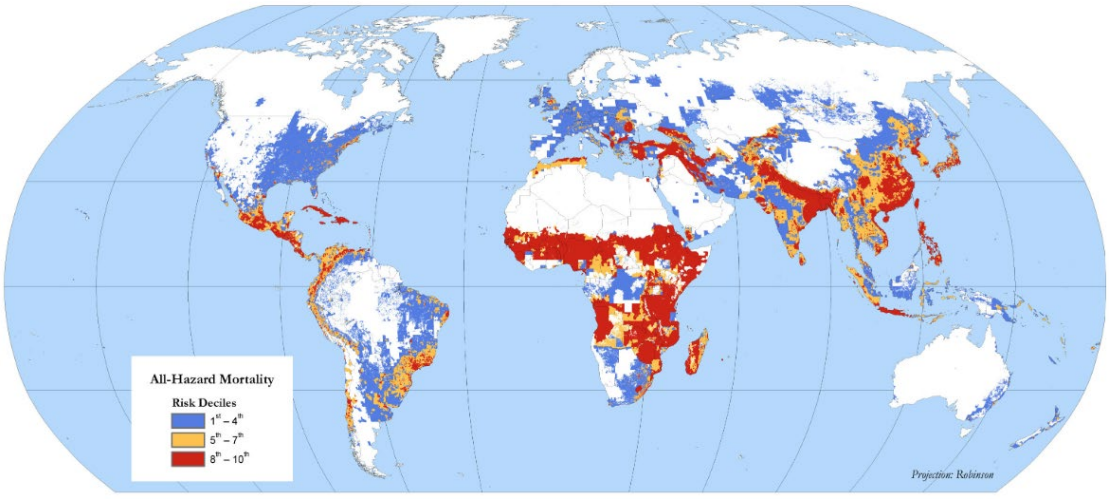
46. In Tonga, the Pacific Resilience Program (GEF ID 5814) strategically targeted cyclone-prone islands, where the intensity of cyclones is predicted to increase. Having successfully provided cyclone early warning in 2018, the program has established Emergency Operations Centers in otherwise isolated island cluster regions (Ha'apai, Vava'u, and Nuku'alofa). It also facilitated accessible warnings to communities and information dissemination on how to prepare. Similarly, in the Strengthening Climate Information and Early Warning Systems in

[11] One of the CIEWS components, the Upala hydrological station, was the first of its kind to be installed in Costa Rica. It contains a sensor that measures the level of the Zapote River; it is located on the Canalete Bridge and can be monitored in real time by anyone, via a web page. The water measurements are updated every five minutes, which allows a strict control of the river. The National Meteorological Institute (IMN) regulates the station and maintains constant communication with the Municipal Emergency Committee, the community emergency committees, and regional liaisons from the National Emergency Commission. An early warning protocol warns the population of the center of Upala that they have between 45 minutes and 1 hour to try to protect their belongings, remove items, and find a safe place while the water drops. As soon as the alert is generated, authorities activate a siren at the Municipality of Upala, along with the sirens of local emergency entities.

Tanzania for Climate Resilient Development and Adaptation to Climate Change project (GEF ID 4991), key sub-regions of Tanzania were targeted for improvement in the country's hydromet monitoring network. This enhancement aimed to provide region-specific flood and drought forecasting, and climate information for early warning and long-term planning.

Figure 12: Global distribution of CIEWS projects

Figure 13: Climate-related hazards by mortality risk distribution

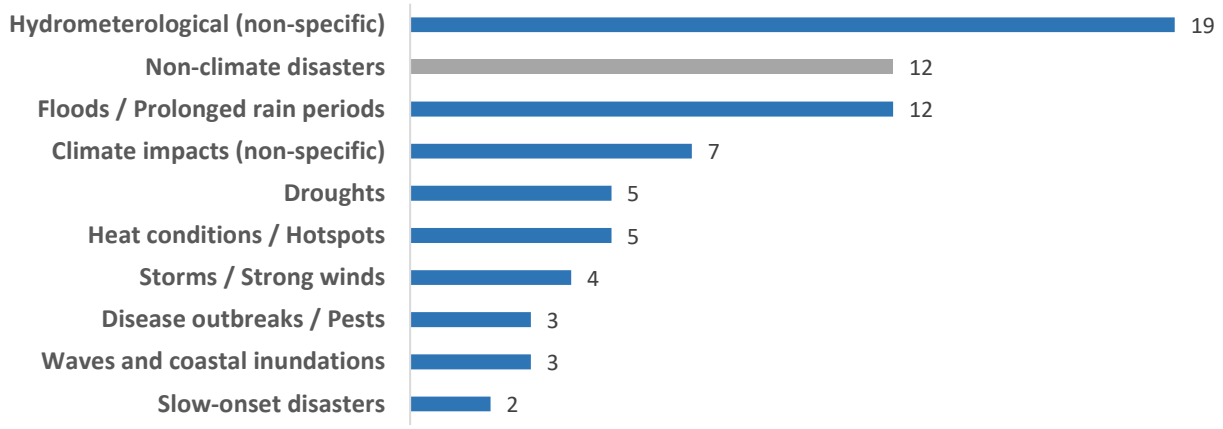


47. CIEWS projects funded through GEF-administered trust funds primarily address disaster events related to hydrometeorological hazards,[12] with a particular focus on fluvial floods,

[12] Hydrometeorological hazards are of atmospheric, hydrological, or oceanographic origin. Examples are tropical cyclones (also known as typhoons and hurricanes); floods, including flash floods; droughts; heatwaves; cold spells;

coastal floods, and droughts. A significant portion of the evaluation portfolio, comprising 36 projects (66 percent), directs interventions toward various aspects of climate information services. Climate services rely on data generated from national and international databases providing information on temperature, rainfall, wind, soil moisture, and ocean conditions as well as projections and scenarios, and risk and vulnerability analyses. When these meteorological data are combined with socioeconomic variables and other non-meteorological data—such as information on agricultural productivity, road and infrastructure plans, mapping, health trends, and human settlements in high-risk zones—the combined dataset can be tailored into climate information services. These services include projections, trends, economic analyses, and customized offerings for specific uses to aid adaptation to climate variability and change. These services are particularly valuable for decision-makers in climate-sensitive sectors.[13] Figure 14 provides an illustration of the primary hazards addressed by the projects in the evaluation portfolio. Among them, floods and extended periods of rainfall constitute the most prevalent category, followed by droughts and other heat-related conditions. While the GEF's primary focus is on environmental and climate-related issues, a subset of CIEWS projects (12 percent) also aims to provide information and early warnings for non-climate-related disasters, such as geological events (tsunamis, volcanic eruptions, and earthquakes).

Figure 14: Types of climate impacts and risks targeted through GEF-supported CIEWS



Note: The data does not account for number of projects, as one project can encompass multiple disaster events.

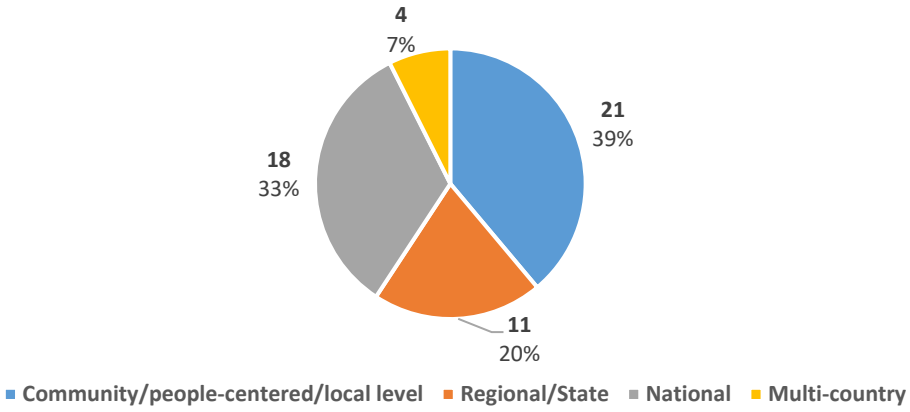
48. **Local communities were found to be the primary focus in the design of CIEWS projects**. As depicted in Figure 15, 39 percent of these initiatives prioritize community and local levels as their primary focus. Following closely behind are projects with a national scope, accounting for 33 percent, while those at the state level constitute 20 percent, and multi-country efforts represent 7 percent of the total. For instance, the project Adaptation to Climate Change in Arid

and coastal storm surges. Hydrometeorological conditions may also be a factor in other hazards, such as landslides, wildland fires, pest incidence (i.e., locust plagues), epidemics, and the transport and dispersal of toxic substances and volcanic eruption material (UN Knowledge Hub).

[13] WMO, Official Website of the Global Framework for Climate Services WMO.

Lands (KACCAL; GEF ID 3249) was designed to address the challenges of drought, which have historically affected poor rural communities in Kenya. Notably, the project introduced the innovative approach of community participation in both the design and implementation phases of the project, an approach that had not been used by the GEF in addressing climate change in Kenya. As a direct result of the training facilitated by the project, government extension officers at the community level in Mumoni and Kyuso successfully integrated adaptation strategies into Municipal Development plans. They have also incorporated climate seasonal predictions and early warning alerts into their outreach efforts within the communities they serve.

