development initiatives

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An uncertain road: Examining the World Bank's climate change poverty projections

briefing

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Overview

The climate crisis is increasing the intensity and frequency of events such as storms, floods and wildfires, events that are pushing more people into extreme poverty. Policymakers need an accurate and reliable understanding of how climate change will impact efforts to end extreme poverty. However, the data available is insufficient and lacks transparency for projecting extreme poverty accurately.

In this briefing, Development Initiatives (DI) explores the World Bank's climate change poverty forecasts, and some of the key assumptions underpinning them. The World Bank's modelling makes it clear that climate change will have a material impact on the number of people falling into poverty, yet estimates are based on limited or inconclusive data, resulting in wide ranges of uncertainty of these impacts. Our paper demonstrates that poverty projections for the next seven years vary significantly, even before considering the possible impacts of climate change. This highlights the difficulty for policymakers trying to harness data to end poverty in the face of climate change.

Given this, and the threat to the goal of limiting global warming to 1.5°C, it is imperative that data on both present-day poverty estimates and forward-looking assessments of climate vulnerability are improved. The World Bank’s future roadmap must ensure that this data is collected and used to improve the evidence base on climate and poverty.

Introduction

Extreme heat, storms and flooding have always been threats to the livelihoods of households in much of the world – especially those living near or below the extreme poverty line. However, climate change is increasing the intensity and frequency of such hazards, pushing more households into poverty.

The World Bank released its 'Evolution Roadmap' in 2023 ahead of the World Bank and IMF spring meetings.[1] The institution reviewed its mandate to eradicate extreme poverty and increase shared prosperity among the growing threats of fragility, climate change and pandemics. The new strategy, which will be finalised with this year's annual meetings, sets out an integrated vision and mission. It recognises that the "twin goals of poverty eradication and shared prosperity can only be achieved through sustainable, resilient and inclusive development."[2]

DI believes that this roadmap needs to urgently respond to the emergency of the climate crisis by supporting the most marginalised people to adapt to climate impacts to ensure that no one is left behind. Indeed, targeted pro-poor climate-sensitive approaches have the potential to simultaneously alleviate poverty and reduce emissions.[3] Understanding where and how climate change is likely to impact poverty is central to developing pro-poor policies under the roadmap.

As the leading authority for measuring and tracking poverty, the World Bank has published three widely-cited estimates of the impact of climate change on extreme poverty, most recently in 2020.[4] The most recent estimates headline that up to 131.5 million more people worldwide could be pushed into poverty by 2030 as the result of climate change. Determining exactly how climate change influences poverty today is complex. Forecasting the impact of climate change on poverty a decade into the future is harder still. The World Bank itself warns that the approach used in generating its estimates is "for exploration, rather than prediction".[5]

This briefing explores the key data aspects and assumptions that underpin the World Bank's climate change poverty forecasts. It demonstrates the uncertainty surrounding climate change's potential impact on people falling into extreme poverty globally, and the lack of timely, high-quality data necessary for good estimates. Ultimately, better data and research are necessary to equip policymakers with effective tools for adapting to the task of ending poverty in the face of climate change.

