



**THE ASSOCIATION OF THE BAR OF THE CITY OF NEW YORK
REPORT OF CLIMATE ADAPTATION TASK FORCE**

**CLIMATE ADAPTATION IN DEVELOPING COUNTRIES:
Planning and Financing for Cities, Farms and Internally Displaced Persons**

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THE ASSOCIATION OF THE BAR OF THE CITY OF NEW YORK TASK FORCE ON CLIMATE ADAPTATION

Planning and Financing for Cities, Farms and Internally Displaced Persons

EXECUTIVE SUMMARY

In June 1992, the nations of the world gathered at the Earth Summit in Rio de Janeiro to adopt the United Nations Framework Convention on Climate Change (UNFCCC), in which they recognized both the fact of accelerating climate change and its potentially catastrophic effects for many millions of people, particularly those living in developing countries that had contributed little to the atmospheric conditions that threatened them. The 153 countries and delegations at Rio pledged in the UNFCCC to act to reverse the Earth's rapidly increasing greenhouse gas (GHG) emissions and to help developing countries adapt to the impacts of those emissions. In particular, each developed country committed in Article 4(2) to "adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its... emissions of greenhouse gases..." In Article 4(4), developed countries also agreed to "assist the developing country Parties that are particularly vulnerable to climate change in meeting the costs of adaptation to those adverse effects." The UNFCCC was ratified by all signatories, including the United States, and became a binding international treaty on March 21, 1994. There are now at least 195 parties to the UNFCCC.

Between 2000 and 2012, global GHG emissions increased by approximately 25%, precisely the opposite of what the UNFCCC parties agreed to at Rio. As a result, in March 2014, the Intergovernmental Panel on Climate Change (IPCC) reported that global temperatures increased by approximately .85 degrees Celsius (1.3 degrees Fahrenheit) between 1880 and 2012 and are now expected to increase further by the end of this century. (2015 is already known to be the warmest year on record.) Temperature increases expected in parts of Africa and Central and South America are projected to reach between 3 and 7 degrees Celsius (5.4 to 12.6 degrees Fahrenheit) by the end of the century absent meaningful action to reduce global GHGs.

As the World Bank made chillingly clear in its 2014 report, "4°--Turn Down the Heat," temperature increases of this magnitude will be profound for virtually all countries and all people, requiring immediate action to reduce carbon dioxide emissions by replacing fossil fuels with renewable energy, reducing methane and other GHG emissions, preserving the Earth's forests and putting in place effective international reporting and monitoring controls to assure that national and international commitments to take these actions are implemented for the remainder of the 21st Century. The parties to the UNFCCC are scheduled to meet in Paris this December to announce such commitments (at least nominally) and agree to report on their implementation in future years. However, the prospects for legally binding GHG commitments by either developed or developing countries remain slight since few countries are willing to slow

their economies or their development plans to protect the global commons. Moreover, a recent study by Climate Initiative, an independent group, predicts that, even if all the non-binding Paris pledges are in fact carried out, the average global temperature is still likely to exceed pre-industrial levels by 3.5 degrees Celsius (6.3 degrees Fahrenheit) by the end of the century, nearly double the 2 degrees Celsius (3.6 degrees Fahrenheit) increase that the U.S. and other UNFCCC parties have agreed is the maximum increase that the world can safely tolerate. Even these projections do not reflect the recent discovery that China's reported GHG emissions understated carbon dioxide by approximately 1 billion tons during the past year.

Our Association has long urged the United States to act forcefully to reduce its own GHG emissions and, by so doing, to encourage others to take corresponding actions. The most recent IPCC reports make even more clear that such actions are urgently needed to reduce (or, in international terminology, "mitigate") GHG emissions, whether through direct regulation (as President Obama has now proposed), a national carbon tax or "cap-and-trade" program, redirection of existing fossil fuel subsidies to renewable energy, building code reforms or more stringent regulation of car, truck, aircraft and ship emissions.

Yet, even if meaningful GHG commitments are eventually made in Washington and Paris and carried out diligently by all UNFCCC parties, the GHGs already in the Earth's atmosphere and oceans, as well as the GHGs certain to be released by both developed and developing countries over the next 50 years, will continue to present overwhelming challenges for the Earth's ecosystem for the balance of the century, and perhaps longer. Our Association therefore believes it essential for the United States and the international community to act promptly, not just to reduce GHG emissions, but also to help vulnerable nations adapt to the inevitable impacts of climate change over the balance of this century, beginning immediately.

Among the cruelest aspects of climate change is that the nations and peoples least responsible for the Earth's warming over the next 50 years will be those most directly impacted by rising temperatures, drought, floods, heat waves, food shortages, water contamination and climate-induced social unrest in both urban and rural areas. Many developing countries are already unable to deal with the explosive growth of their cities, the loss of their croplands to desertification and the waves of migrants crossing their borders or facing internal displacement from their traditional communities.

As the IPCC reports make clear, climate change is exacerbating these problems and in the future is likely to make it all but impossible to govern many of the world's largest cities, to help farmers remain on their lands and to stem the tide of refugees and internally displaced persons (IDPs) that already threaten the stability of many countries. Unless effective adaptation measures are undertaken now to address these challenges, the prospects for democratic governance, the rule of law and regional peace are likely to be overwhelmed by forces beyond the control of even the most thoughtful and diligent government leaders. The European Union is experiencing a foretaste of these problems on the horizon, as significant portions of Africa and the Middle East become less

habitable due to climate change and its socio-economic impacts. The severity of the migration crisis now underway illustrates the critical importance of adaptation planning, and how the interests of every nation would be served by mobilizing the technical, administrative and financial resources needed to launch a massive adaptation effort and reduce the number of people forced into migration as the consequences of climate change unfold.

In this report, we summarize the compelling need for meaningful adaptation measures to anticipate the principal effects of climate change in both urban and rural areas in developing countries. Drawing on our experience in New York City and reports from other cities, we outline in Section I the principal components of a successful urban adaptation program, including provisions for public participation in the development and implementation of that program. In Section II, we draw on the work of the United Nations and others to summarize what we believe to be the essential components of a successful adaptation program to help rural farmers maintain their farms in the face of climate change and to help IDPs survive and exercise their fundamental rights while either voluntarily or involuntarily dislocated from their rural communities.

Because successful climate adaptation -- whether involving cities, farms, or IDPs -- will require far more financial support than most affected countries have available, we outline in Section III a proposed new international financial transaction charge to generate the significant and on-going international resources that effective adaptation will require.

Section I of this report describes the daunting challenges ahead for developing countries in adapting to climate change in cities. Successful urban adaptation will require comprehensive programs to identify the ways in which climate change is likely to exacerbate existing urban challenges of providing adequate municipal services, infrastructure and food to meet the needs of rapidly growing populations, while preparing for additional threats from coastal or river floods, heat waves, droughts and additional migrants seeking relief from the rural impacts of climate change. Responding to these challenges will require not only dedicated municipal leadership but active participation from citizens in developing and implementing those adaptation programs, as well as monitoring their effectiveness.

Section II of the report addresses rural adaptation. To be effective, rural adaptation requires not only a broad array of agricultural improvements (including more efficient irrigation) to help farmers overcome soil degradation, water scarcity and isolation from markets, but also institutional reforms to provide enhanced security, schools, health care, land tenure and ability to sell the farmers' produce in an increasingly globalized marketplace. Rural climate adaptation must also include far greater protection and assistance for IDPs in line with developing international norms for the 40 million of migrants who relocate within their countries' borders and thus do not qualify for protection as refugees. Because climate change is rapidly swelling the number of IDPs and increasing the challenges they face, successful adaptation requires improved national and international efforts to help IDPs to survive the short-term conditions that have

driven them from their homes and to continue to exercise the rights of citizens in their communities, including voting; access to education; opportunities for employment; participation in decisions affecting the future of their communities; access to a functioning and impartial system for resolving property disputes in accordance with local law and custom; and opportunities to return to their homes as soon as feasible.

These climate adaptation programs will require resources far beyond those available to most cities and many countries in the developing world. To provide those resources on a reliable and continuing basis, Section III of the report calls on the UNFCCC parties (and in particular the world's developed nations) to promptly establish an international Financial Transaction Microtax (FTM) to be dedicated to climate adaptation programs that include the core components outlined above. Properly implemented, such an FTM could provide the resources (estimated, over time, to exceed \$100 billion annually) required for the world's most vulnerable countries to begin to adapt to the now-unavoidable threats to their people and ecosystems from changes to the Earth's climate. Addressing this need now is likely to be both more effective and less costly than attempting to do so in the future.

We make these recommendations recognizing that many outside our country have already spoken to individual components of this adaptation program with more eloquence and first-hand knowledge than we can bring to these issues. However, we are concerned that climate change policy in the United States, even among those most aware of the urgent need for action, focuses almost exclusively on mitigation and neglects the equally urgent need to help vulnerable nations adapt to the inevitable consequences of the industrial growth from which our nation and other developed countries have benefited over the past two centuries. Unless the U.S. and other developed economies act now to incorporate effective urban and rural adaptation into our climate programs, the accelerating impacts of climate change are likely to make significant portions of the world either uninhabitable or ungovernable before any GHG reductions become effective.

I. URBAN ADAPTATION

Over the coming decades, climate change—and the altered weather patterns, rising sea levels, public health effects and socioeconomic shifts it is predicted to cause—will affect the lives of people living in every area of the globe. The impacts of these changes will be particularly severe in urban areas, for a number of reasons. First, many of the world's cities are situated in low-lying coastal plains prone to flooding and storm surges associated with sea level rise. A quarter of the global population currently lives in such flood-prone areas.¹ Second, the density of development, extensive infrastructure and concentration of particularly vulnerable elderly and economically disadvantaged populations in cities will magnify the urban impacts of climate change. Third, cities are growing rapidly and, particularly in developing countries, are often lacking the financial resources and governmental structure to provide basic services (water, electricity, waste disposal, food) even before climate change impacts are included. The cumulative effect of these factors means that cities in developing countries are expected to encounter a broad range of social, economic and environmental challenges, including significant increases in illness and death among vulnerable populations as a result of climate change. The devastating effects of Hurricane Katrina on New Orleans, still evident after 10 years, are likely to be magnified in larger cities in developing countries less able to provide recovery aid equal to that New Orleans received from the U.S. Congress.

The prospect of such difficult and unique problems has spurred municipal leaders around the world to begin planning to adapt to the changing climate. While efforts at the national level have lagged, local governments have stepped up to assess the risks they face and develop plans to cope with them. According to a 2012 survey of 468 cities by Local Governments for Sustainability (ICLEI), 79% of responding cities worldwide reported that they have experienced “changes in temperature, precipitation, sea level, or natural hazards that they attributed to climate change,”² and approximately 38% of those cities reported that they had either completed a climate change impact assessment or were in the process of conducting one. There are significant impediments to adapting to climate change in the cities that will be most affected. Three quarters of the world's urban population, and most of its largest cities, are located in low and middle income countries.³ The world has urbanized rapidly in the last few decades, and many such cities have not been able to keep up with the dramatic expansion they have experienced. As a result, “about one in seven people in the world now live in poor quality, over-crowded accommodations in urban areas with inadequate provision for basic infrastructure and

¹ IPCC, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 319 (Martin Parry et al. eds., 2007).