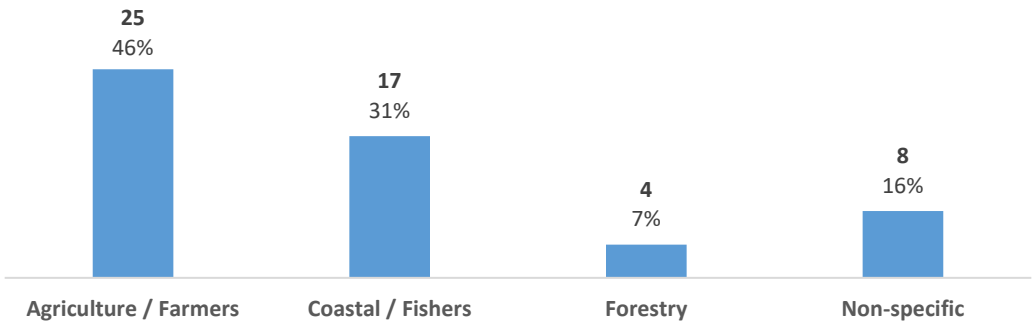
Figure 15: Primary scope of CIEWS projects



49. **The primary beneficiaries of CIEWS interventions are concentrated mainly within the agricultural and fisheries sectors**. Through a comprehensive analysis of completed and ongoing projects, it was found that 46 percent of initiatives specifically targeted farmers and rural communities as their primary beneficiaries (Figure 16). Coastal populations and fishers were the focus of 31 percent of projects. In comparison, 7 percent were dedicated to forestry-related efforts, and 16 percent had no specified beneficiaries, encompassing projects with beneficiaries by geographical area and multiple ecosystems. For those dependent on terrestrial and marine-based livelihoods in the context of climate change and variability, climate information, forecasting, and early warning are critical for decision making. Access to and understanding of agro-meteorological information, for instance, are prerequisites for productive and efficient management and decision making concerning agricultural activities. In the project Strengthening Climate Information and Early Warning Systems for Climate Resilient Development and Adaptation to Climate Change in Guinea (GEF ID 8023), supported by the LDCF, funds were strategically utilized to establish critical infrastructure, thereby enhancing the accessibility of climate information. This initiative supported the Guinean National Directorate of Meteorology in delivering high-quality hydrometeorological data to farmers, enabling them to anticipate climate-induced disasters and take necessary measures proactively. These actions included the development of crop calendars; early detection of heavy rains, storms, and floods; and monitoring water courses to adapt to the impacts of climate-related risks. This targeting of agrometeorological information was common across other projects, given the vulnerability of farmers to climate change and the impact of variability, facilitating climate-risk-informed

decision making in assisting adaptation. For example, in the Strengthening Climate Information and Early Warning Systems in Tanzania for Climate Resilient Development and Adaptation to Climate Change project (GEF ID 4991), farmers in Arusha, exposed to drought and flood, were selected within their wards to receive monthly early warning and climate information forecasting. This allowed them to adapt their cropping and farming practices accordingly.

Figure 16: Beneficiaries of CIEWS projects

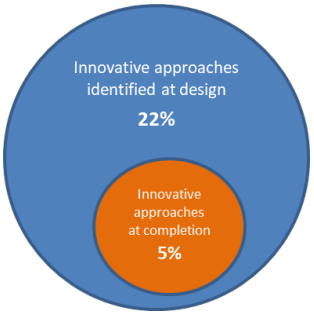


50. **CIEWS initiatives within LDCF, SCCF, and GEF TF projects have strategically integrated with and leveraged existing services and warning system platforms**. Notably, 75 percent of these projects built upon existing services or leveraged existing platforms. Integration commonly involved national meteorological services that collect weather and monitoring data, such as information on flooding, soil humidity, and tidal gauges. However, some projects also leverage international data and regional information platforms and services. For instance, Tonga's Pacific Resilience Program (GEF ID 5814) utilizes the Pacific Community's services and information. By leveraging these existing services, CIEWS interventions fill gaps in the climate information value chain, broaden access to information, and encourage greater user uptake and application of climate information services. As an illustration, the project Strengthening Liberia's Capability to Provide Climate Information and Services to Enhance Climate Resilient Development and Adaptation to Climate Change (GEF ID 4950) successfully implemented a fully functional EWS by procuring and installing 11 automatic weather stations on cell phone communication towers, which are owned by telephone companies and are spread across the country. With sites identified and mapped by the Ministry of Transport (MoT), these weather stations generate hourly weather information, which is updated on a newly developed MoT weather site. The primary purpose of this system is to broadcast weather information to enable local farmers and other users to make informed decisions related to their livelihoods, heavily dependent on weather conditions. This is an example of proactive coordination undertaken by multiple stakeholders to ensure the effective implementation of the EWS. Overall, the integration and leveraging of interventions in existing services and platforms has been a key strategy in GEF projects, allowing for the efficient utilization of resources and the enhancement of climate information services.

51. **The utilization of innovative approaches in GEF projects has been limited.** While certain innovative approaches were piloted and received support via CIEWS interventions, such experiences have been infrequent. As shown in Figure 17, 22 percent of the projects included in

the evaluation portfolio mentioned the utilization of innovative approaches during the design phase. However, a mere 5 percent of the projects reported successful implementation of these innovative approaches at the time of the terminal evaluation. Key stakeholders interviewed as part of the study, expressed that the innovative approaches employed in these projects included the use of mobile apps, toll-free numbers, community radios, Very High Frequency (VHF) radios, and AM transmitters as communication channels (GEF IDs 5003, 5667, 10105). Furthermore, the portfolio analysis indicated that multiple projects had adopted innovative risk and vulnerability platforms to facilitate information sharing between beneficiaries and policy makers. The SCCF, which supported non-LDCs, has been able to support more innovative CIEWS activities (e.g., as part of the Southeast Europe and Caucasus Regional Catastrophe Risk Insurance Facility). In terms of data management techniques, several projects piloted the use of spatial data (GEF IDs 5111, 5581, 8018). Costa Rica (GEF ID 6945) provides a notable example of an innovative approach, where the project implemented an alarm system using sensors to monitor the water level of the Zapote River. This system had the advantage of low maintenance costs, making it a cost-effective solution. Moreover, to improve communication efficiency, the project utilized user-friendly and readily accessible communication tools, including social networks and cost-free cross-platform instant messaging platforms. By harnessing these tools, the project successfully disseminated crucial information to the broader population, ensuring that they were well informed and capable of taking appropriate actions in response to the water level monitoring data.

Figure 17: Innovation in CIEWS projects



52. **A prevalent and noteworthy innovative approach involves the implementation of community-based initiatives.** Additionally, platforms like WhatsApp and Facebook groups were frequently employed to facilitate effective communication among community members. The project Community-based Climate Risks Management in Chad (GEF ID 8001) developed a people-centered EWS that actively engaged and reached communities. As part of their innovative approach, the project utilized the climate information generated to design a financial instrument. This instrument provided services such as micro-credit and climate index micro-insurance to 500 vulnerable households and farmers. The objective was to break the cycle of poverty by providing low-income households, farmers, and businesses with access to liquidity to safeguard their livelihoods during and after climate-related disasters. By combining agricultural micro-insurance with agricultural micro-credit, insurance companies could save on

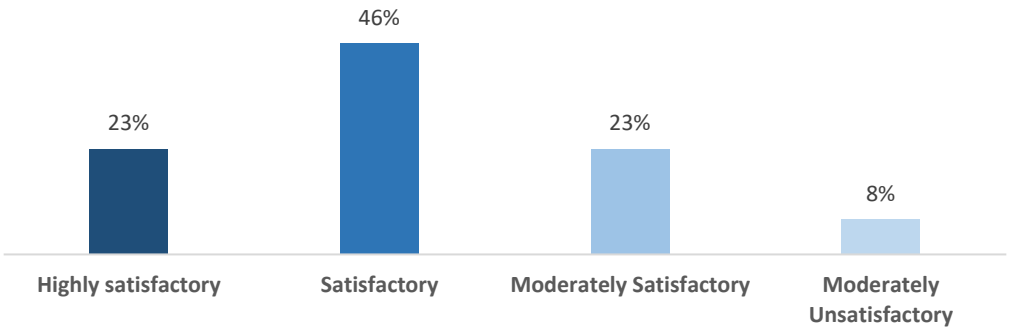
administration costs and extend their services to remote areas. This approach, contingent on accurate climate information, proved to be beneficial for both the insurance companies and the communities they served.

53. **GEF projects wield a significant catalytic potential.** In certain instances, CIEWS initiatives have not only established a robust foundation for sustaining the impacts initiated in their implementation but also demonstrated transferability to other regions. A notable trend is the subsequent financing of projects, based on the successful outcomes of GEF initiatives, by other organizations such as the GCF. This aims to sustain their success and unlock the potential for larger-scale interventions. The GCF's involvement brings a significant increase in financial resources, thereby enhancing the transformative capacity of these projects. This support facilitates the scaling up of interventions, enabling broader coverage and far-reaching influence for climate-risk-informed and early warning decision making. The interdependent relationship between GEF projects and subsequent GCF funding underscores the catalytic role played by GEF initiatives in stimulating broader, transformative actions to address climate challenges. For instance, components from the project design and lessons learned during the implementation of the project Addressing the Risk of Climate-induced Disasters through Enhanced National and Local Capacity for Effective Actions (GEF ID 4976) in Bhutan, led by UNDP, played a decisive role in designing the GCF project Scaling-up Multi-hazard Early Warning Systems and the Use of Climate Information in Georgia, executed by UNDP, and financed by $27 million from the GCF. This initiative effectively established and upgraded a Flood Forecasting Early Warning (FFEW) system along the Rioni River, significantly improving the resilience of 258,841 households, as reported in its 2022 Implementation Report.

