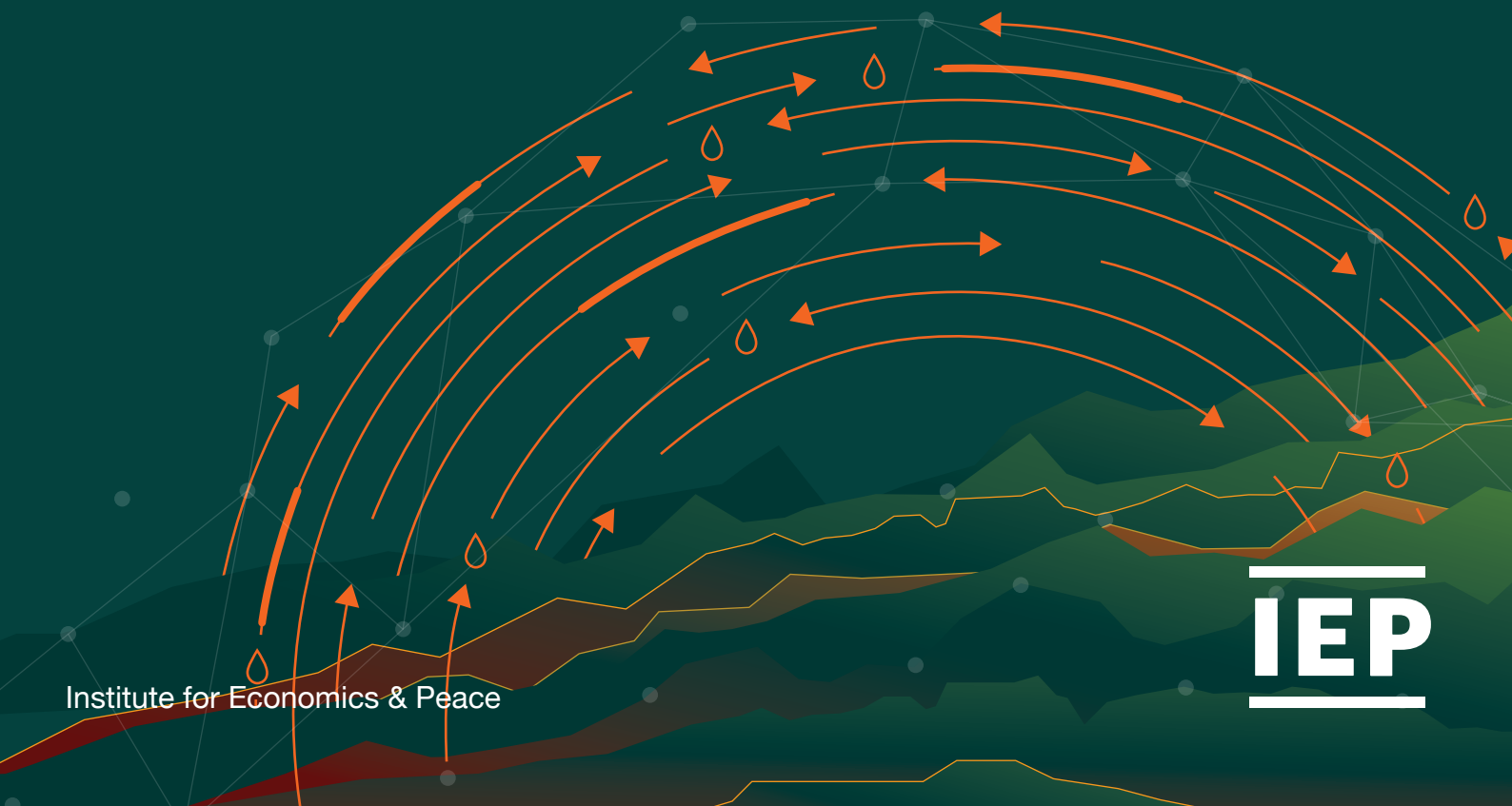
ECOLOGICAL THREAT REGISTER 2020

UNDERSTANDING ECOLOGICAL THREATS, RESILIENCE AND PEACE



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Contents

EXECUTIVE SUMMARY

This is the inaugural edition of the Ecological Threat Register (ETR), which covers 157 independent states and territories. Produced by the Institute for Economics and Peace (IEP), the ETR measures ecological threats that countries are currently facing and provides projections to 2050. The ETR is unique in that it combines measures of resilience with the most comprehensive ecological data available to shed light on the countries least likely to cope with extreme ecological shocks, now and into the future.

The ETR includes: population growth, water stress, food insecurity, droughts, floods, cyclones and rising temperature and sea levels. In addition, the report uses IEP's Positive Peace framework to identify areas where resilience is unlikely to be strong enough to adapt or cope with these future shocks. The ETR clusters threats into two major domains: *resource scarcity* and *natural disasters*. The resource scarcity domain includes *food insecurity, water scarcity* and *high population growth*. The natural disaster domain measures the threat of *floods, droughts, cyclones, sea level rise* and *rising temperatures*.

The ETR identifies three clusters of ecological hotspots, which are particularly susceptible to collapse:

- The Sahel-Horn belt of Africa, from Mauritania to Somalia;
- The Southern African belt, from Angola to Madagascar;
- The Middle East and Central Asian belt, from Syria to Pakistan.

Within these hotspots the most fragile countries will include Iran, Mozambique, Madagascar, Pakistan and Kenya. These countries are broadly stable now but have high exposure to ecological threats and low and deteriorating Positive Peace, which means they are at a higher risk of future collapse. In addition, Syria, Afghanistan, Iraq, Yemen and Central African Republic, are already suffering from ongoing conflicts and are also highly exposed to ecological threats. This group of countries are already trapped in a vicious cycle where competition for scarce resources creates conflict and conflict in turn leads to further resource depletion. The world's least resilient countries, when faced with ecological breakdowns, are more likely to experience civil unrest, political instability, social fragmentation and economic collapse.

High resilience regions, such as Europe and North America, have superior coping capacities to mitigate the effects of these ecological threats, however, they will not be immune from spill over effects, such as large flows of refugees. The refugee crisis of 2015 highlights that even relatively small numbers of refugees, equivalent to half a per cent of Europe's population, can cause considerable unrest and shift political systems.

The ETR results show that 141 countries are exposed to at least one ecological threat between now and 2050. The 19 countries with the highest number of threats have a population of 2.1 billion people. These countries face four to six ecological threats and more than half are among the 40 least peaceful nations. The three countries with the highest exposure to ecological shocks are Afghanistan, which is facing six ecological threats and Mozambique and Namibia, which are each facing five. Another 16 countries are facing four ecological threats.

Approximately one billion people live in countries that do not have the resilience to deal with the ecological changes they are expected to face between now and 2050. Not all of these people will be displaced, however it is likely that a large number of them will be. Pakistan, with 220 million people is the country with the largest number of people at risk, followed by Iran with 84 million people at risk. In such circumstances, even small events could spiral into instability and violence leading to mass population displacement, which in turn would have negative implications for regional and global security.

Ecological threats in many cases lead to humanitarian emergencies. Currently, more than two billion people globally face uncertain access to sufficient food for a healthy life. This number is likely to increase to 3.5 billion by 2050. Both hunger and food insecurity have increased since 2014, with an additional 300 million people now facing food insecurity. The global demand for food is projected to increase by 50 per cent by 2050, which means that without a substantial increase in supply, many more people will be at risk of hunger and food insecurity. Even with increased food production, it is not clear that this will provide those most in need with more food as the increased demand will come from the rising middle class of Asia. The COVID-19 pandemic is also predicted to negatively impact global food security and has not been factored into this analysis.

The world's least peaceful countries are amongst the countries with the highest levels of food insecurity. Yemen is a testament to this with the largest number of

people facing starvation in 2020. In addition, 65 per cent of people in countries with low peace and low income experience an inability to afford adequate food at all times. Among the OECD countries, 16 per cent of the people cannot afford food at all the times, while 2.7 per cent are considered undernourished. This highlights the fact that people even in the richest countries are at risk of food insecurity.

Regionally, more than half of the population in sub-Saharan Africa and one third of the population in South Asia, Latin America and the Caribbean and the Middle East and North Africa are facing moderate to severe food insecurity. Currently 18 of the 20 most food insecure countries are located in sub-Saharan Africa. The five most food insecure countries are Sierra Leone, Liberia, Niger, Malawi and Lesotho, where more than half of the population experience severe food insecurity.

The demand for water is projected to reach crisis levels for some regions over the next few decades. The ETR shows that over a third of countries will experience high or extreme levels of water stress by 2040, meaning that more than half of the available water is being used every year. Water use has increased by one per cent per year for the last four decades and the rise in demand is expected to increase unabated. In 2019 four billion people experienced severe water scarcity for at least one month of the year. Severe water stress is where 40 per cent or more of the available water is used.

While population growth has declined from its heights in 1960s, it is still high in many parts of the world. By 2050, the global population is projected to reach nearly ten billion people. However, the increase in population will be unevenly spread. In the most developed countries it is projected to fall by two per cent on average by 2050, with Japan having the largest fall of ten per cent. There are 17 countries whose population will more than double. Niger is likely to have the largest increase of 171 per cent. Many of these countries are already highly vulnerable. It is estimated that 1.4 billion more people will reside in the 40 least peaceful countries.

Flooding has been the most common natural disaster since 1990. From 1990 to 2019, a total of 9,924 natural disasters occurred globally, of which 42 per cent were floods. The next largest category, storm events, which include cyclones, hurricanes, tornadoes, blizzards and dust storms made up 30 per cent of the total events.

The Asia-Pacific region was exposed to the largest number of natural disasters with 2,845 events recorded since 1990. Two-thirds of natural disasters in the region were either floods or storms with China, Philippines, Indonesia, Japan and Vietnam being the most affected countries. Europe had the second highest number of natural disasters, with 1,324 incidents between 1990 and 2019. France, Italy, Turkey, Romania and the UK have experienced the highest number of incidents in Europe, accounting for a third of the regional total between them.

Ecological disasters displace an average of 24 million people per year with an additional seven million displaced by armed conflict. However, the rate is likely to increase. The majority of these people will be displaced within their country or into neighbouring regions. However, UNHCR estimates show that at least one in five people move beyond their country or region. Population displacement due to ecological threats and climate change could regularly surpass the European migration crisis of 2015.

Although data on Official Development Assistance (ODA) is available, there is currently no publicly available database which tracks funding from International Non-Governmental Organizations (INGOs) and International Financial Institutions (IFIs) for projects that aim to build resilience to ecological threats and climate change. Without adequate tracking, it will not be possible to know whether the appropriate resources are being applied to solve the world's sustainability issues.

Overall, the ETR shows that ecological threats and climate change pose serious challenges to global development and peacefulness. The adverse impacts will disproportionately affect the world's poorest and most vulnerable and create spill over pressures on neighbouring countries through mass movements of people. Building resilience to ecological threats will increasingly become more important and will require substantial investment today.

KEY FINDINGS

SECTION 1: ECOLOGICAL THREAT REGISTER

- One hundred and forty-one countries are exposed to at least one ecological threat, with 19 countries facing four or more threats.
- 6.4 billion people live in countries which are exposed to medium to high ecological threats.
- Of the 157 countries covered in the ETR, 34 per cent will face catastrophic water stress and 22 per cent catastrophic food insecurity by 2050. A catastrophic threat would result in substantial displacement of people or substantial increase in undernourishment.
- An estimated 1.2 billion people are at risk of displacement by 2050.
- Flooding is the most common ecological threat affecting 60 per cent of the countries covered in the report, followed by water stress, which will impact 43 per cent of the countries by 2050.
- Ten of the 19 countries with the highest exposure to ecological threats are among the 40 least peaceful nations on the Global Peace Index.
- Sub-Saharan Africa, South Asia and the Middle East and North Africa are the regions facing the largest number of ecological threats. Two regions of sub-Saharan Africa have the highest risk, the Sahel and the band from Angola to Mozambique.
- The majority of countries in sub-Saharan Africa, 33 out of 43, are exposed to medium to high level ecological threats.
- Water stress poses a large risk in the Middle East and North Africa, with 18 of the 20 countries experiencing high levels of water stress. The projections indicate the situation to worsen over the next two decades.
- The majority of the countries in Europe and South America will face lower levels of ecological threats, because of low population growth.

SECTION 2: RESOURCE SCARCITY, PEACE AND CONFLICT

- The global population is projected to reach ten billion by 2050.
- The majority of the population growth will continue to take place in the world's least peaceful countries. The global population is projected to grow by 35 per cent by 2050 in the least peaceful countries compared to a two per cent decline in the most peaceful.
- By 2050, the 40 least peaceful countries will have an additional 1.3 billion people and will be home to more than half of the world's population.
- Sub-Saharan Africa is vulnerable due to rapid population growth, with 14 countries projected to double their population by 2050.
- By 2050, 80 per cent of the world's population will live in countries which are in the bottom half of the Global Peace Index rankings.
- It is estimated that an additional 1.5 billion people could suffer from food insecurity by 2050, totalling 3.5 billion people.

FOOD SECURITY

- By 2050, estimates indicate that the global demand for food will increase by 50 per cent.
- An estimated two billion people currently face moderate or severe food insecurity. By 2050, this figure is expected to increase to 3.5 billion people.
- The number of undernourished people is projected to increase by 260 million people by 2050, an increase of 32 per cent from 2018 levels.
- Both hunger and food insecurity have increased since 2014, with an additional 300 million people facing food insecurity. COVID-19 will only increase this figure in 2020.
- Sub-Saharan Africa has the highest prevalence of food insecurity at 52 per cent of the population.
- North America and Europe have the lowest prevalence of food insecurity at eight per cent of their population.
- The number of people experiencing undernutrition has increased by 36 million in the three years to 2018. Today, 822 million people are suffering from undernutrition globally, leaving them at the highest risk of starvation.
- The five most food insecure countries are Sierra Leone, Liberia, Niger, Malawi and Lesotho, where more than half of the population experience severe food insecurity.
- The Central African Republic, Zimbabwe and Haiti are countries with the highest proportion of their population undernourished.
- The lack of affordable food has increased among all bands of peace since 2006, including very high peace countries.
- Sixty-five per cent of the population in the world's least peaceful and low income countries experience food affordability problems.

WATER STRESS

- More than 2.6 billion people are living in the 46 countries currently experiencing high or extreme water stress. This means that they do not have enough water to meet their needs or that their water supply is at material risk of disruption.
- The combined effects of rising temperatures, population growth and increased rainfall variability are likely to reduce the water supply in many countries.
- By 2040, a total of 5.4 billion people – or more than half of the world's projected population – will live in the 59 countries experiencing high or extreme water stress. India and China will be among these countries.
- There is now 60 per cent less freshwater available per person today than there was in the early 1960s. The population is increasing faster than water availability.
- Developed countries, on average, consume approximately ten times more water per person than developing countries.
- Domestic water usage accelerated markedly after the global recession of the early 2000s and with the strong economic growth observed in Asia.
- Over the past decade, the number of recorded water-related conflict and violent incidents increased by 270 per cent worldwide.

SECTION 3: NATURAL DISASTERS

- Globally, the frequency of natural disasters increased ten-fold since 1960, increasing from 39 incidents in 1960 to 396 in 2019.
- Floods and storms accounted for 71 per cent of the natural disasters between 1990 and 2019.
- Asia-Pacific was the most affected region, with 29 per cent of global natural disasters occurring in the region in the 30 years to 2019.
- On average, 42 per cent fewer people died due to natural disasters per year in the last three decades compared to the average from 1945 to 1990.
- Natural disasters displaced 25 million people in 2019. This is three times higher than the 8.6 million displaced by armed conflict.
- India had the largest population displacement due to natural disasters, at five million people in 2019.
- The United States recorded 704 natural disasters since 1990, the most of any country globally. This is followed by China with 560 incidents.
- A 2.1-metre rise in sea levels would permanently cover land that is currently home to 200 million people around the world.
- The past five years have been the hottest on record.

SECTION 4: POSITIVE PEACE, RESILIENCE & ECOLOGICAL THREAT

- Positive Peace is an accurate measure of socio-economic resilience to ecological threats.
- There are 31 ecological 'hotspot' countries, which combine high levels of ecological threats with low and stagnant socio-economic resilience. Over one billion people live in these hotspots.
- Most ecological hotspots tend to be clustered on large geographical areas: The Sahel-Horn of Africa belt from Mauritania to Somalia; the southern African belt from Angola to Madagascar and the central Asian belt from Syria to Pakistan.
- Ecological and humanitarian crises often spill over across international borders, increasing the likelihood of civil unrest and political instability in adjacent countries.
- Europe has ecological threat hotspots to its south and east. These hotspots have a combined population of 841 million people. Large displacements of people from these hotspots could affect the European continent, especially in terms of social cohesion and political stability.
- Nearly 25 million people were displaced by ecological threats in 2019.
- China is now the largest provider of developmental aid, ahead of the United States. Of the ten largest recipients, the majority have over a third of their populations facing food insecurity.
- Countries with lower socio-economic development are exposed to more environmental threats than high development countries and have on average the least capacity to handle such shocks.
- A total of 746 million people live in areas that combine resource depletion threats with low and stagnant or deteriorating levels of Positive Peace. They are highly vulnerable to water stress, population growth and food insecurity.
- One billion people live in areas that combine high frequency and intensity of natural disasters with low and stagnant levels of Positive Peace.
- Natural disasters kill seven times more people in the least developed countries than in highly developed ones. This is despite such disasters being comparatively less frequent in the least developed nations.

SECTION 5: RESILIENCE AND DEVELOPMENT ASSISTANCE

- Foreign aid classified as climate-related aid has increased 34-fold from one billion US dollars in 2000 to US $34 billion in 2018.
- Climate-related aid accounted for 29 per cent of total development assistance in 2017.
- Climate-related aid is allocated to developmental projects with aims to mitigate or adapt to the impacts of ecological threats. Nearly half of the aid in this area was allocated to mitigation at 49 per cent, with 24 per cent allocated towards adaptation-related programs.
- Climate-related aid is concentrated in five main sectors: transport, energy, agriculture, general environmental protection and water supply and sanitation.
- Projects which aim to address water scarcity, improve food security and promote general environmental protection remain a priority for development assistance.
- Geographically, climate-related aid is primarily targeted at countries with the highest exposure to ecological threats in sub-Saharan Africa, South Asia and Asia-Pacific. India received the largest amount of climate-related aid in 2018, amounting to US $6.5 billion.

Ecological Threat Register

KEY FINDINGS

- One hundred and forty-one countries are exposed to at least one ecological threat, with 19 countries facing four or more threats.
- 6.4 billion people live in countries which are exposed to medium to high ecological threats.
- Of the 157 countries covered in the ETR, 34 per cent will face catastrophic water stress and 22 per cent catastrophic food insecurity by 2050. A catastrophic threat would result in substantial displacement of people or substantial increase in undernourishment.
- An estimated 1.2 billion people are at risk of displacement by 2050.
- Flooding is the most common ecological threat affecting 60 per cent of the countries covered in the report, followed by water stress, which will impact 43 per cent of the countries by 2040.
- Ten of the 19 countries with the highest exposure to ecological threats are among the 40 least peaceful nations on the Global Peace Index.
- Sub-Saharan Africa, South Asia and the Middle East and North Africa are the regions facing the largest number of ecological threats. Two regions of sub-Saharan Africa have the highest risk, the Sahel and the band from Angola to Mozambique.
- The majority of countries in sub-Saharan Africa, 33 out of 43, are exposed to medium to high level ecological threats.
- Water stress poses a large risk in the Middle East and North Africa, with 18 of the 20 countries experiencing high levels of water stress. The projections indicate the situation to worsen over the next two decades.
- The majority of the countries in Europe and South America will face lower levels of ecological threats, because of low population growth.

Overview

The world's ecology is coming under increasing stress. The number of natural disasters, including floods and cyclones, has tripled in the last four decades. Similarly, fresh water is also becoming more scarce, with 2.4 billion people living in countries experiencing water stress now. This number is expected to increase to 5.4 billion people in 2040.

The number of negative future ecological events will only increase and with the global population expected to increase by 25 per cent in the next 30 years, further stress will be placed on the planet's natural resources. For some countries, the choices will be stark as their populations are expected to more than double in the next 30 years.

As the population of the world increases, consumption will grow and the effects of climate change will become more pronounced. All of these challenges will interact, compounding the pressures on many countries. These challenges may negatively affect existing social and political structures, both in the affected countries and their neighbours. Therefore, it is imperative to understand which countries are likely to be impacted the most and which countries have the resilience to withstand extreme shocks.

Population projections show that, by 2050, 5.2 billion people will reside in countries which rank in the 40 least peaceful countries today.

To dampen the impact of future ecological shocks, it is important to increase the levels of resilience in the most vulnerable countries. This will enable countries to be better prepared for shocks, but also to have stronger capabilities to deal with the after effects of these shocks. High resilience regions, such as Europe and North America, have superior coping capacities to mitigate the effects of these ecological threats, but they will not be immune from large flows of refugees.

The Ecological Threat Register (ETR) presents a comprehensive, data-driven analysis of ecological threats covering 157 independent states and territories. The register measures population growth, water stress, food insecurity, droughts, floods, cyclones and rising temperature and sea levels.

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Population projections show that, by 2050, 5.2 billion people will reside in countries which rank in the 40 least peaceful countries today.

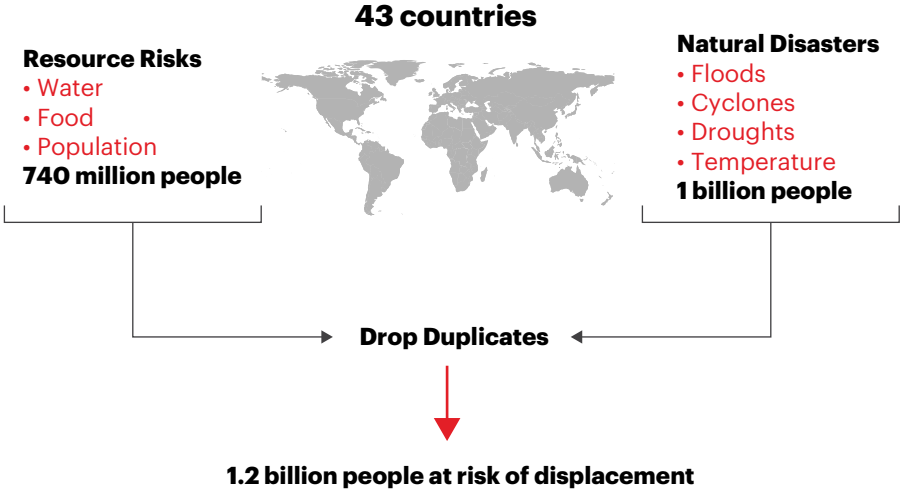
As ecological threats are expected to become more intense in the coming decade, the ETR also covers forecasts to 2050.

To identify populations whose social resilience may not be able to withstand their ecological threats, IEP has developed a unique approach incorporating severe threat projections with measures of societal resilience. The approach identifies two groups of countries. The first group are those that face major resource constraints due to water scarcity, food insecurity and population growth. The second group are those countries that face major threats from natural disasters such as floods, cyclones and droughts. IEP then considers the societal resilience of the countries using its Positive Peace framework. Where the country has low or very low Positive Peace, it is classified as a having low resilience. Figure 1.1 shows this process. Only countries with low resilience and a high level of threat are included.

FIGURE 1.1

Calculating which countries are at risk to ecological threats.

IEP estimates there are 1.2 billion people living in countries where societal resilience is unlikely to be sufficient to withstand the impact of their ecological threats between now and 2050.



Source: IDMC, IEP Calculations

Following this process, there are currently 740 million people living in countries that will face resource scarcity between now and 2050, while countries facing major threats due to natural disasters are home to approximately one billion people.

Combining these two groups and dropping duplicates, IEP estimates that by 2050 there could be 1.2 billion living in countries where the societal resilience is unlikely to be sufficient to withstand the impact of these ecological events between now and 2050.

Not all nations will respond the same way to these future threats. Many countries have strong societal resilience mechanisms and will be better prepared for future threats. Conversely, many countries have a very weak capacity for resilience. IEP's Positive Peace Index (PPI) is a reliable indicator of country resilience. The PPI also shows high statistical associations with improved levels of food security, water security and the ability to manage natural disasters. Countries with many ecological threats and low Positive Peace will be most at risk of humanitarian crises in the coming decades.

Put into perspective, two million people fled to Europe in the wake of the wars in Syria and Iraq. Although this is less than half a per cent of the total population of the EU, it fuelled the rise of new political parties, increased hostilities to immigrants and heightened political instability.

The outcome of these destabilising threats will impact countries internally, as well as having international implications, with flow-on effects, including large numbers of refugees migrating to neighbouring countries and beyond. While the majority of population displacements happen within the affected country, the United Nations High Commission for Refugees (UNHCR) estimates that one in five people are displaced beyond their borders. This will place significant stress on recipient countries.

Environmental disasters currently displace an average of 24 million people per year, with an additional seven million displaced by armed conflict.

There are three clusters of ecological hotspots which are particularly susceptible to collapse - sub-Saharan Africa, the Middle East and North Africa and South and Central Asia. Many countries in these regions are ill equipped to manage these events and to rebuild their economic infrastructure afterwards.

In the next 30 years, there will be many more drivers of mass population displacement. More than two billion people globally face uncertain access to sufficient quantity of food necessary for a healthy life. Another one billion people live in countries that do not have the current resilience to deal with the ecological changes they are expected to face in the future. Last year, 820 million people worldwide were undernourished due severe food shortages.[1] In such circumstances, even small events could spiral into instability and violence leading to mass population displacement and affect regional and global security.

Lack of water and food are likely to be major factors causing large scale migration. Thirty-four per cent of countries covered in the research will experience catastrophic water stress in the next three decades, while 22 per cent will experience severe food shortages. The demand for water is projected to reach crisis levels in some regions in a few decades. For instance, 600 million people in India are facing high or extremely high level of water stress unseen in the country's history.[2]

In 2019, more than two billion people lived in high water stress countries and four billion people experienced water scarcity at least one month of the year. Water use or demand has increased by one per cent per year for the last four decades since 1980. The increase for water demand, population growth and the effects of climate change will accelerate water stress.

A majority of the 19 countries with the highest number of ecological threats are among the world's 40 least peaceful countries. These countries include Afghanistan, Syria, Iraq, Chad, India and Pakistan.

The ETR finds that 141 countries, or 90 per cent of the countries covered in the register, are expected to face at least one ecological threat between now and 2050.

ECOLOGICAL THREAT REGISTER GROUPS

A hundred and forty-one countries are exposed to at least one ecological threat between now and 2050. The 19 countries with the most exposure have a population of 2.1 billion people. These countries face four to six ecological threats. More than 6.4 billion people live in countries exposed to two or more ecological threats. The three countries with the highest ETR count are Afghanistan, which is facing six ecological threats and Mozambique and Namibia, each of which is facing five. Table 1.1 shows countries by their ETR count.

Many of the threats covered in this report are exacerbated by climate change and although some can clearly be identified as a result of climate change, such as rising sea levels, many others can be hard to distinguish from other phenomena. For example, increases in the frequency of droughts or flooding could be related to changing weather patterns or they may also be the direct result of climate change. Untangling the two is difficult. Other threats, such as population growth or higher water consumption are caused by factors not associated with climate change. This report does not attempt to differentiate the causes but focuses on the coping capacity of countries, the number of threats and their likely impact.

Countries with the highest exposure to ecological threats are likely to experience the largest negative effects. India, with a population of approximately 1.35 billion, is facing four different ecological threats including water stress, droughts and cyclones. Nearly 40 per cent of India's population, or 600 million people, live in areas affected by reduced rainfall and droughts.[3]

Fifty countries are exposed to one ecological threat, which is the largest group in the ETR. While this group shows a lower level of exposure in general, the scale and intensity of the ecological threats differ across individual countries. For instance, more than 90 per cent of the people in Sierra Leone face moderate to severe food insecurity, with nearly 26 per cent of the country's population suffering from undernourishment. While Sierra Leone has a lower overall exposure to ecological threats, it is facing a catastrophic level of food insecurity. With a quarter of the population already undernourished, even a small negative shock will leave millions of people at risk of starvation. By contrast, Germany's ETR profile highlights the risk of exposure to floods, the only ecological threat in the country. Germany has experienced severe floods in the last three years, with one reported fatality in 2018.[4] While the likelihood of floods may still remain high in Germany and parts of Europe, its adverse impacts are usually limited by highly developed infrastructure, efficient emergency response mechanisms and ample support from government and non-government organisations for those affected.

Seventy-two countries are exposed to two to three ecological threats. Like the first group, countries may have similar degrees of exposure to ecological threats, however, they will experience different levels of impacts. The extent of negative effects of the ecological threats will depend on the resilience of the affected countries. Yemen and Australia are exposed to three ecological threats and both countries face severe water stress. However, Yemen's coping capacity to deal with the impacts of ecological threats is very low, as shown by its low ranking in Positive Peace. In Yemen, years of drought and water stress combined to exacerbate the already high food insecurity in the country. The competition over resources contributed to further fragmentation of the fragile social structure leading to armed conflict. By contrast, Australia suffered from bushfires caused by extremely high temperatures and low rainfall in 2019. It burned more than 18 million hectare of land and 5,900 buildings, of which 2,800 were residential homes.[5] Australia was able to address the bushfire crisis by establishing disaster recovery funding with contributions from government and large businesses. In addition, many residents of the affected areas were already covered by insurance. Australia's response highlights the level of resilience, not only through government, but also by contributions from businesses and the community. Australia ranks among the top 15 countries in the Positive Peace Index.

China is also in the medium exposure group with three ecological threats. China is exposed to water stress, floods and cyclones, which are projected to get worse in the next three decades. Many regions within China are facing very high levels of water stress in the future, as the demand for water has exceeded supply for the last few decades. The percentage of land area in China facing high and extremely high water stress increased from 28 to 30 percent in the ten years after 2001, meaning 678 million people now live in highly water-stressed areas.[6] Water stress in China is projected to worsen over the coming two decades as the patterns of water demand and supply change. In addition, parts of China experience regular seasonal floods, which kills hundreds and displaces millions of people every year.

Nineteen countries are exposed to four or more ecological threats. Ten of the 19 countries in this group rank among the 40 least peaceful countries on Global Peace Index. In addition, a majority of the countries in this group are either low income or lower middle-income countries. This highlights the nexus between fragility, resource depletion and conflict.

Afghanistan is exposed to six ecological threats, the highest exposure of any country measured in the ETR. The country is exposed to water stress, food insecurity, floods, droughts and higher population growth. Afghanistan is ranked the least peaceful country globally, with more than 30,000 conflict deaths in 2019. More than three million people in Afghanistan were displaced in 2019 due to ongoing conflict and natural disasters.[8] Afghanistan has experienced regular mass population displacement in the last four decades and has been one of the leading countries of origin for refugees. Afghans were the second largest group of asylum seekers in Europe after Syrians during the 2015 migration crisis.

If multiple ecological threats happen simultaneously, these threats can combine and be mutually reinforcing, causing a multiplier effect. For example, a country may be exposed to severe droughts and dedicate resources to addressing this threat. However, a combination of a drought with a growing population may exacerbate food insecurity and increase the lack of access to clean drinking water. The combination of multiple stressors is more likely to lead to negative societal outcomes such as political instability, social unrest and even violent conflict. This in turn may cause damage to physical infrastructure and the depletion of the already scarce resources, which further engender food insecurity and water stress. The interplay between ecological threats and socio-economic dynamics may lead a country into a vicious cycle of progressively greater hardship.

However, in some cases one single ecological threat may be enough to substantially disrupt the socio-economic system and cause great damage to a country or region.

TABLE 1.1

Ecological Threat Register grouped by level of risk

A hundred and forty-one countries are exposed to at least one ecological threat, with 19 countries facing four or more threats.

High Exposure		Medium Exposure				Low Exposure			
Country	ETR count	Country	ETR count	Country	ETR count	Country	ETR count	Country	ETR count
Afghanistan	6	Angola	3	Albania	2	Armenia	1	Bulgaria	0
Mozambique	5	Australia	3	Algeria	2	Austria	1	Costa Rica	0
Namibia	5	Central African Republic	3	Argentina	2	Belgium	1	El Salvador	0
Botswana	4	China	3	Azerbaijan	2	Bhutan	1	Finland	0
Chad	4	Cuba	3	Bahrain	2	Bolivia	1	Guyana	0
Ethiopia	4	Eritrea	3	Bangladesh	2	Bosnia and Herzegovina	1	Iceland	0
India	4	Georgia	3	Belarus	2	Brazil	1	Ireland	0
Iran	4	Haiti	3	Benin	2	Burundi	1	Lithuania	0
Iraq	4	Indonesia	3	Burkina Faso	2	Cambodia	1	Montenegro	0
Kenya	4	Israel	3	Cameroon	2	Colombia	1	New Zealand	0
Kyrgyzstan	4	Liberia	3	Canada	2	Croatia	1	Panama	0
Madagascar	4	Malawi	3	Chile	2	Czech Republic	1	Paraguay	0
Pakistan	4	Mali	3	DRC	2	Denmark	1	Sweden	0
Eswatini	4	Mauritania	3	Dominican Republic	2	Djibouti	1	Switzerland	0
Syria	4	Mexico	3	Egypt	2	Ecuador	1	United Kingdom	0
Tajikistan	4	Moldova	3	Guatemala	2	Equatorial Guinea	1	Uruguay	0
Uganda	4	Morocco	3	Guinea	2	Estonia	1		
Tanzania	4	Netherlands	3	Italy	2	France	1		
Zimbabwe	4	Niger	3	Côte d'Ivoire	2	Gabon	1		
		North Korea	3	Jordan	2	Gambia	1		
		Philippines	3	Kazakhstan	2	Germany	1		
		Republic of the Congo	3	Mongolia	2	Ghana	1		
		Russia	3	Myanmar	2	Greece	1		
		Rwanda	3	Nigeria	2	Guinea Bissau	1		
		Somalia	3	Palestine	2	Honduras	1		
		Sudan	3	Papua New Guinea	2	Hungary	1		
		Tunisia	3	Peru	2	Japan	1		
		Turkmenistan	3	Qatar	2	Kuwait	1		
		United States	3	Senegal	2	Laos	1		
		Uzbekistan	3	South Africa	2	Latvia	1		
		Yemen	3	South Korea	2	Lebanon	1		
		Zambia	3	South Sudan	2	Lesotho	1		
				Spain	2	Libya	1		
				Sri Lanka	2	Macedonia	1		
				Thailand	2	Malaysia	1		
				Timor-Leste	2	Nepal	1		
				Turkey	2	Nicaragua	1		
				Ukraine	2	Norway	1		
				United Arab Emirates	2	Oman	1		
				Vietnam	2	Poland	1		
						Portugal	1		
						Republic of Serbia	1		
						Romania	1		
						Saudi Arabia	1		
						Sierra Leone	1		
						Singapore	1		
						Slovakia	1		
						Slovenia	1		
						Togo	1		
						Venezuela	1		

Source: IEP

BOX 1.1

Methodology at a Glance

The concept of the Ecological Threat Register (ETR) was developed in an attempt to identify countries at the highest risk of ecological threats. The ETR focuses on the problem of resource scarcity and natural disasters and their impact on peacefulness. The ecological threats included in the ETR are *water stress, food insecurity, droughts, floods, cyclones, temperature rise, sea level rise and population growth.* The ETR facilitates analysis of the impacts of ecological threats on peacefulness, as well as the role of resilience in determining the ability to adapt and mitigate such risks.

The ETR is a multi-indicator composite register of risk, which is calculated in two steps. In the first step all indictors are normalised on a score of one to five with a higher score representing higher levels of risk. In the second step, the overall ETR count is calculated as the sum of the individual ecological threats that exceed a specified level of intensity. The ETR count represents the overall number of threats a country faces.

CATASTROPHIC ECOLOGICAL THREATS

The severity of ecological threats varies across geographic regions and time. In some cases, the impacts of the disruptions will lie well beyond a county's coping capacity. Defining and understanding the threshold at which a risk could become catastrophic differs across countries and context. Nevertheless, to highlight the prevalence of catastrophic ecological threats, this research sets a threshold for countries that fall in the upper end of the distribution for each of the threats included in the ETR. The thresholds, along with the results, are summarised in Table 1.2.

TABLE 1.2

Catastrophic Ecological Threats

Water stress, food insecurity and sea level rise are threatening catastrophic levels of impact across 44, 30 and 19 countries, respectively.

Indicator	Criteria to be considered catastrophic	Country count
Water stress	When more than half of the available water is used every year.	44 of 157 (34%) as at 2016
Food security	>=25% of population is food deficient.	30 of 137 (21%) as at 2017
Population at risk due to rising sea level	>10% of population at risk from rising sea levels.	19 of 91 (20%) projection to 2100

Source: IEP

Catastrophic risks are particularly important from the perspective of social stability and resilience. Catastrophic risks can result in substantial population displacement or substantial increases in undernutrition. This is due to their impact being severe enough to damage the physical infrastructure, the economic foundations or the social order in a country. For example, the 2010 earthquake in Haiti caused widespread destruction and triggered a downward spiral leading to social chaos and the breakdown of law and order. In contrast, Japan fared better after the 2011 tsunami, which led to a nuclear power plant meltdown and the contamination of large areas with radiation. Despite the fatalities and destruction, the incident did not fuel any social or political instability. The Japanese government was able to address both the destruction from the tsunami and contain the damage from the meltdown of the nuclear power plant. It also coordinated an effective program for economic recovery. The difference in immediate impacts and repercussions in these two episodes stem from the two countries operating at vastly different levels of Positive Peace. While Haiti displays a very low Positive Peace standing, ranking 146th in 2019, Japan is among the top 20 Positive Peace countries in the world. This contrast highlights the role of Positive Peace as a measure of resilience, capable of both protecting the population from the worst impact of a disaster and rebuilding the socio-economic system in its aftermath. Section 4 of this report explores the dynamics of ecological threats and Positive Peace in details.

Water stress compares available water to the amount of water withdrawn for agriculture, domestic and industrial needs. The indicator used in the ETR compares supply to demand and ranks countries on their ability to balance these two. A higher water stress score indicates that the available sources of water are not sufficient to meet the water demand in that country.[9] When a country uses more than half of its available water every year, it is considered to have a catastrophic level of water scarcity. Water stress can vary within a country with some areas experiencing extreme levels of stress while other areas have sufficient water availability. Once this criterion is applied, 44 of 157 countries are at high risk of water stress. These countries are mainly located in Middle East and North Africa, sub-Saharan Africa, South Asia and Central Asia regions. The five countries with the highest water stress are Qatar, Israel, Lebanon, Iran and Jordan.

