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Climate Change, Adaptation, and Conflict: A Preliminary Review of the Issues

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COVER PHOTO: Sue McIntyre
Victims of Cyclone Sidr, Bangladesh 2007.

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EXECUTIVE SUMMARY

THREATS TO STABILITY FROM CLIMATE CHANGE

The consensus of climate scientists on the probable harmful effects of climate change and the need for climate adaptation has grown stronger in recent years. However, knowledge about the potential links between climate change and conflict, as well as the appropriate climate adaptation measures to prevent or mitigate conflict, remains limited and underdeveloped. This discussion paper provides an initial examination of climate change and climate adaptation, how and where climate change may be linked to conflict, and some of the implications of these linkages for development agencies.

Global temperatures have risen significantly over the last 100 years, with an accelerated warming trend beginning in the mid-1950s. According to the Intergovernmental Panel on Climate Change (IPCC), warming trends are projected to continue, and even if mitigation measures were immediately implemented, global warming would continue for decades. The consensus of climate scientists is that temperatures will rise between 2.0˚C and 4.5˚C by the end of the century.

Scientists have identified a number of ways in which increasing global temperatures may affect long-term climate patterns, including an increase in the incidence of both flooding and droughts, rising sea levels, and stronger, more frequent hurricanes and typhoons. If successful mitigation strategies are not adopted, hundreds of millions of people may face increasing pressure on water resources, damage to crops and dwellings, and exposure to extreme weather, diseases, and pests.

However, these high-probability, large-scale projections are accompanied by uncertainty with respect to how they will be manifested in specific events and locations. Global climate models cannot represent many important small-scale processes.

Climate change may threaten livelihoods, food security, water security, and marine resources in ways that are interrelated. Changes in precipitation patterns resulting in droughts or floods have the potential to reduce or even decimate agricultural production. The globalized nature of food production and consumption means that severe weather events could limit food production in a number of countries simultaneously and trigger a series of events that undermine food security across the globe. In areas subject to drought, climate change may create intense competition for scarce water resources. According to the Food and Agriculture Organization of the United Nations (FAO), increasing water temperatures already are harming aquatic plants and changing the distribution of fish species. The International Union for the Conservation of Nature (IUCN) warns of damage to coral reefs, an increase in invasive species, and ocean acidification. Marine ecosystems act as nature's buffer against the sea, protecting the shoreline—and people living along it—from storms and wave surges. Developing countries are likely to be hit hardest by changes in the aquatic environment, leading to further threats to livelihoods and food security.

With natural hazards predicted to increase in frequency and intensity, areas of the developing world that are already vulnerable to severe weather are especially at risk. Many of these locales have very low capacity to mitigate the impact of natural hazards. Climate change may negatively impact health through the increased incidence of diarrheal diseases that often accompany flooding and increased transmission of tropical diseases such as malaria and dengue fever.

The impacts of climate change on urban areas of the developing world, especially coastal cities, have the potential to affect hundreds of millions of people. Planning for climate change in cities is complicated by weak or absent governance,

uncoordinated land use, pervasive poverty, and health and sanitation problems. Water infrastructure in coastal cities is highly vulnerable to storms and flooding, especially in slums and low-income urban areas. Despite the fact that climate adaptation research has focused primarily on rural populations, urban centers may be more prone to conflict and unrest.

CLIMATE CHANGE AND CONFLICT SCENARIOS

There are two basic scenarios for climate change leading to conflict, with the first more likely:

Climate change could intensify environmental or resource problems that communities are facing already, exacerbating grievances, overwhelming coping capacities, and at times spurring forced migration. In this scenario, climate change places additional stress on pre-existing situations, worsening the quantity, condition, and distribution of already scarce natural resources.

Climate change could create new environmental problems that lead to instability. If coping strategies are unsuccessful or adaptation measures are not taken, the likelihood of conflict may increase as human security is eroded and grievances intensify.

These scenarios anticipate four broad categories of climate-related threats: 1) climate-induced degradation of freshwater resources; 2) climate-induced decline in agricultural production; 3) climate-induced increase in storm and flood disasters; and 4) climate-induced migration.

While it is generally agreed that environmental factors, including climate change, can be contributing factors to conflict, the underlying political, economic, social, and cultural context has a stronger and more direct causal relationship. Hence, climate change is best thought of as an aggravating factor or trigger in places where some of the characteristic ingredients for conflict already exist. Weak, corrupt, fragile, or failed governments are nearly ubiquitous critical factors. Many of the countries predicted to be worst affected by climate change are plagued by poor governance and social and political instability.

RESEARCH AND PROJECT PLANNING

A wide array of governments, international organizations, research institutes, and NGOs are generating assessment tools that provide information on climate variables and projections, climate impacts, climate-related and non-climate-related vulnerability data, and vulnerability mapping. However, very few of these efforts focus directly on the climate-conflict nexus.

Gaps in knowledge about linkages between conflict and climate change derive in part from uncertainties surrounding each of these two issue-areas. Given the uncertainties about which countries are most conflict-prone and which countries or zones are most vulnerable to threats from climate change, a major gap in knowledge is a more precise understanding of where development agencies should focus their limited resources to prevent negative climate change-conflict synergies.

The analysis and discussion of the climate-conflict relationship to date is very largely conceptual, schematic, and deductive. What is missing is a more inductive or case study exploration of specific settings and real locations (countries, regions, transboundary areas) of interest to policymakers and development agencies. Similarly, while climate adaptation responses such as strengthening institutional capacity, livelihood resilience, water harvesting and irrigation works, early warning programs, safety net measures, and conflict management capacities are needed, the hanging questions are: Which of these positive steps should be undertaken where, under what circumstances, with what caveats, and how? More granularity in the understanding of the climate-conflict relationship in specific countries or regions will not only help development agencies determine where they should focus their efforts but also will contribute to a better understanding of how they might devote their resources to conflict prevention or mitigation. One area for research is to gather lessons learned from ongoing real-life efforts to adapt to climate variability in vulnerable regions and communities and apply them to future planning.

As donor governments and multilateral institutions mobilize large financial resources to help vulnerable countries address climate adaptation challenges, it will be important to see that costly initiatives do not run ahead of firm

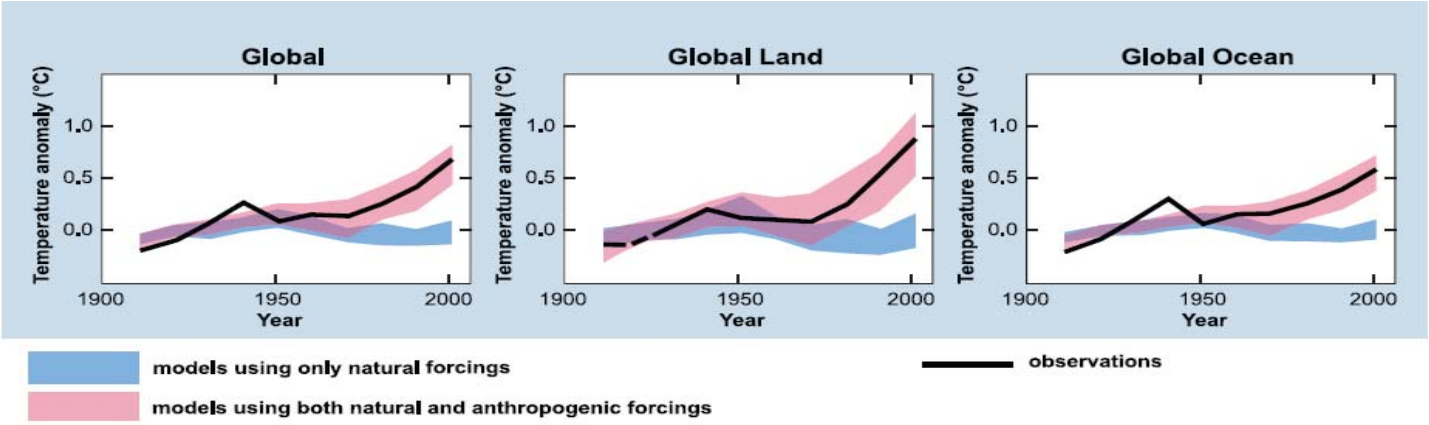
evidence that they are meeting their stated goals. Climate change presents the conundrum of increasingly frequent high impact events (droughts, floods, storms) in combination with highly uncertain timing and location—as well as limited financial resources, still-untested climate adaptation techniques, and unclear linkages to conflict. Added to this is the reality that inaction is not a practical option. Climate scientists, social scientists, economists, and other experts can help to prioritize information needs, bracket the range of costs and benefits, and clarify some of the options available to decision makers.

While the central focus of policy research will continue to be on threats from climate change, the potential for peacemaking and dispute resolution through environmental cooperation, as exemplified in institutional arrangements in the Nile Basin, the Lake Victoria watershed, and the Andes, also may extend to climate adaptation. It may be that the dynamics of some conflictive situations lend themselves well to the use of climate adaptation collaboration as a mutually beneficial mechanism to resolve or reduce tensions between parties in conflict.

INTRODUCTION

This discussion paper provides an initial examination of climate change and climate adaptation, how and where climate change may be linked to conflict, and some of the implications of these linkages for development agencies. The first section of the document discusses climate trends and how climate change is likely to threaten human security and drive grievances that, in combination with other factors, can lead to violent conflict. The section also describes how traditional coping strategies that have enabled populations to survive despite changing or degrading environmental conditions could be infeasible in the context of projected climate change effects. The second half reviews current discussions on how, why, and where violent conflict can erupt in regions experiencing climate change. It highlights the role of governance and the centrality of pre-existing instabilities. The paper concludes by sketching out gaps in knowledge related to climate-induced conflicts and new challenges and implications for development agencies operating in countries where changing climatic conditions may take on growing importance in relation to threats to human security, socioeconomic breakdown, political upheaval, and violent conflict.

Figure 1: Models demonstrating natural and anthropogenic forcings



SOURCE: IPCC 2007C.

OBSERVED EFFECTS OF CLIMATE CHANGE

Global temperatures have risen significantly over the last 100 years, with an accelerated warming trend beginning in the mid-1950s. According to the Intergovernmental Panel on Climate Change (IPCC), 11 of the 12 years between 1995 and 2006 were the warmest on record in terms of global surface temperature. Warming trends are projected to continue, and even if mitigation measures were immediately implemented, global warming would continue for several more decades due to the slow response time of the world's oceans (IPCC 2007c). The IPCC says that it is "very likely" (greater than a 90 percent probability) that most of climate change is anthropogenic (see Figure 1). The consensus of climate scientists is that temperatures will rise between 2.0˚C and 4.5˚C by the end of the century (IPCC 2007c).

The relationship between observed global warming and broader climate change is highly complex and subject to a variety of interactions. In general, greenhouse gas emissions trap the Earth's latent heat and alter the normal pattern of low- and high-pressure systems that drive weather in any given location. Scientists have identified a number of ways in which

increasing global temperatures may affect long-term climate patterns, including an increase in the incidence of both flooding and droughts, rising sea levels, and stronger, more frequent hurricanes and typhoons (IPCC 2007a). The IPCC has stated that, if successful mitigation strategies are not adopted, hundreds of millions of people will face increasing pressure on water resources, damage to crops and dwellings, and exposure to extreme weather, diseases, and pests (IPCC 2007a).

These high-probability, large-scale projections are accompanied by uncertainty with respect to how they will be manifested in specific events and locations. The U.S. Climate Science Program notes that "events such as extreme droughts and floods…occur too infrequently for us to use a large body of observations so we must 'assume' a probability distribution for such events." (Morgan et al. 2009) Further, "[a]s we gain experience with the complex of processes leading to precipitation, we also develop a sense of humility about the incomplete state of our knowledge" (Morgan et al. 2009). The impact of precipitation variability on human populations will be affected significantly by groundwater availability. Yet, in sub-Saharan Africa, one of the regions of greatest concern, "quantitative information on aquifer characteristics and recharge rates, and groundwater flow regimes, abstraction rates and quality controls is very uneven and generally incomplete" (Foster et al. 2006). In general, global climate models have limitations because "many important small-scale processes cannot be represented explicitly in models, and so must be included in approximate form as they interact with larger-scale features" (IPCC 2007c).