4.2 Effectiveness

54. **Most CIEWS projects with terminal evaluations have achieved satisfactory outcomes.** Of the 26 projects with a terminal evaluation, 92 percent received ratings in the satisfactory range, encompassing highly satisfactory, satisfactory, and moderately satisfactory. Only 8 percent received a moderately unsatisfactory rating, and none was assessed as unsatisfactory or highly unsatisfactory (Figure 18). In comparison, the outcome ratings of all 1,294 projects from GEF-managed trust funds included in the IEO Annual Performance Reports (APRs), with available data spanning GEF-3 to GEF-5, exhibited an 81 percent rate of projects receiving a rating in the satisfactory range, a difference of 11 percentage points. However, a considerable proportion of CIEWS projects are still in the process of implementation. Consequently, it is reasonable to anticipate that the percentage of satisfactory ratings may decline, as projects facing implementation challenges are more likely to experience delayed completion and thus be overrepresented among those that have not yet completed their terminal evaluations, particularly for the GEF-5 replenishment period, where most of the projects in the CIEWS evaluation portfolio are included.

Figure 18: Outcome ratings of CIEWS projects



55. **Significant variations in the outcome ratings exist across project categories, with distinctions based on regions and funds.** Figure 19 illustrates the number of projects within different categories that received outcome ratings based on cumulative data from terminal evaluations. Historically within the GEF portfolio, a higher proportion of projects financed by the SCCF have achieved highly satisfactory outcomes, a trend reaffirmed in the CIEWS evaluation portfolio (Figure 20). Conversely, a lower percentage of projects in Africa, in general, have met the criteria for satisfactory outcomes. However, within the specific context of the CIEWS portfolio, there has been a notable improvement in project outcomes in the region. Notably, 93 percent of completed projects in Africa have received a satisfactory rating, aligning with the overall performance of the portfolio.

Figure 19: CIEWS projects' rating by fund

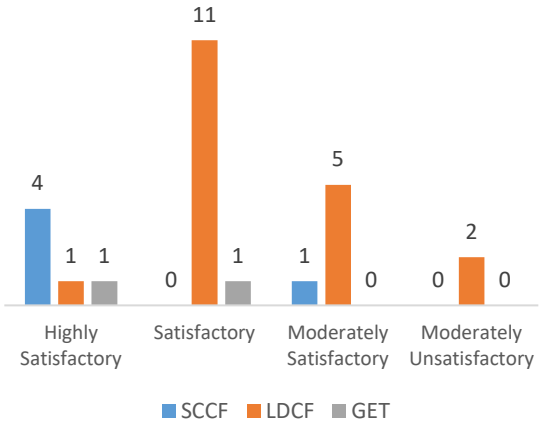
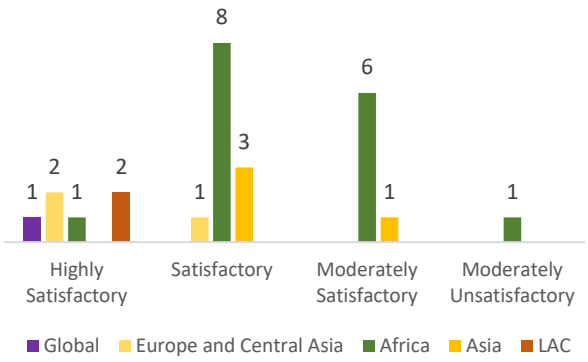


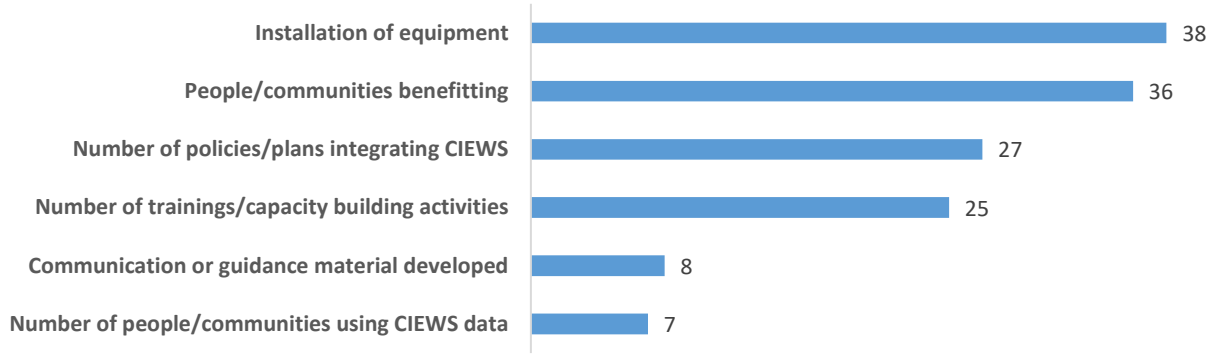
Figure 20: CIEWS projects' rating by region



56. **Although the outcome ratings are favorable, an assessment of the results framework for CIEWS components found that 73 percent of projects require more thorough design.** The review of completed and ongoing projects, coupled with interviews with key stakeholders, highlights one prevalent issue: the choice of indicators may not adequately reflect the specific goals and objectives of the CIEWS interventions. In some instances, indicators are chosen for their simplicity rather than their capacity to accurately measure the project's contribution to

building resilience and adaptive capacity over time. As illustrated in Figure 21, a majority of indicators used in projects incorporating CIEWS components tend to focus on successful equipment installation or the count of beneficiaries residing in the intervention areas.

Figure 21: Type of indicators tracked in CIEWS projects



Note: The data does not account for number of projects, but the sum of indicators used in all the projects in the evaluation portfolio.

57. While establishing target numbers for equipment installation and beneficiary counts can be informative, indicators of this nature may fall short of providing a comprehensive project assessment due to inherent ambiguities. For instance, there are examples where the installed equipment ceases to function effectively post-project completion, often due to insufficient funding and an inadequate operation and maintenance framework. Upon detailed review and in interviews, for example, design issues were identified in a project included in the case study from Tanzania (GEF ID 4991). In this project, activities had been under-budgeted in design costings, and therefore under-resourced, affecting the implementers' ability to undertake all planned project activities. Of note in these findings were the underestimation of costs for technology and local sourcing expenses for certain equipment (e.g., automated weather stations), as well as ongoing subscription costs to the platforms and databases supporting equipment in operation. The reported total of installed equipment may not accurately reflect the operational reality. Furthermore, the total count of beneficiaries, as reported by the project, may be derived from the general population within the project's geographic area rather than those individuals who genuinely have access to CIEWS data. This approach fails to offer insights into the actual utilization of CIEWS data by the project intended beneficiaries.

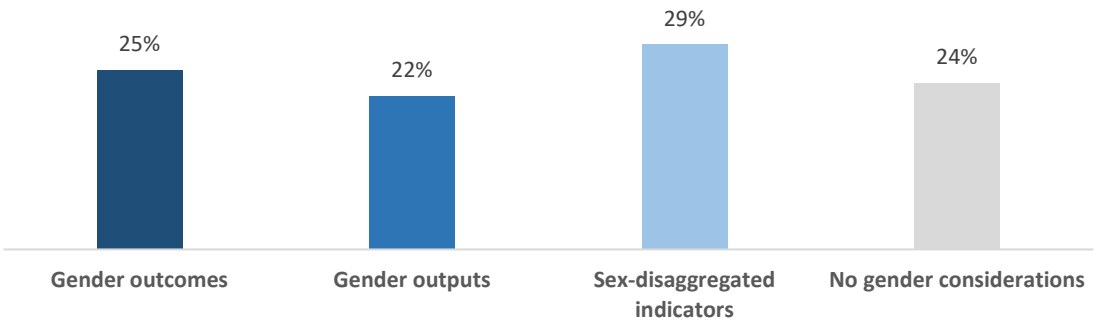
58. As an illustration, the project Adapting to Climate Change-Induced Coastal Risks in Sierra Leone (GEF ID 5902) adopted the number of beneficiaries as the key indicator to measure the progress of its objectives. However, this approach encountered significant challenges. The terminal evaluation found that the project team included the entire population in the targeted area in their assessment, rather than specifically focusing on individuals actively engaged in adaptation measures. Furthermore, the evaluation identified that the mobile phones provided by the project at each site, intended for receiving and disseminating weather information, remained underutilized, particularly for disseminating the information. Consequently, direct

beneficiaries did not derive the expected benefits from the information generated, highlighting a flaw in the design and application of the chosen indicator.

59. **While CIEWS projects demonstrated a close alignment with national priorities aimed at reducing the vulnerability of women and other marginalized groups, the degree to which this integration has been achieved remains somewhat constrained.** The evaluation team classified the CIEWS evaluation portfolio and assessed the degree to which projects included gender in three components of project design: outcomes, outputs/activities, and indicators. The relative degree to which gender is integrated into an operation is positively related to the number of components that incorporate gender. For example, those that include gender elements in all three components have a relatively high degree of integration. Using this criterion, an analysis of the consideration of gender inclusivity in CIEWS interventions showed that 25 percent of projects included explicit outcomes targeting gender inclusivity, 22 percent of projects included gender in project outputs or activities (mainly through training or workshops) as its highest component, 29 percent only included sex-disaggregated indicators, and 24 percent of the projects in the portfolio do not mention relevant gender considerations (Figure 22).