Food insecurity is defined as catastrophic if the prevalence of regular hunger and undernourishment is greater than 25 per cent of the population. Sierra Leone, Liberia and Niger were among the most affected, with over 80 per cent of the population suffering from moderate to servere food insecurity in 2018.[10] More recent estimates

from the Global Hunger Index suggest that Central African Republic, Yemen and Chad are the countries currently most at risk of hunger and food insecurity.[11] Countries experiencing catastrophic level of food insecurity are at a high risk of starvation if they experience economic, social or environmental shock.

Similarly, the population at risk of rising sea levels are considered to be at catastrophic levels if it affects more than ten per cent of a country's population over the coming decades. Estimates for this criteria put 19 of the 91 countries for which data was available at the catastrophic level for this risk. This includes many of the smaller countries such as Suriname, as well as cities with large populations such as Alexandria in Egypt, the Hague in the Netherlands and Osaka in Japan.[12] It should be noted that the Pacific Island states are not covered in this report.

REGIONAL OVERVIEW

To better understand regional variations in their exposure to ecological threats, countries within a region are grouped into three levels of risk exposure. The scale groups countries into low exposure (0 to 1 threats), medium exposure (2 to 3 threats) and high exposure (4 or more threats). Table 1.3 shows the level of regional exposure to ecological threats.

TABLE 1.3

Ecological Threat categories

Countries are grouped into low exposure (0 to 1 threats), medium exposure (2 to 3 threats) and high exposure (4 or more threats).

ETR Category	Number of Ecological Threats faced
Low	0 to 1 threats
Medium	2 to 3 threats
High	4 or more threats

Source: IEP

Sub-Saharan Africa and the Middle East and North Africa are the regions with the most countries exposed to medium or higher levels of ecological threats as shown in Table 1.4. Europe and South America, by contrast, have fewer countries with medium or higher levels of threats. In Europe, the Netherlands is the only country with exposure to three ecological threats - sea level rise, floods and water stress. The Netherlands faces an extremely high risk from sea level rise and floods. Europe is also the region with the largest concentration of countries that are not exposed to high intensity ecological threats.

TABLE 1.4

Regional Ecological Threat profile

The majority of countries in sub-Saharan Africa and the Middle East and North Africa are facing medium to high exposure to ecological threats.

Region	Number of countries in each Ecological Threat group				
	Low (0 to 1)		Medium (2 to 3)		High (>=4)
	0	1	2	3	4 or greater
Asia-Pacific	1	5	7	5	0
Central America and the Caribbean	3	2	2	3	0
Europe	9	20	4	1	0
Middle East and North Africa	0	5	7	5	3
North America	0	0	1	1	0
Russia and Eurasia	0	1	4	5	2
South America	3	5	3	0	0
South Asia	0	2	2	0	3
Sub-Saharan Africa	0	10	10	12	11

Source: IEP

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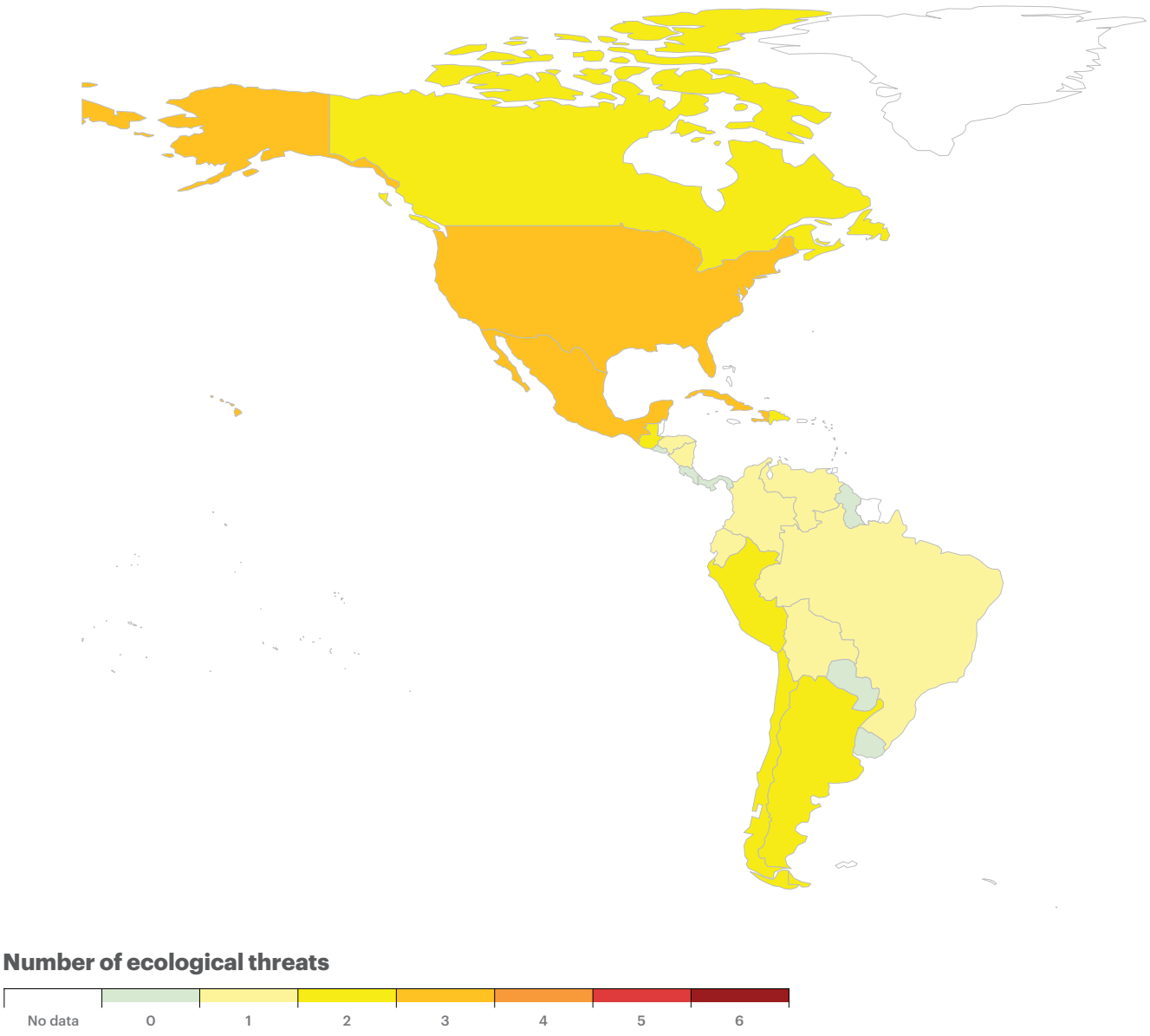
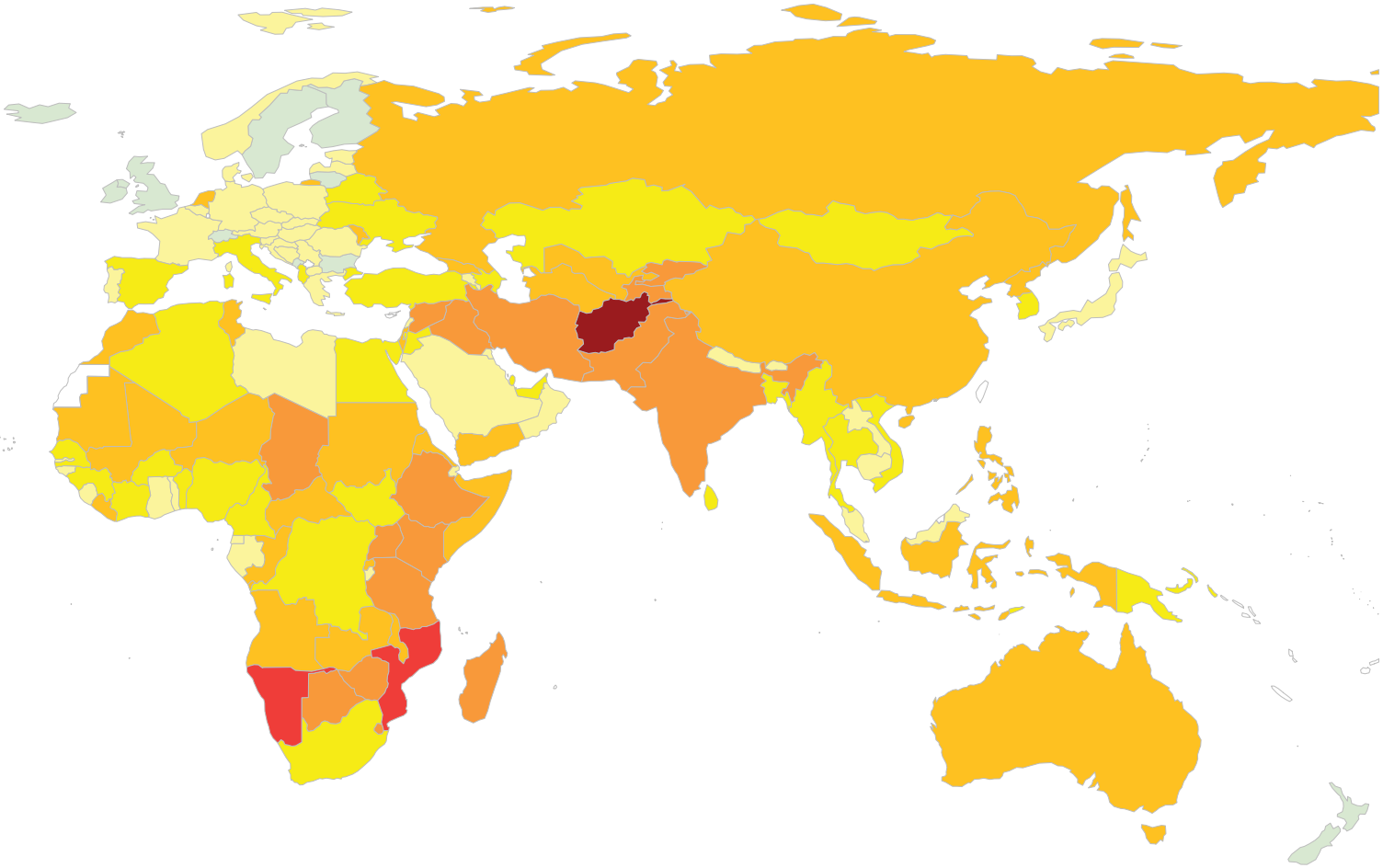
> Water stress poses a large risk to the Middle East and North Africa, with 18 of the 20 countries experiencing high levels of water stress.

The Global Distribution of Ecological Threats



Number of ecological threats

No data | 0 | 1 | 2 | 3 | 4 | 5 | 6



Sub-Saharan Africa is the region most at risk of climate change stresses with all countries in the region exposed to at least one ecological threat. The majority of countries, 33 out of 43, face medium to high exposure. Within the region, Mozambique and Namibia both face the highest exposure with an ETR risk count of five.

Population growth in sub-Saharan Africa is estimated to be 2.4 per cent per year for the next three decades. Although this is a decline from the average population growth that the region has experienced in the last few decades, it is still beyond a sustainable level given the increasing food and water scarcity in the region.

The region is home to 14 countries who are projected to double their population by 2050. The impacts of rapid population growth is compounded by high variability in climate conditions with more than half of the countries in the region, 23 out of the 43, facing droughts.

A combination of environmental, social and economic issues poses a major challenge to food security in sub-Saharan Africa. The region is experiencing entrenched poverty, environmental degradation, rapid urbanisation, high population growth rates, and climate change.[13] Sub-Saharan Africa has the highest prevalence of food insecurity globally at 58 per cent of the population.

Most countries across sub-Saharan Africa are dependent on rain-fed agriculture, making the region particularly vulnerable to changes in climatic conditions, such as prolonged droughts and seasonal floods.[14] Agriculture not only contributes to food security in the region, it is also the mainstay of most African economies, with 20-30 per cent of Gross Domestic Product (GDP) and 55 per cent of regional exports being produced by agriculture.[15] The sector will be detrimentally impacted by rising temperatures as well as increasing water scarcity.

The region is particularly vulnerable to the impacts of climate change because of factors such as widespread poverty, recurrent droughts and overdependence on rain-fed agriculture. Although adaptation options including traditional coping strategies are available, socio-economic factors such as rapid population growth, poor governance and conflict are likely to hinder the human, infrastructural, and economic responses necessary for many of these countries.[16]

Fifteen of the 20 countries in **the Middle East and North Africa (MENA)** are exposed to medium to high ecological threats such as food insecurity, water stress and natural disasters. Iran, Iraq and Syria are the most vulnerable countries in the region with an ETR score of four.

MENA is the most water stressed region globally, with 18 of the 20 countries currently experiencing high levels of water stress and projections indicate the situation will worsen over the next two decades. The region is projected to experience an increase in water stress due to higher demand for water, driven by population growth and reductions in supply due to droughts and reduced precipitation.

Ecological threats in the region are particularly relevant to peacefulness. Recent conflicts and social upheaval in the region has been partially driven by climate change, which exacerbated resource scarcity, leading to population displacement. Over 250 million people in the region were at the prevalence of moderate to severe food insecurity in 2018, which is set to be adversely affected by the COVID-19 pandemic.[17]

Eleven of the 12 countries in the **Russia and Eurasia** region have medium or high exposure to ecological threats. The region includes all of the landlocked Central Asian countries, which are facing extremely high level of water stress, likelihood of droughts and have a higher than average population growth. Within the region, Kyrgyzstan and Tajikistan face the highest exposure to ecological threats, with both registering an ETR score of four. Conversely, Armenia is the only country in the region with low exposure. Water scarcity is the main ecological issue in the region with ten of the 12 countries experiencing different degrees of water stress and another seven countries have experienced droughts.

As a result of climate change, the region is expected to experience increasing temperatures, extreme weather events, and glacial melt which will likely exacerbate desertification. Environmental stressors will affect local and regional economies as overexploitation and lack of resources are expected to impact key industries such as agriculture.[19]

Countries in the **Asia-Pacific** region fall among the medium risk group on the ETR with no country exposed to more than three threats. Australia, China, Indonesia and the Philippines all face three ecological threats. Across the region, the majority of countries, or 13 out of 19, are at high risk of floods.

The Asia-Pacific region recorded the highest number of new displacements between 2008 and 2019 with over 150 million as a result of climate-related hazards including droughts, extreme temperatures, seasonal floods and storms. In 2019 alone, almost 25 million people were displaced in the Asia-Pacific region with China, India and the Philippines accounting for 53 per cent of all displacements.[20]

Five of the seven countries in the **South Asia** region have a medium to high ecological threat profile. Three countries, Afghanistan, India and Pakistan, experience extremely high exposure to ecological threats. In particular, Afghanistan is exposed to six ecological threats, the highest of any country measured in the ETR. Afghanistan faces substantial impacts from natural disasters and climate change, which will hinder prospects for peace and development in the country. For instance, climate change poses a threat to Afghanistan's natural resources, with floods and droughts expected to have an impact on agriculture productivity.[21] The ongoing conflict has also undermined Afghanistan's capacity to cope with ecological threats, with natural disasters adding stress to an already weak system of governance.[22]

More than 649 million people in South Asia face moderate to severe food insecurity.[23] The region also faces high levels of water stress, natural disasters, such as floods and droughts and rapid population growth. All seven countries in South Asia face annual flooding that result in substantial losses of human life, agricultural land and private property.

Central America and the Caribbean includes ten countries of which five rank in the medium risk ecological threat group. Water stress and cyclones are the most likely ecological threat that countries in this region are likely to experience.

Tropical storms and hurricanes are becoming increasingly more powerful in the region, causing increased rainfall and higher storm surges due to environmental changes.[24] Storms are becoming more frequent and intense, leaving less time for recovery between events.[25] The countries facing the highest risk from ecological threats within the region are Cuba, Haiti and Mexico, each with an ETR score of three. They are also the countries that have been most impacted by storms in Central America and the Caribbean. Since 2000, there have been over 110 storms recorded in these three countries, affecting approximately 29 million people.[26]

Countries located in the sub-region of Central America are particularly vulnerable to earthquakes, as they are located within the Pacific "Ring of Fire", the path situated along the Pacific Ocean where frequent earthquakes and volcanic eruptions occur.[27] Central America and the Caribbean have recorded over 224,000 fatalities from earthquakes since 1990.[28] Haiti alone accounts for 99 per cent of these deaths following the 2010 magnitude - 7.0 earthquake, which had a catastrophic impact.

The neighbouring region of **South America** has a similar risk profile with the difference being that only three of the 11 countries in the region face two risks and none facing more than two risks. These countries are Argentina, Chile and Peru. Five countries in the South America region face only one ecological threat and three countries do not face any. Like Central America, the western coast of South America is also situated within the Pacific "Ring of Fire" with Chile, Ecuador and Peru particularly vulnerable to earthquakes and volcanic eruptions.

While South America is one of the regions of the world with the most water resources, distribution and access to safe drinking water is precarious. South America is expected to face increasing water stress in future decades as consumption, driven by high population growth, will continue to increase, while availability is expected to fall.[29] Climate change will increase the risk of prolonged droughts, making it more difficult for many in the region to access safe drinking water.[30]

Of the 34 countries in **Europe**, only five have medium exposure to ecological threats. Twenty of the 34 countries face only one ecological threat. This is due to the lower likelihood of events of ecological threats as well as the more developed and resilient coping mechanisms in place. The European region include the highest number of countries that do not face any ecological threats as measured by the ETR.

Floods and water stress are the most common types of ecological threats faced by countries in Europe. Climate change is expected to increase water scarcity throughout Europe.[31] With most fresh water originating in mountainous areas, such as the Alps, changes in the snow and glacier dynamics and in precipitation patterns may also lead to some water shortages across the region.[32] In some parts of Europe, less precipitation in the summer months, coupled with rising temperatures, will cause more frequent and intense droughts.[33] Sea level rise will also add stress to costal zones particularly in areas that are close to or below sea level, such as the Dutch and German North Sea coastlines and Ukrainian Black Sea coast.[34] European countries are among the most resilient, as measured by Positive Peace and are amongst the countries best equipped to cope with their threats.

The **North America** region includes two countries - the United States and Canada. The United States experiences water stress, cyclones and flooding, placing it in the medium risk group. While Canada faces floods and extreme temperatures, placing it among the low to medium risk countries. Extreme temperatures in Canada could increase the frequency of heat waves and droughts and result in a higher risk of wildfires in some parts of the country.[35]

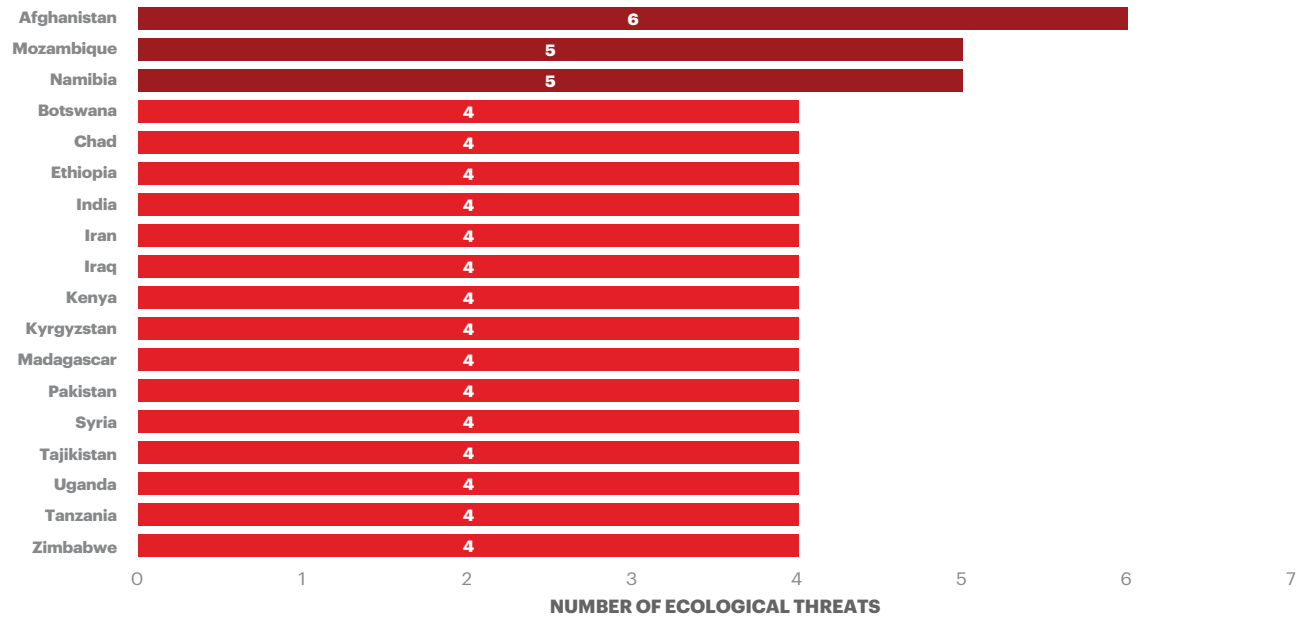
THE MOST AFFECTED COUNTRIES BY ECOLOGICAL THREAT

There is a great deal of disparity in how ecological threats will affect countries. The ETR results find that a higher proportion of less peaceful and low-income countries are exposed to ecological threats. A majority of the countries with higher exposure to ecological threats shown in Figure 1.2 are among the least peaceful countries on the Global Peace Index. These countries have the lowest institutional and social coping capacities to address the impacts of ecological threats. Figure 1.2 shows the most exposed countries to ecological threats.

FIGURE 1.2

The most affected countries by ecological threats

Ten of the 19 most exposed countries to ecological threats are among the world's 40 least peaceful countries.



Source: IEP

Ecological Threat Domains

The threats included in the ETR can be clustered into two major domains: resource scarcity and natural disasters. The resource scarcity domain includes food insecurity, water scarcity and population growth. Resource scarcity highlights the vulnerability of countries and regions to increasing environmental stress. Resource scarcity is particularly important in the context of low and lower middle-income countries, which are likely to have higher population growth. Low-income countries also tend to be less peaceful with lower levels of Positive Peace.

RESOURCE SCARCITY HOTSPOTS

Resource scarcity is predominantly concentrated in less peaceful countries in sub-Saharan Africa, the Middle East and North Africa and South Asia. Seventeen of the 28 most resource scarce countries in the world are located in sub-Saharan Africa, with another four in MENA. MENA is the least peaceful region and sub-Saharan Africa is the fourth least peaceful region on the Global Peace Index. The combination of lower income and lack of peacefulness indicate that most of these countries lack the resilience to address the high level of resource scarcity by themselves. Table 1.5 shows the 28 countries with the highest level of resource scarcity.

Less peaceful countries lack the coping capacities to address resource scarcity shocks. These countries have lower coping capacities due to unsustainable population growth, low or declining economic growth, high poverty rates and greater prevalence to food insecurity. Nearly two thirds of the countries experiencing food insecurity, water stress and high population growth are either low or very low peace countries. Table 1.6 shows the resource scarcity hotspots by type of threat.

TABLE 1.5

Resource scarcity by region and peacefulness

Resource scarcity is predominantly an issue for the sub-Saharan Africa and the Middle East and North Africa regions. There are also substantial risks for the least peaceful countries.

Region	Number of countries
Sub-Saharan Africa	17
Middle East and North Africa	4
Russia and Eurasia	2
South Asia	2
Central America and the Caribbean	1
Asia-Pacific	1
North America	0
Europe	0

Peace level	Number of countries
Very Low Peace	12
Low Peace	6
High Peace	8
Very High Peace	1

Source: IEP

> “
>
> The majority of the countries in Europe and South America will face lower levels of ecological threats, because of low population growth.

TABLE 1.6

Resource scarcity hotspots

Countries where resource scarcity poses the largest threats are predominantly in MENA and sub-Saharan Africa.

Water Scarcity	Food Insecurity	Population Growth
Bahrain	Central African Republic	Angola
Israel	Haiti	Niger
Kuwait	Rwanda	Somalia
Palestine	Zambia	Tanzania
Qatar	Namibia	Zambia
San Marino	Uganda	Congo, DRC
Singapore	Angola	Mali
United Arab Emirates		Burundi
		Mozambique
		Burkina Faso
		Chad
		Benin
		Malawi
		Senegal
		Republic of the Congo
		Madagascar
		Côte d'Ivoire
		Nigeria
		Guinea
		Gambia
		Mauritania
		Cameroon
		Uganda
		Equatorial Guinea
		Togo
		Liberia
		Sudan

Source: IEP

NATURAL DISASTER HOTSPOTS

Natural disasters included in the ETR include floods, droughts, cyclones, sea level rise and rising temperatures. This domain indicates the likelihood of exposure to or vulnerability to the impacts of natural disasters in individual countries. For instance, sea level rise and coastal erosion can pose serious risks to the people living in the coastal areas particularly those in low-lying coastal areas in China, Bangladesh, India, Vietnam, Indonesia, and Thailand over the next three decades. Recent estimates from Climate Central, an independent climate research organisation, projects a rise in sea levels of up to 2.1-meters by 2100, which could potentially permanently affect land that is currently home to 200 million people around the world.

Natural disasters lead to losses of human life, destruction of private property and public infrastructure and hinder future development, especially in underdeveloped regions of the world. The natural disasters domain includes environmental threats that in addition to its direct impacts, also worsen resource scarcity. Changes in weather patterns around the world have led to a rise in the number of floods and more frequent and longer droughts.

Natural disasters affect countries across all regions and levels of peace. Like the threats of resource scarcity, natural disasters are more likely in countries in the sub-Saharan Africa region and among low and very low peace countries. However, natural disasters also occur among the most peaceful countries and across all regions. Twenty-two per cent of the countries affected by natural disasters are among the 80 high peace countries in the GPI. Table 1.7 shows the breakdown of the cluster of countries at high risk of natural disasters by region and peacefulness.

TABLE 1.7

Exposure to natural disaster by region and peacefulness

While a higher proportion of less peaceful countries are represented in countries most affected by natural disasters; natural disasters affects countries across all region and peace level.

Region	Number of Countries
Sub-Saharan Africa	14
Russia and Eurasia	8
Asia-Pacific	8
Middle East and North Africa	5
South Asia	4
Central America and the Caribbean	2
North America	2
Europe	1
Total	**44**

Peace Level	Number of Countries
Very Low Peace	18
Low Peace	16
High Peace	7
Very High Peace	3
Total	**44**

Source: IEP

Flooding is the most common ecological threats affecting 60 per cent of countries. This is followed by water stress, which is projected to have significant impacts in 43 per cent of countries globally by 2050. Table 1.8 shows the countries where natural disasters pose the single greatest risk in the coming decades.

TABLE 1.8

Natural disaster hotspots

Countries where natural disasters pose the greatest threat are distributed globally.

Floods	Temprature rise	Drought	Cyclones	Sea Level Rise
Bangladesh	Canada	Somalia	Japan	Suriname
Vietnam	Denmark	Zimbabwe	Philippines	The Netherlands
Myanmar	Iran	Djibouti	South Korea	
Cambodia	Russia	Mauritania	China	
Iraq	United Arab Emirates	Namibia	Cuba	
Laos	Afghanistan	South Africa	Vietnam	
Serbia	Qatar	Eritrea	Dominican Republic	
Pakistan	Turkmenistan	Afghanistan	Mexico	
Thailand	Belarus	Mozambique	United States of America	
Suriname	Norway	Tajikistan	Madagascar	
Republic of the Congo	Bahrain	Senegal		
Mauritania	Tunisia	Benin		
India	Slovenia	Malawi		
Russia	Latvia	Senegal		
China				
Belize				
Brazil				
Indonesia				
Egypt				
Sudan				
Nigeria				
Somalia				
Chad				
Hungary				
Congo, DRC				

Source: IEP

2 Resource Scarcity, Peace and Conflict

The Nexus Between Peace And Resource Scarcity Threats

KEY FINDINGS

- The global population is projected to reach ten billion by 2050.
- The majority of the population growth will continue to take place in the world's least peaceful countries. The global population is projected to grow by 35 per cent by 2050 in the least peaceful countries compared to a two per cent decline in the most peaceful.
- By 2050, the 40 least peaceful countries will have an additional 1.3 billion people and will be home to more than half of the world's population.
- Sub-Saharan Africa is vulnerable due to rapid population growth, with 14 countries projected to double their population by 2050.
- By 2050, 80 per cent of the world's population will live in countries which are in the bottom half of the Global Peace Index rankings.
- It is estimated that an additional 1.5 billion people could suffer from food insecurity by 2050, totalling 3.5 billion people.

Food Insecurity, Water Stress and Peacefulness

The relationship between peacefulness and food insecurity, water scarcity and population growth is complex. Adverse changes in the natural environment can lead to increased social tensions and civil unrest if societies do not have the necessary levels of resilience to deal with these threats. Similarly, conflict and disorderly population growth have well-documented negative impacts on the environment. These two dynamics of increasing resource scarcity and conflict can create a vicious cycle where one increases the likelihood of the other, leading to societies failing.

Emerging ecological threats act as stressors, however countries react differently to shocks depending on their levels of resilience. Resilience, or the ability of nations to mitigate and adapt to new ecological threats, will be critical in the management of future ecological shocks to ensure the stability of political institutions and prevent future social unrest and violence.

The largest increases in the population will occur in the least peaceful countries, with 53 per cent of the world's population living in the 40 least peaceful countries by 2050, further increasing the likelihood of conflict. This is an additional 1.3 billion people.

Climate change will also exacerbate adverse weather and natural disaster events, leading to increased scarcity of resources in countries that cannot manage these shocks. This will lead to losses of livelihoods and reductions in food production. In turn, there will be increased competition for scarce resources, increasing tensions and leading to conflict among individuals and groups.

In countries with low resilience it is common for ecological shocks to dislodge large numbers of people from affected areas. However, the movement of populations within a country or across international borders usually places additional stresses on the destination countries. For example, the refugee flows from Syria and Iraq into Western Europe.

The resources in surrounding destination countries are often already scarce, especially in fragile or low resilience countries. Changes in climate patterns and large natural disasters can cover vast geographical areas across multiple countries or even continents. In severe or prolonged cases, food insecurity may degenerate into undernourishment or starvation. The definitions of these and other key terms can be found in Box 2.1.

BOX 2.1

Definitions of food insecurity and undernourishment

The concepts of food insecurity and undernourishment are related but not equivalent. Food security primarily refers to access to food. If access is difficult, uncertain or intermittent, a person or group is said to face food insecurity. Undernourishment takes place when a person's or group's actual intake of food is insufficient to meet their dietary energy requirements.

Therefore, it is possible for a person or group to be food insecure but not necessarily undernourished. This happens when despite the difficulty and unpredictability of daily access to food, the actual intake remains on average at or above minimum required levels. The key concepts are defined below.

Food security is achieved when at all times, people have physical, social, and economic access to sufficient, safe, and nutritious food that meets their basic food preferences and dietary needs for an active and healthy life.[1]

Moderate food insecurity is where an individual experiences uncertainty in obtaining food and may be forced to compromise on the dietary quality or quantity of food consumed. Thus, normal eating patterns may be disrupted, with negative impacts on their nutrition, health and well-being.

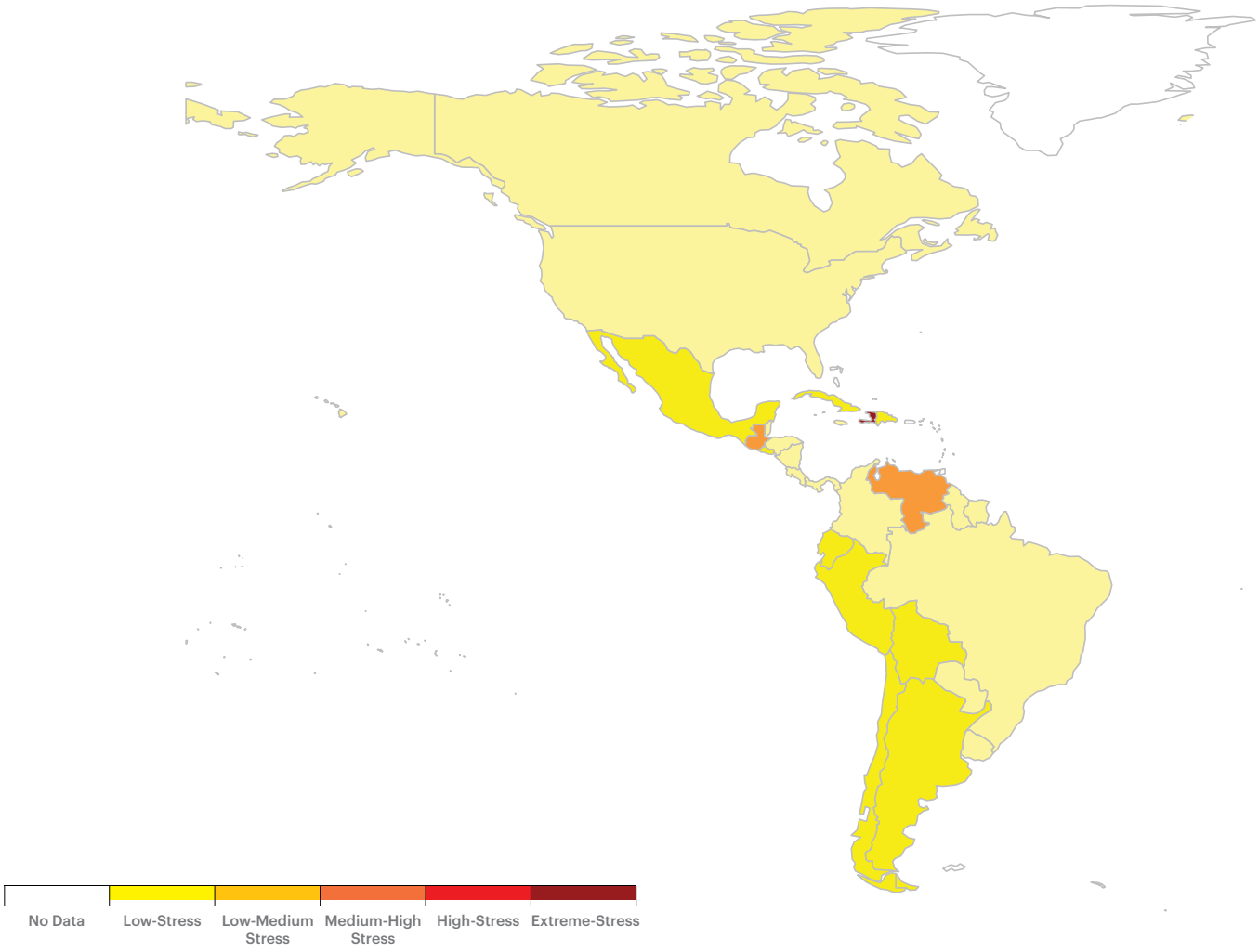
Severe food insecurity is where an individual may have exhausted their food, or gone at least a day without eating. Their health, nutrition and well-being are at severe risk.

Undernourishment is where an individual's habitual food consumption is insufficient to provide the dietary energy levels required to maintain their daily functions and a healthy life.

FIGURE 2.1

Global undernourishment and water scarcity stress

Sub-Saharan Africa and the Middle East and North Africa are the most undernourished and water stressed regions in the world.



Source: FAO, WRI, IEP Calculations

MAPPING UNDERNOURISHMENT AND WATER STRESS

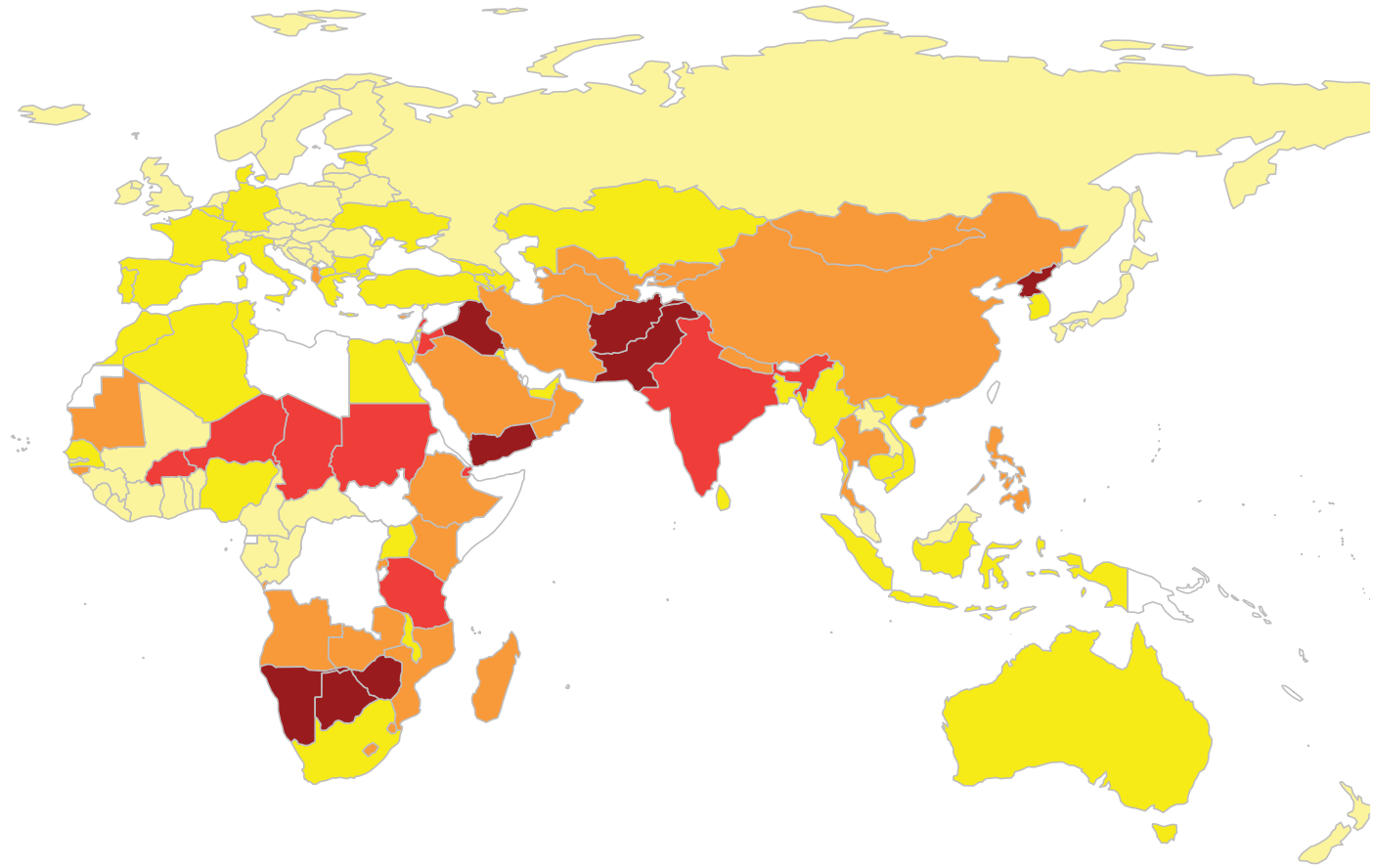
Countries that are facing both high levels of undernourishment and water stress are in a particularly fragile state. These two threats are linked, in that countries suffering from high levels of water stress are likely to have less water to meet their domestic agricultural needs, which in turn increases the risk of undernourishment and starvation.