Whether climate related or not, recent cases of environmental change provide an illustrative glimpse of what climate change may portend. Families had to be transplanted from small islands near Papua New Guinea to Bougainville island as shoreline erosion from storms and salt intrusion made the islands nearly uninhabitable (International Organization for Migration [IOM] 2008). Another village located north of the Bering Strait was forced to migrate several kilometers to the south when erosive currents damaged the natural ice shield, resulting in a 3.3 meter annual loss of shoreline (IOM 2008). Officials in national meteorological agencies in countries like Uganda and Ethiopia strongly believe that recent extremes of droughts and floods are connected to climate change.[1] However, it is not possible to link specific events to macro-level climate trends, and these officials and others around the world are working concertedly to gather more detailed time series data on a long list of weather-related phenomena.

CLIMATE CHANGE AND CONFLICT

Factors linking climate change and the potential for conflict include a number of powerful threats to human security, such as land degradation, water scarcity, decreased food production, increased mortality from diseases, unplanned migration, and hazards associated with extreme weather events. Populations will have to grapple with these severe challenges, and as numerous experts have noted, these effects are likely to be most acute in countries already struggling with low levels of development, persistent poverty, limited social service systems, and in some cases, pre-existing political and social instability. Such threats to human security, especially if unmitigated, have strong potential to increase dramatically grievances that often are the precursors to conflict.

"Factors linking climate change and the potential for conflict include a number of powerful threats to human security, such as land degradation, water scarcity, decreased food production, increased mortality from diseases, unplanned migration, and hazards associated with extreme weather events."

The relationship between environmental change and the erosion of human security is not new and has both distant and recent antecedents. In *Collapse: How Societies Choose to Fail or Succeed*, Jared Diamond (2005) describes the historical evidence that societies in places as diverse as Easter Island, Mayan Central America, Norse Greenland, and the pre-Columbian southwestern United States failed to cope with environmental change (both anthropogenic and natural) and suffered socioeconomic decline, increasing conflict, and eventual collapse. In the ongoing conflict in Darfur, in the Karamoja region of Uganda, and elsewhere in the Horn of Africa, land degradation and the competition for productive land has exacerbated tensions and fueled clashes between agriculturalists and pastoralists since the 1980s (UNEP 2007). As desertification, soil erosion, and nutrient depletion have worsened, conflict over control of viable land has intensified. Changes in weather patterns have contributed to these effects. According to the United Nations Environment Program (UNEP), rainfall in northern Darfur has decreased by 30 percent over the past 80 years, reducing land fertility and productivity. Future scenarios are cause for further concern, with models predicting that further decreases in rainfall could cause a 70 percent reduction in agricultural productivity in some areas of the Sahel belt (UNEP 2007).

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ABOVE: Dried riverbed of the Borkena River near Kombolcha, Ethiopia: The water table has fallen below the level of the great famine of 1984–1985.

The Obama administration already has indicated its awareness of the potential intertwining of the effects of climate change, increased instability, and conflict. In November 2008, President-Elect Obama stated that the United States was ready to open a "new chapter on climate change" (Office of the President-Elect 2008), and during his campaign he stated that "investments to assist fragile states in coping with the challenges of climate change are in the interests of U.S. national security" (Haig 2008). As President-Elect, he told the Governors' Global Climate Summit that "climate change and our dependence on foreign oil, if left unaddressed, will continue to weaken our economy and threaten our national security" (PRI 2008). Other members of President Obama's administration, including Secretary of State Hillary Clinton and Special Envoy on Climate Change Todd Stern, have reiterated these positions, with Secretary Clinton stating at the Major Economies Forum in Energy and Climate Change that "climate change is a clear and present danger to our world that demands immediate attention" (Clinton 2009). Envoy Stern called attention to the potential link between climate change and conflict in his April 2009 statement to the Senate Foreign Relations Committee, which noted that as climate change effects become increasingly severe they could force

mass migrations and more frequent conflict over scarce natural resources. Stern further stated that climate change-induced problems could have "major geopolitical ramifications" (Stern 2009).

THREATS FROM CLIMATE CHANGE, HUMAN INSECURITY, AND INSTABILITY

Climate change has the potential to alter significantly the relationship between people and their environments and undermine the resource base upon which people have built their societies. Human insecurity is the necessary link between climate change and conflict. When human security is threatened, and especially when governance is weak or lacks legitimacy, there is a heightened risk of the sorts of grievances that drive conflictive behavior. Some of the ways in which climate change is likely to negatively impact human security are discussed below.

"...it is clear that shifting or erratic precipitation patterns have the potential to destabilize livelihoods in rural areas, contribute to serious declines in agricultural production, and erode food security."

LIVELIHOODS, FOOD SECURITY, WATER SECURITY, AND MARINE RESOURCES

Climate change may threaten livelihoods, food security, water security, and marine resources in ways that are interrelated. The most obvious link is between changes in precipitation patterns and droughts and floods that have the potential to reduce or even decimate agricultural production. The IPCC estimates that interior parts of sub-Saharan Africa will receive 10 percent less rainfall by the end of the century (IPCC 2007c). The exact effect that this will have on agriculture is unknown because it will depend on the actual distribution of rainfall and adaptation measures, such as water harvesting, investments in land fertility, improved seeds, and other responses. However, it is clear that shifting or erratic precipitation patterns have the potential to destabilize livelihoods in rural areas, contribute to serious declines in agricultural production, and erode food security.

Experts also expect that climate change will cause a shift in hydrological cycles. The effects of such changes will be felt differently across the globe, with some areas seeing increasing water flows as a result of snow and ice melt, others experiencing accelerating erosion and siltation in the form of runoff from degraded lands, and still others suffering from a reduction in water availability as a result of drought or other precipitation variance. Rain events are predicted to become less frequent but more intense, increasing the risk of flooding and reducing the amount of water that is absorbed into the ground for crops and groundwater recharge (IPCC 2007b). In areas subject to drought, climate change may create additional competition for water resources. Heavy downpours and flooding may alter the distribution of water access points, possibly impacting pre-existing relationships and agreements governing water use. In both cases, changes in precipitation patterns may undermine the viability of the arrangements communities have developed in order to reduce the

incidence of conflict. Both rainfed systems and irrigated land will be affected by transformations in the hydrology of rivers, lakes, and groundwater resources.

While these effects are easily grasped at the farm or household level, it also is important to note that the globalized nature of food production and consumption means that what appears to be a local or national decline in food production may in fact have implications for areas hundreds or even thousands of miles away. In many parts of the world, urban areas are heavily reliant on food supplies from both domestic and international markets. Many of these markets have arisen through improved transportation networks and are affected by oil supplies and prices, which also will be subject to policy decisions made regarding climate change.

Price fluctuations for staple commodities have a direct impact on food security for millions of urban poor for whom food expenditures constitute a very high percentage of income. This was demonstrated dramatically in numerous places around the world in 2007 and early 2008, when food prices skyrocketed. Trade prices for rice tripled between November 2007 and April 2008 (Childs and Kiawu 2009). Between February 2007 and February 2008, the price of wheat increased by 120 percent (CNN 2008).

Numerous factors contributed to the price increases, including shifts toward ethanol production, record-high oil prices, and growing demand in India and China. But analysts also noted the role of climate events (Walt 2008). Droughts, floods, heat waves, and other weather events undermined food production around the world, including particularly bad weather in the rice and wheat producing areas of Australia. Governments fearful of food shortages (including India, China, Egypt, and Pakistan, among others) restricted food exports, further tightening supply in food-importing countries and driving up prices (Bradsher and Martin 2008). The result was a well-publicized outcry that led to riots in locations as diverse as Bangladesh, Haiti, Pakistan, Burkina Faso, and Mexico (Walt 2008). A report on global food security published by Chatham House observed that "in numerous countries, the combination of food and fuel inflation has emerged as a highly contentious political issue, and in many, dissatisfaction has led to violence or civil unrest" (Evans 2009). It is not difficult to imagine a scenario in which climate change limits food production in a number of key producer and consumer countries simultaneously and triggers a series of events that undermine food security across the globe.

Climate change is predicted to alter significantly the ocean environment. According to the FAO, increasing water temperatures already are harming aquatic plants and changing the distribution of fish species (FAO 2009b). The IUCN (2009) warns of damage to coral reefs, an increase in invasive species, and ocean acidification. Altered ocean chemistry as a result of acidification is likely to harm shell-forming marine life (such as mussels, oysters, and certain kinds of coral and algae), which could impact food supplies in some places. Although vertebrate fish are predicted to be relatively more resilient to changes in ocean chemistry, acidification may negatively affect the phytoplankton that is the primary base "of almost all marine food chains" (Morgan et al. 2009). Coral reefs mitigate storm surges and are the home to many tropical fish, contributing to biodiversity and attracting tourism. However, coral reefs also are threatened by ocean acidification, which reduces their calcification and increases their dissolution.

Mangrove destruction threatens to undermine the human security of coastal communities, who are already among the populations most vulnerable to climate change. Since 1980, 3.6 million hectares of mangroves have been lost, equivalent to a 20-percent global reduction (FAO 2008). Although the destruction is driven largely by land use changes, especially the development of aquaculture and the expansion of agriculture, the transformed landscape will interact with climate change. These ecosystems act as nature's buffer against the sea, protecting the shoreline—and people living along it—from storms and wave surges. Marine plants have extensive root systems that absorb the impact of high tides, dissipating between 70 percent and 90 percent of the energy of a normal wave before it hits the shore (WRI 2008). The effectiveness of these natural systems are highlighted in a 2007 report by FAO, which states that the effects of the 2004 Indian Ocean tsunami were typically less devastating in areas that had intact coastal vegetation. FAO further notes that well-designed coastal forests could mitigate the effects of storm surges as high as 8 to 10 meters and reduce the extent of storm flooding (FAO 2007). If the predictions of stronger and more frequent tropical storms are realized in the coming years, investing in the rehabilitation of degraded coastal ecosystems is an adaptation measure that can help mitigate the potential for destabilizing natural disasters.

"Natural disasters can spark or add to citizen grievances and contribute to both the motives and the opportunities for violent behavior."

Climate change also is likely to threaten the fishing industry in the years to come. Water temperature increases, changes in the salinity of the water, worsening pollution, increased UV-B radiation, and changes to ocean currents all may aggravate existing pressure on fish stocks (FAO 2009a). Developing countries are likely to be hit hardest by changes in the aquatic environment, raising important questions about the impacts on livelihoods and food security. According to FAO (2009b), "In a warmed world, ecosystem productivity is likely to decline in lower latitudes (i.e. most tropical and subtropical oceans, seas and lakes) and increase in high latitudes." The effects will be felt most acutely in areas where subsistence and small-scale fishing predominate because lack of mobility eliminates access to other fish stocks (FAO 2009a). Although the impact that these changes will have on communities will vary depending on location, mitigation, and other coping strategies, people who depend on fish at a subsistence level will face increasing threats. Sub-Saharan Africa is noted specifically as facing serious threats to fisheries and having little coping capacity to mitigate the worst effects (FAO 2009b).