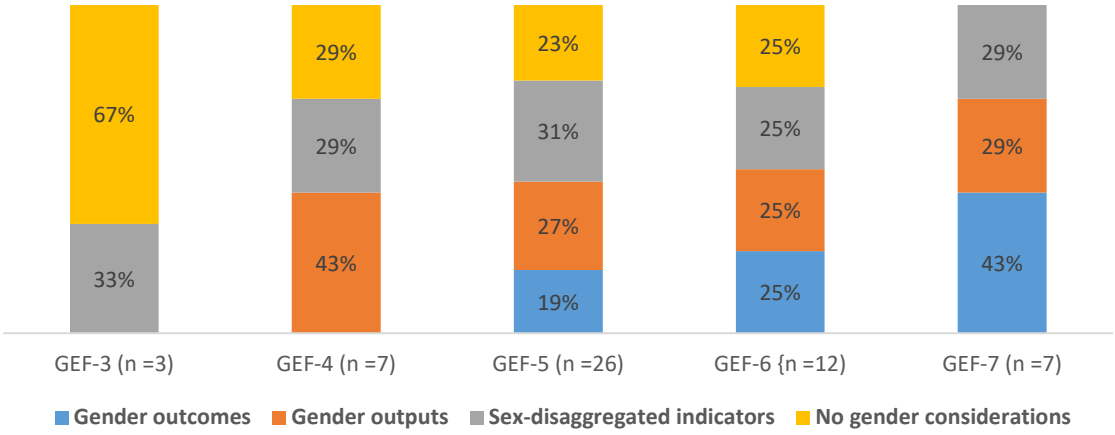
60. The predominant strategy for incorporating gender considerations at an outcome level encompasses several key elements. The approach entails adapting and implementing CIEWS project activities based on a comprehensive understanding of gender dynamics and the potential disproportionate impacts of climate change on women. This includes conducting gender-specific analyses during vulnerability assessments and integrating gender-responsive budgeting to ensure the allocation of resources for specific activities addressing women's adaptation needs, such as livelihood options. Moreover, it involves incorporating women's perspectives in both the development and implementation phases of the project as well as efforts directed at building women's capacities by actively involving them in generating climate and socioeconomic information to address their specific areas of concern. A crucial aspect is strengthening women's roles in mainstreaming adaptation processes within national, regional, and local policies, plans, and budgets, extending to their involvement in sectoral decision making, particularly in the most vulnerable sectors and sites. Lastly, emphasis is placed on promoting the active participation of women in emergency committees and management systems, assigning them significant roles in institutions and organizations. As an example of the high degree of gender integration, in Guinea, as part of the Strengthening Climate Information and Early Warning Systems for Climate-Resilient Development and Adaptation to Climate Change project (GEF ID 8023), a gender-based vulnerability assessment was conducted during the project preparation phase across various targeted villages and regions. The primary goal of this assessment was to identify specific climate information needs related to gender vulnerabilities. Simultaneously, the climate information needs assessment placed particular emphasis on the requirements of vulnerable women to develop tailored tools to ensure their easy access to the information necessary for enhancing their resilience to climate change impacts. There were specific gender-oriented outcomes and outputs, along with the utilization of smart indicators (specific, measurable, achievable, relevant and time-bound) to assess the effectiveness of their interventions.

Figure 22: Gender components in CIEWS projects



61. **A comparative analysis of gender components across GEF replenishment periods reveals a shift in priorities.** Notably, these components received less emphasis during GEF-3 and GEF-4 (Figure 23). However, there was a consistent improvement in prioritization during GEF-5 and GEF-6, reaching a substantial 43 percent in project design during GEF-7. The recognition that gender mainstreaming was less effectively implemented in earlier projects has been noted in previous IEO evaluations. This observation is attributed to the fact that a new GEF Policy on Gender Equality was approved at the 53rd meeting of the GEF Council in 2017. After the Policy was adopted, the GEF Secretariat collaboratively developed guidelines to facilitate the successful implementation of the Policy. This process involved consultations with the GEF IEO, Agencies and various stakeholders to ensure comprehensive input and expertise.

Figure 23: Gender components by GEF replenishment period in CIEWS projects



62. **Efforts to include and focus interventions on vulnerable and marginalized populations show mixed results.** Interviews and case studies accentuated the connection between the most vulnerable groups and their heightened exposure to climate-related risks, indicating the inherent need for CIEWS interventions, particularly at the community level, to address their particular needs. Nonetheless, many projects explicitly aim to bridge the information gap for communities lacking internet or television access, primarily through radio-based data

dissemination or by providing mobile phones (smartphones) for communities to access critical climate information and early warnings (e.g., GEF IDs 3838, 4994, 5003, 5855). These initiatives targeted marginalized and vulnerable populations, especially in rural regions, utilizing local languages and diverse communication methods. Other projects (GEF IDs 4709, 6945, 10089) proactively integrate indigenous knowledge to serve communities with distinct languages and requirements, with the documentation of such knowledge as a promising step toward addressing climate-related challenges. However, insights from stakeholder interviews highlighted the ongoing challenges in effectively delivering outreach programs aimed at marginalized groups. These discussions also mentioned the crucial role of capacity building within organized communities and in reaching dispersed groups with restricted access to essential services or ability to participate in organized activities during times of disaster. Notably, the portfolio review analysis provided limited information on this aspect. This limitation reflects an insufficient discussion on marginalized populations in projects rather than implying their absence at project sites.

63. Collaboration, tailored interventions, and a focus on improving data usability consistently emerge as critical factors supporting the effectiveness of CIEWS projects. Effective collaboration with government entities, especially meteorological departments, disaster preparedness and response agencies, and humanitarian organizations like the Red Cross and Red Crescent, is a crucial factor for ensuring the efficacy of climate information services integrated into projects. In addition, involving multiple agencies from different government levels is vital to promote the broader utilization of climate data. For instance, in The Gambia, the project Strengthening Climate Change Early Warning Systems (GEF ID 3728) shifted from the absence of climate information systems in the country to establishing an operational system actively endorsed by the government and subsequently extended using its resources. Furthermore, a significant lesson learned underscored the importance of initiating cross-sectoral engagement right from the project's outset. While climate information systems initially seemed solely an environmental sector project, stakeholders from various sectors, including transportation, agriculture, and tourism, became engaged during the implementation stage, broadening the project's scope and enhancing its intended outcomes. Similarly, the project Strengthening Climate Information and Early Warning Systems in Tanzania for Climate-Resilient Development and Adaptation to Climate Change (GEF ID 4991) highlighted the critical nature of inclusivity alongside coordination. Engaging all key government agencies—including the meteorological services authority, the Prime Minister's Office responsible for disaster risk management, the Ministry of Water, local government authorities, communities, and users—in coordinating information inputs and networks, as well as packaging information for users, proved to be crucial for success.

64. In the Caribbean, the project Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (GEF ID 5667) highlighted the importance of adopting adaptive management approaches within CIEWS projects, emphasizing the need to remain flexible and tailor interventions to align with the unique requirements and capacities of diverse communities. Establishing a supportive environment for early warning systems within the community proved to be crucial. This encompasses establishing a well-structured response plan and addressing institutional and community preparedness issues. The project points out the imperative nature of stakeholder engagement and securing community buy-in and active involvement in planning

and executing early warning systems. Although precise data on loss prevention were scarce, and even more challenging to assign attribution, it is noted that the training in Global Positioning Systems (GPS) and Very High Frequency (VHF) radios provided by the project to 1300 stewards and fishers might have played a role in preventing the loss of lives in certain areas. The Saint Kitts and Nevis Coast Guard has reported a considerable improvement in sea safety, noting a decline in the number of fishers going missing at sea. Prior to the project's implementation, an average of four such cases were reported annually. Since the project's completion, no cases of fishers going missing at sea have been reported.

65. Regarding data usability, the portfolio review, case studies, and interviews have collectively offered compelling evidence, highlighting its pivotal role in the effectiveness of CIEWS interventions. Clear and user-friendly information enables communities and authorities to take necessary precautions and implement evacuation plans promptly, which can significantly reduce the impact of disasters, and ultimately enhance climate information to improve socioeconomic benefits. For instance, the project Strengthening Climate Information and Early Warning Systems in Zambia (GEF ID 4995) supported the efficient and effective use of hydrometeorological and environmental information in communities. According to the project's terminal evaluation, over 60,000 small-scale farmers, constituting 100 percent in the targeted areas, benefited from weather and climate information in the past four years, with 60 percent being women. This weather and climate information contributed to a substantial increase in maize production from 600 kilograms per hectare to 2.2 tons per hectare, enhancing food security by meeting the average family's requirement of 400 kilograms of maize, with the surplus serving as a valuable source of income generation. Additionally, the accessibility of weather and climate information has encouraged crop diversification, leading farmers to cultivate additional crops like legumes and engage in small livestock rearing. A similar case was identified in Ethiopia, where the project Implementing Climate Resilient and Green Economy plans in highland areas (GEF ID 6967) provided 500 plastic rain gauges to farmers and training to interpret the gathered data. This effort significantly expanded access to weather monitoring, equipping beneficiaries with accurate information to make informed decisions. This proved especially crucial as changing weather patterns rendered certain crops, traditionally grown in these communities, no longer viable.

66. **Integrating hazards, vulnerabilities, and risk reduction measures enhances institutional effectiveness, operational efficiency, and public preparedness, contributing to the overall effectiveness of CIEWS**. Empirical evidence underscores the critical importance of concurrently considering hazards and vulnerabilities for optimizing risk reduction outcomes. Projects that systematically and comprehensively integrate these components demonstrate heightened success in improving institutional effectiveness, streamlining the efficiency of actions, and refining public preparedness. Despite these benefits, projects in the evaluation portfolio lack a systematic and comprehensive integration of climate information and early warning systems into broader disaster risk management strategies. This gap suggests that the full potential of these projects may not be realized, as the synergies between climate-related information and disaster risk reduction strategies are not optimally leveraged.

