Verisk Maplecroft

Risk Resilience Reputation

Quantifying climate risks to support effective strategic decision-making

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Context

Global climate change has the potential to significantly affect livelihoods and economies across the globe. The anticipated changes in regional climate regimes, including the shifting pattern of extreme climate events, will have implications for ecosystems, human health, physical assets, industrial operations, supply chains and infrastructure. The continuing integration of the global economy means that an increasing number of stakeholders are exposed to the disruptive effects of climate-related events. The disruption can prompt cascade effects through space and time, with implications for business and society.

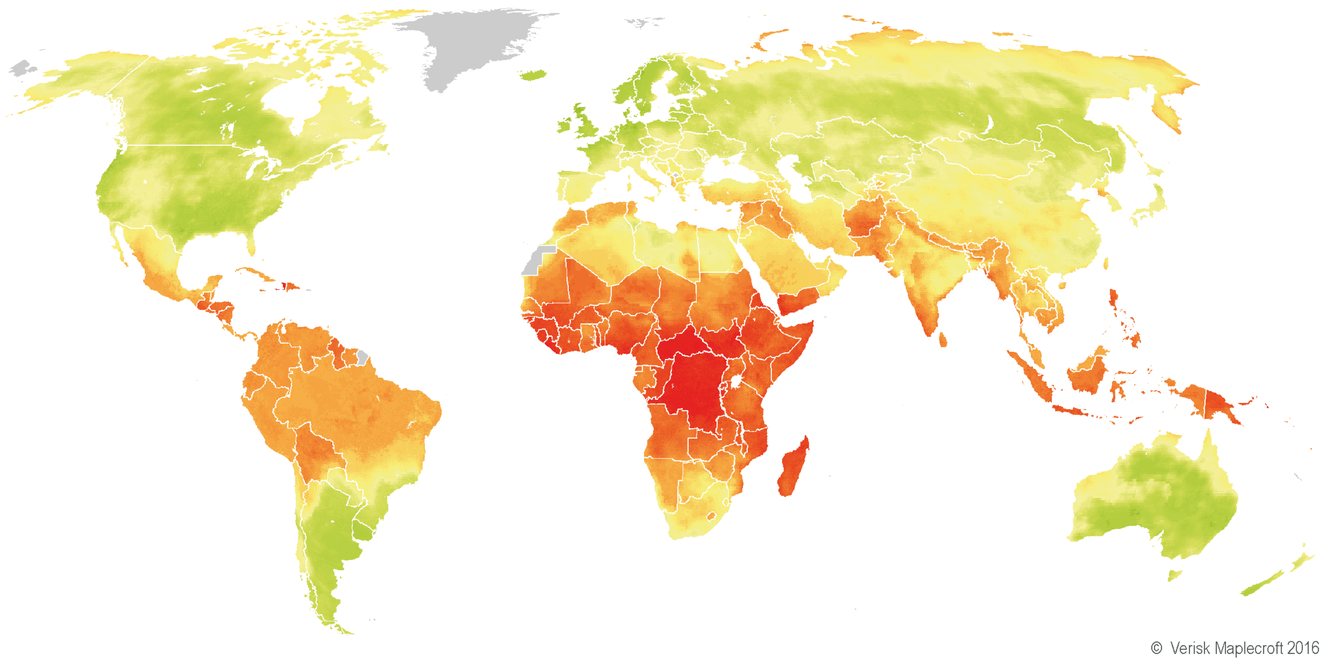
Challenge

Climate change vulnerability is a multi-dimensional issue and effective risk management, in communities and in board rooms, requires the identification and quantification of the inter-connected physical, social and economic risks associated with climate change. A key challenge facing decision makers across public, private and civil society sectors in addressing climate change is the absence of a consistent framework to understand and monitor climate change vulnerability. Access to such information is critical for governments, businesses and societies to manage and mitigate the risks posed by climate change.

Solution

Verisk Maplecroft responds to these challenges by providing organisations with decision support tools. Here, we profile our Climate Change Vulnerability Index which assesses the susceptibility of human populations to the impacts of climate variability and change across 191 countries at the sub-national level. Along with identifying risk hotspots, the index enables the user to understand the key risk drivers across multiple dimensions. It provides companies, civil society and governments with clearly communicated, robust data with which to engage stakeholders and develop actionable risk management strategies.

