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Greenwheel Insights

Climate Adaptation in Emerging Markets in a 1.5°C World

October 2024
For professional investors and advisors only

Greenwheel

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Executive Summary

The negative effects of climate change are increasingly well documented and visible even at current levels of warming. These effects will likely only escalate, even in the much hoped for scenario of 1.5°C of warming.

This research is the first in a series identifying the relative gaps between need and capacity to create demand for adaptation solutions in emerging markets.

The purpose of this is twofold.

1. To identify **countries where the need and the ability to adapt to climate change are well aligned** to support financial return-generating investment opportunities.

2. To identify **countries with high levels of need but low levels of capacity** due to economic and institutional constraints. In these countries, **philanthropic investors act and return-focused investors should take extra care** that investee companies are managing these risks to productivity and profitability.

To do this, **we developed an economic, institutional, and social capacity index – the Greenwheel Adaptive Capacity Index (GACI)** – to analyse the macro indicators of adaptation solution demand across the world. Then, we **overlaid key physical climate risks in a 1.5°C world to identify climate adaptation opportunities and gaps.**

Stephanie Kelly
Head of Greenwheel

Anna Polise
Climate and Environment Analyst, Greenwheel

Our analysis finds:

1. **Brazil, Chile, Argentina, South Africa, Botswana, Malaysia, Vietnam, Thailand Slovenia, and Greece** stand out among investible EMs for their high need and high ability to adapt to the increasing heat, drought, and/or precipitation they face in a 1.5°C world.

2. **The UAE, Saudi Arabia, and Qatar** do similarly well in our analysis, but have already adapted to pre-existing desert conditions so **efficiency and efficacy gains** in technology are the more likely areas of opportunity in these countries.

3. **India flashes red** because it faces extreme heat and weather that will only worsen and has weak macro capacity to adapt. **Investors should engage companies with operational exposure to ensure adequate physical risk planning.**

4. **Sub-Saharan African countries generally need the most substantial support** from philanthropic sources to deal with even hotter, dryer days at 1.5°C.

CONTACT US

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invest@redwheel.com | www.redwheel.com

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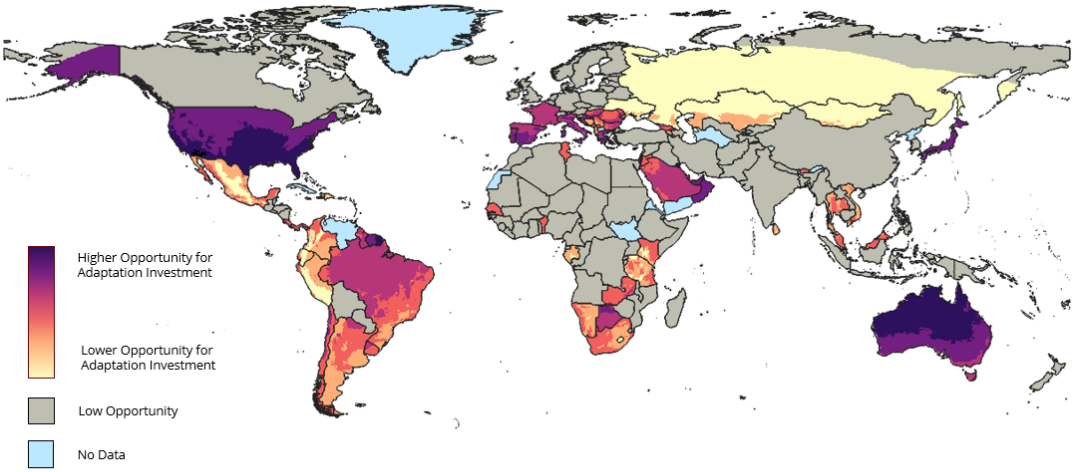
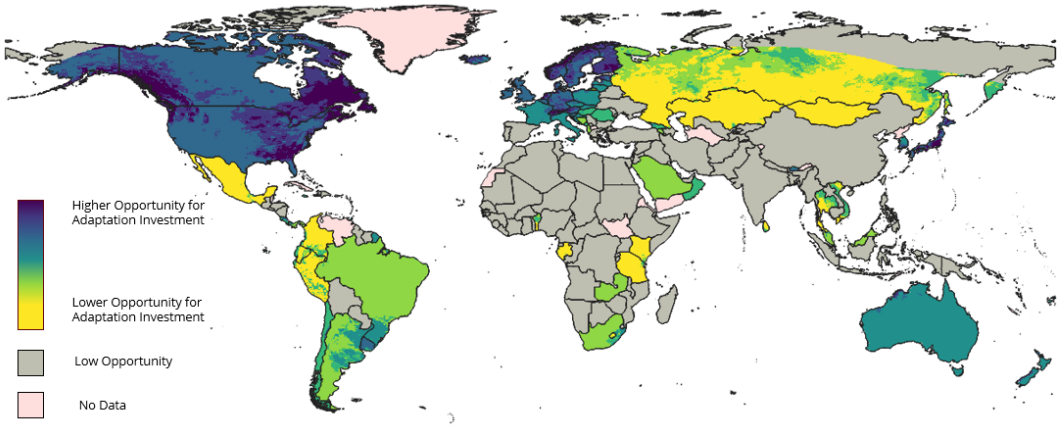
Climate Adaptation Opportunities: the Greenwheel Adaptive Capacity Index and Physical Risk Data from Probable Futures

Heat at 1.5°C



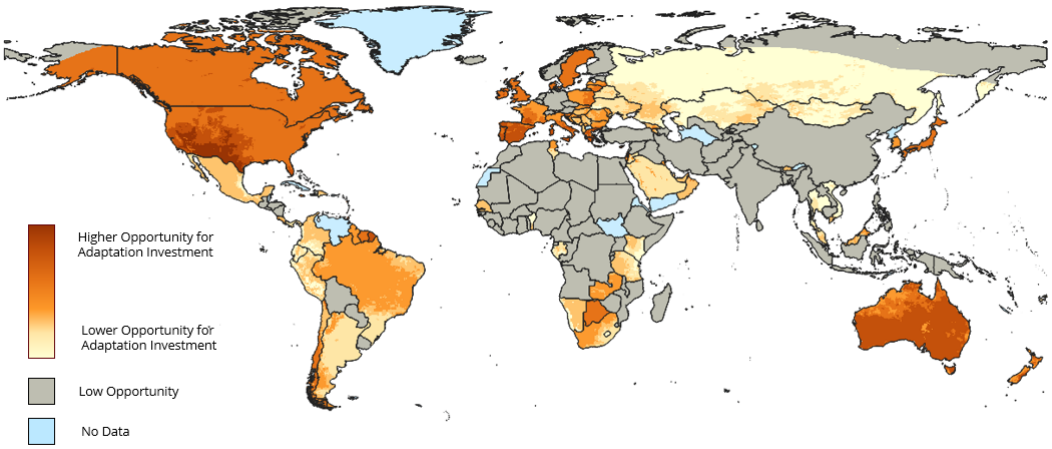
The heat threshold for this analysis was set at 34 days above 32°C in a year. If a whole country has fewer than 34 days above 32°C, it is considered low opportunity and marked in grey. If a country has a GACI score in the lower two quintiles, it is considered low opportunity and is marked in grey.

Precipitation at 1.5°C



The precipitation threshold for this analysis was set at an increase of 41 mm of precipitation in a year compared to 1971-2000. If a whole country has an increase of less than 41 mm, it is considered low opportunity and marked in grey. If a country has a GACI score in the lower two quintiles, it is considered low opportunity and is marked in grey.

Drought at 1.5°C



The drought threshold for this analysis was set at 28% of the year under drought conditions. If a whole country is in drought for less than 28% of the year, it is considered low opportunity and is marked in grey. If a country has a GACI score in the lower two quintiles, it is considered low opportunity and is marked in grey.

Source: Greenwheel, 2024; Probable Futures, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022

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Preface: The Investor Need

Hui Ting Ang

Portfolio Manager, Redwheel
Sustainable Emerging Markets

Victor Erch

Portfolio Manager, Redwheel
Sustainable Emerging Markets

Archana Shah

Portfolio Manager, Redwheel
Sustainable Emerging Markets

"As investors in emerging markets, we have been investing in climate adaptation solutions and are mindful of the risks that climate change presents to our investments.

The reality is that the need and capacity to adapt in emerging and frontier markets don't always match up, and there is little to no data we can draw on in the market to measure this gap.

To help us develop a better understanding of the impact of physical climate risks in our markets, we requested our Greenwheel team to build a tool to help identify countries that have both the need and, crucially, the capacity to adapt to the physical risks of climate change. This work has added depth and nuance to our investments, from water infrastructure across Brazil and India to agriculture and mining globally. We look forward to working with the Greenwheel team in further editions of this research series as we drill down to the specific opportunities by climate hazard and region."

The Climate Tragedy Unfolding

In most developed markets, we expect that economic strength and political stability will support demand from governments, companies, and consumers for adaptation solutions. The picture for emerging markets is likely to be more mixed given the variation in economic strength and institutional stability across these markets.

This divergence is at the heart of the climate tragedy: **while low- and middle-income (LMIC) countries are likely to experience the worst effects of climate change in terms of extreme heat, drought, and weather events, they vary significantly in key factors likely to support the demand environment for adaptation solutions: economic development, social inclusion, and institutional capacity.**

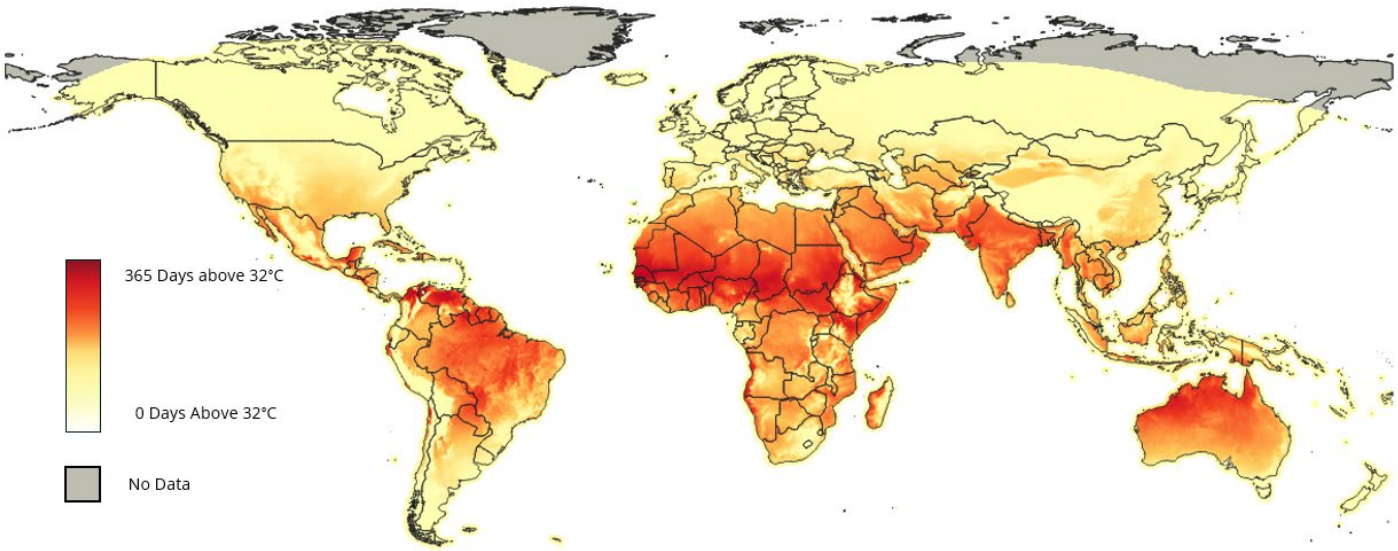


Figure 1: Emerging Markets Face the Greatest Exposure to Extreme Heat in a 1.5°C World (Source: Greenwheel, 2024; Probable Futures, 2024)

As Figure 1 shows, countries in emerging markets face the most substantial challenges when it comes to heat stress. However, **climate change is not limited to increasing heat: a changing climate will cause more frequent and severe natural disasters, like flooding and hurricanes, as well as longer periods of drought in already drought-stricken countries.** Emerging markets will generally struggle more than their developed markets counterparts to manage these challenges.