67. **While there has been some progress, the challenge of reaching the "last mile" persists.** As noted earlier, the "last mile" refers to the delivery of information and services to local

communities. The last mile terminology acknowledges that even when comprehensive systems are in place, the effectiveness of these initiatives ultimately depends on successfully reaching and engaging the most vulnerable and remote communities. This requires not only making climate information accessible but also tailoring it to local needs, ensuring comprehensibility for diverse users, and enabling informed decisions and actions. The "last mile" approach emphasizes the importance of community involvement, user-centered design, and effective communication to bridge the gap between centralized data and the people relying on it for their safety, livelihoods, and resilience to climate-related challenges. Despite the progress made in infrastructure development and capacity building, CIEWS projects have not consistently overcome the challenges of the "last mile." For instance, 11 projects in African least-developed countries (LDCs), approved through the LDCF in 2014 and implemented by UNDP, successfully established essential infrastructure, including the establishment of hydrological and meteorological stations, effectively improved the capabilities of national agencies, and successfully integrated new equipment into national systems. However, despite UNDP's efforts to develop last-mile services to meet needs identified through knowledge management products and the introduction of potential partners, the evidence shows a significant gap between the availability of early warning information and its effective delivery to those who need it most. As a result, despite progress in new infrastructure and capacity building, the "last mile" communities in the UNDP projects continue to be underserved and disproportionately impacted by climate-related disasters and challenges.

68. **CIEWS projects have shown limited effectiveness in transitioning from solely supporting CIEWS to integrating early action measures within disaster events.** While projects have supported countries in accessing and disseminating warnings, the effectiveness of these warnings in saving lives hinges on more than just accessibility. The evaluation team did not find concrete evidence that CIEWS projects consistently succeeded in imparting not only information but also systematic knowledge to populations regarding appropriate responses once a warning is issued. This knowledge gap is particularly pronounced when instructing communities on distinct actions required for various types of climate-related disasters. Information and data extracted from the portfolio review and case studies show that to translate early warnings into early actions, comprehensive national and local plans must be in place. The presence of both communication infrastructure and the knowledge of how to act upon the warnings ensures the successful transition from awareness to life-saving action. For instance, the project Strengthening Climate Information and Early Warning Systems in Sao Tome and Principe for Climate Resilient Development and Adaptation to Climate Change (GEF ID 5004) focused heavily on improving warning mechanisms, such as the development of meteorological and community alert systems. However, the project falls short of providing tangible support for early actions during disasters. While it successfully strengthens the capacity to issue timely warnings, the implementation lacks crucial elements like community drills, pre-positioning of emergency supplies, or establishing safe evacuation routes. As a result, despite the improved warning systems, the affected communities face challenges in effectively responding to disasters due to a lack of practical support for early actions.

69. One example of a project that successfully implemented early warning alerts is Integrating Community-based Adaptation into Afforestation and Reforestation Programs in Bangladesh (GEF ID 4700). The CIEWS component of this project focused on strengthening the

capacity of vulnerable communities in Bangladesh to cope with the increasing risks associated with climate change, particularly cyclones and associated storm surges. The project designed an EWS tailored to the local context. It included the installation of weather monitoring equipment, the establishment of communication channels with local communities, and the development of user-friendly alert messages. These alerts provided timely information on approaching cyclones and storm surges, enabling residents in the project area to take necessary precautions and evacuate to safer locations. The EWS not only delivered advance warnings but also conveyed specific information about the potential impacts of the impending cyclones and recommended actions to be taken. According to the 2020 Project Implementation Review, 5,800 Cyclone Preparedness Programme (CPP) community volunteers underwent comprehensive training. This training emphasizes the critical roles that CPPs play during disasters and educates volunteers in mitigating the impact of cyclones and storm surges. This activity was conducted in close collaboration with the Department of Disaster Management (DDM). Furthermore, the DDM has received support to develop an action plan to facilitate the identification and management of shelters and evacuation routes in the event of a disaster, enhancing the overall preparedness and resilience of the communities involved. This project is a remarkable example of how GEF-supported initiatives can strengthen the resilience of vulnerable communities by implementing effective early warning systems that translate into early actions.

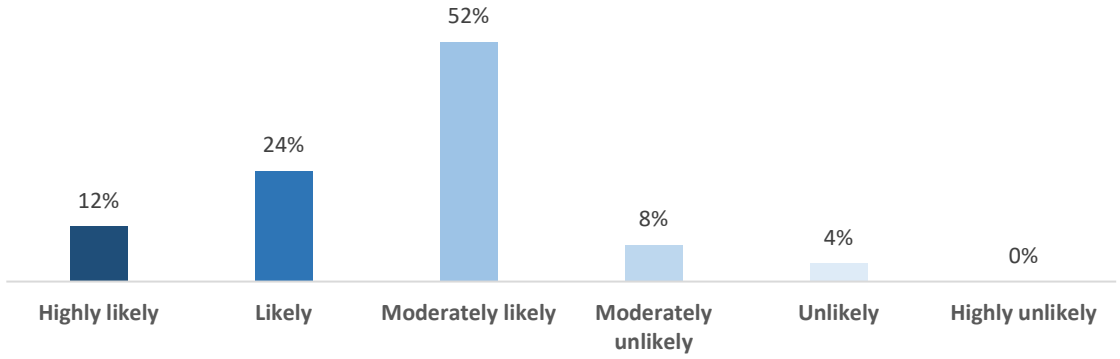
4.3 Sustainability

70. **Projects in the evaluation portfolio exhibited promising sustainability ratings, however the specific outcomes of CIEWS in the long term cannot be ensured.** Sustainability ratings estimate the extent to which a project's outcomes are likely to be durable, and the extent to which a project is likely to achieve its expected long-term impact. Of all CIEWS projects in the evaluation portfolio that have undergone a terminal evaluation, 88 percent received a rating within the likely range for project sustainability at completion (Figure 24). This compares to 68 percent of the projects in the overall evaluation portfolio. The difference can be attributed to several factors. A considerable number of CIEWS projects initially adopted an "infrastructure-based adaptation" approach, which included interventions related to risk management. The primary objective was to lay the foundation for subsequent dialogues regarding more specific CIEWS components. These projects started by addressing basic infrastructure needs as a initial step, progressively broadening their scope, and contemplating the integration of CIEWS components. This approach effectively demonstrated the crucial role of CIEWS interventions in averting losses from natural disasters, involving communities and empowering them to manage these tools for long-term project sustainability.

71. For stakeholders who still needed to fulfill their basic infrastructure needs, CIEWS interventions were often perceived as a subsequent stage of development, deemed feasible only once after addressing more urgent necessities. However, transformative experiences resulting from hazards that caused community shocks and significant damage heightened awareness and motivation for engagement with CIEWS interventions. The difficult situation faced by communities that historically have been affected by natural disasters was identified as a trigger that opened an exceptional window of opportunity for full commitment to CIEWS components. For instance, in Costa Rica, stakeholders in the Guanacaste and Alajuela cantons were deeply impacted by Hurricane Otto in 2017 and Storm Nate in 2018, and exhibited a

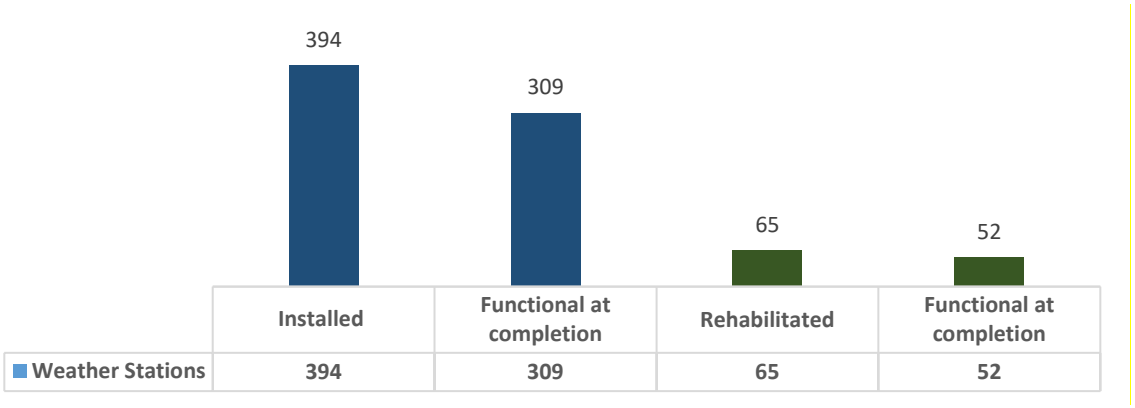
strong eagerness to participate in the development of tools, mechanisms, and procedures aimed at preventing more substantial losses during future natural events. The enthusiastic involvement of these stakeholders played a pivotal role in achieving success and ensuring the long-term sustainability of the ASADAS project (GEF ID 6945).

Figure 24: Sustainability ratings of CIEWS projects



72. **Some of the projects' main CIEWS outcomes showed issues related to operation and maintenance (O&M) at completion.** Several projects supported the installation of hydrometeorological stations and automated weather stations. As illustrated in Figure 25, the portfolio review analysis revealed the installation of approximately 394 weather stations and the rehabilitation or repair of 65 others. However, at project completion, only 309 of the weather stations were deemed functional (78 percent). This figure is similar for weather stations rehabilitated or repaired, as only 52 were functional out of a total of 65 whose rehabilitation was supported by CIEWS projects (80 percent). Notably, the project Strengthening Climate Information and Early Warning Systems in Malawi to Support Climate Resilient Development and Adaptation to Climate Change (GEF ID 4994) encountered significant challenges in this context. The terminal evaluation of the project highlighted critical issues stemming from a lack of funding for O&M, leading to obstacles to the utilization of weather stations. Challenges included a shortage of paper for mechanical recording of temperature and humidity, unpaid water bills resulting in water supply interruptions, and consequently, no water available to refill evaporation pans (limited to a few liters per day at most). Moreover, funding has not been available since September 2017 to reimburse personnel responsible for reading measurements of river water level ($10 per month per person). The proposed strategy during project design to boost revenue for covering O&M costs proved unsuccessful, and no commercial weather services were developed for sale. The outlook for financial sustainability was assessed as unlikely.