Figure 2.1 maps the prevalence of undernourishment and water stress among countries.[2] Higher levels of stress are illustrated by the dark red of the map, indicating a greater proportion of a country's population is undernourished and affected by water stress.

IEP's analysis identified the 18 most vulnerable countries for these stresses, with a combined population of over 1.9 billion people.

The vulnerable countries are clustered in certain geographical regions. Most notably, the Middle East and North Africa, sub-Saharan Africa and South Asia. These regions are also the least peaceful as measured by the GPI. Sub-Saharan Africa has two particularly vulnerable bands, Angola through to Mozambique and the Sahel region.

Yemen is considered the most resource stressed country in terms of water stress and undernourishment. Not only is Yemen suffering from these stresses, but it is also the fifth least peaceful country in 2020. Conflict in Yemen has enormously strained food and water resources to the extent of mass starvation. Thirty-nine per cent of



the country's population suffers from various grades of undernourishment and the country suffers from high levels of water stress.

In South Asia, India experiences medium levels of undernourishment and extreme water stress combined with a rising population. Such high levels of water stress may negatively impact India's future food production and consequently, undernourishment could worsen.

Nigeria offers one example of how resource depletion shocks, along with rapid population growth can be a trigger for increased social instability. For many years, reduced rainfall, higher temperatures and recurrent droughts have led to the encroachment of Fulani herders and pastoralists on established farmland in search of water, as well as the expansion of farms onto traditional grazing areas. Violence has ensued as farmers and the Fulani compete for land and water resources. Since 2016, this conflict has led to over 3,600 deaths.[3]

Population Growth, Economic Growth and Peacefulness

Economic development leads to patterns of greater consumption and more intense utilisation of agricultural and water resources. As a country's average income level rises, household food consumption also shifts towards more resource intensive products, such as meat and dairy. Additionally, in countries that are over-populated there is more intense competition for water from industrial, agricultural and domestic users. When combined with rapid population growth it creates additional pressure. Smaller shocks are more likely to have negative effects as the systems have less resilience.

In its early and intermediary stages, the process of economic development leads to rapid population growth. This is because some of the first results of development are improvements in nutrition, health care and sanitation, decreased mortality rates and extending life expectancy. The vast majority of the world's population is currently undergoing this process today.

By 2050, the global population may grow beyond ten billion people, an increase of 36 per cent from today's 7.8 billion level, as per Figure 2.2. Although this rate represents a high growth scenario, it is consistent with historical experience. From 2020 to 2050, the population of the world is estimated to increase by 65 million people every year.[4] In the absence of technological breakthroughs, this will place intense stresses on already limited water and food resources.

Population growth will be among the main challenges for development and peace. This growth will not be uniform across countries or regions, or by levels of development and peacefulness.

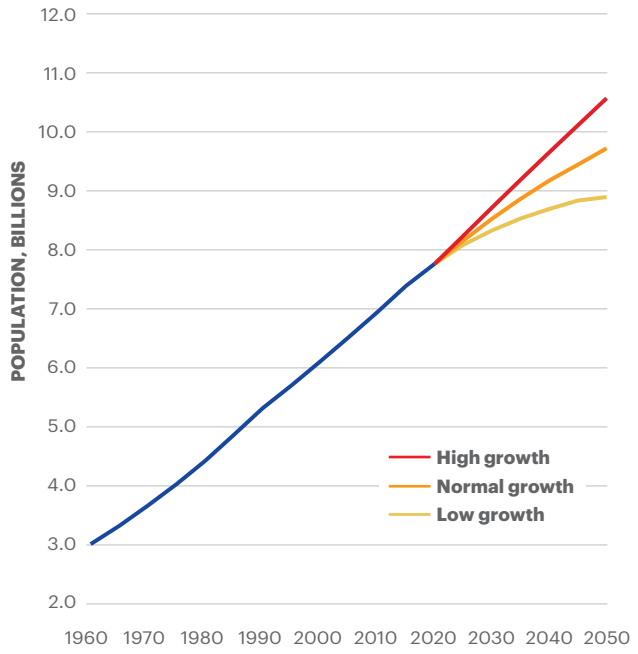
Projections indicate that the populations of regions such as North America and Europe will decrease, while that of sub-Saharan Africa and South Asia will grow substantially. By 2050, sub-Saharan Africa and South Asia will have a combined population over 4.5 billion.

Most of the world's population growth will take place in the least peaceful countries, as shown in Figure 2.3. By 2050, countries in the bottom half of the GPI will be home to 80 per cent of the global population, while only 20 per cent will live in countries in the top half of the index. The 40 least peaceful countries will have an additional 1.3 billion people by 2050, accounting for more than half of the world's population, or 53 per cent.

FIGURE 2.2

Projection of global population, 1960–2050

The global population is estimated to exceed 10 billion by 2050.

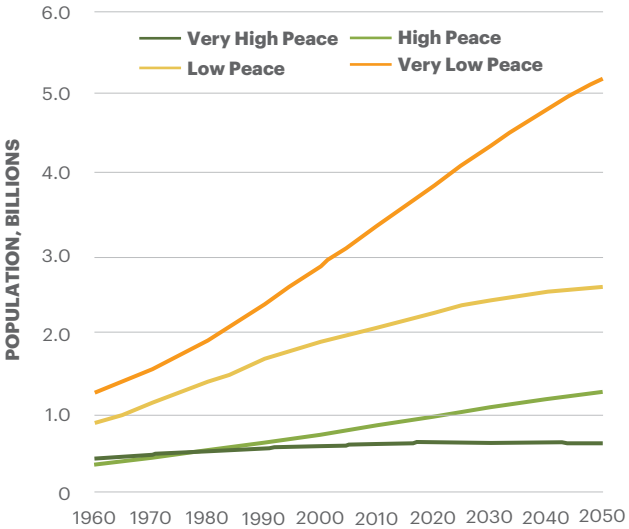


Source: United Nations, Department of Economic and Social Affairs, Population Division (2019)

FIGURE 2.3

Projection of global population, by peace level, 1960–2050

The population is projected to increase by 35 per cent in very low peace countries compared to a decrease of two per cent in very high peace countries.



Source: United Nations, Department of Economic and Social Affairs, Population Division (2019)
Note: Medium-variant projection; peacefulness classification by GPI 2020

The 20 countries with the fastest growth in their population are all located in sub-Saharan Africa. By 2050, 14 sub-Saharan African countries are predicted to double their population. Table 2.1 contains the 20 countries with the highest projected growth in their population for 2050.

Niger is projected to have the largest percentage increase in its population, increasing almost threefold. The level of population growth in Niger will outpace economic development, leading to a decline in living standards and greater completion for economic resources. Between 2020 to 2050, Niger is estimated to record a population growth rate of 3.4 per cent each year — the highest rate of any country. This is followed by Angola, which is estimated to average a 2.9 per cent annual population growth rate. The global average will be 0.74 per cent, which is significantly less than Niger and Angola.

China and India will remain the countries with the largest populations in 2050. However, China's population is projected to decline slightly, averaging a negative growth rate of 0.07 per cent per year. India will experience an increase of 0.6 per cent per year. By 2026, India is expected to overtake China as the most populated country.

TABLE 2.1

The countries with the fastest population growth, 2020–2050

The 20 countries projected to record the highest percentage increase in their populations are all located in sub-Saharan Africa.

Country	2020 Population (Millions)	2050 Population (Millions)	% Change	Factor change	GPI 2020 rank
Niger	24.21	65.59	171%	2.71	138
Angola	32.87	77.42	136%	2.36	91
Somalia	15.89	34.92	120%	2.20	158
Congo, DRC	89.56	194.49	117%	2.17	156
Tanzania	59.73	129.39	117%	2.17	52
Mali	20.25	43.59	115%	2.15	144
Burundi	11.89	25.32	113%	2.13	132
Zambia	18.38	39.12	113%	2.13	44
Mozambique	31.26	65.31	109%	2.09	100
Burkina Faso	20.90	43.43	108%	2.08	122
Chad	16.43	34.03	107%	2.07	134
Gambia	2.42	4.88	102%	2.02	61
Equatorial Guinea	1.40	2.82	101%	2.01	60
Benin	12.12	24.28	100%	2.00	106
Malawi	19.13	38.14	99%	1.99	59
Senegal	16.74	33.19	98%	1.98	47
Guinea	13.13	25.97	98%	1.98	89
Uganda	45.74	89.45	96%	1.96	109
Madagascar	27.69	54.05	95%	1.95	63
Nigeria	206.14	401.31	95%	1.95	147

Source: United Nations, IEP calculations
Note: Based off medium variant projections

Food Security

KEY FINDINGS

- By 2050, estimates indicate that the global demand for food will increase by 50 per cent.
- An estimated two billion people currently face moderate or severe food insecurity. By 2050, this figure is expected to increase to 3.5 billion people.
- The number of undernourished people is projected to increase by 260 million people by 2050, an increase of 32 per cent from 2018 levels.
- Both hunger and food insecurity have increased since 2014, with an additional 300 million people facing food insecurity. COVID-19 will only increase this figure in 2020.
- Sub-Saharan Africa has the highest prevalence of food insecurity at 52 per cent of the population.
- North America and Europe have the lowest prevalence of food insecurity at eight per cent of their population.
- The number of people experiencing undernutrition has increased by 36 million in the three years to 2018. Today, 822 million people are suffering from undernutrition globally, leaving them at the highest risk of starvation.
- The five most food insecure countries are Sierra Leone, Liberia, Niger, Malawi and Lesotho, where more than half of the population experience severe food insecurity.
- The Central African Republic, Zimbabwe and Haiti are countries with the highest proportion of their population undernourished.
- The lack of affordable food has increased among all bands of peace since 2006, including very high peace countries.
- Sixty-five per cent of the population in the world's least peaceful and low income countries experience food affordability problems.

A Snapshot of Global Food Security

More than two billion people globally face food insecurity, defined as uncertainty in access to a sufficient quantity of food necessary for a healthy life. The global number of food insecure people has been on the rise, increasing by 300 million people since 2014. Of the two billion people who are currently food insecure, around 700 million experience a more severe form of food insecurity. This means the individual has to skip meals or go without food for an entire day. This form of food insecurity has adverse consequences on an individual's physical and mental health. Economic productivity is also affected. When large proportions of a country's population are severely and regularly food insecure, a country's economic development is stifled. Table 2.2 shows the number of food insecure people as well as the prevalence of food insecurity globally.

TABLE 2.2

Global food insecurity, 2014–2018

Since 2014, the number of food insecure people has risen 18 per cent.

Indicator	2014	2015	2016	2017	2018
Total population in moderate or severe food insecurity (billions of people)	1.7	1.7	1.8	1.9	2.0
Prevalence of moderate or severe food insecurity in the adult population	23.2%	23.2%	24.1%	25.6%	26.4%

Source: FAO

FOOD INSECURITY BY REGION

Sub-Saharan Africa is the most food insecure region. More than 600 million people in the region are facing food insecurity, equivalent to 58 per cent of the region's population. This means that more than one in two people in sub-Saharan Africa are suffering from some level of food insecurity, either severe or moderate. The 16 most food insecure countries in the world are located in sub-Saharan Africa.[5] In addition to the existing food insecurity, the region is also projected to experience rapid population growth, with a projected population of 2.1 billion in 2050, an increase of 94 per cent.

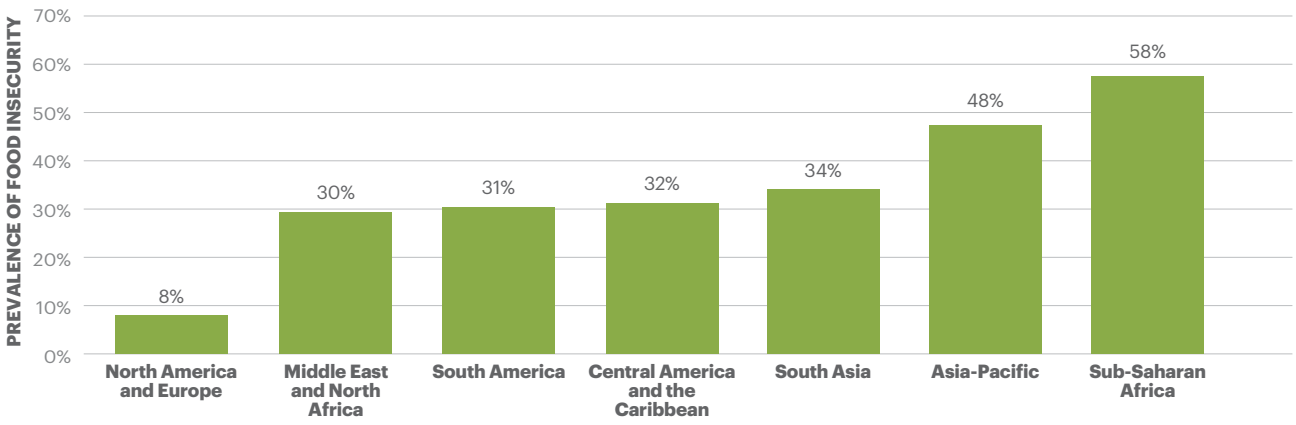
North America and Europe have the lowest prevalence of food insecurity at eight per cent of their population. In terms of severe levels of food insecurity, the proportion is much lower at one per cent. Despite the fact that food insecurity is less prevalent in Europe and North America, the phenomenon is not limited to the developing countries alone. Figure 2.4 shows the regional prevalence of food insecurity across the regions of the world in 2018.

> “
>
> An estimated two billion people currently face moderate or severe food insecurity. By 2050, this figure is expected to increase to 3.5 billion people.

FIGURE 2.4

Food insecure persons by region, percentage of total region population, 2018

Sub-Saharan Africa has the highest prevalence of food insecurity with 58 per cent of the population deemed food insecure.



Source: FAO, IEP Calculations

South Asia and sub-Saharan Africa each have over 600 million people experiencing food insecurity. South Asia has around 34 per cent of its population – more than one in every three people – in a state of food insecurity.[6] The proportion of sub-Saharan Africa is higher, at 58 per cent, but the region's population is comparatively smaller.

FOOD: ACCESS AND INTAKE

For food security to be achieved people must have access to sufficient food that meets their basic preferences and dietary needs for an active and healthy life.[7] Food security comprises two dimensions: *availability* and *accessibility*.

- Food availability requires a sufficient amount of food of appropriate quality be supplied, whether through domestic production, food imports or food aid.
- Food accessibility requires that the legal, political, economic and social arrangements allow for the individual to have the ability to acquire food.

If any of these dimensions are not met, food security is compromised.

There can be many sources of disruptions to domestic food supply. Not only can they be ecological shocks, they can also be related to subsidies, cartel activity or poor logistics, which also have an effect on the pricing of food or its availability.

Any sudden shock not only disrupts the availability of and access to food, they can also create knock-on effects resulting in heightened political instability, higher levels of civil unrest, higher numbers of forced migration and a higher likelihood of civil conflict.

FOOD INSECURITY AND PEACEFULNESS

Food insecurity can be a direct result of violence, conflict or political instability, but food insecurity can also be a trigger to and stressor of social tensions. In 2019, most of the 41 active conflicts were in countries that are food insecure such as Somalia, Afghanistan and the Central African Republic.[8] Conflict, extreme poverty and severe food insecurity interact in systemic ways by generating negative feedback loops. This is where social order deteriorates continuously, along with the food and water resources.

Yemen is an example of the interaction between conflict, extreme poverty and food insecurity. Since 2018, conflict has led to a food security crisis leaving 14 million people on the brink of starvation. Some estimates point to nearly 50,000 children dying from extreme hunger and hunger related disease caused by the conflict.[9]

Over 453 million people in very low peace countries experience food insecurity. This compares to 68 million countries in very high peace countries.[10]

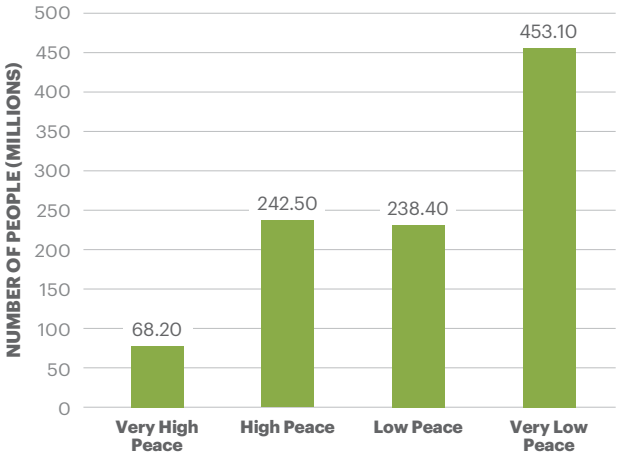
Figure 2.5 highlights the number of people experiencing food insecurity by levels of peacefulness.

Food insecurity and peacefulness have a strong correlation. Table 2.3 displays the statistically significant correlations between the prevalence of food insecurity and Global Peace Index indicators. The prevalence of food insecurity increases as countries experience deteriorations in safety and security, internal peace or increases in violent crime. The strong relationship between peacefulness and food insecurity highlights that less peaceful countries have a higher prevalence of food insecurity.

FIGURE 2.5

Total population facing food insecurity by level of peacefulness, 2018

A significantly higher number of people face food insecurity in less peaceful countries.



Source: FAO, IEP Calculations

The strongest relationship is between the prevalence of food insecurity and violent crime, with a correlation coefficient of 0.65. The relationship between peace and food insecurity is expected, given food insecurity can be either an exacerbating factor or direct result of conflict, violence or political instability.

TABLE 2.3

Strongest correlations between the prevalence of food insecurity and GPI indicators

Measures of food insecurity strongly correlate with indicators and domains from the Global Peace Index.

FAO indicator	GPI indicator	Correlation coefficient	Number of countries
Prevalence of food insecurity	Violent Crime	0.65	87
Prevalence of food insecurity	Safety & Security	0.59	87
Prevalence of food insecurity	Internal Peace	0.57	87

Source: FAO, IEP Calculations

FOOD INSECURITY BY INCOME

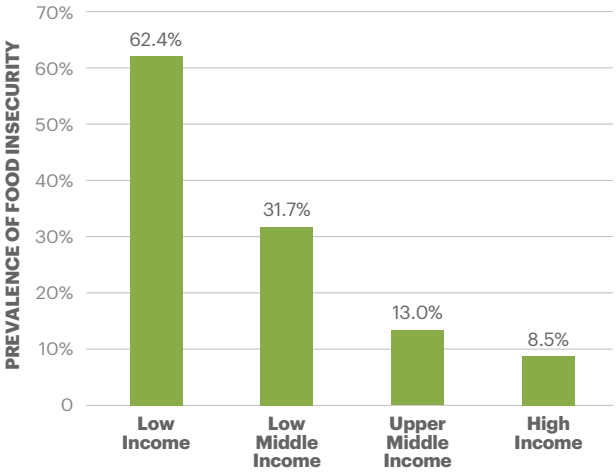
As expected, low income and lower middle income countries have a higher prevalence of food insecurity. Figure 2.6 displays the prevalence of food insecurity by income levels. The prevalence of food insecurity in low income countries is 62.4 per cent, indicating that more than six out of ten people experience food insecurity. Many residents of low income countries are in absolute poverty and consequently, may not have adequate access to food. In low income countries, 27.3 per cent of the population suffer from severe food insecurity.

In high income countries, the prevalence of food insecurity is much lower at 8.5 per cent, meaning that one in 12 people are subject to this threat.[11] Only 1.8 per cent of the population of high income countries was classified as suffering from severe food insecure in 2018.

FIGURE 2.6

Prevalence of food insecurity by country income level, percentage of total population, 2018

As the income of a country improves, so does food security.



Source: FAO, IEP Calculations

FOOD INSECURITY BY COUNTRY

Sierra Leone was the world's most food insecure country in 2018, with 91 per cent of the population facing food insecurity. This high level of food insecurity led to 26 per cent of the country's population being undernourished.

An estimated 53 per cent of Sierra Leoneans live below the $1.25 per day poverty line. Climatic conditions have caused many crops to fail or have low outputs, which have led to shortages of food. Further, the COVID-19 pandemic has disrupted international food procurement causing food imports to decline. Consequently, the availability of food has fallen. From January 2018 to June 2020, the price of Cassava in Sierra Leone has increased almost three-fold. The higher prices for staple foods, as well as the tightening supplies driven by domestic and international circumstances, will further compromise food insecurity in Sierra Leone.

In 2018, six countries had over 50 per cent of their population suffering from severe food insecurity — Sierra Leone, Liberia, Niger, Malawi, Yemen and Lesotho.[12] With the exception of Lesotho, the other five are among some of the world's poorest countries with an average GDP per capita approximately $500.

Lesotho, Niger and Sierra Leone are examples of how internal and external factors coalesce to drive food insecurity. For example, Lesotho's food insecurity is driven by successive droughts, which have led to years of consecutive crop failures. The populations' heavy reliance on subsistence farming coupled with low incomes and high food prices have resulted in half of the population being severely food insecure.[13]

In Niger, 83 per cent of the population suffers from food insecurity. Frequent droughts and floods in Niger have caused a 12 per cent decline in cereal production in 2020 compared to 2019.[14] This has adversely affected food availability of staple foods. Simultaneously, Niger suffers from medium-intensity conflict, which also impacts on food security.[15]

The Sahel region is suffering from intercommunal hostilities and conflict, which has resulted in a refugee crisis. Most notably, the region's displacement is exacerbated by Mali's Islamist and Tuareg separatist movement, political violence in Nigeria and ongoing terrorist activity dominated by Boko Haram. Niger is home to more than 200,000 displaced people, which places additional pressure on the country's already scarce resources and threatens to intensify intercommunal rivalries. The number of food insecure people are projected to increase as poor harvests, widespread displacement and ongoing conflict continues to place additional pressure on already scarce food and water resources.[16]

TABLE 2.4

Highest levels of food insecurity by country, 2018

The 12 countries with the highest prevalence of food insecurity are located in sub-Saharan Africa.

Country	Prevalence of food insecurity in the total population %	Number of food insecure people, millions	Average annual population growth (2018 to 2050)
Sierra Leone	91%	6.9	1.6%
Liberia	86%	4.1	2.1%
Niger	83%	17.8	3.4%
Malawi	82%	15.3	2.3%
Lesotho	78%	1.7	0.7%
Guinea	74%	9.4	2.3%
Cameroon	71%	17.1	2.2%
Botswana	70%	1.6	1.3%
Tanzania	69%	39.7	2.6%
Mozambique	69%	20.4	2.5%
Togo	68%	5.3	2.1%
Namibia	68%	1.7	1.5%
Angola	65%	18	2.9%
Eswatini	64%	0.9	1.3%
Côte d'Ivoire	58%	13.8	2.2%
Kenya	57%	28.1	1.8%
Afghanistan	54%	19.3	1.7%
Gambia	54%	1.1	2.4%
Philippines	53%	55.1	0.9%
South Africa	51%	29	0.8%

Source: UNSTATS, World Bank, FAO, IEP Calculations

Undernourishment and Food Insecurity

In 2018, the number of people facing undernourishment increased to 822 million, up by 36 million from 2015. Undernourishment results from persistent food insecurity that leads to regular and tangible compromises on the quantity and quality of food necessary for a healthy life. Food insecurity has a strong predictive relationship with micronutrient deficiency and inadequate diets.[17]

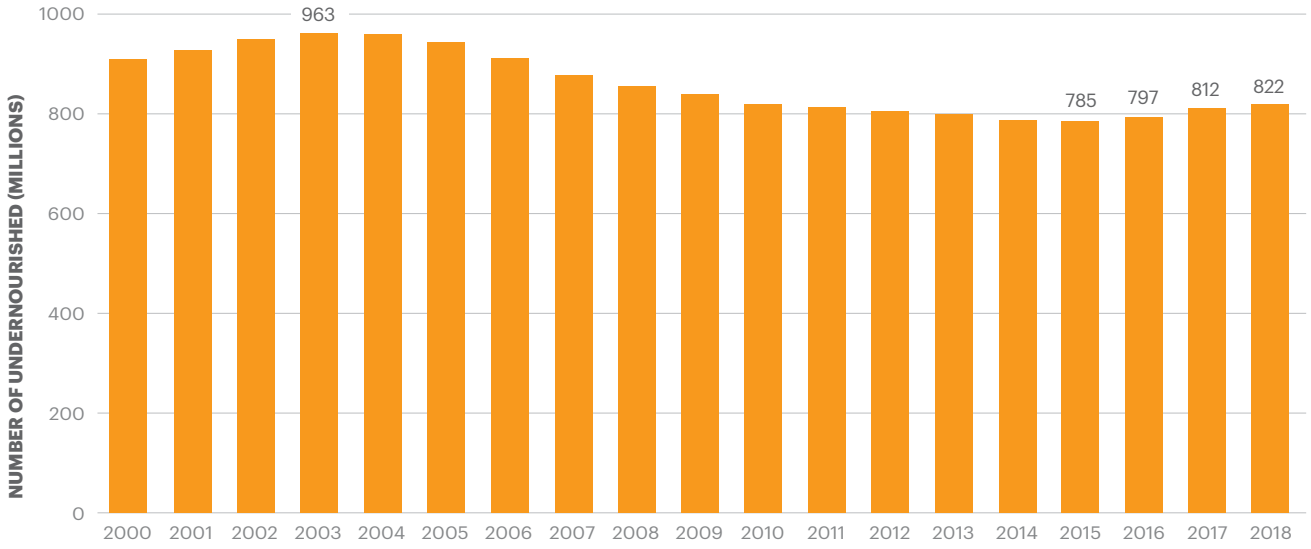
Figure 2.7 displays the trend for global undernourishment. Since 2015, the global level of undernourishment has been on the rise after a decade of decline. The rising level of undernourishment over the past years has resulted in the number of unnourished people globally nearly reverting back to 2000 levels. This trend will not improve in the next couple of years due to the COVID-19 lockdowns and the ensuing economic downturn.

South Asia and sub-Saharan Africa have the highest rates of undernourishment, equal to 14.7 and 22.8 per cent of the population, respectively. This accounts for two-thirds of the world's undernourished population with 279 million people in South Asia and 239 million people in sub-Saharan Africa.[18] Along with food insecurity, undernourishment is on the rise in many regions of the world and has been increasing in sub-Saharan Africa and Latin America and the Caribbean since 2014 and MENA since 2012.

FIGURE 2.7

The number of undernourished globally, 2000–2018

Since 2015, the number of undernourished people has been on the rise.



Source: FAO

EXAMPLES OF UNDERNOURISHED COUNTRIES

The incidence of undernourishment is highest in the Central African Republic, Zimbabwe and Haiti equal to 60, 51 and 49 per cent of the total population, respectively. These three countries demonstrate that social, economic and ecological threats can interact to drive food insecurity and consequently undernutrition. A short description of the dynamics in each of these countries follows.

Haiti is an example of how economic slowdowns and rising prices of food can negatively impact food security and nutrition. Food prices in Haiti are up to 77 per cent higher than the rest of Latin America and the Caribbean. Haiti is heavily dependent on food imports, which account for more than 50 per cent of available food — a consequence of poor agricultural output compounded by severe storms, flooding, landslides and drought. Haiti clearly demonstrates that when poverty is high, even small shocks can substantially increase food insecurity. Not only do natural disasters contribute to food insecurity, but Haiti is also vulnerable to economic instabilities such as inflation and international price volatility. This subsequently weakens the volume of food imports.[19] Haiti is also weak in its Positive Peace measures, especially corruption and measures of government effectiveness. Due to Haiti's dependence on food imports, slight changes in economic conditions for the worse can have much larger effects on Haiti's level of nutrition and food security.

The Central African Republic has suffered from ongoing conflict since 2012.[20] Conflict has disrupted livelihoods and food production and resulted in the displacement of one in four citizens. Consequently, household purchasing power has deteriorated.[21] The level of undernutrition in the population has increased from 32 per cent in 2010 to approximately 60 per cent in 2018.

Zimbabwe has experienced severe drought, which was intensified by an economic slowdown and economic instability of the past decade. This in turn has lowered the ability for households to adapt to the shocks. Recurrent ecological shocks, coupled with low agricultural yields and food subsidiaries, which have negatively affected Zimbabwe's food security and nutrition levels. As a consequence, Zimbabwe has one of the highest levels of undernutrition in the world equal to 51 per cent of the population.

By 2050, estimates indicate that the global demand for food will increase by 50 per cent.[22] In order to feed everyone adequately, the number of calories produced will need to exceed 20,500 trillion calories. This is a 56 per cent increase from the number of calories produced in 2010.[23]

Figure 2.8 displays the projected number of undernourished people under the worst of the three scenarios developed by the FAO for food insecurity.[24] By 2050, the number of undernourished is projected to increase by 260 million people, an increase of 32 per cent from 2018 levels.

Since 2015, the number of undernourished people has increased markedly and the poorer projection is looking increasingly likely. Events such as the COVID-19 pandemic have brought significant strain on global food markets, limiting the access to, and availability of global food.

Under this projection, income inequalities are exacerbated, deepening the divide between the richest and poorest. Furthermore, the FAO projection accounts for increasing reliance on animal products, increases in food waste and a lack of investment into sustainable food and agricultural systems.

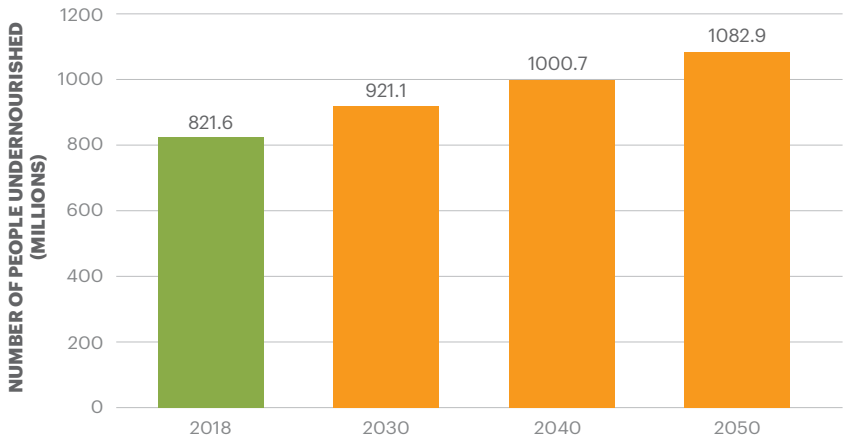
Achieving food security by 2050 will be a significant challenge for the global community. Not only must the additional population be supplied with adequate food, but the two billion people suffering today from food insecurity must also be addressed. Using the projections of undernourishment and accounting for population growth, an additional 1.5 billion people could suffer from food insecurity by 2050, totalling 3.5 billion people.[25]

In order to address global food insecurity these significant challenges will need to be overcome. Most importantly, the challenges of improving agricultural land productivity, sustainably developing additional agricultural land, reducing food wastage, implementing programs to reduce population growth and changing consumer preferences as well as mitigating impacts from ecological threats.

FIGURE 2.8

Projection of the number of undernourished people, 2018–2050

The number of people suffering from undernutrition is projected to increase by 32 per cent by 2050.



Source: FAO

> The incidence of undernourishment is highest in the Central African Republic, Zimbabwe and Haiti equal to 60, 51 and 49 per cent of the total population, respectively.

FOOD PRICE VOLATILITY

Since 2006 food prices have been more volatile, displaying larger and more frequent swings, although agricultural commodity prices are not significantly higher in real terms since the 1970s. Prior to 2006 the majority of the indices did not experience large swings or fluctuations in the price. Civil unrest is regularly associated with major price increases in poorer countries.

Figure 2.9 displays the trend in food price indices from 1990 to 2020. Food prices are a potential stressor that can increase a country's fragility and be an early trigger for domestic instability, including violent demonstrations and civil unrest. In already fragile countries, sudden price rises in food can increase the number of hungry, while sudden price falls can undermine subsistence livelihoods and make local markets uncompetitive. This is especially prevalent in places where much of the population is already struggling with food security.

Food prices reached their highest levels for 30 years during June of 2008, before collapsing shortly after because of the 2008 Global Financial Crisis. However, following the collapse, prices began to rise again rapidly.[26] Both Cameroon and Haiti suffered increases in violence and political instability in the wake of the sudden price hikes of 2008.

The prices witnessed in 2008 led to protests and riots over the affordability of food in Haiti and resulted in violent demonstrations and the dismissal of Prime Minister Jacques Edouard Alexis.[27] Similarly, Cameroon experienced riots in 2008 over the volatility and high food prices, which led to Cameroon's worst civil unrest in over a decade. The riots resulted in the death of at least 40 people and 1,500 arrests.[28] Figure 2.9 indicates that since 2007, global markets have seen a series of dramatic swings in food prices, indicating that price volatility has increased.

Dramatic swings in food prices mostly affect the disadvantaged. These price spikes in the short-run reduce the affordability of food. For the most food insecure people, this can heavily worsen their food situation making them more at risk of undernourishment, disease and starvation.

For food security to be achieved, the access and availability to food must not only be improved but must also be stabilised. Stability is achieved when food supply is maintained throughout the year and over the long-term. This can be achieved through many mechanisms, including diversity of crops, better capture and storage of water, food banks to offset the years when crops fail or the economy is not sufficiently strong enough to support imports. However, high levels of Positive Peace provides the systemic factors necessary to solve these systemic problems.

COVID-19 has caused significant disruptions to the global food market. This is especially evident in already fragile and conflict affected countries. Figure 2.10 displays the change in the monthly domestic price for different food staples in selected conflict-affected countries from January 2018 to June 2020.

Since January 2018, these countries have experienced at least a 33 per cent price increase in food staples. Ongoing fragility and conflict paired with COVID-19 restrictions and climatic events have driven enormous increases in prices after January 2020. For example, since January 2020, the average retail price of wheat in South Sudan has doubled.[29]

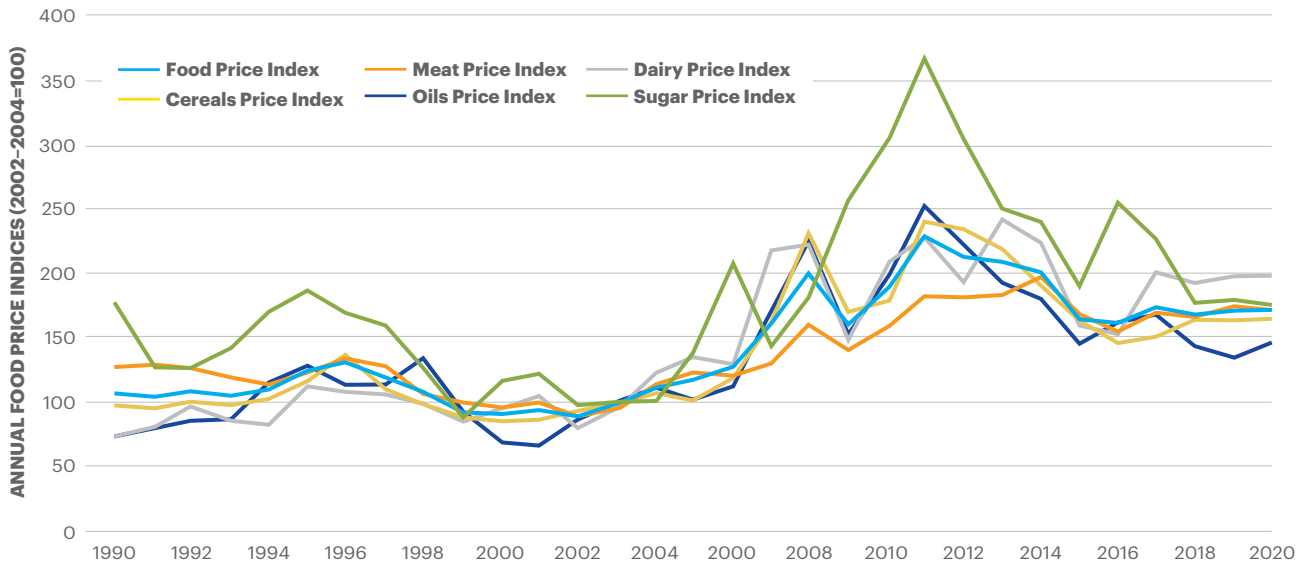
South Sudan provides one example of how internal and external shocks can coalesce to drive food insecurity. In South Sudan, estimates place the level of food insecurity above 50 per cent of the population. Continuous conflict stretching over six years has crippled South Sudan's economy, and consequently, the GDP per capita has fallen from $1,120 in 2015 to less than $300 by 2017. The level of poverty is severe and widespread with 82 per cent of the population considered to live below $1.90 a day. Ongoing conflict has disrupted food production, for example, domestic cereal production has declined 25 per cent when compared to pre-conflict levels.[30]

The conflict has led to an estimated 4.4 million people fleeing

FIGURE 2.9

Global food price indices (2002–2004=100)

While food prices are not at historic highs, they have increased by approximately 68 per cent when comparing the 1990 to 2005 average price to the 2006 to 2020 average.

