



Full length article

Multilateral funding for health adaptation and the health co-benefits of climate mitigation: An observational study

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ABSTRACT

Background: The health impacts of climate change have been increasingly recognised for the past years. However, it remains unclear how this has translated into funding for health adaptation and health co-benefits of climate mitigation.

Methods: We analysed the projects funded by the Green Climate Fund (GCF) between 2021 and 2023 and the Adaptation Fund between 2019 and 2024 to estimate the amount of funding provided for health adaptation and the health co-benefits of climate mitigation. Based on the Notre Dame Global Adaptation Index (ND-GAIN), we estimated adaptation vulnerability and readiness for each country and investigated the association between this index and the total adaptation funding received by each country.

Findings: Between 2021 and 2023, 85 projects were funded by the GCF, of which 37 were adaptation, 32 cross-cutting, and 16 mitigation projects. The funds provided by the GCF contributed US\$764 million to health adaptation (US\$178 million in 2021 to US\$422 million in 2023). There was no association between the amount of funding provided by the GCF towards adaptation and the estimated vulnerability, resilience, and combined adaptation index (ND-GAIN) at country level. Among the 48 mitigation and cross-cutting projects, 15 did not mention health, 13 mislabelled health co-benefits, 11 identified specific health co-benefits, and 9 correctly identified and measured health co-benefits as outcomes. The main health co-benefits were reduction in the health impact of air pollution, improved nutrition, and reduction in traffic casualties. There were 15 active projects on the Adaptation Fund website, amounting to a total of US\$51,944,915. Seven of the projects mentioned health benefits but only one explicitly measured health adaptation indicators as outcomes.

Interpretation: Funding for health adaptation and health co-benefits of mitigation provided by the two main multilateral adaptation funds has been increasing over the recent years. However, it remains insufficient and does not seem to be targeting the countries facing the greatest impacts of climate change.

1. Introduction

Climate change has myriad impacts on population health and has hence been considered the biggest threat to our health in the twentieth century by the World Health Organization. On one hand, climate change is leading to more extreme and frequent disasters and weather events, such as storms, floods, droughts, and wildfires (Stott, 2016). These have direct and indirect health consequences, by increasing the risk of deaths, noncommunicable diseases, the emergence and spread of infectious diseases, and health emergencies (Ballester et al., 2023; Mora et al., 2022; Adger et al., 2022). On the other hand, climate change has protracted yet detrimental consequences on the ecosystems on which our

lives depend, which ultimately threaten our health, for instance by reducing the yields or nutritional quality of staple crops (Smith and Myers, 2018; Cheung et al., 2023). In addition, climate change also has a negative impact on the health workforce and infrastructure, thus undermining the efforts to achieve universal health coverage (Braithwaite et al., 2024).

Climate change has a profoundly unequal impact on populations and exacerbates existing health inequalities within and between countries (Smith et al., 2022; Green and Healy, 2022). The population groups who experience the most severe consequences of climate change are those living in deprived conditions or who have increased vulnerability to extreme weather events due to health or environmental factors. These

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include, among others, women, children, older adults, people with disabilities or long-term conditions, those experiencing homelessness, poverty, or food insecurity (Ngcamu, 2023; Xi et al., 2024). Besides widening health inequalities within countries, climate change exacerbates health inequalities at global level, due to its disproportionate impact on low- and middle-income countries. This results in climate injustice as the populations who experience the most severe impacts of climate change are those who have contributed the least to greenhouse gas emissions and have the lowest ability to adapt (Rouf and Wainwright, 2020).

At the same time, the policies and actions necessary to mitigate climate change present a unique opportunity to improve population health by addressing many of the environmental determinants of ill-health (Haines, 2017). The health co-benefits of climate change mitigation result from the transition to sustainable lifestyles (e.g., plant-based diets, active travel) and non-fossil energy sources, which reduce exposure to air pollution (Reynolds et al., 2024). Besides the benefits for physical health in terms of increasing physical activity and promoting healthy diets with increased consumption of fruit and vegetables, increasing green and blue spaces, especially in urban environments where they reduce the urban heat island, translates into mental health benefits (Barton and Rogerson, 2017; Hemler and Hu, 2019). Therefore, investment in climate change mitigation entails investment in health improvement.

The impact of climate change on health, and the potential to address existing health challenges through climate change mitigation measures, have been increasingly recognised by populations, non-governmental organisations and, critically, by policy makers at national and international level (Planetary and Health, 2024). This increasing recognition is also indicated in the agenda of the annual meetings of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC), which in 2023, for the first time, featured a “Health day” (Vyas et al., 2024). Reducing the impact of climate change on health, i.e., climate change adaptation, and harnessing the potential health co-benefits of climate change mitigation, requires adequate funding from both public (states and international organisations) and private sources. Yet, it is unclear whether this increasing global attention translates into increased financial flows for health-related climate

mitigation and adaptation projects, and whether such projects are targeted to where they can make the greatest impact.