Figure 25: Status of weather stations installed and rehabilitated by CIEWS projects



73. **Despite the increasing importance of climate resilience and the critical role played by accurate and timely information in disaster risk reduction, private sector involvement in CIEWS projects remains constrained.** Several factors contribute to this limitation according to the information collected from interviews, case studies, and the portfolio review analysis. First, many stakeholders hold the perception that financing for climate information services should solely rely on public funds, with no consideration for contributions from the private sector. Second, the lack of a well-defined participation framework and incentive structures deter private sector involvement. Furthermore, in some cases, competition between governments and the private sector for the provision of climate information services overrides collaboration efforts. In Liberia, the project Strengthening Capabilities for Climate Information and Services to Enhance Climate-Resilient Development and Adaptation to Climate Change (GEF ID 4590) aimed to engage the private sector in developing fee-based meteorological and hydrological services while also establishing a framework for dialogue on both public and private financing to support the creation of climate information and early warning systems. Despite these objectives, no visible progress was achieved, resulting in an unsatisfactory rating for this specific outcome. Other efforts were made with more positive results in Cambodia, where the project Strengthening Climate Information and Early Warning Systems to Support Climate Resilient Development and Adaptation to Climate Change (GEF ID 5318) developed a feasibility study and an engagement strategy for the incorporation of the private sector in CIEWS activities. Despite facing limitations, the project achieved concrete results by creating partnerships with companies dedicated to allocating a portion of their Corporate Social Responsibility funds to improve environmental and climate change adaptation initiatives.

74. Another interesting example is the SMARTFARM project (GEF ID 10965), which stands out as a promising initiative focused on leveraging data and digital technology specifically designed for climate resilience. Currently in progress in Ethiopia and Rwanda, the project strategically devises engagement strategies to involve private sector stakeholders. The primary objective is to elevate the visibility of agricultural value chains, with the potential outcomes of risk mitigation and strengthening of these chains. The reinforced chains, in turn, are anticipated to attract increased investments from diverse entities such as agro-processing companies, input suppliers, financial institutions, telecom companies, and development agencies. This

collaborative effort involves extensive networks of smallholder farmers under the platform. To secure the economic sustainability of the platform, the project is exploring the adoption of a user subscription model. This model is reinforced by the provision of value-added services through innovative technology. The overarching goal is to establish a robust and self-sustaining ecosystem that brings benefits to both farmers and various stakeholders within the agricultural value chain. This approach reflects a forward-thinking strategy to create lasting positive impacts in the realm of climate-resilient farming practices with the support of the private sector.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

75. **GEF support for climate information and early warning systems demonstrated a strong alignment with the GEF Trust Fund and LDCF/SCCF strategies and remained highly relevant to the distinctive circumstances and challenges in various contexts.** In the early replenishment periods of the GEF-supported evaluation portfolio, projects emphasized an upstream approach, involving meteorological and climate monitoring stations, satellite observations, climate models, and data analysis techniques. However, recent projects have shifted towards a downstream approach, aiming to deliver practical and tailored information to individuals, communities, and organizations, facilitating effective climate change adaptation. This transition from a predominantly upstream focus to a more balanced approach is evident over time and across different regions. GEF projects were responsive to the demands of beneficiary countries and were driven by the recognition of the need for climate information and early warning systems. These needs were shaped by geography, climate-related hazards, and specific national requests. Additionally, there was a high alignment between GEF projects and the global distribution of climate-related hazards, particularly in Africa.

76. **In GEF projects, the components of CIEWS often lack a systematic and comprehensive integration into disaster risk management strategies.** While CIEWS are designed to provide vital information for disaster preparedness and response, their effectiveness is limited when they are not seamlessly integrated into broader disaster risk management strategies. This lack of integration can lead to a fragmented approach, where CIEWS components are provided in isolation, rather than forming part of a holistic disaster risk reduction framework. GEF projects often fell short of achieving a systematic integration of early warning systems into comprehensive disaster risk management and reduction programs, coupled with practical strategies for proactively mitigating the impact of climate-related disasters and reducing associated vulnerabilities. These initiatives should also contribute to broader social and economic development to strengthen local resilience to climate change. Addressing this deficiency by fostering a more cohesive integration of climate information and early warning systems into broader risk reduction frameworks could significantly enhance the overall impact and effectiveness of GEF projects in mitigating climate-related risks.

77. **GEF projects have faced challenges in effectively transitioning from their primary focus on supporting early warning systems to fully integrating early action measures within disaster events.** While GEF projects have improved the generation of climate information and early warnings, there is evidence indicating a lack of systematic knowledge transfer to communities for appropriate responses, especially for different types of climate-related disasters.

Furthermore, limited attention has been dedicated to fostering community-level risk awareness and building the capacity for appropriate responses among the population. The success of translating warnings into actions depends on, among other factors, comprehensive national and local plans, coupled with communication infrastructure and knowledge for effective response.

78. **While there have been improvements in project design in terms of their vertical logic, substantial opportunities remain for enhancing the projects' results framework and the learning process.** The evidence highlighted a significant lack of improvement in the quality of indicators used to track CIEWS interventions in GEF projects. Notably, good practices for CIEWS indicators as documented by the WMO encompass metrics such as the number of the population covered by early warnings per 100,000 inhabitants, the number of evacuees (corresponding to indicator G-6 of the Sendai Framework for Disaster Risk Reduction), the number of individuals provided shelter, and the quantification of avoided disaster losses, encompassing both human and economic losses. None of these examples of high-quality indicators was found to be utilized in GEF projects, as these mostly prioritized simplicity over effectively measuring their contributions to the long-term development of resilience and adaptive capacity.

79. **GEF projects performed strongly in terms of effectiveness, but the long-term sustainability of their outcomes remains uncertain.** Although GEF projects have encountered challenges, particularly in the realms of communication and preparedness activities, they have collectively achieved success in fulfilling objectives across various CIEWS domains, notably in facilitating warning services through infrastructure development and capacity building. Nevertheless, sustaining funding and resources for the main outcomes generated by GEF projects is not guaranteed in the long term since often the costs of operation and maintenance of CIEWS can be challenging, especially for LDCs. Additional factors identified as potential risks to the sustainability of GEF projects include the variation in government priorities, limited collaboration among agencies and countries, insufficient community involvement in system maintenance, and high turnover of technicians within government agencies. On a practical level, it is essential to conduct a comprehensive evaluation of financial and governance risks and integrate them into the exit strategy of GEF projects. This should involve a thorough assessment of annual operating, maintenance, and replacement costs for infrastructure assets, covering an initial period of five to seven years. This assessment can help identify any funding shortfalls and inform the development of a strategy to address them effectively.

80. **There are noteworthy successes of effectively incorporating CIEWS components into existing systems, leveraging technologies, and enhancing the results of other interventions.** State-of-the-art, technology-based projects and even standard solutions used in developed countries may not necessarily be the best nor the most affordable option for low-income countries. This is because they often entail escalating O&M expenses, which can place an added strain on public budgets. GEF projects consistently integrated and capitalized on pre-existing services and platforms. Through these synergies with established services, CIEWS interventions targeted the mitigation of gaps within the climate information value chain. This approach sought to broaden information accessibility and stimulated user adoption and application of climate information services. Moreover, GEF projects have shown a substantial catalytic

potential. They have established a robust foundation for continuing the impacts initiated by these projects, which often are being financed by the GCF and involve larger-scale interventions and greater financial resources, enhancing their transformative capacity.

81. **Notable progress has been made in the development of infrastructure and capacity building for CIEWS, although the critical "last mile" challenge persists.** While GEF projects have successfully enhanced forecasting capabilities, including strengthening the institutional capacity of the meteorological offices in LDCs in their ability to use CIEWS, there remains a need to transform this knowledge into actionable and accessible information. GEF projects have not consistently accounted for the challenges in project implementation at the "last mile" of service delivery, particularly in the distribution of climate information and warnings to local communities often marginalized by disaster risk reduction strategies. These communities require special consideration and focused attention to ensure that they are not inadvertently left behind.

5.2 Recommendations

82. **Recommendation 1. GEF projects should shift their focus from solely providing early warning information to fostering early actions during disaster events.** GEF projects ought to prioritize data usability and ensure that both national and local plans are in place. This involves establishing effective communication systems and providing the necessary knowledge of how to respond once the warning is issued. To overcome the “last mile” challenge, GEF projects must prioritize community engagement, capacity building, and the development of tailored communication strategies to address the specific needs and challenges of remote and vulnerable communities.

83. **Recommendation 2. The GEF Secretariat, STAP, and GEF Agencies should continue aligning indicators with established good practices.** It is advisable for GEF projects to adopt the most fitting indicators in line with WMO guidelines that are informed by international good practices, and lessons learned from past experiences. These indicators would effectively measure the success of CIEWS interventions, serve as a roadmap for future interventions and provide information to global results frameworks. Furthermore, for effective monitoring, it is suggested to set minimum standards for measuring and tracking CIEWS components at the project level. In alignment with the ongoing efforts to streamline and simplify the GEF results framework, this approach emphasizes repurposing existing indicators at the project level rather than introducing new ones. The overarching goal is to enhance the quality of measurement and tracking of the application of CIEWS components, ensuring that interventions are well-informed and impactful.

84. **Recommendation 3. The GEF Secretariat and GEF Agencies should continue to explore strategies to enhance the financial sustainability of CIEWS components.** The significant costs associated with the operation and maintenance of CIEWS initiatives require a tailored approach to secure long-term financing to enable their continued success beyond the project's completion. Recognizing the complexities of engaging the private sector and acknowledging their potential role, particularly in LDCs, GEF projects are encouraged to support creating an enabling environment for the private sector in developing innovative adaptation solutions derived from CIEWS. This is especially important considering the multiple applications and

increasing advantages that CIEWS offers to several sectors, including transportation, agriculture, tourism, finance, and insurance.