The unequal distribution of damage from weather events is not new. Between 1970 and 2021, **91% of deaths and 37% of economic losses from weather, climate, and water-related disasters were in emerging markets.**[i]

While developed markets experience larger economic losses in absolute terms, **emerging markets tend to suffer proportionally more.** For example, most disasters in developed markets resulted in economic losses of less than 0.1% of GDP, while many disasters in developing economies have economic impacts ranging from 5% to more than 100% of GDP.[ii]

This deep inequality will only be exacerbated by continued inaction on adaptation to climate change.

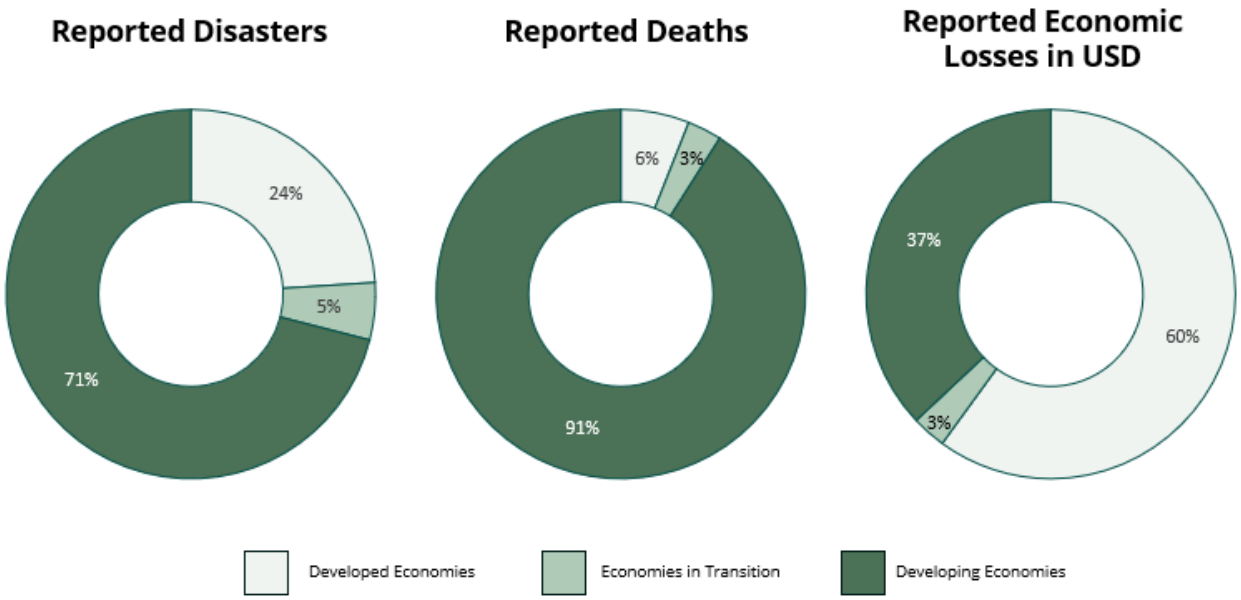
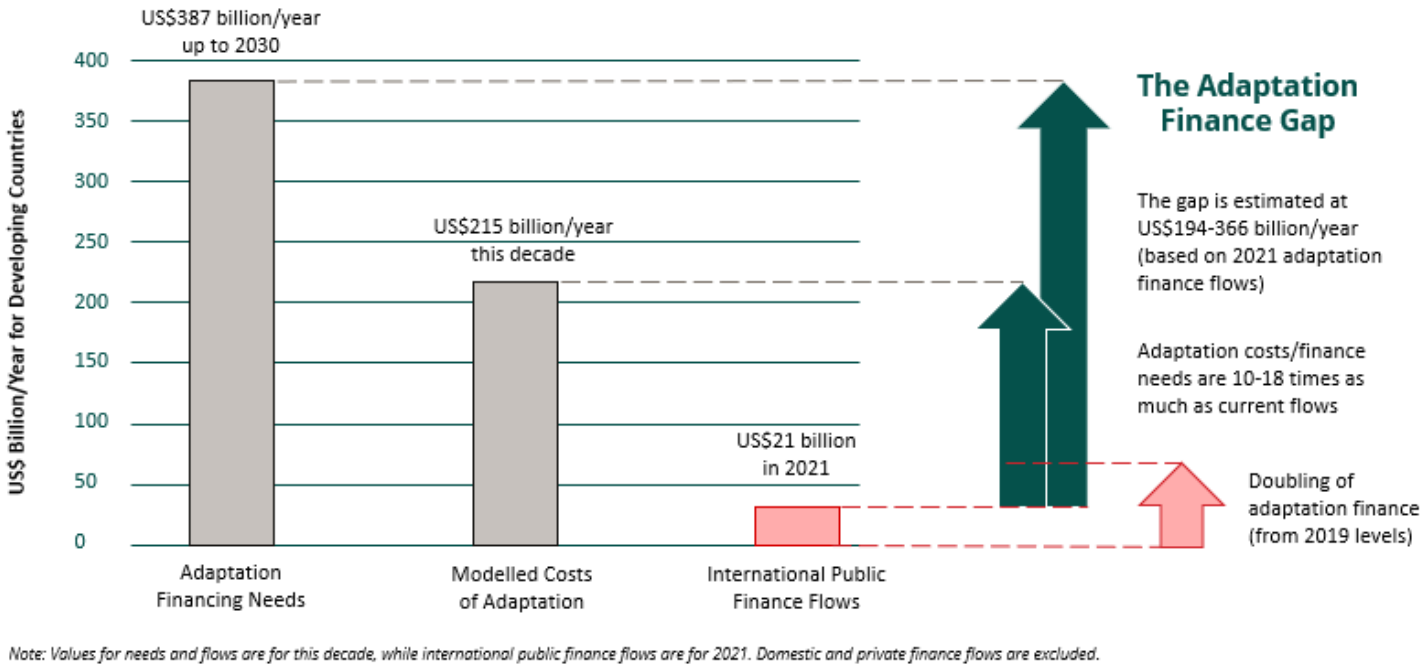


Figure 2: Developing Economies Face the Most Events, Human Casualties and Relative Economic Cost (Source: Greenwheel, 2024; World Meteorological Organisation, 2023).
The information shown above is for illustrative purposes.

The Funding Gap

Governments in the developed world have pledged to provide financial support for adaptation to emerging markets, which should in theory help mitigate the adaptation funding gap. However, **the stated funding goals, let alone actual transfers, are nowhere near enough to keep up with need. If they were, this analysis would not be necessary.**



Note: Values for needs and flows are for this decade, while international public finance flows are for 2021. Domestic and private finance flows are excluded.

*Figure 3: The Adaptation Finance Gap (Source: Greenwheel, 2024; UN, 2023) *Note: Doubling the adaptation finance gap was a commitment of COP26.*
The information shown above is for illustrative purposes.

The UN estimates that the adaptation finance gap now stands at $194 - $366bn p.a., 0.6% -1% of the total GDP of developing countries combined. Meanwhile, only $21 billion was allocated to public adaptation finance flows in 2021.[iii] While imprecise definitions and shifting recognition of adaptation investments may mean that some adaptation investments fall under the radar, the scale of the gap between allocation and need is still huge.

Importantly for investors, these figures are focused on the need to invest in adaptation this decade. This underscores the crucial point that investors often miss: **climate adaptation is an investment theme for today rather than a multi-decadal prospect.**

In the Greenwheel Adaptation Theory of Change, we highlighted evidence that the cost-benefit ratios of investing in adaptation and resilience for companies can be attractive. The UN also highlighted this in their 2023 Global Adaptation Report, citing evidence that every $1bn invested in adaptation against coastal flooding could lead to $14bn reduction in economic damages, while $16bn invested in agriculture per annum could protect 78m people from death and chronic hunger due to climate change.[iv]

We believe that just as the negative consequences of climate change fall disproportionately on emerging markets, so too can the benefits of climate adaptation have an outsized impact in emerging markets with sufficient capacity to support demand for solutions.

The Greenwheel Adaptive Capacity Index (GACI)

We drew on academic, white, and grey literature to identify the key indicators of adaptive capacity, or an economy's ability to adapt to the costly effects of climate change. We then sought out high quality, high coverage, publicly available data to construct an index that represents relative country-level adaptive capacity.

Our commitment to data robustness means not every meaningful indicator of adaptive capacity could be included. As such, **we recommend using this index in conjunction with country-specific investment expertise to fully investigate the adaptation capacity profile of a given country.**

Across a wide-ranging evidence base, we identified three core pillars of adaptive capacity: economic, social, and institutional capacity.

The Role of Economics in Climate Adaptation

The role of economic strength in the face of climate change is intuitive: **adapting to climate change requires expensive investments in infrastructure, technology, and services across the economy.**

A range of academic literature[v], most notably modelling from Halkos et al (2020), identified GDP per capita and public debt as key drivers of climate change vulnerability.[vi] When we explored available data sets, we found high quality GDP data from the World Bank but could not incorporate public debt data due to quality and coverage issues.

In addition, the relative size and importance of the agricultural sector in an economy was identified as a key source of climate vulnerability because climate change is likely to damage crop yields and grazing pastures.[vii] We were able to find high quality data from the Food and Agriculture Organisation of the UN to incorporate into our index.