The World Bank’s model

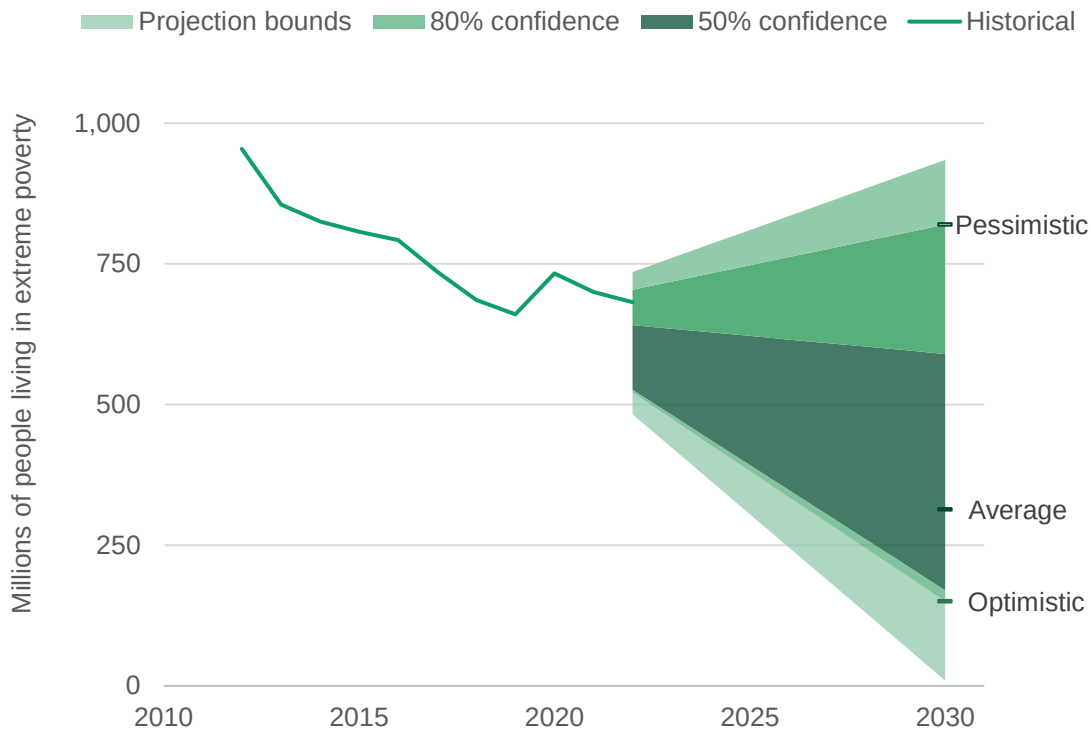
Ending extreme poverty, defined as living on less than US$2.15 per day (purchasing power parity),[6] is a cornerstone commitment of the Sustainable Development Goals. As of 2022, it is estimated that 681.7 million people − 8.5% of the world’s population – are living in extreme poverty.[7] Climate change threatens the possibility of meeting this goal. Whether extreme poverty will be eliminated by 2030 may be forecast using modelling techniques and assumptions about the socioeconomic characteristics in the near future. A key basis for these characteristics is the narrative frameworks described by the Intergovernmental Panel on Climate Change's Shared Socioeconomic Pathways (SSPs). The SSPs consider the potential socioeconomic challenges to climate adaptation and mitigation. They present five distinct scenarios the world may face by 2100 (see the Appendix for more information).

The World Bank has to date published three reports looking at how poverty is likely to change up to 2030 using this approach. Most recently, the World Bank used two SSP scenarios − SSP4: Inequality (A Road Divided), and SSP5: Fossil-fuelled Development (Taking the Highway) − to form the basis of its analysis. Creating poverty forecasts under this approach draws on data from both ‘back-casted’ key socioeconomic variables under the SSP scenarios and historical national household surveys which inform the World Bank’s current poverty figures.

Using this approach, the World Bank estimates that before considering the direct impacts of climate change, an average of 315.5 million people could be living in poverty by 2030. However, widely diverse outcomes arise from this method, with the World Bank also creating optimistic and pessimistic baselines from the same data inputs. In an optimistic baseline linked to high economic growth, it is estimated that approximately 150 million people will be living in extreme poverty by 2030. In a pessimistic baseline tied to slower, unequal growth, this number rises to around 820 million people (Figure 1).

Figure 1: Confidence bounds of poverty projections are wide even without considering the possible impacts of climate change

World Bank extreme poverty projections under SSP4/SSP5 before considering direct climate impacts



Source: Development Initiatives based on World Bank (2020).
Notes: Optimistic and pessimistic baseline positions are approximate. Historical data reflects most recent available estimates. Projection model used 2019 figures as baseline. Confidence bounds indicate model outputs for 2030, not necessarily progression paths.