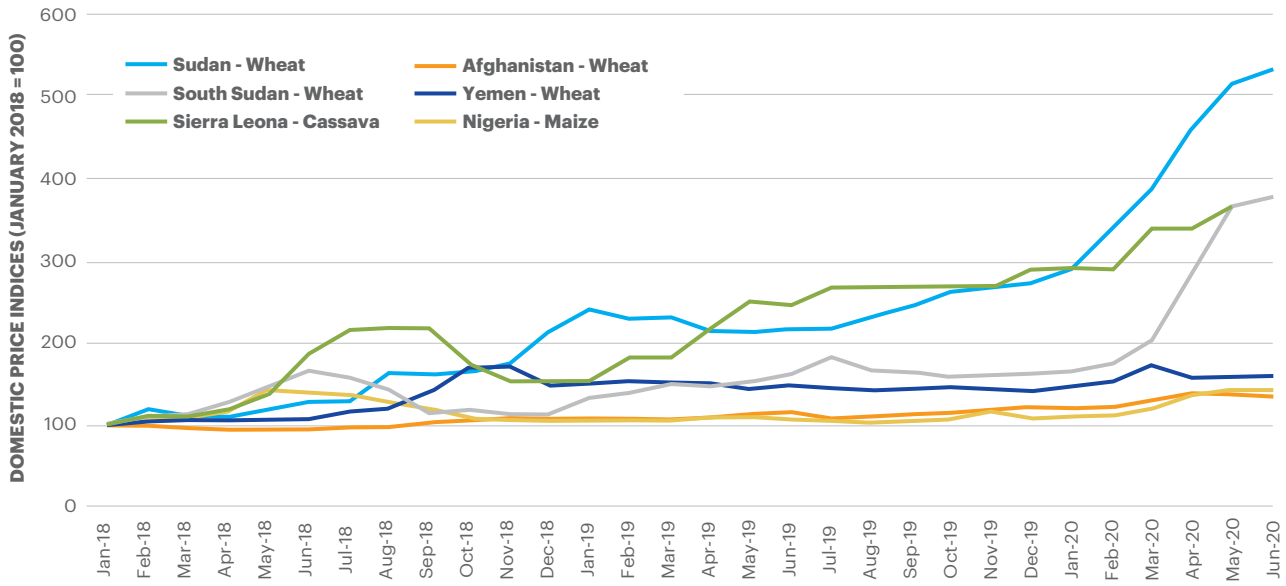


Source: FAO

FIGURE 2.10

Change in local food prices from January 2018, 2018–2020

Sharp increases in the price of food staples can lead to sudden increases in food insecurity.



Source: FAO, IEP Calculations

their homes since 2013, which has further disrupted agricultural production. Agriculture productivity has also been impacted by recurring floods, droughts and insect infestations that further constrain food production and livelihoods. Consequently, in 2019, more than half of the population of South Sudan required humanitarian assistance.[31]

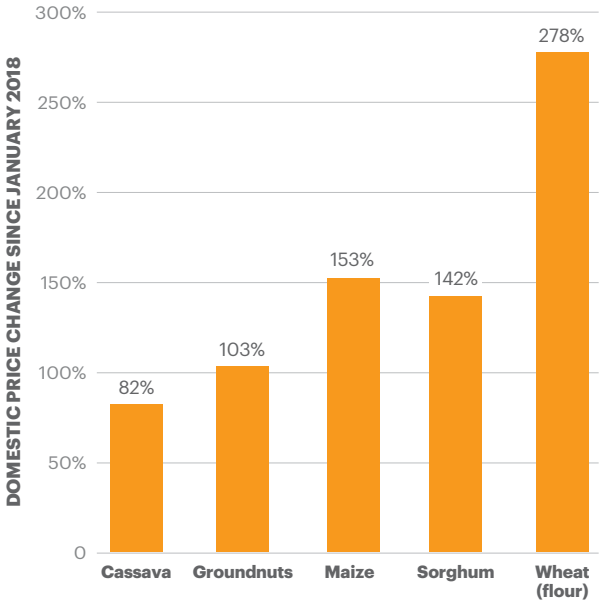
Figure 2.11 displays the change in the prices of food staples from January 2018 when compared to June 2020 prices.

South Sudan highlights the multitude of negative shocks that in the context of ongoing armed conflict, absence of effective government systems and lack of strong social cohesion, can push a country to the brink of starvation in only a few short months. Ecological threats such as natural disasters, severe food insecurity and high level of water stress combine with a lack of stable institutions to create a vicious cycle in conflict-affected countries. This leaves them at high risk of a humanitarian crisis. Therefore, building peace and resilience in these societies requires a consistent and significant humanitarian intervention to address the combination of these negative threats.

FIGURE 2.11

Change in food prices, South Sudan, January 2018 to June 2020

All food staples in South Sudan have increased significantly from January 2018 levels.



Source: FAO, IEP calculations

Perceptions of Food Insecurity

The perception of food insecurity has worsened over time in almost all regions. The Middle East and North Africa recorded the highest increase, from 16 per cent of the population unable to afford adequate food in 2006, to 33 per cent in 2018. Figure 2.12 displays the proportion of the population that was unable to afford the necessary amount of food at all times.

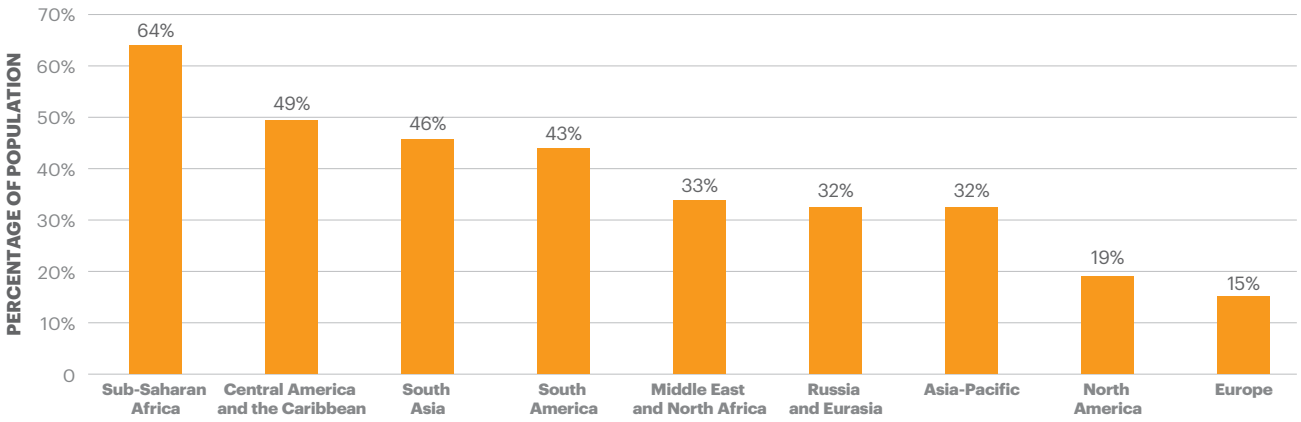
The Gallup World Poll —the leading global survey of public perceptions — measures public perceptions of food security. Sub-Saharan Africa had the highest proportion of its population that felt they could not afford adequate food at 64 per cent, followed by Central America and the Caribbean at 49 per cent. In Europe and North America, the proportion of the population unable to afford adequate food was much lower at 15 and 19 per cent, respectively.

Public perception of food insecurity is the highest among the world's least peaceful countries. This is in line with the higher level of food insecurity and undernourishment that is witnessed in countries with low levels of peacefulness. Nearly half of the population in the least peaceful countries express an inability to afford food. By contrast, 15 per cent of the population in very high peace countries express the inability to afford food. The lack of affordability has increased among all levels of peace, even the most peaceful countries, as shown in Figure 2.13.

FIGURE 2.12

The proportion of the population saying that they have been unable to afford adequate food, by region, 2018

Sub-Saharan Africa has the highest percentage of the population unable to afford food.

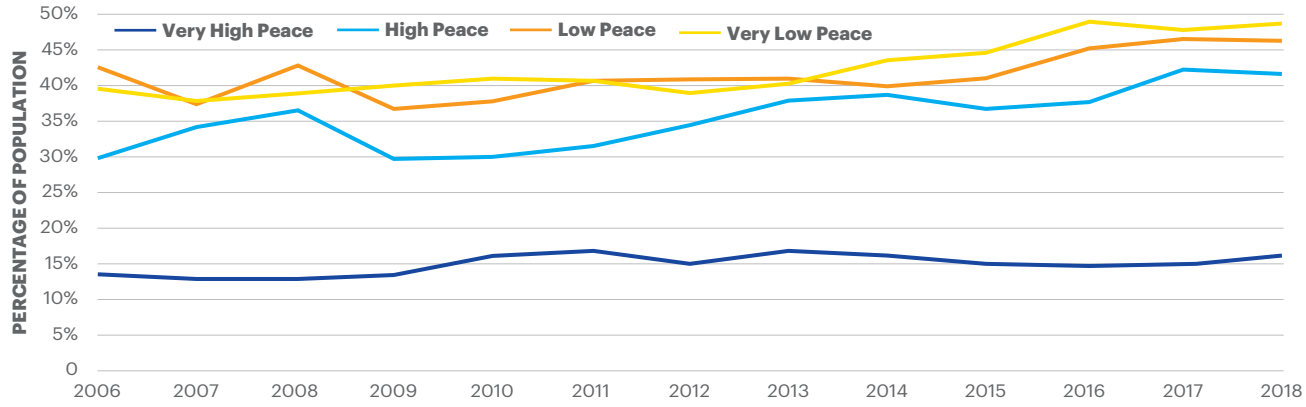


Source: Gallup, IEP Calculations
Note: Question asked: Have there been times in the past 12 months when you did not have enough money to buy food that you or your family needed?

FIGURE 2.13

Proportion of the population that have been unable to afford adequate food, by GPI peace level, 2006–2018

The proportion of the population who perceive themselves to be unable to afford food has consistently increased since 2006, in all bands, including high peace countries.



Source: Gallup, IEP Calculations
Notes: Question asked: Have there been times in the past 12 months when you did not have enough money to buy food that you or your family needed?

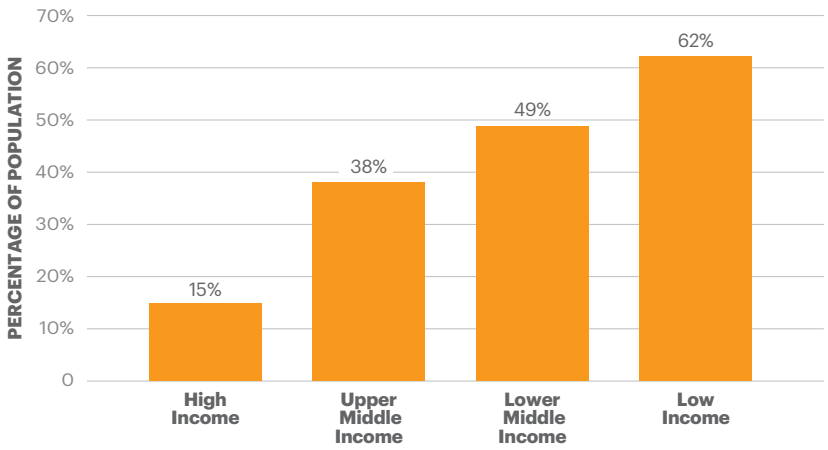
The proportion of people that can afford food increases as the income level rises. However, 15 per cent of the population in high income countries experienced an inability to buy adequate food at all times. By contrast, the inability to afford food all the times is experienced by 62 per cent of the population in low and lower middle income countries. Figure 2.14 shows the proportion of people that expressed inability to afford food at all times, averaged across each income group.

In addition, 12 per cent of the population in the most peaceful and high income countries express an inability to afford food at all times. This compares to 65 per cent of the population among the least peaceful and low income countries. Uruguay, Kawait and Qatar are the high income and high peace countries with the largest percentage of people who experienced food affordibiltiy problems, with all of them at over 20 per cent. Table 2.5 shows countries by income and peace classification with highest reported inability to afford food.

FIGURE 2.14

Proportion of the population unable to afford food, by income group, 2018

Sixty-two per cent of the population in low-income countries lack enough money to buy adequate food compared to 15 per cent in high income countries.



Source: Gallup, IEP Calculations
Note: Question asked: Have there been times in the past 12 months when you did not have enough money to buy food that you or your family needed?

KEY FINDINGS

PERCEPTIONS OF FOOD INSECURITY

Nearly half of the population in the least peaceful countries express an inability to afford food. By contrast, 15 per cent of the population in very high peace countries express the inability to afford food.

TABLE 2.5

The ten countries with the highest proportion of the population unable to afford food, high income & high peacefulness; low income & very low peacefulness, 2018

Countries that are low income and very low peace on average have a much higher proportion of the population unable to afford the necessary food compared to high income and very high peace countries.

High Income & Very High Peace	
Country	**Percentage of the population**
Uruguay	29%
Kuwait	22%
Qatar	21%
Portugal	19%
Estonia	16%
Latvia	16%
Croatia	15%
Slovenia	14%
Canada	14%
Lithuania	14%

Low Income & Very Low Peace	
Country	**Percentage of the population**
Niger	76%
Burundi	73%
Zimbabwe	72%
Chad	72%
Congo, DRC	67%
Somalia	64%
Yemen	61%
Afghanistan	57%
Ethiopia	51%
Mali	48%

Source: FAO, IEP Calculations

Water Stress

KEY FINDINGS

- More than 2.6 billion people are living in the 46 countries currently experiencing high or extreme water stress. This means that they do not have enough water to meet their needs or that their water supply is at material risk of disruption.
- The combined effects of rising temperatures, population growth and increased rainfall variability are likely to reduce the water supply in many countries.
- By 2040, a total of 5.4 billion people – or more than half of the world's projected population – will live in the 59 countries experiencing high or extreme water stress. India and China will be among these countries.
- There is now 60 per cent less freshwater available per person today than there was in the early 1960s. The population is increasing faster than water availability.
- Developed countries, on average, consume approximately ten times more water per person than developing countries.
- Domestic water usage accelerated markedly after the global recession of the early 2000s and with the strong economic growth observed in Asia.
- Over the past decade, the number of recorded water-related conflict and violent incidents increased by 270 per cent worldwide.

A Snapshot of Global Water Stress

More than 2.6 billion people globally are living in countries exposed to high and extreme levels of water stress, defined as the imbalance between the renewable water supply and industrial, agricultural and domestic sector demand. Higher levels of water stress indicate that not enough water is available to meet the levels of withdrawal and countries may be forced to redirect water allocation only to the most critical uses.

When water stress is at its most severe levels, such redirections may no longer be sufficient. In these cases, household water supply may be shut off intermittently, irrigation curbed and industrial use limited or barred. Globally, 1.8 billion people are exposed to these extreme levels.

As a consequence of extreme water stress, economic development and food production are impeded, with the nourishment, health and well-being of the population being compromised. Social tension, conflict and displacement can ensue and possibly spread from national levels into regional and global concerns. The definitions of these water stress levels can be found in Box 2.2.

Along with industrialisation, population growth is a key driver of increased demand for water. As the population grows, households and cities require more water through direct water usage, irrigation of crops and animal husbandry. Water stress is verified all over the world, but areas of more intense scarcity are South Asia, Middle East and North Africa (MENA), South-western Europe, Eastern Latin America, Southern Africa and Oceania.

BOX 2.2

Water stress thresholds

Water stress is calculated as the annual water withdrawals divided by the total available freshwater.[1] High stress is indicative of intense competition for available water among domestic, industrial and agricultural sectors. In some situations, there may also be competition for water resources among different households, municipalities, tribes or ethnic groups. The higher the level of water stress, the greater the risk of water resource exhaustion, conflict over water sources and reduced capacity to deal with ecological threats, such as wildfires and droughts.

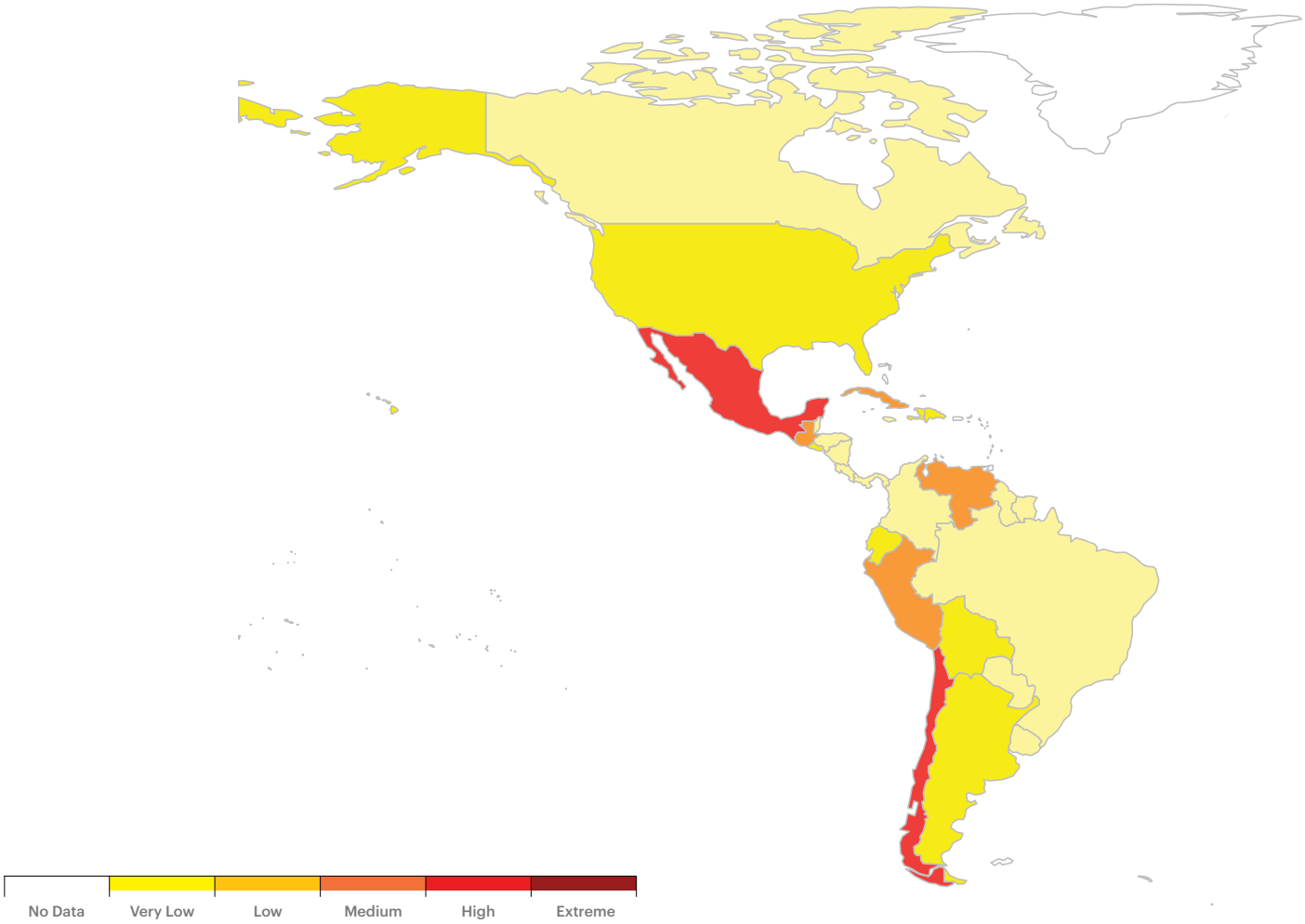
In this report, a country's level of water stress is classified as:

Water Stress status	Proportion of available supply withdrawn every year
Extreme	Over 80 per cent
High	40 to 80 per cent
Medium	20 to 40 per cent
Low	Ten to 20 per cent
Very Low	Less than ten per cent

FIGURE 2.15

Global map of country level water stress

Water-related stress is highest in the Middle East and North Africa.



Source: WRI, IEP Calculations
Note: Map data available for 134 countries.

WATER STRESS BY REGION

Globally, 2.6 billion people are exposed to high and extreme water stress, with the majority living in South Asia and MENA. By 2040 this number will grow to 5.4 billion, driven by increasing water stress in the Asia-Pacific region.

South Asia has the largest population living in countries exposed to water stress equal to 1.7 billion people throughout the region. This is projected to worsen by 2040, when an additional 305 million people will be living in countries facing water stress in the region. There are large disparities across the region in regards to water availability. For example, India suffers from extreme water stress, exposing 1.4 billion people to this ecological risk. Whereas neighbouring Bangladesh has abundant water and low levels of water stress. However, it does suffer from recurent flooding. Figure 2.16 displays high and extreme levels of water stress today and its projections for 2040.

Water stress is projected to increase in the Asia-Pacific, mainly as a result of the rapid development of agriculture and manufacturing and more intense use of hydroelectricity.[2] Today, a majority of the countries in the Asia-Pacific region experience medium-level water stress. By 2040 an additional 1.9 billion of its inhabitants will be living in countries exposed to high and extreme levels of water stress. Currently, only one country in the region suffers from high to extreme water stress — Singapore. By 2040, six additional countries within the region will also face the same level of threat. China and Indonesia are two of the six countries that will transition into high or extreme water stress levels in the region, largely contributing to the 1.9 billion that will be living in countries exposed to high levels of water stress. The other four countries are Australia, Mongolia, the Philippines and Timor-Leste.

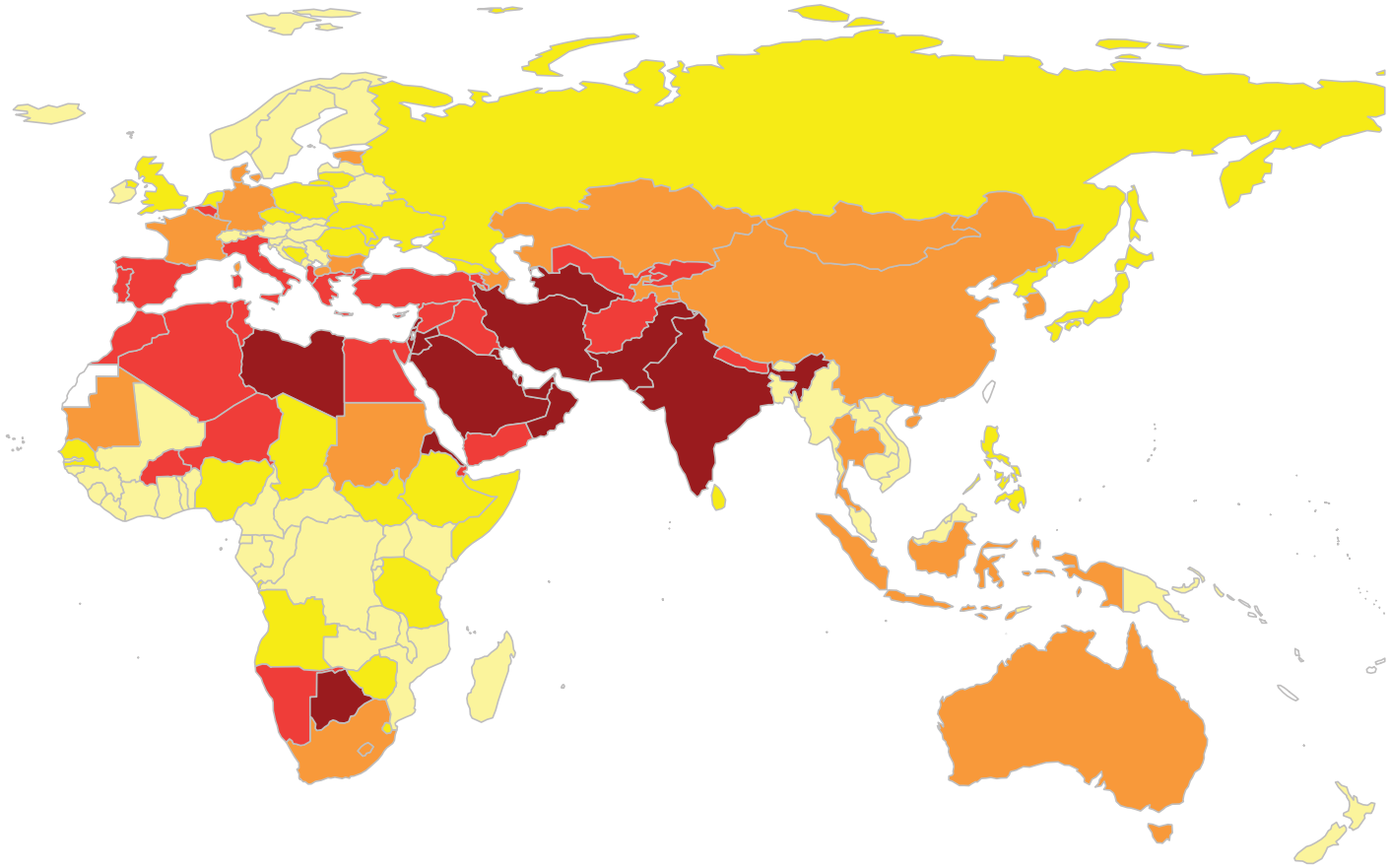
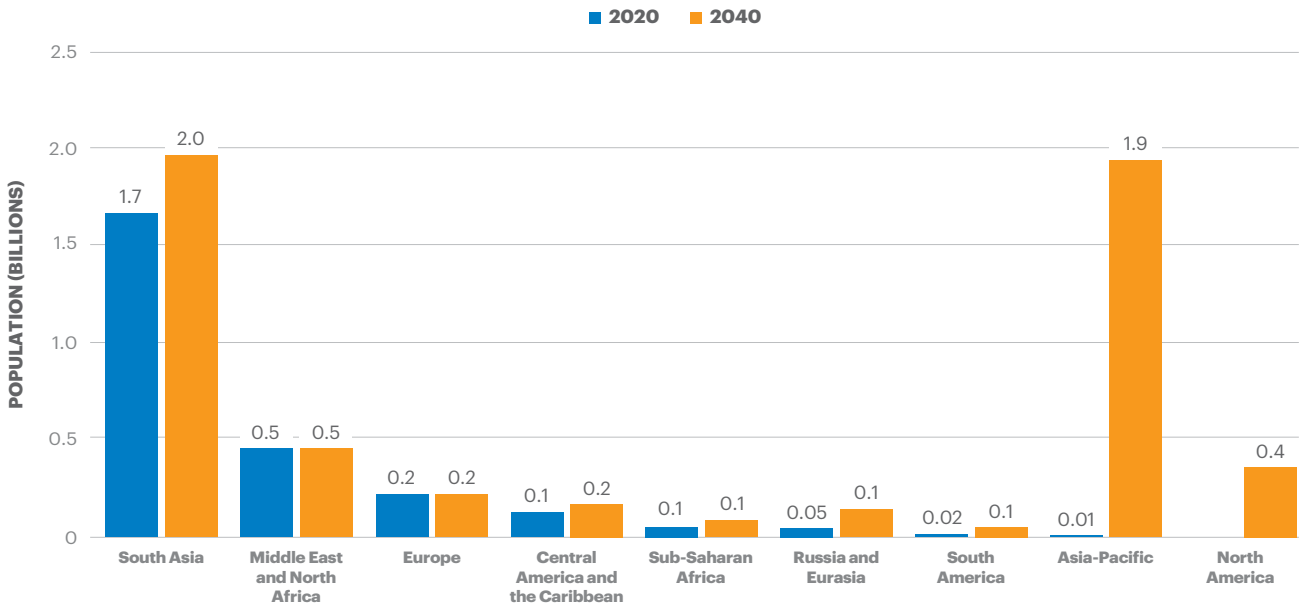


FIGURE 2.16

Population exposed to high and extreme water stress by region, current and projected

Approximately 1.9 billion people in Asia Pacific are living in countries that will transition to high or exterme water stress by 2040, most notably, China and Indonesia.



Source: WRI, UN, IEP Calculations

WATER STRESS BY COUNTRY

By 2040, 57 per cent of countries in South Asia will face high to extreme water stress, as shown in Figure 2.17. In contrast, virtually all countries in MENA will face the same level of threat. As such, the problem of water scarcity in the region will be patently supranational, requiring cross-border coordination and action.

In regions such as sub-Saharan Africa and South America, comparatively smaller proportions of countries face extreme water scarcity. In these regions, it is possible that national-level initiatives could suffice to mitigate this ecological threat.

Water stress is one of the most common ecological threats in the world, with 70 countries facing medium to extreme levels of water stress. MENA – the world's least peaceful region – is also the most water stressed. The 12 countries in this region suffering from extreme levels of water stress are home to approximately 180 million people. By 2040, this will increase to 18 countries, exposing 461 million people.

Countries that experience extreme water stress are particularly vulnerable to ecological threats, such as droughts, which can further reduce water availability. This can exacerbate social tensions, as people, ethnic groups and economic interests compete for a finite resource. Table 2.6 displays the number of countries exposed to different levels of water stress as well as the population exposed.

Of the countries facing high and extreme water stress, India has the largest exposed population around 1.4 billion people. This is followed by a distant second, Pakistan, at 220 million. India ranks 139th in the GPI, which means the country already operates at low levels of peace. Tensions between different political, ethnic and religious groups pose a threat to peacefulness in India. As water becomes increasingly scarce in the region, internal tensions may escalate, potentially leading to greater violence. Concerned with this fragility, the international community granted India the largest amount of official development assistance in 2019, linked to water conservation programs.

TABLE 2.6

Levels of water stress and the population exposed

Water-related stress is highest in the Middle East and North Africa.

	Medium water stress	High water stress	Extreme water stress
Number of countries	24	27	19
Population (billions)	2.3	0.8	1.8

Source: WRI, IEP Calculations

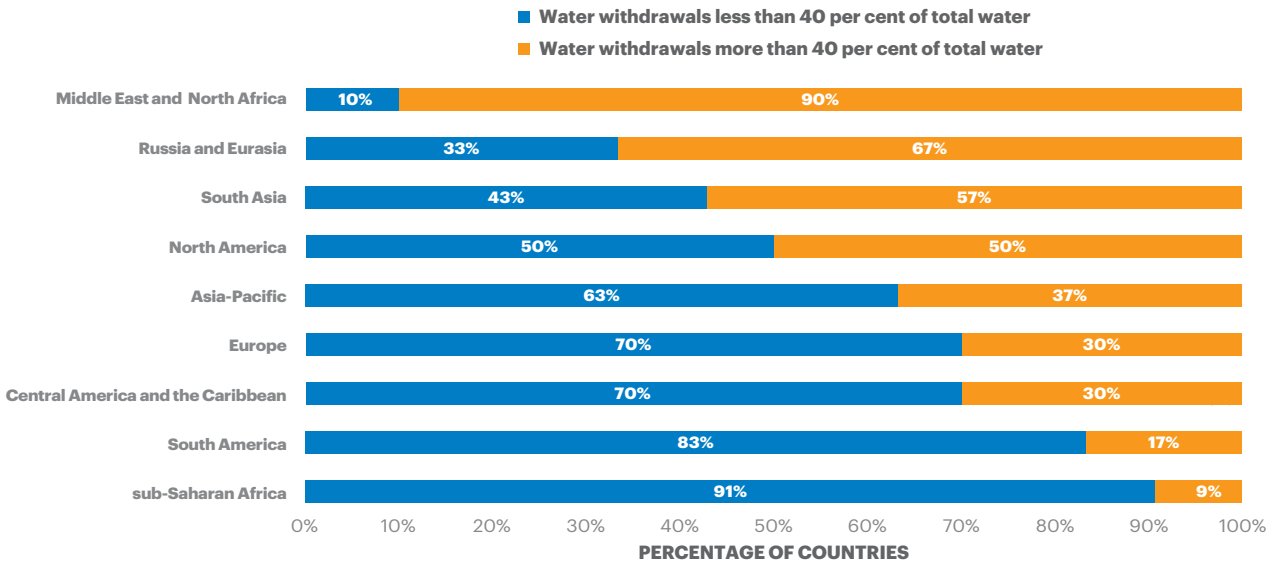
When accounting for both high and extreme water stress, 59 countries home to 5.4 billion people, will be experiencing these levels of water stress by 2040. This will make up more than 50 per cent of the world's population. India and China will be among these countries. They will have a combined population exceeding three billion. They will each be suffering from high levels of water stress. Violent demonstrations have been occurring in China and water stress could further exacerbate social tension and instability.[3]

Table 2.7 displays the change in water stress from the current levels of stress to 2040, as well as the population affected.[4] The combined effects of rising temperatures, population growth and increased rainfall variability are likely to reduce the water supply in many countries. By 2040, 101 countries are projected to increase in water stress; 58 countries will experience a severe deterioration and 43 countries will experience a slight deterioration.

FIGURE 2.17

Percentage of countries with high or extreme water stress by region, 2040 projections

In MENA, 90 per cent of countries will face high to extremely high water stress by 2040.



Source: WRI, IEP Calculations

TABLE 2.7

Change in water stress, today to 2040

In total, 58 countries are expected to severely worsen in terms of water stress.

Change in score	Number of countries	Proportion of countries (%)	Population exposed (billions)
Severe Deterioration	58	35	3.5
Slight Deterioration	43	26	1.8
Slight Improvement	34	20	1.6
Large Improvement	23	14	2.3
No Change	8	5	0.1
Total	**166**	**100**	**9.2**

Source: WRI, IEP Calculations

Water Usage and Stress

Only 2.5 per cent of the world's water is freshwater. Even then, a mere one per cent of this freshwater is easily available for withdrawal, with the remainder being trapped in the form of glaciers and snowfields.[5] A rising global population, greater agricultural irrigation and increasing industrialisation has placed substantial stresses on these limited water resources and as a result, water withdrawal have risen sharply. Since 1900, the global population has increased four-fold, whereas global water withdrawal increased approximately seven-fold, as seen in Figure 2.18.

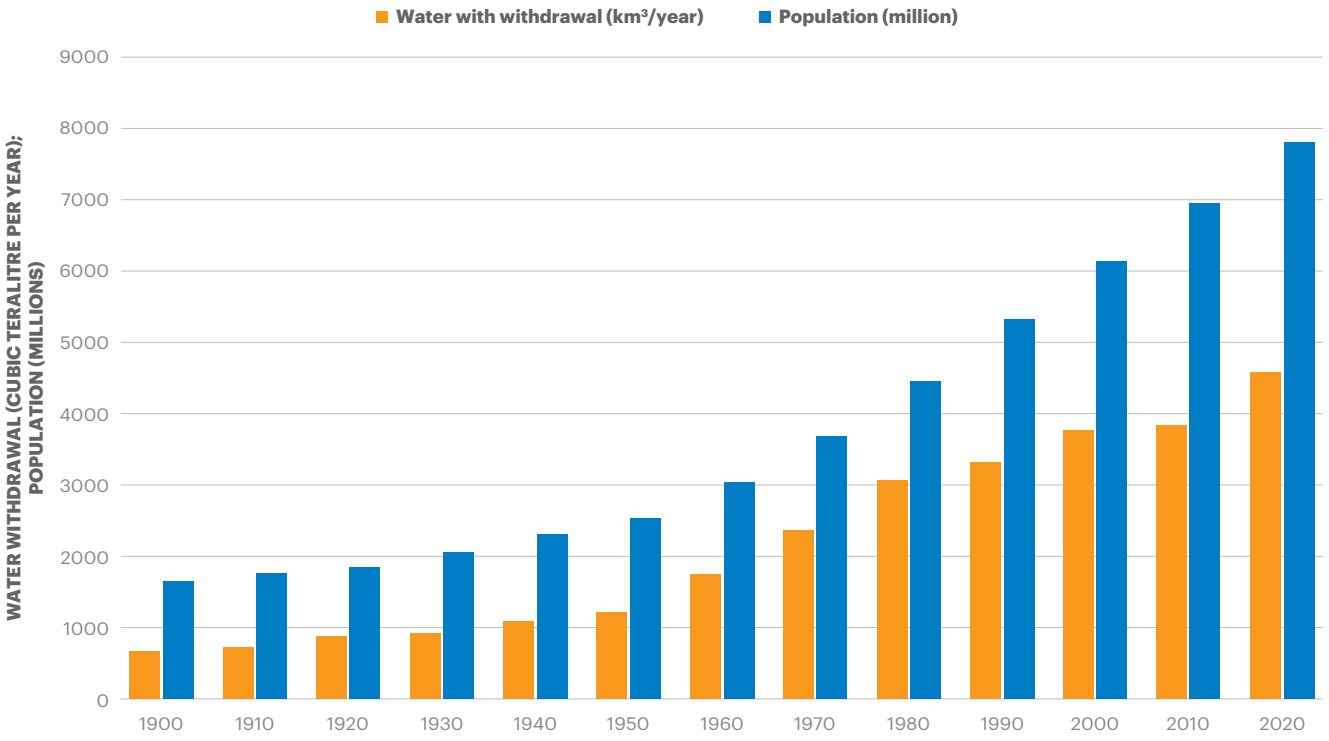
On the current freshwater use trajectory, by 2050, water demand will be 50 per cent higher than it is today.[6] The world's demand for water is likely to surge, driven by population growth and economic transitions towards more water intensive consumption. The number of people who lack sufficient water for at least one month of the year is projected to increase from 3.6 billion to more than five billion by 2050.[7]

After World War II, most societies experienced a rapid period of re-industrialisation that saw a pronounced acceleration in the rate of freshwater withdrawals. This is depicted in Figure 2.18. At the current trend, the global freshwater use by 2050 will be almost nine times what was withdrawn in 1901.[8]

FIGURE 2.18

Water usage and population changes by decade, 1900–2020

The growth in water withdrawals has exceeded population growth.

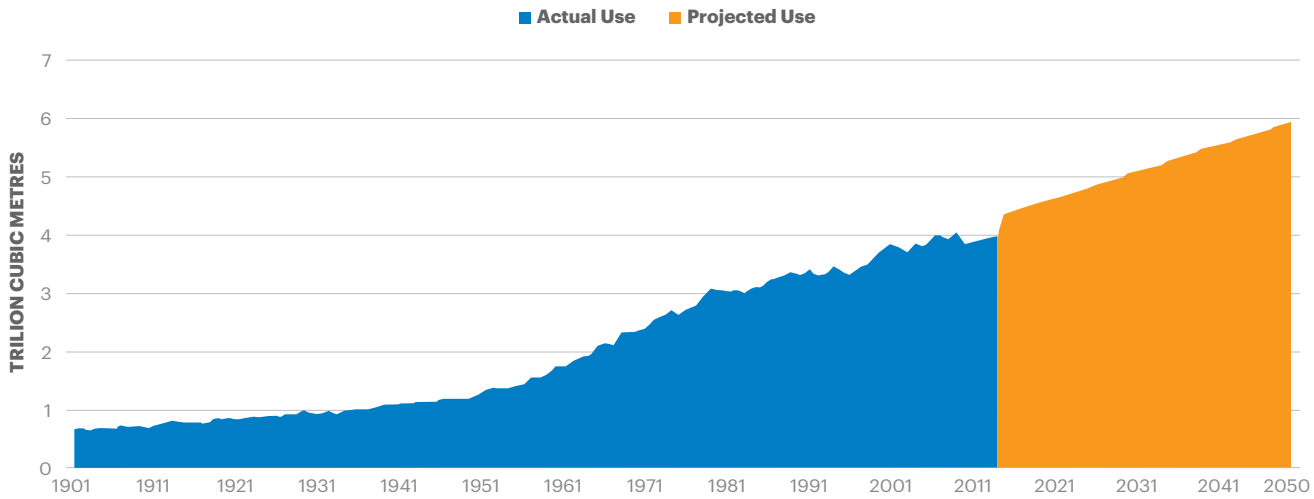


Source: Flörke et al. 2013, World Bank, IEP Projections
Note: Figures display water usage of the year commencing the decade

FIGURE 2.19

Global freshwater use and projections, 1901–2050

After 1950, water withdrawals has started to rise rapidly.