² JOANN CARMIN ET AL., M.I.T. DEP'T OF URB. STUDIES AND PLANNING, PROGRESS AND CHALLENGES IN URBAN CLIMATE ADAPTATION PLANNING: RESULTS OF A GLOBAL SURVEY 1 (2012), *available at* http://resilient-cities.iclei.org/fileadmin/sites/resilient-cities/files/Resilient_Cities_2012/Urban_Adaptation_Report_23May2012.pdf.

³ AROMAR REVI ET AL., IPCC, CLIMATE CHANGE 2014: URBAN AREAS 541 (C.B. Field et al. eds., 2014).

services, mostly in “informal settlements.”⁴ It will be exceedingly difficult to prepare such areas for the changes in climate that are predicted over the next several decades.

At the same time, the trend towards urbanization provides opportunities for climate change adaptation, because of the concentrated nature of transportation systems, housing and energy facilities in urban areas. Recognizing these opportunities, organizations like ICLEI, C40 Cities Climate Leadership Group and the Clinton Climate Initiative have begun providing assistance at the local level in an emerging urban adaptation effort.

Over the last decade, the City of New York, an urban area with abundant economic, scientific, technical and societal resources, has focused a great deal of time and effort in developing its own programs for adapting to climate change. New York has formulated detailed strategies for climate change adaptation through a science-based approach founded on current technical information and existing land-use patterns. Other major cities with more limited financial or institutional resources have also sought to identify their vulnerability to climate change. We hope that the adaptation measures that New York and a number of other cities have implemented, and the lessons learned in the process, can provide a useful roadmap for adaptation efforts in other cities, both in terms of the essential components of an adaptation plan and the process for approving and implementing that plan.

This Section of the report first identifies the most pressing climate-related concerns for urban areas generally, then discusses the adaptation programs of New York City (and the State of New York) and then summarizes briefly the corresponding efforts of four other cities (Cape Town, Dakar, Dhaka and Maputo). We then discuss some of the lessons that can be drawn from those planning initiatives and how other jurisdictions, and the organizations that assist them, might build upon and refine the adaptation programs that have been used in New York and other major cities facing impacts made more severe by climate change.

A. CLIMATE-RELATED CHALLENGES TO CITIES

Climate change is expected to cause disproportionate impacts in urban areas in many sectors, including water quantity and quality, energy supply and demand, public health, socioeconomic stability, and transportation.

1. Water and Wastewater

As ocean levels continue to rise, cities situated in coastal areas risk inundation from rising sea levels and more frequent and severe storm surges. Such flooding will cause significant damage to coastal wastewater treatment facilities and sewer systems

⁴ *Id.* at 543–44.

throughout the affected areas.⁵ In addition, water supplies will be affected by droughts, shrinking snowpack, and salinity intrusion caused by sea level rise.

The New York City Panel on Climate Change (“NPCC”) has reported that mean annual precipitation has increased at a rate of .8 inches per decade from 1900-2013 in Central Park.⁶ The NPCC expects mean annual precipitation to increase 4-11% by the 2050s and by 5-13% by the 2080s.⁷ In addition, the NPCC has reported that sea level rise in NYC has averaged 1.2 inches per decade since 1900, and predicts that it will rise 11-21 inches (28-53 centimeters) by the 2050s, up to 39 inches (1.0 meters) by the 2080s, and as much as 6 feet (1.8 meters) by 2100.⁸ Similar, or larger, sea level increases are expected in other coastal cities around the world.

Even a small increase in sea level can have a significant impact. In New York, where the rising sea levels predicted as a result of climate change are just beginning to take hold, “Hurricane” Sandy (actually a storm just below hurricane levels) swamped major infrastructure, such as LaGuardia Airport, the Hugh Carey Tunnel, the New York City subways, and several electrical substations. If the storm had hit at a slightly different time, it could also have overwhelmed the City’s Hunt’s Point Food Distribution Center in the Bronx, which moves up to 60% of the city’s produce.⁹ Power plants that control up to a third of the city’s power could also have been affected.¹⁰ As the World Bank’s report makes clear, other cities around the world are likely to experience similar (or greater) impacts from flooding and storm surges.

2. Energy

The effect of rising temperatures will be intensified in cities, because impervious urban surfaces—such as buildings and pavement—trap heat, giving rise to a “heat island” effect. Moreover, as heat waves become more commonplace, peak energy demand will increase and electrical supply and distribution systems will be strained, increasing the frequency of outages. The direct physical effects of storm surges and sea level rise will also put power-generating facilities, which are often located along waterways, at risk.¹¹ Additionally, the increased demand for energy and greater outage frequency will place further stress on municipal services.

⁵ David C. Major et al., *Climate Change, Water, and Wastewater in Cities*, in CLIMATE CHANGE AND CITIES: FIRST ASSESSMENT REPORT OF THE URBAN CLIMATE CHANGE RESEARCH NETWORK 113, 113–43 (C. Rosenzweig et al. eds., 2011).

⁶ *NYC Panel on Climate Change 2015 Report Executive Summary*, 1336 ANNALS N.Y. ACAD. SCI. 9, 9 (2015), available at <http://onlinelibrary.wiley.com/doi/10.1111/nyas.12591/pdf>.

⁷ *Id.* at 10.

⁸ *Id.* at 11.

⁹ NYC MAYOR’S OFFICE OF SUSTAINABILITY, A STRONGER, MORE RESILIENT NEW YORK 19 (2013).

¹⁰ *Id.*

¹¹ Steven A. Hammer et al., *Climate Change and Urban Energy Systems*, in CLIMATE CHANGE AND CITIES: FIRST ASSESSMENT REPORT OF THE URBAN CLIMATE CHANGE RESEARCH NETWORK 85, 85–111 (C. Rosenzweig et al. eds., 2011).

The NPCC predicts that mean annual temperatures will increase in the New York metropolitan area by 4.1 to 5.7 degrees Fahrenheit (2.3 to 3.2 degrees Celsius) by the 2050s, and 5.3 to 8.8 degrees Fahrenheit (2.9 to 4.9 degrees Celsius) by the 2080s.¹² The frequency of heat waves also is expected to increase dramatically, tripling by the 2080s.¹³ The IPCC predicts proportional increases for most other urban areas around the globe and, particularly in sub-Saharan Africa, even greater increases. Such temperature increases, coupled with the periodic disruptions that will be occasioned by more frequent storm events, will place unprecedented stress on the energy grid in New York and even greater stress on systems in less developed cities in other areas of the world.

3. Public Health

Public health impacts resulting from more intense and prolonged heat waves, flooding events, diminished air quality, and the increase in allergens and vector-borne diseases will be exacerbated in urban areas as a result of climate change. As noted above, cities are particularly vulnerable to climate change because of their dense populations and the urban heat island effect -- factors which affect health in general. As more people migrate to cities, the impacts of climate change will be experienced by a greater portion of the world's population.

Heat is dangerous in an urban environment. The Center for Communicable Diseases reports that heat waves kill more people in the United States than any other extreme weather incidents.¹⁴ In the years between 2000 and 2011, an average of 447 patients per year were treated for heat illness and released in New York City.¹⁵ On average, 152 people were hospitalized and 13 people died each year from heat stroke.¹⁶ Investigations into the fatalities revealed that, where records existed, none of the deceased had a working air conditioner in use.¹⁷ Heat-related casualties in other parts of the world are even more dramatic. For example, the 2003 heat wave in Europe killed over 30,000 people.¹⁸ Just this past June a heat wave devastated Pakistan, where over 40,000 individuals suffered from heat stroke, and heat stroke and dehydration caused more than 1,200 deaths. The country's largest city, Karachi, suffered huge power cuts leaving more than 20 million people struggling to cool their homes. Clinics were set up in the streets to treat the suffering population and morgues ran out of space.¹⁹

¹² *New York City Panel on Climate Change 2015 Report*, *supra* note 6, at 10.

¹³ *Id.*

¹⁴ Ctrs. for Disease Control and Prevention, *Heat Illness and Deaths— New York City, 2000–2011*, 62 MORBIDITY & MORTALITY WKLY. REP. 617, 617–21 (2013), *available at* <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6231a1.htm> (citing NAT'L WEATHER SERV., WEATHER FATALITIES (2012)).

¹⁵ *Id.*

¹⁶ *Id.*

¹⁶ *Id.*

¹⁷ *Id.*

¹⁸ Shaoni Bhattacharya, *European Heatwave Caused 35,000 Deaths*, NEW SCIENTIST, (Oct. 10, 2003), <https://www.newscientist.com/article/dn4259-european-heatwave-caused-35000-deaths/>.

¹⁹ Lizzie Dearden, *Thousands of People Killed by Extreme Weather in 2015 as El Nino Arrives to Bring More Chaos*, THE INDEPENDENT (June 27, 2015), <http://www.independent.co.uk/environment/climate-change/thousands-of-people-killed-by-extreme->

The Centers for Disease Control (CDC) reported that Superstorm Sandy took the lives of 117 people on the northeastern U.S. coastline, mainly in New York and New Jersey, while over 6,000 people were killed when a typhoon hit the Philippines in 2013.²⁰ In addition to the direct adverse health effects from heat events and storm exposure, flooding events may also expose people to contaminated drinking water, contaminated floodwaters, and the build-up of mold and moisture in dwellings. Because total evacuation of urban areas is not always possible, the risks to urban dwellers from storms associated with climate change are quite significant.²¹

As temperatures rise, larger areas of land are also becoming more hospitable to disease vectors such as mosquitoes, ticks, and mice. For example, malaria, a common mosquito-borne disease, may be the most climate-sensitive vector-borne disease and is affected by temperature, precipitation, humidity, and wind.²² Additionally, there is evidence that the tick species that carries Lyme disease has expanded its range northward from New England into Canada, in part because of rising temperatures.²³

4. Transportation

Superstorm Sandy caused almost five billion dollars in damage to the mass transportation system in and around New York City. Given that damage on such a scale was caused by one storm event, it is plausible to expect that sea level rise, intense precipitation events and storms have the potential to wreak havoc on urban transportation systems as climate change takes hold.²⁴ Storm surges that flood tunnels, subway and train stations, roads and airports cause both travel disruptions and economic impacts. The effects spiral further as subways, trains, and airports all rely on electricity and fuel, thus interconnecting transportation and energy. If the energy supply is affected because of

weather-so-far-in-2015-as-climate-change-feared-to-bring-more-heatwaves-hurricanes-and-floods-in-future-10345883.html.

²⁰ Ctrs. for Disease Control and Prevention, *Deaths Associated with Hurricane Sandy, October–November 2012*, 62 MORBIDITY & MORTALITY WKLY. REP. 393, 393–97 (2013), available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6220a1.htm>.

²¹ Rising average temperatures also will likely lead to the earlier onset of the spring pollen season, as both the timing of the season and the amount of pollen are linked directly to temperature and precipitation levels prior to the pollen season. Rising CO₂ concentrations coupled with higher temperatures exacerbate allergic reactions and allergic asthma, and adversely affect individuals who previously had not experienced allergy symptoms. Aeroallergens tend to be intensified in urban areas because of exposure to common air pollutants such as diesel exhaust.

²² Martha Barata et al., *Climate Change and Human Health in Cities*, in CLIMATE CHANGE AND CITIES: FIRST ASSESSMENT REPORT OF THE URBAN CLIMATE CHANGE RESEARCH NETWORK 179, 187 (C. Rosenzweig et al. eds., 2011).