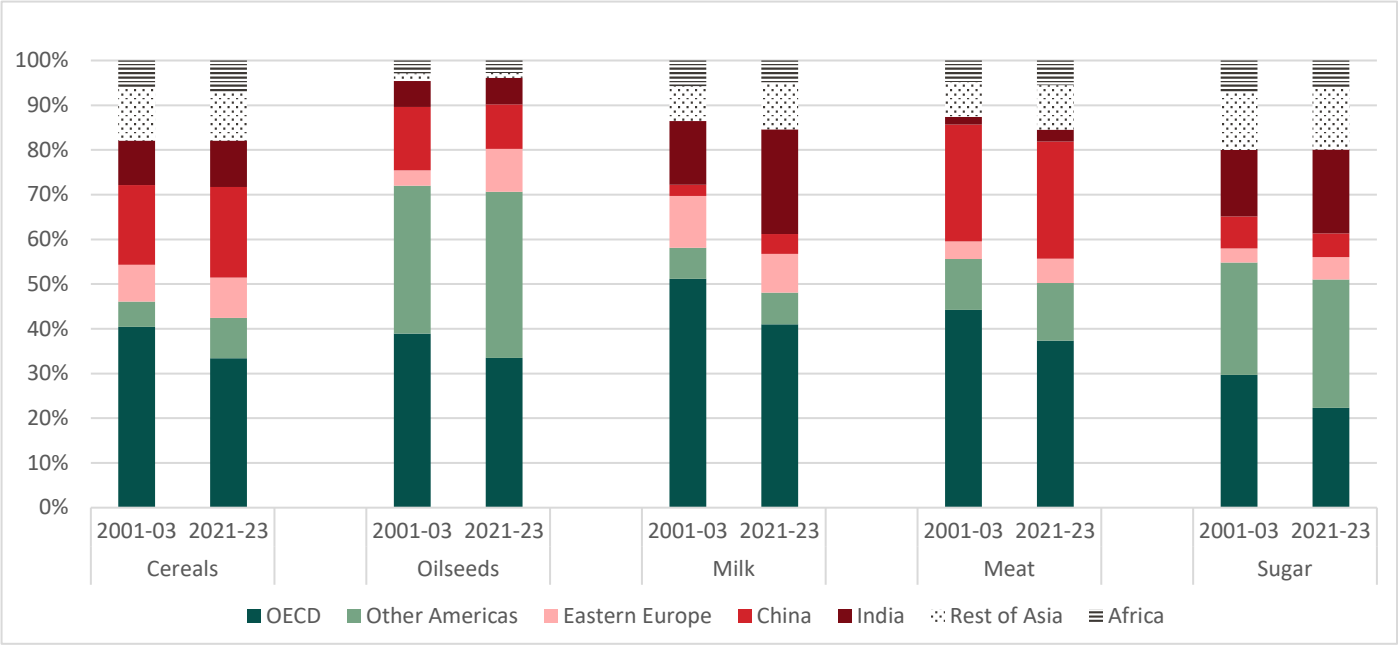


Figure 4: Proportion of Global Production of Agricultural Products (Source: Greenwheel, 2024; OECD/FAO, 2024). The information shown above is for illustrative purposes.

The Role of Institutional Strength in Climate Adaptation

The literature on this topic identified the quality of public institutions and how they interact with the private sector as important factors in determining adaptive capacity. Instability and ineffectiveness emerge as factors that are likely to limit the efficiency of climate change adaptation action.[viii]

The evidence suggests that rule of law potentially supports resilience to climate change by providing the strong regulatory frameworks, predictable application of law, and institutional capacity needed to effectively undertake adaptation action. Further, these traits can encourage foreign investment and influence one's ability to accurately gauge the success of an investment.[ix]

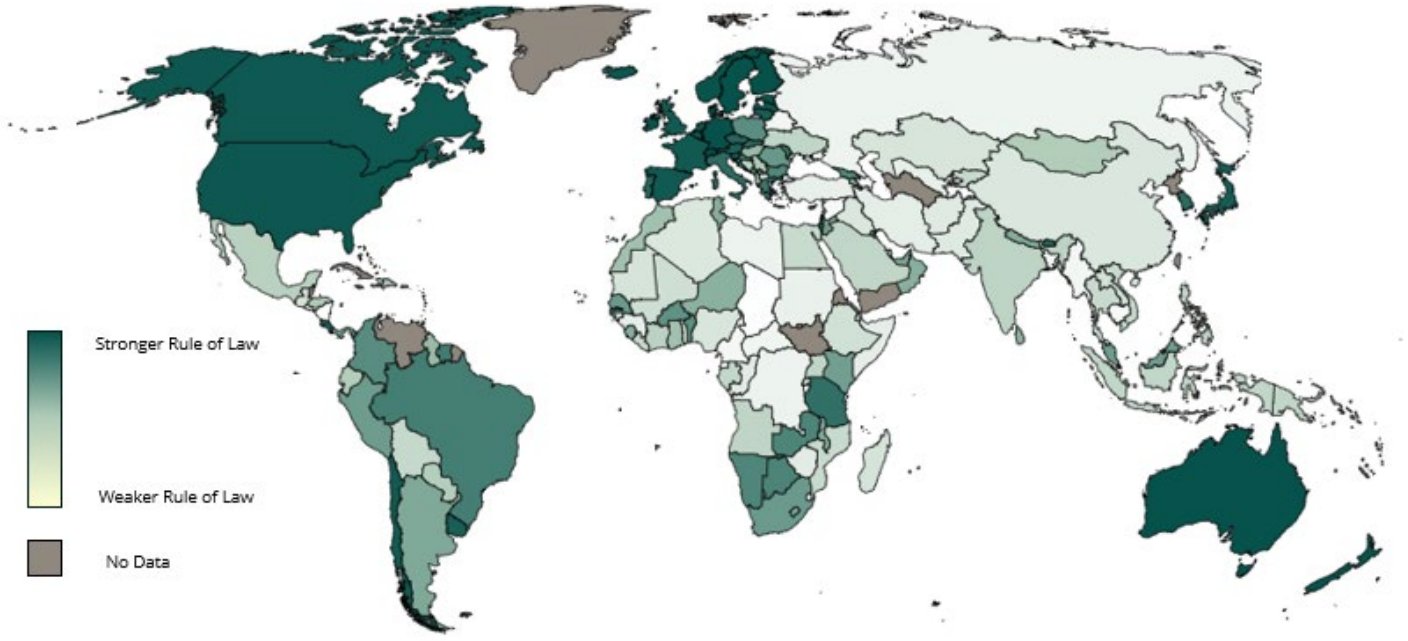


Figure 5: Rule of Law (Source: Greenwheel, 2024; V-Dem, 2024)

The Role of Social Factors in Climate Adaptation

In addition to economic and institutional capacity, social factors are fundamental to a country's ability to adapt to climate change. In particular, our research found that **education and inequality are at the heart of adaptative capacity.**

Education is a useful indicator of adaptive capacity: education levels provide a proxy for the labour force skills base, which is often inversely related to climate sensitive activities like mining, agriculture and low skilled work; education provides a base of human capital for an economy to draw on to find and implement solutions to climate challenges; and education provides individuals with the skills to engage with climate change realities and lobby for change.[x]

Inequality emerges in the literature as a barrier. It reflects and affects the ability of certain communities and stakeholders to access the resources needed to adapt, participate in adaptive processes, and benefit from investment in adaptation. Crucially, the literature emphasizes that adaptive capacity is influenced by both social and economic inequalities: social cohesion is a key enabler of climate action. We chose to incorporate these traits as a single 'exclusion' variable using V-DEM data to capture both socioeconomic and gender-based exclusion.[xi]

An Investor Guide to Using the Greenwheel Adaptive Capacity Index

The GACI is an index of countries that allocates each country with a score between 0 and 100, with higher scores indicating higher adaptive capacity. It is not indicative of a country's need for adaptation: rather, it estimates the ability of a country to adapt to climate change based on its economic, political, and social traits. The next section of this paper will overlay need with this capacity.

Importantly, the GACI is estimating a country's *ability to adapt* to the physical impacts of climate change. It is not measuring the country's *ability to transition* to a new energy complex, i.e. it does not measure how fossil fuel reliant a country is or its ability to switch to more renewable energy sources.

There are two versions of the Index: **the global index covers 169 countries, while the emerging and frontier markets (EMFM) version covers the 63 countries that MSCI classifies as emerging, frontier, or standalone markets.**[xii] These two versions allow investors to explore adaptive capacity through lenses, depending on their investment universe and focus.

Investors can use this index to understand which countries indicate a strong opportunity backdrop for adaptation capacity and which countries may indicate higher need for philanthropic support and/or enhanced due diligence for exposed assets.

What's in the Index?

The GACI breaks indicators empirically linked to adaptive capacity into three structural pillars that form the foundation of the Index.

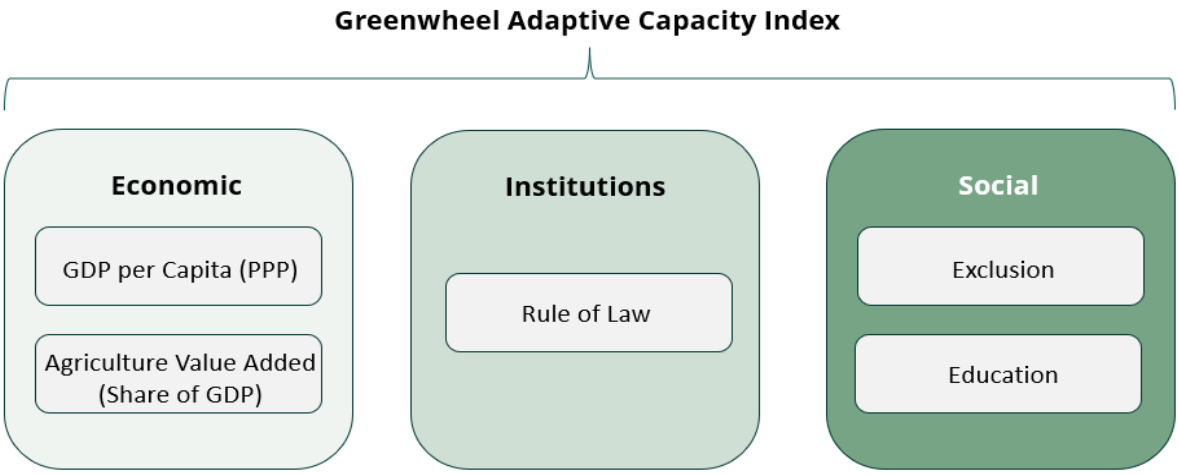


Figure 6: Construction of the Greenwheel Adaptive Capacity Index (Source: Greenwheel, 2024)

The GACI only includes generic indicators of adaptive capacity when there is a clear, literature-backed rationale for doing so and where the quality, timeliness, and coverage of the data is sufficiently high. Therefore, we do not include every possible indicator that is linked to adaptive capacity, particularly those that are relevant for specific hazards or locations.

