Humanitarian Implications of Climate Change

Mapping Emerging Trends and Risk Hotspots for Humanitarian Actors

August 2008

This document is based on research commissioned jointly by the UN Office for the Coordination of Humanitarian Affairs and CARE International. Comments or requests for further information should be directed to Jenty Kirsch-Wood at OCHA (kirsch-wood@un.org) and Dr. Charles Ehrhart at CARE (ehrhart@careclimatechange.org).

REPORT BACKGROUND

- Human-induced climate change is already modifying patterns of extreme weather such as flooding, cyclones and drought. In many cases, it is making these hazards more intense, more frequent, less predictable and/or longer lasting. This magnifies the risk of disasters everywhere, but especially in those parts of the world where there are already high levels of human vulnerability.

- As a result, OCHA's Policy Development and Studies Branch and CARE's Poverty, Environment and Climate Change Centre commissioned a research project to compare how current high-risk areas for humanitarian disasters might be affected by climate change over the next 20-30 years.[1]

- Using a Geographical Information Systems (GIS) mapping approach, the team looked at specific hazards associated with climate change [2] – specifically: floods, cyclones and droughts – and placed them in relation to factors influencing human vulnerability. [3] The results identify *hotspots of high humanitarian risk* under changing climatic conditions.

The complexity of climate change science and measurements of human vulnerability means the results should be interpreted as indicative only. Further research and refinement is necessary, particularly at the regional and local levels.

GROWING VULNERABILITY

- Over the next 20-30 years, the intensity, frequency, duration and extent of weather-related hazards will increase in many parts of the world. However, we are unlikely to see significant changes in the location of these hazards.

- Humanitarian disasters occur as a result of people's exposure to particular hazards and their degree of vulnerability. Vulnerability can be viewed as the capacity of individuals, communities and societies to cope with the impact of hazards [4] without suffering a long-term, potentially irreversible loss of wellbeing and stability. The degree of vulnerability is determined by underlying natural, human, social, physical and financial factors and is a major reason why poor people – especially those in marginalised social groups like women, children, the elderly and disabled – are most affected by disasters.

- By exposing people to more intense hazards, climate change is increasing the risk of humanitarian disasters, particularly in areas where people are already vulnerable.

- Even small changes in climate can significantly increase future disaster risk in highly vulnerable, ill-prepared communities. The day-to-day impacts of climate change also amplify existing stresses, and can contribute to the breakdown of livelihood systems, fuelling factors such as chronic hunger, conflict and displacement. Integrating disaster risk reduction into development strategies in highly vulnerable areas break a potentially vicious cycle, in which more intense disasters reinforce vulnerability and make communities more prone to future shocks.

HUMANITARIAN HOTSPOTS

- For humanitarian actors, the major concern until 2030 are likely to be areas already subject to extreme weather and with high human vulnerability (i.e. areas identified as risk hotspots by this study).
- The largest and most important regions of high overall human vulnerability identified by the study are in: Africa, particularly the Sahel, Horn of Africa and Central Africa; Central and South Asia, particularly Iran/Afghanistan/Pakistan/India and the Caspian region; and Southeast Asia, particularly Myanmar, Laos, Cambodia and Indonesia (maps 1 and 2).
- **Flood-risk** hotspots occur in: Africa, including the Sahel, the Horn of Africa, Great Lakes region, Central Africa and Southeast Africa; Central, South and Southeast Asia; and Central America and the western part of South America (maps 3 and 4).
- **Drought-risk** hotspots are mainly located in sub-Saharan Africa; South Asia, particularly Afghanistan, Pakistan and parts of India; and South East Asia, particularly Myanmar, Vietnam and Indonesia (maps 7 and 8).
- **Cyclone and hurricane risk** hotspots include Mozambique and Madagascar, Central America, Bangladesh, parts of India, Vietnam and several other Southeast Asian countries (maps 5 and 6).
- **Several parts of the world are hotspots for more than one of the three hazard types**. These include much of sub-Saharan Africa, especially the east coast, and much of South Asia. Some areas including Southeast Africa and parts of South and Southeast Asia are at risk from all three hazards (map 9). Such locations are warrant particular attention from humanitarian actors.
- At the local level, changing weather patterns will also make the distribution of hazards increasingly unpredictable, and increasing the risk that communities not used to coping with hazard events will become disaster victims.

POLICY CONSIDERATIONS

Over the next 20-30 years the increasing intensity of climate hazards in 'hotspot' areas is likely to result in a significant increase in humanitarian need. At the community household level, the poorest and most vulnerable social groups will be hardest hit. Climate change will stretch existing humanitarian capacity and provides an additional incentive to increase preparedness for response and to reduce disaster risk. New thinking and practical approaches are needed to overcome these challenges. These include:

Greater investment in disaster risk reduction (DRR); Concentrate on reducing vulnerability rather than just reacting to emergencies. In signing the Hyogo Declaration in 2005, 168 Governments acknowledged that working to reduce disaster risks, especially at the community level, is critical. There needs to be greater investment in DRR now, especially in poor countries that have always been hazard hotpots but are experiencing an increase in extreme weather due to climate change. Reducing disaster risk needs to be factored in to both development and humanitarian planning from the start. [5] For every dollar invested in disaster risk reduction and preparedness, roughly seven dollars are saved in disaster response. [6]

Ensuring faster and more appropriate responses to disasters: Climate change will increase the need for humanitarian response. Investing in early warning systems and strengthening response preparedness saves livelihoods as well as lives. Future agreements on how to adapt to climate change need to clearly reflect the importance of disaster risk reduction and preparedness for response. Applying 'build-back-better' principles for the recovery process means that disasters need not undermine development or perpetuate people's vulnerability. If fragile livelihoods are allowed to erode, people are left even more vulnerable to disasters in the future.

Investing in improved hazard and vulnerability analysis and mapping systems to better assess climate change risk. This includes improving climate-monitoring technology in order to improve mapping and improve forecast reliability. This information then needs to be translated into policies to make sure that populations affected by climate change receive adequate support.

Significantly reducing the greenhouse gas emissions that are ultimately responsible for climate change: The international community has until December 2009, at the Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC) to agree on a way forward on how to reduce greenhouse gas emissions from energy production, deforestation, transport and industrial processes. If this deadline is not met, the world risks to commit future generations to a very different and much more hazardous world.

End Notes

1. Maps displayed in the current document were generated by Maplecroft and taken from their original discussion paper, which is available at: http://share.maplecroft.com/OCHA/Final_Reports_pdf/UNOCHA_Climate_Change_Humanitarian_Implications_Summary.pdf. High resolutions images and technical annexes can be downloaded at http://www.careclimatechange.org.

2. Based on climate models as outlined in the 2007 IPCC Fourth Assessment Report as well as historical data from a number of existing risk analysis such as the 2005 World Bank, Natural Disaster Hotspots: A Global Risk Analysis. (See Ch. 3 and 4 of the Technical Annex for details and references on climate models and mapping of hazard risks)

3. Sources on human vulnerability include the UNDP Human Development Index, Uppsala Conflict Data Program, World Bank Development Indices, etc (see Table 1 below as well as Ch. 5 of the Technical Annex for references and discussion on human vulnerability factors).