²³ E.g., DOUG SIDER, MD, ET AL., PUBLIC HEALTH ONTARIO PARTNERS FOR HEALTH, TECHNICAL REPORT: UPDATE ON LYME DISEASE PREVENTION AND CONTROL 1 (2012), available at <http://www.publichealthontario.ca/en/eRepository/PHO%20Technical%20Report%20-%20Update%20on%20Lyme%20Disease%20Prevention%20and%20Control%20Final%20030212.pdf>

²⁴ Shagun Mehrotra et al., *Climate Change and Urban Transportation Systems*, in CLIMATE CHANGE AND CITIES: FIRST ASSESSMENT REPORT OF THE URBAN CLIMATE CHANGE RESEARCH NETWORK 145, 145–177 (C. Rosenzweig et al. eds., 2011). Less dramatic damage is likely to be caused by the extraordinary swings in temperature, from extreme heat to arctic conditions that are predicted due to climate change.

storm surges or extreme heat events, outages and brownouts will disrupt a city's transportation network. Such outages also dislocate individuals and affect their ability to access necessary resources, including emergency health care.

In the New York City metropolitan region, most of the transportation infrastructure is located ten feet or less above sea level.²⁵ The transportation infrastructure in many other coastal cities is similarly situated. This puts urban transportation systems at extreme risk during and after a major storm event. In addition to risks from flooding and storm surges, infrastructure like roadways, railway tracks, and bridges is sensitive to extreme heat, as many materials currently used in urban centers have a limited range of heat tolerance. Thus, instances of extreme heat may cause softening, buckling, and stress on expansion joints.²⁶

5. Housing

Residential building damage from Superstorm Sandy was widespread and severe. In some areas, storm surge and rising floodwaters pushed houses off their foundations or caused walls to collapse. Elsewhere, floodwaters filled basements and ruined electrical and other building systems, as well as personal possessions. As of December 2012, the City had tagged nearly 800 buildings as structurally damaged or destroyed across the five boroughs, with tens of thousands more impacted, including buildings containing nearly 70,000 housing units that were registered with FEMA and determined to have sustained some level of damage. Over 100 of the lost homes and businesses were destroyed by storm-related fires, which were often electrical in nature, caused largely by the interaction of electricity and seawater.

Overall, older, one-story, light-frame buildings suffered the most severe structural damage, representing 73 percent of all buildings tagged as structurally damaged or destroyed by Sandy. Wave action along the Atlantic Coast (including Southern Brooklyn, South Queens, and the East and South Shores of Staten Island) accounted for the majority of damaged buildings, and for nearly all buildings structurally damaged or destroyed citywide.

6. Social Impacts/Public Participation

The consequences of the temperature changes, sea level rise, flooding, drought and consequent reduced food availability will have major effects on the stability of many governments, both local and national. The U.S. Department of Defense has identified climate change as a “threat multiplier” and warned that its effects will “intensify the challenges of global instability, hunger, poverty and conflict” because those effects will “likely lead to food and water shortages, pandemic disease, disputes over refugees and resources, and destruction by natural disasters in regions across the globe.”²⁷ Likewise,

²⁵ See RAE ZIMMERMAN, GLOBAL CLIMATE CHANGE AND TRANSPORTATION INFRASTRUCTURE: LESSONS FROM THE NEW YORK AREA 5 tbl. 1 (2003).

²⁶ See *id.* at 5–6.

²⁷ Chuck Hagel, *Preface* to U.S. Dep’t of Def., 2014 Climate Change Adaptation Roadmap (2014), available at http://www.acq.osd.mil/ie/download/CCARprint_wForeword_c.pdf.

the IPCC predicts “climate change will be an increasingly important driver of human insecurity in the future by exacerbating poverty, discrimination and inadequate provision of public services and public health.”²⁸ Indeed, some analysts point to the effects of climate change as being a factor in igniting civil unrest in Sudan, Yemen and most recently Syria, noting that a severe drought preceded the uprising and had a catalytic effect contributing to the political unrest.²⁹ According to one report, “[d]urable droughts and gradual deterioration of environmental conditions may push marginal populations into cities in order to find new modes of livelihood. Such a dynamic was discernible in the years preceding the 2011 outbreak of the Syrian civil war.”³⁰ Thus, one reason climate change is predicted to give rise to social unrest is that it will make well populated areas less habitable and induce people to migrate from rural areas to cities within a country, or from one country to another. Paradoxically, efforts to mitigate or adapt to climate change—implemented without proper planning and outreach to the affected communities—have themselves been identified by IPCC as contributing to social unrest by dislocating people or depriving them of their property rights.³¹

B. NEW YORK CITY CLIMATE ADAPTATION PLANNING

Initially under Mayor Bloomberg, and now under Mayor de Blasio, New York City has sought to grapple with the urban impacts of climate change noted above. In 2007, the City issued its first comprehensive strategic plan, entitled “PlaNYC,” aimed at identifying the challenges faced by the City in the next few decades, including climate change. In 2008, the City Council enacted legislation creating the Mayor’s Office of Long-Term Planning and Sustainability (“OLTPS”) to oversee the implementation of PlaNYC. OLTPS, along with the newly created Mayor’s Office of Recovery and Resiliency, develops PlaNYC updates every four years and provides annual progress reports. Most recently, Mayor de Blasio announced a new plan entitled “One New York – The Plan for a Just and Strong City” (“OneNYC”). That plan advances the work begun by the previous administration in the area of sustainability and resilience. However, recognizing the importance of a vigorous economy and a strong social fabric to the City’s ability to meet the coming environmental challenges, the plan also includes strategies aimed at reducing income inequality and promoting healthy local communities.

Through its planning process, the City has made significant progress in bringing into focus the impending effects of climate change, and beginning the process of making the City more climate-resilient. Mayor Bloomberg created the New York City Panel on Climate Change (NPCC) in 2008 to identify the impacts that climate change would have on the City in the mid- and late 21st century, calling on some of the world’s leading

²⁸ VIRGINIA R. BURKETT ET AL., IPCC, CLIMATE CHANGE 2014: POINT OF DEPARTURE 178 (2014).

²⁹ Colin P. Kelley et al., *Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought*, 112 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 3241, 3241–42 (2015), available at <http://www.pnas.org/content/112/11/3241.full.pdf>.

³⁰ Halvard Buhaug & Ida Rudolfson, *A Climate of Conflicts?*, CONFLICT TRENDS, 2015, available at http://file.prio.no/publication_files/prio/Buhaug.%20Rudolfson%20-%20A%20Climate%20of%20Conflicts,%20Conflict%20Trends%2005-2015.pdf.

³¹ W. NEIL ADGER ET AL., IPCC, CLIMATE CHANGE 2014: HUMAN SECURITY 770–79 (2014).

experts on climate change, including scientists from the NASA Goddard Institute for Space Studies and Columbia University's Earth Institute. The NPCC has utilized global climate models and data derived locally to assess the City's future climate change vulnerabilities, and issued a report ("Climate Risk Information 2009") that predicted a future with substantially higher sea levels in 2050, more frequent severe storms and heavy downpours, as well as extended heat waves. Mayor Bloomberg then convened a "Climate Change Adaptation Task Force" of utility and agency experts to develop plans to address such long-range problems. By local law, the City Council institutionalized the NPCC and the Climate Change Adaptation Task Force in 2012, mandating periodic updates to impact predictions and adaptation strategies.

Superstorm Sandy, an unprecedented event that came as no surprise to those working on PlaNYC, infused the City's long-range planning efforts with a sense of urgency. In the storm's wake, Mayor Bloomberg convened the "Special Initiative for Rebuilding and Resiliency," to update the NPCC technical work and come up with a robust agenda of adaptation strategies. This effort produced a 2013 update to the NPCC's "Climate Risk Information 2009" report, and a comprehensive agenda of resiliency strategies in a report entitled "PlaNYC – A Stronger, More Resilient New York." The most recent NPCC report, "Building a Knowledge Base for Climate Resiliency," was issued in February 2015.

The 2015 NPCC report paints a troubling picture. As noted above, according to the latest projections, the predicted "middle range" for sea level rise as of the 2050s is 11-21 inches (28 to 53 centimeters), and sea levels could rise by the end of the century by up to six feet (approximately 1.8 meters). Heavy downpours are very likely to increase, and heat waves will become more frequent and intense. By mid-century, the NPCC predicts that the number of days above 90 degrees annually will double from what exists today and will be about the same as now experienced in Birmingham, Alabama.³²

The State of New York has also been actively engaged in climate change adaptation efforts. The Governor's Office of Storm Recovery, which was organized to spearhead the rebuilding effort after Superstorm Sandy, has implemented specific reconstruction projects, as well as developed programs to advance climate change adaptation in New York. It has implemented a "buyout" program under which the State purchases residential properties in high risk areas affected by Superstorm Sandy, Hurricane Irene, and Tropical Storm Lee. Also, the Office compiled a description of approaches being utilized in urban areas around the world to increase resilience to flooding, storm surges and intense rainfall, as well as to increase community preparedness and emergency response capacity.³³

Through their efforts over the past several years, the City and State have developed a number of programs to address the most pressing climate change-related

³² NYC MAYOR'S OFFICE OF SUSTAINABILITY, *supra* note 9, at 30.

³³ NY Rising Communities, GOVERNOR'S OFFICE OF STORM RECOVERY, COMMUNITY RESILIENCE TECHNIQUES: A COMPILATION OF APPROACHES USED TO INCREASE RESILIENCE (2013), *available at* https://web.archive.org/web/20140118180157/http://www.stormrecovery.ny.gov/sites/default/files/documents/Community_Resilience_Techniques_October_2013.pdf.

problems in this particular urban area. Paradoxically, the region's ability to move forward with such programs, funded in large measure by billions of dollars in storm recovery funding from the federal government, has stemmed from the environmental devastation experienced in recent years. The discussion below describes examples of the projects that could be pursued as such funding becomes available.

1. Water

Superstorm Sandy damaged the city's coastline, infrastructure and buildings. According to the NYC Department of Buildings, 70 percent of buildings in areas flooded by Sandy were seriously damaged or destroyed.³⁴ New York has been awarded \$340 million from the federal government to create projects to protect drinking water and wastewater treatment plants from climate change-related threats (\$283 million for wastewater facilities and \$56.6 million for drinking water projects).³⁵ Recently, Governor Cuomo announced a \$28 million New York State program for flood protection efforts at LaGuardia Airport.³⁶

In June 2013, the U.S. Department of Housing and Urban Development ("HUD") launched the "Rebuild by Design" initiative, a competition to develop innovative projects to promote resilience in the New York region. Two of the winning projects illustrate the different approaches to threats from rising sea levels appropriate for low-density residential areas versus high-density commercial centers. One project, "Living Breakwaters," would mitigate storm surges and enhance ecological diversity along the southern shore of Staten Island. The breakwater system envisioned would stretch 13,000 feet across the shoreline and be sited to optimize wave height reduction and coastal erosion. The breakwaters would also provide reef habitat to shelter juvenile fish and increase the concentration of filter-feeding organisms like oysters and mussels. Another winner of the "Rebuild by Design" competition was the "Big U," a U-shaped berm system stretching around lower Manhattan. The system would begin on the west side of Manhattan, near 57th Street, move south to the Battery, then stretch up the east side of Manhattan to 42nd Street. In total, the "Big U" would protect 10 miles of Manhattan's coast. Separate but coordinated berm systems would reduce flooding in some of Manhattan's most densely developed areas.

2. Energy

The power outages experienced during Superstorm Sandy demonstrated the vulnerabilities in the current electrical supply system in New York, whereby energy

³⁴ NYC MAYOR'S OFFICE OF SUSTAINABILITY, *supra* note 9, at 18.