For example, the GACI does not include infrastructure data nor public debt data. While there is a clear empirical basis for its inclusion, limited country coverage and time series ability, as well as complex statistical methods, mean that the data does not meet our data quality standards at this time. A complete explanation of each indicator and its rationale for inclusion can be found in the Research Appendix, which is available on demand.

The GACI is weighted by pillars: 50% of each country's GACI score out of 100 comes from the economic pillar, with the remaining two pillars accounting for 25% each. This reflects the outsized role that economic strength plays in climate adaptation capacity.

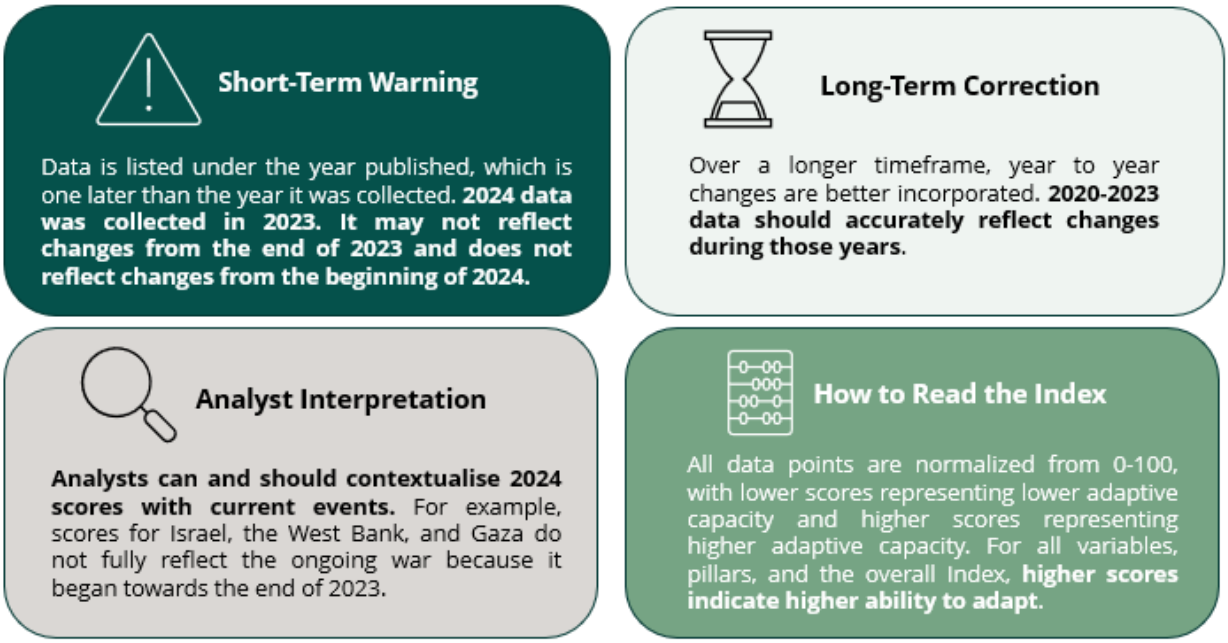


Figure 7: Four Guiding Points (Source: Greenwheel, 2024)

The Greenwheel Adaptive Capacity Index 2024

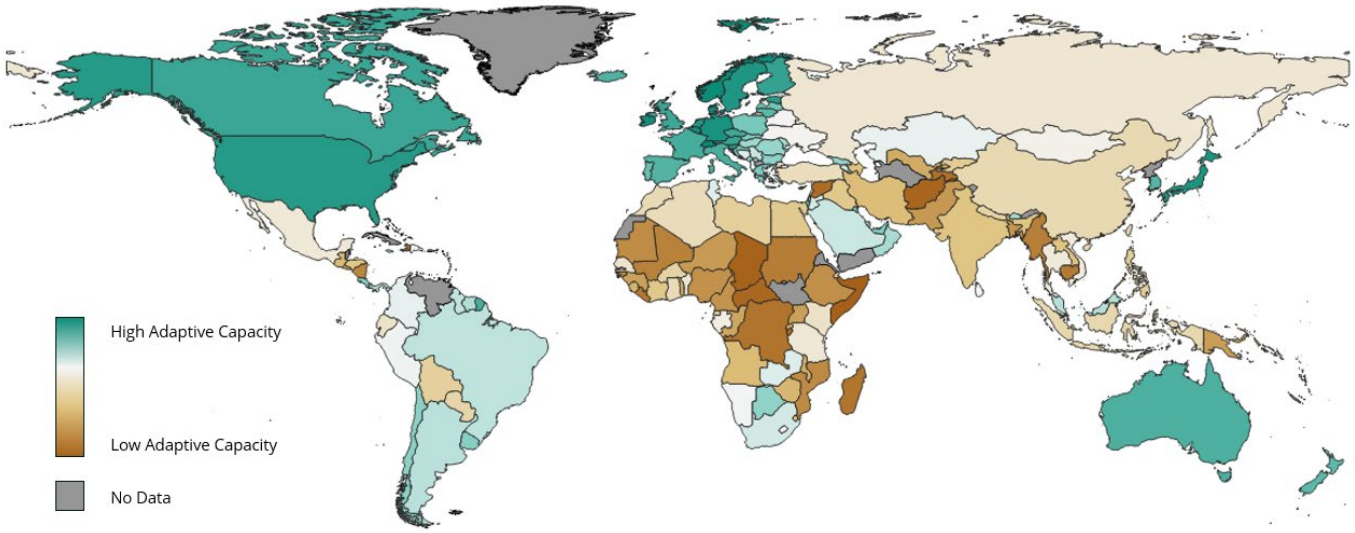


Figure 8: GACI 2024 (Source: Greenwheel, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022)

The results of the global version of the Greenwheel Adaptative Capacity Index highlight the clear advantage that developed markets have in terms of the economic, institutional, and social tools to equip them to adapt to climate change. **Within emerging markets, there is a lot more variation in capacity**, as Figure 1 shows.

This is very much as we expected and indeed is the premise of this research; that **emerging markets have varying levels of capacity to adapt to the extremes that climate change will bring.** For this reason, the EMFM version of the Index allows for clearer analysis of the relative adaptive capacity across EMs.

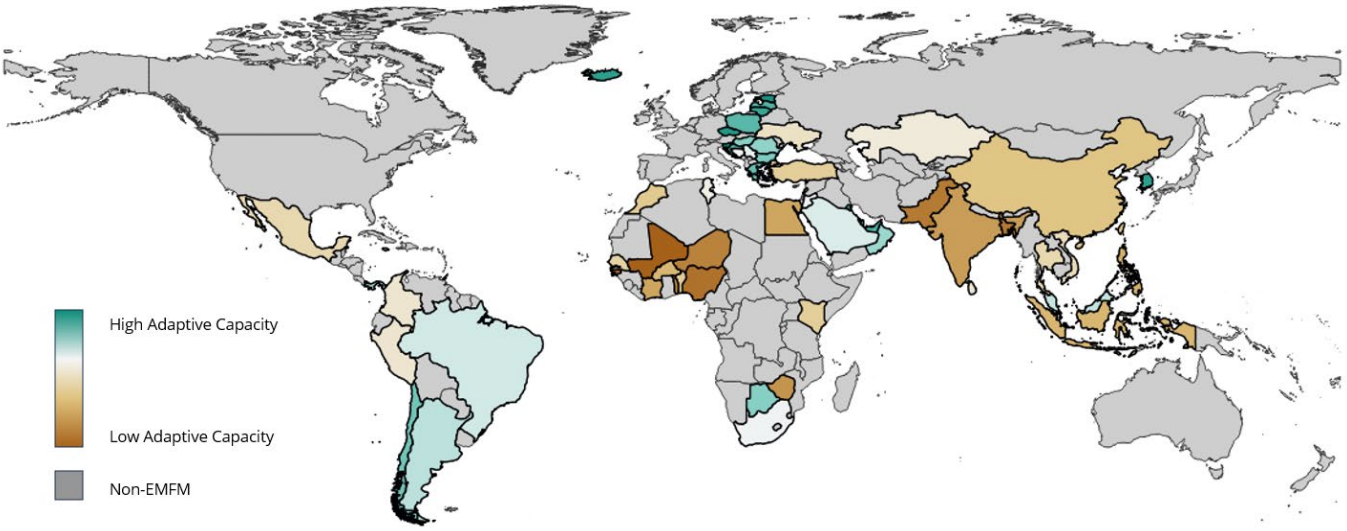


Figure 9: EMFM Adaptative Capacity Index (Source: Greenwheel, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022)

The top end of the EMFM Index is comprised of more developed EMs. This is unsurprising, given the importance of GDP and agricultural exposure in driving adaptive capacity. Malta takes the top spot followed by Eastern European states and stable Middle Eastern states.

Breaking the scores down into the constituent pillars allows us to better understand what is driving adaptive capacity among the top performers. **We see that many of the European countries benefit from strong institutions, likely due to their EU member state status.** Interestingly, Malta is not the top performer in any single category but comes top of the index thanks to solid performance across the three pillars.