The SSPs do not describe direct climate change impacts − these are modelled separately on top of the SSP-informed baselines. The model covers five factors of climate change impact, and considers two broad 'severity' scenarios − one where overall climate change impact is high, the other where it is low. The five factors are:

1 Agricultural productivity
2 Food availability and prices
3 Exposure and losses from disasters
4 Labour productivity
5 Health

Impacts of each of the key factors are modelled individually with the average socioeconomic baseline, and simultaneously in combination with the optimistic and pessimistic baselines. This produces an overall estimate of the impact of climate change on extreme poverty by 2030.

Table 1: Individual factors of direct climate change impacts on poverty with average socioeconomic baseline

	Low climate impact		High climate impact	
	Additional people in poverty	**% share effect**	**Additional people in poverty**	**% share effect**
Agricultural productivity	−0.4 million	<1%	+0.4 million	<1%
Food availability and prices	+4.2 million	11%	+33.5 million	33%
Exposure and losses from disasters	+6.1 million	17%	+18.2 million	18%
Labour productivity	+1.8 million	5%	+6.2 million	6%
Health	+25.0 million	68%	+44.1 million	43%

Source: Development Initiatives based on World Bank (2020).

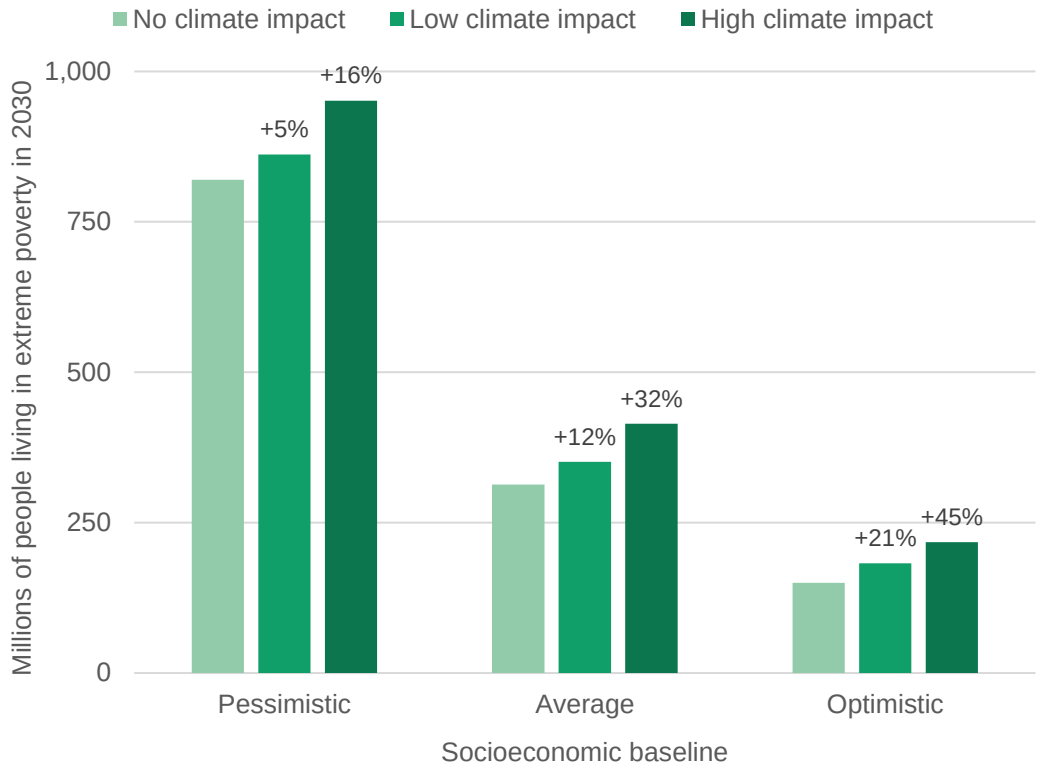
The result of these combined factors is that climate change is forecast to push between 37.6 million (low climate impact) and 100.7 million (high climate impact) people into extreme poverty. Combined with the average baseline forecast, this amounts to a total of between 351.1 million and 414.2 million people living in extreme poverty in 2030. The low impact scenario results in 12% more people living in extreme poverty over the average baseline in 2030, whereas a high impact scenario results in 32% additional people.