4. ISDR Definiition of Vulnerability, see: ISDR : Terminology

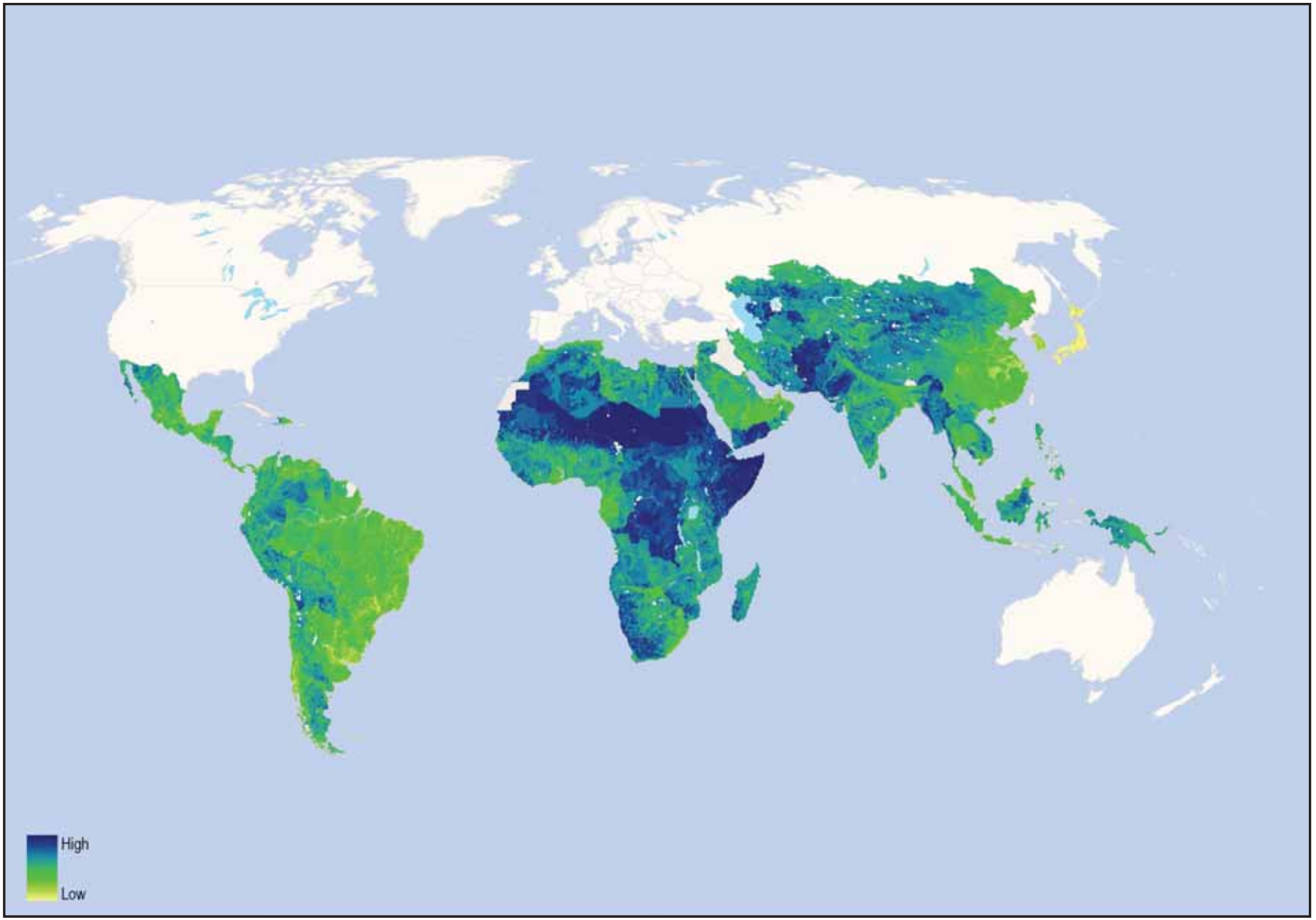
5. An Evaluation of World Bank Assistance for Natural Disasters. World Bank, June 2007. Evaluation of World Bank Assistance for Natural Disasters - Hazards of Nature, Risks to Development

6. Simms, A. Up in Smoke: Africa. Working Group on Climate Change and Development. New Economics Foundation, London, 2005.

Bangladesh, Cyclone Sidr

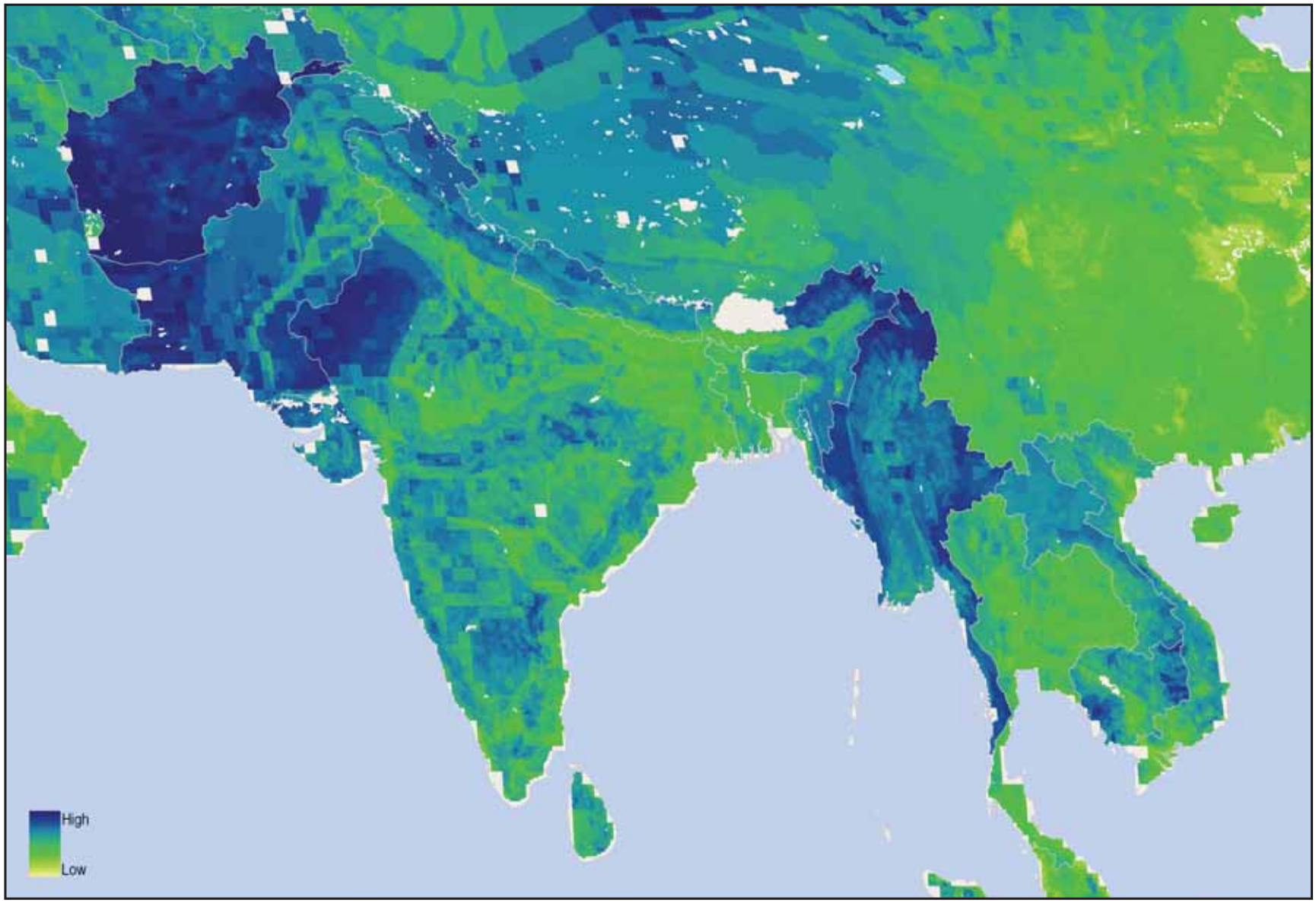
A boy looking at books found outside the remains of Santara Abbas, a school in Santara Barier in Morolgonj, Bangladesh, after Cyclone Sidr. More than 6.7 million people were affected by Cyclone Sidr that reached the Bay of Bengal in Bangladesh on November 15, 2007. CARE and emergency aid groups assisted the thousands of families and orphans that struggle to get clean water and blankets. It is been said that numbers of dead people reached 3500 by the cyclone. © 2007 Peter Caton