This study seeks to understand whether the increasing recognition of the health impacts of climate change has been matched by a comparable increase in climate funding for health. First, it investigates the level and proportion of multilateral climate finance flowing to health adaptation projects or to mitigation projects with health co-benefits among projects supported by the Green Climate Fund and the Adaptation Fund—the two largest multilateral public finance funds dedicated to climate change (see Box 1). Second, it analyses whether health-related adaptation projects are targeted to countries in which they can have the greatest adaptation impact and reduce global inequity.

2. Methods

2.1. Data collection and extraction

2.1.1. Global climate fund

We included the adaptation, mitigation and cross-cutting projects funded by the GCF between 2021 and 2023. This period was chosen as prior to 2020 data on the amount of funding allocated to health adaptation specifically was not available. First, we downloaded a spreadsheet from the GCF Data Library with detailed information about all the projects funded by the GCF, which included the amount of funding contributed by the GCF and beneficiaries, the country and continent where the project was based, and the theme and size of the project. This information was complemented by extraction of data from the funded Project Approval Documents, which were downloaded from the GCF website (<https://www.greenclimate.fund/>).

For adaptation projects, we extracted the proportion of total and GCF funding allocated to health, as this was specified in the Project Approval Document (percentage of Financing for Adaptation Elements of the Project and the percentage of Finance for ‘Health, Food, and Water Security’ Elements of the Project, outlined in section A.4 Result Area(s)).

For mitigation projects, we extracted information about health co-benefits as reported in section D3. We classified projects according to whether health co-benefits were present, correctly identified and measured as outcomes, according to the following classification scheme:

Box 1

. The Green Climate Fund and the Adaptation Fund.

The two main sources of multilateral public finance are the Green Climate Fund (GCF) and the Adaptation Fund. The GCF, established by the Paris Agreement, is the world’s largest climate fund. It aims to support low- and middle-income countries achieving their Nationally Determined Contributions (NDCs) and to build climate resilience in multiple systems, including health. It invests across four transitions – built environment; energy and industry; human security, livelihoods and wellbeing; and land-use, forests and ecosystems. Although health is included in the human security, livelihoods and wellbeing transition, projects related to other fields can also have health co-benefits.

A core GCF principle is to follow a country-driven approach, which means that developing countries lead GCF programming and implementation. Country ownership of GCF financing decisions enables developing countries to turn NDC ambitions into climate action. GCF operates through a network of over 200 Accredited Entities and delivery partners who work directly with developing countries for project design and implementation. These partners include international and national commercial banks, multilateral, regional and national development finance institutions, equity funds institutions, United Nations agencies, and civil society organizations. GCF provided financial support through a flexible combination of grant, concessional debt, guarantees or equity instruments to leverage blended finance and crowd-in private investment for climate action in developing countries. GCF is mandated to invest 50 % of its resources to mitigation and 50 % to adaptation in grant equivalent. At least half of its adaptation resources must be invested in the most climate vulnerable countries. Further details on the GCF are provided on its website (<https://www.greenclimate.fund/>).

The Adaptation Fund was established in 2001, under the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC), to finance adaptation projects and programmes that help vulnerable communities in developing countries adapt to climate change. Since 2010, the Adaptation Fund has committed over USD\$1 billion for climate change adaptation and resilience projects and programmes, including 160 concrete, localized projects in the most vulnerable communities of developing countries around the world with over 43 million total beneficiaries. The Fund is financed largely by governments and private donors as well as a two percent share of proceeds of Certified Emission Reductions (CERs) issued under the Protocol’s Clean Development Mechanism projects. Further details on the Adaptation Fund are available on its website (<https://www.adaptation-fund.org>).

(1) absent – no health co-benefits, (2) mislabelled – health co-benefits mentioned but mislabelled or not correctly articulated, (3) identified – health co-benefits directly identified but not measured as outcomes, (4) core – health co-benefits identified, correctly labelled, and measured as outcomes. For cross-cutting projects, we combined the strategies employed for adaptation and mitigation projects.

Data extraction and classification were undertaken in duplicate by two reviewers (ACPG and LJ) with disagreements resolved by consensus.

2.1.2. Adaptation fund

We extracted the project documents under the section of “Projects to Date” on the Adaptation Fund website (<https://www.adaptation-fund.org>). Each project document was searched for the word “health” to explore whether health adaptation was included in the project. If health was mentioned in the project document, information about the scope and measurement of health indicators was extracted. In addition, the fields “health”, “public health”, and “population health” were consulted for each project to investigate whether projects had considered health adaptation as a public health impact.

2.1.3. Climate adaptation

We used the Notre Dame Global Adaptation Initiative (ND-GAIN) Country Index to assess climate adaptation worldwide. The ND-GAIN Country Index is composed of two dimensions of adaptation: vulnerability and readiness. Vulnerability reflects the exposure, sensitivity, and capacity of each country to adapt to the negative effects of climate change. The index considers overall vulnerability across six life-supporting sectors: food, water, health, ecosystem service, human habitat, and infrastructure. Readiness reflects the ability of each country to leverage investments and convert them into adaptation actions. The index considers overall readiness across three components: economic readiness, governance readiness, and social readiness. Both vulnerability and readiness vary between zero and one, but whilst lower is better for vulnerability, higher is better for readiness. Thirty-six indicators are used to assess vulnerability, and nine indicators measure aspects of readiness. The overall ND-GAIN Score is calculated as the average of the vulnerability and readiness scores for each country and varies between zero and one (higher means greater adaptation). A detailed explanation of each indicator and respective data sources is available elsewhere (Notre Dame University, 2023).