Comparatively, **economic strength drives Qatar into the top group. It is the only country in the top fifteen to score below 50 on social and institutional factors.** This emphasizes the outsized role economic strength plays in determining country-level capacity to create demand for climate adaptation solutions: **while social and institutional factors are undoubtedly enablers, economic power is the key driver of adaptive capacity.**

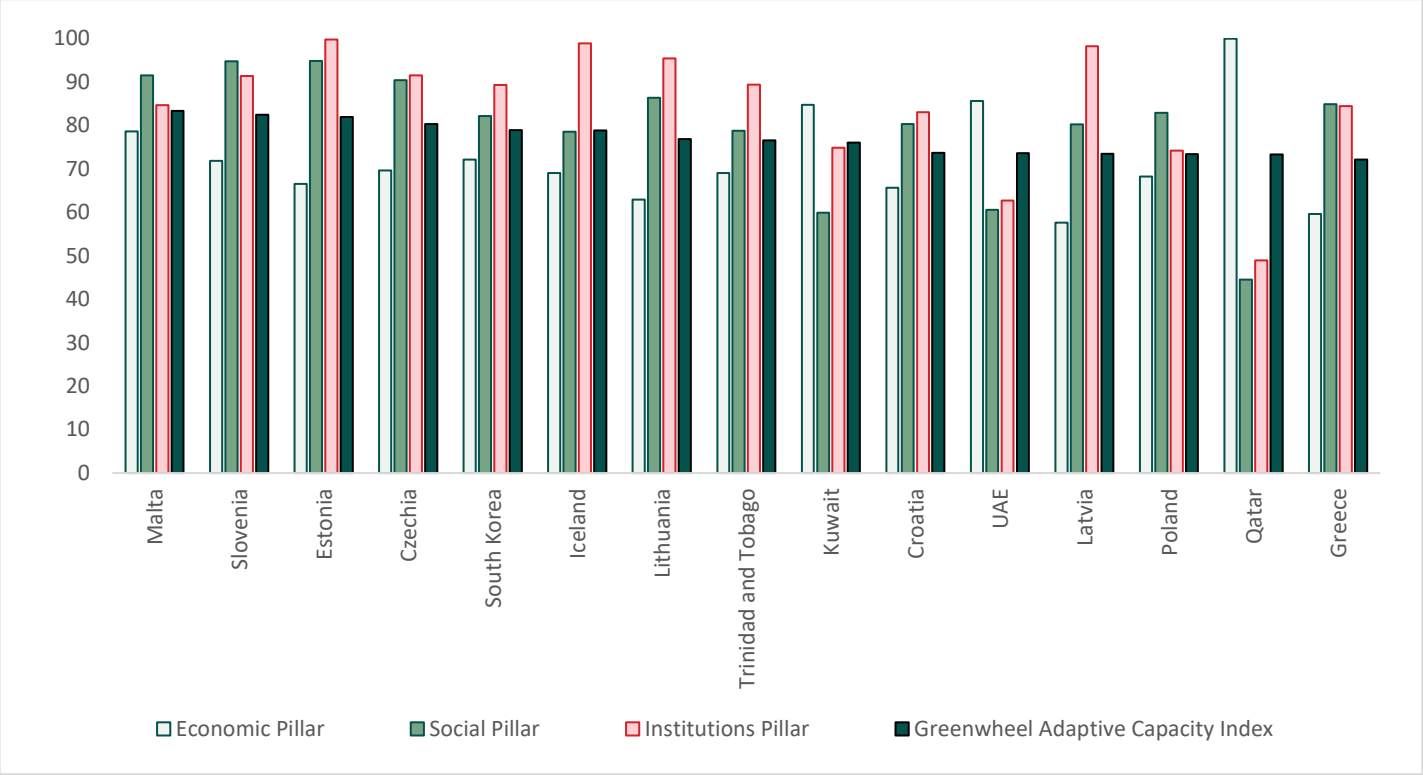


Figure 10: The GACI Top Fifteen (Source: Greenwheel, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022).
The information shown above is for illustrative purposes.

At the bottom end of the Index, we see **countries in West and Northern Africa with Mali taking the bottom spot, alongside South Asian countries. It is particularly notable to see India in the bottom ten, with weak performance across all three pillars.**

It is interesting to see some variation in the lower rankings: Burkina Faso has an unusually high institutions score, as does Niger, while Togo stands out for its social performance. However, for the most part we see a broadly consistent relationship whereby weak economic, institutional, and social factors reinforce one another.

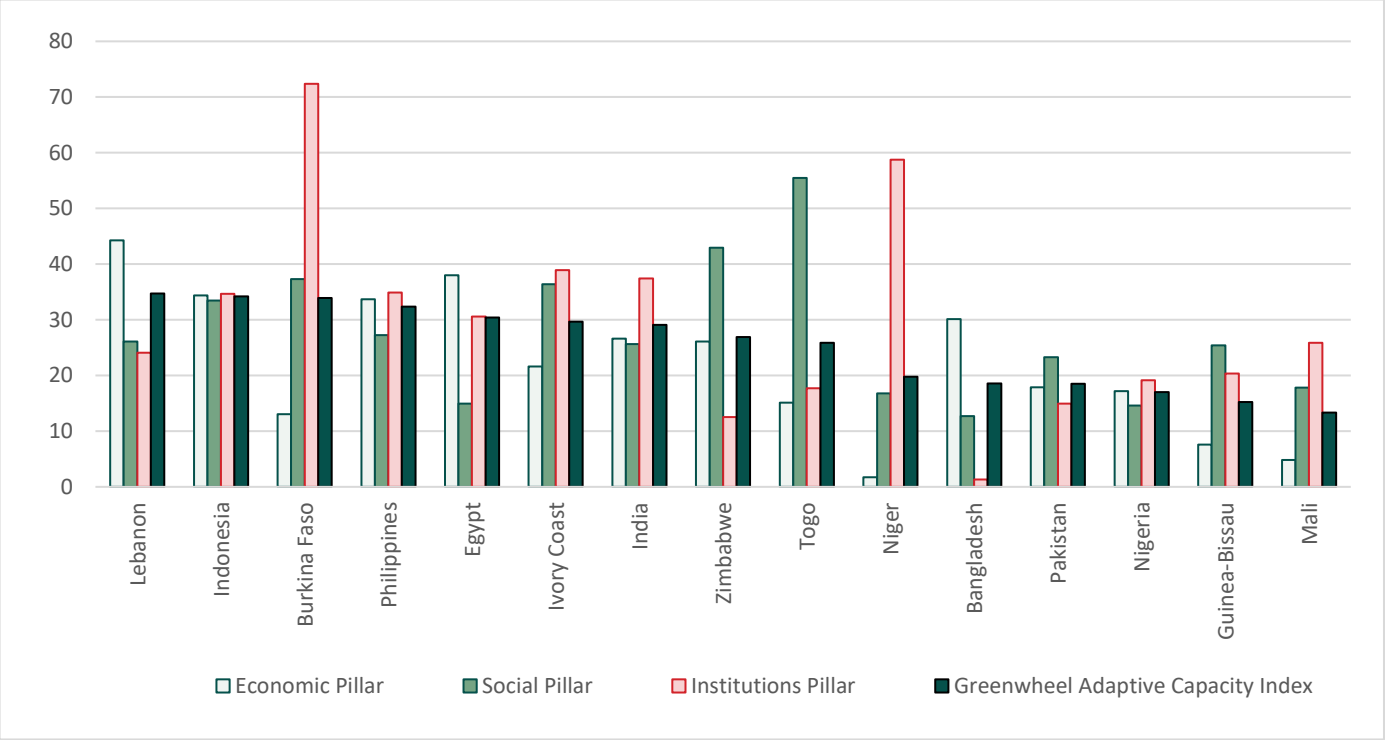


Figure 11: The GACI Bottom Fifteen (Source: Greenwheel, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022).
The information shown above is for illustrative purposes.

Mapping Adaptation Capacity to Adaptation Need

Now that we have a sense of the countries that have the greatest capacity to adapt to the physical effects of climate change – and those that are likely to struggle **– we can investigate the overlap between adaptive capacity and the extent to which it will be needed, i.e. where these physical risks will be felt most.**

This overlap is crucial for investors because it tells us which countries have both the need to adapt and the capacity to do so, indicating potential locations of demand for adaptation solutions. This allows investors to better understand the investment opportunity set for adaptation solutions.

Furthermore, this mapping allows us to identify areas with a high need to adapt to climate change but low capacity to do so. This is important because it **highlights areas where public and philanthropic funds are needed to fill the most severe gaps, as well as where returns-focused investors should consider enhanced due diligence on investee companies** to ensure businesses are managing physical risk exposures in these countries.

To understand these opportunities and gaps, we used data from Probable Futures to assess the physical risks of climate change in a 1.5°C world. We are very close to this temperature threshold, so this data is useful for indicating near term adaptation opportunities and challenges across three climate hazards:

1. **Days Above 32°C Per Year**
2. **Changes in Precipitation**
3. **Months of Drought**

We then overlaid the GACI scores to identify hot spots of opportunities – countries with high need and high capacity to adapt – and gaps – countries with high need but low capacity to adapt. Future research will focus on the specific adaptation solutions opportunities and more in-depth country case studies as well as exploring the opportunities and challenges in an even hotter world.

Adaptation Opportunities and Gaps from Extreme Heat

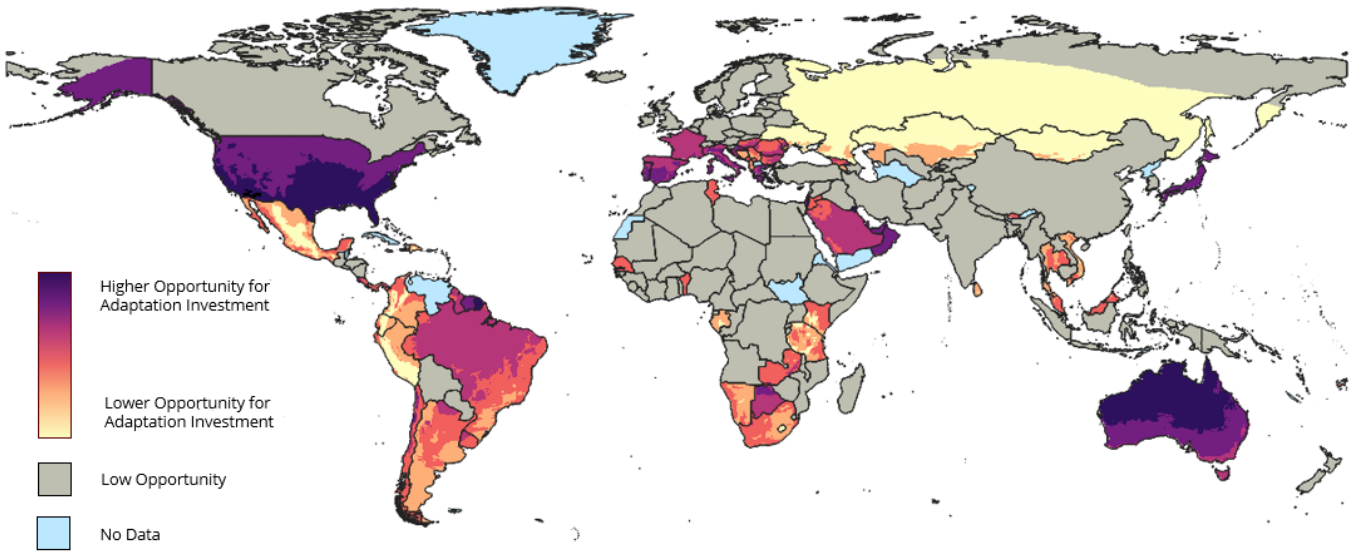


Figure 12: Opportunities to Adapt to Heat in a 1.5°C World (Source: Greenwheel, 2024; Probable Futures, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022). The heat threshold for this analysis was set at 34 days above 32°C in a year. If a whole country has fewer than 34 days above 32°C, it is considered low opportunity and marked in grey. If a country has a GACI score in the lower two quintiles, it is considered low opportunity and is marked in grey.