Human Vulnerability



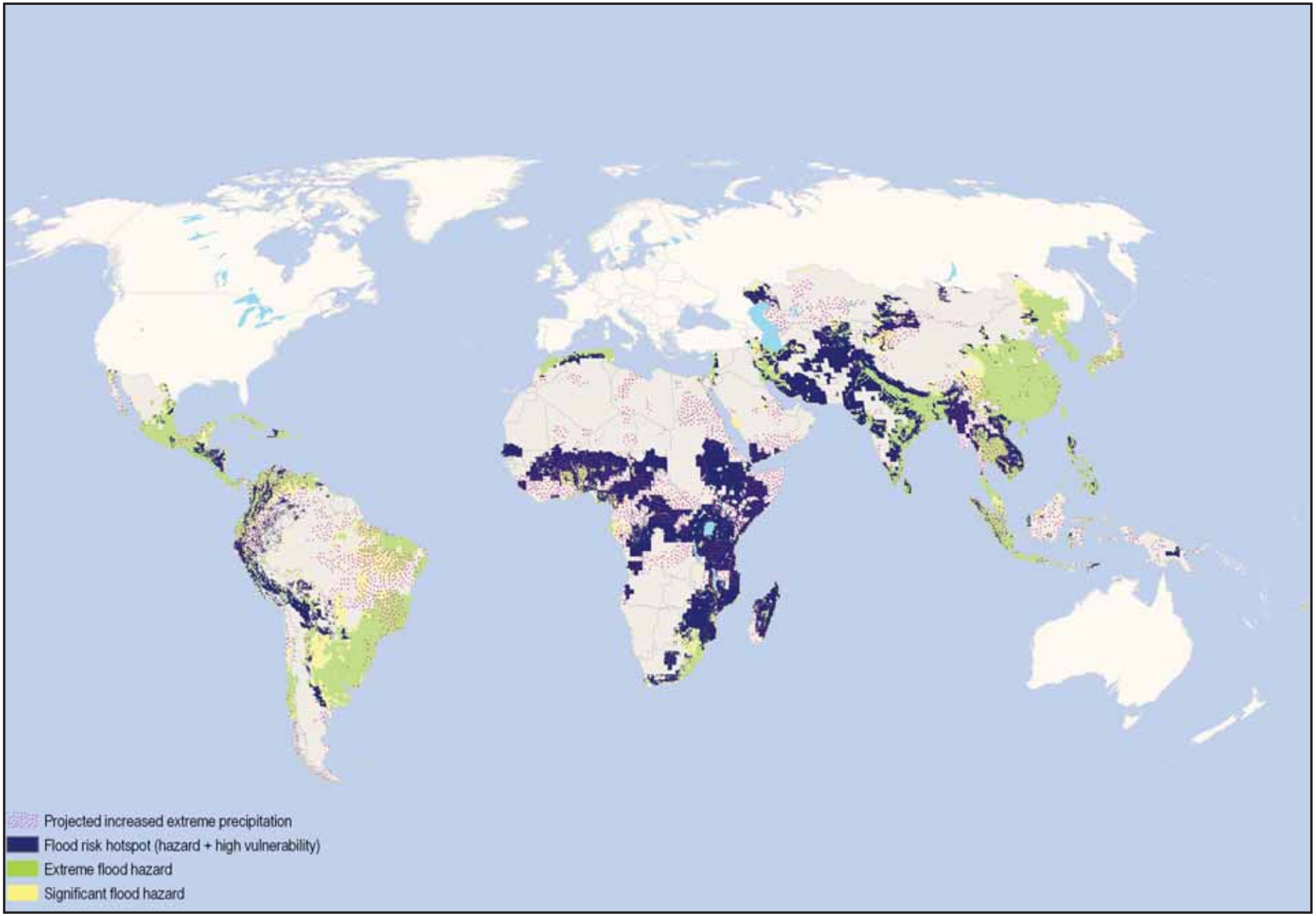
Map 1 shows overall human vulnerability based on a combination of natural, human, social, financial and physical factors. Areas shown in darkest blue are likely to be most at risk if exposed to extreme weather, such as floods, cyclones and droughts, or other impacts of climate change. They are also those areas most vulnerable if exposed to other humanitarian hazards – earthquakes for example.

Human Vulnerability in South Asia



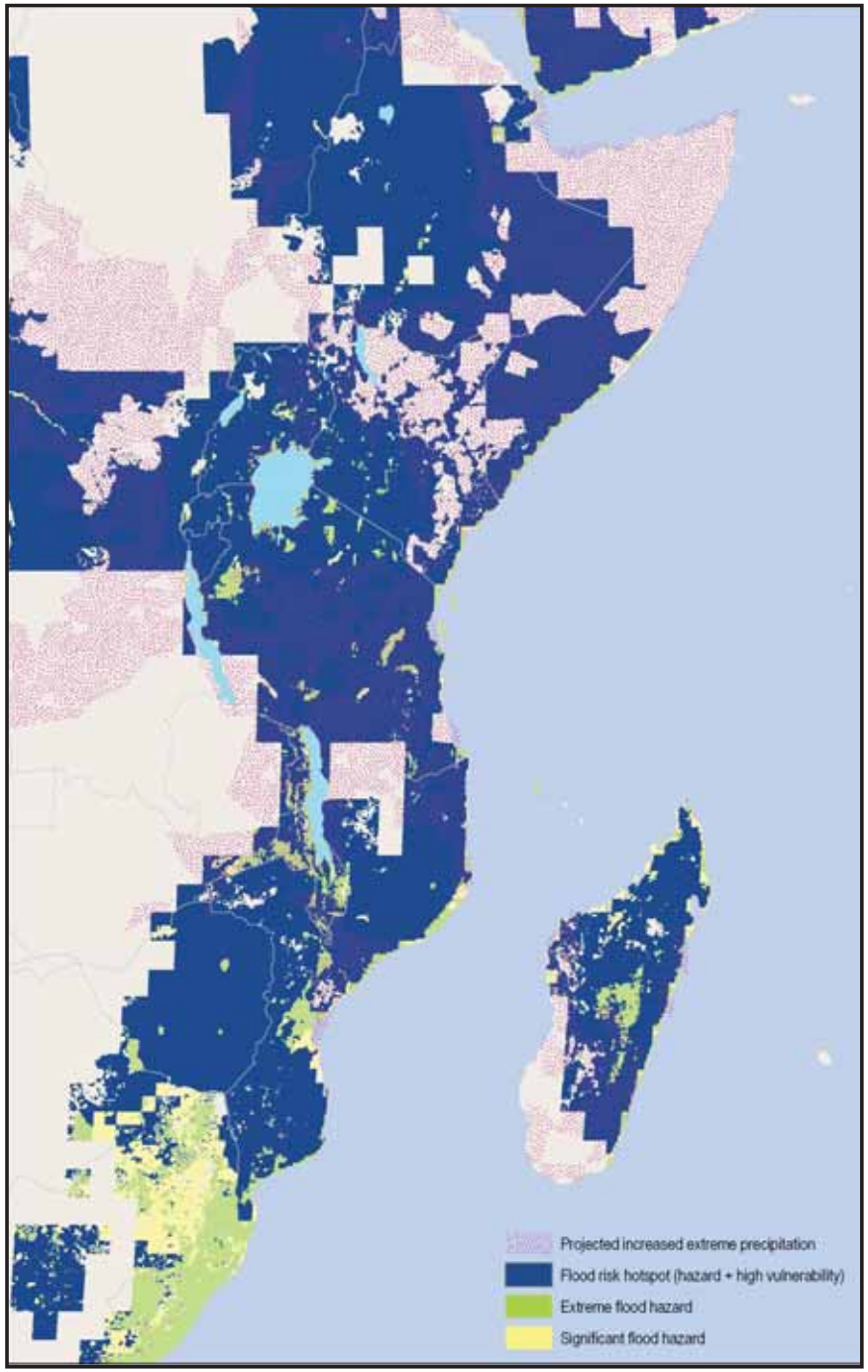
Map 2 shows the overall human vulnerability in South Asia. The map highlights variation in human vulnerability according to the natural, human, social, financial and physical factors considered. For example, the overall higher vulnerability of Myanmar and Afghanistan is partially due to national indicators such as governance and conflict risk. The lower vulnerability in areas along the foothills of the Himalaya and the Indus Valley in Pakistan represent areas where natural vulnerability is lower than surrounding areas because there is more water and fertile land available. The delta region of Bangladesh is an area that is naturally highly exposed to hazard events. However, the overall vulnerability in this region is now recorded as moderate. This is because, through sound investment in preparedness and risk reduction, the governments and communities have been able to successfully reduce their disaster vulnerability.