Source: Flörke et al. 2013, World Bank, IEP Projections

The building of dams and developments in desalination has increased available freshwater capacity. However, this was insufficient to meet population growth and industrialisation. By the early 1960s, there were over 13,000 cubic meters of renewable freshwater available for every person on the planet. After six decades, this number has fallen to around 5,000 cubic meters. This represents a 60 per cent decline in freshwater available per capita.

TABLE 2.8

The countries with the lowest renewable freshwater per capita, 1962 and 2014

As of 2014, the countries with the lowest per capita freshwater have averaged a decline per person, equivalent to 77 per cent since 1962.

Country	Available freshwater per capita (cubic meters)		Change (%)
	1962	2014	
Bahrain	23.1	3	-87
United Arab Emirates	1337.9	16.3	-99
Egypt	64	19.9	-69
Qatar	995.3	22.8	-98
Jordan	674.8	76.5	-89
Saudi Arabia	550.1	77.6	-86
Yemen	383.7	81.3	-79
Israel	327.1	91.3	-72
Mauritania	443.6	101.8	-77
Singapore	342.8	109.7	-68
Libya	451.4	110	-76
Malta	155.9	116.2	-25
Niger	975.4	181.9	-81
Pakistan	1165.3	281.6	-76
Algeria	968.2	289	-70

Source: Food and Agriculture Organization, AQUASTAT data, IEP Calculations

WATER USE BY COUNTRY

Countries in the Middle East and North Africa region are among those with the lowest renewable freshwater resources available. Bahrain, the United Arab Emirates, Qatar, Jordan and Saudi Arabia have had some of the most significant declines in the available freshwater per capita since the 1960s, as per Table 2.8. As a consequence of having low levels of naturally resourced freshwater, these countries have become heavily dependent on desalination to provide water for the population. However, the desalination process comes with heavy financial, energetic and environmental costs.[9]

Since 1962, many countries have had large deteriorations in available freshwater per capita. India, China and the United States are the largest users of water, each using over 400 billion cubic metres annually.[10] On average, developed countries consume approximately ten times more water per person than the water consumed in developing countries.

WATER ALLOCATION

Globally, agriculture uses the largest share of the water supply, followed by industrial use and then domestic consumption. Figure 2.20 displays the change in water usage from 1960 levels by the three sectors: domestic, industrial and agricultural.

Since 1960, domestic water withdrawals have increased five times – the most of any sector. Domestic withdrawals intensified after the year 2000, driven by growing cities and household use. Industrial water withdrawals have had the second largest increase, approximately doubling. The increased reliance on water for electricity production has contributed to the increased industrial use. In particular, the growth of water-intensive fracking practices and biofuels production.

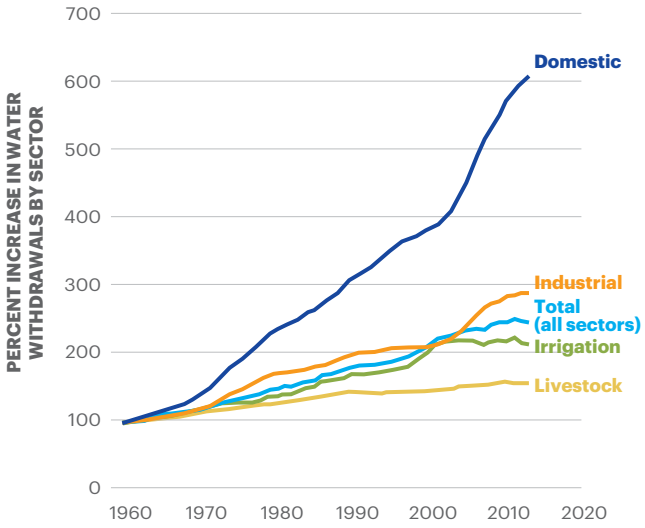
Increasing populations, economic development and shifting consumption patterns, in addition to the effects of climate change, will accelerate the stress on water supplies in the coming decades. Since 1960, the global demand for water has doubled.

The increase in water withdrawal differs heavily between regions. Globally, 69 per cent of freshwater drawn from lakes, rivers and

FIGURE 2.20

Sector water withdrawal percentage increase from 1960

Domestic withdrawal has increased by 600 per cent since 1960.



Source: Chart is taken from the WRI
https://www.wri.org/blog/2020/02/growth-domestic-water-use

underground sources is used within the agricultural sector. Central Asia and the Middle East and North Africa are the regions that allocate the highest allotment of water to agriculture, both exceeding 80 per cent of water used. The industrial sector uses the largest quantity of water in North America and Europe. Figure 2.21 displays the percentage agricultural sector water withdrawal by region.

Majority of withdrawn water used in agriculture is allocated to irrigation, which provides approximately 40 per cent of the world's food production.[11] With the global population projected to exceed 9.7 billion by 2050, achieving sustainable food production for all will be challenging. Food production needs to double over this time to meet the food security requirements — this will require vast amounts of water withdrawals. Without material improvements in transport and efficiency, water availability will remain a major hurdle on the path towards food security.

WATER ACCESS

The quantity of useable water available is not the only problem facing populations in stress. Access to that water is a material concern and a possible stressor of future water crises. Poor physical infrastructure, insufficient technology, pollution and geopolitical barriers between water sources and users are some of the key impediments to adequate water access. Despite some improvements in technology, including desalination, and infrastructure, especially in the areas of recycling and damming – two billion people around the world still lack access to safe drinking water.[12]

Poor water access is associated with low socioeconomic development, especially in terms of physical infrastructure. Around 89 per cent of the world population has access to basic drinking water services. While this is a relatively high proportion, many countries have exceedingly low access rates, as seen in Figure 2.21. With the exception of Papua New Guinea, the 20 countries with the lowest access to basic drinking water are located in sub-Saharan Africa. Chad has the lowest percentage of the population with access to basic drinking water, equal to just 39 per cent.

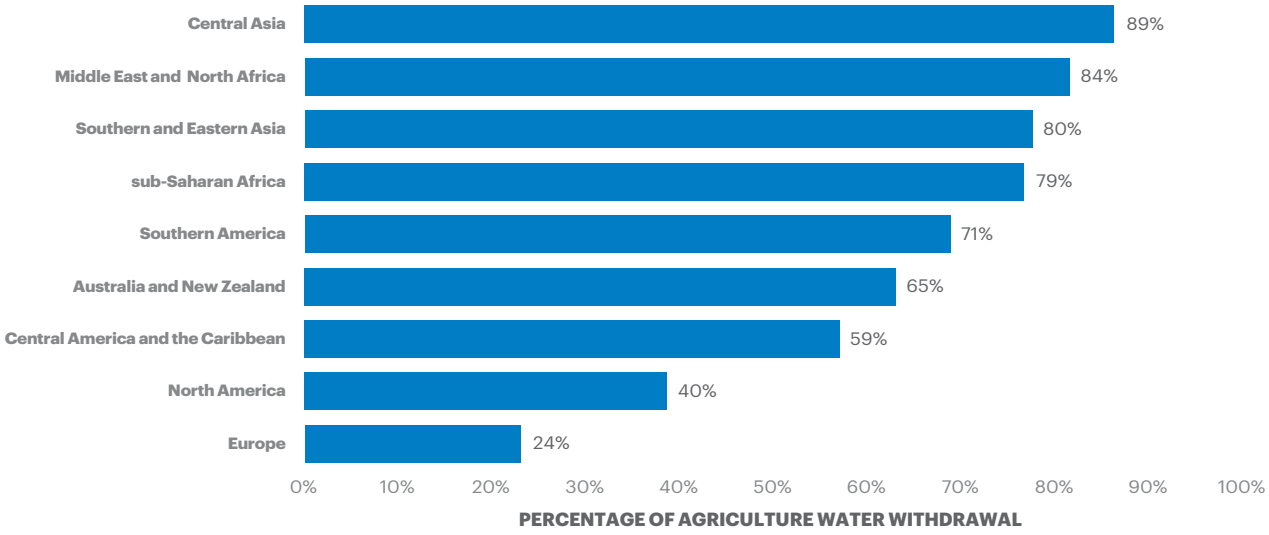
The percentage of the population using at least basic water services includes both basic water services and those using safely managed water services. Basic drinking water services are defined as drinking water from an improved source, provided the water collection time is less than 30 minutes for a round trip. Safely managed water sources include piped water, boreholes, protected dug wells, protected springs and packaged or delivered water.[1]

Low precipitation can lead to reduced groundwater, rivers and

FIGURE 2.21

Agriculture sector water withdrawal by region, percentage of total water withdrawn

Globally, 69 per cent of freshwater withdrawn is allocated to agriculture.



Source: FAO AQUASTAT, IEP Calculations
Note: The regions do not include all countries

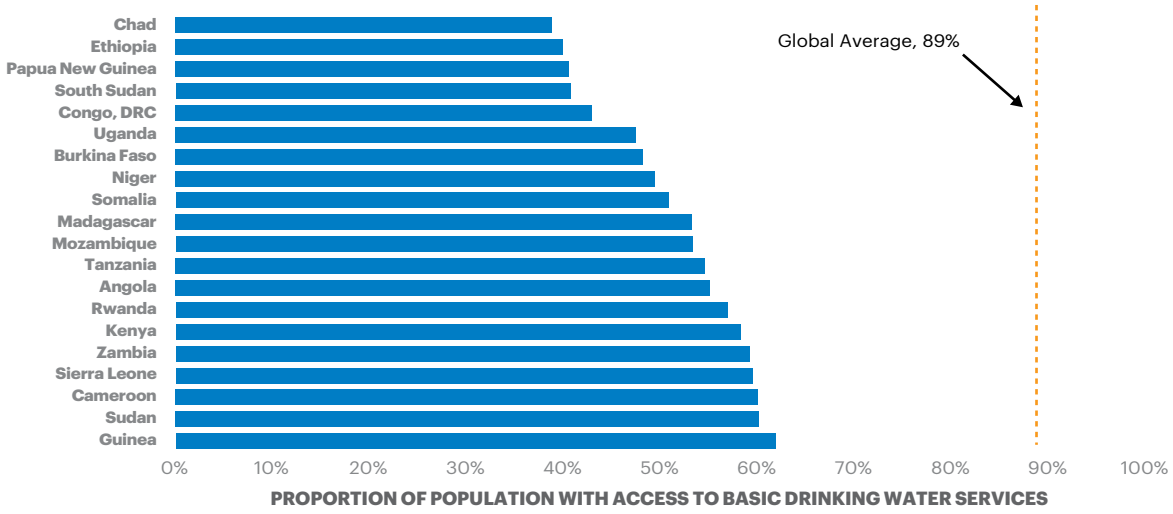
dams and cause water shortages. This can limit or impede drinking water access. However, water sources can also be contaminated from poor water management and pollution, especially from the agricultural and industrial sectors. Figure 2.22 displays the 20 countries with the highest mortality rate due to unsafe water, unsafe sanitation and lack of hygiene.

The 20 countries with the highest mortality rate due to unsafe water, unsafe sanitation and lack of hygiene are all located in sub-Saharan Africa. Chad has the highest mortality rate due to unsafe water, unsafe sanitation and lack of hygiene at 101 people per 100,000. The global mortality rate due to unsafe water and hygiene is 12 people per 100,000.

FIGURE 2.22

Countries with the least access to basic drinking water services, 2017

Nineteen of the 20 countries with the least access to basic drinking water are located in SSA.

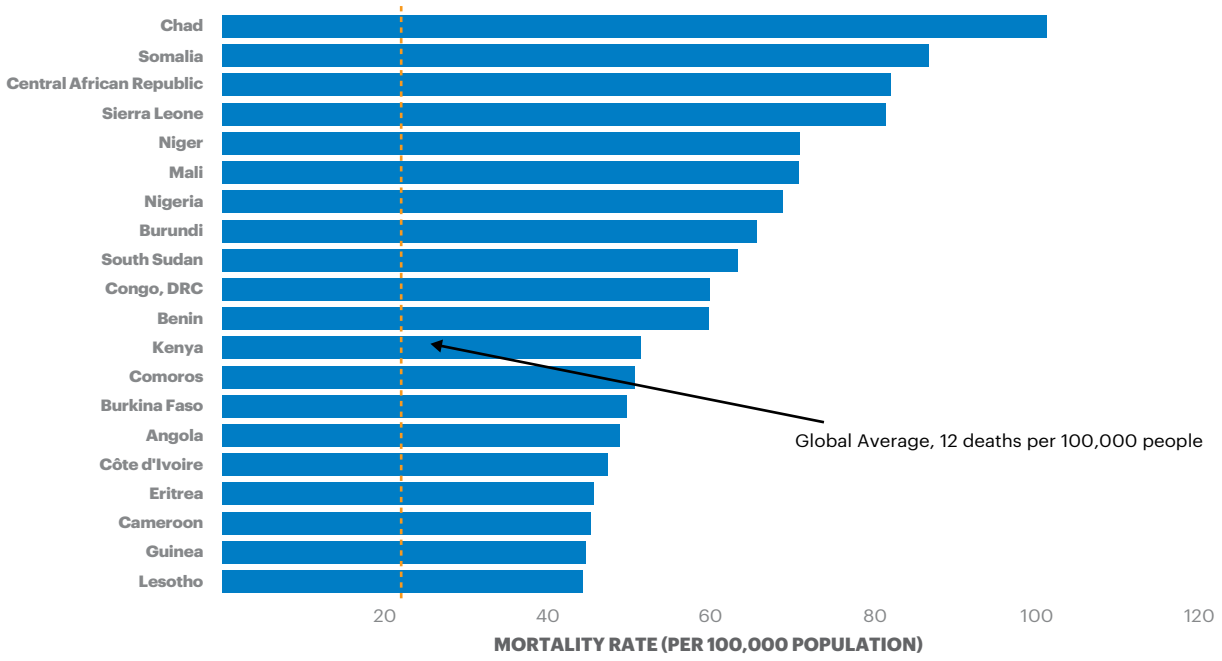


Source: WHO/UNICEF, IEP

FIGURE 2.23

Countries with the highest mortality rate due to unsafe water, unsafe sanitation and lack of hygiene, 2016

The 20 countries with the highest mortality rate due to unsafe water, unsafe sanitation and lack of hygiene are all located in sub-Saharan Africa.



Source: GHO & WHO, IEP

Water Stress and Conflict

As scarcity intensifies, water will become more relevant as a stressor of social unrest and cause of disputes and violence. Figure 2.24 shows that water-related violent incidents increased by 270 per cent globally from 20 per year in 2010 to 74 per year in 2018. An incident is included when:

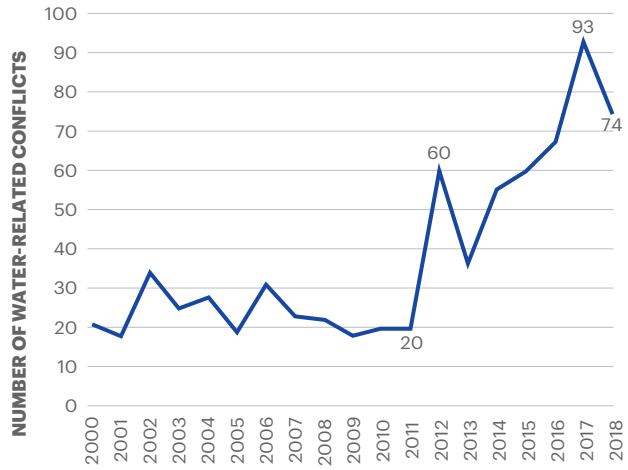
- it results in injuries or deaths; or
- there are threats of violence such as military manoeuvres and show of force.[14]

Water-related violent incidents increased after 2011, peaking in 2017 at 93 incidents.

FIGURE 2.24

Trend in water-related violent incidents, 2000–2018

The number of incidents where water has been involved as a cause or stressor of violence increased by 270 per cent from 2010 to 2018.



Source: Worldwater, IEP Calculations

Syria is an example of how water stress can exacerbate social tensions and fragilities. From 1999 to 2011, approximately 60 per cent of Syrian land underwent two long-term droughts. About 75 per cent of farmers had total crop failure and in the northeast, farmers lost 80 per cent of their livestock. This forced a substantial proportion of the population to relocate to urban centres, with an estimated 1.3 million to 1.5 million people migrating by 2011. The Syrian conflict illustrates how ecological risks can intensify existing social and political grievances. It also highlights that the adverse effects of climate change-related ecological risk, such as population displacement, play a critical role in igniting extreme levels of mass violence and armed conflict.

Figure 2.25 displays the countries with the highest number of water-related violent incidents. Since 2000, the majority of water incidents have taken place in Yemen, Iraq and India. All three countries suffer from high or extreme water stress and are among the least peaceful countries in 2020, as measured by the GPI. Yemen recorded 134 incidents, the most of any country since 2000. This is followed by Iraq at 64 incidents.

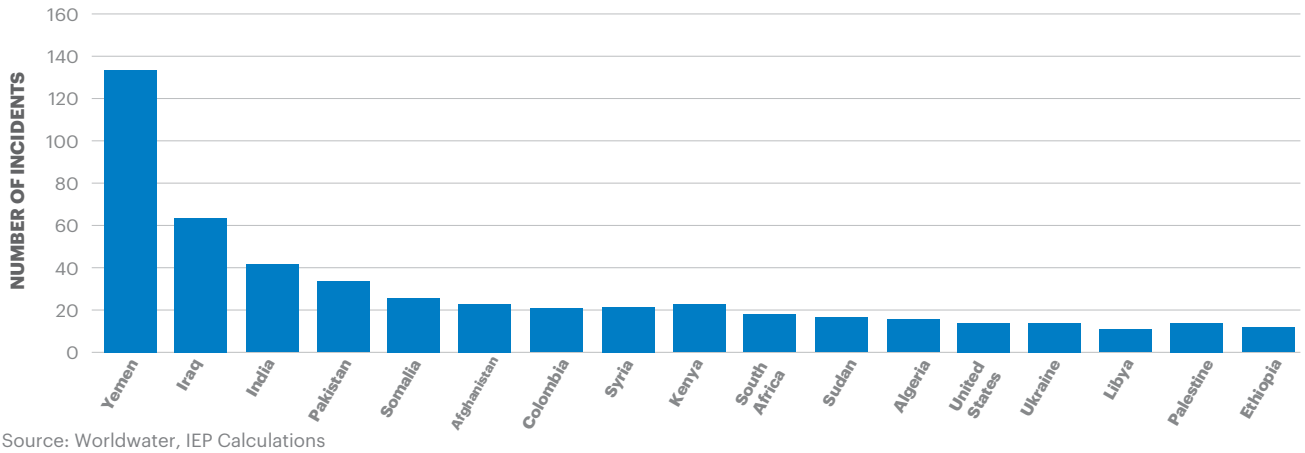
The water incidents range in their levels of severity. Some incidents have been a show of force that did not end in violence, such as protests over water shortages or water prices. Some incidents do, however, result in extreme levels of violence. As examples, a series of massacres in Mali throughout 2019 were exacerbated by feuds over water that displaced 50,000 people.[15] The revoking of a water-sharing agreement between Malawian villagers and Fulani herders from Burkina Faso led to an outbreak of violence that resulted in the death of at least 30 people.

Water can also be the focus-point of terrorism due to this resource's strategic value. The Islamic State (IS) conducted attacks on water resources and infrastructure across Iraq and Syria. In 2015, IS seized the Tharthar Dam Fallujah in the Anbar province, Iraq. During the attack, 127 Iraqi soldiers died. The Islamic State also proceeded to open at least one floodgate, affecting communities downstream.[16]

FIGURE 2.25

Countries with the highest number of water incidents, 2000–2018

Since 2000, Yemen has suffered 134 violent incidents that involved water.



Source: Worldwater, IEP Calculations

3 Natural Disasters

KEY FINDINGS

- Globally, the frequency of natural disasters increased ten-fold since 1960, increasing from 39 incidents in 1960 to 396 in 2019.
- Floods and storms accounted for 71 per cent of the natural disasters between 1990 and 2019.
- Asia-Pacific was the most affected region, with 29 per cent of global natural disasters occurring in the region in the 30 years to 2019.
- On average, 42 per cent fewer people died due to natural disasters per year in the last three decades compared to the average from 1945 to 1990.
- Natural disasters displaced 25 million people in 2019. This is three times higher than the 8.6 million displaced by armed conflict.
- India had the largest population displacement due to natural disasters, at five million people in 2019.
- The United States recorded 704 natural disasters since 1990, the most of any country globally. This is followed by China with 560 incidents.
- A 2.1-metre rise in sea levels would permanently cover land that is currently home to 200 million people around the world.
- The past five years have been the hottest on record.

The Trend in Natural Disasters

Globally, the number of natural disasters has increased ten-fold since 1960, increasing from 39 incidents in 1960 to 396 in 2019. The cost due to natural disasters has also risen from US$ 50 billion in the 1980s to US$ 200 billion per year in the last decade.[1] Hydrological events that result in 'sharp and harmful changes either in the quality of the earth's water, or its distribution', either in aquifers, rivers, cyclones or floods, have seen the largest increase since 1980. Figure 3.1 displays the trend in the number of natural disasters from 1900 to 2019.

The largest number of natural disasters occurred in 2005, with 442 incidents globally causing 90,000 deaths. It also left 160 million people affected and in need of immediate assistance. The negative impacts of natural disasters depend on the intensity of individual incidents. Natural disasters can be of low intensity and occurring frequently, or they can be one-off catastrophic events. For instance, the 2004 Tsunami that affected numerous countries in Southeast Asia represents the one-off catastrophic incidents that have substantial impacts. The tsunami caused more than 220,000 deaths and widespread destruction across the region. The extent of the negative impacts of natural disasters also depends on the level of resilience and preparedness at the individual country level.

Flooding is the most common natural disaster since 1990. From 1990 to 2019, a total of 9,924 natural disasters occurred globally, of which 42 per cent were floods.[2] This was followed by different types of storms including cyclones, hurricanes, tornadoes, blizzards and dust storms at 2,942 incidents or 30 per cent of the total natural disasters in this time period. Table 2.9 shows the largest natural disasters from 1990 to 2019. Floods and storms account for 71 per cent of the disasters that have occurred since 1990.

Changes in climate conditions, especially the warming of global temperatures increases the likelihood of weather-related natural disasters. Hotter global temperatures increase the risk of droughts as well as increase the intensity of storms and create wetter monsoons.[3] This is most visible when seen through changes in the intensity and frequency of droughts, storms, floods, extreme temperatures and wildfires. In the face of more common extreme weather events and climate related disasters, natural resources such as land and water will be most vulnerable.

TABLE 3.1

Total number of global disasters, by disaster type, 1990–2019

Globally, floods and storms account for 71 per cent of the natural disasters that occurred between 1990 and 2019.

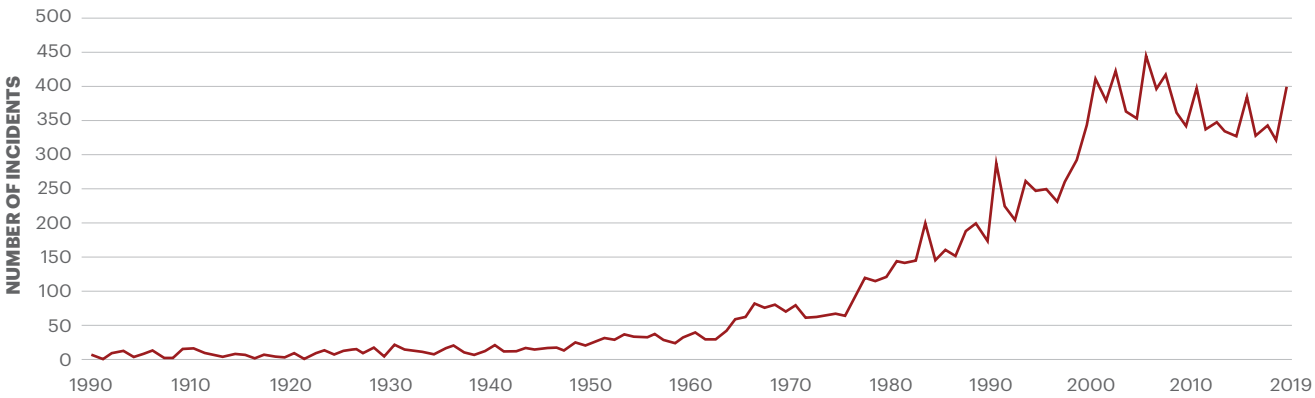
Disaster Type	Number of disasters (1990 – 2019)	Percentage (%)
Flood	4119	41.5%
Storm	2942	29.6%
Earthquake	818	8.2%
Landslide	551	5.6%
Extreme temperature	524	5.3%
Drought	475	4.8%
Wildfire	341	3.4%
Volcanic activity	154	1.6%
Total	**9924**	**100%**

Source: EM-DAT, IEP Calculations

FIGURE 3.1

Trend in the number of natural disasters, 1900 to 2019

The global number of natural disasters has increased tenfold since 1960.



Source: EM-DAT
Note: Includes Drought, Earthquakes, Volcanic activity, Mass movement (dry), Storms, Floods, Landslides, Wildfire and Extreme temperature.

BOX 2.3

What disasters are included?

The EM-DAT is an aggregation of natural disasters from 1900 to the present day. Disasters included are: drought, earthquake, extreme temperature, flood, landslide, storm, volcanic activity and wildfire. Storms include hail, lightning/thunderstorms, rain, tornadoes, sand/dust storms, winter storms and blizzards, storm surges and extreme winds.

For a natural disaster to be included, at least one of the following conditions must be satisfied:

1. At least ten people reported killed
2. At least one-hundred people affected
3. A declaration for a state of emergency
4. A call for international assistance

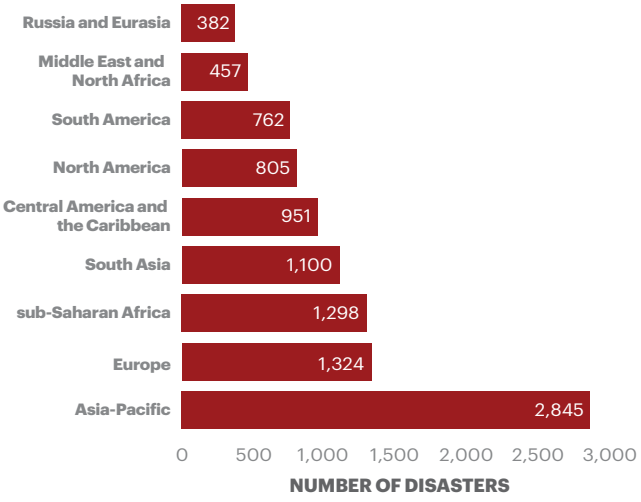
REGIONAL TRENDS IN NATURAL DISASTERS

Asia-Pacific was exposed to the largest number of natural disasters with 2,845 events in the last 30 years since 1990. Floods and storms make the largest share of the total natural disasters in the Asia-Pacific region at more than two thirds of the total. The most affected countries in the region are China, the Philippines, Indonesia, Japan and Vietnam. Figure 3.2 displays the total number of disasters by region from 1990 to 2019.

FIGURE 3.2

Total number of disasters, by region, 1990–2019

Globally, floods and storms account for 72 per cent of the natural disasters that occurred between 1990 and 2019.



Source: EM-DAT, IEP Calculations

Europe has been impacted by the second largest number of natural disasters with 1,324 incidents from 1990 to 2019. France, Italy, Turkey, Romania and the UK have experienced the highest number of incidents in Europe with one third of the total natural disasters in the region. Flooding is the most common natural disaster in Europe accounting for 35 per cent of the region's disasters.

Sub-Saharan Africa experienced the largest number of droughts of any region, adding further strain to the already limited water supplies in the region. Sub-Saharan Africa experienced 180 droughts from 1990 to 2019. It also experienced the third largest number of natural disasters with 1,298 incidents. South Africa, Kenya, Ethiopia and Mozambique were the most affected countries in the region.

South Asia suffered from 1,100 disasters from 1990 to 2019 with floods making up nearly half of the disasters at 49 per cent. Natural disasters cause the largest population displacement of any region in South Asia with more than ten million people displaced every year in India, Bangladesh and Pakistan.

The United States, China, India and the Philippines are the countries most affected by natural disasters in the last 30 years. On average, these countries have experienced more than ten natural disasters per year. Floods and Storms are the most common natural disasters in these countries. Table 2.10 shows the number of natural disasters for the 20 most affected countries.

TABLE 3.2

Countries most affected by climatic disasters, 1990–2019

The United States has suffered the largest number of climatic disasters since 1990.

Country	Drought	Extreme temperature	Flood	Storm	Wildfire	Total
United States	14	20	145	444	81	704
China	31	13	246	264	6	560
India	7	39	216	110	3	375
Philippines	6	0	123	219	1	349
Bangladesh	1	22	65	108	0	196
Indonesia	3	0	170	5	11	189
Vietnam	6	0	85	90	1	182
Mexico	5	14	52	87	3	161
Australia	5	7	45	66	28	151
Japan	0	16	27	103	1	147
Russia	5	21	66	21	24	137
Brazil	10	4	95	10	4	123
France	2	18	41	56	6	123
Pakistan	2	15	84	20	0	121
Thailand	12	2	68	33	1	116
Afghanistan	5	7	85	9	1	107
Haiti	5	0	45	34	0	84
Canada	0	4	33	28	17	82
Argentina	4	7	48	16	4	79
Colombia	2	0	68	5	3	78

Source: EM-DAT, IEP Calculations

Deaths and Displacement from Natural Disasters

POPULATION DISPLACEMENT

Environmental disasters displace an average of 24 million people per year with an additional seven million displaced by armed conflict. While the majority of the population displacement happens within a country or into neighbouring countries, UNHCR estimates show that at least one in five people moves beyond their country and region. Figure 3.3 displays the number of new displacements from conflict and natural disasters since 2008.

By 2050, climate change is estimated to create up to 86 million additional migrants in sub-Saharan Africa, 40 million in South Asia and 17 million in Latin America as agricultural conditions and water availability deteriorate across these regions.[5] Empirical evidence suggests that people living in less developed countries without the ability to mitigate these problems are those most likely to migrate and that this migration may cause increased societal strife in destination countries and regions.

Migration is used as an adaptation mechanism in the face of natural disasters and environmental shocks. However, if it happens in a sudden and unplanned manner, it can exacerbate socioeconomic fragilities in their destination places. In Ethiopia, droughts in the mid-1970s and 1980s, then subsequent famines led to waves of migration from drought-stressed areas, both voluntary and government-forced.[6] In this case, both climatic and political factors impacted displacement and international migration. As a result of this instability, violence and insecurity increased in neighbouring countries, which further impacted Ethiopia.

> “
> On average, 42 per cent fewer people died due to natural disasters per year in the last three decades compared to the average from 1945 to 1990.

Protracted mass population displacement result from the impact of natural disasters in which certain regions become uninhabitable. For example, sea level rise and storm tides, which lead to coastal flooding and erosion can make previously populated areas uninhabitable by destroying agriculture and infrastructure. Recent projections show a rise in sea levels of up to 2.1-meters by 2100, which could potentially permanently drown land that is currently home to 200 million people around the world.[7] Coastal flooding resulting from sea level rise will impact the lives of 300 million people who live in low-lying coastal areas in China, Bangladesh, India, Vietnam, Indonesia, and Thailand over the next three decades.

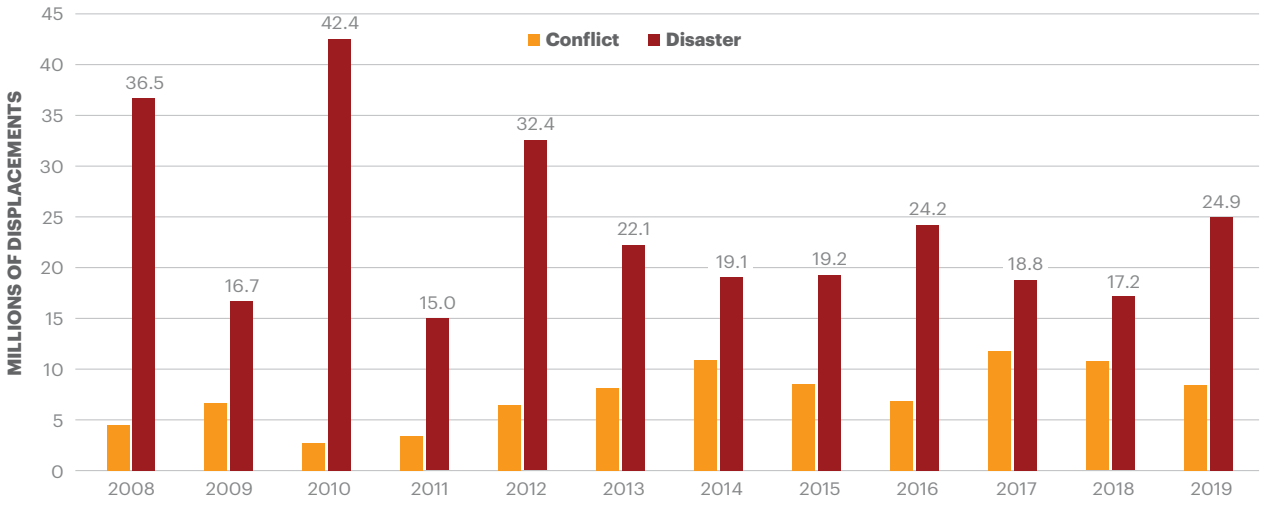
Since 2008, there has been an estimated 379 million displacements from natural disasters and armed conflict. Natural disasters have caused 288 million displacements, whereas conflict has caused 90 million displacements in the 11 years to 2019.

Figure 3.4 shows the cumulative displacements from conflict and natural disasters.

FIGURE 3.3

Displacements due to conflict and natural disasters, 2008–2019

New disaster displacements reached 24.9 million in 2019, while armed conflict accounted for 8.6 million displacements.



Source: IDMC

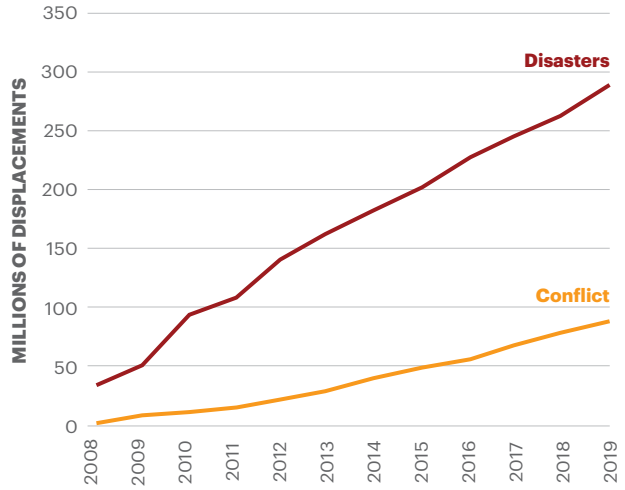
Natural disasters have a substantially larger impact in countries with larger population density and poorer early warning systems. For example, natural disasters caused larger population displacement in the worlds most populated countries, as shown in Table 2.11.

Since 2008, the average number of new displacements from natural disasters per year is approximately 24 million

FIGURE 3.4

Cumulative displacements from conflict and natural disasters, 2008–2019

There has been almost 200,000 more displacements from natural disasters than conflict since 2008.



Source: IDMC

displacements, whereas conflict triggers 7.5 million displacements. This reinforces the significance that natural disasters have on the movement of the global population.

At a country level, China, India and the Philippines average the highest number of displacements annually from natural disasters. Since 2008, China has averaged 6.8 million natural disaster displacements each year followed by India at 3.7 million displacements and the Philippines at 3.6 million.

Natural disasters displace a relatively larger number of people in India in comparison to other countries. India's vulnerability to natural disasters is exacerbated by the high level of population density. In 2019, India had its wettest monsoon season of the last 25 years. Consequently, India suffered five million displacements from natural disasters — one million displacements more than the next highest country. India's displacement from conflict and violence was significantly less with 19,000 displacements, reinforcing the higher impact that natural disasters have on highly populated areas.

The geographic location of the Philippines leaves the country more vulnerable to storms, floods and earthquakes, which displace millions of people every year. The largest event to hit the Philippines in 2019 was Typhoon Kammuri, which caused approximately 1.4 million displacements. Typhoon Kammuri, in addition to other storms and floods led to four million displacements in the country in 2019.

China also has a very high population density and suffers from a greater number of natural disasters. Therefore, natural disasters cause large population displacement in different parts of the country. China's largest individual event was the 2010 floods and landslides, which led to 15.2 million displacements. The floods began in May and continued through to September, resulting in enormous destruction of homes and farmland leaving millions without water and sufficient food. The second largest displacement event in China was the 2008 earthquake. The earthquake, which hit the Sichuan province, registered a magnitude of 8.0 and was China's deadliest earthquake since the 1976 Tangshan earthquake. The enormous destruction of the 2008 earthquake caused 15 million displacements.

Table 2.12 displays the disasters that triggered the largest number

TABLE 3.3

The 20 countries with the most displaced people from disasters, 2019

India has the highest number of displaced people in 2019.

Country	Number of Displacements	Number of Disasters
India	5,018,000	12
Philippines	4,094,000	16
Bangladesh	4,086,000	6
China	4,034,000	17
United States	916,000	20
Iran	520,000	5
Mozambique	506,000	5
Ethiopia	504,000	2
Somalia	479,000	3
Indonesia	463,000	19
Brazil	295,000	8
South Sudan	294,000	3
Sudan	272,000	2
Myanmar	270,000	3
Japan	265,000	3
Congo, DRC	233,000	3
Congo, Rep	166,000	2
Nigeria	157,000	3
Uganda	130,000	8

Source: IMDC, EM-DAT, IEP calculations

> “
> Since 2008, China has averaged 6.8 million natural disaster displacements each year followed by India at 3.7 million displacements and the Philippines at 3.6 million.

of displacements since 2008.

DEATHS FROM NATURAL DISASTERS

Since 1945 natural disasters have, on average, caused 103,000 deaths a year. Despite this significant increase in the number of natural disasters, its fatality rate has declined significantly.

On average, 42 per cent fewer people died due to natural disasters per year in the last three decades when compared to the average from 1945 to 1990. Technological advances for earlier prediction, better communication, more resilient infrastructure, emergency preparedness and response systems have resulted in the reduction of the global death toll.

TABLE 3.4

Largest number of displacements by disaster events, by country, 2008–2019

China, India and the Philippines have suffered the largest displacements.