Climate Change Vulnerability Index



Methodology

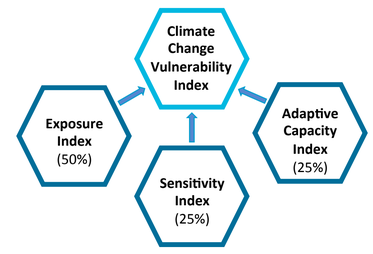
The Climate Change Vulnerability Index combines exposure to climate variability and change with the current human sensitivity to those climate stressors and the capacity of the country to adapt to the impacts of climate change.

Exposure
The Climate Change Exposure Index assesses the degree to which countries are exposed to the physical impacts of climate extremes and future changes in climate over the next three decades. It combines the following indicators:

- Current climate extremes, including: floods; droughts; tropical cyclones; landslides; extra-tropical cyclones; wildfires; storms surge
- Changes in climate extremes (frequency and/or intensity), including: drought length, extreme temperatures, heavy rainfall events, and frequency of record seasonal temperatures and rainfall
- Changes in climate variability, including intra- and inter-annual temperatures and rainfall variation
- Climate shifts reflect long term changes in seasonal mean temperatures and rainfall, and sea level rise

Future changes in climate parameters are calculated using a 14-member climate model ensemble. These indicators reflect longer term changes in climate parameters between current climate (1981-2005) and future climate (2036-2060).*

"The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes." - Intergovernmental Panel on Climate Change



Sensitivity
The Climate Change Sensitivity Index assesses the human population's susceptibility to the impacts of extreme climate related events and projected climate change. Sensitivity is a function of a population's existing physical, social and livelihood circumstances, with the index examining aspects of sensitivity related to health, poverty, knowledge, infrastructure, conflict, agriculture, and population and resource pressure.

Adaptive Capacity
The Climate Change Adaptive Capacity Index assesses the abilities of a country's institutions, economy and society to adjust to, or take advantage of, existing or anticipated stresses resulting from climate change. The index focuses on the structural, gradually changing factors that determine adaptive capacity, including: education and innovation; institutional strength; resource management; public awareness; and existing finances and burdens.

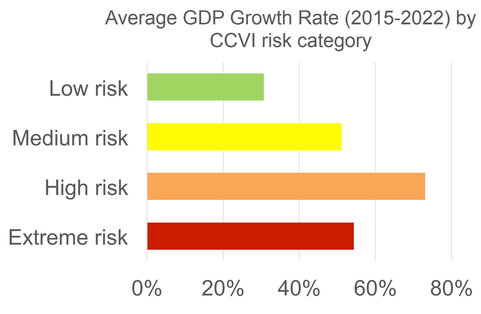
* Climate model data are kindly provided by the World Climate Research Programme's Working Group on Coupled Modelling, which is responsible for CMIP5, and Verisk Maplecroft thanks the climate modelling groups listed for producing and making available their model output. For CMIP, the US Department of Energy's Program for Climate Model Diagnosis and Intercomparison provides coordinating support and led the development of software infrastructure in partnership with the Global Organization for Earth System Science Portals.

Economic growth in South East Asia under threat

Many of the most vulnerable locations to climate change are found in South East Asia and are expected to undergo significant economic growth in the coming years. Investment in these markets is therefore accompanied by an increase in risk exposure to climate change, including to operations, supply chains and consumer bases.

Climate change is being viewed increasingly through an economic lens, with a focus on the impacts on emerging economies. The impact of climate change on GDP growth is highly uncertain. However, some estimates put the annual consumption loss as a fraction of global GDP in 2100 at 5%.[1]

The greatest future economic growth is projected to occur in countries most vulnerable to climate change. In countries classified as high or extreme risk in the Climate Change Vulnerability Index, economic output is projected to grow at a rate of almost 70% by 2022, compared with a figure of 42% for those countries considered low or medium risk.



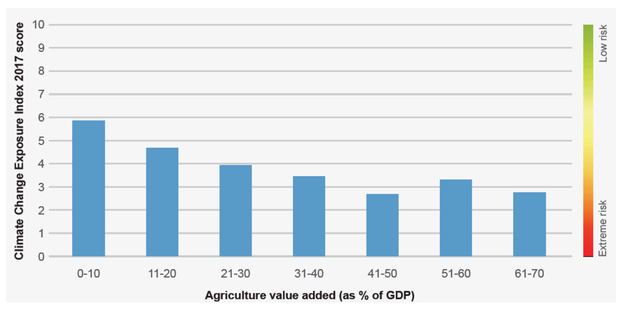
Outside of sub-Sharan Africa, the region most at risk is South East Asia, with an average score of 4.28/10.00 in Climate Change Vulnerability Index. The most vulnerable areas in this region are characterised by high rates of poverty and poor access to public services. Furthermore, significant growth in population density will increase pressure on natural resources and existing infrastructure, increasing vulnerability to climate change.