Flooding Hotspots



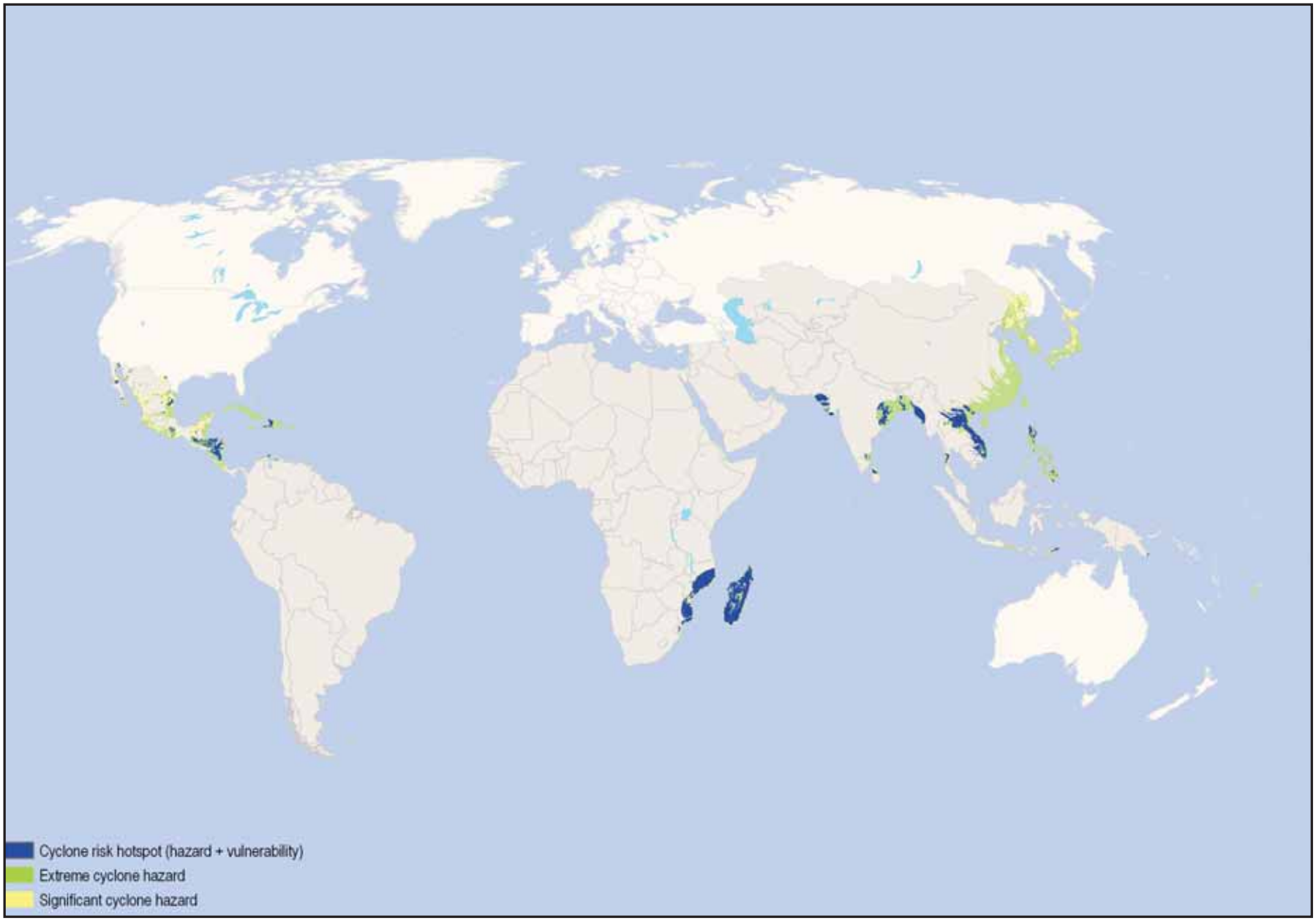
Map 3: The map shows 'flood risk hotspots' based on the interaction of extreme and significant flood hazard and high overall human vulnerability. Also shown are areas with significant or extreme flood hazard but lower human vulnerability and areas where climate models predict an increase in extreme precipitation, as an indicator of possible future increases of flood risk.

Flooding Hotspots in East Africa



Map 4: Humanitarian risk hotspots for flooding in the East Africa region. The map shows 'flood risk hotspots' based on the interaction of extreme and significant flood hazard and high overall human vulnerability. Also shown are areas with significant or extreme flood hazard but lower human vulnerability and areas where climate models predict an increase in extreme precipitation, as an indicator of possible future increases of flood risk. NB: As with most of the maps, this one has many "blank" squares. These are areas where gaps in vulnerability parameter datasets prevented sufficient mapping. Further details on the limitations and datasets can be found in Ch 1 of the Technical Annex of the original discussion paper