HEALTH

In addition to health challenges caused by malnutrition, climate change may negatively impact health through the increased incidence of diarrheal diseases that often accompany flooding and increased transmission of tropical diseases such as malaria and dengue fever. Anticipated increases in global temperature and rainfall have led researchers to hypothesize that malaria-carrying mosquitoes will proliferate, especially at higher altitudes where they were previously unknown. As global warming makes previously inhospitable locations attractive to mosquitoes, communities with little previous exposure to the disease may be confronted with health challenges for which they are ill-prepared. Effects also may be felt at lower altitudes where malaria already is a problem because warmer temperatures will allow the parasite to develop more quickly. In places where increased rainfall is expected or flooding is likely to be a problem, wetter conditions may allow malaria-carrying mosquitoes to survive longer and breed more frequently, contributing to increased exposure for the human populations. Finally, although droughts will dry up some of the standing water in which mosquitoes prefer to breed, they also kill frogs, dragonflies, and other species that prey on mosquitoes (Potter 2008).

It is difficult to quantify the likely increases in malaria rates because they will depend on migration patterns of human populations and the effectiveness of malaria prevention and treatment programs. However, many developing countries already are unable to cope with malaria. Increasing the prevalence of the disease would strain already tight health budgets and potentially subject larger populations to its devastating effects.

Negative impacts on health from climate change could interact with other factors and circumstances to increase instability and the potential for conflict. For example, new or more severe health problems could contribute to social and economic vulnerabilities within already fragile communities; the inability or failure of government to deliver urgently needed health services to a rapidly expanding number of at-risk individuals could erode state legitimacy; or the diversion of resources to deal with health crises could detract from the capacity of

governments to respond to other critical issues.

NATURAL HAZARDS AND NATURAL DISASTERS

The vulnerability of a population to natural hazards is directly related to how well it prepares for and responds to a given event. Storms of similar intensities can have vastly different effects in different places depending on the coping mechanisms in place. For this reason, discussions about the relationship between climate change, natural hazards, and the impacts on human populations cannot be divorced from discussions about governance, development, and resilience. With proper planning and emergency management, storms and other severe weather events do not have to become humanitarian disasters, even if climate change increases their frequency. However, as is evident throughout the developing world, much of the world's population lacks even rudimentary capacities to mitigate the effects of these events. In cases where people already are living at the margins, natural disasters may act as shocks to the system, further eroding human security and increasing the likelihood for conflict.

With natural hazards predicted to increase in frequency around the globe, several hotspots in the developing world are likely to experience especially serious weather-related events. Many of these locales have very low capacity to mitigate their effects. According to CARE International, climate change is poised to intensify droughts in sub-Saharan Africa (especially in the conflict-prone Horn of Africa), South Asia, and Southeast Asia. These areas also are at high risk for flooding, as are Central and Southeast Africa, Central America, and the western part of South America (CARE and Maplecroft 2008). Cyclones also are likely to increase, although the exact effects of climate change on their frequency and intensity is unknown. However, the IPCC found in its most recent report that the prevalence of intense tropical cyclones has increased since the 1970s, and it projects that future storms may be accompanied by higher winds and rainfall (IPCC 2007a). The increased exposure of vulnerable groups to the effects of natural hazards also may create negative synergies that hamper development efforts. Weather-related shocks that threaten human security can render a population more vulnerable to the next shock, creating a negative spiral of vulnerability and insecurity. Natural disasters can spark or add to citizen grievances and contribute to both the motives and the opportunities for violent behavior.

URBANIZATION

The impacts of climate change on urban areas of the developing world have the potential to affect hundreds of millions of people. Planning for climate change in cities is complicated by weak or absent governance, uncoordinated land use, pervasive poverty, and health and sanitation issues, all of which undermine people's adaptive capacity (Brown and Crawford 2009). Despite these challenges and the large numbers of people that are likely to be affected by them, adaptation research has focused primarily on rural dwellers to this point (Satterthwaite et al. 2007). At the same time, urban centers may be more prone to conflict and unrest, especially where pervasive poverty and the erosion of human security interact with a keener sense of relative deprivation and a greater capacity to mobilize and recruit large numbers of people.

JEFFREY STARK.

ABOVE: Coastal cities such as Freetown, Sierra Leone may be increasingly vulnerable to flooding and saltwater intrusion as a result of storm surges and sea level rise.

The United Nations estimates that 67 percent of the population in developing countries will live in urban areas by 2050 (UN DESA 2008). Africa and Asia are expected to urbanize faster than the rest of the developing world (UN DESA 2008), driven both by natural increase and rural-to-urban migration. UN HABITAT (2008b) estimates that by 2030, 50 percent of Africans will live in cities, resulting in a doubling of Africa's urban population (from 373.4 million to 759.4 million). By 2050, the urbanization rate of Asia is expected to reach 66.2 percent, up from 40.8 percent in 2007 (UN DESA 2008). Rates of urbanization already are "exceptionally high" in Latin America and the Caribbean, at approximately 78 percent (UN DESA 2008).

Urbanization in the developing world is characterized by substantial population increases in slums and other peripheral areas that have very limited resilience when struck by natural hazards. The United Nations estimates that such impacts will become more severe with climate change because "3 to 4 of every 10 non-permanent houses in cities in the developing countries are located in areas prone to floods, landslides, and other natural disasters" (UN HABITAT 2008a). This will intensify the negative impacts of emergencies because of the lack of infrastructure such as piped water, wastewater treatment, sanitation, reliable electricity supply, health clinics, and other social services that are essential for adequate response operations (Satterthwaite et al. 2007).

Even in places where disaster management institutions are in place, the poorest urban communities often are left out of the plans that could help them prepare for emergencies. This primarily is due to the contentious nature of the relationship between urban government officials and poor residents (particularly illegal slum dwellers), which hinders adaptation and disaster management planning. Poor residents often are seen as "the problem" and are thus specifically excluded from such action plans (Satterthwaite et al. 2007). Insecure tenancy also may mean that people are reluctant to leave their homes and belongings, putting their lives at greater risk during emergencies.

Climate change is likely to impact cities in a number of ways, including

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ABOVE: USAID providing relief in Sudan's North Darfur region. The conflict-ridden Darfur region has experienced significant land degradation, water scarcity, and drought.

sea level rise, severe weather events, water resources management, and the urban heat island effect. Each of these will have specific consequences unique to cities, owing to high population concentrations and the lack of physical and social infrastructure.

Sea Level Rise and Severe Weather

Approximately two thirds of the world's cities with populations greater than 5 million people are at least partially in a coastal zone, and a higher percentage of developing country cities are located along a coast than those in the developed world (Satterthwaite et al. 2007). Africa, Asia, Latin America, and the Caribbean all have large populations living in low-lying areas that will be vulnerable to sea level rise and increased storm surges. For instance, 6 of the 10 largest cities in Africa are located on the coast (UN HABITAT 2008b). Sea level rise can cause salt water intrusion into groundwater supplies, making it unfit for human consumption and agricultural use.

The impacts of storm surges on coastal cities are projected to vary by region, with the largest percentage of affected land area in Latin America and the Caribbean, the highest percentage of affected population in the Middle East and North Africa, and the greatest impact on GDP in East Asia and the Pacific (Dasgupta et al. 2009). According to one study of 84 developing countries, if storm surges intensify by 10 percent in the coming decades, the potential inundation zones of coastal areas will subject an additional 52 million people to flooding and other ill effects (Dasgupta et al. 2009). Water infrastructure in coastal cities is highly vulnerable to storms and flooding because it often is nonexistent, inadequate, or outdated, especially in slums and low-income urban areas. Such gaps increase exposure to the "potentially deadly" effects of storms and floods (Dasgupta et al. 2009).

Water Management

As more people move to cities, land is converted to dwellings and roads, which increases the amount of area covered by impervious surfaces. Packed earth, asphalt, and concrete reduce the amount of rainwater that can be absorbed into the ground. Rainfall runs off these surfaces into rivers and streams, overwhelming their capacity and resulting in flooding. The problem is compounded by lack of proper drainage networks. Flooding results in health problems such as cholera, dysentery, and other waterborne illnesses. A study by Action Aid on flooding in six of Africa's urban areas found that "there are few…collective mechanisms either for reducing flood risks or for managing floods once they do happen (Action Aid 2006).

The provision of fresh water already poses significant challenges for many cities. Growing populations, combined with the effects of climate change, are likely to worsen water scarcity. For example, the Peruvian capital of Lima obtains much of its water supply from glacial melt in the Cordillera Blanca. Climate change experts predict that the glaciers located below 5,500 feet may disappear completely by 2015, with significant negative effects on the urban water supply (INRENA 2005). Other cities rely on groundwater supplies from distant watersheds because local supplies are either depleted or polluted. Climate change effects in rural areas may impact the resources upon which urban areas depend.

Urban Heat Island Effect

Temperatures in urban areas can be as much as 6°C higher than in surrounding rural areas. Loss of vegetation that would normally provide a measure of cooling combined with large numbers of heat producing-appliances, automobile exhaust, and construction, drive up air temperatures. Cities are likely to become even hotter, the result of which "will be very hot conditions for more than half of the world's population" (Scott 2006). Abnormally high temperatures can be deadly, especially for vulnerable groups such as children, the elderly, and the poor. In 2003, the European heat wave killed an estimated 35,000 people (Larsen 2003). The consequences for developing countries may be much more pronounced given the low levels of disaster preparedness and the extreme vulnerability of millions of urban residents.

TRADITIONAL COPING STRATEGIES

Will the Same Strategies Still Work?

Humans have evolved numerous mechanisms for coping with environmental change and resource limitations. For example, pastoralists move from location to location seeking optimal food and water resources for their livestock. In times of environmental stress, these groups may be required to increase their range and travel further distances. Agriculturalists also attempt to cope with environmental stress by moving to more productive land when feasible (PAES 2003). However, in many parts of the world, groups now face the reality that these coping strategies may no longer be an option. In the case of pastoralist groups, traveling further afield may be made much more difficult by new roads and the development of large-scale commercial agriculture. Agricultural groups may find that shifting their plots to a more fertile location will bring them into conflict

with other groups. Other strategies, such as lengthening fallow periods or selling assets, may not be feasible or provide the same cushion as in the past.

Population Pressure and Land Degradation

In recent decades, dramatic population increases in developing countries have contributed significantly to land degradation and food insecurity. As households increase in number, the need for additional food production leads to land fragmentation, shortened fallow periods, and the intensification of agricultural production. These factors ultimately undermine the fertility of the land and reduce per capita agricultural output. One frequently employed strategy to address these shortfalls has been migration, whether of households or entire communities. In the past, this was often a viable option. Today, however, many groups find it difficult to locate to new areas that are both unclaimed and agriculturally productive.

Pastoralist coping mechanisms are equally at risk. As productive land has become progressively scarcer and valuable, agricultural communities have become less tolerant of increasing numbers of pastoral groups grazing on their land. In Darfur, many of the clashes that have occurred began as disputes over access to agricultural and grazing land (UNEP 2007). Climate change may intensify such dynamics by accelerating the rate at which land becomes too degraded to meet subsistence needs. As groups turn to traditional coping strategies, there is an increased risk that they will be brought into competition and conflict with other groups.

Levels of Adaptation

Climate change adaptation strategies will be necessary at all levels, from internationally funded projects and national government policy responses to community-level projects and household coping strategies. To the extent that these initiatives build resilience and response capacity, bolster human security, and reduce grievances, they can be instrumental in avoiding climate change-induced conflict.

Internationally Funded Adaptation

In 2007, USAID produced a guidance manual for development planning, "Adapting to Climate Variability and Change," whose aim is to help "Missions and other partners to understand how climate change may affect their project outcomes and identify adaptation options" (USAID 2007). The Australian Agency for International Development (AusAID), the Canadian International Development Agency (CIDA), the United Kingdom's Department for International Development (DfID), the Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ), the Japan International Cooperation Agency (JICA), and Swedish International Development Cooperation Agency (SIDA), among other bilateral donors, also have begun addressing climate change issues and have started mainstreaming climate concerns into forthcoming and existing project designs. Similarly, among multilateral donors, the World Bank, Asian Development Bank, African Development Bank, Inter-American Development Bank, and the G8 have major initiatives on climate change. All provide funds to support adaptation projects of various types (see Appendix 1 for short summaries of some of these bilateral and multilateral initiatives). However, pilot programs and projects are yet to appear that are designed explicitly to test the links between climate change and conflict.