2.2. Data analysis

For each GCF project, we calculated the total amount of financing for adaptation by multiplying the “Percentage of Financing for Adaptation Elements” by the “Total GCF Financing Approved”. We calculated the total amount of financing for health by multiplying the “Percentage of Financing for Increased Resilience of Health and well-being, and food and water security” by the “Total GCF Financing Approved”.

Scatterplots were used to display the association between the total funding provided by the GCF for adaptation and the ND-GAIN index, with loess (i.e., local polynomial regression) curves fitted to explore the inherent assumption of linearity. All analyses were carried out using R version 4.3.0.

3. Results

3.1. Green climate fund

3.1.1. Overview

Between 2021 and 2023, a total of 85 projects were funded by the GCF, of which 37 were adaptation, 32 cross-cutting, and 16 mitigation projects (Table 1). Most projects were for public sector (62 out of 85). Most projects were in Africa (28) and Asia Pacific (28). Africa had the highest number of cross-cutting projects (13) followed by Latin America and Caribbean (8), whilst Asia-Pacific had the highest number of adaptation projects (17). In total, 85 countries received GCF funding. Indonesia, Kenya, and Rwanda had the highest number of projects (9), whilst 24 countries had one project (Table S1). Overall, funded projects were estimated to avoid 1,780 million tonnes of carbon emissions, with cross-cutting projects contributing with 1,017 million tonnes and mitigation projects with 762 million tonnes.

Funding.

The total value of all projects was US\$2,923 million, with US\$1,235 million accounted for by mitigation projects, US\$1,136 million by cross-cutting projects, and US\$551 million by adaptation projects. The GCF provided US\$641million, with co-financing by beneficiaries contributing with US\$2,282 million.

Of the funding provided by the GCF between 2021 and 2023, US \$254 million were grants, US\$244 million were loans, US\$116 million were equities, and US\$28 million were financing guarantees. The funds

Table 1
Projects funded by the Green Climate Fund between 2021 and 2023.

Funding	Adaptation (N = 37)	Cross-cutting (N = 32)	Mitigation (N = 16)	Overall (N = 85)
Project value, USUS\$ (%)	5,514,656,380 (18.9)	11,365,249,736 (38.9)	12,351,930,529 (42.3)	29,231,836,645
GCF, USUS\$ (%)	1,809,823,410 (28.2)	2,764,111,300 (43.1)	1,839,649,883 (28.7)	6,413,584,593
Co-financing, USUS\$ (%)	3,704,832,970 (16.2)	8,601,138,436 (37.7)	10,512,280,646 (46.1)	22,818,252,052
Adaptation funding, USUS\$ (%)	1,089,700,610 (48.2)	1,169,633,316 (51.8)	0	2,259,333,926
Health adaptation funding, USUS\$ (%)	305,183,447 (51.9)	282,713,264 (48.1)	0	587,896,711
Type of GCF financing, USUS\$ (%)				
Loan	395,000,000 (15.6)	1,167,544,191 (46.0)	974,795,450 (38.4)	2,537,339,641
Guarantee	40,000,000 (14.2)	13,000,000 (4.6)	229,000,000 (81.2)	282,000,000
Grant	909,823,410 (37.3)	1,225,067,109 (50.2)	303,354,433 (12.4)	2,438,244,952
Equity	465,000,000 (40.2)	358,500,000 (31.0)	332,500,000 (28.8)	1,156,000,000
Tonnes of emissions avoided, m (%)	NA	1,017 (57.1)	762 (42.8)	1,780
Region, N (%)				
Africa	12 (42.9)	13 (46.4)	3 (10.7)	28
Africa; Asia-Pacific	0	1 (50)	1 (50)	2
Asia-Pacific	17 (60.7)	4 (14.3)	7 (25)	28
Eastern Europe	1 (100)	0	0	1
Eastern Europe; LAC; Africa; Asia-Pacific	0	2 (100)	0	2
LAC	5 (29.4)	8 (47.1)	4 (23.5)	17
LAC; Africa	1 (50)	0	1 (50)	2
LAC; Africa; Asia-Pacific	1 (20)	4 (80)	0	5

GCF, Green Climate Fund; LAC, Latin America and Caribbean.

allocated by the GCF contributed US\$3.3 billion towards adaptation, of which US\$764 million were for health adaptation. Adaptation projects accounted for US\$1.7 billion, with US\$446 million specifically for health adaptation. Cross-cutting projects accounted for US\$1.6 billion of the total funds committed to adaptation with US\$318 million targeted to health adaptation. There was an increase in the funding provided by the GCF to adaptation from US\$1 million in 2021 to US\$1.56 billion in 2023 (Fig. 1). There was also an increase in funding for health adaptation from US\$178 million in 2021 to US\$422 million in 2023.