Hotspots for Cyclones

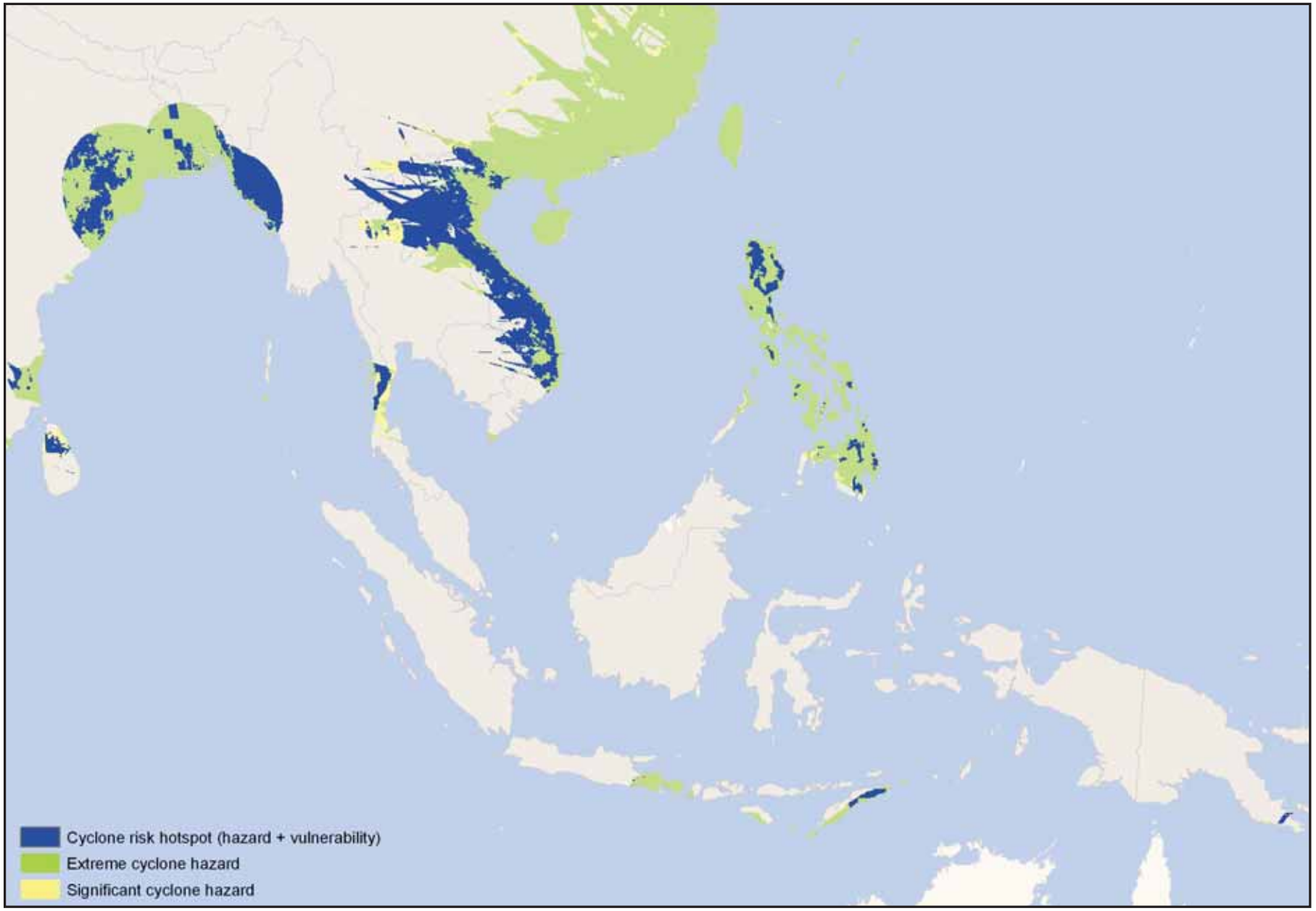


Map 5: This map shows 'cyclone risk hotspots' based on the interaction of extreme and significant cyclone hazard and high overall human vulnerability. Also shown are areas with significant or extreme cyclone hazard but lower human vulnerability. Projections from climate models were not used to identify cyclone risk hotspots because the effect of climate change on future cyclone distribution is very uncertain.

Floods, South Asia

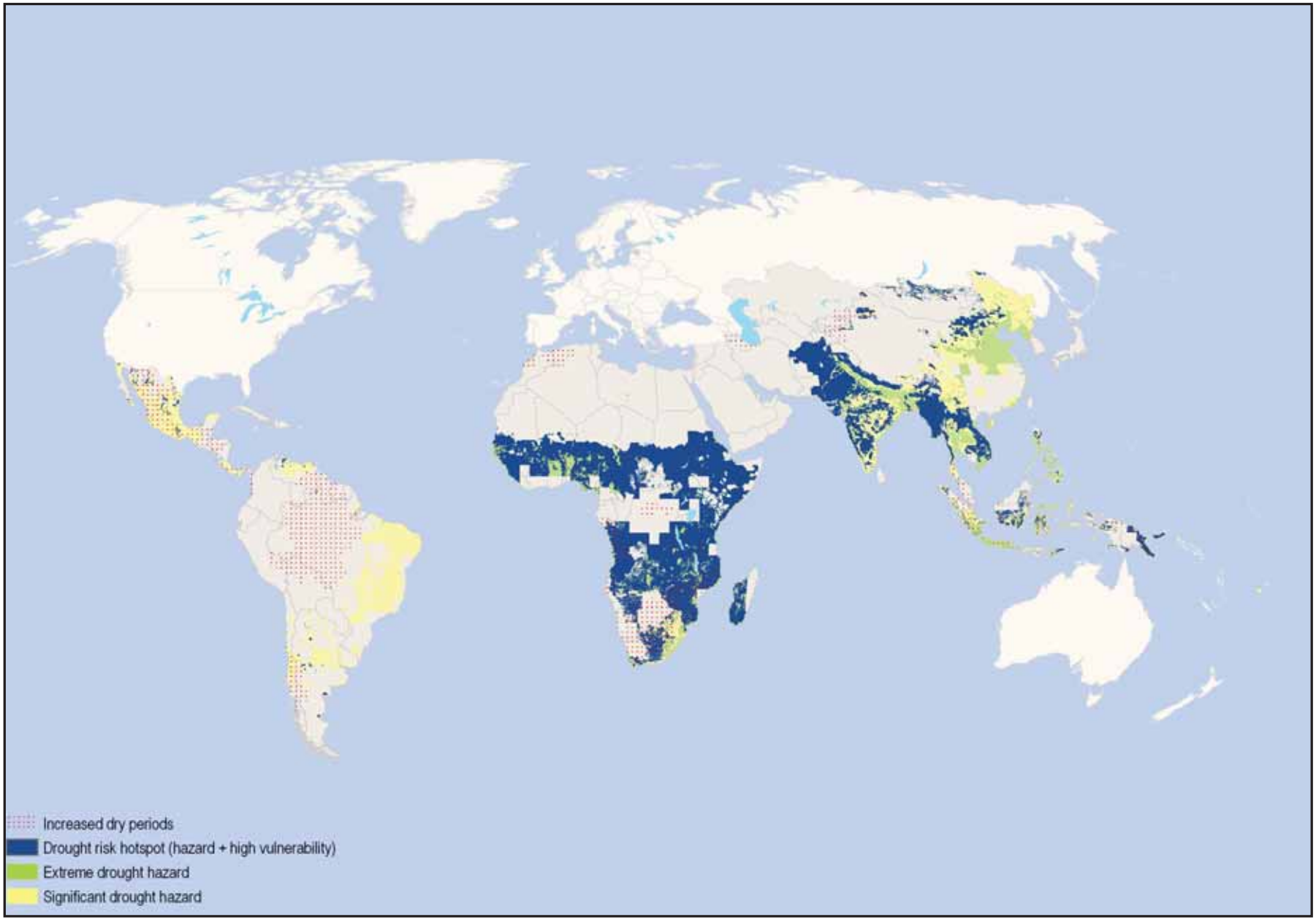
South Asia Floods, Aug. 2004. Dhaka Bangladesh DMP Project; Water levels have now receded throughout the region but meteorologists are predicting more rains to come before wet season is finished. Devastation in Nepal, India and Bangladesh, have left millions homeless, damaged vast amounts of agriculture, destroyed infrastructure and impoverished millions more. © 2004 Josh Estey/CARE

