Met Office Hadley Centre

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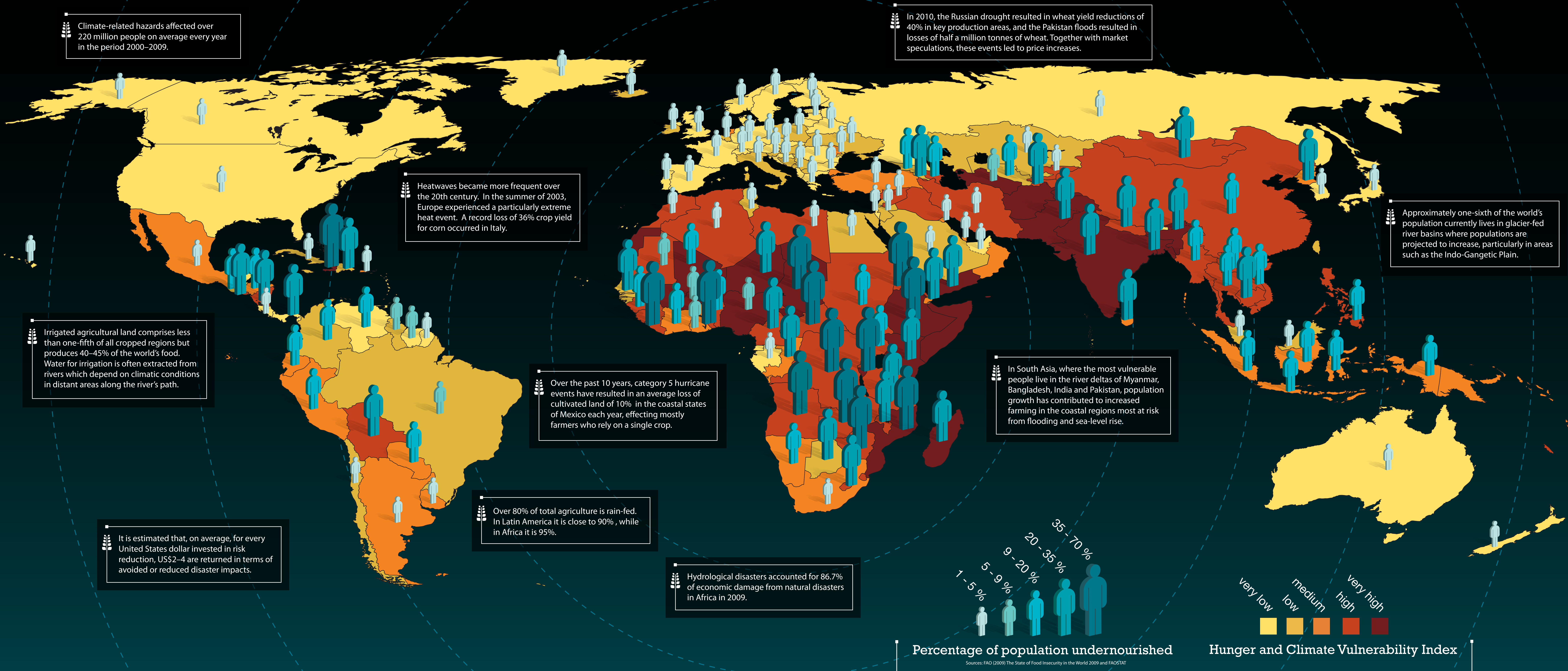
Food insecurity and climate change



MEAN TEMPERATURE

Average temperatures are expected to increase across the globe in the coming decades. In mid to high latitudes increasing average temperatures can have a positive impact on crop production, but in seasonally arid and tropical regions the impact is likely to be detrimental.

MEAN PRECIPITATION

On average an increase in global precipitation is expected, but the regional patterns of rainfall will vary: some areas will have more rainfall, while others will have less. There are high levels of uncertainty about how the pattern of precipitation will change, with little confidence in model projections on a regional scale. Areas that are dependant on seasonal rainfall, and those that are highly dependant on rain-fed agriculture for food security, are particularly vulnerable.