Country	Year	Disaster type	Displacements
China	2010	Flood	15,200,000
China	2008	Earthquake	15,000,000
Pakistan	2010	Flood	11,000,000
India	2012	Flood	6,900,000
Philippines	2013	Typhoon Haiyan	4,095,280
Nigeria	2012	Flood	3,871,063
China	2011	Flood	3,514,000
Philippines	2014	Typhoon Rammasun	2,994,054
India	2019	Flood	2,623,349
Nepal	2015	Earthquake	2,622,733
Cuba	2008	Storm	2,616,000
Philippines	2016	Typhoon Nock-Ten	2,592,251
India	2009	Flood	2,500,000
India	2008	Flood	2,400,000
Philippines	2016	Typhoon Haima	2,376,723
India	2009	Cyclone 'Aila'	2,300,000
Myanmar	2008	Storm	2,250,000
Bangladesh	2019	Cyclonic, torm Bulbul	2,106,918
India	2008	Flood	2,100,000
China	2019	Typhoon Lekima	2,097,000
China	2012	Storm	2,079,000
India	2008	Flood	2,055,925
Philippines	2008	Storm	2,039,155
Chile	2010	Earthquake	2,000,000
India	2012	Flood	2,000,000
China	2016	Flood	1,990,000
India	2018	Flood	1,967,258
Philippines	2012	Storm	1,931,970
United States	2008	Storm	1,900,000
Pakistan	2012	Flood	1,856,570
Philippines	2014	Typhoon Hagupit	1,823,176

Source: IMDC, EM-DAT, IEP calculations

However, catastrophic natural disasters that happen occasionally still cause large and sudden one-off increases in fatalities. For instance, the Haiti earthquake of 2010 or the Indian Ocean tsunami of 2004 killed in excess of 220,000 and 165,000 people, respectively.[8] These one-off catastrophic natural disasters show that the potentially large negative impacts of such events still present a substantial challenge, especially for the most vulnerable countries. Figure 3.5 displays the trend in the deaths from natural disasters.

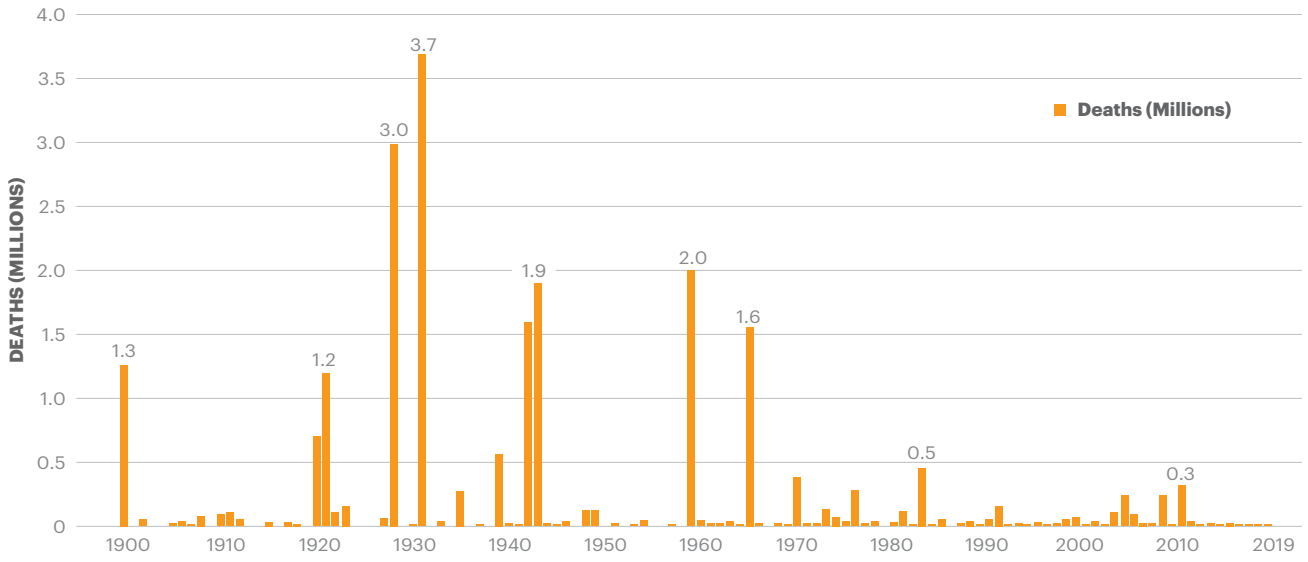
Over 581,000 deaths have occurred in Asia Pacific since 1990 —the most of any region. Earthquakes have claimed the most lives in Asia-Pacific exceeding 319,000, followed by storms at 191,000. Figure 3.6 displays the deaths from natural disasters by region from 1990 to 2019.

South Asia has suffered the second-largest number of deaths from natural disasters at 447 thousand. Similar to Asia-Pacific, earthquakes have had the largest burden on South Asia in terms of fatalities, accounting for 50 per cent of natural disaster deaths in the region. Droughts are responsible for 21,000 of the total 48,000 deaths that have occurred in sub-Saharan Africa due to natural disasters.

FIGURE 3.5

Trend in deaths from natural disasters, 1900–2019

The years with the one-off catastrophic natural disasters experience significantly larger numbers of deaths.

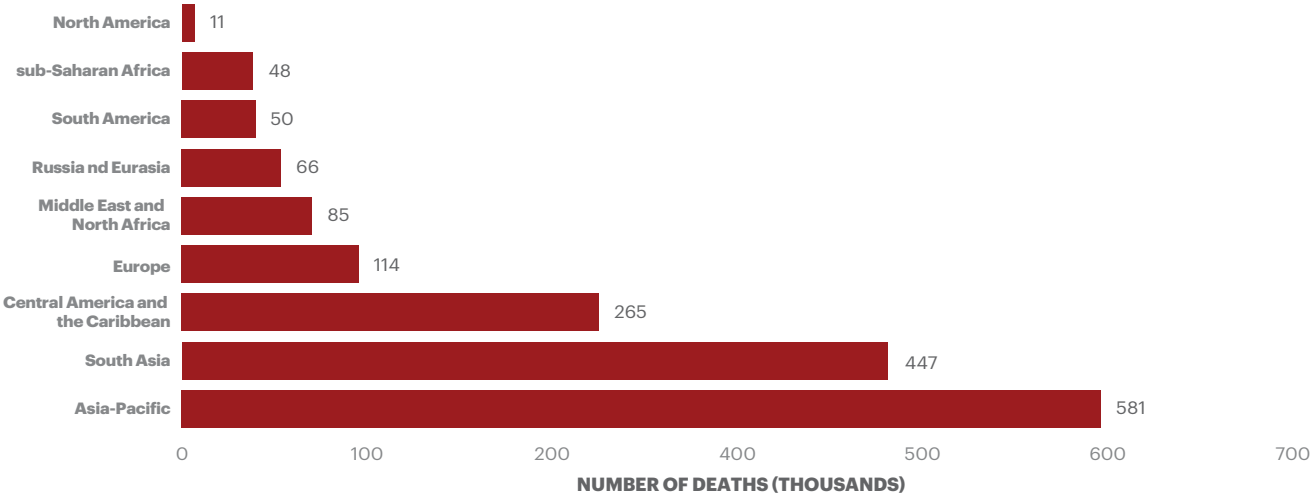


Source: EM-DAT, Calculations: IEP

FIGURE 3.6

Deaths from natural disasters, by region, 1990–2019

Since 1990, Asia-Pacific has suffered the largest number of deaths from natural disasters.



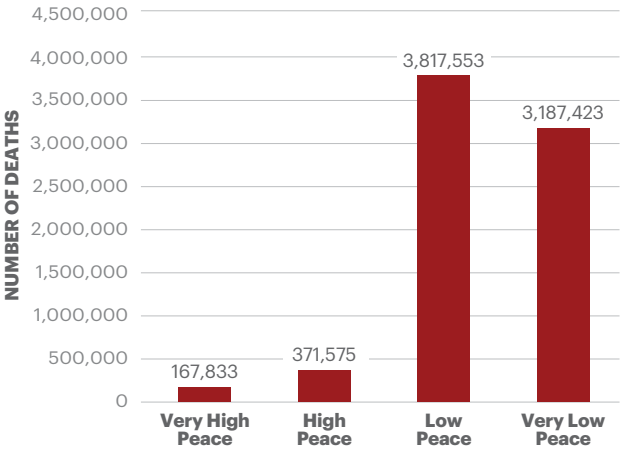
Source: EM-DAT, IEP Calculations

Figure 3.7 displays the total number of deaths from natural disasters since 1945 by level of peace. Countries with low and very low levels of peacefulness, as measured by the GPI, have suffered significantly more deaths than countries of high peace and very high peace. Very high peace countries have suffered 168,000 deaths compared to the 3.2 million in very low peace countries. Countries of low and very low levels of peace have also endured a greater number of disasters compared to countries with high and very high peace. However, the average deaths per disasters are significantly higher in countries with lower levels of peacefulness. Figure 3.8 displays the number of disasters by peace level.

FIGURE 3.7

Total deaths by peace level, 1945–2019

Deaths from natural disasters have been higher in countries with lower levels of peace.

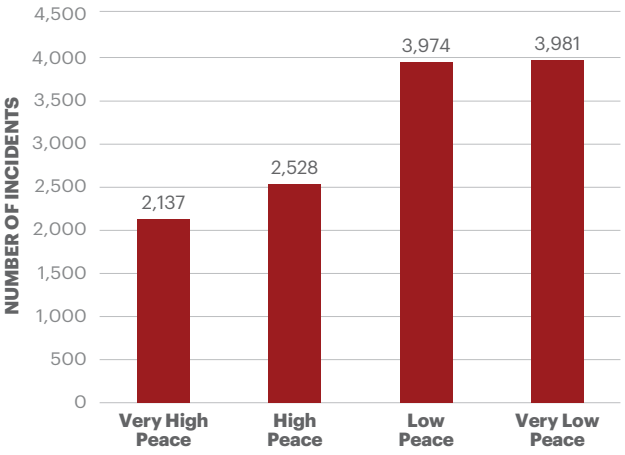


Source: EM-DAT, IEP Calculations

FIGURE 3.8

Total number of incidents by peace level, 1945–2019

Countries with low levels of peace have suffered more natural disasters than countries of high peace.



Source: EM-DAT, IEP Calculations

4 Positive Peace, Resilience and Ecological Threats

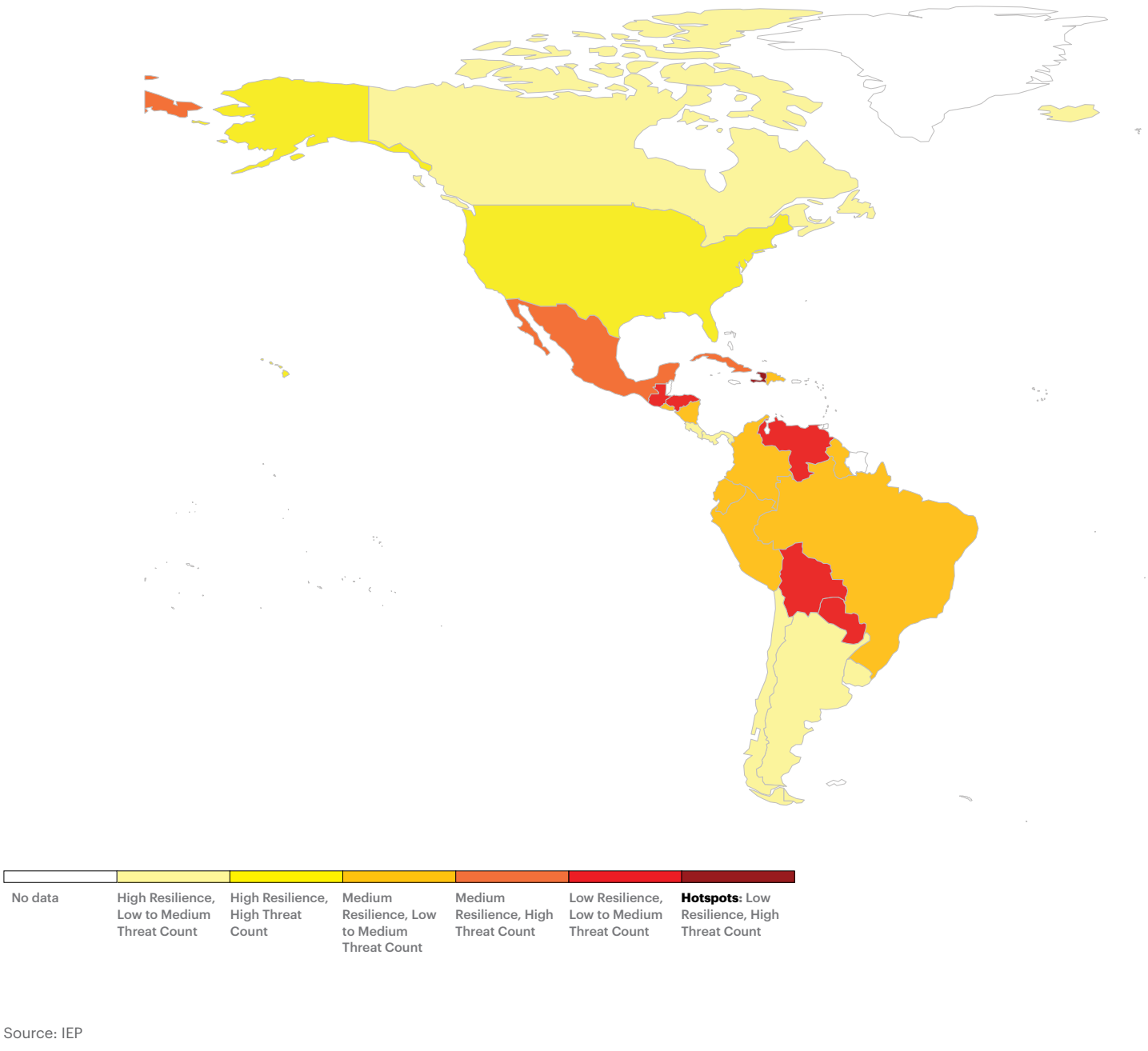
KEY FINDINGS

- Positive Peace is an accurate measure of socio-economic resilience to ecological threats.
- There are 31 ecological 'hotspot' countries, which combine high levels of ecological threats with low and stagnant socio-economic resilience. Over one billion people live in these hotspots.
- Most ecological hotspots tend to be clustered on large geographical areas: The Sahel-Horn of Africa belt from Mauritania to Somalia; the southern African belt from Angola to Madagascar and the central Asian belt from Syria to Pakistan.
- Ecological and humanitarian crises often spill over across international borders, increasing the likelihood of civil unrest and political instability in adjacent countries.
- Europe has ecological threat hotspots to its south and east. These hotspots have a combined population of 841 million people. Large displacements of people from these hotspots could affect the European continent, especially in terms of social cohesion and political stability.
- Nearly 25 million people were displaced by ecological threats in 2019. An estimated 1.2 billion people are at risk of displacement by 2050.
- China is now the largest provider of developmental aid, ahead of the United States. Of the ten largest recipients, the majority have over a third of their populations facing food insecurity.
- Countries with lower socio-economic development are exposed to more environmental threats than high development countries and have on average the least capacity to handle such shocks.
- A total of 746 million people live in areas that combine resource depletion threats with low and stagnant or deteriorating levels of Positive Peace. They are highly vulnerable to water stress, population growth and food insecurity.
- One billion people live in areas that combine high frequency and intensity of natural disasters with low and stagnant levels of Positive Peace.
- Natural disasters kill seven times more people in the least developed countries than in highly developed ones. This is despite such disasters being comparatively less frequent in the least developed nations.

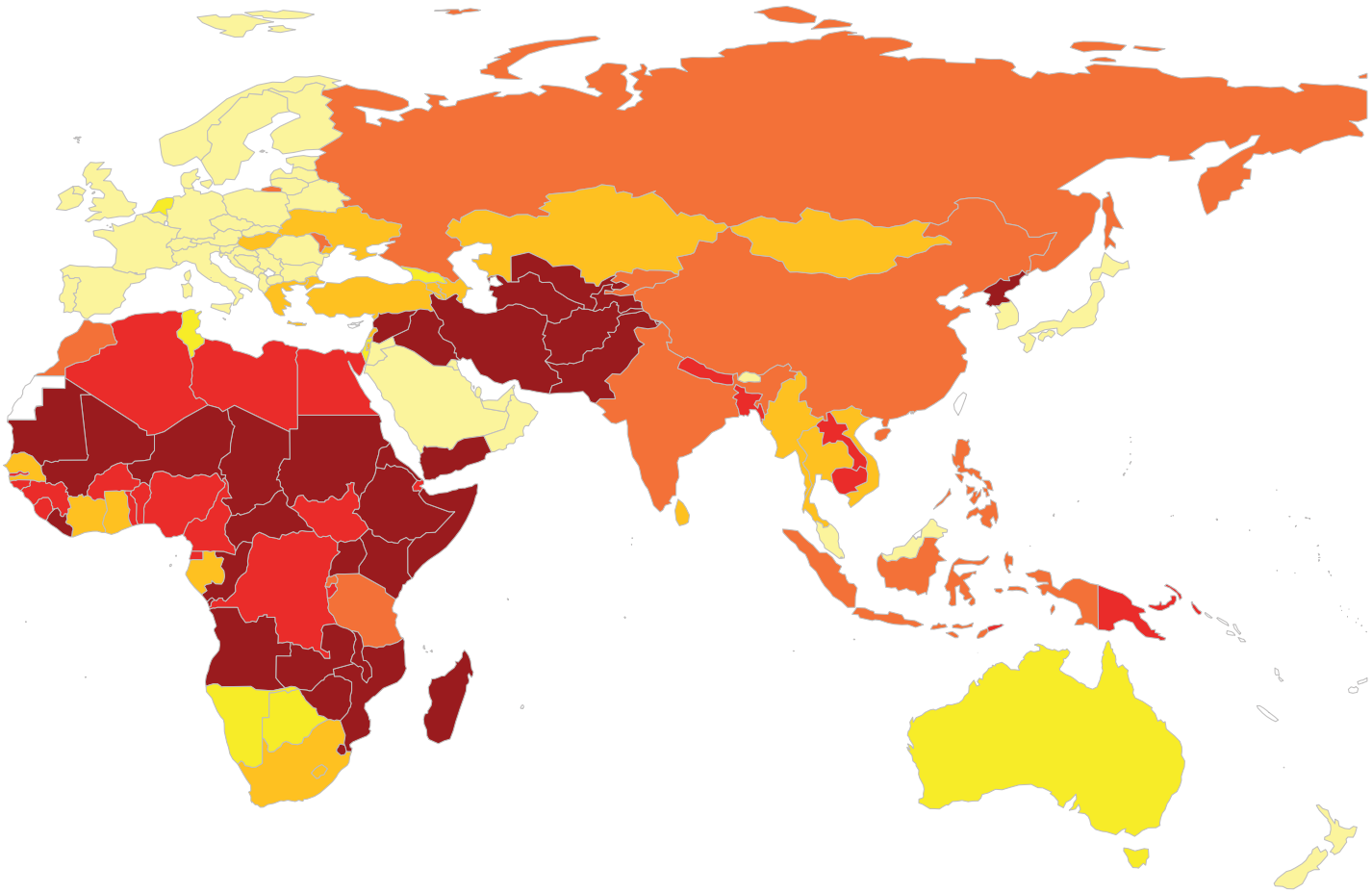
FIGURE 4.1

Ecological Threat Register and Resilience

ETR hotspots – countries with high ETR count and low socio-economic resilience – tend to be concentrated in certain areas, forming a Sahel-Horn of Africa belt from Mauritania in the West to Somalia in the East, a southern African belt from Angola to Madagascar and a central Asian belt from Syria to Pakistan.



Source: IEP



Positive Peace, defined as the *attitudes, institutions and structures that create and sustain peaceful societies*, is an effective gauge for socio-economic resilience. This resilience is a fundamental tool for countries facing ecological threats. Firstly, it provides a country with the capacity to cope with ecological shocks, minimising their negative impact on the population and economic structure. Secondly, it facilitates the recovery or rebuild of the socio-economic system in the aftermath of an ecological shock.

The Ecological Threat Register (ETR) combines seven hazards – *food insecurity, water stress, droughts, floods, cyclones, rising temperatures, rising sea levels and population growth* – to assess the overall level of ecological risk facing nations from now to 2050. This combination allows the identification of countries that are particularly at risk from environmental factors and do not have the socio-economic resilience to mitigate these threats.

Ecological Threat Hotspots

Countries that face a high number of threats and do not have the socio-economic resilience to meet them will find it particularly difficult to protect their populations and economic infrastructure. IEP's analysis identified 31 'hotspots' for ecological stress. These are nations that combine high numbers of threats, low or very low levels of Positive Peace and an inability to improve Positive Peace meaningfully. Over one billion people that live in these hotspots are particularly vulnerable to ecological threats, as shown in Figure 4.1 and Table 3.1. A complete list of countries according to their ETR count and Positive Peace status is found in the Appendix.

Ecological hotspots tend to be clustered on certain geographical areas. For example the Sahel-Horn of Africa belt from Mauritania to Somalia, the southern African belt from Angola to Madagascar and the central Asian belt from Syria to Pakistan. This clustering is significant because ecological and humanitarian crises often spill over across international borders. This spill over effect occurs through refugee flows, cross-border conflict and logistic links. One example of this is the European Migrant Crisis where over 5.2 million refugees entered Europe between 2010 and 2016, primarily from conflict affected countries such as Syria, Iraq and Afghanistan.[1] Europe, as a high resilience region, has ecological threat hotspots to its south and east, making it a likely destination for future displacement from ecological threats.

Syrian refugees also fled to neighbouring Jordan in large numbers. This inflow of refugees from a low resilience country to a high resilience country had a significant impact on worsening resource scarcity in Jordan, which will be discussed later in the section.

KEY FINDINGS

NATURAL DISASTERS

1 billion

One billion people live in areas that combine high frequency and intensity of natural disasters with low and stagnant levels of Positive Peace.

ECOLOGICAL THREAT HOTSPOTS

841m

Europe has ecological threat hotspots to its south and east. These hotspots have a combined population of 841 million people.

RESILLIENCE AND DISPLACEMENT

25m

Nearly 25 million people were displaced by ecological threats in 2019.

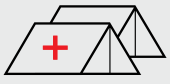


TABLE 4.1

High ecological threat countries and Positive Peace

More than one billion people across 31 countries, highlighted in light red, are facing high ecological threats and with low levels of resilience.

Country	ETR count	Positive Peace status in 2018	Change in Positive Peace from 2009 to 2018	Population (Millions)
Afghanistan	6	Very Low	Marginal Improvement	38.9
Mozambique	5	Low	Deterioration	31.3
Namibia	5	High	Moderate Improvement	2.5
Botswana	4	High	Broadly Stable	2.4
Ethiopia	4	Low	Broadly Stable	115
Madagascar	4	Low	Broadly Stable	27.7
Uganda	4	Low	Broadly Stable	45.7
Iran	4	Low	Deterioration	84
Syria	4	Very Low	Deterioration	17.5
India	4	Medium	Marginal Improvement	1,380.0
Iraq	4	Very Low	Marginal Improvement	40.2
Pakistan	4	Very Low	Marginal Improvement	220.9
Chad	4	Very Low	Marginal Improvement	16.4
Tajikistan	4	Very Low	Marginal Improvement	9.5
Kenya	4	Low	Moderate Improvement	53.8
Eswatini	4	Low	Moderate Improvement	1.2
Zimbabwe	4	Very Low	Moderate Improvement	14.9
Tanzania	4	Low	Strong Improvement	59.7
Kyrgyzstan	4	Medium	Strong Improvement	6.5
Liberia	3	Low	Broadly Stable	5.1
Malawi	3	Low	Broadly Stable	19.1
Zambia	3	Low	Broadly Stable	18.4
Mexico	3	Medium	Broadly Stable	128.9
Russia	3	Medium	Broadly Stable	145.9
Netherlands	3	Very High	Broadly Stable	17.1
Republic of the Congo	3	Very Low	Broadly Stable	5.5
North Korea	3	Very Low	Broadly Stable	25.8
Sudan	3	Very Low	Broadly Stable	43.8
Somalia	3	Very Low	Broadly Stable	15.9
Turkmenistan	3	Very Low	Broadly Stable	6
Australia	3	Very High	Deterioration	25.5
United States	3	Very High	Deterioration	331
C. African Rep.	3	Very Low	Deterioration	4.8
Eritrea	3	Very Low	Deterioration	3.5
Haiti	3	Very Low	Deterioration	11.4
Mali	3	Very Low	Deterioration	20.3
Mauritania	3	Very Low	Deterioration	4.7
Yemen	3	Very Low	Deterioration	29.8
Tunisia	3	High	Marginal Improvement	11.8
Angola	3	Very Low	Marginal Improvement	32.9
Niger	3	Very Low	Marginal Improvement	24.2
Uzbekistan	3	Low	Moderate Improvement	33.5
Cuba	3	Medium	Moderate Improvement	11.3
Morocco	3	Medium	Moderate Improvement	36.9
Rwanda	3	Medium	Moderate Improvement	13
Georgia	3	High	Strong Improvement	4
Philippines	3	Low	Strong Improvement	109.6
China	3	Medium	Strong Improvement	1,439.3
Indonesia	3	Medium	Strong Improvement	273.5
Moldova	3	Medium	Strong Improvement	4
Israel	3	Very High	Strong Improvement	8.7
Total, 3 or more ETR count				**5,033.4**
Of which:				
Total hotspots				**1,021.6**

Source: IEP, United Nations Department of Economic and Social Affairs Population Division

The 31 hotspot countries include Afghanistan, Syria, Iraq, Pakistan, Chad, Tajikistan and Yemen. These countries have very low resilience and are already experiencing adverse effects from ongoing conflict and the COVID-19 pandemic. Without strong improvements in Positive Peace, the lack of coping capacity in these countries could lead to worsening food insecurity, civil unrest, mass displacement and competition over resources.

Afghanistan faces the highest number of ecological threats of any country measured by the ETR, with a score of six. Natural disasters, such as droughts, earthquakes and floods are exacerbating vulnerability and poverty in the country. Rapid population growth and extreme temperatures also contribute to resource depletion, leading to food insecurity and water stress.[2]

Afghanistan's lack of coping capacity has increased the risk of fatalities and displacements due to ecological threats, as explained in Box 3.1.

Another group among high threat countries comprise of nations with consistently high or very high levels of Positive Peace since 2009. These countries are Australia, Botswana, Georgia, Israel, Namibia, the Netherlands, Tunisia and the United States. All eight countries are at high risk from water stress. While this group faces high exposure to ecological threats, their high levels of Positive Peace mean they have superior coping capacity to mitigate the impacts of ecological threats such as resource depletion, widespread displacement and political instability.

BOX 4.1

Resilience in conflict areas, Afghanistan

Following more than 40 years of conflict, Afghanistan has a low level of socio-economic development, weak governance and low resilience.[3] By the end of 2019, almost three million people in Afghanistan were displaced as a result of armed conflict, while 1.2 million were displaced as a result of natural disasters.[4] Since 2008, the majority of new displacements were attributed to droughts and floods, which account for 46 and 42 per cent of displacements, respectively.[5] In the same period, most fatalities from ecological threats were attributed to floods and extreme temperatures.

Climate change poses a threat to Afghanistan's natural resources. Recurring drought combined with extreme temperatures have resulted in insufficient water resources for agriculture.[6] The COVID-19 pandemic is expected to worsen food insecurity in Afghanistan, with food prices increasing in the first half of 2020. Following the closure of Afghanistan's border with Pakistan in March 2020, food prices in Kabul rose by 30 per cent overnight.[7] Despite government efforts to control excessive pricing, the prices of staple foods have continued to increase.[8] As of May 2020, approximately 10.9 million people, or 35 per cent of the population, face acute food insecurity.[9]

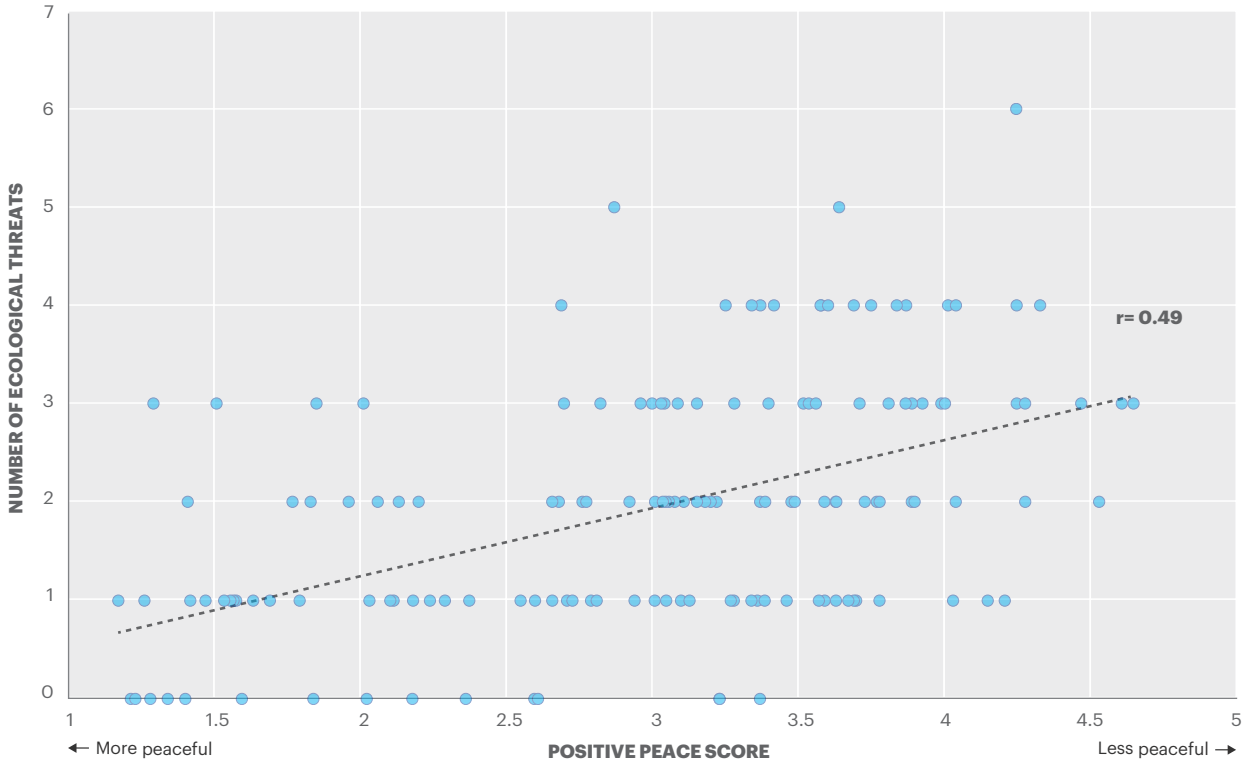
Building resilience is particularly challenging in Afghanistan due to protracted conflict, limited access to remote areas and poor transport connectivity.[10] However, the country has taken steps towards building some resilience to ecological threats. In 2015, the Afghanistan National Disaster Management Agency introduced the Establishing Critical Risk Information project (ECRI) in collaboration with the Global Facility for Disaster Reduction and Recovery (GFDRR), the World Bank and the Government of Japan.[11] The project aims to improve access to information used by the Government of Afghanistan to identify areas most at risk, make schools and energy supply resilient to ecological threats and build community capacity for resilience.[12]

The conceptual relationship between environmental threats and Positive Peace levels is also empirically verified. The correlation coefficient between the ETR risk count and the Positive Peace score for the 157 countries assessed is material at 0.49, as shown in Figure 4.2. This means that the countries with higher exposure to ecological threats are on average those with the least capacity to handle such shocks.

FIGURE 4.2

Ecological Threat Register vs Positive Peace

Countries with low Positive Peace are exposed to a larger number of ecological threats.



Source: IEP

What is Positive Peace?

Positive Peace is defined as the *attitudes, institutions and structures* that create and sustain peaceful societies. It measures the level of socio-economic development of a society and gauges its resilience, prospects for economic development and ability to resolve grievances without resorting to violence. The Positive Peace framework can be used to assess socio-economic development at any level of social organisation. It can be applied to neighbourhoods, cities, nation states or the global community.

FIGURE 4.3

Positive Peace and Negative Peace

Positive Peace is a complementary concept to negative peace.

IEP has created a framework for the statistical analysis of Positive Peace and its eight Pillars:

- ***Well-functioning Government*** – A well-functioning government delivers high-quality public and civil services, engenders trust and participation, demonstrates political stability and upholds the rule of law.

- ***Sound Business Environment*** – This reflects the strength of economic conditions as well as the formal institutions that support and regulate the operation of the private sector. Business competitiveness and economic productivity are both associated with the most peaceful countries.

- ***Equitable Distribution of Resources*** – Peaceful countries tend to ensure equity in access to resources such as education, health and to a lesser extent, equity in income distribution.

- ***Acceptance of the Rights of Others*** – Peaceful countries often have formal laws that guarantee basic human rights and freedoms, and the informal social and cultural norms that guide citizens' behaviour.

- ***Good Relations with Neighbours*** – Peaceful relations with other countries are as important as good relations between groups within a country or local community. Countries with positive external relations are more peaceful and tend to be more politically stable, regionally integrated, have better functioning governments and have lower levels of organised internal conflict.

- ***Free Flow of Information*** – Free and independent media disseminates information in a way that leads to greater knowledge and helps individuals, businesses and the civil society make better-informed decisions. This leads to superior outcomes and more rational responses in times of crisis.

- ***High Levels of Human Capital*** – A skilled human capital base reflects the extent to which societies educate citizens and promote the development of knowledge, thereby improving economic productivity, care for the young, political participation and social capital.

- ***Low Levels of Corruption*** – In societies with high levels of corruption, resources are inefficiently allocated, often leading to a lack of funding for essential services and civil unrest. Low corruption can enhance confidence and trust in institutions.

Positive Peace Systems

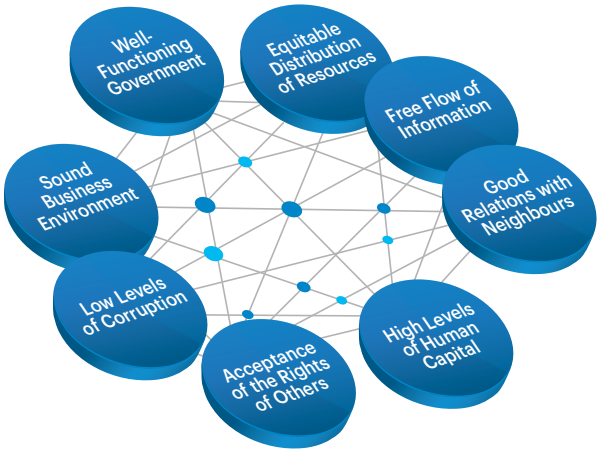
Societies organise themselves and operate in complex ways. Interactions between individuals, groups or institutions are multifaceted, dynamic and difficult to represent with traditional statistical models.

A more effective approach to study social complexity is offered by Systems Theory – a body of knowledge originally developed for biological and engineering applications. It recognises that understanding the workings of individual components is insufficient to describe how the system operates as a whole. It also bypasses the traditional notion of causality – whereby causes can be uniquely and distinctly identified and isolated from effects. This notion very rarely applies in real-life socio-economics, where events and trends continuously influence one another. The properties of systems are discussed in Box 3.2.

FIGURE 4.4

The Pillars of Positive Peace

All eight factors are highly interconnected and interact in varied and complex ways.



BOX 4.2

Key properties of systems

These are some of the properties of systems:

The system is a *whole*. It cannot be reduced to its component parts. The simple aggregation or combination of behaviour patterns of individual parts is insufficient to describe the operation of the whole. This is known as *systemic complexity*.

The evolution of a system is *path-dependent*. Systems have *memory*, in that they retain information about the path taken to reach a given state. For example, consider two countries 'A' and 'B' now experiencing exactly the same degree of peacefulness and social order. If 'A' has just emerged from a long period of internal conflict, while 'B' has always been peaceful, 'A' will more easily be nudged into unrest and turmoil by a negative shock, as old rivalries and resentments flare up again.

The social system has *intent*. The intent of a system is its willing pursuit of desired outputs or states. For example, the intent of a school system is to provide pupils with the best possible education through the most efficient use of resources.

The social system has *norms*. Norms are patterns of conduct that members should or usually follow. Norms can change over time or in response to a disruptive shock. For example, the COVID-19 pandemic changed social norms about how individuals greet one another, congregate and work. Norms can also be expressed through the legal frameworks.

The system is *self-regulating*. It aims to maintain a steady state by stabilising itself through feedback loops. The system adjusts to create balance between inputs, outputs and internally coded requirements. Feedback loops may lead to *virtuous* or *vicious cycles*, depending on whether the self-regulation mechanism places the system in states of greater or lesser peacefulness.

The system is *self-modifying*. When there is a persistent mismatch between inputs and desired outputs, the system searches for a new pattern of operation. For example, a corporation that is consistently not achieving its profit goals, will modify itself by reducing or re-training the workforce, redesigning production processes or changing the product it manufactures.

The system *does not operate in isolation*. Social systems interact with one another, for example as two nations interact through trade, economic investment, migration, exchange of knowledge and other means. Systems interact with other systems of higher or lower hierarchy, as for example, a city interacts with both the national 'super-system' and the household 'sub-system.'

The system operates *non-linearly*. Systems usually display *tipping points*, which are systemic state thresholds beyond which the internal relationships change very quickly. For example, both corruption and per capita income exhibit tipping points. Decreases do not have a lot of effect until a certain point is reached, after which small deteriorations in peace have a substantial impact on corruption or per capita income. Positive tipping points also occur with improvements.

Shock and Resilience

Shocks are sudden substantial changes to a system's inputs or in its internal structure. The COVID-19 pandemic, for instance, was a shock to society because a new input – fear of contagion – affected how individuals, groups and companies operate.

Some shocks can be internally generated, in that they are the result of a social system's own dynamics. Examples of these *endogenous* shocks are political revolutions, civil unrest or economic crises. *Exogenous* shocks are those whose causes and triggers lie outside the social system, such as some types of natural disasters. Shocks are often amplified by *stressors* – factors not necessarily related to the shock itself, but which reduce the ability of a social system to cope and recover.

Resilience is a social system's ability to minimise the effect of a shock and recover in its aftermath. When faced with a shock, systems will first attempt to limit its direct impact on sub-systems. This is termed *coping capacity*, and has been defined by the UN as "the ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies of disasters."[13]

High levels of resilience mean that national systems have superior coping capacity in terms of physical infrastructure, regulatory frameworks, economic strength and diversification, emergency preparedness and response systems. In addition, they also have superior capacity to rebuild their socio-economic systems in the aftermath of the shocks.