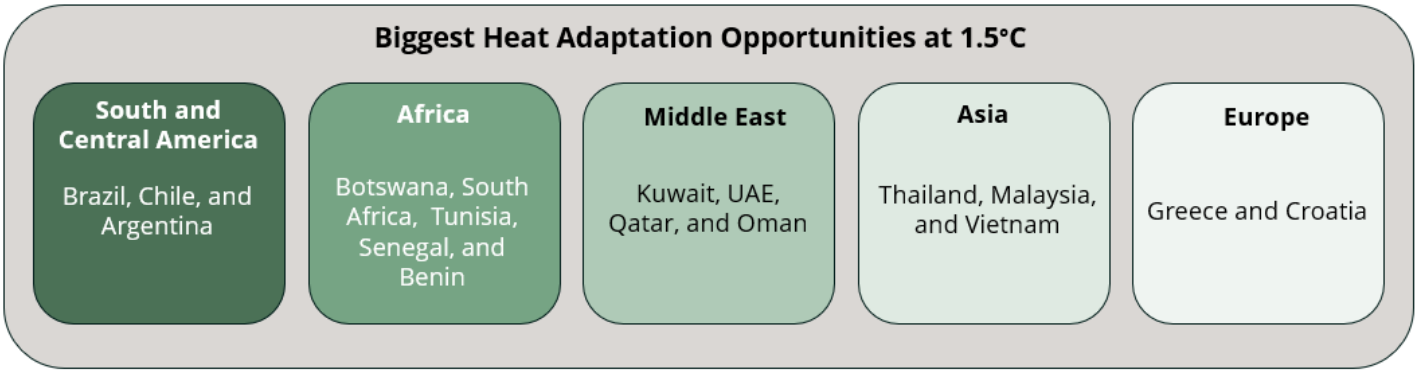


*Figure 13: Biggest Heat Adaptation Opportunities at 1.5°C (Source: Greenwheel, 2024) *Countries highlighted are investible for equity investors based on MSCI EMFM/Standalone index.*

In the case of the Middle Eastern states listed, we believe there has already been substantial investment in adaptation as these countries have developed in desert areas (e.g. extensive air conditioning integration in homes, businesses, etc). This will need to be maintained and enhanced over time, creating opportunities for more efficient and effective heat adaptation solutions in these regions.

Meanwhile, **we believe that the less developed, investible countries in Africa, Asia, and South America highlighted above may present new opportunities as they are likely to increasingly demand heat adaptation solutions**. Uruguay, French Guyana, and Suriname are also well positioned but are not directly investible markets represented in the MSCI EMFM/Standalone index.

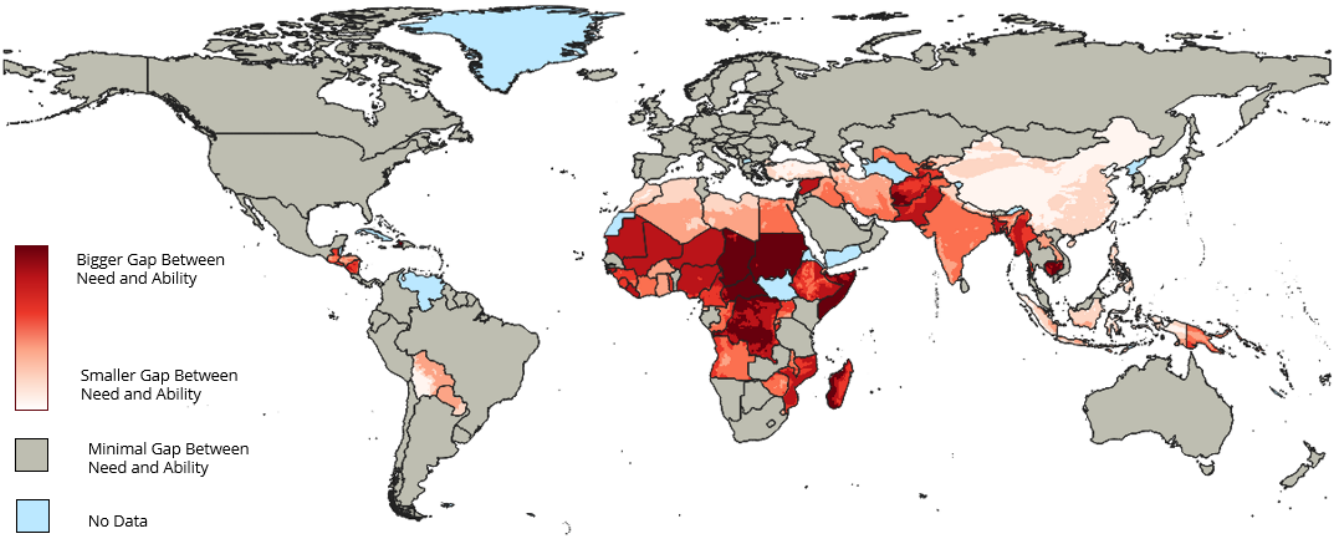


Figure 14: Heat Adaptation Gaps at 1.5°C (Source: Greenwheel, 2024; Probable Futures, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022). The heat threshold for this analysis was set at 34 days above 32°C in a year. If a whole country has fewer than 34 days above 32°C, it is considered low need and marked in grey. If a country has a GACI score in the upper three quintiles, it has the ability to adapt and is marked in grey.

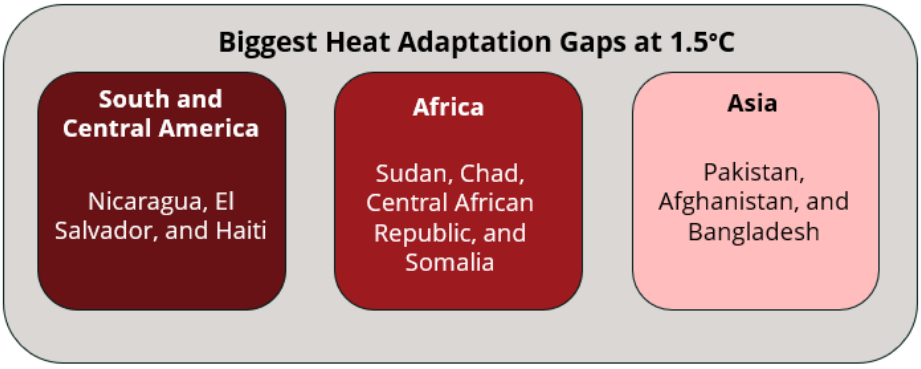


Figure 15: Biggest Heat Adaptation Gaps at 1.5°C (Source: Greenwheel, 2024)

India stands out as particularly concerning for equities investors in this modelling. While it is not the most dire country in our analysis, its importance as an investible market combined with its weak capacity and high climate risk means that investors should engage with investee companies to understand how they are investing in their exposed operations in India to ensure workers and capital assets are safe and productive in extreme temperatures.

For philanthropic investors, sub-Saharan Africa faces the most extreme challenges in terms of heat versus adaptive capacity. These regions need external support to ensure that the populations and economies are supported to survive the new normal in the near term. **Bangladesh and Pakistan also face severe risk with little capacity to adapt, so will need substantial external support in the years ahead.**

Adaptation Opportunity and Gaps from Increased Precipitation

Climate change is not just about heat. Precipitation levels are expected to change across the world, with some areas experiencing dramatic increases or decreases in rainfall. At 1.2°C warming already, many countries are already experiencing these changes.

In this context, we believe that investors should focus on the change in precipitation levels associated with climate change. We measure change in precipitation from a 0.5°C world in our modelling, rather than the absolute level of precipitation. For example, the Brazilian Amazon experiences a significant level of rainfall, but the level of precipitation in this region in a 1.5°C world is unlikely to increase significantly versus 0.5°C.

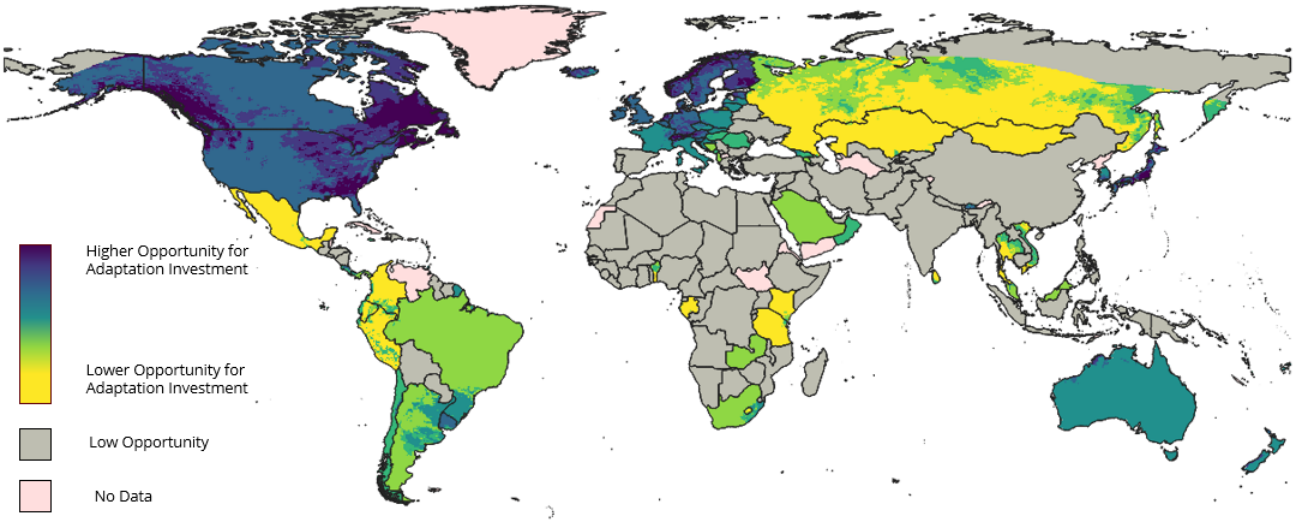


Figure 16: Opportunities to Adapt to Higher Precipitation in a 1.5° World (Source: Greenwheel, 2024; Probable Futures, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022). The precipitation threshold for this analysis was set at an increase of 41 mm of precipitation in a year compared to 1971-2000. If a whole country has an increase of less than 41 mm, it is considered low opportunity and marked in grey. If a country has a GACI score in the lower two quintiles, it is considered low opportunity and is marked in grey.