EXTREME EVENTS

Recurrent extreme weather events such as droughts, floods and tropical cyclones worsen livelihoods and undermine the capacity of communities to adapt to even moderate shocks. This results in a vicious circle that generates greater poverty and hunger. The impacts on food production of extreme events, such as drought, may cancel out the benefits of the increased temperature and growing season observed in mid to high latitudes.

CO_2 FERTILISATION

Carbon dioxide (CO_2) concentrations are known to be increasing. However, the effect of CO_2 fertilisation on crop growth is highly uncertain. In particular, there is a severe lack of experimental work in the Tropics exploring this issue. There is some evidence that although CO_2 fertilisation has a positive effect on the yield of certain crops, there may also be a detrimental impact on yield quality.

DROUGHT

Meteorological drought (the result of a period of low rainfall) is projected to increase in intensity, frequency and duration. Drought results in agricultural losses, reductions in water quality and availability, and is a major driver of global food insecurity. Droughts are especially devastating in arid and semi-arid areas, reducing the quantity and productivity of crop yields and livestock. Seven hundred million people suffering from hunger already live in semi-arid and arid zones.

HEATWAVES

In all cases and in all regions, one in 20-year extreme temperature events are projected to be hotter. Events that are considered extreme today will be more common in the future. Changes in temperature extremes even for short periods can be critical, especially if they coincide with key stages of crop development.

HEAVY RAINFALL AND FLOODING

While uncertain, it appears that there will be more heavy rainfall events as the climate warms. Heavy rainfall leading to flooding can destroy entire crops over wide areas, as well as devastating food stores, assets (such as farming equipment) and agricultural land (due to sedimentation).

MELTING GLACIERS

Melting glaciers initially increase the amount of water flowing in river systems and enhance the seasonal pattern of flow. Ultimately, however loss of glaciers would cause water availability to become more variable from year to year as it will depend on seasonal snow and rainfall, instead of the steady release of stored water from the glacier irrespective of that year's precipitation.

TROPICAL STORMS

For many arid regions in the Tropics, a large portion of the annual rain comes from tropical cyclones. However, tropical cyclones also have the potential to devastate a region, causing loss of life and widespread destruction to agricultural crops and lands, infrastructure, and livelihoods.

Some studies suggest tropical cyclones may become more intense in the future with stronger winds and heavier precipitation. However, there is a limited consensus among climate models on the regional variation in tropical cyclone frequency.

SEA-LEVEL RISE

Increases in mean sea-level threaten to inundate agricultural lands and salinise groundwater in the coming decades and centuries. Sea-level rise will also increase the impact of storm surges which can cause great devastation.

CHANGES IN HEALTH AND NUTRITION

Climate change has the potential to affect different diseases, including respiratory illness and diarrhoea. Disease results in a reduced ability to absorb nutrients from food and increases the nutritional requirements of sick people. Poor health in a community also leads to a loss of labour productivity.

The production of this poster was partly funded by the Government of Luxembourg.

For more information on food security and climate change and for references for the poster, please visit: **www.metoffice.gov.uk/climate-change/guide/impacts/food** or **www.wfp.org/climate-change**