Hotspots for Cyclones in the Southeast Asia Region



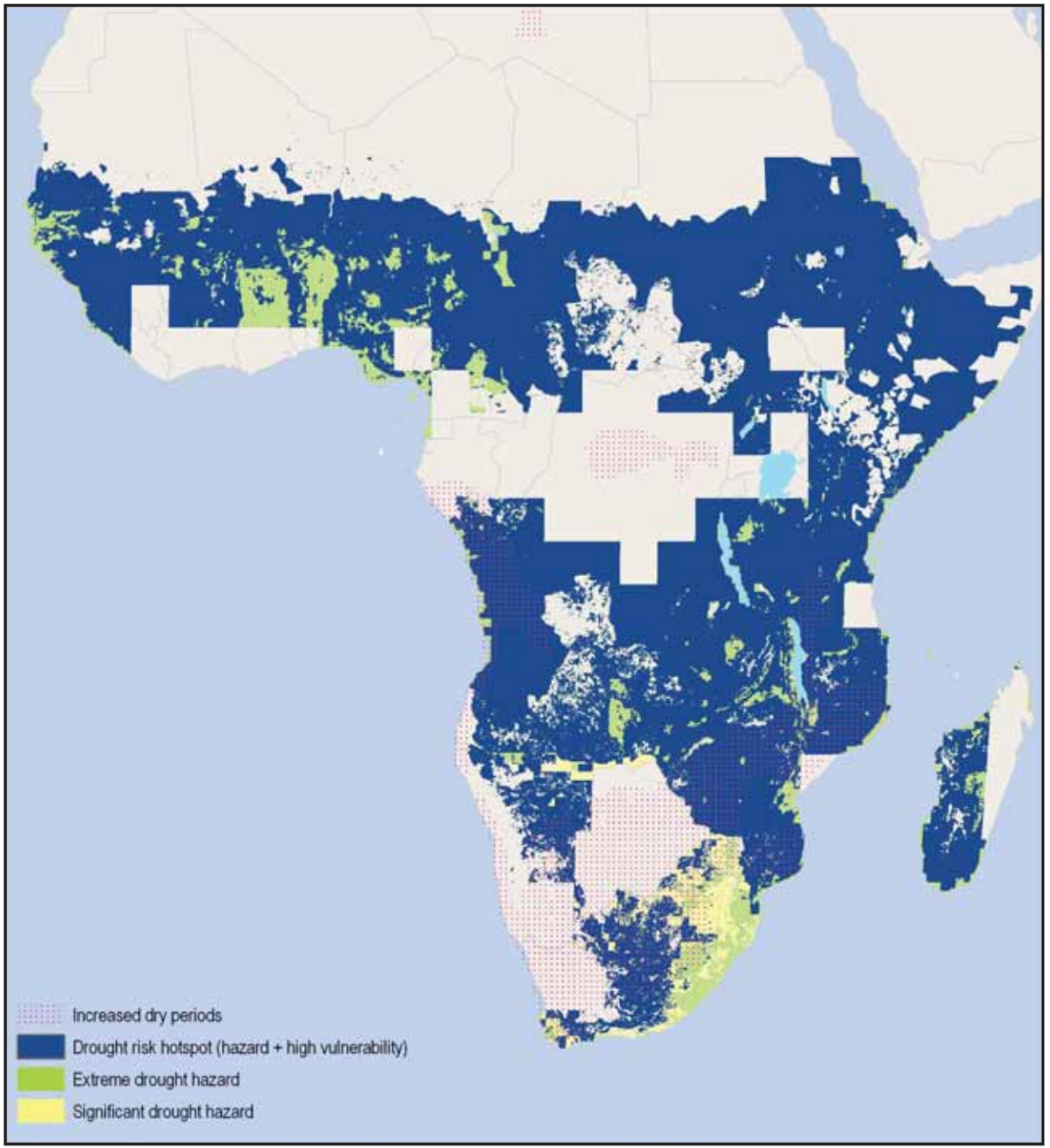
Map 6: The map shows 'cyclone risk hotspots' based on the interaction of extreme and significant cyclone hazard and high overall human vulnerability. Also shown are areas with significant or extreme cyclone hazard but lower human vulnerability. Projections from climate models were not used to identify cyclone risk hotspots because the effect of climate change on future cyclone distribution is very uncertain.

Hotspots for Drought



Map 7: Humanitarian risk hotspots for drought. The map shows 'drought risk hotspots' based on the interaction of extreme and significant drought hazard and high overall human vulnerability. Also shown are areas with significant or extreme drought hazard but lower human vulnerability and areas where climate models predict an increase in dry periods, as an indicator of possible future increases of drought risk.

Humanitarian Risk Hotspots for Drought, Sub-Saharan Africa

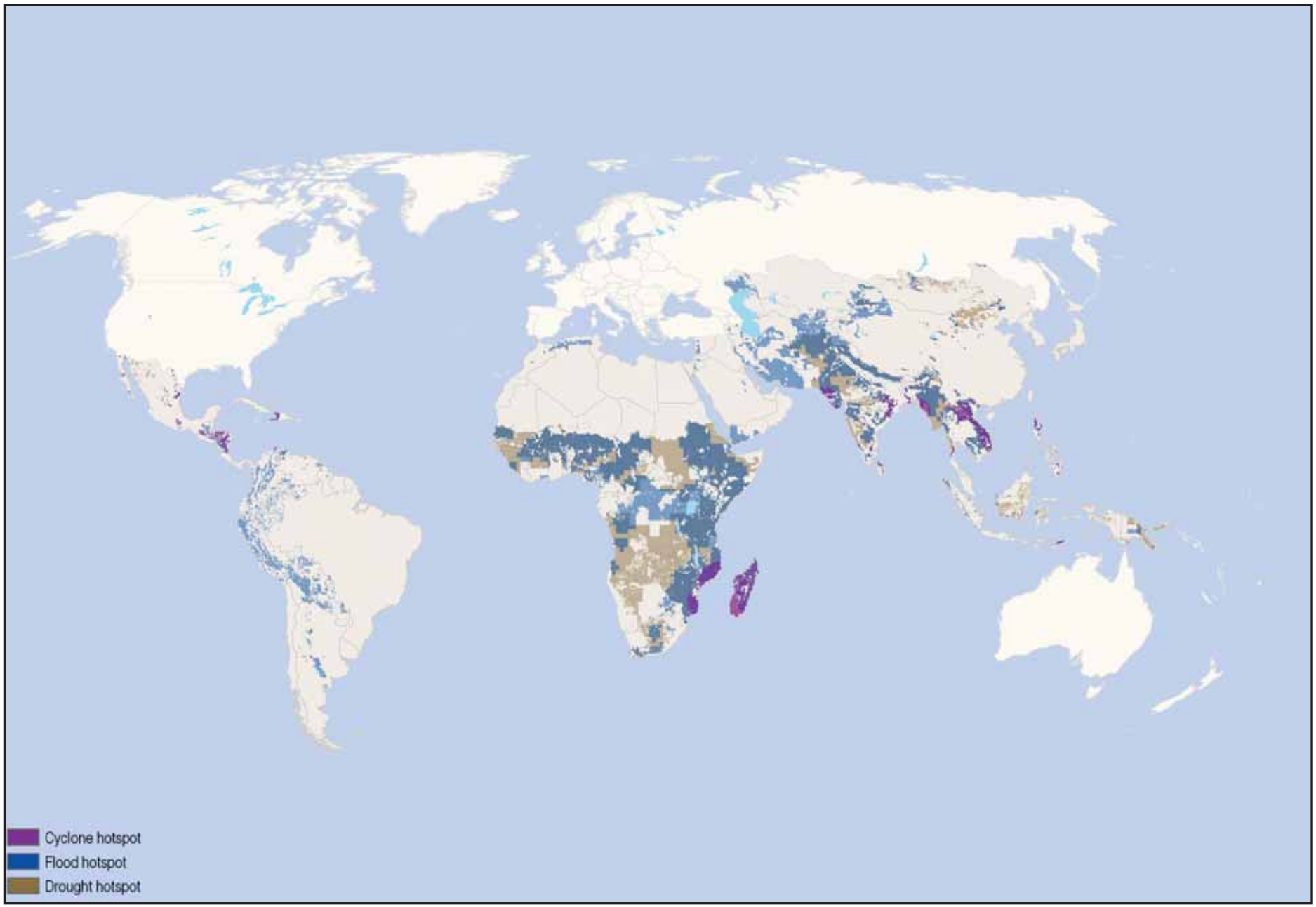


Map 8: The map shows 'drought risk hotspots' based on the interaction of extreme and significant drought hazard and high overall human vulnerability. Also shown are areas with significant or extreme drought hazard but lower human vulnerability and areas where climate models predict an increase in dry periods, as an indicator of possible future increases of drought risk.