³⁵ Press Release, N.Y. State Office of Governor Andrew M. Cuomo, Governor Cuomo Announces New York Awarded \$340 Million to Flood-Proof Drinking Water and Wastewater Treatment Plants Damaged by Sandy (May 2, 2013), <https://www.governor.ny.gov/news/governor-cuomo-announces-new-york-awarded-340-million-flood-proof-drinking-water-and-wastewater>.

³⁶ Press Release, N.Y. State Office of Governor Andrew M. Cuomo., Governor Cuomo Announces \$28 Million for Flood Protection at LaGuardia Airport (Feb. 19, 2015), <https://www.governor.ny.gov/news/governor-cuomo-announces-28-million-flood-protection-laguardia-airport>.

generated at centralized stations is distributed across the State through an extensive “macrogrid.” To address these vulnerabilities, the New York State Public Service Commission (“PSC”), along with the New York State Energy Research and Development Authority (“NYSERDA”), has initiated an energy strategy called “Reforming the Energy Vision” (“REV”), with the goal of creating a more decentralized distribution system in New York. The PSC issued its first “Track I” REV order in February 2015. The order is the first major step toward the goal of “distributed energy” generation in New York.

After Superstorm Sandy, some alternative energy sources could have functioned in New York, but for their inability to supply power to the centralized grid system. For example, almost 700 solar arrays were in use on New York City rooftops when Sandy hit. Although those facilities sustained little or no damage during the storm, they were unable to provide power to the grid during the subsequent power outage.³⁷ While New York State has a growing solar market, with more than 18,000 solar electric systems now deployed, only a small fraction of those facilities are equipped with battery storage, which could provide a critical role for such systems in supplying emergency power, or are able to distribute electricity to other users.³⁸

To address this limitation, NYSERDA also has initiated a “NY Prize Community Microgrid Competition” to spur the development of local energy distribution networks to provide power from distributed sources of energy (including combined heat/power and renewable energy facilities) to multiple customers. Such microgrid systems would supplement macrogrid power during normal operation and provide off-the-grid service during extreme weather events. In October 2015, Governor Cuomo announced funding for the initial planning phase of more than 80 microgrids across the State. Each recipient will receive \$100,000 initially, and can apply for more funding in the second and third stage of the competition this summer.

The governor also announced an agreement between the New York Power Authority and SUNY Polytechnic Institute to create a facility devoted to energy technology innovation and modernizing New York’s electric grid. The facility will research methods to quickly deploy smart grid technology in the State.

3. Public Health

Trees reduce the impact of heat stress on urban environments and residents. One of New York City’s long-term planning initiatives is “MillionTreesNYC,” a public-private partnership to plant and care for one million new trees throughout New York City’s five boroughs. Since its inception in 2007, about one million trees have been planted.

³⁷ Press Release, NYC Office of the Mayor, Mayor de Blasio Announces U.S. Department of Energy Award to CUNY to Spur Solar Electric Systems For Emergency Power During Power Outages (Jan. 29, 2015), <http://www1.nyc.gov/office-of-the-mayor/news/074-15/mayor-de-blasio-u-s-department-energy-award-cuny-spur-solar-electric-systems>.

³⁸ *Id.*

Additional strategies include enhancing heat-wave preparedness. New York City currently provides cooling centers during extreme heat events, and offers outreach and transportation services to high-risk individuals. Anticipated community-based efforts under OneNYC may also include education and neighbor look-in programs to check on those most at risk for heat stress.

Communication is critical for positive health outcomes during extreme weather events. Enhancing communication within and to vulnerable neighborhoods and populations prior to major storm events and engaging rapid response before, during and after storms improves health-related storm resilience. New York City is working to expand its online emergency notification contact system to include individual emergency contact information and information on building components, such as whether a specific building has an emergency generator, the type of heating system within the building, and where the building is located so that vulnerable populations can be identified and contacted prior to a storm event.

4. Transportation

Because flooding was such a major issue after Superstorm Sandy, the MTA is raising and waterproofing structures and equipment and establishing design guidelines for all capital projects to be relocated, elevated, and/or protected in place to increase resiliency during and after storm events. Permanent emergency generators are being installed and flood barriers are being erected in and around the East River tunnels. Tunnel air vents are also being raised above flood levels to assure adequate ventilation during and after a storm. At the same time, New York City is implementing several initiatives to protect and back-up critical transportation elements. Additional ferry routes are being added to residential areas; traffic signals located in vulnerable flood areas are being elevated and traffic control electrical equipment is being placed above the 100-year flood elevation.

In addition, several redundant connections have been approved or proposed along heavily traveled transportation corridors, although the required capital funding for some of these projects remains uncertain. For example, Amtrak's Gateway Program would build additional tunnels into and throughout New York City; Long Island Rail Road is working on a second major connection to Manhattan (to Grand Central Terminal on the East Side); and Metro-North Railroad service might be extended from Grand Central Station to Penn Station. All of these major capital projects will provide additional and alternative access for commuters into and out of New York City.

5. Housing

Statewide, housing recovery efforts have been spearheaded by the Governor's Office of Storm Recovery, which assisted more than 10,000 residents with home repairs, rehabilitation, and elevation of single family homes in areas prone to storm surges. Housing recovery within the five boroughs has been administered primarily by the City through its "Build It Back" program. By the third anniversary of Superstorm Sandy, most owners of impacted dwellings have been offered financial assistance, and the

majority have received reimbursement or undertaken construction at a total cost of over \$100 million.

For homes that were damaged in high risk areas where recovery is not a viable option, the State has been managing a voluntary Buyout and Acquisition Program. Operating in select neighborhoods on Long Island and Staten Island, these programs improve the resiliency of the larger community by transforming the acquired parcels of land into wetlands, open space, or stormwater management systems that will provide natural coastal buffer to safeguard against future storms. To date, approximately \$370 million has been paid out for buyouts and acquisitions under this program.

6. Social Impacts/Public Participation

The socioeconomic issues that New York City and State confront with respect to climate change adaptation pale in comparison to those faced by cities in the developing world. Nevertheless, the processes followed by the City and State in developing projects and policies to promote climate change resiliency can be a helpful reference for other municipalities. The hallmark of those processes is public outreach and involvement. Thus, the State Environmental Quality Review Act (“SEQRA”) and the City Environmental Quality Review (“CEQR”) procedures require that significant discretionary governmental actions that go beyond preliminary planning be preceded by a thorough airing of environmental impacts, with ample opportunity for public review and comment. The Uniform Land Use Review Procedure (“ULURP”), applicable to a wide array of City actions—including site selection for major capital projects, text changes to the New York City Zoning Resolution and changes to the City Map—requires all such actions to undergo review by affected community boards, the Borough President, the City Planning Commission and the City Council before they are finalized. Such public outreach and review requirements assure that affected communities have a role in shaping the projects that will affect them. A thorough environmental and community review must precede the adoption of new zoning requirements restricting or precluding development within certain waterfront areas of the City, or the implementation of a major capital project aimed at flood control.

As illustrated by the extensive stakeholder involvement in the development of projects under the Rebuild by Design initiative, federal involvement in adaptation planning can further enhance opportunities for public input. Moreover, concepts of “environmental justice” are now part of capital planning in New York, and principles of environmental equity are increasingly considered in the review of projects under federal, state and local law.

The City recently has opened up a new dimension in its climate change adaptation effort through the OneNYC plan. Recognizing that a socially cohesive community is more likely to handle climate-related emergencies successfully, the City has integrated strategies aimed at creating economic vitality and equity with strategies directed towards environmental sustainability and resilience. Such an integrated approach could be effective in climate change adaptation efforts in other urban areas as well.

Beyond its impressive array of careful studies and long-term residency plans, the New York experience also demonstrates the importance of public participation in both the selection and implementation of climate change adaptation plans. Neighborhood residents and businesses often have a hands-on understanding of local conditions and danger zones, as well as a heightened sensibility to the practical problems that residents will face from electricity or transportation outages or even short-term displacement during storm surges. Moreover, community input to adaption plans is often essential to successful implementation. Emerging communication and assistance networks play a major role in reducing death and illness during heat waves, floods and food (or water) shortages and in providing both needed transportation and information to isolated neighborhoods. Public participation is also essential to developing a practical adaptation plan, as the New York experience illustrates, and in adjusting or amending the plans in light of actual experience.

7. Implementation

For all of its planning efforts, the New York experience also illustrates the difficulty of implementing resiliency plans in practice. Following Superstorm Sandy, many public housing tenants, assisted living residents and even hospital patients found themselves isolated and without electrical power or necessary medical care for days before emergency assistance was available. In several shoreline communities, electrical power was not restored for weeks and relocation or home repair loans were delayed for many months thereafter, despite the best intentions of state and local agencies and public utilities. It is clear that resiliency planning requires the identification and training of on-the-ground resources ready to respond quickly and effectively to the sorts of emergencies arising during storm events.

C. **URBAN CLIMATE ADAPTATION IN DEVELOPING COUNTRIES**

New York City's planning efforts to confront climate change are by no means unique. Both medium-size and major cities throughout Central and South America, Europe, the Middle East, Asia and Africa are experiencing similar climate-related impacts from flooding, drought and heat, as well as the accelerating impacts of climate change on water availability, food security and migration. In this part of the report, we summarize briefly the efforts of four major cities – three in Africa and one in Asia – to address these problems.

1. Cape Town, South Africa

Cape Town lies along 190 miles of the South Africa coastline.³⁹ It is home to 3.8 million people and thousands of different plant and animal species, many of which occur

³⁹ See ENVTL. RES. MGMT. DEP'T, CITY OF CAPE TOWN LOCAL ACTION FOR BIODIVERSITY (LAB), CITY OF CAPE TOWN BIODIVERSITY AND CLIMATE CHANGE ASSESSMENT REPORT 1–2 (2011), *available at* <http://cbc.iclei.org/Content/Docs/LAB%20Pioneer%20Biodiversity%20and%20Climate%20Change%20report%20Cape%20Town.pdf>.

nowhere else in the world.⁴⁰ Parts of the city are especially susceptible to rising sea levels and resulting flooding.⁴¹ Some areas already regularly experience severe flooding that displaces tens of thousands of residents,⁴² and the city's recently developed Risk and Vulnerability Map shows that large swaths of Cape Town's coastline and freshwater sources are at further risk as sea levels rise.⁴³ Some neighborhoods and coastal habitats are expected to be completely lost to flooding if the projections prove true.⁴⁴

In 2015, Cape Town adopted its Integrated Coastal Management Programme (ICMP) as part of the requirements of South Africa's National Environmental Management: Integrated Coastal Management Act of 2014.⁴⁵ The program incorporates no fewer than 23 laws and regulations that are relevant to coastal management and integrates the efforts of many existing regulatory areas within the city government, including zoning and land use, conservation, and water rights.⁴⁶ The hope is that the intelligent deployment of artificial structures (such as seawalls and breakers) and the restoration of natural habitats to act as natural barriers to the sea will help to significantly lessen the impact of rising sea levels. At the same time, the human population and the city's socioeconomic wellbeing can be protected as much possible by limiting development and infrastructure to more inland areas on higher ground.⁴⁷

Although the ICMP is in its infancy, many of the programs it incorporates have existed for years and have shown promising results: some sand dunes have been restored to near-natural states; populations of kelp, which act as natural sea breakers, are thriving; estuaries, which act as natural buffers between seawater and freshwater sources, are

⁴⁰ See CITY OF CAPE TOWN, MOVING MOUNTAINS: CAPE TOWN'S ACTION PLAN FOR ENERGY AND CLIMATE CHANGE 2 (2011), available at

https://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/Moving_Mountains_Energy+CC_booklet_2011-11.pdf; CITY OF CAPE TOWN, STATE OF THE ENVIRONMENT REPORT 7–11 (2012), available at https://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/State_of_Environment_Report_2012.pdf.