Government-Level Adaptation

Policies implemented by governments can help strengthen community adaptation and significantly increase resilience. The development of such policies is being encouraged through the creation of National Adaptation Programmes of Action (NAPAs) under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC). According to the UNFCCC secretariat, "NAPAs provide a process for Least Developed Countries (LDCs) to identify priority activities that respond to their urgent and immediate needs with regard to adaptation to climate change" (UNFCCC n.d.).

NAPAs

NAPAs are a way for developing countries to address climate change priorities for which delay could "increase vulnerability or lead to increased costs at a later stage" (UNFCC n.d.). To date, 41 countries have submitted a NAPA.[2] Included in each is a list of prioritized activities that respond to the issues presented in the report. Examples of the proposed projects include country-wide surveys of available water resources, improving weather monitoring systems, restoring critical ecosystems, and investing in sustainable agricultural development. Upon completion, the Global Environment Facility (GEF) works with countries to develop project concepts, provides monetary support for selected projects, and assists countries in implementation.

Although the NAPAs are a good point of departure for developing countries to begin thinking about and responding to the challenges of climate change, their effectiveness as adaptation tools remains to be seen. Moving from analysis to implementation will be difficult. LDCs are by definition countries that have limited budgetary resources and

weak institutional capacities. Implementing climate change action plans alongside pre-existing development initiatives will mean overcoming or negotiating competing demands for funding and other program needs.

Technological Adaptation

Investing in technological adaptations such as water harvesting and irrigation works, sanitation systems, and early warning meteorological systems may help developing countries better cope with climate change. Reliable water for irrigation can help blunt the effects of drought, sanitation systems can make available safe water for consumption, and a country-wide network of weather monitoring stations can give policymakers data about climate change that increases their capacity to make informed interventions. Measures for technological adaptation may be expensive and involve a high degree of coordination in order to be developed and maintained effectively. However, they also promise a high return on investment by mitigating some of the most serious effects of climate change.

Facilitating Distribution Networks

Improving the road system and other transportation links between rural communities and urban centers will facilitate the development of distribution networks and increase human security by reducing the amount of time necessary to transfer food and other goods. In times when food security is threatened by natural disasters, a well-maintained and resilient transportation network is essential for delivering supplies to affected communities. Urban centers also benefit when transportation infrastructure has the capacity to adjust to regional variations in food production, ensuring that surplus food production in one area is not wasted, especially while residents in another area may be experiencing shortages.

Community-Level Adaptation

At the community level, adaptation responses are likely to focus on ways to increase livelihood and food security. Strategies may include:

Seed banks/food storage. Establishing seed banks and facilities for food storage can provide livelihood support for farmers and provide a buffer in times of food shortages.

Small irrigation projects. While large-scale irrigation projects are only feasible for governments, communities can develop local irrigation schemes that they implement and maintain. Diverting local water sources by channels or small generators can provide a buffer against total crop loss in the case of extreme weather.

Water management initiatives. Communities can adopt rain harvesting techniques that will allow them to collect water during downpours, allowing them to release water as necessary during dry periods.

Pesticides and fertilizer use. Climate change is likely to exacerbate land degradation and increase the prevalence of pests. In the past, communities abandoned cultivated areas in order to allow land fertility to return. Today, however, better access to agricultural inputs such as pesticides and fertilizers may sustain harvests and lengthen the time that people can remain on their land. Training in the proper use of these inputs is essential, however.

Household-Level Adaptation

Climate change also will require adaptation measures at the household level. Individuals will have to adjust livelihood strategies that are no longer viable and coping mechanisms that no longer work or may even increase insecurity.

Crop Choices

Farmers may address declining agricultural yields by re-evaluating longstanding choices about which crops to plant and at what time. In places where water scarcity is a problem, farmers may need to invest in drought resistant versions of traditional crops or shift cultivation to different plants altogether. In areas subject to intense rainfall or frequent flooding, farmers may have to shift to crops that can withstand periods of water logging. Dependence on livestock may no longer be a viable strategy in places where dry conditions and a lack of water and pasture are likely to worsen.

Reduction in Consumption

There also is the possibility that households will be unable to adapt their livelihood strategies sufficiently to stave off threats to their food security. During these times, many families simply will be forced to reduce consumption. This may be manifested in reduced caloric intake or elimination of non-essential spending. In the short-term, this is unlikely to lead to conflict. However, if climate change significantly alters either the duration or frequency of the lean season, households may be caught in downward spirals of deepening poverty and insecurity.

POTENTIAL PATHWAYS TO CONFLICT

"The threat of conflict is greater in areas where there are pre-existing governance problems and low institutional capacity."

IMPLICATIONS OF CLIMATE CHANGE FOR CONFLICT

The relationship posited between the consequences of climate change and violent conflict has its roots in the environmental security paradigm. After two decades of scholarship and analysis, the roles that natural resource management and environmental change sometimes play as factors contributing to insecurity, instability, and violence are now widely acknowledged. Climate change has been incorporated to some degree in these discussions, but they typically focus on more immediate instances of water scarcity, land scarcity, or conversely, resource abundance. More recently, however, as scientific evidence continues to accumulate, academics, think tanks, and development agencies have raised the profile of climate change and produced reports focusing more clearly on the potential for climate change to contribute to various forms of violent conflict (Reuveny 2007; Purvis and Busby 2004; WBGU 2008; CNA Corporation 2007; Campbell et al. 2007; CARE and Maplecroft 2008; and Smith and Vivekananda 2007).

This body of literature explores multiple causal pathways, with climate change viewed as one of a number of variables interacting with others in any given scenario leading to violence. In these scenarios, however, it is weak, corrupt, fragile, or failed governments that are nearly ubiquitous critical factors that cause or allow grievances to develop, mobilizations to occur, and violence to erupt.

Whether through slow incremental changes in weather patterns that accumulate over time or as the result of abrupt shocks such as natural hazards, there are two general paths for climate change and conflict that are identified:

First, climate change could intensify environmental or resource problems that communities are facing already, exacerbating grievances, overwhelming coping capacities, and at times spurring forced migration. In this instance, climate change places additional stress on pre-existing situations, worsening the quantity, condition, and distribution of already scarce natural resources.

Second, climate change could create new environmental problems that lead to instability. If coping strategies are unsuccessful or adaptation measures are not taken, the likelihood of conflict may increase as human security is eroded and grievances intensify.

Both of these paths posit scenarios in which the frequency or magnitude of climate-related changes or shocks overwhelm response capacity, exacerbate pre-existing grievances,

contribute to instability, and potentially lead to violent unrest. They anticipate that negative political, social, and economic trend lines will intensify, leading to greater stress on populations and households already living at the margin. The CNA Corporation's (2007) report on climate security, produced with the help of a dozen retired U.S. admirals and generals, argues that "climate change can act as a threat multiplier for instability in some of the most volatile regions of the world."

Analysts agree there is an alarming overlap between projected climate change hotspots and areas of already existing instability. International Alert terms this a dual deficiency: "the two parts are mutually reinforcing; many of the countries predicted to be worst affected by climate change are also affected or threatened by violence and instability" (Sida 2008).[3] The countries that are most unstable, fragile, impoverished, and unable to respond to their citizens' grievances are most susceptible to the destabilizing consequences of climate change (Purvis and Busby 2004; WBGU 2008). These countries lack the institutions, economic stability, civil society, and social capital to withstand increases in the frequency and severity of extreme weather events.

A group of scientists and policy experts from a wide range of fields, including foreign policy, history, and national security were brought together by the Center for Strategic and International Studies (CSIS) and the Center for a New American Security to review three possible climate change scenarios and their security implications. In the edited volume that summarized their findings, the contributors came to the conclusion that "the United States can expect that climate change will exacerbate already existing North-South tensions, dramatically increase global migration both inside and between nations, lead to increasingly serious public health problems, heighten interstate tension and possibly conflict over resources, collapse agricultural markets and global fisheries, challenge the institutions of global governance, cause potentially destabilizing domestic political and social repercussions, and spur unpredictable shifts in the global balance of power" (Campbell and Weitz 2008). The group of contributors also agreed that "destabilizing global events are clearly on the horizon" and that their work "makes clear, climate change has the potential to be one of the greatest national security challenges that this or any other generation of policymakers is likely to confront" (Campbell and Weitz 2008). The CNA Corporation's (2007) study echoes these findings, noting that "in the national and international security environment, climate change threatens to add new hostile and stressing factors. On the simplest level, it has the potential to create sustained natural and humanitarian disasters on a scale far beyond those we see today."

THE ROLE OF GOVERNANCE

The threat of conflict is greater in areas where there are pre-existing governance problems and low institutional capacity. Institutional weaknesses and failures that inhibit or prevent credible government responses to perceived problems may contribute significantly to the potential for conflict. The inability of governments to respond adequately to climate-related challenges may lead to further reductions in perceived government legitimacy. While cumulative environmental degradation and stress are not likely to trigger conflict within a short time

"The inability of governments to respond adequately to climate-related challenges may lead to further reductions in perceived government legitimacy."

horizon, a steady build-up of environmental problems coupled with weak government responses and ongoing social, political, and economic challenges—or a dramatic and sudden environmental shock—may trigger instability and mobilization. Some observers remain skeptical about the circumstances under which the threshold to conflict may be surpassed. For example, the German Advisory Council on Global Change (WBGU) argues that the evidence is still limited that conflict increases in fragile states as a result of environmental degradation. Nevertheless, the WBGU believes that over time the unprecedented environmental changes anticipated as a result of climate change could play a role in the instability of states (WBGU 2008).

Scholars looking at the causes of conflict emphasize the importance of government legitimacy and effectiveness as measured by public perceptions as a factor in the outbreak of violence. Legitimacy can be eroded in various ways, including government incapacity to remedy serious problems or a complete absence of government response. Unmet expectations lead to frustration and aggression against a society's ruling authorities. Tremblay et al. (2003) argue that when parties engage in violence, "it is frequently due to the lack of residual support or political legitimacy that the state experiences and to the breakdown of the normative ordering." The erosion of a society's basic needs and social trust can be caused by the interactions of unstable institutions and rapid population growth with the kinds of problems of livelihood insecurity and resource scarcity that are made more acute by climate change.

Colin Kahl's (2006) discussion of the state failure hypothesis supports the idea that violent conflict could result as a consequence of climate-induced stresses in combination with other factors. Kahl explains that "large-scale violence is only likely to occur when social grievances emanating from rapid population growth, environmental degradation, and natural resource scarcity combine with eroding state authority and escalating intra-elite competition." Further, "severe demographic and environmental stress can threaten the capacity, legitimacy, and cohesion of the state in developing countries by simultaneously increasing demands for government expenditures, exacerbating intra-elite competition, and decreasing government revenues" (Kahl 2006). At just the time the state needs to respond to pressing problems, it lacks the funds necessary to try to alleviate suffering. This dilemma may then aggravate and worsen existing cleavages in society, especially among contending elites. Stability is threatened by the tensions and violence that may result from this confluence of circumstances. As Nigel Purvis and Joshua Busby (2004) conclude, "weak states have almost no capacity to respond to climate change or prevent it from triggering a large-scale humanitarian disaster."