Of the co-funding provided by beneficiaries, US\$6.4 billion contributed to adaptation and US\$1.6 billion to health adaptation. More funding towards adaptation and health adaptation accrued from cross-cutting than adaptation projects (US\$3.7 billion versus US\$2.7 billion for adaptation and US\$840 million versus US\$808 million for health adaptation, respectively). The co-funding for adaptation provided by beneficiaries increased from US\$1.3 billion in 2021 to US\$5.0 billion in 2023, with funding for health adaptation increasing from US\$229 million to US\$1.4 billion. Co-financing contributed proportionally more towards adaptation than the GCF (Fig. 1).

The geographic distribution of the funding by country is depicted in Fig. 2. The country with the least amount of funding was Belize with US\$735,294 and the country with the largest amount of funding was South Africa with US\$2390 million.

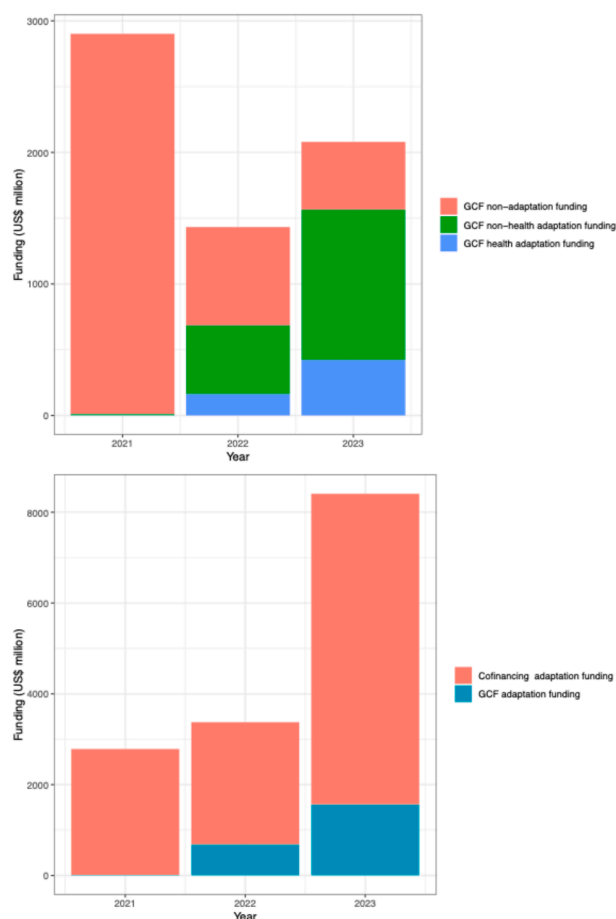


Fig. 1. Contribution to adaptation and health adaptation by the Green Climate Fund and cofinancing by beneficiaries between 2021 and 2023. The bars represent the total amount of funding provided by the Green Climate Fund by year to adaptation and non-adaptation (i.e., mitigation and cross-cutting) projects (left panel) and the amount of funding provided for adaptation projects by the Green Climate Fund and partners (i.e., cofinancing) (right panel). Further details provided in the text.

3.2. Funding versus climate adaptation

There was no association between the amount of funding provided by the GCF towards adaptation and the estimated vulnerability, resilience, and the combined index of adaptation (ND-GAIN) at country level (Fig. 3).

3.3. Health co-benefits of mitigation

Among the 48 mitigation and cross-cutting projects, 15 did not mention health, 13 mentioned relevant co-benefits but did not articulate health specifically (mislabelled) or mentioned health without articulating specific co-benefits, 11 directly identified specific health co-benefits and pathways, and 9 correctly identified, labelled, and measured health co-benefits as outcomes (Table 2). The main health co-benefits were a reduction in the health impact of air pollution, particularly improvement in indoor air quality, improved nutrition due to increased food security, and reduction in traffic casualties. The main outcomes reported by projects that measured health co-benefits as core outcomes were deaths due to lung cancer or other causes associated with indoor air quality, agrochemicals in vegetables, and traffic casualties.

3.3.1. Adaptation fund

There were 15 active projects on the Adaptation Fund website, which had been approved between 2019 and 2024 (Table 3). Of those projects, 8 were NIE Small Grants for Innovation, 5 were Adaptation Fund Climate Innovation Accelerator grants and 2 were Large Innovation Projects. Bhutan and Indonesia had two projects and the remaining countries had one project each (Uganda, Vietnam, Dominican Republic, Chile, Armenia, and Antigua and Barbuda). The 5 Climate Innovation Accelerator grants were regional. In total, US\$51,944,915 were provided to the 15 projects, with the majority of funding provided to Climate Innovation Accelerator grants (US\$40,000,000). Seven of the projects mentioned health benefits but only 1 explicitly measured health adaptation indicators as outcomes. Four Climate Innovation Accelerator grants mentioned briefly that there would be potential health benefits but did not specify those benefits. These grants were regional funds that would be distributed to small projects that fitted with the scope of the grant. There was no requirement for those projects to demonstrate health benefits. The projects that clearly identified health adaptation mentioned improvement in food and nutrition and access to healthcare and reduction in risk of infectious diseases.