Unlike in the case of heat, increased precipitation is likely to be a challenge mostly for developed markets, which is not the focus of this research. However, a number of emerging markets stand out as having both high need and high macro capacity to adapt to increased precipitation in a 1.5° world:

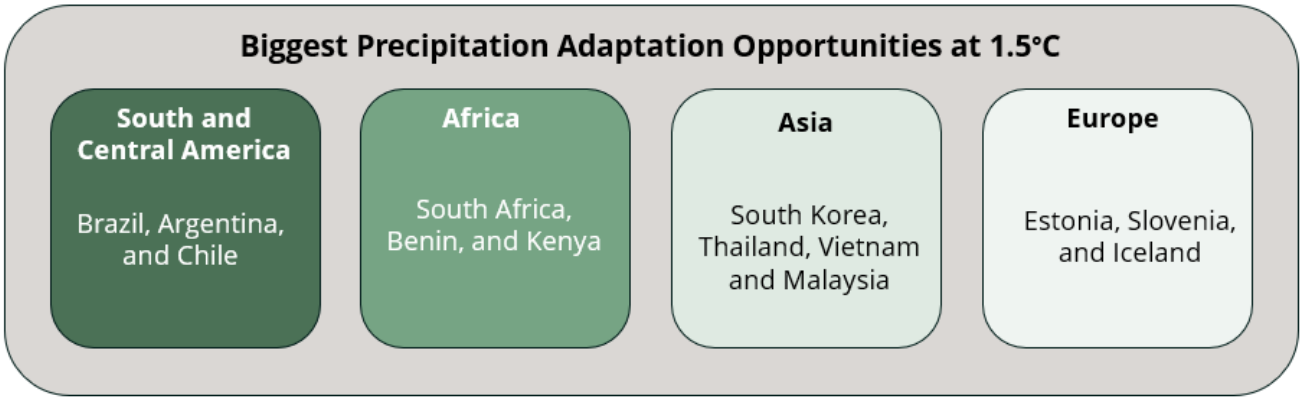


*Figure 17: Biggest Precipitation Adaptation Opportunities at 1.5°C (Source: Greenwheel, 2024) *Countries highlighted are investible for equity investors based on MSCI EMFM/Standalone index.*

Many of these countries are already experiencing increased levels of precipitation, making this a **useful indicator of near-term opportunities for investment into products and services that address flood risk, like monitoring technology and defenses, as well as water management.**

We believe that the less developed countries in South and Central America, Africa, and Asia presented above offer new adaptation investment opportunities. Many of these countries are reliant

on water-intensive sectors such as agriculture and mining, which are likely to be a source of demand for water adaptation solutions.

There are also many countries with a high need and low ability to adapt to increased precipitation in a 1.5° world.

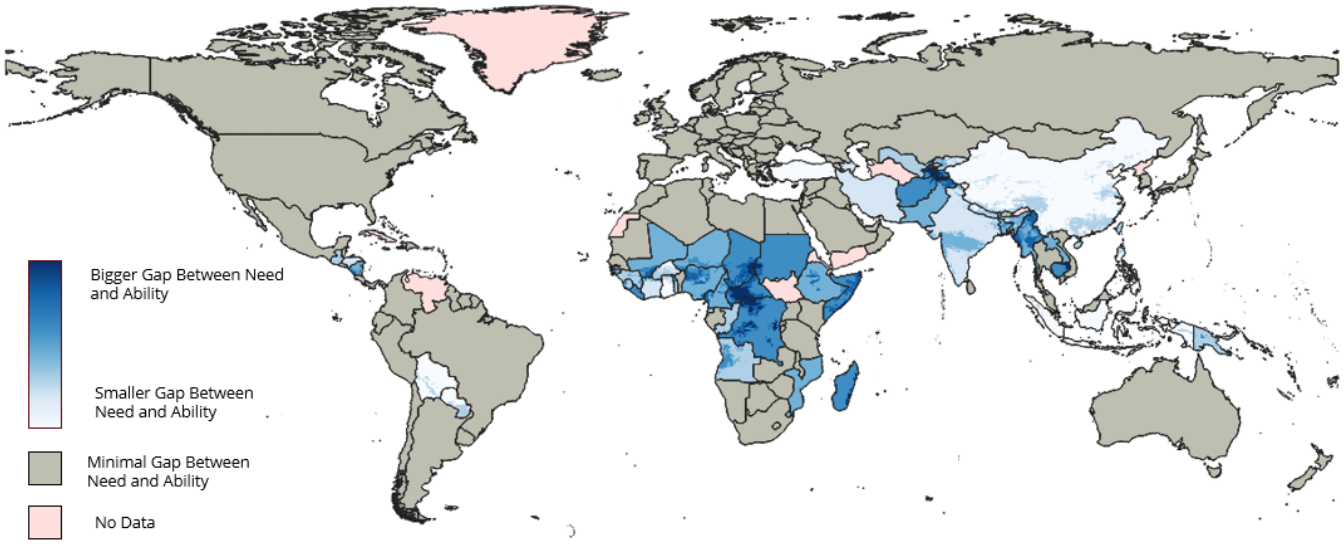


Figure 18: Precipitation Adaptation Gaps at 1.5°C (Source: Greenwheel, 2024; Probable Futures, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022). The precipitation threshold for this analysis was set at an increase of 41 mm of precipitation in a year compared to 1971-2000. If a whole country has an increase of less than 41 mm, it is considered low need and is marked in grey. If a country has a GACI score in the upper three quintiles, it has the ability to adapt and is marked in grey.

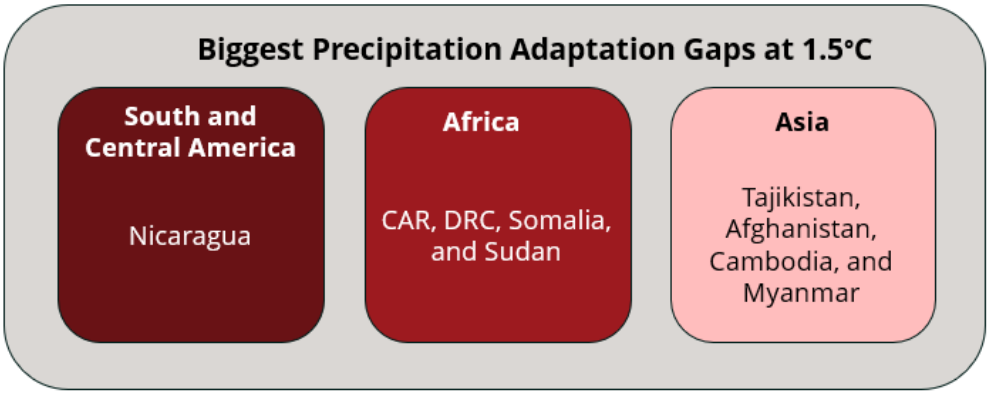


Figure 19: Biggest Precipitation Adaptation Gaps at 1.5°C (Source: Greenwheel, 2024)

Many of these countries are very reliant on agriculture, a sector that is highly exposed to changing precipitation levels. Additionally, **many of the farmers in these countries are more vulnerable** to changing precipitation levels than farmers in developed countries, who generally have easier access to insurance, irrigation technologies, and crop-protecting chemicals and fertilisers.

While we often think of precipitation risk in terms of drought, sudden increases in precipitation can also be harmful. For example, **higher than normal precipitation can lead to flooding and create a 'vicious cycle' where infrastructure damage, decreased crop yields, and mass displacements can lead to weaker economic performance, which further limits adaptive capacity.**

Philanthropic investments in these places could run the gamut from affordable parametric crop insurance for farmers to water infrastructure and flood control, all of which can help communities adapt to higher precipitation levels.

Adaptation Opportunities and Gaps from Drought

Drought is often an unnoticed disaster that does not attract the same media, public, and political responses as other climate hazards. Drought has significant negative consequences on both agriculture-dependent regions and global food supply chains.[xiii]

Products and services that provide drought adaptation solutions often revolve around water and agriculture. For example, **drought-resistant seed technologies, efficient irrigation systems, water infrastructure projects, and water quality and quantity monitoring technologies can all provide exposure to drought adaptation investment.**

Unlike the precipitation data, this analysis does not focus on change: we focus on countries with a high likelihood of drought, which we define as roughly 3.5 months a year.

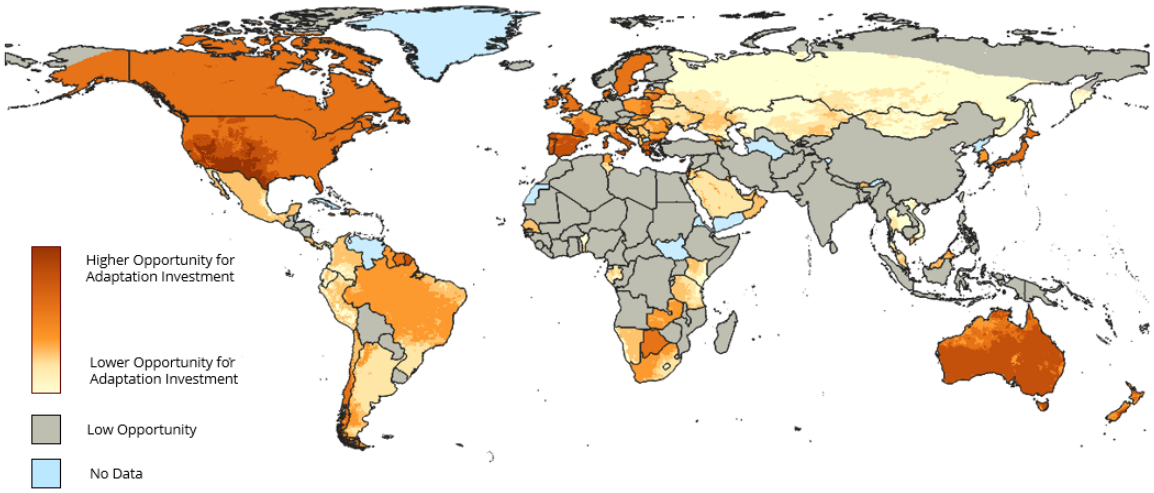


Figure 20: Opportunities to Adapt to Drought in a 1.5° World (Source: Greenwheel, 2024; Probable Futures, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022). The drought threshold for this analysis was set at 28% of the year under drought conditions. If a whole country is in drought for less than 28% of the year, it is considered low opportunity and is marked in grey. If a country has a GACI score in the lower two quintiles, it is considered low opportunity and is marked in grey.