International Alert emphasizes the importance of governance in relation to climate change-related instability: "[P]olitical stability rests on the strength of the social contract between the government and its citizens. When the state is perceived to be failing in its basic functions, this contract is eroded" (Sida 2008). If climate change leads to heightened threats to human security, demands on government will increase. How the government responds to the new and larger demands is critical. International Alert notes that governments can either "moderate" or "accelerate" the outcomes of climate change according to policy responses, and how they respond will influence the threat of violent reaction (Sida 2008). At the same time, the demands of climate change could diminish the capacity of a government to provide essential services (e.g., public safety, health and nutrition, education), increasing the likelihood of aggrieved reactions that lead to violence. International Alert states the threat in strong terms:

"From everything we know about how mutually interlocking factors such as poverty, bad governance and the legacy of past conflicts generate risks of new violence, it is safe to predict that the consequences of climate change will combine with other factors to put additional strain on already fragile social and political systems. These are the conditions in which conflicts flourish and cannot be resolved without violence because governments are arbitrary, inept and corrupt. If the relationship between climate change and violent conflict is not addressed, there will be a vicious circle of failure to adapt to climate change, worsening the risk of violent conflict and, in turn, reducing further the ability to adapt" (Sida 2008).

The CNA Corporation also envisions a confluence of factors that can overwhelm weak or flawed systems of governance and public institutions. Climate change impacts:

"… will likely foster political instability where societal demands exceed the capacity of governments to cope… Economic and environmental conditions in already fragile areas will further erode as food production declines, diseases increase, clean water becomes increasingly scarce, and large populations move in search of resources. Weakened and failing governments, with an already thin margin for survival, foster the conditions for internal conflicts, extremism, and movement toward increased authoritarianism and radical

ideologies" (CNA Corporation 2007).

For International Alert, "the issue of adaptation to climate change is at heart a matter of governance—the strength of government institutions, the state's efficiency (or lack of it) in providing basic services, and the influence of regional and international cooperation. It is the state's job to handle the effects of climate change so as to minimise harm to its citizens; states with good governance are by definition better equipped for the task than those without" (Sida 2008). Campbell and Weitz describe the potential for a marked loss in public confidence in national leadership, leading to scenarios of rapid alternation of ineffectual governments or even outright coups attempts. Ultimately, the role of climate change in these scenarios is to cause more chaos and crisis in conflict-prone states and push weak states closer to the brink of outright violence or collapse (Campbell and Weitz 2008).

WHAT CLIMATE CHANGE CONSEQUENCES MIGHT BE LINKED TO CONFLICT AND IN WHAT WAYS?

The German Advisory Council on Global Change (WBGU) has tried to elaborate and schematize the possible linkages between climate change and conflict through four scenarios: 1) climate-induced degradation of freshwater resources; 2) climate-induced decline in food production; 3) climate-induced increase in storm and flood disasters; and 4) environmentally induced migration (WBGU 2008).

In the climate-induced water crisis scenario, a regional water crisis, resulting from a combination of increased demand for agriculture, poor water management, and political instability, sparks destabilization, and ultimately, violent conflict. In the food production scenario, violent crisis begins with a decline in food output in the context of competing land-use needs, economic weaknesses, social and community instability, and global market factors. The disasters scenario is triggered by a significant storm or flood event that is exacerbated by a political power vacuum, problems with emergency responses, and the creation or intensification of ongoing conflicts. The scenario of environmentally induced migration results in violent conflict through the low capacity of relevant institutions and governance structures, shifts in ethnic composition, and competition for resources. Figure 2 (above) summarizes the key factors and

Figure 2: WBGU conflict constellations chart

Key factors / Conflict constellation	State constitution, political stability	Governance structures	Economic performance and distributional equity	Social stability and demographics	Geographical factors	International power distribution and interdependency
Degradation of freshwater resources	General relevance	Effective national and international water management prevents crisis	High conflict potential in DCs due to great dependence upon agricultural sector	High risk of water crises due to rising demand in conjunction with stagnating supply	High risk of local conflict in catchment areas Risk of regional destabilization ('spillover')	High conflict potential due to disparate national interests and local needs
Decline in food production	General relevance	High conflict potential where land-use rights are inequitable	High conflict potential in DCs due to great dependence upon agricultural sector	High risk of food crisis due to drought and population growth and density	Risk of regional destabilization ('spillover')	Major relevance of world market conditions in cases where agricultural production declines
Increase in storm and flood disasters	General relevance Acute pressure to act compromises government legitimacy	Effective disaster risk management prevents crisis	High conflict potential in DCs Elevated conflict potential in ICs due to dependence upon complex infrastructures	High conflict potential due to high population density and weak institutions	Risk of regional destabilization ('spillover')	General relevance
Migration	General relevance	Effective migration management prevents crisis	High conflict potential in DCs	High conflict potential due to changes in or instrumentalization of ethnic composition	Elevated conflict risk due to mounting resource competition in destination country	General relevance
General relevance for all conflict constellations	Lack of stability acts as catalyst High conflict risk in periods of state transition (e.g. democratization)	Effective performance of state governance functions forestalls crisis and conflict	Poverty and socio-economic disparities increase susceptibility to crisis and potential for conflict	High risk of conflict where civil society structures are weak	Increased potential for conflict with neighbouring countries	Divergent impacts of economic integration and world market conditions Cooperative foreign policy and action forestalls conflict

SOURCE: WBGU 2008. DC = DEVELOPING COUNTRIES; IC = INDUSTRIALIZED COUNTRIES

interactions for these four scenarios. International Alert views the threat of conflict as originating in four problem areas made worse by climate change: political instability, economic weakness, food insecurity, and demographic change (Sida 2008). Where political instability reigns, "climate change will put increased pressure on basic state functions such as the provision of basic health care and the guarantee of basic food security." Economic weakness produces a double-sided dilemma: "[The] impacts of climate change will hinder economic development and the lack of economic development hinders the ability to adapt to climate change. Climate change can thus increase obstacles to economic development, worsening poverty and thereby increasing the risk of violent conflict in these states." Climate threats to food security are projected "to have a profound and destabilising effect on ordinary people's daily lives." With respect to demography, alterations in the number or location of population "always entail a change in power systems and resource allocation. Climate change-related movements of people will place strain on host communities that already have scarce resources, whether because of population growth, government policy or as an effect of climate change itself" (Sida 2008). With the addition of climate change to each of these four problems areas, the threat of violent upheaval intensifies. Based on their research on vulnerability resulting from climate change, CARE and Maplecroft (2008) are more circumspect in their analysis of potential conflict. Their recent report simply notes that "we consider drought, with its implications for water shortages and food insecurity, the most significant weather-related hazard contributing to conflict" (CARE and Maplecroft 2008).

However, three different scenarios—"expected," "severe," and "catastrophic"—developed by the Center for Strategic and International Studies (CSIS) and the Center for a New American Security (CNAS) suggest that conflict linked to climate change might be more pervasive (Campbell and Parthemore 2008). These scenarios, informed by the IPCC Assessment Report 4, but modified by other scientific sources and the expertise of the participants, all contain various elements of violence and armed conflict. Migration, instability, and violent unrest are all considered plausible consequences, worsening according to the severity of the expected climate changes.

In the "expected" scenario of a 1.3°C warming by 2040, also identified as the least that planners should be prepared for, there are anticipated "internal and cross-border tensions caused by large-scale migrations; conflict sparked by resource scarcity, particularly in the weak and failing states of Africa; [and] increased disease proliferation, which will have economic consequences" (Campbell and Weitz 2008). As a result of changing economic and social conditions, "countries with weak or nondemocratic political foundations [face] a heightened risk of civil war or a toppling of the government" (Podesta and Ogden 2008).

In the "severe" scenario based on an increased average temperature of 2.6°C by 2040, "internal cohesion of nations will be under great stress," "protests, civil unrest, and violent upheaval of governments are possible," and "armed conflict between nations over resources and even territory is likely, and even a rise in nuclear tensions is possible" (Campbell and Weitz 2008). Significantly, the "nonlinear" changes in climate are expected to produce "nonlinear" political and social repercussions (Fuerth 2008). The "catastrophic" scenario is based on a 5.6°C rise in temperature by 2100 in which changes in climate will be massive and sudden. It projects "rage at government's inability to deal with abrupt and unpredictable crises," "hostility and violence toward migrants and minority groups," and "electricity generation and distribution highly vulnerable to attack by terrorists and rogue states" (Campbell and Weitz 2008). Acute challenges will be faced in relation to temperature, water, food productivity, and health all over the planet. There will be a dramatic increase in failing states, failed states, and intrastate wars.

The basic point underlying all of these scenarios is that the effects of climate change, whether moderate or harsh, will intertwine in meaningful ways with economic, social, and political systems in conflict-prone countries, with important specificities in each instance. For example, as Erika Weinthal (2008) puts it with respect to Central Asia, "…these systems are all interlinked. If we just focus on the snowmelt and what is happening with the glaciers, we will fail to see what is happening downstream in Uzbekistan and Turkmenistan. Here you find a system of cotton farming, which in turn is linked to government and social control. If these countries find themselves forced to restructure their entire economies so as to be able to deal with climate change, they may find themselves facing increased social unrest."

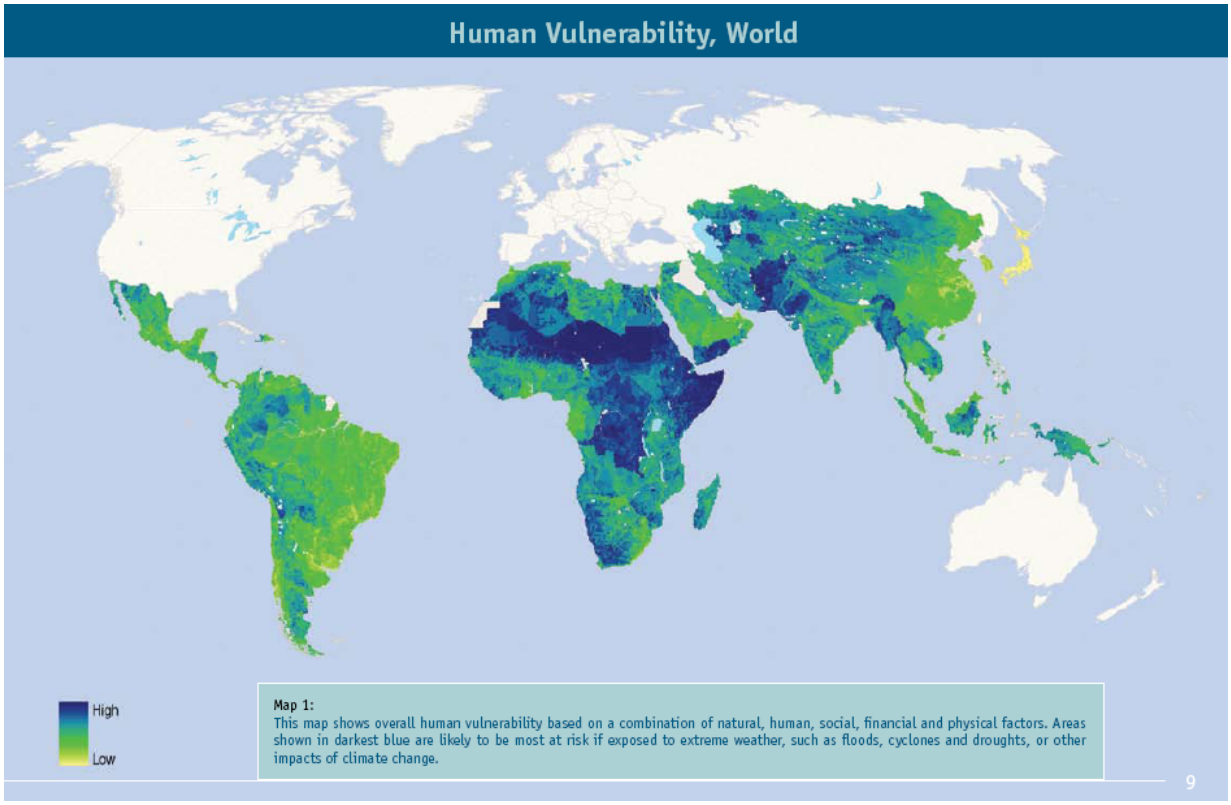
A final consideration in relation to climate change and conflict is the potential for heightened tensions between developed and developing nations. At the international level, despite rising greenhouse gas emissions from China and India, as well as the role of deforestation in places like Brazil and Indonesia, climate change is viewed by many

developing countries as a problem visited upon them by advanced industrialized nations. These resentments may deepen over time, accompanied by growing requests for climate-related donor assistance "over and above" traditional development assistance. At the same time, given that response capacity is a crucial determinant of the impact of climate change, the effects of climate change could increase further the development gap that exists between developed and developing nations. As the WBGU notes, "the greater the damage and the burden of adaptation in the South, the more intensive the distributional conflicts between the main drivers of climate change and those most affected will become" (WBGU 2008). A growing sense of relative deprivation, not just within countries but between countries, could add a further layer of resentment and an additional incentive to mobilize resources for confrontation or conflict.