For small to moderate shocks, the social system will limit the negative repercussions on population and the economy, and the recovery will lead to a return to pre-shock levels of wellbeing. However, if the shock is severe enough, as in a catastrophic level threat, a system may have to reconfigure its internal structure. This means that the recovery will require more time and effort. But it also means that the reconfigured system may not be able to reach levels of wellbeing experienced before the shock. The concept of resilience is illustrated in Figure 4.5.

Positive Peace is an effective predictor of socio-economic resilience for countries and regions, as discussed in previous IEP research.[14] This is because societies that operate with high levels of Positive Peace tend to:

1. be more effective in protecting lives and livelihoods from the impact of natural disasters;
2. recover more rapidly from economic crises;
3. adjust more easily and quickly to technological, business and social disruption; and
4. promote the peaceful resolution of grievances and disputes between citizens and groups.

One example of resilience comes from national preparedness for and responses to natural disasters. These shocks occur with broadly the same frequency across all types of countries. However, countries with very low levels of Positive Peace have a fatality rate seven times higher than those with very high levels of Positive Peace. This happens because the Pillars of Positive Peace work in systemic ways to enhance a country's coping capacity.

Sound Business Environment guarantees enough resources and infrastructure assets to treat patients affected by the disaster and repair physical damage. *Equitable Distribution of Resources* means that all individuals, groups and demographics have access to protective infrastructure, equipment and services. A *Well-Functioning Government* allocates resources efficiently and transparently to groups or areas where they are most needed, and so on.

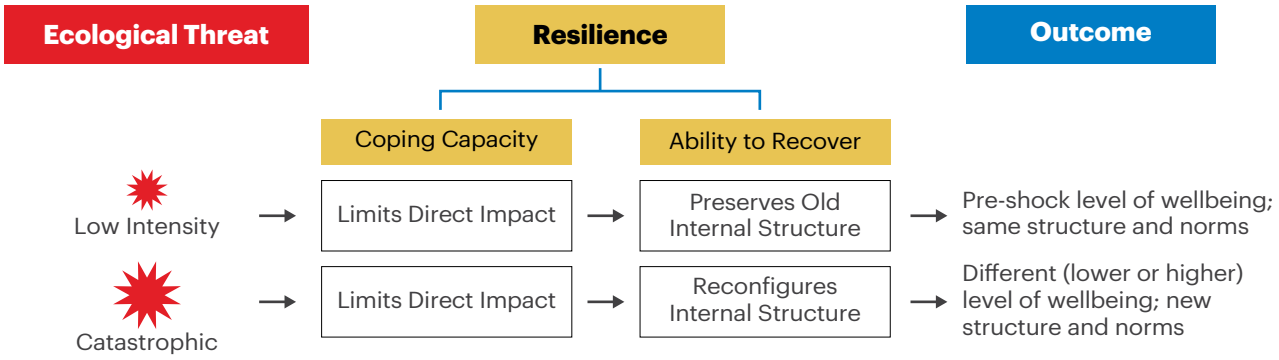
A socio-economic system such as a nation comprises multiple sub-systems. These can be concrete such as households, cities or regions, or notional such as a nation's education system or its judiciary.

When it first manifests, a shock may impact only some of a nation's sub-systems directly. In time, however, the interconnectivity between sub-systems re-transmits the ramifications of the shock throughout the nation. This pattern is illustrated in Figure 4.6.

FIGURE 4.5

Resilience involves coping with and recovering from shocks

Resilience is the ability to protect the population by limiting primary impacts of a shock and to restore the system, sometimes to higher levels of wellbeing. A catastrophic ecological threat may prompt the system to change its internal structures and norms.

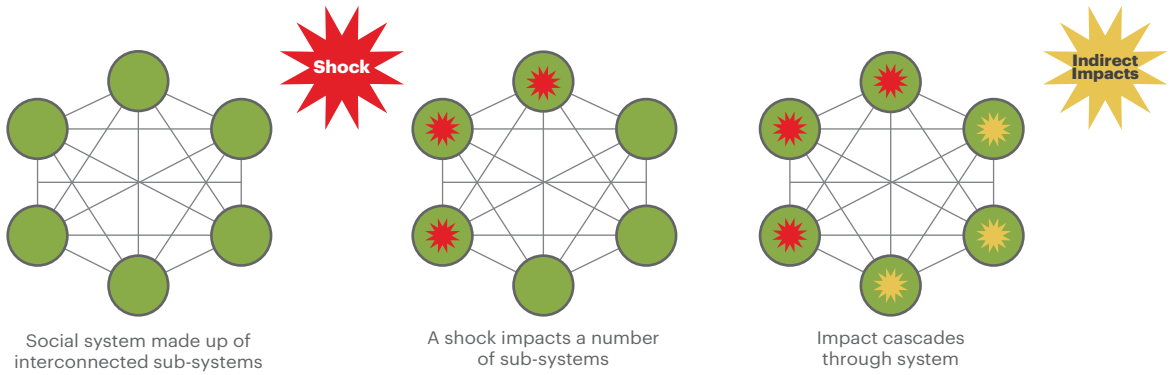


Source: IEP

FIGURE 4.6

A shock's direct and indirect impact

A shock impacts system components in different ways. After the initial impact, the shock cascades through the system.



Source: IEP

The Japanese tsunami of 2011 offers one example of a shock transmission through sub-systems. In its direct impact, the disaster caused death and destruction on the north-eastern coast of the country. Subsequently, damaged nuclear power plants in the region contaminated crops and water supplies with radiation, affecting health and food production sub-systems in surrounding areas.

Another example is the 2010 earthquake in Haiti, which caused severe loss of life and widespread destruction. After this immediate impact, the country experienced a breakdown of its law and order infrastructure contributing to civil unrest and looting.

Positive Peace and Resilience to Ecological Threats

Countries most exposed to ecological threats are also those with lower levels of Positive Peace. This is because some of the threats – such as water stress and food security – are accentuated by poor socio-economic development, as commented in Box 3.3.

Others, like droughts and floods, are natural phenomena whose impact on society could be mitigated and managed through the combined use of the Pillars of Positive Peace.

BOX 4.3

Ecological threats and socio-economic development

Most of the eight ecological threats assessed in the ETR are exacerbated by low levels of Positive Peace.

Water Stress. Countries with poor development in the *Sound Business Environment* Pillar lack the economic resources to build water conservation infrastructure and improve the efficiency of water usage in their agricultural and industrial sectors. This combines with deficiencies in *Well-Functioning Government* causing poor planning, implementation and monitoring of water sharing and conservation schemes.

Food Security. A weak *Sound Business Environment* means the economic structure may be insufficient to produce enough food for the population. In addition, deficiencies in the *Good Relations with Neighbours* Pillar hamper efforts to secure food through regional trade. Poor *High Levels of Human Capital* may equate to insufficient research and rudimentary food production techniques, ineffective storage and wasteful distribution channels.

Population Growth. Countries and regions with poor socio-economic development have higher rates of population growth. Larger family sizes are usually a response to high mortality rates, which is caused by a variety of issues, including under-developed health care and food production systems, unequal access to family planning, health care and education and a need for offspring to support them in old age. Many Positive Peace Pillars are involved including *Sound Business Environment*, *High Levels of Human Capital, Equitable Distribution of Resources* and *Well-Functioning Government* Pillars.

Droughts. These are natural phenomena exacerbated in recent decades by climate change. However, the impact of droughts on societies can be mitigated by adequate food production planning, proper water management, reduced economic reliance on agriculture and increased agricultural efficiency through the use of technology and water usage schemes. All these factors have been discussed in the context of the Positive Peace Pillars above.

Floods. Similar to droughts, these are natural events accentuated by climate change. *Well-Functioning Governments* and *Sound Business Environment* allow the building of infrastructure assets such as levees, detention basis, reservoirs and weirs.

Sea Level. Sea levels are changing on a global scale, but in some cases it may be possible to mitigate the impact of sea level rise through engineering work. This requires both *Sound Business Environment* and *Well-Functioning Government* providing the means and the political will and effectiveness to carry out large infrastructure works.

Tropical cyclones. The impacts of this threat can be mitigated with appropriate building construction codes – *Well Functioning Government* – and technology – *High Levels of Human Capital*.

In addition to being less exposed to ecological shocks, high Positive Peace countries are also better equipped to handle such shocks. Their high levels of resilience, as measured by the PPI, mean they have superior coping capacity in terms of physical infrastructure, regulatory frameworks, economic strength and diversification, emergency preparedness and response systems. In addition, they also have superior capacity to rebuild their socio-economic systems in the aftermath of the shocks.

Reflecting this, the Yale University's Environmental Performance Index (EPI) scores are closely correlated with Positive Peace scores, as seen in Figure 4.7. The EPI measures the effectiveness of countries' policy and physical infrastructure to promote development in ten areas: air quality, water and sanitation, heavy metals management, biodiversity and habitat, forests, fisheries, climate and energy, air pollution, water resources, and agriculture. The correlation coefficient between the EPI and the PPI in 2018 is -0.85.

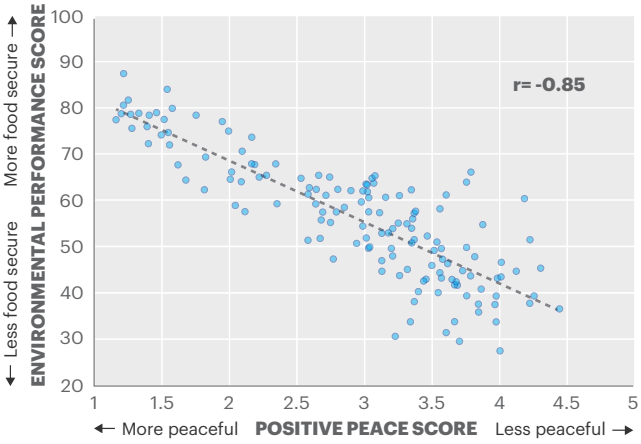
Physical infrastructure is an important component of a country's level of socio-economic resilience. It allows nations to shield their populations from resource depletion shocks and to some extent, natural disasters. Well-developed physical infrastructure is a characteristic of high Positive Peace countries, as shown in Figure 4.8.

The relationship between physical infrastructure and Positive Peace also offers an example of non-linear behaviour, which is one of the defining characteristics of social systems. As Positive Peace improves physical infrastructure also improves. However, after Positive Peace scores reach a level around 2.5, further improvements in physical infrastructure are harder to achieve. This represents a tipping point marking the changing relationship between these two variables.

FIGURE 4.7

Environmental Performance Index vs. Positive Peace score, 2018

There is a strong correlation between higher levels of positive peace and better environmental performance.

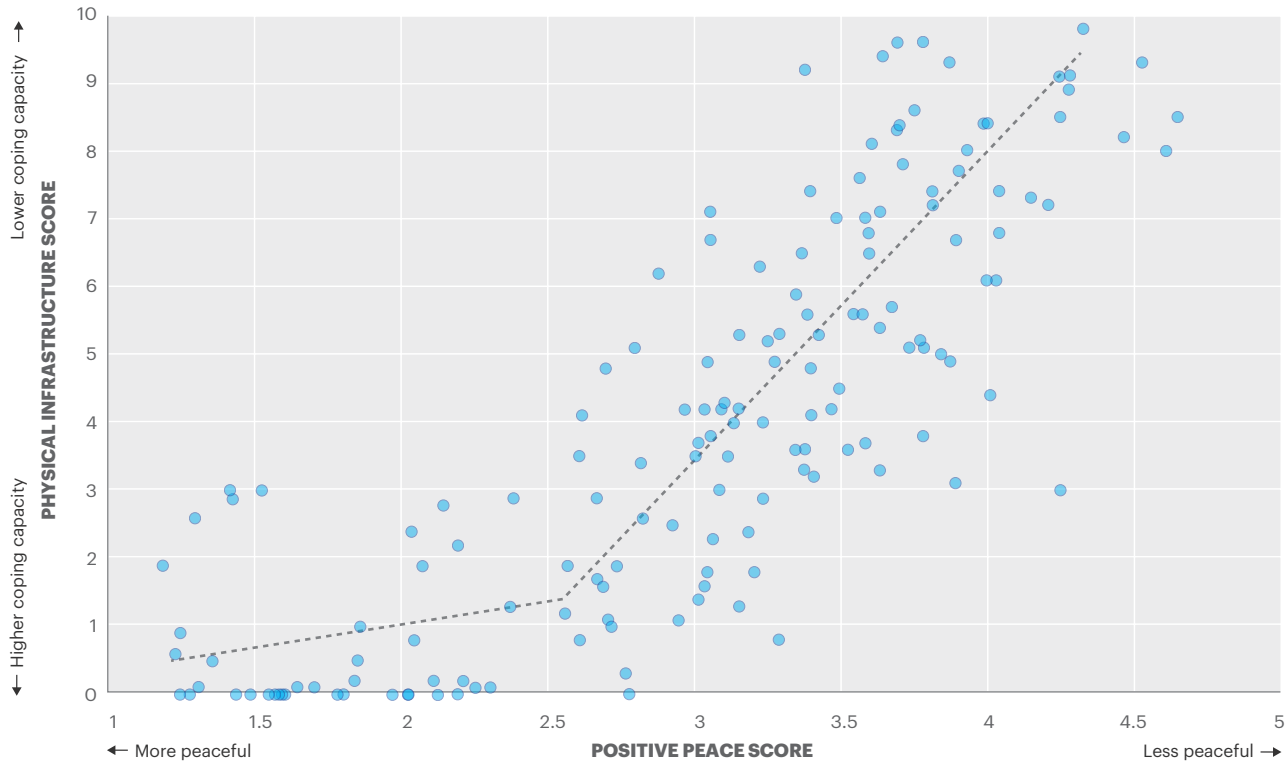


Source: Environmental Performance Index, IEP

FIGURE 4.8

Physical coping capacity vs Positive Peace score

Countries with high levels of Positive Peace also have high infrastructure coping capacity. When the Positive Peace score is below the 2.5 level, further improvements in physical infrastructure are harder to achieve.



Source: IEP, INFORM

Resilience and Displacement

Population displacement is one of the most disruptive consequences of ecological threats. It is also a key contagion factor whereby a shock to a country reverberates on neighbours and beyond.

Nearly 25 million people were displaced by ecological threats in 2019. Over 74 per cent of new displacements that year occurred in low and very low Positive Peace countries, that is, those with poor socio-economic resilience.

High resilience countries are better able to withstand shocks and stresses, such as natural disasters or depletion of resources. As a result, the need for individuals to migrate is less. Even if displacement does take place, high-resilience countries are capable of resettling their citizens quickly and without significant losses to their social networks, financial and physical assets or well-being[15]. One example was the Japanese earthquake and tsunami of 2011. Six years after this event there were still 150,000 evacuated people living in temporary housing, but no widespread social unrest or upheaval was recorded.[16]

On the other hand, low resilience countries are less capable of shielding their populations. Individuals affected by shocks often relocate as a strategy to minimise hardship, thus becoming internally displaced persons (IDPs) or cross-border refugees.

Seen in this light, displacement can be a system's last attempt to cope with a shock, after other layers of resilience have failed.

Somalia is one example where recurring ecological shocks, protracted conflict and political instability resulted in widespread internal displacement and humanitarian crises. Between 2008 and 2019, the country recorded 2.5 million new displacements as a result of conflict and 2.2 million as a result of natural disasters.[17] Widespread displacement, poverty and insecurity reduced access to education[18] and exacerbated social tensions and conflict.

Displacement is also a contagion mechanism whereby the impact of an ecological threat on a country can spread well beyond its borders. An example of how crises in Syria affected social cohesion in Europe is discussed in Boxes 3.4 and 3.5.

BOX 4.4

Resource depletion and displacement crises in Syria

From 1999 to 2011, Syria experienced two severe droughts. Approximately 75 per cent of farmers experienced total crop failure and in the northeast, farmers lost 80 per cent of their livestock. This forced a substantial proportion of the population to relocate to urban centres, with an estimated 1.3 to 1.5 million people migrating by 2011. The World Bank estimated in a 2011 survey of Syrian migrants that over 85 per cent of the respondents used migration as an "adaptation strategy."

The country was highly dependent on agriculture, which contributed to around one-quarter of its GDP and employed about 38 to 47 per cent of its work force.[19] The prolonged drought affected 1.3 million people and the loss of the 2008 harvest accelerated migration to urban areas and exacerbated poverty.[20, 21, 22] As a consequence of shortages, the price of food and basic resources increased markedly, further aggravating the hardship to which the Syrian people were subject. Extreme poverty led to malnutrition, families selling their assets, greater indebtedness, increases in urban migration and children interrupting their studies to seek work.[23, 24, 25]

Deprivation contributed to further dissatisfaction with the regime of President Bashar al-Assad, who had come to power in 2000 following the death of the previous president, his father Hafez.[26]

Syria's Positive Peace deficiencies combined to plunge the country into a vicious cycle of unrest and deprivation. These stressors and systemic behaviour are discussed below.

- *Sound Business Environment*. Syria's underdeveloped economy and over-reliance on agriculture meant it was particularly susceptible to ecological threats.

- *Equitable Distribution of Resources*. High levels of poverty and reliance on agricultural activity combined to exacerbate the deprivation caused by the drought. Syria's weak and poorly diversified economy – low development of *Sound Business Environment* – meant it was not able to import enough food and basic goods for its population.

- *Well-Functioning Government* and *Low Levels of Corruption*: combined deficiencies in these two Pillars meant the administration had neither the diligence nor the means to mitigate the impact of the drought.

In addition to facing droughts, internal displacement and civil unrest, Syria plunged into a civil war in 2012. Government forces engaged in open combat with opposition militias, and many foreign governments aligned with one side or another, providing weapons and other resources. The full-scale civil war led to millions of Syrians leaving the country seeking refuge in neighbouring nations and Europe.

BOX 4.5

Syrian displacement crisis and deteriorations in Positive Peace in Europe

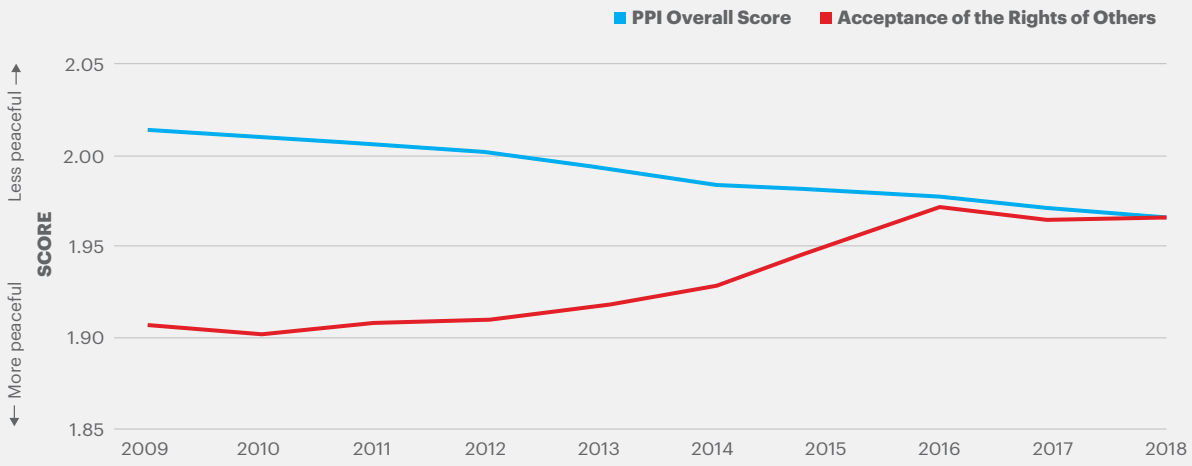
Systems do not operate in isolation, instead being in constant exchange with other systems. The collapse of the Syrian socio-economic system resulted in severe refugee flows into neighbouring countries, especially Turkey, Lebanon and Jordan. Iraq and Egypt also received inflows, albeit to a lesser extent than the former three countries. A total of 5.7 million Syrians have been received by these five nations, which in turn are struggling to maintain and supply refugee camps. In addition to the stress on economic resources, these five countries also have internal ethnic tensions, which may be exacerbated by the inflow of Syrian refugees.

In 2015, the crisis resulted in large inflows into Europe, with more than one million refugees seeking asylum in the continent that year. The vast majority of these were Syrians, although Afghans, Iraqis and other nationalities were also recorded. Countries like Germany, Sweden, Hungary and Austria gave asylum to most of this refugee population. However, these and other European countries experienced a rise in political instability and the emergence of new anti-immigration parties. This led to a deterioration of 3.3 per cent in the Pillar *Acceptance of the Rights of Others* in Europe, despite the overall level of Positive Peace improving at the same time, as shown in Figure 4.9. The migration crisis was also one of the many factors influencing the United Kingdom's decision to leave the European Union in the 2016 referendum.

FIGURE 4.9

Positive Peace in Europe

Despite a general improvement in Positive Peace over the past decade, the *Acceptance of the Rights of Others* Pillar recorded a marked deterioration.



Source: IEP

> Nearly 25 million people were displaced by ecological threats in 2019. IEP estimates that by 2050 armed conflict and ecological threats will leave 1.2 billion people at risk of displacement.

Resource Depletion Threats

Resource depletion threats – food insecurity, water stress and population growth – are strongly associated with low levels of socio-economic development. This is because countries with weak economies and poor social development are less capable of producing or importing food and erecting water conservation infrastructure. These countries are also more likely to experience lower levels of education and have poor family planning practices.

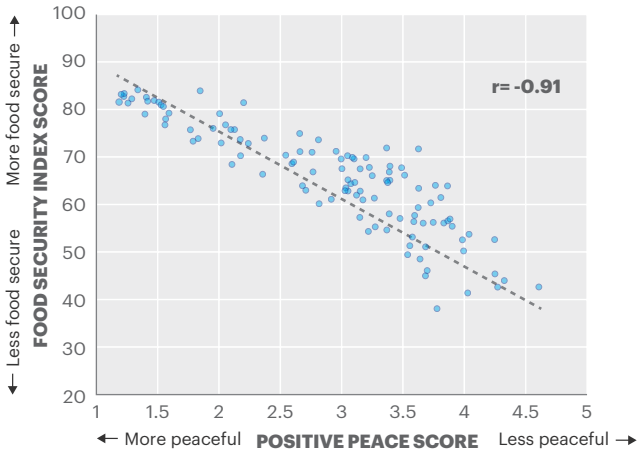
These countries have a combined population of 746 million people and are listed in Table 3.2.

As discussed above, food security is strongly associated with socio-economic resilience. The correlation coefficient between the Economist Intelligence Unit Food Security Index and the Positive Peace Index is high in absolute terms, at -0.91, illustrated by Figure 3.10.

FIGURE 4.10

Food security vs Positive Peace

Countries with low levels of Positive Peace have higher levels of food insecurity.



Source: Economist Intelligence Unit, IEP
Notes: EIU provides Food Security Index scores for 112 out of 157 ETR countries

TABLE 4.2

Resource scarcity hotspots

A total of 746 million people live in countries with very low capacity to deal with resource depletion threats such as rapid population growth, water stress and food insecurity.

Country	Resource depletion count	Highest threat	Positive Peace status in 2018	Change in Positive Peace from 2009 to 2018	Population (Millions)
Afghanistan	3	Water Stress	Very Low	Marginal Improvement	38.9
Iraq	3	Water Stress	Very Low	Marginal Improvement	40.2
Eswatini	3	Food Security	Low	Moderate Improvement	1.2
Yemen	3	Water Stress	Very Low	Deterioration	29.8
Mozambique	2	Population Growth	Low	Deterioration	31.3
Angola	2	Population Growth	Very Low	Marginal Improvement	32.9
Central African Republic	2	Food Security	Very Low	Deterioration	4.8
Eritrea	2	Population Growth	Very Low	Deterioration	3.5
Chad	2	Population Growth	Very Low	Marginal Improvement	16.4
Haiti	2	Food Security	Very Low	Deterioration	11.4
Ethiopia	2	Population Growth	Low	Broadly Stable	115.0
Liberia	2	Population Growth	Low	Broadly Stable	5.1
Kenya	2	Population Growth	Low	Moderate Improvement	53.8
Madagascar	2	Population Growth	Low	Broadly Stable	27.7
Pakistan	2	Water Stress	Very Low	Marginal Improvement	220.9
Republic of the Congo	2	Population Growth	Very Low	Broadly Stable	5.5
Syria	2	Water Stress	Very Low	Deterioration	17.5
Tajikistan	2	Population Growth	Very Low	Marginal Improvement	9.5
Timor-Leste	2	Water Stress	Low	Marginal Improvement	1.3
Uganda	2	Population Growth	Low	Broadly Stable	45.7
Zambia	2	Population Growth	Low	Broadly Stable	18.4
Zimbabwe	2	Population Growth	Very Low	Moderate Improvement	14.9
Total					**745.7**

Source: IEP
Note: Food security data available for 131 of 157 ETR countries

Low levels of Positive Peace and food insecurity combine to create a vicious cycle, in which political instability and social unrest are fed by hardship, which in turn leads to more instability. The Pillars of Positive Peace provide a framework for analysis of the causes and dimensions of food insecurity. For instance, countries with a highly developed *Sound Business Environment* are better positioned to produce or import adequate levels of food for their populations. The *Equitable Distribution of Resources* Pillar provides guidance on the ability of a society to address inequality in access to food.

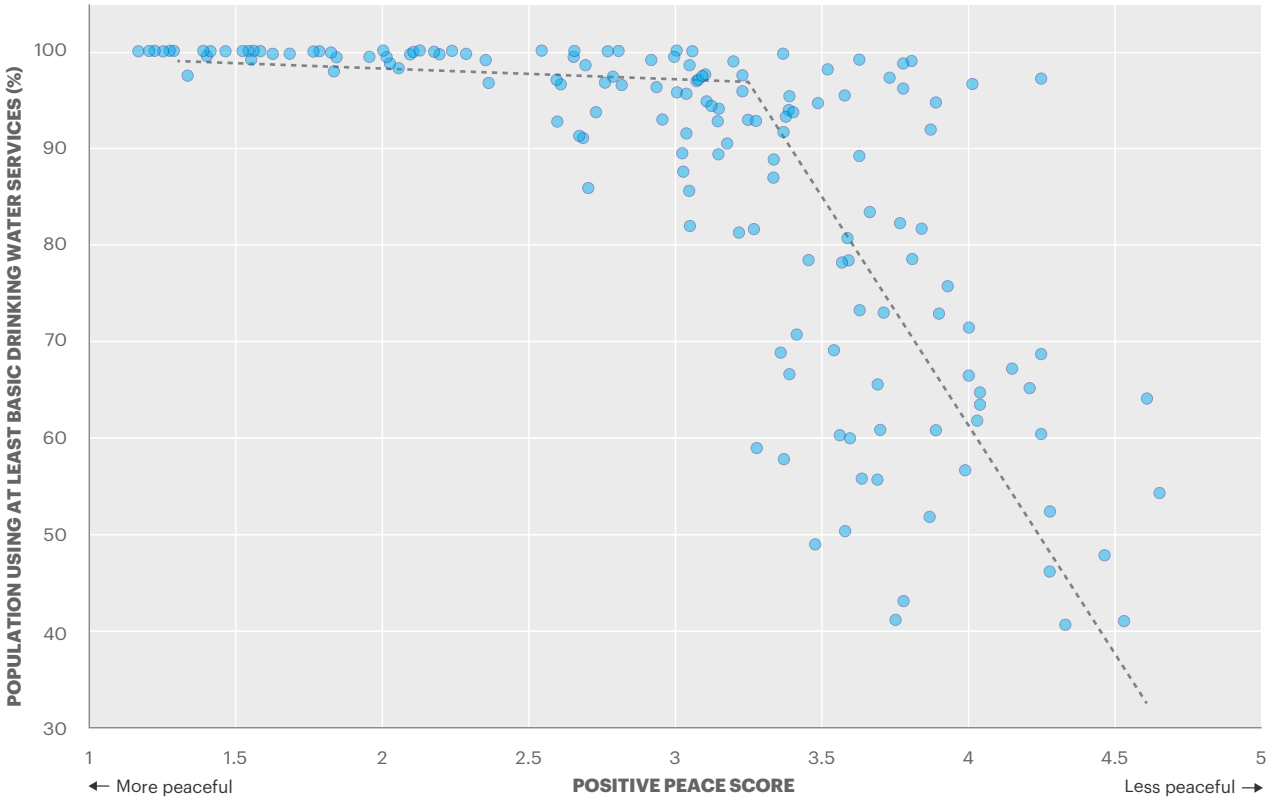
Similarly, water stress is more effectively managed by nations with higher levels of Positive Peace. This is evident in Figure 4.11, which also shows that as countries improve their PPI scores, the proportion of their populations using at least basic water treatment increases markedly. This relationship is also an example of systemic non-linearity, as countries with a PPI score below three have generally provided their population with adequate water and quality of water treatment.

Severe resource depletion shocks may nudge fragile socio-economic systems into vicious cycles of progressively greater humanitarian crises. This is particularly true where the system has already been heavily stressed by low levels of Positive Peace. The example of the Syrian crisis discussed previously is a case in point.

FIGURE 4.11

Access to basic water services vs Positive Peace

Improvements in Positive Peace are associated with better access to water treatment. When the PPI tipping point score of 3 is achieved, nations usually have already reached maximum quality of water services.



Source: FAO, IEP

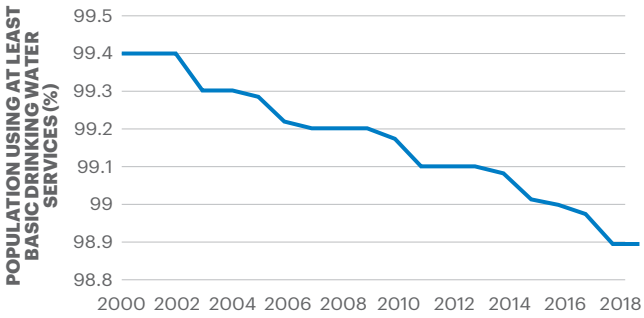
> A total of 746 million people live in areas that combine resource depletion threats with low and stagnant or deteriorating levels of Positive Peace.

The Syrian resource depletion crisis also severely impacted neighbourng countries through refugee flows. One of these countries was Jordan, which was already suffering water stress before the inflow of Syrian refugees, as per Figure 4.12. This is an example of the transmission of humanitarian crises across borders, which accelerated water stress and undernourishment in Jordan, as shown in Figure 4.13 and Box 4.5.

FIGURE 4.12

Access to basic drinking water services in Jordan, 2000–2018

Water stress was intensifying in Jordan even before the refugee crisis.

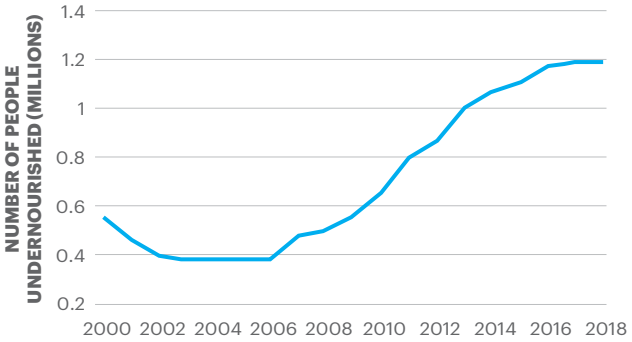


Source: FAO

FIGURE 4.13

Undernourishment in Jordan, 2000–2018

Inflows of refugees from Syria greatly accelerated undernourishment.



Source: FAO

BOX 4.5

Resource scarcity in Jordan

Jordan is a high Positive Peace country, ranking 62 out of 163 nations assessed in the 2019 Positive Peace Index.[27] The country has sheltered a disproportional amount of Syrian refugees since 2011, greatly assisting the international community in managing the crisis.

With an ETR score of two, Jordan faces high exposure to droughts and water stress. The country is facing extremely high water stress and withdraws more than 80 per cent of renewable water resources each year.[28]

Jordan's high population growth – a result of natural growth and the arrival of large numbers of refugees from neighbouring Syria – placed additional strain on the country's already limited water supply.[29] Since the start of the Syrian conflict in 2011, more than 670,000 Syrians have registered as refugees in Jordan[30], although the actual number of refugees is estimated to be as high as 1.3 million.[31] The vast majority of registered refugees – 84 per cent – live in urban areas, while the remaining 16 per cent live in three refugee camps.[32]

In 2018, more than 98.9 per cent of the Jordanian population had access to basic drinking water services[33], while an estimated 93.8 per cent had access to safely managed drinking water services.[34] As Figure 4.12 shows, access to basic drinking water services in Jordan has declined continuously since 2000.

Along with population growth, increasing agricultural and industrial capacity also contributed to diminishing water resources.[35] Areas of inefficient water management practices and water theft will likely exacerbate the effects of climate change in Jordan as levels of precipitation become less certain.[36]

Food security also remains a critical concern in Jordan. Between 2000 and 2018, the number of undernourished has more than doubled, reaching 1.2 million. Food security is a particular concern among the refugee population in Jordan. In 2016, approximately 28 per cent of Syrian refugees were thought to be food secure. This has since declined to 23 per cent in 2018.[37]

The stressors are discussed in terms of Positive Peace Pillars below.

- *Sound Business Environment*: Although well developed by regional standards, this Pillar was not strong enough in Jordan to provide work for the large number of refugees the country received. Today, these refugees account for around ten per cent of the Jordanian population, which shows that the original shock was excessively severe.

- *Well-Functioning Government* and *Equitable Distribution of Resources*: Relatively strong performances in these two Pillars allowed Jordan to mitigate to some extent the impact of the inflow. More than 100,000 refugees were granted working permits by Jordanian authorities. External assistance from the UN World Food Programme and non-governmental organisations contributed to some degree of stabilisation and averted social unrest among the Jordanian population.

THE COVID-19 PANDEMIC AND FOREIGN AID

COVID-19 is expected to increase resource depletion threats, particularly in countries already facing high exposure to ecological threats and operating with low resilience. Yemen is another example of a resource scarcity hotspot where a shock such as the COVID-19 pandemic may push an already fragile humanitarian situation beyond a point of social collapse.[38] This is discussed in more detail in Box 3.6.

The COVID-19 pandemic is arguably the greatest shock to the global socio-economic system so far in the 21st century. Countries with high levels of Positive Peace prior to the pandemic will be better placed to manage the contagion and to rebuild their economies after the economic contraction due to lockdowns.

However, many countries do not have appropriate levels of socio-economic resilience to withstand strong shocks. When faced with adverse shocks, these fragile countries can fall into vicious cycles of political turmoil, social unrest and economic instability. For these nations, foreign aid is an important supplement of resilience, boosting their efforts to mitigate the negative impacts of shocks on their populations.

The COVID-19 pandemic had a triple negative impact on such fragile nations. Firstly, the pandemic caused a large number of fatalities and stretched already precarious health systems. Secondly, the global recession reduced household incomes through decreased investment and trade. And lastly, the severe economic contraction expected for advanced economies in 2020 will most likely curtail the foreign aid flows fragile countries need to preserve social stability.

BOX 4.6

COVID-19 and the ongoing humanitarian crisis in Yemen

Since 2015, ongoing conflict in Yemen has led to what the UN describes as the "worst humanitarian crisis in the world."[39] Armed conflict resulted in the displacement of millions, caused a deep economic crisis and led to a widespread food insecurity crisis. More than 80 per cent of the country's population is at risk of hunger and disease.[40] The COVID-19 pandemic is set to exacerbate the humanitarian crisis, with some estimates predicting 17 million people are in need of humanitarian assistance. This represents the largest food insecure population in the world.[41]

Yemen is considered a resource scarcity hotspot, facing high exposure to all three resource depletion indicators measured in the ETR – *water stress, food security and population growth* – and with low resilience to respond to such threats. The UN estimates that approximately 17.8 million people lack access to safe water and sanitation, while 19.7 million lack access to adequate health care.[42] Heavy rains and intense floods have disrupted access to safe drinking water and sanitation services, creating ideal conditions for the spread of water-borne diseases, namely cholera and dengue fever.[43]

Ongoing conflict and ecological threats led to widespread displacement across Yemen. Since 2015, over 3.4 million new displacements were recorded as a result of conflict, while disasters, mainly floods, resulted in 177,000 new displacements.[44]

The COVID-19 pandemic will intensify the impacts of the ongoing conflict and recurring ecological threats in Yemen. These can be categorised by fragilities in the Positive Peace Pillars:

- *Well-Functioning Government*: The ongoing civil war fought between the Saudi-backed Yemeni government and Houthi armed movement, along with their allies, has meant that no central government is in charge, making the COVID-19 pandemic much harder to contain. This weakness in the *Well-Functioning Government* Pillar interacts with deficiencies in *Free Flow of Information*, as reporting on case numbers vary widely between government and rebel-held areas. This has made it difficult for aid organizations to understand the level of disease transmission and prepare accordingly.

- *High Level of Human Capital*: Yemen's health care system was already under stress following years of conflict and outbreaks of communicable diseases, such as cholera. Many healthcare facilities have been destroyed by airstrikes and shelling and the country also has a shortage of healthcare workers. With the onset of the COVID-19 pandemic, the rise in case numbers and limited supply of medical equipment has led to the effective collapse of Yemen's health care system.[45]

- *Sound Business Environment*: Prior to the conflict, Yemen was primarily dependent on food imports with only around 25 per cent of food being produced domestically.[46] Food affordability is a critical concern to households, as pre-existing global food price increases and currency depreciation interact with COVID-19 related trade restrictions.[47] Remittances, which play a critical role in the economy, have been substantially reduced and other income is expected to decline further as COVID-19 disruptions affect businesses.[48] Food imports and remittances were examples of *Good Relations with Neighbours* dynamics mitigating the weakness in *Sound Business Environment*. But it is difficult to predict how this systemic interaction will behave in a post-pandemic world.

Among developed countries, the economic contraction forecast for 2020 is many orders of magnitude higher than most donor countries' development aid budgets, as shown in Table 3.3. For example, the contraction in GDP predicted for the United States is 30 times larger than the country's foreign aid budget of recent years. Almost all of the top foreign aid donors find themselves in a similar situation. As a result, it is possible that provision of foreign aid will be reduced severely in 2020, in the same way that foreign direct investment is predicted to fall by 40 per cent this year.[49]

In contrast to other large aid donors, China's economy is not predicted to contract in 2020, although growth is expected to lie substantially below recent levels. This can potentially enhance China's position as a foreign aid donor, as the country is already seen by some as a major source of funding and an alternative to the International Monetary Fund.[50] The fact that China is considering debt relief for certain African nations – a proposal discussed at a recent Forum on China-Africa Cooperation – may further enhance the country's influence.[51]

Some of the top recipients of foreign aid have severe deficiencies in food security, as shown in Table 3.4. For example, more than half of the populations of countries, such as Afghanistan, Syria and Iraq face food insecurity. Other nations, such as Bangladesh, Nigeria and Ethiopia also struggle to feed adequately large proportions of their populations.