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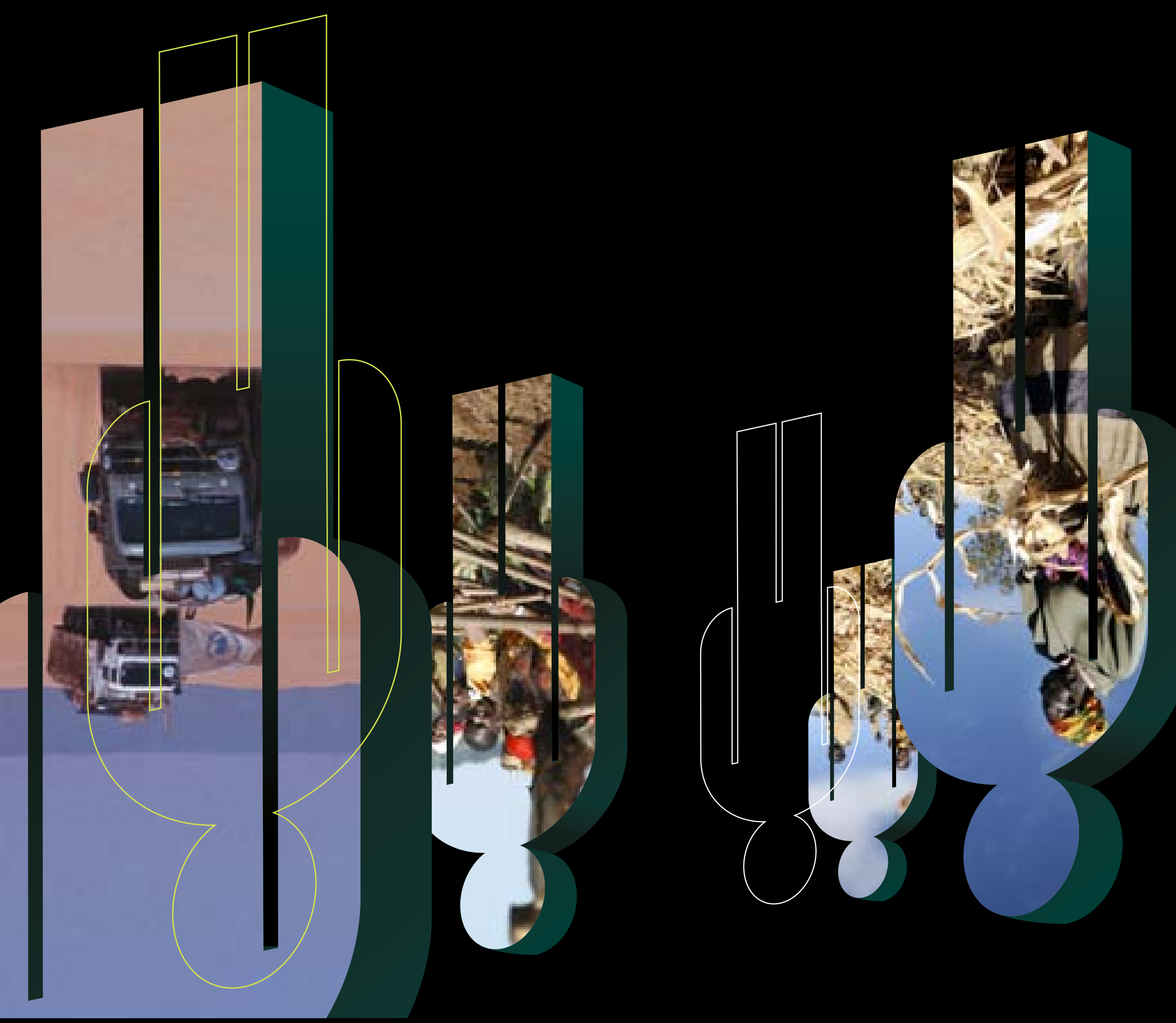

Defining food security and climate change impact

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs, and their food preferences are met for an active and healthy life (World Food Summit, 1996). Analysis of food security should be based on four aspects: (i) food availability; (ii) food access; (iii) food utilisation; and (iv) food stability. Food availability refers to the physical presence of food through domestic production, commercial imports and food aid. Food access concerns a household's ability to acquire adequate amounts of food, through a combination of home production and stocks, purchases, gifts, borrowing and aid. Food utilisation refers to households' consumption of the food they have access to and individuals' ability to absorb and metabolise the nutrients. Finally, food stability refers to the condition where food is regularly and periodically available and affordable so that it contributes to nutritional security.

Some projections suggest that 100–200 million additional people could be at risk of hunger due to climate change by 2050. While such studies produce estimates that are highly uncertain and dependent upon a range of assumptions, they show how climate change could impact all aspects of food security. The overall availability of food is affected by changes in agricultural yields as well as by changes in arable land. Changes in food production, together with other factors, are likely to impact food prices and will affect the ability of poor households to access food.

Decreased water availability and quality in some areas are likely to result in increased health and sanitation problems, such as diarrheal disease, which, together with changes in the patterns of vector-borne disease, has the potential to increase malnutrition by negatively affecting food utilisation. Changes in climate and increases in some extreme weather events, such as floods and droughts, will disrupt the stability of the food supply, as well as people's livelihoods, making it more difficult for them to earn a stable income to purchase food.