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ANNEXES

Annex I: Evaluation matrix

Key question	Indicators/measures	Source of information	Methodology
1. How do GEF-administered trust funds support CIEWS?			
1a. What types of disaster events are being targeted and what types of activities associated with CIEWS are funded by LDCF, SCCF, and the GEF TF to support CIEWS?	# of projects supporting: Risk knowledge Monitoring and warning service Dissemination and communication Response capability	Project proposals and performance documents	Project portfolio review
1b. Are LDCF, SCCF, and GEF TF projects addressing the most relevant aspects of CIEWS?	Alignment of project design with international best practices	Academic literature and practice-based studies, project proposals and performance documents, GEF Agencies, country stakeholders	Best practices summary, project portfolio review, interviews, case studies
1c. What proportion of the project deals with climate information and early warning in GEF projects?	Project funding allocated to CIEWS	Project proposals and terminal evaluations	Project portfolio review
1d. Are LDCF, SCCF, and GEF TF projects integrating or leveraging other services and warning system platforms?	Evidence of integration, replication or scaling up	Project proposals, PIRs, terminal evaluations, GEF Secretariat, GEF Agencies, country stakeholders	Project portfolio review, interviews, case studies

2. How effective are the GEF supported CIEWS interventions financed by the GEF?			
2a. How have CIEWS interventions performed based on performance documentation?	Development outcome and progress implementation ratings for CIEWS interventions	Project terminal evaluations, midterms reviews, PIRs	Project portfolio review, case studies
2b. How effective have CIEWS interventions been when tested with disaster events?	Aggregated results from completed projects and projects under implementation with performance information available	Project terminal evaluations, midterms reviews, PIRs	Project portfolio review
2c. How have CIEWS interventions considered gender and inclusivity?	Type/extent of gender analyses, actions or results delivered through CIEWS projects	Project proposals, performance documents and terminal evaluations, GEF Secretariat, GEF Agencies, country partners	Project portfolio review, interviews, case studies
3. What is the added value of the GEF support in CIEWS interventions?			
3a. What innovations, approaches or new technologies are being piloted or supported within LDCF, SCCF, and the GEF TF projects?	# of projects supporting innovations, approaches or new technologies	Project proposals, PIRs, terminal evaluations, GEF Secretariat, GEF Agencies, country stakeholders	Project portfolio review, interviews, case studies
3b. What indicators are being used to track the effectiveness of CIEWS	List of indicators, evidence of outcomes	Project proposals, PIRs, terminal evaluations, GEF Secretariat, GEF Agencies, country stakeholders	Project portfolio review, interviews, case studies

outcomes, and how successful are the outcomes?			
3c. What are the risks to sustainability of CIEWS outcomes?	Aggregate ratings of likely sustainability of outcomes, perception of stakeholders	Project terminal evaluations, country stakeholders	Project portfolio review, interviews, case studies
4. What are the lessons learned specific to the design and implementation of CIEWS projects supported by GEF-administered trust funds?			
4. What are the lessons learned specific to the design and implementation of LDCF, SCCF and GEF TF EWS projects?	Lessons learned as recorded in performance documentation	Project terminal evaluations, midterms reviews, PIRs, GEF Secretariat, GEF Agencies, country stakeholders	Project portfolio review, interviews, case studies

Annex II: Portfolio review protocol

Portfolio Review_Protocol.pdf

(Link available on the IEO website)

Annex III: Case study project selection

Case study projects were carefully selected based on a set of objectives and country-specific characteristics, including: (i) diversity of GEF funds; (ii) representation from various Agencies; (iii) consideration of diverse country conditions; and (iv) different stages of development and implementation of Comprehensive Early Warning Systems (CIEWS).

Specifically, the chosen projects are as follows:

1. Strengthen the weather, climate, and hydrological monitoring capabilities, early warning systems, and available information for responding to extreme weather and planning adaptation to climate change in Tanzania (GEF ID 4991, UNDP, LDCF, Completed).

2. Pacific Resilience Program (GEF ID 5814, World Bank, SCCF, Tonga, Regional, Under Implementation).

3. Strengthening Capacities of Rural Aqueduct Associations (ASADAS) to address climate change risks in water-stressed communities of Northern Costa Rica (GEF ID 6945, UNDP, SCCF, Completed).

4. Strengthening transboundary cooperation and integrated natural resources management in the Songwe River Basin (GEF ID 9420, AfDB, GEF TF, Regional Malawi & Tanzania, Under Implementation).

The case studies drew evidence from three primary sources: desk reviews, portfolio inputs, field visits and interviews with key stakeholders. The desk review provided a summary of project characteristics and outcomes, government priorities, GEF's approach, and relevant documentation at the project level. Portfolio inputs, generated through portfolio review, offered insights into operational relevance and effectiveness. Interviews were conducted during missions and involved both directly and indirectly engaged stakeholders, including beneficiaries. The evaluation team utilized a standardized template and methodology connected to the evaluation questions. Evaluators were tasked with ensuring the defensibility of causal inferences drawn from the cases studied. This involved employing precisely specified causal theories, giving careful consideration to alternative explanations, and assessing the trustworthiness and probative value of the evidence supporting causal inferences in the examined cases. Subsequently, the evaluative evidence was compiled and integrated to establish a foundation for further generalization.

Annex IV: CIEWS portfolio

GEF ID	GEF Project Name	Country/Countries	GEF Replenishment period	Lead Agency	Region	Funding
2553	Piloting Climate Change Adaptation to Protect Human Health	Barbados, Bhutan, China, Fiji, Jordan, Kenya, Uzbekistan	GEF-3	UNDP	Global	SCCF
2630	Lake Balaton Integrated Vulnerability Assessment, early warning and adaptation strategies	Hungary	GEF-3	UNDP	Europe and Central Asia	GET
3249	Adaptation to Climate Change in Arid and Semi-Arid Lands	Kenya	GEF-3	World Bank	Africa	SCCF
3704	Integrated Adaptation Programme to Combat the adverse Effects of Climate Change on Agricultural Production and Food Security in Benin	Benin	GEF-4	UNDP	Africa	LDCF
3728	Strengthening of the Gambia's Climate Change Early Warning Systems	Gambia	GEF-4	UNEP	Africa	LDCF
3838	Reducing Vulnerability to Climate Change by Establishing Early Warning and Disaster Preparedness Systems and Support for Integrated Watershed Management in flood prone areas	Rwanda	GEF-4	UNEP	Africa	LDCF
3841	Build Lesotho's capacity for monitoring and predicting climate change impacts, delivering early warning for extreme events and local and national planning for adaptation to climate change.	Lesotho	GEF-4	UNEP	Africa	LDCF
4018	São Tomé and Príncipe: Adaptation to Climate Change	São Tomé and Príncipe	GEF-4	World Bank	Africa	LDCF
4469	Integrated approach to management of forests in Turkey, with demonstration in high conservation value forests in the Mediterranean region	Turkey	GEF-5	UNDP	Europe and Central Asia	GET
4700	Integrating Community-based Adaptation into Afforestation and Reforestation Programmes in Bangladesh	Bangladesh	GEF-4	UNDP	Asia	LDCF
4709	GGW: Integrated Disaster and Land Management (IDLM) Project	Togo	GEF-5	World Bank	Africa	MTF
4950	Strengthening Liberia's capability to provide climate information and services to enhance climate resilient development and adaptation to climate change	Liberia	GEF-5	UNDP	Africa	LDCF
4958	Climate risk finance for sustainable and climate resilient rain-fed farming and pastoral systems – Sudan	Sudan	GEF-5	UNDP	Africa	LDCF
4991	Strengthening climate information and early warning systems in Tanzania for climate resilient development and adaptation to climate change	Tanzania	GEF-5	UNDP	Africa	LDCF
4992	Strengthening climate information and early warning systems in Africa for climate resilient development and adaptation to climate change – Ethiopia	Ethiopia	GEF-5	UNDP	Africa	LDCF
4993	Strengthening climate information and early warning systems in Africa for climate resilient development and adaptation to climate change	Uganda	GEF-5	UNDP	Africa	LDCF
4994	Strengthening climate information and early warning systems in Africa for climate resilient development and adaptation to climate change – Malawi	Malawi	GEF-5	UNDP	Africa	LDCF

4995	Strengthening climate information and early warning systems in Eastern and Southern Africa for climate resilient development and adaptation to climate change – Zambia	Zambia	GEF-5	UNDP	Africa	LDCF
5002	Strengthening climate information and early warning systems in Western and Central Africa for climate resilient development and adaptation to climate change	Benin	GEF-5	UNDP	Africa	LDCF
5003	Strengthening climate information and early warning systems in Africa for climate resilient development and adaptation to climate change – Burkina Faso	Burkina Faso	GEF-5	UNDP	Africa	LDCF
5004	Strengthening climate information and early warning systems in São Tomé and Principe for climate resilient development and adaptation to climate change.	São Tomé and Principe	GEF-5	UNDP	Africa	LDCF
5006	Strengthening climate information and early warning systems in Africa for climate resilient development and adaptation to climate change	Sierra Leone	GEF-5	UNDP	Africa	LDCF
5049	Adaptation to Climate Change in Vanuatu	Vanuatu	GEF-5	UNDP	Asia	LDCF
5071	Strengthening climate services and early warning systems in the Gambia for climate resilient development and adaptation to climate change	Gambia	GEF-5	UNEP	Africa	LDCF
5111	Reducing vulnerability and increasing adaptive capacity to respond to impacts of climate change and variability for sustainable livelihoods in agriculture sector in Nepal	Nepal	GEF-5	FAO	Asia	LDCF
5318	Strengthening climate information and early warning systems in Cambodia to support climate resilient development and adaptation to climate change	Cambodia	GEF-5	UNDP	Asia	LDCF
5328	Building Climate Change Resilience in the Fisheries Sector in Malawi	Malawi	GEF-5	FAO	Africa	LDCF
5451	Strengthening Hydro-Meteorological and Climate Services	Democratic Republic of Congo	GEF 5	World Bank	Africa	LDCF
5581	Community Resilience to Climate and Disaster Risk in Solomon Islands Project	Solomon Islands	GEF-5	World Bank	Asia	LDCF
5604	Technology transfer for climate resilient flood management in Vrbas River Basin	Bosnia and Herzegovina	GEF-5	UNDP	Europe and Central Asia	SCCF
5667	Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project	St Vincent and the Grenadines, Grenada, Dominica, St Lucia, Trinidad and Tobago, Antigua and Barbuda	GEF-5	FAO	Latin America and Caribbean	SCCF
5723	West Balkans Drina River Basin Management Project	Bosnia-Herzegovina, Serbia, Montenegro	GEF-5	World Bank	Europe and Central Asia	SCCF
5814	Pacific Resilience Program	Pacific Islands (regional), Tonga	GEF-5	World Bank	Asia	SCCF
5855	Flood hazard and climate risk management to secure lives and assets in Mali	Republic of Mali	GEF-5	UNDP	Africa	LDCF
5902	Adapting to climate change induced coastal risks in Sierra Leone	Sierra Leone	GEF-5	UNDP	Africa	LDCF