WHICH COUNTRIES ARE VULNERABLE TO CLIMATE-RELATED CONFLICTS?

Attempts by climate scientists to predict the geographical distribution of climate change impacts are still in their early stages. However, the IPCC (2007a) predicts a few basic trends with relative certainty, notably including the "virtual certainty" (i.e., greater than a 99 percent probability) of "warmer and more frequent hot days and nights over most land areas" and the "very likely" (i.e., greater than 90 percent) probability of "heavy precipitation events… over most areas." A few organizations have taken these basic parameters and combined them with other factors to begin to map out vulnerability to climate change across the globe. Based on the previous discussion of the postulated linkages between climate change and conflict, a country's likely vulnerability to climate change is a relevant consideration in thinking about its vulnerability to conflict.

Figure 3: Vulnerability map



SOURCE: CARE AND MAPLECROFT 2008.

CARE's and Maplecroft's human vulnerability map (Figure 3) is based on five vulnerability categories, including natural, human, social, financial, and physical aspects. As indicated in the caption, areas shown in the darkest blue are the most at risk to the impacts of climate change. Each of these categories contains at least one indicator; several contain multiple indicators. While its aim is to identify areas where grave vulnerability could lead to

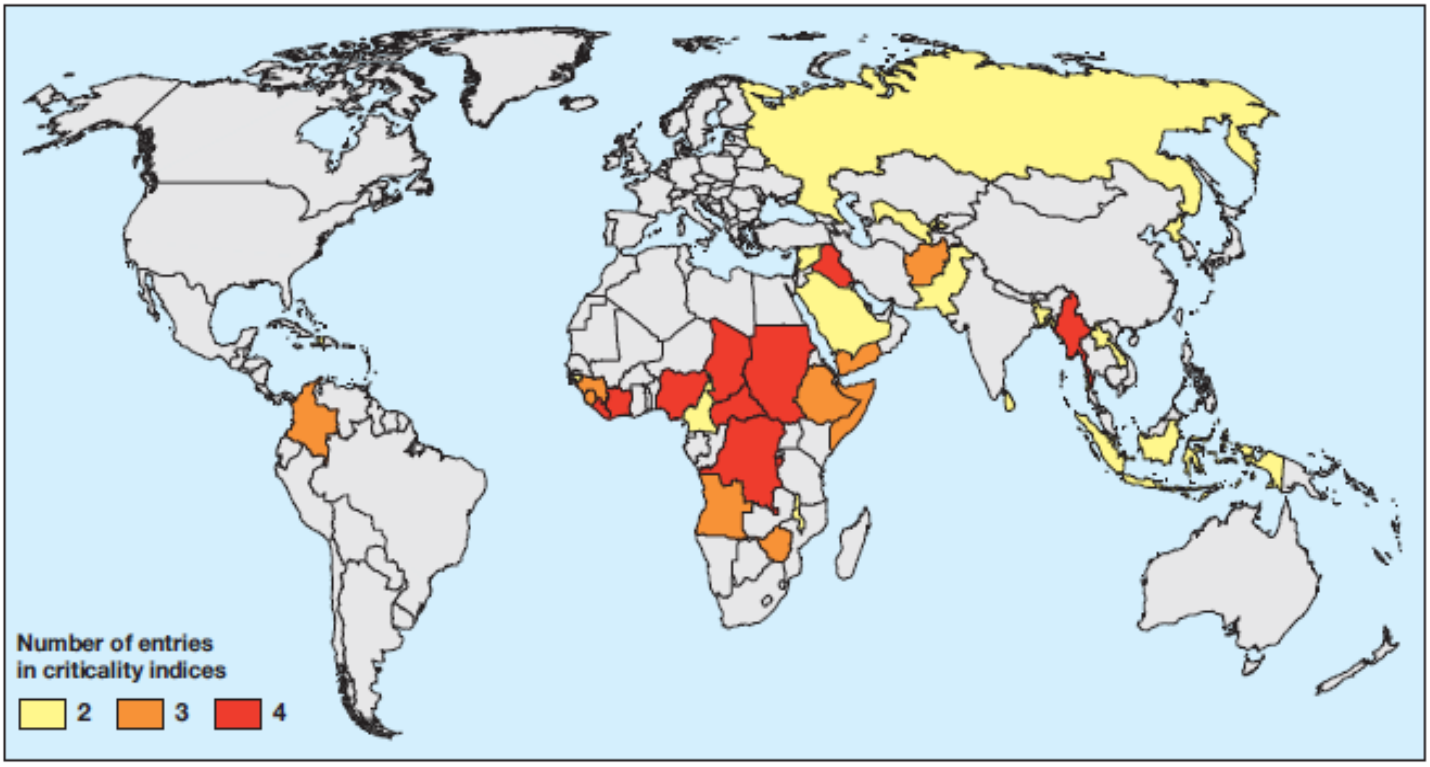
humanitarian crises (which are not necessarily linked to conflict), the social vulnerability category does contain conflict indicators. The authors note that "conflict and political violence reduces the capacity of a population to make adaptive changes in response to climate changes and increases vulnerability" (CARE and Maplecroft 2008). As shown, much of sub-Saharan Africa, parts of the Middle East and Central Asia, and a few areas in Latin America, notably the Andes, are especially vulnerable to the negative consequences of climate change.

In its analysis of climate change and conflict, the WBGU found the number of states potentially "at risk of further destabilization" from climate effects to be very large. To limit the number somewhat, the WBGU developed a list of 34 countries most at risk based on inclusion in 2 or more of 4 leading conflict and governance "criticality" indices (the World Bank's Bad Governance Index, Freedom House's Level of Freedom Index, the Working Group on the Causes of War's Prevalence of Armed Conflict, and the Fund for Peace's and Foreign Policy's Failed States Index). Most of these countries have experienced violent conflict in the recent past; the densest cluster is again found in Africa. The states identified by the WBGU include the following (see Figure 4):

- Sub-Saharan Africa: Burundi, Chad, Central African Republic, Côte d'Ivoire, Democratic Republic of Congo, Liberia, Nigeria, Sudan, Angola, Ethiopia, Guinea, Sierra Leone, Somalia, Zimbabwe, Cameroon, Guinea-Bissau, and Malawi;
- Central America and the Caribbean: Colombia and Haiti;
- Middle East: Iraq, Yemen, Lebanon, Saudi Arabia, and Syria;
- Eastern Europe and Central Asia: Afghanistan, Russia, and Uzbekistan; and
- South and South-East Asia: Myanmar, Bangladesh, Indonesia, Laos, North Korea, Pakistan, and Sri Lanka (WBGU 2008).

International Alert identified 46 countries facing significant risk of conflict as a result of the effects of climate change. In addition to climate factors, these countries were selected based on their listing in several well-known global indices tracking fragility, conflict, and low-income status (UK DFID's fragile states list, the Global Peace Index, International Crisis Group's Crisis Watch list, and the World Bank's Low Income Countries Under Stress list), the existence of UN peacekeepers, their current or recent incidence of war, their vulnerable governance structures, and weak

Figure 4: Weak and fragile states at risk of further destabilization from climate change



SOURCE: WBGU 2008.

economic indicators (Sida 2008). The 46 countries on this list include: Afghanistan, Algeria, Angola, Bangladesh, Bolivia, Bosnia & Herzegovina, Burma, Burundi, Central African Republic, Chad, Colombia, Congo, Côte d'Ivoire, Democratic Republic of Congo, Djibouti, Eritrea, Ethiopia, Ghana, Guinea, Guinea Bissau, Haiti, India, Indonesia, Iran, Iraq, Israel & Occupied Territories, Jordan, Lebanon, Liberia, Nepal, Nigeria, Pakistan, Peru, Philippines, Rwanda, Senegal, Sierra Leone, Solomon Islands, Somalia, Somaliland, Sri Lanka, Sudan, Syria, Uganda, Uzbekistan, and Zimbabwe (Sida 2008).

TWO SPECIAL TYPES OF CLIMATE-RELATED VIOLENT CONFLICTS

Migration and Conflict

There is a consensus that one of the potentially most significant linkages between climate change and conflict is likely to derive from migration. In January 2009, the United Nations High Commissioner for Refugees (UNHCR), António Guterres, told the UN Security Council that "conflict, climate change and extreme deprivation will inter-relate, strengthening each other as a cause of displacement" (UN News Service 2009).

Increased migration is one of "ten highly consequential implications of climate change" identified by the contributors to the CNAS project (Campbell and Weitz 2008). According to Campbell and Weitz, "massive migrations within a relatively short time are likely to be deeply problematic for the 'host' countries for these climate refugees." Research has shown that people tend to move along somewhat predictable pathways, generally preferring to migrate to areas where they have prior connections, but refugee groups tend to change the composition of the areas into which they move (IOM 2008). In some situations, migrants could bear the brunt of unresolved social and historical problems. In addition to competition over scarce resources, migrants can easily become a target or scapegoat for mounting pressures and problems that may have only indirect ties to the recently arrived groups.

In an article on migration and violence resulting from climate change, Rafael Reuveny (2007) explains the process through four "channels" and certain "auxiliary conditions." He argues that when at least two of these four channels interact with auxiliary conditions, conflict linked to climate-induced migration is "more likely." The four channels include the following: 1) competition over natural and economic resources; 2) ethnic tensions between migrants and residents; 3) distrust between the new arrivals and host communities; and 4) fault lines developing across socioeconomic issues. The auxiliary conditions pertain to the coping capacity of recipient areas. What makes climate-induced migration different from ordinary migration is the "scope" and "speed" of climate-related incidents (Reuveny 2007).

How and whether population movements take place is complex, influenced by numerous factors, from government policy to community-level resilience and the strength of social networks. Migration is not typically the first coping strategy employed. According to the IOM, most households will first rely on the sale of assets, moving only when the situation becomes untenable and the government has proved itself incapable of providing necessary assistance (2008). Projections of climate change-induced migration are

"Projections of climate change-induced migration are difficult because the exact spatial distribution of shocks (such as droughts or severe storms) is impossible to predict."

difficult because the exact spatial distribution of shocks (such as droughts or severe storms) is impossible to predict. However, even if relatively modest numbers of people are displaced over the next few decades (and low end estimates run in the millions), there will be a significantly increased risk for conflict.

Yet, Vikram Kolmannskog (2008) of the Norwegian Refugee Council cautions that "the term 'climate refugees' implies a mono-causality that one rarely finds in human reality. No one factor, event or process, inevitably results in forced migration or conflict." Correspondingly, "conflict potential normally depends on a range of socio-economic and political factors often similar to those that can trigger forced migration" (Kolmannskog 2008).