⁴¹ See CITY OF CAPE TOWN, FRAMEWORK FOR ADAPTATION TO CLIMATE CHANGE IN THE CITY OF CAPE TOWN 38–41 (2006), available at [https://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/Framework_for_Adaptation_to_Climate_Change_\(FAC4T\)_08_2006_38200713832_465.pdf](https://www.capetown.gov.za/en/EnvironmentalResourceManagement/publications/Documents/Framework_for_Adaptation_to_Climate_Change_(FAC4T)_08_2006_38200713832_465.pdf).

⁴² See, e.g., *id.*; see also *Governing Risks Associated with Flooding and Sea-Level Rise in Cape Town, South Africa*, weADAPT (Oct. 18, 2015), <https://www.weadapt.org/knowledge-base/urban-adaptation-to-climate-change/governing-climate-risks-in-cape-town>.

⁴³ CITY OF CAPE TOWN DISASTER RISK MGMT. CTR., RISK & VULNERABILITY MAP (2013); see also UNIV. OF CAPE TOWN AFRICAN CTR. FOR CITIES, CAPE OF STORMS: SHARING THE COAST IN THE FACE OF TURBULENT, RISING SEAS (2013), available at <https://www.weadapt.org/sites/weadapt.org/files/legacy-new/knowledge-base/files/1280/5255713e84aaaacc-fliccr-capeofstorms-2013.pdf>.

⁴⁴ CITY OF CAPE TOWN, FRAMEWORK FOR ADAPTATION, *supra* note 41, at 38–41.

⁴⁵ *Integrated Coastal Management Policy and Programme*, CITY OF CAPE TOWN, <http://www.capetown.gov.za/en/EnvironmentalResourceManagement/projects/MarineCoastal/Pages/CoastalManagementProgramme.aspx> (last visited Oct. 9, 2015).

⁴⁶ See INTEGRATED COASTAL MANAGEMENT POLICY OF THE CITY OF CAPE TOWN 7–8 (2014), available at http://www.capetown.gov.za/en/EnvironmentalResourceManagement/projects/MarineCoastal/Documents/CCT_Integrated_Coastal_Management_Policy_2014-09.pdf.

⁴⁷ See *id.*; *Integrated Coastal Management Policy and Programme*, *supra* note 45.

healthier; and development near the coast has been limited, with many areas permanently set aside for conservation.

In addition to flooding, Cape Town is also vulnerable to severe drought; the city has undertaken a mixed program of water conservation and infrastructure programs, including leak and meter repair, pipe replacement, water restrictions, and user tariffs.⁴⁸ As a result of these measures, the city reached its target of reducing per capita consumption to 180 liters (approximately 43 gallons) per day by 2014.⁴⁹ However, the overall use of water continues to increase as the population, number of buildings, and industry all grow, and the city has said that it needs to develop a new source of water by 2017.⁵⁰

Funding all of Cape Town's proposed actions remains a challenge, despite help it has received from the national government and international donors. The municipal government is currently investigating other funding options, including the "Clean Development Mechanism" under the Kyoto Protocol.⁵¹

2. Dakar, Senegal

Dakar, on the westernmost point of the African continent, has an arid climate, with a long dry season and a short rainy season. The metropolitan area is on a peninsula, surrounded by water on three sides. The most pressing threats that face the metropolitan area's 2.4 million residents are flooding, rising sea levels and coastal erosion, and water scarcity.

Senegal's lowlands flood during periods of heavy rainfall, with between 100,000 and 300,000 people nationwide affected each year.⁵² Many rural flood victims move to Dakar, which is particularly at risk due to poor urban planning and lack of drainage systems in the flood plains where new arrivals often settle.⁵³ Each year thousands of city residents must relocate due to flooding, and the property damage is immense.⁵⁴ Flooding also leads to severe water contamination from pollution or sewage due to the lack of adequate natural drainage and sewer systems.⁵⁵

Although Senegal released a National Adaptation Program of Action in 2006 and, in 2013, secured World Bank funding for its Stormwater Management Project,

⁴⁸ CITY OF CAPE TOWN, STATE OF THE ENVIRONMENT REPORT, *supra* note 40, at 34.

⁴⁹ CITY OF CAPE TOWN, UPDATE AND ADDITIONS TO EXISTING LONG-TERM WATER CONSERVATION AND WATER DEMAND MANAGEMENT STRATEGY 39, tbl. 7; *see also* CITY OF CAPE TOWN, STATE OF THE ENVIRONMENT REPORT, *supra* note 40, at 35.

⁵⁰ *See* CITY OF CAPE TOWN, UPDATE, *supra* note 49, at 10.

⁵¹ *See* CITY OF CAPE TOWN, MOVING MOUNTAINS, *supra* note 40, at 38.

⁵² *See Senegal: Breaking the Cycle of Annual Floods*, United Nations Office for the Coordination of Humanitarian Affairs (Oct. 8, 2013), <http://www.unocha.org/top-stories/all-stories/senegal-breaking-cycle-annual-floods>; GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY, VULNERABILITY, RISK REDUCTION, AND ADAPTATION TO CLIMATE CHANGE: SENEGAL 7 (2011).

⁵³ *See, e.g.*, GLOBAL FACILITY FOR DISASTER REDUCTION AND RECOVERY, *supra* note 52, at 7.

⁵⁴ *See, e.g., id.*

⁵⁵ *See, e.g., id.*

implementation efforts have been hindered by a decentralized government structure and a lack of funding. Senegal is divided into 14 sub-national regions and even further into local governments that are largely decentralized. Dakar itself consists of a national “Regional” government, a lower government called the “Department,” and three different types of local governments.⁵⁶ The lack of communication, cooperation, and fund allocations among various national, municipal, and local government bodies has long been an obstacle to proper urban planning and flood response plans.⁵⁷

Rising sea levels also have led to large amounts of coastal erosion along the entire Senegal coast, including Dakar.⁵⁸ Senegal’s coast is made up of mangrove ecosystems, and as the mangroves disappear so does the livelihood of people who live along the coast.⁵⁹ The mangroves also protect inland water sources from the salt water of the Atlantic Ocean, so loss of mangroves means more rapid salination of freshwater sources.⁶⁰ It is estimated that 20 to 30% of mangroves along the West African coast have been lost in the past 25 years.⁶¹

Although, Senegal’s national government has undertaken efforts to conserve the mangroves (such as joining Wetlands International’s Mangrove Charter and Action Plan),⁶² the results have been limited. While further adaptation and conservation efforts have been made by local governments, NGOs, and private organizations,⁶³ the rate of coastal erosion and the loss of mangrove forests continues.

3. Dhaka, Bangladesh

Bangladesh is one of the largest deltas in the world and, apart from island nations, is perhaps the country most at risk from climate change.⁶⁴ According to the Adaptation Partnership country profile, Bangladesh “nearly annually experiences floods, cyclones, tornadoes, and tidal bores . . . [and] approximately one-third of the country is prone to tidal inundation, and during monsoons up to 70 percent of the country becomes flooded.”⁶⁵ These conditions are expected to become worse as the climate warms and the sea levels rise.⁶⁶

⁵⁶ See HYOUNG GUN WANG & MARISELA MONTOLIU-MUNOZ, “PREPARING TO MANAGE NATURAL HAZARDS AND CLIMATE CHANGE RISKS IN DAKAR, SENEGAL 9 (June 30, 2009).

⁵⁷ *Id.* at 9–10.

⁵⁸ *E.g.*, WANG & MONTOLIU-MUNOZ, *supra* note 56, at 19.

⁵⁹ See *Senegal: Protecting Livelihoods through Mangroves*, HUMANITARIAN NEWS AND ANALYSIS (Oct. 14, 2008), <http://www.irinnews.org/report/80906/senegal-protecting-livelihoods-through-mangroves>.

⁶⁰ *Id.*

⁶¹ *Mangroves and Coastal Conservation*, WETLANDS INT’L, <http://africa.wetlands.org/Whatwedo/Mangrovescoasts/tabid/2943/language/en-GB/Default.aspx> (last visited Oct. 9, 2015).

⁶² *Id.*

⁶³ See *id.*; *Mangroves and Coastal Conservation*, *supra* note 61.

⁶⁴ ADAPTATION PARTNERSHIP, REVIEW OF CURRENT AND PLANNED ADAPTATION ACTION: SOUTH ASIA 50–51 (2011).

⁶⁵ *Id.* at 51.

⁶⁶ *Id.*

In 2009, Bangladesh released its Climate Change Strategy and Action Plan, which will take an estimated \$5 billion to implement in the first five years alone.⁶⁷ Bangladesh was able to contribute significant funds to its Climate Change Trust Fund (\$100 million each year for three years),⁶⁸ but largely relies on outside aid, such as the Bangladesh Climate Change Resilience Fund (\$160 million from eight countries and coalitions).⁶⁹

Dhaka, the capital city and home to over 18 million people, has severe urban planning, drainage, sewage, and related issues that have contributed to severe flooding.⁷⁰ The Bangladesh national government has constructed 97 miles of river bank protection, 65 water control infrastructures, and 25 miles of urban drainage nationwide since adopting the 2009 Action Plan,⁷¹ but it has not made any concrete plans solely for Dhaka.⁷²

The municipal government formed a Climate Change, Environment, and Disaster Management Department in 2011, but it has completed only small-scale projects. Although the national government's policies set out a robust plan for climate adaptation, responsibility for implementing them is spread across different agencies and departments in the Dhaka government.⁷³ As a result, local governments and residents, especially in Dhaka's expansive slums, often cannot comply with the national government's policies and regulations.⁷⁴

4. Maputo, Mozambique

Mozambique lies along approximately 1700 miles of the southeastern Africa coastline, with sandy beaches, dunes, coral reefs, and mangroves.⁷⁵ The city of Maputo, with a fluctuating population of between 2 and 3 million people, is located on the coast of the Indian Ocean, downstream of two major south African river systems that flood the city whenever there is increased rainfall upstream and lead to water shortages in the city whenever droughts lead to higher water consumption upstream.⁷⁶ As a result, the city is

⁶⁷ *Id.* at 54.

⁶⁸ See INT'L INST. FOR ENVTL. AND DEV., THE BANGLADESH NATIONAL CLIMATE FUNDS 3–4, *available at* <https://ldccclimate.files.wordpress.com/2012/05/bangladeshnationalfund.pdf>.

⁶⁹ BANGLADESH CLIMATE CHANGE RESILIENCE FUND, ANNUAL REPORT 2014 18 (2014), *available at* http://bccrf-bd.org/Documents/pdf/BCCRF%20AR2014_web_resolution.pdf.

⁷⁰ Mozaharul Alam & MD Golam Rabbani, *Vulnerabilities and Responses to Climate Change for Dhaka*, 19 ENVIRONMENT & URBANIZATION 81, 85–91 (2007).

⁷¹ Bangladesh Ministry of Env't and Forests, *Achievements*, BANGLADESH CLIMATE CHANGE, <http://www.bcct.gov.bd/index.php/key-achievements> (last visited Oct. 9, 2015).

⁷² Malcolm Araos, *Adaptation to Climate Change—How Well Is Dhaka Doing?*, DHAKA TRIBUNE (Sept. 20, 2015), <http://www.dhakatribune.com/environment/2015/sep/19/adaptation-climate-change-how-well-dhaka-doing>.