When combined with the optimistic and pessimistic socioeconomic baselines, the model forecasts that climate impacts will push between 32.2 million people (optimistic baseline, low climate impact) and 131.5 million people (pessimistic baseline, high climate impact) into extreme poverty by 2030. These results should be understood in the context of the resulting totals − between 182.2 million people in the former case and 951.9 million people in the latter living in extreme poverty in 2030.[8] The pessimistic baselines therefore describe a world where we could see 10 years' progress of poverty reduction reversed by 2030.

While the overall effect of climate change is found to push more people into poverty across all three socioeconomic baselines, the relative scale of impact differs between them. The effect is most apparent in the optimistic socioeconomic baseline − with the lowest baseline forecast − where a high climate impact scenario could increase the total number of people living in extreme poverty by 45% (67.7 million more people) by 2030. Meanwhile, under the pessimistic baseline − with the highest baseline forecast − the impact of climate change could be as little as a 5% increase in the total (42.0 million more people).

Figure 2: Projections of climate impacts on poverty are dwarfed by the differences in projections when using different socioeconomic baselines

Relative climate change impacts on extreme poverty by socioeconomic baseline



Source: Development Initiatives based on World Bank.
Notes: Forecasts based on data available for 86 countries in the Global Monitoring Database, with results upscaled to the total projected global population in 2030. Figures for pessimistic and optimistic scenarios are approximate.

Discussion

Data input reliability

From the results of the World Bank's modelling, it is clear that climate change will have a material impact on efforts to eliminate poverty by 2030. However, many of the key factor estimates are based on limited or inconclusive data inputs, resulting in wide ranges of uncertainty of these impacts. Consequently, we must treat the headline impact figure of 131.5 million people with caution.

Issues with the reliability and availability of household survey data mean that even current-day poverty estimates for some countries are uncertain or missing. National statistical systems which lack the capacity to conduct timely and comprehensive data collection mean household surveys for some countries may cover only limited areas or may not be conducted at all. This is notably the case in places experiencing prolonged humanitarian crisis or conflict.

Even when household surveys are conducted, they are not a comprehensive method of evaluating poverty. Notably, they do not reflect intrahousehold inequalities, and often miss people experiencing marginalisation. As a result, household surveys hide individual deprivations and ultimately do not account for all people in poverty.[9] While work can be done to fill these gaps with existing data, the resulting estimates have high uncertainty.[10]

There is also limited coverage of present-day climate data from national statistical systems − particularly in low-income countries. Both national and international statistical systems poorly record the impacts of slow-onset climate-related disasters such as drought.[11] The projected impacts of climate change at national and regional levels rely on a present-day baseline which, in many cases, is not comprehensive.[12]

The intersection of vulnerability to climate change and protracted crisis means that countries where climate change is likely to have the greatest impacts are also those where accurate data is least available.[13] As long as national statistical systems remain stressed and under-resourced, this challenge will continue.

Model comprehensiveness

The World Bank model consider five key factors of direct climate change impact. However, the extent to which these cover the sum of intersections between climate change and poverty is unclear. The key factors themselves only consider direct economic impacts. For example, impacts from exposure and losses due to climate-related disasters are limited to primary economic losses and excludes injury and loss of life. Impacts from health only cover loss of earnings due to child stunting, malaria, and diarrhoea. Secondary and indirect impacts of the key factors are not modelled.

One key intersection between climate change and poverty that is absent from both the World Bank's model and the SSPs themselves is conflict, although other authors have made attempts to consider this variable.[14,15] There are significant implications to not factoring conflict into poverty modelling, particularly as populations facing conflict risk are among the most vulnerable to poverty. Estimating the impact of conflict on poverty is also difficult, but evidence shows that countries facing prolonged crisis and conflict have the slowest rates of poverty reduction.[16] Other key factors that the model does not directly consider include, for example, impacts of changes to soil and water security.