4. Discussion

By analysing the projects supported by the GCF between 2021 and 2023, we found that funding for adaptation amounted to US\$3.3 billion, of which US\$764 million were for health adaptation. In addition, beneficiaries contributed with US\$6.4 billion towards adaptation, of which US\$1.6 billion were for health adaptation. These funds were mostly delivered through cross-cutting projects, with a smaller contribution by pure adaptation projects. Health co-benefits were rarely mentioned by mitigation and cross-cutting projects and, when mentioned, they were not adequately articulated or measured as outcomes. The funding provided by the GCF towards adaptation did not seem to be targeted to the countries with the greatest need due to increased vulnerability and/or reduced capacity to respond. The Adaptation Fund had 15 active projects, which were approved between 2019 and 2024 and amounted to US\$51,944,915. Of those projects, seven mentioned health benefits and one measured health adaptation indicators as outcomes. Projects funded by both the GCF and the Adaptation Fund referred health adaptation benefits related to improvements in food and nutrition, access to healthcare, and reduction in infectious diseases.

Our study builds on previous evidence highlighting the gap between funding pledges made by governments at COP meetings and funding that is actually delivered for adaptation, especially to the countries at

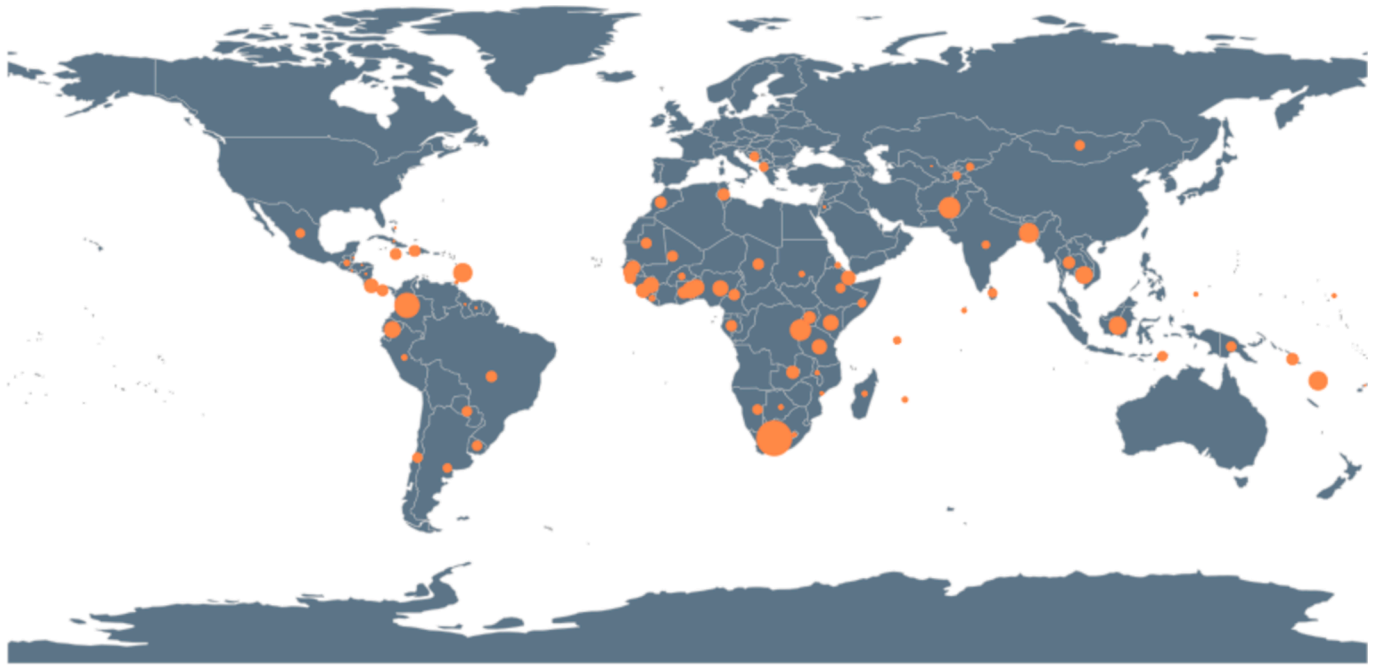


Fig. 2. Distribution of total Green Climate Funding by country. The map illustrates the total funding provided by the Green Climate Fund to individual countries with the size of the bubbles proportional to the amount of funding.

the forefront of climate change (Romanello et al., 2023). Similarly to previous evidence gathered between 2009 and 2019, we found a paucity of health indicators as part of project monitoring and evaluation criteria, and lack of emphasis on local health adaptation and health system resilience (Alcayna et al., 2023). In keeping with previous research, we also found that most health adaptation projects remained in Africa and the Asia-Pacific regions. The lack of association between climate vulnerability and readiness and the amount of multilateral funding is also in line with a previous finding that only about 25% of total health adaptation financing was received by fragile and war-torn countries (Alcayna et al., 2023). The underlying reasons are likely manifold and might include the fact that health investments do not lead to immediately obvious economic growth, lack of information on opportunities, lack of involvement of health actors in climate change processes, and lack of capacity to prepare country proposals (World Health Organization, 2019). These barriers might explain the persisting low levels of climate financing for health adaptation provided to the most vulnerable countries.