Hunger and Climate Vulnerability Index

The Hunger and Climate Vulnerability Index – the base layer of this map – is work in progress to illustrate the complex interactions between food security and climate change. The analysis is based on the definition of vulnerability to climate change from the Intergovernmental Panel on Climate Change. In this case, vulnerability is defined as the relationship between the degree of climate stress on populations (exposure), the degree of responsiveness to stress (sensitivity) and the ability of populations to adjust to the climatic changes (adaptive capacity). Indicators are selected based on their relevance to food security through rigorous statistical analysis. A total of 17 indicators have been chosen for exposure (demographics, climate-related hazard frequency and intensity), sensitivity (agricultural and environmental profiles) and adaptive capacity (socio-economics, infrastructure and governance).

Uncertainty and evidence-based planning

Climate scientists are confident that the climate is changing and they concur on some of the ways it is changing, such as the increasing global average temperature. However, the details of what this means on a regional scale and the impacts of those changes on other systems, such as agriculture or markets, are more complex. This uncertainty means that we cannot talk about the future in definite terms, but instead must use the language of risk. Understanding the risk of particular events occurring, along with the potential consequences of those events, helps to keep decision-makers fully informed of the range of impacts that could occur.

Despite uncertainties in the climate science, it is vital that food security planning decisions are based on the available evidence. Improving resilience and reducing risk are the best ways to approach adaptation to climate change. Basing decisions on input from experts who understand the twin complexities of the climate system and food security reduces the likelihood of investment in misguided adaptation measures.

Climate change and variability

When we talk about climate change, scientists usually mean change in the long-term trend in climate, generally over decades and centuries. This can include long-term changes or trends in the average climate (such as annual average temperature) and changes or trends in extremes (such as the frequency of intense rainfall). However, people experience climate as individual weather events, which naturally fluctuate from year to year. In addition to natural variation, climate change will mean a shift in the patterns of weather events over the long-term. The changes in climate described on this poster apply to the coming decades and are largely the result of greenhouse gases already emitted into the atmosphere so cannot be avoided. The magnitude of these changes to our climate in the second half of this century will depend on how successful policies are at reducing greenhouse gas emissions.

Every day WFP reaches the world's hungriest and most malnourished people, affected by storms, floods and droughts. These weather-related disasters leave millions vulnerable. Through community adaptation programmes and nutrition interventions, WFP helps vulnerable communities build resiliency and nations adapt.

Josette Sheeran, WFP Executive Director

Linking climate science and food security

Although some regions could benefit from climate change, in others it may offset gains in food security from economic and social development. Planning for these changes is made more difficult by uncertainties in our understanding of climate impacts on food security. This uncertainty is caused by a number of factors. Climate science itself is uncertain, which means that information, particularly at high levels of detail, must be treated with caution. Some of the broad scale features of the climate are well understood, but what will happen at a local level is far more difficult to determine. There is also a lack of understanding of how crops respond to changes in weather and climate. Finally, to understand food security it is essential to analyse the effects of climate change in the context of complex socio-economic interactions and development, which are difficult to anticipate.

Despite the level of uncertainty, it is possible to make robust plans based on a growing scientific understanding. There is much that scientists do know about the climate and many tools and research options to allow useful information to be extracted from climate model experiments. Expert interpretation of research by climate scientists and careful integration of this information with food security expertise are essential.

A fundamental challenge is the lack of integration across disciplines: generally, modelling studies have simplified food security as food availability without explicitly addressing the issues of food access, stability and utilisation. It is important to evaluate climate science together with information about socio-economics and human vulnerability.
This will require a more systematic integration of climate science with food security vulnerability analysis to begin to develop a more robust understanding of the impacts of climate change on hunger at the global, regional and national levels.

Food security policies should also be flexible, focusing on reducing risks, building capacity at different levels, and enhancing resilience. In this way, it will be possible to manage risk, adapt to a range of different outcomes, and act despite the uncertainty.

Although still work in progress, the Climate and Hunger Vulnerability Index presented here is a small first step to addressing the issue of integration. By combining the expertise of climate scientists and food security analysts to apply and extend the concept of a Climate and Hunger Vulnerability Index, there is the opportunity to develop a working tool for planners. This would enable decision-makers to access the best available information about climate change and food security for their region, to build resilience and reduce the risk of future hunger.

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