The degree to which economies will be affected is dependent on their ability to adapt to climate change. In these markets, the incentive of foreign investment may be a significant driver of adaptation. It will be increasingly important for countries with a large number of overseas companies, such as Thailand and the Philippines, to consider their vulnerability to climate change. Adaptation measures taken to minimise disruption to transport, power and water infrastructure may be key in retaining and attracting new investment.

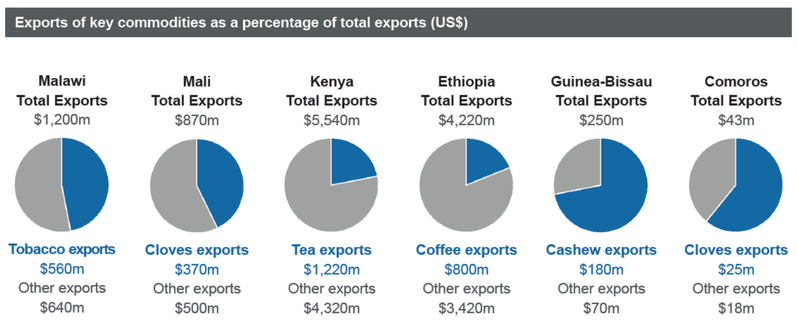
Currently, USD22.5 billion of global investment in climate adaptation is occurring in developing countries each year, although UNEP estimates to that a further 6-13 times that amount will be required by 2030.[2] While a number of international financial mechanisms have been set up to help build climate resilience in developing countries, such as the UNFCCC Green Climate Fund, private sector adaptation-related investments are critical.

Agriculturally dependent nations most exposed

Societies and economies which are heavily reliant on climate-sensitive sectors, like agriculture, are highly susceptible to climate shocks. In the long term, yields of staple crops, such as rice, wheat and maize are all likely to shrink in a warming world. While estimates vary widely, the majority of studies considered by the Intergovernmental Panel on Climate Change (IPCC) suggest that crop yield declines may reach 50% by mid-century.[3] As shown opposite countries that are more exposed to climate change are also those which are most economically dependent on agriculture.



In addition to long-term changes in climate, the shifting frequency and intensity of climate extremes, will drive greater inter-annual variability in crop yields. With this increasing yield variability, there are likely to be greater fluctuations in the economic output of the agricultural sector. Sub-Saharan Africa is home to 17 of the 20 countries most economically reliant on agriculture, including Somalia, Sierra Leone and Chad – all of which derive more than half their economic output from agriculture. Climate change impacts on crop yields are likely to introduce volatility into global markets as well threatening the livelihoods of subsistence farmers in the region.



Kenya - the world's leading exporter of black tea – suffered extensive drought in 2015, prompting lower tea yields and record prices. A bumper harvest followed in early 2016 due, in part, to abundant rain associated with El Niño. This volatility – in both production and price – is likely to be amplified under climate change. Tea growing areas in Kenya are categorised as high risk in the Climate Change Exposure Index, with extreme rainfall events set to increase by almost 50% by mid-century.

Ethiopia's biggest export coffee represents 19% of total export value and is highly sensitive to changes in climate, with above- and below-average temperatures and rainfall affecting both productivity and quality. In addition, pests and disease are expected to become more prevalent under climate change, posing an additional threat to sustainable long-term yields.

Elsewhere, climate projections for Guinea-Bissau indicate an overall reduction in rainfall of approximately 8% by 2050, with increasing drought length and more inter-annual variability in rainfall. This may have implications for production of cashew nuts, a crucial component of the country's total exports. Drought conditions significantly reduce cashew nut production, while more variable rainfall may damage the plant during flowering, affecting productivity and quality of the cashew nut.[4]

References

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4. T. Rupa, R. Rejani & M. Bhat, 2013, impact of climate change on cashew nut adaptation strategies. In Climate-Resilient Horticulture: Adaptation and Mitigation Strategies, pp189-198.