The substantial increase in climate-induced or exacerbated disasters across the globe, such as droughts, forest fires, heatwaves, storms and floods, emphasise the urgent need to increase adaptation funding, particularly the proportion targeted to health, including healthy systems and wider determinants of health (European Environment Agency, 2024). Although health adaptation funding has been gradually increasing for the past decade, the gap between funding available and funding needed has been widening due to the faster increase in the funding needed by countries experiencing the impact of climate change in comparison to the funding provided by public and private donors (UN Environment Programme, 2023). The increase in funding for climate adaptation reflects the increasing recognition of the need to adapt to the adverse effects of climate change across multiple sectors. However, funding for health adaptation remains a small fraction of the total funds committed towards adaptation. This is clearly insufficient considering the devastating impact of climate change on population health. Besides the loss of lives and livelihoods as direct consequence of disasters caused or exacerbated by climate change (e.g., floods, extreme heat, droughts), there are indirect and long-lasting physical and mental health consequences that threaten the survival of current and future generations

(Singh et al., 2022).

Unless there is clear reporting of the funding committed to health adaptation and the co-benefits of mitigation, it is impossible to hold countries accountable for the pledges they make. This is particularly important considering the mismatch between what governments promise at COP meetings and what they actually deliver. For instance, at COP28, major health institutions and philanthropic organisations endorsed new Climate and Health Financing Principles and pledged US \$1 billion for health investments in climate action. Although this seems a substantive commitment of funds towards health adaptation, a more in-depth analysis reveals that a significant proportion is not actually new funding and was already committed to health projects ahead of COP28. It is imperative that institutions openly report how these funds are deployed and evaluate the impact they make for accountability and sharing of good practice (Arora, 2024). This can be achieved by making funding data publicly available on their websites and discriminating on their project plans how the funds contribute to mitigation and adaptation by sectors.

Furthermore, the amount of funding provided for climate and health both in terms of adaptation and mitigation is dwarfed by the ongoing investments in the fossil fuel industry, which is unequivocally the largest contributor to climate change (International Energy Agency. World Energy Investment, 2023). Indeed, international spending on fossil fuels has been steadily increasing from about US\$738 billion in 2020 to US \$963 billion in 2023 for gas, oil, and coal. It is, thus, paradoxical that countries continue investing in extraction and combustion of fossil fuels, whilst at the same time commit increasingly larger sums of money towards adaptation to climate change. The relentless international investment on fossil fuels suggests lack of understanding that adaptation to unmitigated climate change is unrealistic (OECD, 2021). Adaptation and mitigation are complementary strategies for reducing and managing the risks associated with climate change. Therefore, the increasing recognition that health is a key pillar in climate action at global level needs to be matched by a commensurate investment of funds, especially towards health adaptation, and a parallel divestment from fossil fuels. In low- and middle-income countries, funding for health adaptation should focus on building health systems resilience with a view to address the pressing need to achieve universal health coverage. Although this is a