Drought, East Africa

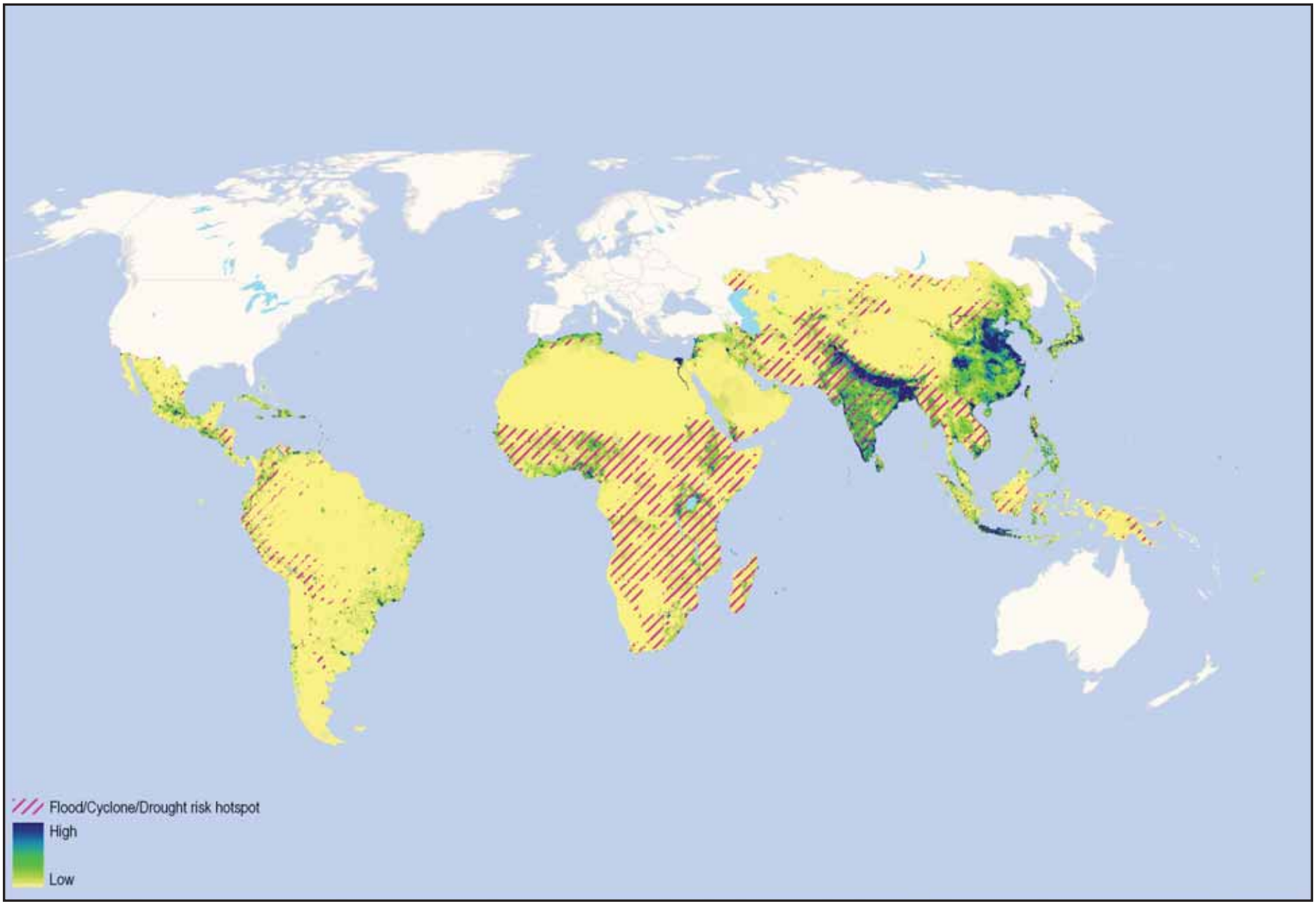
A cattle herder with his son with what remains of their herd. A severe drought has devastatingly impacted the livelihoods of thousands of pastoralists, who rely on rainfall and grazing, in northeastern Kenya and southern Somalia. © 2006 Kate Holt

Hotspots for All Three Climate Related Hazards



Map 9: Humanitarian risk hotspots for the three major climate-related hazards studied – flood, cyclones and drought. Risk hotspots are defined as areas where high human vulnerability coincides with the distribution of weather-related hazards. The risk hotspots are shown as transparent layers to show where they overlap

Displacement

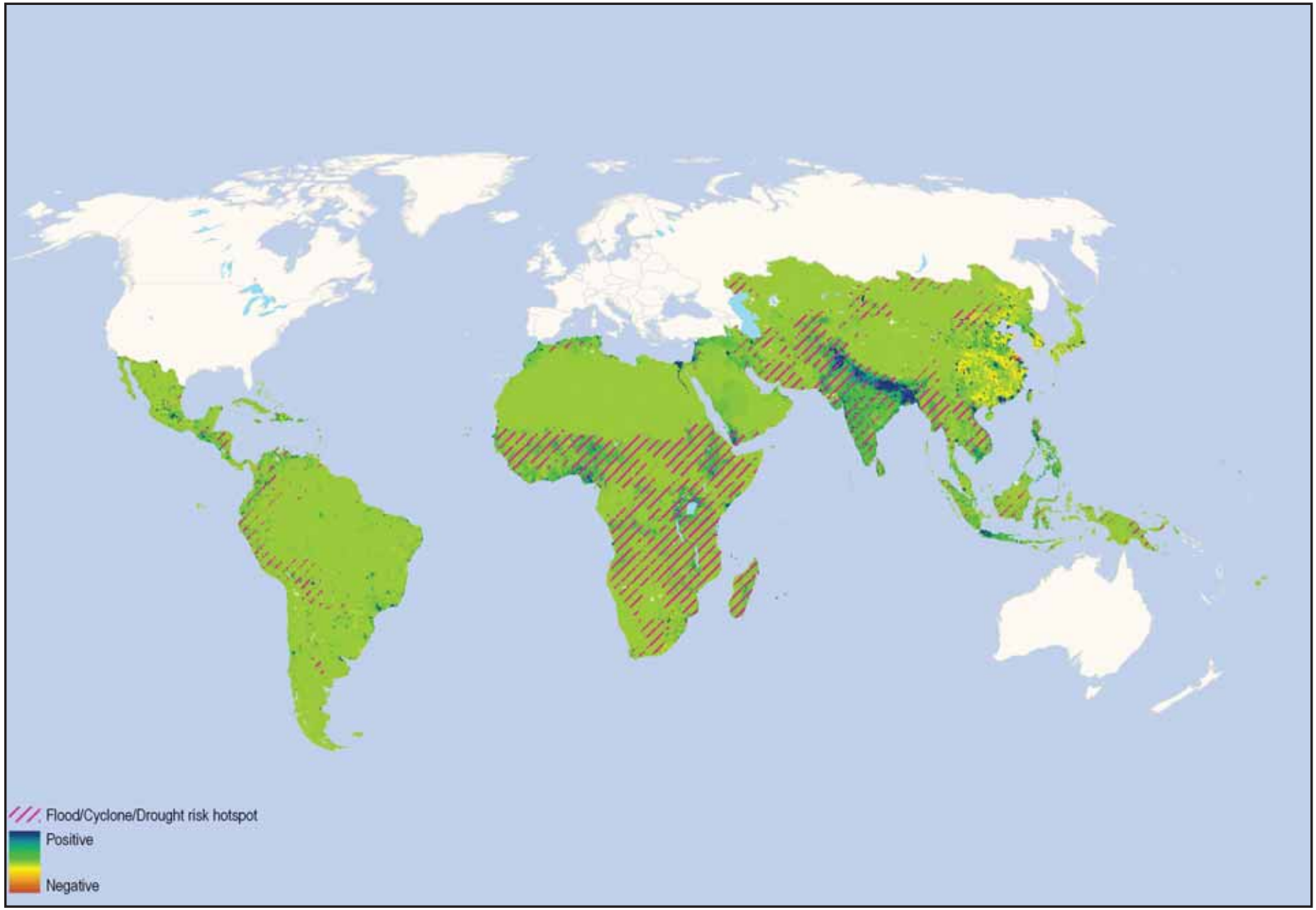


Map 10: Map showing hotspots of humanitarian risk for floods, cyclones and drought (combined) overlaying a population density gradient. Blue areas with striped overlay represent areas of high population density that are also risk hotspots. These areas could be interpreted to be at higher risk of future population displacement as a result of climate hazards.