Terrorism

In the view of some, another form of violence and unrest that could result from unmitigated climate change is terrorism. The same basic climate-conflict dynamic applies, although in a more acute form: "When a government can no longer deliver services to its people, ensure domestic order, and protect the nation's borders from invasion, conditions are ripe for turmoil, extremism, and terrorism to fill the vacuum" (CNA Corporation 2007). Admiral T. Joseph Lopez sees these unstable conditions as connected to the poverty, forced migrations, and higher unemployment likely to result from climate change (CNA Corporation 2007). Reuveny (2007) believes that climate change-induced migration and conflict could contribute to the growth of terrorism. In his view, "the inevitable feeling of hostility may foster a fertile atmosphere for global terrorism recruitment." In most cases, the threat of terrorist activities is linked to state failure. General Anthony Zinni highlights the significance of the state's role in allowing or preventing terrorist groups to form in areas hit hard by climate change. As he argues, "if the government is not able to cope with the effects, and if other institutions are unable to cope, then you can be faced with a collapsing state. And these end up as breeding grounds for instability, for insurgencies, for warlords. You start to see real extremism. These places act like Petri dishes for extremism and for terrorist networks" (CNA Corporation 2007). Put somewhat more systematically, the hypothesized relationship is that 1) climate change creates hardships and exposes government inability or unwillingness to respond, eroding legitimacy and creating grievances; 2) climate change is viewed as an injustice imposed by the West, thereby creating the basis for anti-Western recruitment and mobilization; and 3) climate change-induced grievances thus may provide windows of opportunity for terrorists, especially when linked to the kind of severe events that often act as triggers.

INRENA

ABOVE: Yanamarey Glacier, Peru in 1987.

INRENA

ABOVE: Yanamarey Glacier, Peru in 2004.

CLIMATE CHANGE AND STATES IN CONFLICT: THE FEEDBACK LOOP

States prone to conflict or embroiled in conflict will find it difficult or impossible to develop or implement climate adaptation plans. A country experiencing unrest or violent conflict will not be able to collect and track the data necessary to respond to climate change-related impacts. Essential ingredients for effective climate adaptation measures, including the ability to identify and put into practice actions that incorporate a diverse set of

stakeholders will be almost nonexistent. Absent a response to negative climate effects, the problems of insecurity or perceived injustice that trigger or amplify grievances leading to conflict are likely to worsen and perhaps be joined by new ones. The difficulty of conflict resolution in conflict zones also may increase with the disruptions of more frequent extreme weather events. The cycle of violence may intensify and prove even more difficult to end.

According to International Alert, "if nothing is done, the relationship between the two parts of the [conflict-climate] problem will be mutually and negatively reinforcing" (Sida 2008). By way of analogy, this cycle of violence can be compared to the feedback loop that many climate scientists believe to be speeding Arctic glacier melt. Melting ice exposes darker water and land surfaces, which trap more heat and then accelerate the further melting of ice. Similarly, conflict precludes effective responses to climate change effects, maximizing their impact, which in turn is likely to accelerate or aggravate conflict itself.

CONCLUSION

"More granularity in the understanding of the climate-conflict relationship in specific countries or regions will not only help development agencies determine where they should focus their efforts but also will contribute to a better understanding of how they might devote their resources to conflict prevention or mitigation."

GAPS IN KNOWLEDGE

Gaps in knowledge about linkages between conflict and climate change derive in part from uncertainties surrounding each of these two issue-areas. While there is general agreement that conflict results from a series of events that can be captured through such concepts as greed, grievances, groupness, mobilization, governance, institutional weakness, and windows of opportunity, each of these concepts is subject to varying interpretations and considerable debate. Moreover, although violent conflict is often connected to weak, fragile, failed or failing states, scholars and analysts do not agree fully on the causes of weak, fragile, failed or failing states. Therefore, as Monty Marshall (2008) points out, there is a lack of consensus on which states should receive priority attention and assistance.

Climate science has advanced to the stage that there is a consensus that future temperature increases over land are considered virtually certain, and it is very likely (greater than 90 percent probability) that most of the observed increase in globally averaged temperatures since the mid-20th century is due to the observed increase in human-caused greenhouse gas concentrations (IPCC 2007c). However, the timing, extent, and exact distribution of future temperature increases and intense precipitation are not known. While some very preliminary projections exist for regions or select countries, subnational data or projections are still speculative. Cross-cutting early warning systems, such as the USAID-sponsored Famine Early Warning Systems Network (FEWS NET), which brings together both meteorological data and information about crop conditions, are very limited in number and need to be further developed and strengthened.

As a consequence, given the uncertainties about which countries are most conflict-prone and which countries or zones are most vulnerable to threats from climate change, a major gap in knowledge is a more precise understanding of where development agencies should focus their limited resources to prevent negative conflict-climate change synergies. Some broad areas already very likely to be acutely vulnerable can be identified (e.g., Horn of Africa, Central Africa, Central Asia, the Andes), but much more work needs to be done. In part, the challenge is to keep fully abreast of what is a large and fast-moving research agenda for both conflict studies and climate science.

A wide array of governments, international organizations, research institutes, and NGOs are generating assessment tools that variously provide information on climate variables and projections, climate

impacts, climate-related and non-climate-related vulnerability data, and vulnerability mapping. Very few of these efforts focus directly on the climate-conflict nexus. The work of organizations like CARE and Maplecroft does examine issues of human insecurity and state fragility, but at a high level of aggregation (i.e., regions, countries) that provides a useful general orientation but very little operational guidance for development agencies.

Nevertheless, some possible elements of an integrated climate-conflict research agenda can be identified. It is generally agreed that environmental factors, including climate change, are contributing factors to conflict, while the underlying political, economic, social, and cultural context has a stronger and more direct causal relationship. In other words, climate change is best thought of as an aggravating factor or trigger in places where some of the characteristic ingredients for conflict already exist.

One major ingredient is flawed or weak governance. Governance is a concept that can be disaggregated in a number of ways. For example, the World Bank uses six dimensions to measure governance: voice and accountability; political stability and absence of violence; government effectiveness; regulatory quality; rule of law; and control of corruption (Kaufmann et al. 2009). Another related or overlapping ingredient is state weakness, fragility, or instability. Researchers at the Center for Global Policy at George Mason University have designed a State Fragility Index based on scores of "effectiveness" and "legitimacy." Both the effectiveness score and the legitimacy score make use of composite indicators linked to state performance in relation to security and political, economic, and social variables (Marshall and Cole 2008). Other indices use other conflict variables, such as regime type, infant mortality, state-led discrimination, militarization, and the "bad neighborhood" syndrome (Goldstone et al. 2005; Hewitt et al. 2008). Setting aside the relative merits of these analytic frameworks, the essential point is that one area for research would be to ask whether climate change is likely to have a greater impact on some of these disaggregated elements of governance and state fragility than others. For example, will climate change lead to particularly acute challenges for the rule of law, the control of corruption, or public perceptions of voice and accountability? Or will the effects of climate change be especially destabilizing for certain sorts of political, social, and economic configurations (e.g., dispute resolution mechanisms, roles of the military, authority of traditional leaders, types of land tenure)? If so, by what pathways? Beginning to develop a clearer understanding of these kinds of relationships may provide the basis for the differentiation and prioritization of possible policy interventions.

However, the research challenge can be posed another way. The analysis and discussion of the climate-conflict relationship to date is very largely conceptual, schematic, and deductive. Extreme weather (droughts, floods, typhoons) is likely to threaten human security and well-being (livelihoods, food security, health, forced migration) resulting in grievances (protests, unrest, social discontent) that will potentially overwhelm the governance capacities of fragile states (access, institutions, policy response, project implementation) and result in mobilization and violent conflict (uprisings, ethnic clashes, rebellions, coups). What is missing is a more inductive or case study exploration of what this all might mean in specific settings and real locations (countries, regions, transboundary areas) of interest to policymakers and development agencies. This would require a focused effort to look at how the political, social, economic, and cultural specificities of select conflict-prone states are likely to interact with best-estimate climate change effects, probable vulnerability, and adaptive capacities within the geographic limits and ecological characteristics of those states. More granularity in the understanding of the climate-conflict relationship in specific countries or regions will not only help development agencies determine where they should focus their efforts but also will contribute to a better understanding of how they might devote their resources to conflict prevention or mitigation.

WHAT KIND OF ADAPTATION AND WHERE?

Since 1991, USAID has devoted most of its climate-related resources to mitigation, focusing on mitigating climate change though programs in such areas as energy efficiency and forest conservation. The agency states that "USAID commits about $195 million each year to support climate change related development activities" (USAID 2008b), while the U.S. State Department reports that USAID funding for direct adaptation activities was US$14 million in 2007 and approximately US$13 million in 2008" (DOS 2008). As mentioned earlier, USAID has published a guidance manual for "Adapting to Climate Variability and Change," which describes a six-step process to assess vulnerabilities and identify and incorporate appropriate climate adaptation measures into its project activities. Between the meta-level challenge of climate change mitigation and the micro-level task of ensuring

that projects take into account and adapt to the anticipated effects of climate change ("climate-proofing"), there is a still-underdeveloped meso-level for the formulation of policies and programs whose purpose is not to adapt already existing or planned projects to climate change but rather to design and put in place projects whose main purpose is climate change adaptation ("discrete adaptation").[4] On a select basis—the obvious candidates would be projects intended for already conflict-prone areas—some of these projects might provide support for conflict management and mitigation through "conflict-proofing" based on strengthening relevant adaptive capacities.

The imbalance or gaps in location-specific inductive knowledge and the imbalance or gaps in adaptation-specific programmatic or project efforts are two sides of the same coin. Increasing knowledge through targeted case studies is a first step toward providing the basis for country-specific or location-specific climate adaptation programs.[5] In relation to conflict issues, USAID's "Adapting to Climate Variability and Change" offers a constructive list of climate adaptation responses under the heading of "peace and security," including strengthening institutional capacity, livelihood resilience, early warning programs, safety net measures, and conflict management capacities (USAID 2007). However, the hanging questions are: Which of these positive steps should be undertaken where, under what circumstances, with what caveats, and how? These are questions that can only be answered from focused investigation, including strong stakeholder participation that produces an expanded base of location-specific, policy-relevant knowledge. With that added knowledge, adaptation plans can be made to be sensitive to conflict vulnerabilities as well as to the fundamental threats to livelihoods, food supplies, water resources, and health posed by climate change.

PITFALLS, RISKS, AND COST-BENEFIT CALCULATIONS

As donor governments and multilateral institutions mobilize large financial resources to help vulnerable countries address climate adaptation challenges, it will be important to see that costly initiatives do not run ahead of firm evidence that they are meeting their stated goals. As a response to the existing gaps in knowledge, the prudent option is to focus on a spectrum of relatively small-scale pilot projects that test the effectiveness of different approaches to climate adaptation. Some of these also may be "no regrets" or "low regrets" interventions that bring benefits independent of their direct contribution to climate adaptation. There also is a need to identify already approved national plans and projects that may lead to climate maladaptation. As the Organization for Economic Cooperation and Development (OECD) notes, "planned development of certain geographical zones (e.g., coastal areas vulnerable to sea-level rise and storm surges) or sectors (such as hydropower in the energy sector) may be viewed in a different light when the medium- to long-term risks posed by climate change are taken into consideration" (OECD 2009).

Indeed, the entire domain of risks, costs and benefits, and the development of relevant metrics and indicators is an important area of research in relation to climate change, adaptation, and conflict. Climate change presents the conundrum of increasingly frequent high-impact events (droughts, floods, storms) in combination with highly uncertain timing and location—as well as limited financial resources, still-untested climate adaptation techniques, and unclear linkages to conflict. Added to this is the reality that inaction is not a practical option. However daunting, this difficult problematic has affinities with complex forms of insurance that have evolved to address such multilayered contingencies. Economists and other experts in this field can help to prioritize information needs, bracket the range of costs and benefits, and clarify some of the options faced by decision makers.