6926	Strengthening climate services in Lesotho for climate resilient development and adaptation to climate change	Lesotho	GEF-6	UNEP	Africa	LDCF
6945	Strengthening Capacities of Rural Aqueduct Associations' (ASADAS) to address climate change risks in water stressed communities of Northern Costa Rica	Costa Rica	GEF-6	UNDP	Latin America and Caribbean	SCCF
6968	Chad National Adaptation Plan	Chad	GEF-6	UNDP	Africa	LDCF
6984	Building Resilience of Health Systems in Asian LDCs to Climate Change	Bangladesh, Cambodia, Lao PDR, Myanmar, Nepal, Timor-Leste	GEF-6	UNDP	Asia	LDCF
8001	Community-based Climate Risks Management in Chad	Chad	GEF-6	UNDP	Africa	LDCF
8014	Climate Change Adaptation for Sustainable Rural Water Supply in Lowlands Lesotho	Lesotho	GEF-6	AfDB	Africa	LDCF
8018	Building Resilience of Health Systems in Pacific Island LDCs to Climate Change	Kiribati, Solomon Islands, Tuvalu, Vanuatu	GEF-6	UNDP	Asia	LDCF
8023	Strengthening Climate Information and Early Warning Systems for Climate Resilient Development and Adaptation to Climate Change in Guinea	Guinea	GEF-6	UNDP	Africa	LDCF
9194	Strengthening Adaptive Capacities to Climate Change through Capacity Building for small scale Enterprises and Communities Dependent on Coastal Fisheries	Gambia	GEF-6	UNIDO	Africa	LDCF
9303	Climate Change Adaptation in the Lowland Ecosystems	Ethiopia	GEF-6	UNDP	Africa	LDCF
9364	São Tomé and Príncipe Additional Financing - West Africa Coastal Area Resilience Investment Project	Sao Tome and Principe	GEF-6	World Bank	Africa	LDCF
9420	Strengthening transboundary cooperation and integrated natural resources management in the Songwe River Basin	Tanzania/Malawi	GEF-6	AfDB	Africa	GET
10089	Building Climate Change Resilience in the Fisheries Sector	Malawi	GEF-7	AfDB	Africa	LDCF
10105	Strengthening climate information and early warning systems for climate resilient development and adaptation to climate change in Guinea-Bissau	Republic of Guinea-Bissau	GEF-7	UNDP	Africa	LDCF
10160	Increased resilience and adaptive capacity of the most vulnerable communities to climate change	Guinea	GEF-7	UNDP	Africa	LDCF
10203	Strengthening the Adaptive Capacity and Resilience of Communities in Uganda's watersheds	Uganda	GEF-7	AfDB	Africa	LDCF
10376	Enhancing the resilience of vulnerable coastal communities in Sinoe County of Liberia	Liberia	GEF-7	UNDP	Africa	LDCF
10411	Malawi-climate resilient and sustainable capture fisheries, aquaculture development and watershed management	Malawi	GEF-7	AfDB	Africa	LDCF
10415	Adaptation to Climate Change in Vanuatu – Phase II	Vanuatu	GEF-7	UNDP	Asia	MTF
10965	SMARTFARM - A data and digital technology driven and farm management solution for climate resilience.	Ethiopia and Rwanda	GEF-7	IFAD	Africa	LDCF
4976	Addressing the Risk of Climate-induced Disasters through Enhanced National and Local Capacity for Effective Actions	Bhutan	GEF-5	UNDP	Asia	LDCF

Note: Project GEF ID 4976 has been featured in the report to duly acknowledge its significant contributions. However, it was not factored into the portfolio review analysis. This decision of the evaluation team was guided by the observation that, although the CIEWS component was acknowledged as relevant during the design phase, its priority level diminished in the subsequent implementation stage in comparison to other projects within the portfolio.

Annex V: GEF support in relation to other donors

The funding allocated for disaster risk management initiatives, particularly those involving early warning and rapid response systems, has seen a steady increase over the years. In the period from 2013-2014, it stood at $1.9 billion, rising to $2.9 billion in 2015-2016, and has now reached an annual average of $6.6 billion (WMO 2020). Despite this upward trend, when viewed in the context of the total annual adaptation finance and overall adaptation needs, these figures still represent a relatively small portion of the resources available.

The tracking of investments intended to enhance risk information and improve meteorological and hydrological early warning systems remains somewhat lacking in granularity, making it challenging to make a precise assessment of the required financing for hydro-met systems and their specific components that warrant attention. Nonetheless, there is emerging data that provides valuable insights into the levels and directions of funding in this domain. Some of them include the World Bank, the Adaptation Fund, the Climate Investment Funds (CIF), the Green Climate Fund (GCF), the United Nations Development Program (UNDP), the World Meteorological Organization (WMO), among others.

Within the World Bank, in 2015 was announced the Climate Risk and Early Warning Systems (CREWS) Initiative. The Initiative aimed to strengthen Multi-Hazards Early Warning Systems in Least Developed Countries and Small Island Developing States. CREWS projects are implemented by the World Bank (WB), World Meteorological Organization (WMO) and United Nations Office for disaster Risk Reduction (UNISDR), through a Special Program managed by the World Bank's Global Facility for Disaster reduction and Recovery (GFDRR). Since its inception, $88 million had been allocated to cover all costs related to country, regional and global projects. Most CREWS projects are in Africa. According to the 2022 CREWS Annual Report, sand and dust warnings issued in Burkina Faso since 2018 have proved helpful for health, agriculture, and transportation. New partnerships will extend such warnings to six other Sahelian countries a daily weather service to better protect the lives and livelihoods of 107 million people. Additionally, fifteen countries in Central and West Africa have improved its access to standardized early warning information through improved cellphone technology and alerting practices. Besides the CREWS initiative, by 2020, World Bank funding that supports hydro-met components amounts to $1.1 billion spread across more than 60 projects. The hydro-met investments have increased as compared to 2019 (from $944 million to $1.1 billion). Asia ($453 million) and Africa ($353 million) dominate the portfolio with the highest share of the total funds, followed by South-West Pacific with a total of $100 million, and Europe with $83 million.

The Adaptation Fund portfolio consists of a total of $745 million going into 107 projects for adaptation across various sectors as of June 2020. Of that total, 102 projects for US$ 580 million have hydro-met components. Those projects are geographically distributed as follows: $225 million in Africa, $99 million in South America, $101.5 million in Asia, $26 million in Eastern Europe, and $129 million in the Pacific, Central America and the Caribbean. The total invested in hydro-met components is $46 million, of which $20 million is directed to Africa, US$ 8 million to South America, $7 million to Asia, $5 million to Europe, and $3 million to the Pacific, Central America and the Caribbean. From the total portfolio, $17 million is financing the disaster reduction and recovery sector, of which $6 million is channeled to Africa. The Adaptation Fund

has channeled $65 million towards climate information services. This financial backing is geared towards establishing infrastructure for climate information services and enhancing the capabilities of crucial government institutions and other stakeholders.

Meanwhile, the Climate Investment Funds (CIF) have allocated $220 million from their $1.2 billion climate-resilience budget to fortify hydrometeorology and climate services in select nations. This investment spans the entire spectrum of weather and climate information services, encompassing aspects such as data collection and monitoring, data management, research, forecasting, modeling, and the development of improved services. Additionally, it emphasizes the critical component of training and capacity building.

At COP26 in November 2021, The GCF announced that they had become the world's largest financier of climate information services and early warning systems. The GCF stated that $1.2 billion of GCF's approved budget has been allocated to CIEWS, including approved and pipeline operations, which represents 40 projects and 12 percent of its total funding historical portfolio. CIEWS projects funded by the GCF focused on expanding the hydrometeorological observation network and modeling capacities to secure reliable information on climate-induced hazards, vulnerability, and risks. Asia Pacific and Africa dominate the portfolio with a combined share of 85 percent of the total resources. Latin America & Caribbean and Eastern Europe represent 11 percent and 4 percent respectively.

The UNDP, which is also a GEF Agency, has been leading recent initiatives related to CIEWS. In December 2018, the Systematic Observations Financing Facility (SOFF) was created. UNDP administers and operates SOFF to facilitate investments and projects related to systematic observations and data collection, which are essential for addressing climate change, enhancing climate resilience, and improving early warning systems. SOFF has a comprehensive approach, providing observations that are to be considered an essential global public good. By July 2023, SOFF has supported 40 initiatives all over the world with an average amount of $100,000 per initiative.