⁷³ *Id.*

⁷⁴ See Alam & Rabbani, *supra* note 70, at 82.

⁷⁵ ADAPTATION PARTNERSHIP, *supra* note 64, at 123.

⁷⁶ *Id.*; see also CITIES AND CLIMATE CHANGE INITIATIVE OF THE UN-HABITAT, CLIMATE CHANGE ASSESSMENT FOR MAPUTO, MOZAMBIQUE: A SUMMARY 8 (2010); ⁷⁶ ICLEI-AFRICA 2012 ET AL., BUILDING CLIMATE RESILIENCE: ADAPTING SANITATION SYSTEMS TO CLIMATE CHANGE THROUGH PARTICIPATORY RESEARCH AND LOCAL ACTION IN MAPUTO, MOZAMBIQUE 11 (2012), *available at*

particularly vulnerable to flooding, rising sea levels, cyclones, coastal erosion, and water scarcity.

The Mozambique government has tried various measures to lessen the human impact of flooding and help Maputo become more resilient to flooding through improved urban planning, drainage, and sewage systems.⁷⁷ However, the project has faced shortfalls in funding, political concerns that hinder major changes or enforcement in land use policy and zoning, and lack of cooperation and implementation between the national, municipal, and local neighborhood governments.⁷⁸ Thus, an attempted relocation project largely failed to reduce the population in Maputo's most vulnerable neighborhoods.

Flooding in Maputo is likely going to worsen as inland areas experience heavier rainfall during their wet seasons, causing river systems in Maputo to overflow and, as sea levels rise, eroding the coast and destroying mangrove forests.⁷⁹ Flooding events have already caused the salination of water sources and subsequent loss of crops, as well as the loss of fisheries supported by the mangrove ecosystem.⁸⁰

Mozambique adopted its National Adaptation Program of Action in 2007, but while the national plan addressed some conditions threatening Maputo, it did not include a specific plan of action for the city. Maputo has an Urban Master Plan that lays out policy changes in urban planning, land use, and data collection, but it does not appear to have achieved a high level of implementation due to lack of funding and political concerns.⁸¹ While there are some climate change adaptation programs in Maputo, many of them are funded or implemented by third party organizations such as the Least Developed Countries Fund, the United Kingdom's Climate Change Adaptation in Africa Program and the governments of Germany, Denmark, and others.⁸² Maputo has, however, successfully implemented some plans meant to target discrete places, such as the Maputo Municipal Development Programme (Pro-Maputo), a \$150 million project that seeks to improve the city's infrastructure, particularly drainage and sewage systems.⁸³

<http://www.resilientafrica.org/Resources/Final%20Resources/Final%20Handbooks/Maputo%20adaptation%20handbook.pdf>.

⁷⁷ See ADAPTATION PARTNERSHIP, *supra* note 64, at 126–37; CITIES AND CLIMATE CHANGE INITIATIVE OF THE UN-HABITAT, *supra* note 76, at 11–12.

⁷⁸ See ICLEI-AFRICA 2012, *supra* note 76; CITIES AND CLIMATE CHANGE INITIATIVE OF THE UN-HABITAT, *supra* note 76, at 11–16.

⁷⁹ CITIES AND CLIMATE CHANGE INITIATIVE OF THE UN-HABITAT, *supra* note 76, at 5–10 & tbl. 2.

⁸⁰ See, e.g., ADAPTATION PARTNERSHIP, *supra* note 64, at 123–25.

⁸¹ See CITIES AND CLIMATE CHANGE INITIATIVE, *supra* note 76, at 12.

⁸² ADAPTATION PARTNERSHIP, *supra* note 64, at 126–37.

⁸³ See CITIES AND CLIMATE CHANGE INITIATIVE, *supra* note 76, at 12; *Projects & Operations: ProMaputo, Maputo Municipal Development Program*, WORLD BANK, <http://www.worldbank.org/projects/P096332/promaputo-maputo-municipal-development-program?lang=en> (last visited Oct. 12, 2015); Orlando Henriques, *PROMAPUTO II Destined for Suburban Development*, O PAÍS (Mar. 7, 2011), <http://opais.sapo.mz/index.php/sociedade/45-sociedade/12684-promaputo-ii-destinado-ao-desenvolvimento-suburbano.html>.

D. LESSONS LEARNED FROM ADAPTATION EFFORTS AT THE LOCAL LEVEL

Drawing on the experience of New York and other cities in developing their adaptation plans and the advice of other citizen groups, planners and public officials who have studied New York's adaptation efforts in detail, we offer the following observations:

1. A Methodical Approach Is Essential to Adaptation Planning

New York's NPCC, a joint panel established to study likely climate impacts on the City, contributed to the sustainability effort by developing a systematic approach to infrastructure adaptation that can be used by other urban areas in preparing for climate change. This methodical approach is embodied in the NPCC's "Adaptation Assessment Guidebook," which sets forth a multi-step process for identifying climate change-related risks to infrastructure, and coming up with initiatives to address them.⁸⁴ The steps recommended by the NPCC for developing a plan to protect critical infrastructure from the risks of climate change are discussed briefly below.

- **Identify Current and Future Climate Hazards**

For New York City, the projections provided by the NPCC Climate Risk Information Reports (most recently updated in 2015) have created a solid technical basis for adaptation planning. A number of other major cities have also developed detailed technical information regarding impending climate change impacts that can inform their planning efforts.

- **Conduct an Inventory of Infrastructure and Assets**

The Guidebook provides a very detailed questionnaire to assist municipal officials in identifying the critical infrastructure and assets that may be at risk as a result of climate change-related effects.

- **Characterize the Risk of Climate Change on Infrastructure**

The Guidebook recommends that cities draw on whatever information may be available with respect to future local or regional climate impacts to prepare a detailed inventory of the potential risks posed to specific categories of critical infrastructure. In making this assessment, stakeholders are advised to consider the likelihood that a given climate hazard would result in the vulnerability of certain infrastructure, and the magnitude of the overall consequence should the impact occur.

- **Develop and Prioritize Initial Adaptation Strategies**

The Guidebook recommends that initial strategies be identified on an agency-wide basis, and also in coordination with other stakeholders as part of a city-wide effort. Once those strategies are identified, they are to be categorized (i.e., as operation and maintenance,

⁸⁴ DAVID C. MAJOR & MEGAN O'GRADY, NYC PANEL ON CLIMATE CHANGE, ADAPTATIONS ASSESSMENT GUIDEBOOK, *available at* http://pubs.giss.nasa.gov/docs/2010/2010_Major_OGrady_1.pdf.

capital investment, regulatory, etc.) and prioritized. The NPCC notes that in the past infrastructure planning has been keyed to historical experience, but now climate change-related *projections* must also be taken into account. In setting priorities, the Guidebook recommends that factors such as feasibility, efficacy, resiliency and co-benefits be considered.

- Identify Opportunities for Coordination

Given the complexity of urban infrastructure, the Guidebook is clear that agencies should not act in isolation from other municipal and regional agencies in their planning and implementation of adaptation strategies. Instead, the panel suggests that such planning should be undertaken as a city-wide strategic initiative, with the participation of a broad range of public and private stakeholders. As an example, the Guidebook notes the efficiencies that can be derived in New York by coordinating the transportation infrastructure initiatives of the various affected agencies such as the MTA, Amtrak and the Port Authority of New York and New Jersey.

- Link Strategies to Capital and Rehabilitation Planning

Recognizing that climate change adaptation is a long-term effort that will play out over decades, the Guidebook recommends that adaptation initiatives be folded into infrastructure operation and maintenance, and the capital planning process for the municipality. Substantial savings could result from building climate change adaptation measures into infrastructure rehabilitation and replacement cycles.

- Prepare and Implement the Adaptation Plan

The NPCC recommends that strategies identified and refined through the previous steps should then be compiled into comprehensive written plans, which should include low-cost near-term strategies, readily implementable operational strategies, a medium-term more aggressive strategy, and finally, any necessary long-term capital strategy.

- Monitor and Adjust the Plan on a Regular Basis

The NPCC Guidebook recommends that an adaptation plan include metrics to measure success, and that it be reviewed and updated on a regular basis. The panel emphasizes throughout the Guidebook that flexibility is a key aspect of adaptation planning, in light of the uncertainties surrounding the impacts that climate change will have in any particular geographic area.

The Task Force is aware that innovation and experimentation are important to the climate-change adaptation planning effort, and that a “one size fits all” approach may be counterproductive. However, the step-by-step process suggested by the NPCC is a methodology that can serve as a guide for other municipalities around the world in approaching the complex task of developing a plan to protect their infrastructure against the risks posed by climate change.

2. Climate Risk Identification Should Be Scientifically Based

As discussed above, a critical factor in New York's planning effort was the technical input of the NPCC. The same is true in Cape Town, where a special planning body was established for this purpose. The Task Force believes that a community's adaptation planning should, to the extent possible, be grounded in science because strategies cannot be developed to address risks if those risks have not been properly identified. The process should begin with the identification of each geographic area within the municipality where climate-related impacts can be expected; the nature, severity and expected frequency of those impacts; and the number of people and kinds of cultural or natural resources in each such area. It is not always obvious which communities would be most severely affected by coastal floods, torrential rains, drought, high winds or heat waves. Once these communities, and potential impacts to them from these events, are identified on the basis of sound scientific study, planning for appropriate forms of adaptation can begin.

The Task Force recognizes that many cities do not have the scientific resources at hand to perform the risk assessment we believe should be a first step in adaptation planning. The NPCC suggests, as one solution to that problem, that cities lacking the resources needed for location-specific projections might in many cases rely on regional information developed by organizations like the IPCC. Although funding has been made available to some cities by national governments, UN agencies, private foundations, development banks and other sources, a recent survey of 468 cities worldwide indicates that most do not receive financial support for their adaptation efforts.⁸⁵ The challenge related to funding is discussed in Section III of this report.

3. Adaptation Planning Should Not Be a Top-Down Exercise

Because the impacts of climate change are expected to fall most heavily on socioeconomically vulnerable communities, stakeholders from those communities should be involved in planning for those impacts from the outset. As noted above, there are legal mechanisms in New York (such as the Uniform Land Use Review Procedures in New York City and the environmental review process under the State Environmental Quality Review Act) that allow for the opportunity for such input. However, formalized opportunities for consultation with the affected public may not yet exist in certain other cities, and those opportunities should be put into place at the outset of the planning process. The Task Force believes that planners must consult with a broad range of community residents and organizations to solicit their views as to the area's existing environmental, economic and social needs, the nature of the area's vulnerability to climate-related impacts, and the kinds of adaptive actions that would be required to protect the area, its residents and its significant cultural and natural resources.

It is important for municipal officials to include community organizations not only in the initial planning process, but also throughout the plan's implementation. As noted above, community networks play an important role in helping residents survive

⁸⁵ JOANN CARMIN ET AL., *supra* note 2, at 20–22.

climate-related crises and in carrying out adaptive measures relating to health care, education, water and electricity, transportation, rebuilding, and alternative employment opportunities.