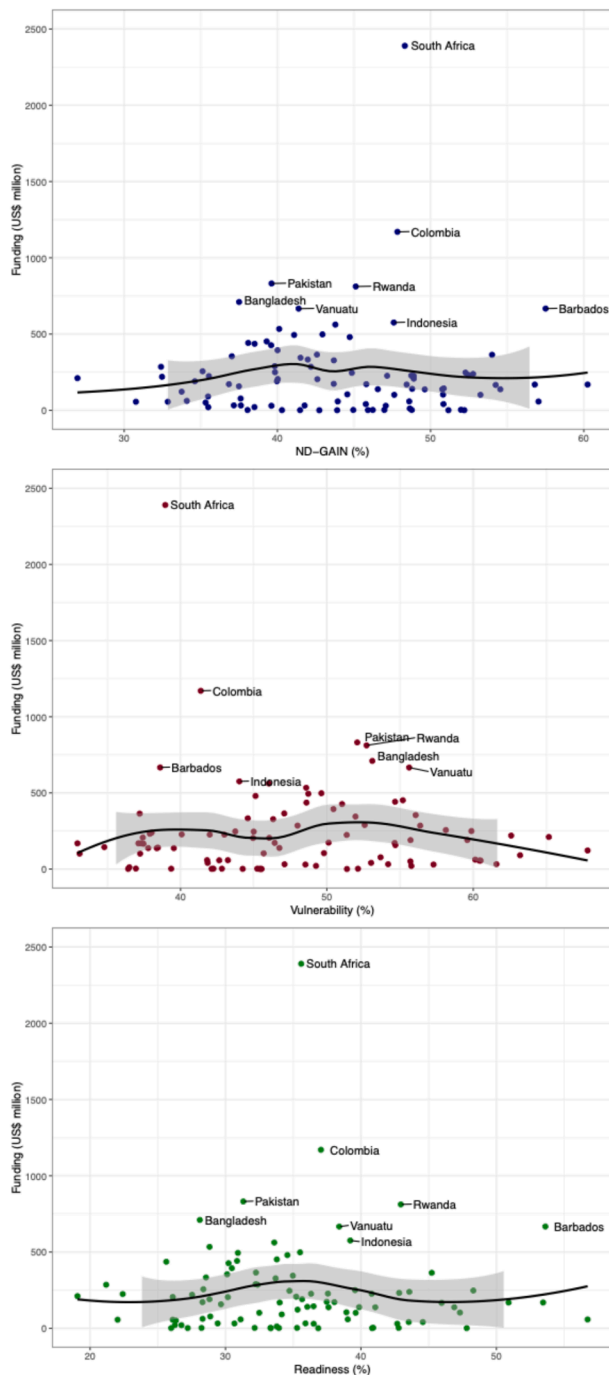


Fig. 3. Association between climate adaptation and the funding for adaptation provided by the Green Climate Fund. Scatterplots display the association between climate adaptation measured by the ND-GAIN index and its subdomains vulnerability and readiness and the amount of funding of funding towards adaptation provided by the Green Climate Fund. Black line represents loess regression line; coloured dots represent the total amount of funding for each country.

sustainable development goal that ought to be achieved by 2030, progress has been slowing since 2015, thus putting its achievement in jeopardy (Verguet et al., 2021). A just transition needs to enshrine universal human rights and address different dimensions of inequality and inequity, thus promoting a healthy and fair society where everyone has access to climate-resilient health systems.

Table 2

Health co-benefits in mitigation and cross-cutting projects funded by the Green Climate Fund between 2021 and 2023.

	Absent	Mislabelled	Identified	Core	Comment
FP154			x		Significant mention and description of health co-benefits, particular in relation to air pollution.
FP156	x				No mention of health co-benefits.
FP158	x				Resilience health co-benefits mentioned but not mitigation co-benefits.
FP159		x			Mention of health, but mostly in relation to resilience and no specific mention of pathways.
FP162			x		Mention of multiple health co-benefits and clear description of the pathways.
FP163	x				No mention of health co-benefits.
FP164		x			Some mention of water and air quality but not specific.
SAP021		x			No mention of health but description of impact on reduction of GBV (hepatitis virus).
SAP023	x				No description of co-benefits.
FP154				x	Reduction in air pollution and casualties due to traffic measured as outcomes.
FP155				x	Improved nutrition and clean cooking (less indoor air pollution).
FP160			x		Reduction in air pollution clearly labelled as mitigation health co-benefit.
FP156				x	Indicator for reduction in diseases associated with indoor pollution measured.
FP157				x	Indicator for improved food security measured.
FP166	x				No mention.
FP167	x				Only mention of health adaptation.
FP168	x				Only mention of health adaptation.
FP182		x			Some mention of food security as an outcome and reducing impacts of pesticides. But mostly in the context of resilience.
FP183		x			By promoting local climate resilient, low emission options, the programme will contribute to cost-saving health benefits thanks to cleaner air for local communities and access to clean energy, water and food, thus reducing food insecurity.
FP185			x		Focus on healthy diets, water security, and economic growth.

(continued on next page)

Table 2 (continued)

	Absent	Mislabelled	Identified	Core	Comment
FP186			x		It will promote environmental sustainability and increase health benefits through the reduction of pollution. This is listed in section D3 on co-benefits.
SAP024		x			No mention.
FP187			x		Identifies that better food ecosystems will benefit health in the long run. Quite a lot of content on adaptation health.
FP188				x	Public health is increased around the fish landing sites from the reduced pollution from the improve. Measuring Percentage of lung disease deaths out of total deaths.
FP189			x		Direct mention of health impacts of air pollution but doesn't have indicator for this. No measurement of health outcomes but measurement of co-benefits of PM2.5 and NOx.
FP190			x		Identification of water and sanitation benefits but no measurement of outcomes.
FP192		x			Inclusion of information about air pollution co-benefits but without measurement or monitoring of health outcomes.
FP193		x			Some potential co-benefits but none identified.
FP194			x		Identification of health as a co-benefit broadly but without monitoring it.
FP195				x	Monitoring of air quality as improvement of health.
FP196		x			Brief mention of health co-benefits.
FP197				x	Direct monitoring of co-benefits for public health
FP198		x			No social/health co-benefits mentioned.
FP163		x			Health benefits from adaptation; indirect benefits from food/nutrition
FP164		x			Improved nutrition and reduction of poverty for farmers
FP169	x				No social/health co-benefits mentioned.
FP170	x				No social/health co-benefits mentioned.
FP158				x	Direct benefits mention via reduction in air pollution; indicator to measure air quality indoors and by hospital

Table 2 (continued)

	Absent	Mislabelled	Identified	Core	Comment
FP161			x		records of air quality sensitive diseases. Direct health co-benefits from reduction in air pollution and increase in safety.
FP171	x				No social/health co-benefits mentioned.
FP172	x				No social/health co-benefits mentioned.
FP159				x	Protection of farmers' health and consumers' food safety from the reduction of unnecessary agrochemical use and practising responsible use when needed; indicator to measure agrochemicals in foods.
FP162			x		Direct health co-benefits from reduction in air pollution and increase in food security/nutrition.
FP165		x			Reduction in air pollution but not mentioned as health only as environment benefit.
FP173	x				No social/health co-benefits mentioned.
FP174	x				No social/health co-benefits mentioned.
FP175	x				Improved quality of life by connecting communities and critical services to electricity but no actual health co-benefit.
FP176	x				Health benefits from adaptation mentioned.