TABLE 4.3

Growth forecasts for top 15 aid donors

Reduction in GDP forecast for the top developmental donors in 2020 is likely to affect foreign aid budgets.

Country	Development Aid - ODA and other official flows (OOF)		GDP Growth Forecast for 2020 (%)	GDP Growth 2020 as a proportion of aid 2016 (Ratio)
	US$ Billions	Proportion of GDP (%)		
China	38	0.3	1.2	4
US	31.1	0.2	-5.9	-30
UK	18.7	0.7	-6.5	-9
Germany	17.8	0.5	-7	-14
Japan	10.4	0.2	-5.2	-26
France	9.2	0.4	-7.2	-18
Sweden	7.1	1.4	-6.8	-5
Netherlands	5.8	0.7	-7.5	-11
UAE	4.4	1.2	-3.5	-3
Canada	4.3	0.3	-6.2	-21
Norway	4.3	1.2	-6.3	-5
Turkey	3.9	0.5	-5	-10
Italy	3.8	0.2	-9.1	-46
Switzerland	3.5	0.5	-6	-12
Australia	3.2	0.3	-6.7	-22

Source: OECD, AidData, IMF, IEP calculations

TABLE 4.4

Aid recipients and food insecurity

With the exception of Jordan and Indonesia, the top ten foreign aid recipients have moderate to high proportions of their populations in states of food insecurity.

Country	Aid received, 2017 and 2018 (US$ million)	Proportion of population in food insecurity(%)
India	3,963	15
Afghanistan	2,758	54
Indonesia	2,559	8
Syria	2,549	54
Bangladesh	2,434	31
Ethiopia	2,173	27
Iraq	2,172	53
Jordan	2,082	4
Vietnam	1,831	15
Nigeria	1,741	36

Source: OECD, FAO, Industan Times, Humanitarian Needs Overview, Integrated Food Security Phase Classification, World Food Programme

Note: Estimates for food security come from different sources and are not directly comparable

> China is now the largest provider of developmental aid, ahead of the United States. Of the ten largest recipients, the majority have over a third of their populations facing food insecurity.

Natural Disasters

Natural disasters are the most common type of exogenous shock. Since 1990, over 9,000 natural disasters have occurred worldwide, resulting in 1.6 million fatalities.[52] The frequency and severity of natural disasters are outside the control of national policymakers, whose only course of action is to prepare and respond. Importantly, as the effects of ecological degradation and climate change accelerate, so too may the frequency and impact of natural disasters.

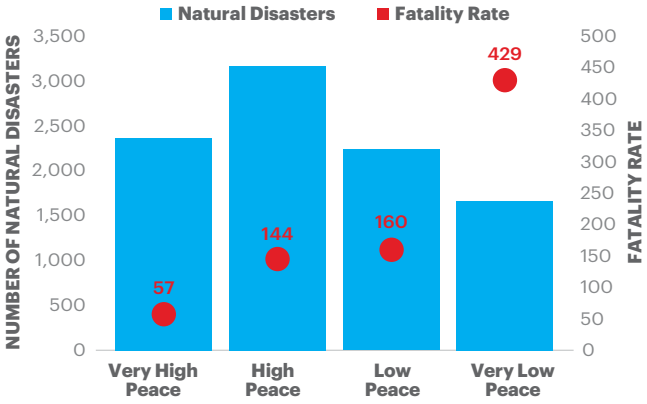
The countries most at risk from natural disasters experience high exposure to natural disasters with low levels of Positive Peace. These countries hold a combined population of one billion people and are listed in Table 3.5.

Figure 4.14 illustrates the frequency of natural disasters by level of Positive Peace compared to the fatality rate. Natural disasters kill seven times more people in very low Positive Peace countries than in very high Positive Peace countries. This is despite the frequency of such events being lower in very low Positive Peace countries. Countries with higher levels of socio-economic development are able to implement effective coping strategies to respond to natural disasters. This is because they have more resources, extensive and reliable infrastructure and better funded emergency agencies.

FIGURE 4.14

Frequency of natural disasters by level of Positive Peace, 1990–2019

Natural disasters are only slightly less frequent in very low Positive Peace countries, yet they have a fatality rate over seven times higher than countries with very high levels of Positive Peace.



Source: EMDAT, IEP

TABLE 4.5

Natural disaster hotspots

More than one billion people live in countries with high exposure to natural disasters and very low resilience.

Country	Natural Disaster count	Highest threat	Positive Peace status in 2018	Change in	Population
Mozambique	3	Droughts	Low	Deterioration	31.3
Afghanistan	2	Droughts	Very Low	Marginal Improvement	38.9
Bangladesh	2	Floods	Low	Marginal Improvement	164.7
Chad	2	Floods	Very Low	Marginal Improvement	16.4
Ethiopia	2	Droughts	Low	Broadly Stable	115.0
Iran	2	Floods	Low	Deterioration	84.0
Kenya	2	Droughts	Low	Moderate Improvement	53.8
Madagascar	2	Cyclone	Low	Broadly Stable	27.7
Malawi	2	Droughts	Low	Broadly Stable	19.1
Mali	2	Floods	Very Low	Deterioration	20.3
Mauritania	2	Droughts	Very Low	Deterioration	4.6
Niger	2	Floods	Very Low	Marginal Improvement	24.2
North Korea	2	Floods	Very Low	Broadly Stable	25.8
Pakistan	2	Floods	Very Low	Marginal Improvement	220.9
Somalia	2	Droughts	Very Low	Broadly Stable	15.9
Sudan	2	Floods	Very Low	Broadly Stable	43.8
Syria	2	Droughts	Very Low	Deterioration	17.5
Tajikistan	2	Droughts	Very Low	Marginal Improvement	9.5
Uganda	2	Droughts	Low	Broadly Stable	45.7
Uzbekistan	2	Droughts	Low	Moderate Improvement	33.5
Zimbabwe	2	Droughts	Very Low	Moderate Improvement	14.9
Total					**1,027.5**

Source: IEP

The example of earthquakes in Chile and Haiti demonstrates how the impacts of natural disasters differ significantly between countries with different levels of Positive Peace. Figure 4.15 shows the difference in Positive Peace score between both countries. Chile has recorded a strong improvement in Positive Peace since 2009 and continues to outperform the global average. Haiti has recorded some improvement from 2011 onwards but strong deteriorations prior to that mean that the country still operates with low levels of resilience.

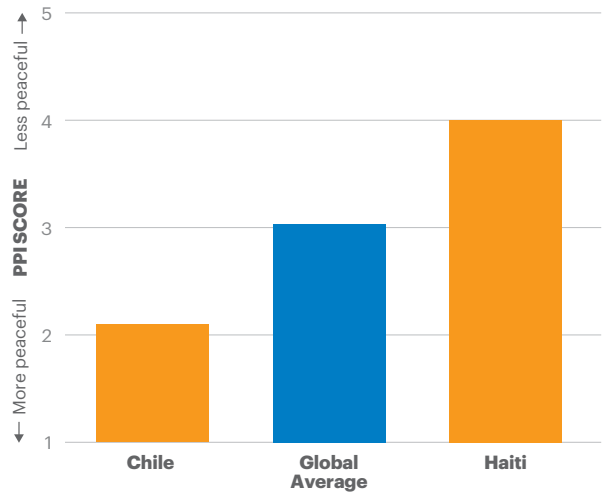
Both Chile and Haiti are among the most earthquake-prone countries in the world and are situated along the Pacific "Ring of Fire", where earthquakes and volcanic eruptions frequently occur. While Chile has successfully built resilience to earthquakes following a history of devastating impacts, Haiti lacks the coping capacity to respond and recover from such events.

High levels of poverty and weak institutions of governance have contributed to the high loss of life and wide-scale destruction from natural disasters in Haiti. Since 1990, Haiti has recorded over 230,000 fatalities from 86 natural disasters, namely earthquakes and tropical storms. In the same period, Chile has recorded just over 1,300 fatalities from 75 natural disasters. Box 3.7 details the difference in resilience to natural disasters between Chile and Haiti.

FIGURE 4.15

Difference in Positive Peace score, Chile and Haiti, 2018

Haiti has considerably lower levels of Positive Peace compared to the global average, while Chile has consistently recorded very high levels of Positive Peace.



Source: IEP

BOX 4.7

Resilience in different Positive Peace contexts, Chile and Haiti

The magnitude-7.0 earthquake that struck Haiti in 2010 was a catastrophic event exacerbated by the extreme vulnerability of the population and the lack of preparedness and response capacity of national authorities.[53] The 2010 earthquake was one of the biggest natural disasters in the country's history resulting in over 200,000 fatalities[54] and the displacement of approximately 1.5 million people.[55] Prior to the earthquake, Haiti suffered from high levels of poverty and weak institutions of governance, increasing the country's vulnerability in the immediate aftermath of the disaster. The slow distribution of resources in the days after the earthquake resulted in civil unrest and looting.[56] Additionally, government capacity was severely disrupted with approximately 20 per cent of federal employees killed or injured, a quarter of government buildings destroyed and further damage to almost all major infrastructure in Haiti.[57] Damage and losses were estimated to be equivalent to 120 per cent of Haiti's GDP.[58]

Haiti had introduced several mechanisms to build resilience to natural disasters. In 2001, Haiti's National Disaster Risk Management System (SNGRD) was signed into effect.[59] This proved effective in the 2008 Hurricane season, with substantially fewer deaths recorded than previous hurricane seasons. However, the 2010 earthquake was beyond the capacity of the SNGRD due to its unexpected catastrophic nature.[60] The lack of political stability has had a significant impact on the continuity and effectiveness of Haiti's response to disasters. Haiti also lacks any comprehensive data collection on natural disasters and has no enforced building codes or nationwide early warning system.[61]

In contrast, Chile's extensive disaster response preparations and early detection systems were proven to substantially limit the impact of the magnitude-8.3 earthquake that struck in April 2015. The earthquake resulted in 12 fatalities with approximately 60 houses destroyed and a further 200 damaged.[62]

Early detection and efficient communication networks were critical in Chile's response. In 2015, Chilean officials were able to detect the earthquake and track tsunami waves before they occurred. Approximately one million people were evacuated in the provinces of Choapa and Coquimbo, following the tsunami warning and declaration of a disaster area.

Chile has improved its disaster response following its history of strong earthquakes. In 2010, an 8.8-magnitude earthquake occurred off the coast of central Chile. Together the earthquake and subsequent tsunami caused destruction across southern and central Chile, resulting in more than 500 fatalities and destroying over 200,000 homes. In response, building codes were updated with the requirement that all new building must be able to withstand a 9.0-magnitude earthquake.[63]

5 Resilience and Development Assistance

KEY FINDINGS

- Foreign aid classified as climate-related aid has increased 34-fold from one billion US dollars in 2000 to US $34 billion in 2018.
- Climate-related aid accounted for 29 per cent of total development assistance in 2017.
- Climate-related aid is allocated to developmental projects with aims to mitigate or adapt to the impacts of ecological threats. Nearly half of the aid in this area was allocated to mitigation at 49 per cent, with 24 per cent allocated towards adaptation-related programs.
- Climate-related aid is concentrated in five main sectors: transport, energy, agriculture, general environmental protection and water supply and sanitation.
- Projects which aim to address water scarcity, improve food security and promote general environmental protection remain a priority for development assistance.
- Geographically, climate-related aid is primarily targeted at countries with the highest exposure to ecological threats in sub-Saharan Africa, South Asia and Asia-Pacific. India received the largest amount of climate-related aid in 2018, amounting to US $6.5 billion.

Foreign Aid and Resilience to Ecological Threats

In recent years, resilience to ecological threats and climatic events has gained increasing attention from international donors and multilateral organisations. Aid is used as a mechanism to build resilience to ecological shocks such as droughts, water stress and food insecurity in developing countries.

Resilience provides a country with the capacity to cope with ecological shocks, minimising the negative impact on their population and economic structures. This section looks at programmatic approaches within the development assistance sector that address ecological threats and climate change.

Climate-related aid includes official development assistance such as bilateral and multilateral financing of development projects. It also includes private grants and financing to developing countries. Climate-related aid is an emerging area of development assistance, however, in practice, it is difficult to separate from broader developmental objectives such as poverty reduction, improved access to water and sanitation and emergency aid in crisis situations.

The Organisation for Economic Co-operation and Development (OECD) publishes a dataset on climate-related aid each year with detailed project level information. Financing for this category of aid is reported by Development Assistance Committee (DAC) countries[1] as well as some non-DAC countries such as Israel, Russia, Saudi Arabia, Turkey and the United Arab Emirates. Box 4.1 details some of the key terms used to define climate-related aid.

Climate-related aid increased from one billion US dollars in 2000 to US $34 billion in 2018, as shown in Figure 5.1. This steady increase in the level of aid highlights the increasing importance of climate change adaptation and mitigation programs as part of the global development agenda. The 2030 Agenda for Sustainable Development targets 17 goals, of which goal 13 aims to mobilise development finance to assist vulnerable regions in adapting to ecological threats and climate change. Climate-related aid accounted for approximately 29 per cent of overall development finance in 2017.[2]

BOX 5.1

Defining climate-related aid

Climate-related development finance data includes official development assistance (ODA), other official flows (OOF) and private flows.

Official development assistance (ODA) is defined as grants and loans provided by official agencies, including state and local government, or by their executive agencies on concessional terms.[3]

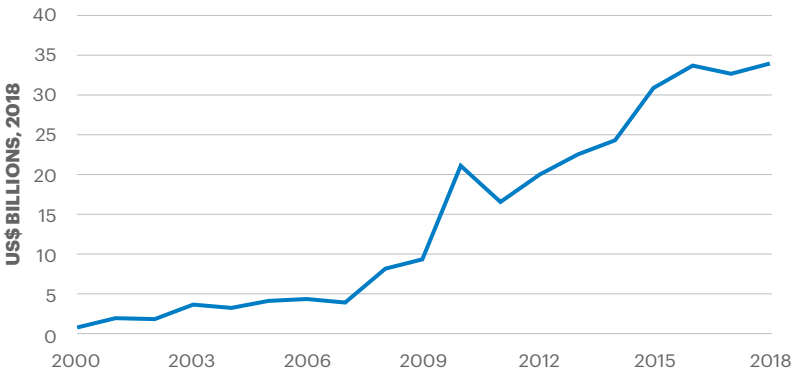
Other official flows (OOF) are defined as official sector transactions that do not meet ODA criteria. OOF includes grants to developing countries for representation or commercial purposes, official bilateral transactions intended to promote development with a grant element of less than 25 per cent, or bilateral transactions that are aimed at facilitating exports.[4]

Private flows are defined as finance from private sector resources including grants from non-governmental organisations (NGOs), remittances and subsidies.[5]

FIGURE 5.1

Trend in climate-related aid, 2000–2018

Climate-related aid has increased 34-fold from one billion US dollars in 2000 to US $34 billion in 2018.



Source: OECD
Note: Includes bilateral flows only

> “Climate-related aid increased from one billion US dollars in 2000 to US $34 billion in 2018.

Aid builds resilience to ecological threats and climate change through mitigation and adaptation. Mitigation projects address the causes of environmental shocks that recipient countries face, whereas, adaptation projects refer to interventions which assist communities in tackling the effects of climate change. Table 4.1 provides examples of mitigation and adaptation projects.

Nearly half of climate-related development finance, or 49 per cent, was allocated to mitigation projects in 2018, equal to US $17 billion. Adaptation-related programs accounted for 24 per cent of climate-related aid, while the remaining 27 per cent was allocated to a mix of projects that have both mitigation and adaptation-related objectives. Figure 5.2 shows a breakdown of climate-related aid by objective over time.

TABLE 5.1

Objectives of climate-related aid

Projects can be classified as having mitigation or adaptation objectives, or a combination of both.

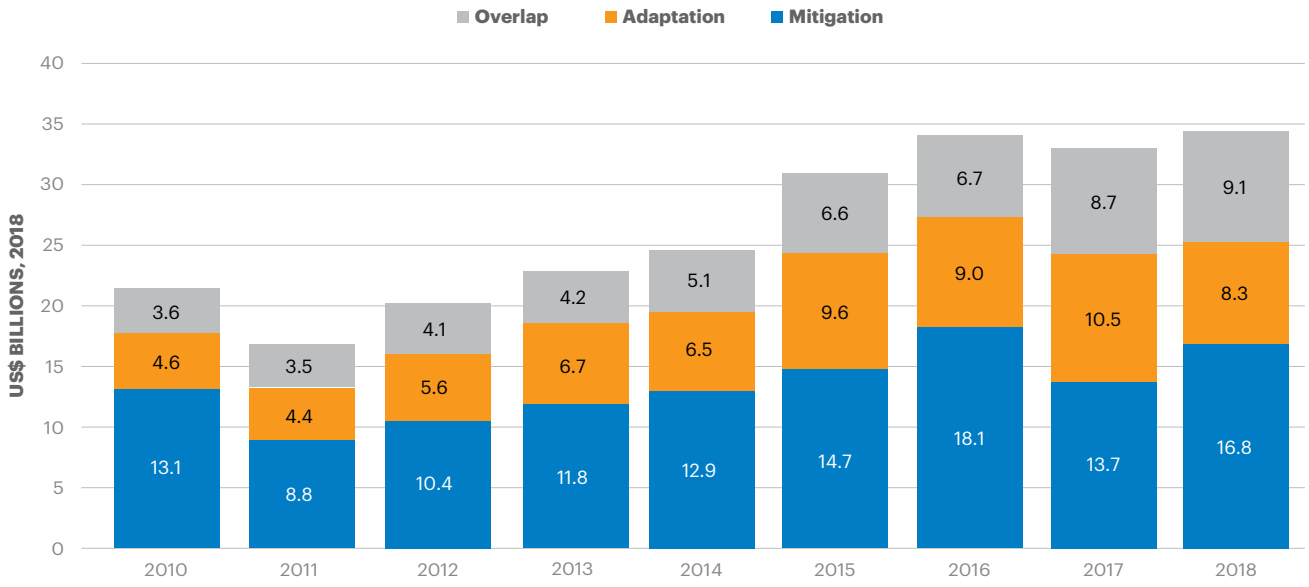
Objective	Definition	Examples
Mitigation	*Promote efforts which address the causes of ecological threats and climate change.*	• Development of technologies that control, reduce or prevent human-induced emissions, in particular in waste management, transport, energy, agriculture and industry. • Strengthening the capacity of national planning or environment institutions whose responsibilities include coordinating and planning mitigation activities.
Adaptation	*Reduce vulnerability of human or natural systems to the impacts of climate change and ecological threats, by maintaining or increasing adaptive capacity and resilience.*	• Promoting heat and drought resistant crops and water saving irrigation methods to withstand climate change. • Implementing measures for flood prevention and management such as watershed management, reforestation or wetland restoration. • Post-disaster assistance to rebuild infrastructure to withstand future extreme weather events.
Overlap	*A project that has both mitigation and adaptation-related objectives.*	• Sustainable forest management project that contributes to biodiversity conservation, by capturing carbon (mitigation) and reducing climate risk (adaptation).

Source: OECD

FIGURE 5.2

Climate-related aid by objective, 2010–2018

Since 2010, mitigation-related aid has consistently comprised the largest proportion of climate-related aid.



Source: OECD
Note: Includes bilateral flows only

South Asia and sub-Saharan Africa received the largest amounts of climate-related aid in 2018. This was followed by Central America and the Caribbean and South America.

At the country level, India received the largest amount of climate-related aid amounting to US $6.5 billion, followed by Bangladesh and Indonesia at US $1.8 and US $1.6 billion, respectively. Table 4.2 displays the ten countries receiving the largest amounts of climate-related aid in 2018.

Aid allocated to building resilience to ecological threats has mostly been directed to countries with higher exposure to ecological threats. For example, India, Bangladesh, Uganda, Ethiopia and Iraq are among the most exposed countries to ecological threats. In particular, Ethiopia, Iraq and Uganda are considered ecological threat hotspots since they face the highest number of ecological threats and have low resilience to deal with these threats. For countries with medium to low levels of resilience, aid functions as a significant support-mechanism in improving and maintaining resilience in the face of high ecological threats. Resilience is measured by IEP's Positive Peace Index (PPI), which is discussed in more detail in Section 3 of this report on page 55.

Climate-related aid is concentrated in five main sectors: transport, energy, agriculture, general environmental protection and water supply and sanitation. In 2018, climate-related aid for transport projects amounted to US $7.9 billion. A large number of transport projects were in India, accounting for US $4.5 billion. These projects aimed to invest in public transportation in urban areas to alleviate traffic congestion and reduce air pollution.

TABLE 5.2

The ten countries with the largest amount of climate-related aid received in 2018

India received significantly more climate-related aid than any other country in 2018, at US $6.5 billion.

Country	Total Climate-related Development Finance US$(millions)	Positive Peace status in 2018	ETR count
India	$6,533	Medium	4
Bangladesh	$1,800	Low	2
Indonesia	$1,626	Medium	3
Uganda	$1,164	Low	4
Philippines	$993	Low	3
Morocco	$918	Medium	3
Colombia	$535	Medium	1
Ethiopia	$526	Low	4
Iraq	$439	Very Low	4
Mexico	$428	Medium	3

Source: OECD, IEP
Note: Includes bilateral flows only

“
Climate-related aid is concentrated in five main sectors: transport, energy, agriculture, general environmental protection and water supply and sanitation.

Programmatic Approaches to Resilience Building

A brief review of climate-related aid and its programmatic approaches was undertaken as part of this research. This review includes projects undertaken by a number of International Non-Governmental Organizations (INGOs) and International Financial Institutions (IFIs) such as the World Resources Institute (WRI), the World Bank and World Vision, which partner with national governments and agencies. These developmental projects were conducted at the local, national, regional and global level with the majority conducted in low and middle-income countries across sub-Saharan Africa, South Asia, Asia-Pacific and Central America and the Caribbean. Information and data on these sampled projects comes from the individual websites of INGOs and IFIs.

There is currently no publicly available database which tracks projects funded by INGOs and IFIs and which aims to build resilience to ecological threats. IEP reviewed 44 projects to provide an insight into what is currently being funded.

The review has divided the projects into nine key sectors based on their scope and objectives, as illustrated by Figure 5.3. Across the 44 projects included in the programmatic review, water supply and sanitation, food security and general environmental protection were the main priorities for development assistance.

Water supply and sanitation accounted for 27 per cent of the projects in the sample. These projects targeted water management and governance, both at the national and international level and involved some of the world's leading international organisations such as the United Nation's Food and Agriculture Organisation (FAO).

A key objective of the water projects was to address water scarcity by collating resources, expertise and funding in order to facilitate political and technical leadership on the issue of water management. At the local level, water supply and sanitation projects sought to invest in local solutions, strengthen local knowledge and enable discussions in order to better monitor and manage water resources.

Food security projects also remain a priority for development assistance, accounting for 16 per cent of the sample size. Food security projects emphasised the necessity to reduce the vulnerability of poorer communities most at risk of food insecurity. Projects focused on investment and education around sustainable farming practices, income diversification and strengthening agricultural supply chains.

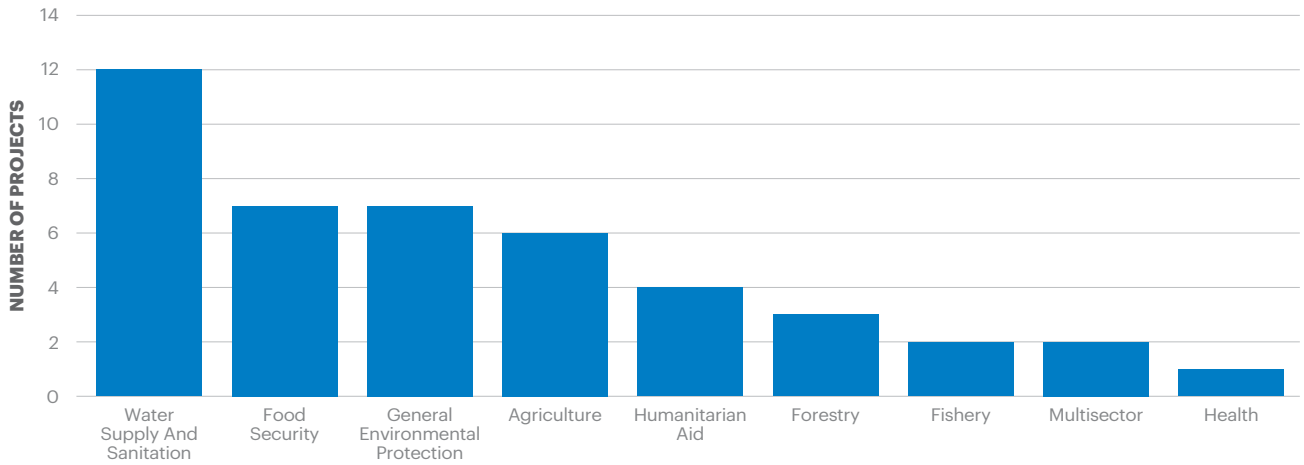
Projects classified under general environmental protection include those concerned with environmental policy, bio-diversity, conservation and education and training. For example, the Ocean Cleanup project aims to remove 50 per cent of floating plastics from the "Great Pacific Rubbish Patch", which is home to the largest accumulation of ocean plastic in the world. The project also seeks to create public awareness of the damaging impacts of plastic pollution on wildlife, humans and the economy.

Despite the ongoing efforts to promote climate resilience in developing countries, there is a limited understanding of the effectiveness of different programmatic approaches. As a result, there remains a major knowledge gap concerning the effectiveness of climate-related aid. A comprehensive framework for measuring effectiveness is needed to know which projects are successful, under which circumstances and at what cost. Evidence of the effectiveness of current environmental projects is essential to promote the efficient use of future funds to tackle worsening ecological threats.

FIGURE 5.3

Programmatic review

Water supply and sanitation and food security are the two major areas of programmatic focus, highlighting the importance of addressing resource depletion in developing countries.



Source: IEP

6 Appendices

APPENDIX A

Ecological Threat Register Methodology

The concept of the Ecological Threat Register (ETR) was developed to identify the overall level of ecological risk that countries face between now and 2050. Ecological threats included in the ETR are *water stress, food insecurity, droughts, floods, cyclones, temperature rise, sea level rise and population growth*.

Analysis from the ETR allows for the identification of countries and regions where ecological crises are more likely to occur and have a severe impact on populations residing in those areas. The ETR focuses on the impacts of resource scarcity and natural disaster threats on peacefulness as well as the role of resilience in limiting the impact of such shocks.

The ETR is a multi-indicator composite register of risk, which is calculated in two steps. In the first step, all indictors are normalised on a score of 1 to 5 with a higher score representing higher levels of risk. In the second step, the overall ETR count is calculated as the sum of the individual ecological threats that exceed a specified level of intensity. The ETR count represents the number of threats a country faces such as water stress, floods and food insecurity.

The Indicators

The ETR is composed of the following eight indicators, scored between 1 and 5, where 1 represents lower risk and 5 higher risk.

WATER STRESS

Baseline water stress is used and is defined as the ratio of total annual water withdrawals to total available annual renewable supply. A country receives the corresponding risk score for the following baseline water stresses:

Score	Baseline Water Stress
1	Less than 10 per cent of water is used
2	Ten to 20 per cent of water is used
3	Twenty to 40 per cent of water is used
4	Forty to 80 per cent of water is used
5	More than 80 per cent of water is used.

Data for baseline water stress is sourced from the World Resource Institute.

FOOD INSECURITY

The prevalence of undernourishment is an estimate of the proportion of the population whose food consumption is regularly insufficient to provide the dietary energy levels that are required. The prevalence of undernourishment is used as a proxy for food insecurity, as data for food insecurity is limited in the number of countries covered.

The concepts of food insecurity and undernourishment are related but not equivalent. Undernourishment results from persistent food insecurity that leads to regular and tangible compromises on the quantity and quality of food necessary for a healthy life. Food insecurity has a strong predictive relationship with micronutrient deficiency and inadequate diets. Data for undernourishment is sourced from the United Nations Food and Agriculture Organisations (FAO). At the time of the report, the latest available data was for 2018.

POPULATION GROWTH

Population growth is calculated using the total resident population in each country. The population data is source from the United Nation's World Population Prospect Project by the UN's Department of Economic and Social Affairs (UNDESA).

DROUGHTS

The impact of drought is measured by the probability of an agricultural drought and the population affected by droughts in recent years. Droughts are defined by EM-DAT as the extended period of unusually low precipitation that produces a shortage of water for people, animals and plants. Data for drought is sourced from the INFORM risk index.

FLOODS

The risk of floods is measured as the probability of flood events using flood hazard maps GAR 2015 and the INFORM risk index. The score is reflective of the probability of floods in particular geographic area.

TROPICAL CYCLONES

Tropical cyclones include hurricanes and typhoons that affect a population through high speed winds as well as storm surges, heavy rainfall and riverine floods. The tropical cyclones aggregate the average of the physical exposure to cyclones and cyclone surges. The data is sourced from the INFORM rise index.

SEA LEVEL RISE

The sea level rise indicator aggregates the population exposed to rising sea levels in 2100. The data is sourced from the World Bank World Development Indicator database for people who live five meters below sea levels. The estimation then uses a one-meter rise in sea levels and projects the population size that will be exposed to rising sea levels by 2100 with a linear model.

EXTREME TEMPERATURE

Average temperature change since 1960, degrees Celsius per century. Country level data is sourced from Berkeley Earth, an independent research organisation.

APPENDIX B

Ecological Threat count and Positive Peace status by country

Country	ETR count	Positive Peace status in 2018	Change in Positive Peace from 2009 to 2018	Population (Millions)
Afghanistan	6	Very Low	Marginal Improvement	38.9
Mozambique	5	Low	Deterioration	31.3
Namibia	5	High	Moderate Improvement	2.5
Botswana	4	High	Broadly Stable	2.4
Chad	4	Very Low	Marginal Improvement	16.4
Ethiopia	4	Low	Broadly Stable	115.0
India	4	Medium	Marginal Improvement	1380.0
Iran	4	Low	Deterioration	84.0
Iraq	4	Very Low	Marginal Improvement	40.2
Kenya	4	Low	Moderate Improvement	53.8
Kyrgyzstan	4	Medium	Strong Improvement	6.5
Madagascar	4	Low	Broadly Stable	27.7
Pakistan	4	Very Low	Marginal Improvement	220.9
Eswatini	4	Low	Moderate Improvement	1.2
Syria	4	Very Low	Deterioration	17.5
Tajikistan	4	Very Low	Marginal Improvement	9.5
Tanzania	4	Low	Strong Improvement	59.7
Uganda	4	Low	Broadly Stable	45.7
Zimbabwe	4	Very Low	Moderate Improvement	14.9
Angola	3	Very Low	Marginal Improvement	32.9
Australia	3	Very High	Deterioration	25.5
Central African Republic	3	Very Low	Deterioration	4.8
China	3	Medium	Strong Improvement	1439.3
Republic of the Congo	3	Very Low	Broadly Stable	5.5
Cuba	3	Medium	Moderate Improvement	11.3
Eritrea	3	Very Low	Deterioration	3.5
Georgia	3	High	Strong Improvement	4.0
Haiti	3	Very Low	Deterioration	11.4
Indonesia	3	Medium	Strong Improvement	273.5
Israel	3	Very High	Strong Improvement	8.7
Liberia	3	Low	Broadly Stable	5.1
Malawi	3	Low	Broadly Stable	19.1
Mali	3	Very Low	Deterioration	20.3
Mauritania	3	Very Low	Deterioration	4.6
Mexico	3	Medium	Broadly Stable	128.9
Moldova	3	Medium	Strong Improvement	4.0
Morocco	3	Medium	Moderate Improvement	36.9
Netherlands	3	Very High	Broadly Stable	17.1
Niger	3	Very Low	Marginal Improvement	24.2
North Korea	3	Very Low	Broadly Stable	25.8
Philippines	3	Low	Strong Improvement	109.6
Russia	3	Medium	Broadly Stable	145.9
Rwanda	3	Medium	Moderate Improvement	13.0
Somalia	3	Very Low	Broadly Stable	15.9
Sudan	3	Very Low	Broadly Stable	43.8
Tunisia	3	High	Marginal Improvement	11.8
Turkmenistan	3	Very Low	Broadly Stable	6.0

Country	ETR count	Positive Peace status in 2018	Change in Positive Peace from 2009 to 2018	Population (Millions)
United States	3	Very High	Deterioration	331.0
Uzbekistan	3	Low	Moderate Improvement	33.5
Yemen	3	Very Low	Deterioration	29.8
Zambia	3	Low	Broadly Stable	18.4
Albania	2	High	Strong Improvement	2.9
Algeria	2	Low	Marginal Improvement	43.9
Argentina	2	High	Strong Improvement	45.2
Azerbaijan	2	Low	Strong Improvement	10.1
Bahrain	2	High	Deterioration	1.7
Bangladesh	2	Low	Marginal Improvement	164.7
Belarus	2	High	Strong Improvement	9.4
Benin	2	Low	Deterioration	12.1
Burkina Faso	2	Low	Marginal Improvement	20.9
Cameroon	2	Very Low	Deterioration	26.5
Canada	2	Very High	Broadly Stable	37.7
Chile	2	High	Strong Improvement	19.1
Democratic Republic of the Congo	2	Very Low	Moderate Improvement	89.6
Côte d'Ivoire	2	Low	Strong Improvement	26.4
Dominican Republic	2	Medium	Moderate Improvement	10.8
Egypt	2	Low	Deterioration	102.3
Guatemala	2	Low	Broadly Stable	17.9
Guinea	2	Very Low	Moderate Improvement	13.1
Italy	2	Very High	Moderate Improvement	60.5
Jordan	2	High	Marginal Improvement	10.2
Kazakhstan	2	Medium	Strong Improvement	18.8
Mongolia	2	Medium	Moderate Improvement	3.3
Myanmar (Burma)	2	Very Low	Strong Improvement	54.4
Nigeria	2	Very Low	Marginal Improvement	206.1
Palestine	2	Medium	Marginal Improvement	5.1
Papua New Guinea	2	Very Low	Broadly Stable	8.9
Peru	2	Medium	Moderate Improvement	33.0
Qatar	2	High	Strong Improvement	2.9
Senegal	2	Medium	Moderate Improvement	16.7
South Africa	2	Medium	Deterioration	59.3
South Korea	2	Very High	Strong Improvement	51.3
South Sudan	2	Very Low	Deterioration	11.2
Spain	2	Very High	Broadly Stable	46.8
Sri Lanka	2	Medium	Marginal Improvement	21.4
Thailand	2	Medium	Broadly Stable	69.8
Timor-Leste	2	Low	Marginal Improvement	1.3
Turkey	2	Medium	Deterioration	84.3
Ukraine	2	Medium	Marginal Improvement	43.7
United Arab Emirates	2	Very High	Strong Improvement	9.9
Vietnam	2	Medium	Moderate Improvement	97.3
Armenia	1	Medium	Strong Improvement	3.0
Austria	1	Very High	Deterioration	9.0
Belgium	1	Very High	Deterioration	11.6
Bhutan	1	High	Strong Improvement	0.8
Bolivia	1	Low	Marginal Improvement	11.7
Bosnia & Herzegovina	1	High	Moderate Improvement	3.3
Brazil	1	Medium	Deterioration	212.6
Burundi	1	Very Low	Deterioration	11.9
Cambodia	1	Low	Moderate Improvement	16.7
Colombia	1	Medium	Strong Improvement	50.9
Croatia	1	High	Moderate Improvement	4.1

Country	ETR count	Positive Peace status in 2018	Change in Positive Peace from 2009 to 2018	Population (Millions)
Czech Republic	1	Very High	Moderate Improvement	10.7
Denmark	1	Very High	Deterioration	5.8
Djibouti	1	Low	Marginal Improvement	1.0
Ecuador	1	Medium	Strong Improvement	17.6
Equatorial Guinea	1	Very Low	Deterioration	1.4
Estonia	1	Very High	Strong Improvement	1.3
France	1	Very High	Broadly Stable	65.3
Gabon	1	Medium	Marginal Improvement	2.2
The Gambia	1	Low	Moderate Improvement	2.4
Germany	1	Very High	Marginal Improvement	83.8
Ghana	1	Medium	Marginal Improvement	31.1
Greece	1	High	Deterioration	10.4
Guinea-Bissau	1	Very Low	Deterioration	2.0
Honduras	1	Low	Marginal Improvement	9.9
Hungary	1	High	Deterioration	9.7
Japan	1	Very High	Moderate Improvement	126.5
Kuwait	1	High	Moderate Improvement	4.3
Laos	1	Low	Broadly Stable	7.3
Latvia	1	Very High	Strong Improvement	1.9
Lebanon	1	Medium	Broadly Stable	6.8
Lesotho	1	Medium	Marginal Improvement	2.1
Libya	1	Very Low	Deterioration	6.9
North Macedonia	1	High	Moderate Improvement	2.1
Malaysia	1	High	Strong Improvement	32.4
Nepal	1	Low	Moderate Improvement	29.1
Nicaragua	1	Medium	Marginal Improvement	6.6
Norway	1	Very High	Marginal Improvement	5.4
Oman	1	High	Marginal Improvement	5.1
Poland	1	High	Broadly Stable	37.8
Portugal	1	Very High	Strong Improvement	10.2
Romania	1	High	Marginal Improvement	19.2
Saudi Arabia	1	High	Strong Improvement	34.8
Serbia	1	High	Strong Improvement	8.7
Sierra Leone	1	Low	Moderate Improvement	8.0
Singapore	1	Very High	Moderate Improvement	5.9
Slovakia	1	High	Broadly Stable	5.5
Slovenia	1	Very High	Marginal Improvement	2.1
Togo	1	Low	Moderate Improvement	8.3
Venezuela	1	Very Low	Deterioration	28.4
Bulgaria	0	High	Moderate Improvement	6.9
Costa Rica	0	High	Strong Improvement	5.1
El Salvador	0	Medium	Broadly Stable	6.5
Finland	0	Very High	Broadly Stable	5.5
Guyana	0	Medium	Marginal Improvement	0.8
Iceland	0	Very High	Deterioration	0.3
Ireland	0	Very High	Broadly Stable	4.9
Lithuania	0	Very High	Strong Improvement	2.7
Montenegro	0	High	Broadly Stable	0.6
New Zealand	0	Very High	Moderate Improvement	4.8
Panama	0	High	Moderate Improvement	4.3
Paraguay	0	Low	Marginal Improvement	7.1
Sweden	0	Very High	Deterioration	10.1
Switzerland	0	Very High	Marginal Improvement	8.7
United Kingdom	0	Very High	Deterioration	67.9
Uruguay	0	Very High	Strong Improvement	3.5

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SECTION 2 - FOOD SECURITY

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SECTION 2 - WATER STRESS

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