Final results confidence

The uncertainty in the range of total figures illustrate the difficulties faced in accurately forecasting extreme poverty over the next decade, and present problems for policymakers in deciding how to target poverty reduction efforts. Overall, 84% of the uncertainty in the World Bank's forecast poverty totals is in fact not due to direct climate change impacts, but rather uncertainty in the socioeconomic baselines. While forecasts show that climate change impacts will have a real and significant impact on the number of people living in extreme poverty in the next decade in all instances of the model, the World Bank's results are ambiguous when the total figures are considered.

One significant consideration which the World Bank paper does not highlight is the fact that SSP5 refers to a socioeconomic pathway defined by global fossil-fuelled development, with the optimistic baseline deriving mostly from this SSP. This scenario sees very few socioeconomic challenges to adaptation and, as a result, high economic growth follows from the accelerated exploitation of carbon-intensive resources. The necessary indications of an SSP5 scenario result in a world with high greenhouse gas emissions, and global temperature rises well above the 1.5°C threshold (see the Appendix). The potential impacts on poverty of such a runaway climate change scenario are not well understood but would almost certainly exclude the 'low climate impact' outcome modelled here.

Putting results into action

Finally, there is the question of the usefulness of these results in aiding the achievement of the Sustainable Development Goals. While global-level projections have wide appeal and demonstrate the worldwide nature of climate change's effects on poverty, they are of limited use for putting into action focused climate-conscious poverty reduction efforts. Localised climate vulnerability assessments provide a strong basis for targeted interventions for poverty reduction not possible with global estimates.

Recommendations

Improve present-day poverty measurements

To address the uncertainty of how climate change will affect poverty in the future, stronger investment in effective collection of present-day poverty data is essential. There is a need to allocate resources to improve the frequency and reach of household surveys, particularly in regions facing protracted crises. There is also the need for an expansion of foundational approaches to measuring individual deprivations that go beyond household surveys, and to invest in efforts that use existing data sources and innovative technologies to overcome gaps.[17]

Expand and improve global modelling

Models used to project climate change's impact on poverty, such as the one the World Bank employs, need expansion to include secondary and indirect consequences of climate change on poverty. In particular this would extend to the effects of soil and water security, as well as the consequences of conflict associated with climate change. As poverty becomes more concentrated in fragile and conflict-affected states, it is necessary that poverty projections consider the likelihood of conflict continuing, or increasing, as climate change progresses.[18]

Invest in localised climate vulnerability assessments

While global-level projections provide a broad understanding of how climate change might impact poverty, only localised assessments of climate vulnerability can provide actionable information at a national or local level and allow countries to understand and leverage data on climate vulnerability. There needs to be greater investment in regional assessments to identify areas and communities with the greatest climate vulnerabilities. These assessments would then serve as the foundation for strategies that address poverty while considering climate impacts.[19]

Appendix: Climate pathways

The Intergovernmental Panel on Climate Change (IPCC) is a global scientific body the United Nations established to assess the state of knowledge on climate change. The IPCC produces Assessment Reports (ARs) every five to seven years synthesising the latest scientific research in this field. Part of each report focuses on forecasting the likely trajectories and impacts of climate change. These forecasts form the basis of the World Bank's poverty projections.

The AR forecasts are formed of two 'pathways' with distinct focuses. The first, known as Representative Concentration Pathways (RCPs), consider the effects of different concentrations of greenhouse gas emissions from the present day up to 2100. The RCPs are centred around a metric known as 'radiative forcing', a measure of energy concentration (see Box 1). There are currently seven distinct scenario projections developed under the RCPs. These scenario projections are labelled according to the level of radiative forcing in 2100, ranging from the lowest and most optimistic at 1.9 (RCP1.9) up to a pessimistic 8.5 (RCP8.5).[20]

The second set of scenarios are the Shared Socioeconomic Pathways (SSPs). The SSPs consider the potential socioeconomic challenges to climate adaptation and mitigation. They present five distinct scenarios the world may face by 2100, outlining different trajectories future societies may take with regards to metrics such as population growth, economic development, and urbanisation. For example, SSP1 describes a scenario of global sustainability, where there are low socioeconomic barriers for mitigating and adapting to climate change. SSP2 is a middle-of-the-road scenario, with moderate challenges to both mitigation and adaptation. SSP3 sees high challenges in both ways and describes a world of regional rivalry. SSP4 and SSP5 match low challenges to one dimension with high challenges to another.