5. Strengths and limitations

The main strengths of this study are the detailed analysis of the projects funded by the GCF and Adaptation Fund, which are the two largest multilateral funds supporting climate change adaptation and mitigation. However, there are other multilateral sources of funding, such as the funds committed by the Alliance for Transformative Action on Climate and Health (ATACH). There are also unilateral funds, such as the Bill & Melinda Gates Foundation, which has committed US\$1.4 billion to help meet the climate adaptation needs of smallholder farmers (Foundation, 2024). Second, our analysis is restricted to the past three years as previously the form describing GCF projects did not specify funding committed to health adaptation. Third, the Adaptation Fund did not specify the proportion of each project committed to health. Fourth, our analysis relied on applicants' self-assessment of how their project had health co-benefits or contributed to health adaptation. This may have resulted in a degree of misclassification.

6. Conclusion

Funding for health adaptation and health co-benefits of mitigation provided by the GCF and the Adaptation Fund has been increasing since 2021. However, the amount of adaptation funding received by countries does not seem to be associated with their climate vulnerability and readiness to adapt. To avoid the worst consequences of climate change on the most vulnerable countries and populations, further increases in health adaptation are required over the coming years in line with

Table 3

Projects funded by the Adaptation Fund between 2019 and 2024.

Country	Title	Amount (USUS\$)	Year	Health adaptation
Indonesia	Towards Climate and Economic Resilience: Development Sustainable Adaptation-based of Coffee Village and Tourism Village through Co-production Social Forestry	250,000	2023	No
Indonesia	Developing “Climate Smart Community” System to Increase Climate Resilience for Saddang Watershed Communities	250,000	2023	No
Uganda	Enhancing Resilience to Climate-induced Flooding and Drought through the Deployment of a Water-filled Barrier	250,000	2022	The project will improve health conditions for the population. People, and women and children in particular, have better access to health care. Improved food security leads to less diseases and less conflicts. Health indicator included as outcome.
Bhutan	Building Adaptive Capacity through Innovative Management of Pests/Disease and Invasive Alien Species (IAS) in Bhutan to Enhance Sustainable Agro-Biodiversity and Livelihoods	250,000	2021	The Giant African Land Snails (GALS) are known to carry several pathogens including a parasitic nematode capable of causing meningitis. The removal of the GALs will result in a positive impact on human health of the people in the area.
Dominican Republic	Strengthening of a Replicable Micro Ecosystem of Accelerated Technological Innovation for Adaptation and Mitigation to Climate Change in Dominican Republic through the Development of a Pilot Thermo Solar Desalination Appropriate Technology	249,929	2020	No
Chile	Water Security: Improving Water Access during Emergency Situations in San Antonio Province, Region Valparaíso	230,000	2019	No

Table 3 (continued)

Country	Title	Amount (USUS\$)	Year	Health adaptation
Armenia	Engaging Future Leaders: Digital Education Module on Adaptation Challenges and Best Practices for Youth	231,250	2019	No
Antigua and Barbuda	Innovative Technologies for Improved Water Availability to Increase Food Security in Antigua and Barbuda	250,000	2020	The project mentions potential health benefits but does not specify or measure them.
Regional	Adaptation Fund Climate Innovation Accelerator II	10,000,000	2024	Regional
Regional	The Adaptation SMEs Innovation Facility (ASIF)	10,000,000	2023	The identified and selected innovative climate adaptation micro, small and medium-scale enterprises' solutions may be deployed in the market, as means to to avoid an increase of communities' and beneficiaries' exposure to climate-induced health, safety and security risks and impacts.
Regional	Climate Adaptation Innovation Accelerator Programme (CAIAP)	10,000,000	2023	The programme activities targeting climate adaptation are expected to have positive impacts on health outcomes. Notably any innovation ventures working in food safety or nutrition will prospectively tackle the underlying causes of malnutrition and benefit community health.
Regional	Adaptation Fund-UN Environment Special Financing Window in Support of Innovation for Adaptation	5,000,000	2019	No
Regional	Adaptation Fund-UNDP Innovation Small Grant Aggregator Platform (ISGAP)	5,000,000	2019	No
Viet Nam	Innovative Financial Incentives for Adaptation in Wetland Livelihoods (IFIA)	5,000,000	2023	No
Bhutan	Innovative Adaptation Financing to Build the Resilience and Adaptive Capacity of Smallholder Farmers in Bhutan (InAF-Bhutan)	4,983,736	2024	The project is designed to be nutrition sensitive, and thus will contribute to tackling the underlying causes of malnutrition through increasing

(continued on next page)

Table 3 (continued)

Country	Title	Amount (USUS\$)	Year	Health adaptation
				agricultural production and processing, promoting sustainable natural resource management and supporting nutritious value chains.

pledges made at international meetings.

CRediT authorship contribution statement

Ana-Catarina Pinho-Gomes: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Louis Jamart:** Writing – review & editing, Validation, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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Data availability

Data will be made available on request.

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