4. Where Relocation Is Necessary, It Should Be Part of a Long-Term Plan That Is Transparent and Fair

With a science-based risk assessment and community impact study, municipal officials will sometimes identify regions where no feasible measures are available to avoid inundation over the long term. Planners are likely to find—as they did in parts of New York outside Manhattan—that coastal retreat is the most viable option in such coastal areas. Responsible municipal officials will recognize the need for relocation where inundation is inevitable and must begin the long-term planning needed to accomplish that task fairly and equitably. Where protection is not possible with potentially available resources, consultation with the affected communities should begin early in the planning process, and should include the kinds of public and private actions that would be required to make relocation feasible and successful. Relocation programs must include procedures for assuring prompt and equitable compensation for homes and personal property, relocation assistance payments and enforceable commitments to provide replacement homes in a viable community with adequate education, health care, transportation and employment for new residents, as well as appropriate protection for any relocated natural or cultural resources.

5. Climate Change Adaptation Should Be Paired with Shorter-Term Co-Benefits

Many of the measures needed to adapt to a changing climate will be costly, and some will entail extended periods of disruption in existing communities. With this in mind, the Task Force endorses the view that climate-change adaptation planners should assess whether there may be opportunities to develop adaptation strategies having co-benefits that will also contribute to improving existing environmental, social and economic conditions in the community. For example, near-term plans for the reconstruction and improvement of transportation infrastructure should be prepared with an eye towards protecting against the potentially devastating long-term impacts of impending climate change. With proper planning, local governments can proactively reduce these threats and enhance the transportation systems' resilience to various extreme weather events.⁸⁶ Moreover, sound land use planning should include avoiding new infrastructure development in flood-prone areas, raising infrastructure above flood levels, relocating or abandoning structures or roads that experience repeated flooding, and preserving open space to enhance drainage.

6. Emergency Planning Should Focus on Vulnerable Communities

Recent experience indicates that underprivileged and elderly populations are particularly vulnerable to climate-related disasters. Thousands of people were left stranded in high-rise, low-income housing after Superstorm Sandy because New York

⁸⁶ H. G. SCHWARTZ ET AL., U.S. GLOBAL CHANGE RESEARCH PROGRAM, CLIMATE CHANGE IMPACTS IN THE UNITED STATES, CH. 5, AT 138–39 (J. M. Melillo et al. eds., 2014).

City, a municipality with comparatively abundant resources at hand, did not have a safety net in place to assist such people in the aftermath of the storm. This shortcoming is now being addressed by the City. Other municipalities should do likewise and assure that the plans they develop identify: (a) areas requiring particular attention with respect to emergency response during climate emergencies, and (b) how the risks posed by climate change-related disasters (such as flooding and power outages) are to be addressed in such areas during those times.

7. Climate Change Adaptation Planning Must Be Institutionalized

Climate change impacts are now emerging and will only worsen over time. Municipalities should recognize these hard facts by incorporating into applicable law a continuing mandate for adaptation planning. As noted above, New York City has institutionalized its long-term planning structure, and New York State law now requires agencies to consider climate change-related impacts when they approve projects or issue regulations.⁸⁷ Given the long-term nature of the problem, it is likely that without such a mandate the attention of governmental planners will be diverted as more immediate political concerns arise. Such a legal mandate should include provisions for: (a) the periodic review and updating of plans; (b) requiring continuing community input with respect to plan implementation, not only to assure support for the plan but also as an essential component of community resiliency; and (c) mechanisms to address complaints, because even the most sensitively developed and implemented urban adaptation plan will encounter difficulties, including objections from individuals, groups and entire communities who believe their rights have been denied or commitments contained in the plan have been ignored in practice.

8. Urban Adaptation Will Be Hugely Expensive

As noted above, as a result of the federal funding provided in the wake of Superstorm Sandy, the New York metropolitan area has some of the funding needed to transform certain of its major resiliency plans into reality. The Task Force is well aware that this is not the case with other cities in the United States and other areas of the world. Indeed, Cape Town, Dakar, Dhaka and Maputo all have severe funding problems that undermine their ability to carry out the plans they have already developed. It seems clear that, absent that funding, many of those plans will be overtaken by climate-driven changes before they can be implemented. Thus the single most difficult issue to be addressed in helping cities adapt to a changing climate is finding the funds needed to meet that challenge in the coming decades. That issue is discussed in Section III of this report.

⁸⁷ Community Risk and Resiliency Act, S.B. 6617 (2013).

II. RURAL ADAPTATION

If cities face extraordinary challenges in adapting to climate change in the face of swelling populations and infrastructure that are unable to provide clean water, reliable electricity, or adequate food to residents, many rural areas in developing countries face equally daunting issues. Depleted soil and water sources and the absence of any infrastructure to help farmers sell agricultural produce are causing people to flee their traditional homes and farms. In an increasing number of countries, rural violence, whether from insurgents or government security forces, has driven rural residents toward cities or other parts of their own or neighboring countries. Climate change exacerbates these trends by converting arable land to deserts or flood plains, disrupting age-old rainfall patterns on which planting and harvesting are based and depleting traditional sources of water. Beyond the impacts on those families choosing (or forced) to leave their farms, the collapse of rural agriculture leaves a growing number of cities at continuing risk of food shortages absent continuing foreign assistance.

Some who leave their farms migrate to cities. For others, that option is not feasible, and so they move, often in groups, to other regions of their country or seek to cross borders to neighboring nations. As noted above, the focus of this Section II of the report is on rural migrants who remain in their countries and become part of the 40 million “internally displaced persons” (IDPs) trying to survive in home countries that seem to have no place for them. Although factors other than climate change contribute to the rapidly increasing number of IDPs, climate change is already accelerating this trend and is certain to drive increasing numbers of rural families from their homes in the future.

Part A of this Section sets forth the components of agricultural adaptation programs that have been proposed to help farmers continue to remain on their land and contribute to the “food security” requirements of their country. Part B summarizes the current state of protection for IDPs and the measures widely recognized – though rarely implemented – as necessary to protect their basic human rights. As indicated below, the levels of international investment required to carry out these adaptation programs are beyond the capacity of all but a few developing countries.

A. AGRICULTURAL ADAPTATION

The importance of climate change impacts on agriculture and food security will become particularly urgent as the global population increases. Given current food consumption trends, an estimated 60 percent more food will be needed by 2050 to sustain the growing global population.⁸⁸ While more food is currently grown per capita than needed to feed the global population, nearly 900 million people remained hungry between 2010 and 2012, the vast majority of whom lived in developing countries.⁸⁹ The highest proportion of food insecure people reside in sub-Saharan Africa, where an estimated 27 percent of the population was undernourished between 2010 and 2012; in

⁸⁸ JOHN R. PORTER ET AL., IPCC, CLIMATE CHANGE 2014: FOOD SECURITY AND FOOD PRODUCTION SYSTEMS 491 (Pramod Aggarwal & Kaiji Hakala eds., 2014).

⁸⁹ *Id.*

absolute terms, the largest number of food-insecure persons live in South Asia, where approximately 300 million people are undernourished.⁹⁰

1. International Standards on the Right to Food

The right to food is reflected in numerous international treaties and conventions and recognized by a growing number of international organizations. The United Nations Office of the High Commissioner for Human Rights (UNHCHR) has defined the human right to food as the “right to have regular, permanent and unrestricted access, either directly or by means of financial purchases, to quantitatively and qualitatively adequate and sufficient food corresponding to the cultural traditions of the people to which the consumer belongs, and which ensure a physical and mental, individual and collective, fulfilling and dignified life free of fear.”⁹¹ This definition embodies principles set forth in the Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights (ICCPR), and the International Covenant on Economic, Social and Cultural Rights (ICESCR). General Comment No. 12, issued by the UN Committee on Economic, Social, and Cultural Rights (which monitors implementation of the ICESCR), expounds on the nature of the legal obligations of State parties to “progressively realize” the right to adequate food. Definitions of food security have emphasized not only food production, but also access to food. The 1996 World Food Summit defined food security as a condition when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs.

More recent guidelines adopted by organizations such as the UN Open Working Group on Sustainable Development Goals and the Food and Agriculture Organization (FAO) have strengthened the legal framework on the right to food, supporting the principle that the right to food is coterminous with the right to life.

As noted in the previous Section of this report, the adverse impact of changing weather patterns on agriculture and food security have also been cited as contributory factors to human conflicts, including, for example Darfur, Yemen and Syria. In Syria, evidence suggests that drought led to crop failures and the migration of roughly 1.5 million rural Syrian residents into urban areas, intensifying social unrest,⁹² and, more recently, increasing the waves of migrants bound for neighboring countries or Europe. A working group of the IPCC has likewise concluded that there is a “justifiable common concern” that climate change contributes, as one of several factors, to the increased risk of armed conflict.⁹³

⁹⁰ *Id.*

⁹¹ See Office for the United Nations High Commissioner for Human Rights, Fact Sheet No. 34: The Right to Adequate Food 2, available at <http://www.ohchr.org/Documents/Publications/FactSheet34en.pdf>.

⁹² Colin P. Kelley et al., *supra* note 29, at 3241–42; see also Henry Fountain, *Researchers Link Syria Conflict to a Drought Made Worse by Climate Change*, N.Y. TIMES (Mar. 2, 2015), <http://www.nytimes.com/2015/03/03/science/earth/study-links-syria-conflict-to-drought-caused-by-climate-change.html>.

⁹³ See Fountain, *supra* note 92.

Accordingly, climate adaptation strategies that contribute to improved agricultural production in developing regions and strengthen social safety nets for farmers will be critical in offsetting climate change-related food shortages.

2. Climate Change Adaptation in Agriculture

Extreme weather patterns resulting from climate change have a direct impact on agricultural and food systems. Studies have shown that the increase in global average temperatures and extreme temperature variations have had detrimental effects on crop yields, particularly wheat and maize.⁹⁴ A fluctuation of a few degrees can lead to changes in crop growth and livestock production. For example, temperatures above approximately 86 degrees Fahrenheit (30 degrees Celsius) can reduce yields of maize by 1.7 percent each day under drought conditions, while animals reduce their feed intake 3 to 5 percent for each additional degree of temperature above their normal comfort zones of 50 to 86 degrees Fahrenheit (10 to 30 degrees Celsius). Additionally, crop disease and losses in South America and India have been attributed to pathogenic adaptations to climate change; for example, aggressive strains of wheat yellow rust have adapted to high temperatures and arid environments.⁹⁵

In addition to their sensitivity to rising average temperatures, agricultural and crop production are equally vulnerable to extreme rainfall variability. More than 70 percent of agriculture relies on rainfall, and increasing incidences of floods and droughts attributed to anthropogenic activity have had a debilitating impact on crop growth for decades.⁹⁶ Meanwhile, the global demand for water withdrawals for agricultural purposes is expected to increase 11 percent by 2050, even as freshwater resources and groundwater supplies needed for both staple crops and production of livestock feed continue to decline.⁹⁷ Many regions in the tropics and subtropics will be particularly affected by reduced rainfall amounts in the decades to come, and it is estimated that by 2050, more than half the global population will live in areas of severe water constraints.⁹⁸

a. Adaptation Strategies

The stabilization and preservation of food security therefore requires not only efficient agricultural production, but also resilience to climate risk disruption. Farm adaptation strategies typically focus on preventive strategies (actions taken in anticipation of climate disruption) or recovery strategies (measures to decrease crop losses or sell livestock and other assets following droughts or floods).⁹⁹ The effects of these adaptation strategies can vary, with some preventive strategies resulting in lower yields during more

⁹⁴ PHILIP THORNTON & LESLIE LIPPER, INT'L FOOD POLICY RESEARCH INST., IFPRI DISCUSSION PAPER 01340: HOW DOES CLIMATE CHANGE ALTER AGRICULTURAL STRATEGIES TO SUPPORT FOOD SECURITY 2 (2014); JOHN R. PORTER ET AL., *supra* note 88, at 491.