The seven RCPs and five SSPs are used together to create a range of combined scenarios which match greenhouse gas emissions with socioeconomic situations.[21] For example, SSP1-RCP1.9 and SSP1-RCP2.6 both refer to a socioeconomic pathway with a high amount of sustainability (SSP1), but with the latter indicating higher levels of radiative forcing due to greenhouse gases (RCP2.6). By contrast, SSP3-RCP8.5 is a combined pathway with low international cooperation and significant adaptation and mitigation challenges (SSP3), coupled with a very high level of greenhouse gas emissions (RCP8.5).

These combined scenarios present possible variations of the world in 2100. Each variation envisages different outcomes in six broad categories: environment and natural resources, demographics, technology, human development, policies and institutions, and economy and lifestyle.[22] From these outcomes, we can estimate related key variables −

such as global temperature, GDP per capita, and levels of education – and 'back-cast' them to the present day to reveal trajectories for each scenario. Some of these key variables then form the basis for projecting poverty according to each trajectory.

Box 1: Radiative forcing climate models

Existing climate model assumptions centre on several key components: the level of pollution generated, the levels of heating resulting from emissions, the impact the heating has on climate in various places with short-term disasters and long-term ecosystem changes occurring, forecasts about social and demographic patterns that influence who climate events will impact, and what adaptations may result to changes in climate.

The first assumptions focus on future levels of pollution. This is modelled with an approach known as radiative forcing. This is a measure of how much energy enters the earth's atmosphere from space, minus the energy leaving the atmosphere − generally as heat dissipating into space. In the pre-industrial era, the level of energy entering the earth from sunlight during the day would roughly balance with the level of Watts leaving earth during the night. However, atmospheric pollution is now preventing heat from leaving the earth's atmosphere at the same rate it is entering, resulting in higher radiative forcing and, therefore, higher temperatures. The greenhouse effect caused by carbon dioxide or methane emissions, among many other potential pollutants, increases radiative forcing.

Different assumptions about emissions have dramatic impacts on the estimated impacts of climate change. The (increasingly unlikely) scenario where the world reaches the Paris Climate Agreement goal of limiting warming to 1.5°C above the pre-industrial average would create a world that would look very different from a world that is 4.5°C warmer.

Models then make assumptions about what impact different levels of radiative forcings might have on the frequency, intensity and location of climate-related disasters, and how climate change more broadly would impact ecosystems. These models aim to translate levels of radiative forcings into estimates of the likelihood of outcomes such as extreme temperature days in South Asia, increasing volatility in rainfall in the United States, coastal flooding in the Pacific, drought in Madagascar and many, many other potential impacts of climate change.

Once assumptions are made about how the climate may change, models then consider how various social and demographic changes could influence the relationship between climate change and poverty. This is key for understanding how many, and to what extent, the changing incidence of events such as extreme heat, floods, storms, drought might impact people.

Notes

[1] The World Bank, Evolving the World Bank Group's Mission, Operations, and Resources: A Roadmap, 2022, World Bank. Available at: https://www.worldbank.org/en/news/statement/2023/01/13/world-bank-group-statement-on-evolution-roadmap

[2] ODI, 2023. The time is now: what the World Bank's (R)evolution Roadmap should look like. Available at: https://odi.org/en/insights/the-time-is-now-what-the-world-banks-revolution-roadmap-should-look-like/ (accessed 18 September 2023)

[3] Soergel et al., Combining ambitious climate policies with efforts to eradicate poverty, 2021, Nature Communications. Available at: https://www.nature.com/articles/s41467-021-22315-9.pdf

[4] Jafino et al., Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030, 2020, World Bank. Available at: http://hdl.handle.net/10986/34555

[5] The World Bank, 2020. Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030. Available at: https://openknowledge.worldbank.org/entities/publication/a549a5ee-71cd-5ed4-bcf3-3a8cb508b199

[6] The World Bank, 2022. Fact Sheet: An Adjustment to Global Poverty Lines. Available at: https://www.worldbank.org/en/news/factsheet/2022/05/02/fact-sheet-an-adjustment-to-global-poverty-lines#:~:text=The%20new%20global%20poverty%20line,in%20this%20situation%20in%202017

[7] Development Initiatives, 2023. Economic poverty trends: global, regional and national. Available at: https://devinit.org/resources/poverty-trends-global-regional-and-national/

[8] These totals do not explicitly feature in the World Bank's published paper on the model but approximate figures are calculable from the given percentage figures.