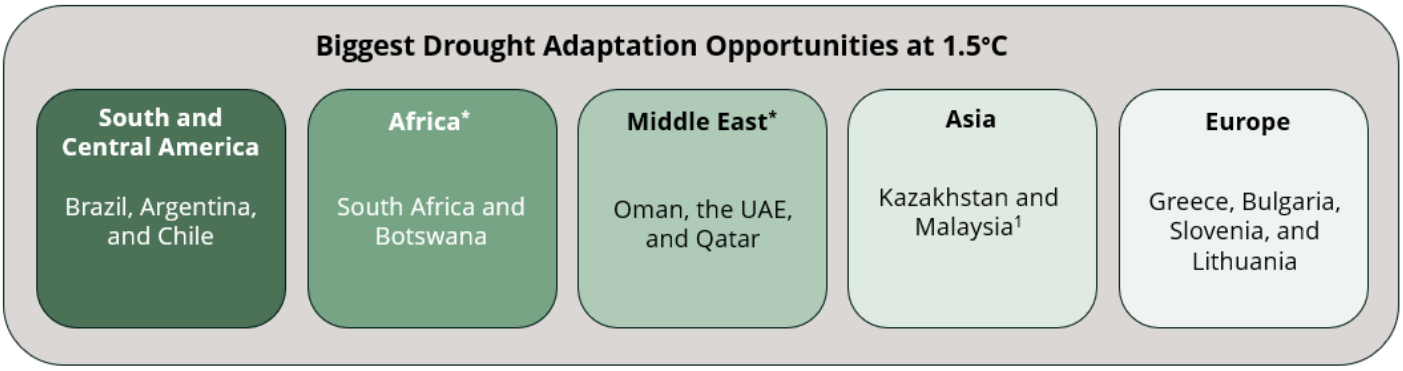


*Figure 21: Biggest Drought Adaptation Opportunities at 1.5°C (Source: Greenwheel, 2024) *Countries highlighted are investible for equity investors based on MSCI EMFM/Standalone index.*

Many of these countries are already experiencing more frequent, longer droughts as we approach 1.5°C.[xiv] As with heat, the wealthier Gulf states have already seen substantial investment in products and services to reduce the impact of drought.

Water scarcity is not a new issue in this region: the Middle East is one of the most water-scarce regions in the world and over 60% of the region's GDP is generated in high to very high surface water stress areas.[xv]

Gulf states have a long history of using unconventional water resources, like wastewater recycling and desalination. Similarly, EU member states look set to continue to benefit from supportive policy and public investment in drought-related infrastructure.[xvi] Thus, the investment opportunity in these regions is in **maintaining and improving existing practices, as well as innovative products and services that deliver new water solutions.**

The less developed investible Asian, African, and South and Central American countries in the list are likely to be sources of new, increasing demand for drought adaptation solutions.

There are also many countries with a high need and low ability to adapt to increased likelihood of drought in a 1.5°C world.

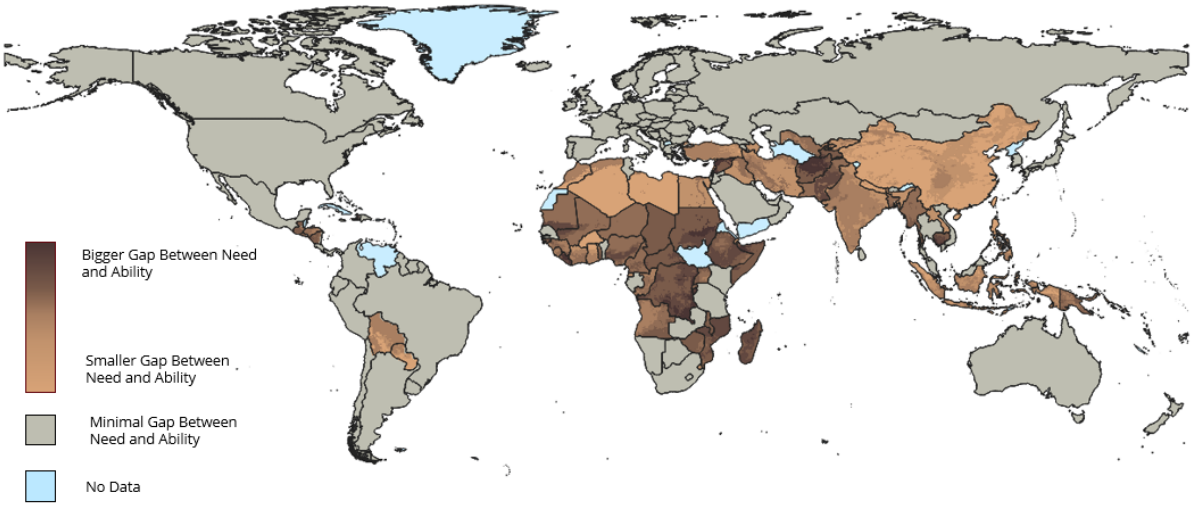


Figure 22: Drought Adaptation Gaps at 1.5°C (Source: Greenwheel, 2024; Probable Futures, 2024; V-Dem, 2024; World Bank, 2023; FAOSTAT, 2022). The drought threshold for this analysis was set at 28% of the year under drought conditions. If a whole country is in drought for less than 28% of the year, it is considered low opportunity and is marked in grey. If a country has a GACI score in the lower two quintiles, it is considered low opportunity and is marked in grey.

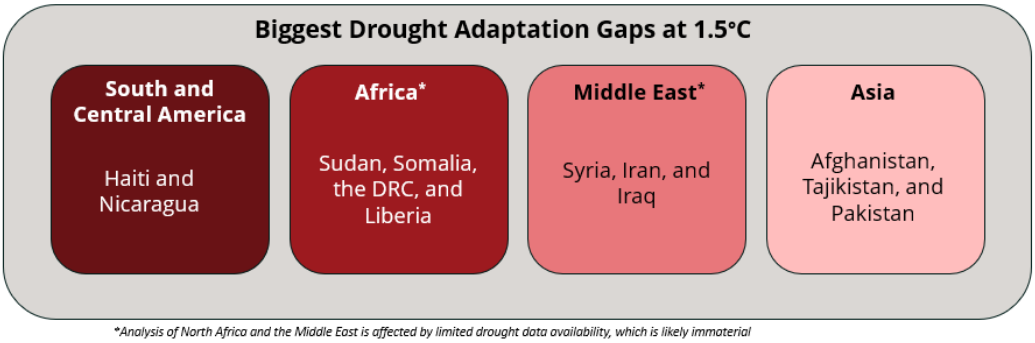


Figure 23: Biggest Drought Adaptation Gaps at 1.5°C (Source: Greenwheel, 2024)

These states have limited adaptive capacity and are likely to struggle to support the adaptation investment needed at a large scale. **Where corporate supply chains rely on these countries, engagement and due diligence processes can help investors understand how investee companies are keeping workers and capital assets safe and productive despite water scarcity.**

Many of these countries are currently in conflict or extremely fragile, threats that compound the impacts of drought on the people and communities who call these countries home.[xvii] In the Middle East and North Africa, historic improvements to water supply and sanitation have been reversed by conflict, while conflict and a historic four-year drought in the Horn of Africa has led to a humanitarian crisis.[xviii]

This intersection leads to mass displacement, food insecurity, and economic upheaval, which further weakens adaptive capacity in the very countries that most need to adapt. In these countries, philanthropic support is often focused on immediate needs like food, sanitation, and medical care.

In some cases, philanthropic investors, NGOs, and other organisations can provide much-needed stability, expertise, and capital to help these communities adapt to droughts while also addressing their present needs. Philanthropic support for drought-resistant seeds, systems that monitor water quality and supply, and efficient irrigation methods can drive resilient livelihoods for people most affected by drought.

Conclusion

This first edition of our Climate Adaptation in Emerging Markets series highlights that countries vary substantially on their exposure to, and capacity to cope with, the physical risks of climate change.

Our analysis finds:

1. **Brazil, Chile, Argentina, South Africa, Botswana, Malaysia, Slovenia, and Greece** stand out among investible EMs for their high need and high ability to adapt to the increasing heat, drought and/or precipitation they face in a 1.5°C world.

2. **The UAE, Saudi Arabia, and Qatar** do similarly well in our analysis, but have already adapted to pre-existing desert conditions so **efficiency and efficacy gains** in technology are the more likely areas of opportunity in these countries.

3. **India flashes red** because it already faces extreme heat and weather that will only worsen and has weak macro capacity to adapt. **Investors should engage companies with operational exposure to ensure adequate physical risk planning.**

4. **Sub-Saharan African countries need the most substantial support** from philanthropic sources to deal with even hotter, dryer days. at 1.5°C.

Future editions in this series will focus on each specific physical risk tackled in this modelling – heat, increased precipitation, and drought – to drill down into country and region-specific opportunities and the technologies emerging in these spaces to support adaptation.

We will also extend the mapping analysis to identify the opportunities and risks for emerging markets in a world of more extreme climate change.

Endnotes

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[i] WMO, 2023
[ii] WMO, 2023
[iii] UN Adaptation Gap Report 2023
[iv] UN Adaptation Gap Report 2023
[v] Fussel, 2010; Adger et al, 2004; Benzie and Lager, 2022; Brooks, Adger, and Kelly, 2005
[vi] A Hierarchical Multilevel Approach in Assessing
Factors Explaining Country-Level Climate
Change Vulnerability
[vii] Fussel, 2010; Gyimah et al, 2024; ND-GAIN, 2023; Brooks, Adger, and Kelly, 2005
[viii] A Hierarchical Multilevel Approach in Assessing
Factors Explaining Country-Level Climate
Change Vulnerability
[ix] ND-GAIN, 2023; Adger et al, 2004; Wenta, McDonald, and McGee, 2018; Ebbesson, 2009; IDLO, 2021; Brooks, Adger, and Kelly, 2005; Lee, Scotford, and Vaughan, 2021
[x] Barnes et al, 2020; Defiesta and Rapera, 2014; Adger et al, 2004; Juhola and Kruse, 2015; Brooks and Adger, n.d.; Siders, 2019; IPCC AR4, 2007
[xi] Adger et al, 2004; Blaikie et al, 1994; Twigg, 2001; UNDP, n.d.; Tamasiga et al, 2024
[xii] MSCI, 2024
[xiii] GLOBAL DROUGHT SNAPSHOT 2023 | The need for proactive action (unccd.int)
[xiv] World 'at a crossroads' as droughts increase nearly a third in a generation | UN News
[xv] Beyond Scarcity (worldbank.org)
[xvi] Greece: €160 million EIB and CEB financing for vital water irrigation investment helps protect key farming area in Crete
[xvii] Beyond Scarcity (worldbank.org)
[xviii] who-ghoa-phsa-090724.pdf; Beyond Scarcity (worldbank.org)

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invest@redwheel.com | www.redwheel.com

Redwheel London
Verde
10 Bressenden Place
London SW1E 5DH
+4420 72276000

Redwheel Europe
Fondsmæglerselskab A/S,
Havnegade 39, 1058
København K, Denmark

Redwheel Miami
2640 South Bayshore Drive
Suite 201
Miami
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