Drought, East Africa

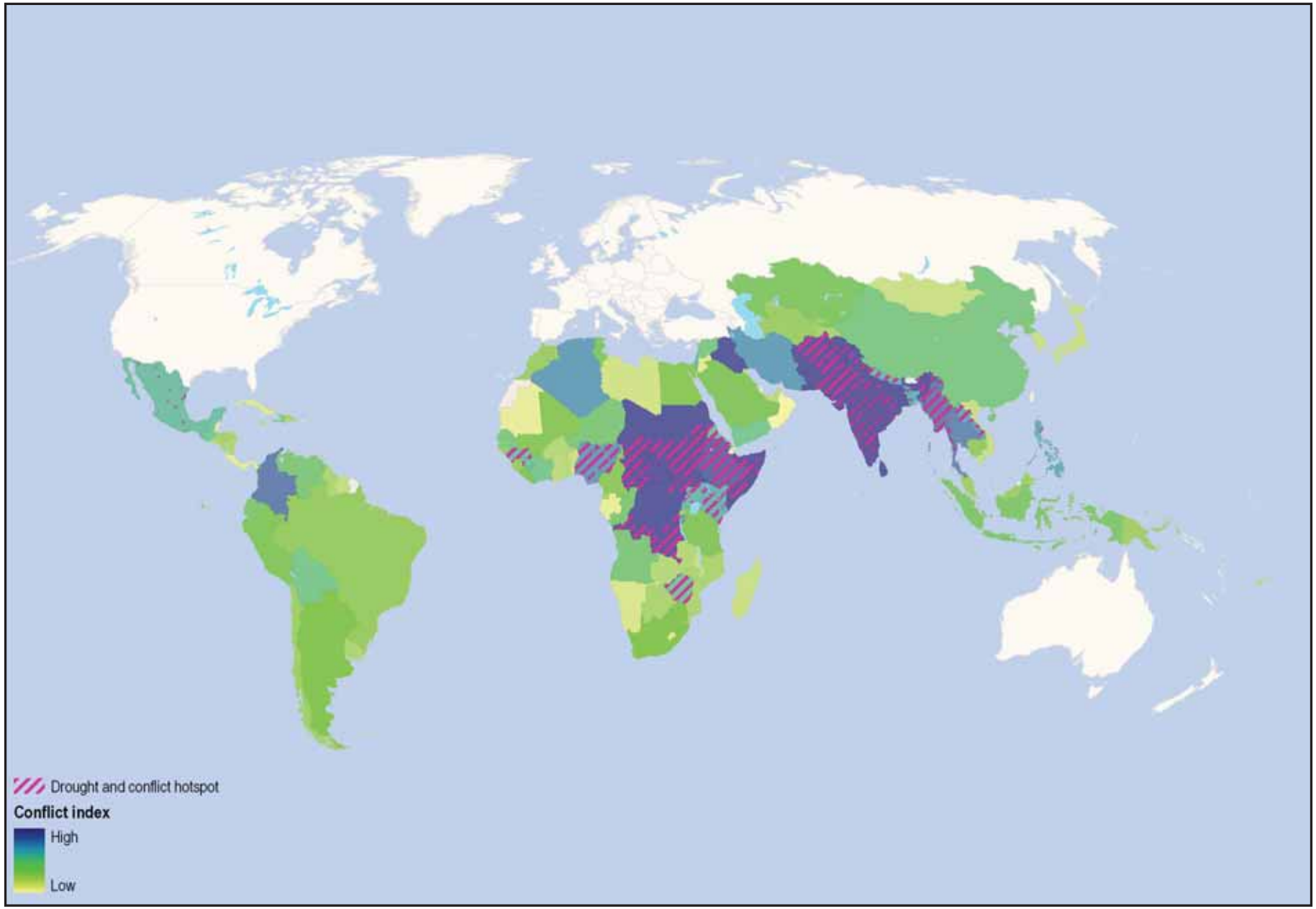
Displacement in Somali

Floods, Cyclones and Drought Risk Areas Compared to Population Density



Map 11: Blue areas with striped overlay represent areas of predicted population density increases that are also risk hotspots. These areas could present increased humanitarian risks in the future as more people become exposed to climate hazards.

Humanitarian Risk Hotspots for Drought and Conflict



Map 12: The base map shows an index of conflict risk. The striped areas of the map represent areas where drought risk hotspots coincide with high and extreme conflict risk. These areas are interpreted to be at relatively higher risk of climate-risk conflict. However, over the timeframe of this analysis the risk of additional humanitarian response being required as a result of climate change induced conflict is not considered much higher than from conflict in general and is very uncertain.

Sources Used in This Study

GROUP		THEME	GIS LAYER	FUTURE	SOURCE(S) SCENARIOS	YEAR
GROUP 1 HAZARDS	Projected trends	Temperature trends	Areas projected to temperature increase	yes	IPCC, WBGU, MPI	Various
		Precipitation trends	Areas projected to undergo change	yes in precipitation	IPCC, WBGU, MPI	2080-2099
	Current climate hazards	Floods	Distribution of flood mortality risk Change in extreme precipitation	qualitative yes	World Bank (sourced from UNEP), EM-DAT, MPI	2005 2071-2100
		Tropical cyclones	Distribution of cyclone mortality risk Distribution of tropical storm tracks	qualitative	World Bank (sourced from UNEP), EM-DAT	2005
		Drought	Distribution of drought mortality risk Change in maximum dry periods Future dynamics of drought risk	qualitative yes yes	World Bank (sourced from UNEP), EM-DAT, MPI, Hadley Centre	2005 2071-2100 2041-2070
GROUP 2 VULNERABILITY	Natural	Water availability	Distribution of water stress	qualitative	WWDRII, IPCC AR4, FAO, Alcamo	2007
		Agricultural suitability	Agricultural suitability for combination of staple crops	no	FAO GAEZ, GLC 2000, IPCC WGII	2000
		Land degradation	Distribution of soil degradation	no	ISRICI	2005
	Human	Poverty	Distribution of child malnutrition Human development index	no no	CIESIN UNDP	2002 2008
		Health	National index for HIV, TB, malaria, malnutrition	no	WHO, UNAIDS, Maplecroft	2007
	Social	Governance	National index	no	World Bank, OCHA Global Focus Model	2007
		Conflict risk	National index	Forward looking	ICG, Uppsala University, Maplecroft	2007
		Displacement	National index	no	UNHCR, Maplecroft	2007
	Financial	GDP	Sub national GDP	no	CIESIN, World Bank, CIA Fact book	2006
	Physical	Road infrastructure	Market accessibility	no	VMAP0 Digital Chart of the World	1997
		Road coverage	National index	no	IRF	2000-2005
		Telecommunication	National index	no	World Bank Development Indicators (WDI)	2007
ANALYSIS	HUMAN VULNERABILITY					
	FLOOD AND CYCLONE DISASTERS					
	FOOD AND WATER					
	POPULATION, DISPLACEMENT AND CONFLICT					

Table 1: Climate trends, associated hazards and vulnerability factors considered in the study.

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