[9] Equality Insights, 2018. Individual Deprivation Measure. Knowing who is poor, in what ways and to what extent. Available at: https://equalityinsights.org/resources/idm-technical-update/

[10] For example, Development Initiatives, 2018. Filling the gaps in current global poverty data estimates. Available at: https://www.devinit.org/resources/filling-gaps-global-poverty-data/

[11] Panwar & Sen, 2019. Disaster Damage Records of EM-DAT and DesInventar: A Systematic Comparison. Available at: https://doi.org/10.1007/s41885-019-00052-0

[12] PARIS21 Secretariat, 2022. Envisioning a climate change data ecosystem. A path to co-ordinated climate action. Available at: https://paris21.org/ccde

[13] Development Initiatives, 2016. Global Humanitarian Assistance Report, 2016. Available at: https://devinit.org/resources/global-humanitarian-assistance-report-2016/

[14] For example, a paper by Hegre et al in 2016 modelled the share of countries likely in conflict under the various SSPs. They find that globally and regionally, conflict is most likely under SSP3 and SSP4. SSP1 and SSP5 are virtually identical in their estimates of the likelihood of conflict and generally reflect low levels of conflict.

[15] According to the IPCC's AR6 Working Group 2, climate's direct influence on conflict has been assessed thus far as relatively weak but has the potential to be exacerbated by indirect factors caused by climate change. Available at: https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf.

[16] Development Initiatives, 2019. Global Humanitarian Assistance Report, 2019. Available at: https://devinit.org/resources/global-humanitarian-assistance-report-2019/

[17] Development Initiatives has worked to develop techniques using existing data from non-traditional sources to fill the gaps in global poverty estimates. For example: Development Initiatives, 2018. Filling the gaps in current global poverty data estimates. Available at: https://www.devinit.org/resources/filling-gaps-global-poverty-data/

[18] For example, work done by Development Initiatives in projecting the incidence of global conflict under the SSP scenarios (publication forthcoming).

[19] For example, Development Initiatives has conducted Leave No One Behind assessments in Nepal (https://devinit.org/resources/lnob-assessment-in-nepal-data-landscaping-in-simta-municipality/), Kenya (https://devinit.org/resources/social-protection-disability-inclusion-kenya-uganda/), and Benin (https://devinit.org/resources/the-p20-in-benin-data-to-leave-no-one-behind-in-atakora-and-donga/).

[20] RCP scenarios from AR5: RCP2.6, RCP4.5, RCP6.0, RCP8.5; scenarios added in AR6: RCP1.9, RCP3.4, RCP7.0.

[21] Rogelj et al. Scenarios towards limiting global mean temperature increase below 1.5 °C. Nature, 2018. Available at: https://www.nature.com/articles/s41558-018-0091-3#Ack1

[22] O'Neill et al, 2017. The roads ahead: Narratives for shared socioeconomic pathways describing world futures in the 21st century. Available at: https://doi.org/10.1016/j.gloenvcha.2015.01.004

DI unlocks the power of data to enable policies and investments that improve the lives of people experiencing poverty, inequality and crisis.

Our mission is to work closely with partners to ensure data-driven evidence and analysis are used effectively in policy and practice to end poverty, reduce inequality and increase resilience.

While data alone cannot bring about a better world, it is a vital part of achieving it. Data has the power to unlock insight, shine a light on progress and empower people to increase accountability.

The boundaries and names or countries and regions used do not imply official endorsement or acceptance by Development Initiatives Poverty Research Ltd.

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