CURRENT LESSONS AND RESOURCES

The climate adaptation assessment tools currently being used appear to have a stronger focus on physical or applied science than on social science, although some attention is being given to community-based approaches (Osman Elasha 2006). Yet, as the OECD notes, "adaptation activities are often best observed at the local level," and "[d]ecisions about livelihood strategies and investments can represent real-life demonstrations of adaptation" (OECD 2009). If one assumes that the climate vulnerabilities and risks seen now are going to be worsened by climate change, assessments can look at how people are responding to changes that are currently occurring and determine how resilient these responses may be to present and future climate change. Hence, an additional area for research is to gather the lessons learned from real-life efforts to adapt to climate variability in vulnerable regions and communities and apply them to future planning. Successful climate adaptation practices that emerge from such investigations should be made part of broader campaigns to

disseminate information, increase awareness, and build capacity through civil society organizations and community associations.

The National Adaptation Programmes of Action (NAPAs) that have been prepared are a basic resource that provides a starting point and general guidance for the 41 developing countries that have completed them. These reports should be read as both programmatic and political documents that reflect the views of the relevant bureaucracies and national authorities. Although the GEF will provide some assistance for climate adaptation to some countries, large funding and capacity gaps exist between the NAPAs' identified needs and available resources. Development agencies can engage constructively with developing countries to help clarify and prioritize those climate adaptation measures that offer the greatest positive impact, including conflict prevention and mitigation.

LOOKING FORWARD: POLITICS AND PEACEBUILDING

The international political context also is likely to affect the climate adaptation efforts of development agencies. At present, there is a strong perception in developing regions of the world, especially Africa, that the United States has not taken sufficient actions to mitigate climate change. This perception raises expectations that the U.S. and other industrialized nations should undertake compensatory measures, including significant increases in funding specifically devoted to climate adaptation.[6] Looking forward, if U.S. participation in climate change mitigation protocols and international regimes is seen to be increasing, it may reduce somewhat the claims upon its financial assistance for climate adaptation from developing countries. The increase of carbon emissions from China and India, and China's rapidly expanding role in resource-rich countries of Africa and other developing regions, also may change the expectations of donor assistance for climate adaptation in ways that are not yet known.

One positive development in recent years has been the use of environmental cooperation (e.g., protected areas, watershed management) as an element of peacebuilding and conflict resolution. The peace accords ending the Peru-Ecuador conflict of the 1990s are a notable example in relation to protected areas. Scholars have noted the potential for enhancing peace and stability through institutional arrangements to manage transboundary water resources using cases from the Aral Sea, Caspian Sea, and water systems in Southern Africa and South Asia (Conca and Dabelko 2002). The Nile Basin Initiative and Lake Victoria Environmental Management Project stand as additional examples. The potential for peacemaking through environmental cooperation also may extend to climate adaptation and conflict mitigation. It may be that the dynamics of some conflictive situations lend themselves well to the use of climate adaptation collaboration as a mutually beneficial mechanism to resolve or reduce tensions between parties in conflict. This, too, is an area worthy of further investigation.

Endnotes

1. This is based on FESS interviews in Kampala, Uganda in November 2004 and Addis Ababa, Ethiopia in November 2007.
2. The following 41 countries have submitted a National Adaptation Programme of Action (NAPA) to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat: Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Cape Verde, Central African Republic, Comoros, Democratic Republic of Congo, Djibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao People's Democratic Republic, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Niger, Rwanda, Samoa, São Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Sudan, Tanzania, Tuvalu, Uganda, Vanuatu, Yemen, and Zambia.
3. This report was originally produced in 2007 by International Alert, a partner of Sida and a non-profit organization based in the United Kingdom. In 2008, with the support and permission of International Alert, Sida adapted the document for a conference it organized on climate change.
4. See the discussion by McGray et al. (2007) on disaggregating the concept of adaptation into the subcategories of "serendipitous adaptation," "climate-proofing," and "discrete adaptation."
5. Some steps in this direction are envisioned in the plans of the USAID Regional Development Mission for Asia to "prepare and launch, through a comprehensive consultative process, a detailed policy research and action report on the likely impacts of climate change on the entire Mekong ecosystem." The Mission also plans the development of a "Water Utility Risk Assessment and Planning Activity" to assist selected water utilities serving large cities in Asia to investigate their vulnerability to climate change (USAID 2008b).
6. For example, in the late summer of 2009, African leaders agreed that a delegation representing 53 African countries and led by Ethiopia's prime minister, Meles Zenawi, would travel to the December 2009 UN Climate Change Conference in Copenhagen to petition the United States, European Union, Japan, and other industrialized countries to pay US$67 billion a year to Africa in compensation for climate change effects and the costs of adaptation (The Economist 2009).

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APPENDIX 1

The following is a brief overview of six bilateral aid agencies' efforts to address climate change:

AusAID. The Australian government is in the process of setting strategic directives for how they will address climate change between 2009 and 2012. The draft is expected to be finalized in mid-2009. However, AusAID has announced that the program will contain an adaptation financing and implementation component that will "build the capacity of institutions in the region to implement adaptation responses, and provide funding for immediate, practical adaptation work" (AusAID 2008a). In July 2008, AusAID announced that they would be investing 150 million dollars over a three-year period in climate change adaptation programs. Funding will be primarily for Australia's neighboring countries, although some funds will be available for other countries. Examples of such activities include supporting the Tuvalu's Water and Sanitation Strategy and the construction of about 300 large rainwater tanks in the capital, Funafuti. Rooftop rain water-harvesting and other water conservation initiatives also will be developed. In drought prone areas, such as the island of Aniwa in Vanuatu, AusAID is supporting communities to build small solar desalination stills to produce fresh drinking water (AusAID 2008b).

CIDA. In 2000, Canada established the five-year Canada Climate Change Development Fund (CCCDF) "to promote activities addressing the causes and effects of climate change in developing countries, while helping to reduce poverty and promote sustainable development" (CIDA 2009). The program was extended through 2006. According to CIDA, the CCCDF supported programs in 50 countries. Canada also donates to the Least Developed Countries Fund. In addition, CIDA's sustainable development programs address "climate change indirectly through projects that work to achieve results in environmental management, energy efficiency, conservation, sustainable forestry practices, water resource management, and emissions reduction, among others" (CIDA 2007).

DfID. The British government is addressing development and climate change primarily through an £800 million grant to the Environmental Transformation Fund (ETF) to help fight climate change and poverty (DfID 2009). Part of the money will eventually find its way to developing countries, however, the primary purpose of the funding is "to stimulate a bigger global effort for more funding to help tackle climate change and poverty" (DfID 2009). DfID also has earmarked £20 million

for use on adaptation projects, although the projects themselves are not specified. Through its Climate and Development Knowledge Network, DFID "will deliver an integrated set of knowledge management, research and advisory services on all aspects of climate change and development" with the goal of supporting "policy-making and practice on adaptation and low carbon development in developing countries" (DfID n.d.).

GTZ. As part of its larger Climate Protection Program, GTZ is "helping developing countries to adapt efficiently and appropriately to changed climatic conditions" (GTZ n.d.). With the objective of "enhance [ing] adaptive capacity and minimiz [ing] vulnerability to climate impacts," efforts cover such areas as safeguarding natural resources; rural development; disaster mitigation; food security; and management of water catchment areas, water resources and coastal zones (GTZ n.d.). In May 2009, GTZ conducted a workshop on mainstreaming adaptation to climate change to discuss the state of the art of adaptation decision making tools and assess strengths and weaknesses. In the same month, GTZ published a guide to enable practitioners and decision makers in developing countries to "obtain climate change information; interpret it adequately, and communicate the resulting knowledge in a careful and responsible way" (Kropp and Scholze 2009).

JICA. According to JICA, the agency "promot[es] adaptation measures to climate change, based on the concept of 'human security' as a critical basic policy for development assistance…" (JICA 2007). It also seeks to "assist developing countries to strengthen their resilience so that eventually they can adapt to climate change by themselves" (JICA 2007). In 2008, the Japanese government unveiled a five-year US$10 billion fund to help developing countries combat global warming. The funds include US$2 billion in grants and technical assistance for clean energy projects (JICA 2008). It also produced a set of guiding principles for combating climate change that emphasize "sustainable economic development and a reduction of greenhouse gases; global research to promote a low carbon society; the utilization of Japan's cutting-edge technologies including a greater involvement of private industry; and a cross-sectoral approach in planning projects" (JICA 2008).

Sida. Although Sida notes that reducing vulnerability to climate change is important, their work focuses primarily on reducing greenhouse gas emissions (Sida 2009a). Sida states that they "contribute to partner countries being able to prepare themselves" (Sida 2009b). They state that their aim is to have its departments "integrate climate considerations into development cooperation as a whole, rather than making targeted efforts" (Sida 2009b). On the issue of climate change and conflict, Sida adapted and re-published International Alert's 2007 report "A Climate of Conflict: The Links between Climate Change, Peace and War" with additional information reflecting the agency's priority areas and topics.

Multilateral agencies and the G8 are making similar efforts in relation to climate change, but direct links to conflict remain limited:

World Bank. In October 2008, the World Bank released its "Development and Climate Change: A Strategic Framework for the World Bank Group." The Framework covers six key areas incorporating adaptation and mitigation that seek to "support climate actions in country-led development processes; mobilize additional concessional and innovative finance; facilitate the development of market-based financing mechanisms; leverage private sector resources; support accelerated development and deployment of new technologies; and step-up policy research, knowledge, and capacity building" (World Bank 2008).

Asian Development Bank. Guided by the "Strategy 2020" framework, the ADB addresses climate change as part of environmentally sustainable growth objectives. Climate mitigation actions include advancing energy efficiency and use of low-carbon energy sources; enabling sustainable transport policies and applying efficient systems; promoting improved urban sanitation and reduction of fugitive methane emissions; and promoting sustainable land use and forestry (ADB 2008). Adaptation programs cover "addressing vulnerability risks in national development strategies and actions; increasing the climate resilience of vulnerable sectors such as water and agriculture; climate proofing projects; and addressing social dimensions" (ADB 2008).

African Development Bank. As part of the African Development Bank's (AfDB) Medium Term Strategy, climate change efforts will include "work on the special challenges of adaptation and climate-proofing," "selective partnerships in the area of climate change and … a convening role to identify regional opportunities, solutions and co-operation" (AfDB 2008). The Bank also identifies climate change and mitigation as one of its sectors of intervention. The programmatic emphasis is the Clean Energy Investment Framework, which seeks to promote clean energy

development, but the AfDB also includes climate risk management and adaptation (CRMA) in its development support. One of the main goals of CRMA is "assist[ing] African countries to strengthen their capacities to respond effectively to the risks, threats and opportunities (if any) posed by climate change, variability and extremes – to protect communities; sustain[ing] economic growth, development and poverty reduction; and protect[ing] critical natural resources and ecosystems" (AfDB n.d.).

Inter-American Development Bank. The Inter-American Development Bank's (IADB) climate change activities center around its Sustainable Energy and Climate Change Initiative. The Initiative's goals are the "provision of comprehensive sustainability options in areas related to the energy, transportation, water and environmental sectors as well as that of building climate resilience in key priority areas vulnerable to the impacts of climate change" (IADB 2009). The four key components include renewable energy and energy efficiency; sustainable biofuel development; access to carbon markets; and adaptation to climate change (IADB 2009).

G8. The challenges of climate change were recognized and addressed at the July 2009 G8 Summit in L'Aquila, Italy. According to the "Declaration of the Leaders the Major Economies Forum on Energy and Climate" released on July 9, 2009, the G8 recognizes that "climate change poses a clear danger requiring an extraordinary global response, that the response should respect the priority of economic and social development of developing countries, that moving to a low-carbon economy is an opportunity to promote continued economic growth and sustainable development, that the need for and deployment of transformational clean energy technologies at lowest possible cost are urgent, and that the response must involve balanced attention to mitigation and adaptation" (G8 Summit 2009). It stated that "financial resources for mitigation and adaptation will need to be scaled up urgently and substantially and should involve mobilizing resources to support developing countries" (G8 Summit 2009).

APPENDIX II

The following is a list of further selected readings on climate security:

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