⁹⁵ FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO), "CLIMATE-SMART" AGRICULTURE: POLICIES, PRACTICES AND FINANCING FOR FOOD SECURITY, ADAPTATION AND MITIGATION 2 (2010), available at <http://www.fao.org/docrep/013/i1881e/i1881e00.pdf>.

⁹⁶ PORTER ET AL., *supra* note 88, at 492, 514; THORNTON & LIPPER, *supra* note 94, at 2.

⁹⁷ THORNTON & LIPPER, *supra* note 94, at 2.

⁹⁸ *Id.*

⁹⁹ Burke and Lobell at 135.

stable weather periods. Similarly, the long-term impact of recovery strategies such as selling livestock can stifle food production in the long term, even as those strategies may boost human consumption in the short term.¹⁰⁰

“Sustainable intensification” and “climate-smart agriculture” are complementary adaptation strategies that focus on improving risk management and information flows while bolstering local institutions to support adaptive capacity.¹⁰¹ The objectives of climate-smart agriculture are three-fold: increasing agricultural productivity; increasing adaptive capacity at multiple levels; and decreasing GHG emissions from cropland. The FAO has suggested the adoption of specific agricultural production strategies that lead to improvements in the efficiency, resiliency, and adaptive capacity of farms. Some of these strategies are:

- Soil and nutrient management: Subsistence crop production system soils are frequently depleted and have low levels of nutrient content. The use, production, and transportation of synthetic fertilizers contribute to GHG emissions. Alternatively, practices like composting manure and crop residues can reduce the need for synthetic fertilizers while increasing organic nutrient inputs and more precisely match nutrients with plant needs.¹⁰²
- Water harvesting and use: While irrigation is currently practiced on approximately 20 percent of agricultural land in developing countries, agricultural yields can be improved by more than 130 percent over rain-fed systems by using irrigation systems and improved water harvesting and retention, such as pools, pits, and retaining ridges.¹⁰³ Drip irrigation, while capital intensive, uses water far more efficiently than traditional spray systems and can help overcome water shortages that reduce crops and permit more equitable sharing of scarce irrigation sources.
- Resilient ecosystems: The control of pests and diseases, regulation of microclimate, decomposition of waste, regulation of nutrient cycles, and crop pollination can produce more resilient and sustainable ecosystems and bio-diversification, while also reducing GHGs.¹⁰⁴
- Genetic resource: Efficient seed production systems and varying the variety and breeds of plants help develop resilience to temperature extremes, rainfall variation, and pests and disease. At the same time, such measures can shorten production cycles, generating higher yields while preserving the quality and nutrient content of crops.¹⁰⁵

¹⁰⁰ Burke and Lobell at 136.

¹⁰¹ Campbell et al., *Sustainable Intensification: What Is Its Role in Climate Smart Agriculture?*, 8 Current Opinion in Env'tl. Sustainability 39, 39–43 (2014).

¹⁰² FAO, *supra* note 95, at 1–3.

¹⁰³ *Id.* at 1.

¹⁰⁴ *Id.*

¹⁰⁵ *Id.* at 2.

- Harvesting, processing and supply chains: The reduction of post-harvest losses will be critical as supply chains become longer. Improving the operational efficiency of processing, packaging, storing, and transporting agricultural produce to urban markets increases the availability of food and income by allowing food surplus to be stored for use during low production years and staggered sales.¹⁰⁶

While changes to agricultural production systems are critical to meet food security and development needs in the face of climate change, institutional and policy adjustments are equally necessary to help facilitate the implementation of such agricultural strategies.

b. Information Dissemination

Improvements in access to timely and accurate climate information and knowledge, in addition to facilitating better climate-sensitive decisions like planting times and livestock shelter, can enable farmers to reduce their exposure to climate-related risks.¹⁰⁷ Improvements in climate information and the means of communicating that information include adapting local forecasts and the availability of technological solutions geared to the needs of local farmers.

c. Risk Management

Improved social safety net programs in developing countries could transform risk management in agriculture production and absorb climate-related shocks as they occur. These measures include expanding the availability of credit and insurance and developing crop insurance schemes that reimburse farmers following climate-related production shortfalls. For example, an index-based insurance scheme might link payouts to a publicly observable rainfall index, with payments triggered when rainfall irrigation levels fall below a pre-determined threshold.¹⁰⁸

d. Access to Financing

Financing for agricultural adaptation to climate change has been largely overshadowed by international efforts to mitigate GHGs, rather than adaptation financing in general or agricultural adaptation in particular. According to a 2012 FAO report on investment in agriculture, sub-Saharan Africa and South Asia were low on two of the most important measures of agricultural investment: expenditure per worker, and share of agricultural expenditure in relation to the importance of the sector in GDP. Meanwhile, areas with high levels of food insecurity and high dependence on agriculture were especially prone to the poor targeting of public-sector investments required for sustainable development. Beyond increased national investment priorities, there are specific actions that could expand financing opportunities for small farm owners,

¹⁰⁶ *Id.* at 3.

¹⁰⁷ *Id.* at 16–17. <http://www.fao.org/docrep/013/i1881e/i1881e00.pdf>.

¹⁰⁸ Burke and Lobell at 148.

including revolving loan funds, microcredits and favorable financing terms for more efficient irrigation, machinery, fertilizer and drought-resistant seeds.

e. Land Tenure and Registration

In many developing countries, women (who make up a majority of the world's farmers) are unable to own land in their own right. Even where female ownership is lawful, title registration locations, procedures and cost may make it practically impossible for female farmers to secure title in their own names, further eroding their opportunities to secure financing or favorable distribution terms for their product. With modern communications and land-title agents equipped with mobile devices, it should be possible to overcome this age-old problem and give women farmers the ability to own, mortgage, convey and let their children inherit the family farm.

3. Security, Export Subsidies, Trade Restrictions, Foreign Land Ownership and Other Constraints

We recognize that there are a number of other significant factors that bear on the viability of any agricultural adaptation plan and, in particular, the ability and willingness of farmers to remain on their lands rather than migrate toward cities or IDP communities. These include (1) the government's ability to provide reliable security to protect farmers and their families against insurgent or rogue security force attacks; (2) the availability of functioning schools and health care clinics in agricultural townships; (3) elimination of developed country subsidies for competing agricultural products; (4) modification of import bans by developed countries (particularly the European Union members) of products grown by small farmers with any genetically modified organisms; and (5) a coherent government response to the trend of foreign corporate purchasers of cropland that force domestic farmers either to abandon their farms, or become at-will employees of large-scale corporate farms. Although each of these factors is beyond the scope of this report, a successful adaptation program must attempt to deal with them in ways that reflect the nation's priorities and long-term interests in rural stability and food security.

B. MIGRATION

As noted above, the loss or degradation of agricultural land from rising sea levels, drought, desertification and climate-related conflict in developing countries, is contributing to the growing number of cross-border migrants (some 20 million, according to UNHCR) and the much larger number of IDPs (approximately 40 million according to UNHCR). Migration is sometimes temporary, sometimes long-term, and sometimes circular, with people moving to less affected areas and then returning home.

Migration resulting from climate change, especially in low-income developing countries, often leads to loss of wealth and income sources because the areas moved to are also poor, crowded, and unprepared to receive migrants. For many migrants, this means deeper poverty, loss of health care, loss of educational opportunities, loss of community, rejection by receiving communities, ethnic tensions and corruption in securing even basic services. For migrants from disappearing island nations, loss of

statehood is a real possibility. There are also legal problems for cross-border migrants, especially climate-change migrants, who are not considered “refugees” and thus may not be allowed to enter another country. However, as discussed below, IDPs (who far outnumber cross-border migrants) have in practice even fewer rights and are far more neglected by the international community.

1. International Standards

International norms protecting climate-change migrants are few and mostly non-binding. According to the 1951 United Nations Convention on the Status of Refugees (UNCSR), a refugee is a person who “owing to a well-founded fear of being persecuted for reason of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable, or owing to such fear, is unwilling to avail himself of the protection of that country...”¹⁰⁹ A cross-border climate-change migrant does not fit that definition.

Internally displaced persons (IDPs) have rights under United Nations covenants, but those rights are limited and widely dishonored in practice. Article 6 of the International Covenant on Civil and Political Rights (ICCPR), adopted by the UN General Assembly in 1966, recognizes that all persons have the right to life. Article 12 protects individuals’ rights to freedom of movement and choice of residence, though it does not entitle individuals to select a residence in another country. The International Covenant on Economic, Social, and Cultural Rights (ICESCR), which was adopted by the UN General Assembly in 1966 and entered into force in 1976, outlines certain other rights, such as the right to work, the right to housing, and the right to an adequate standard of living, all of which are compromised by climate change. However, not all states have ratified the ICESCR, which in any case requires states to realize such obligations only “progressively” and even then only “to the extent of available resources.”¹¹⁰

Although responsibility for the protection of IDPs is primarily that of national governments, international humanitarian organizations have assisted (in the form of shelter, monitoring, and reporting) when national authorities are unable or unwilling to provide the necessary protection. In addition, the Guiding Principles on Internal Displacement (Guiding Principles), presented by the Representative of the UN Secretary-General to the UN Commission on Human Rights (UNCHR) in 1998, have been recognized by the heads of state and governments assembled at the World Summit in New York in September 2005, as providing “an important framework for the protection of internally displaced persons.”¹¹¹ The Guiding Principles prohibit arbitrary displacement, affirm displaced persons’ retention of economic, social, cultural, and civil and political rights, including the right to basic humanitarian assistance (such as food, medicine, and shelter), the right to be protected from physical violence, the right to

¹⁰⁹ United Nations Convention Relating to the Status of Refugees, June 28, 1951, 189 U.N.T.S. 137, art. 1, sec. A(2).

¹¹⁰ International Covenant on Economic, Social, and Cultural Rights, Dec. 16, 1966, 993 U.N.T.S. 3, art. 2, sec. 1.

¹¹¹ G.A. Res. 60/L. 1, ¶ 132, U.N. Doc. A/60/L.I.

education, freedom of movement and residence, political rights such as the right to participate in public affairs, and the right to participate in economic activities. In addition, the Guiding Principles affirm displaced persons' right to assistance in voluntary return, resettlement, or local integration, including compensation for or recovery of lost property and possessions. The Guiding Principles, however, as their name suggests, are voluntary "soft law" and not yet binding on states.

In the absence of either treaty-based or United Nations-based international requirements governing migration induced by climate change effects, a number of other proposals regarding internal migration have been developed. The African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa (the Kampala Convention) is a treaty, dated October 23, 2009, among 15 African nations to protect persons or groups of persons who have been forced or obliged to flee their homes, including as a result of "natural or human-made disasters including climate change."¹¹² The treaty concerns only those "who have not crossed an internationally recognized State border."¹¹³

The Kampala Convention requires that its member states provide IDPs "to the fullest extent practicable and with the least possible delay, with adequate humanitarian assistance, which shall include food, water, shelter, medical care and other health services, sanitation, education, and any other necessary social services."¹¹⁴ The Convention also requires that member states "protect individual, collective and cultural property left behind by displaced persons"¹¹⁵ and allow IDPs "to participate in decisions relating to their protection and assistance"¹¹⁶ and "enjoy their civic and political rights, particularly public participation, the right to vote and to be elected to public office."¹¹⁷ IDPs shall also be allowed "to make a free and informed choice on whether to return, integrate locally or relocate."¹¹⁸ The Kampala Convention went into effect in December, 2012, after being ratified by 15 African states. Since then, it has been ratified by several more African states.

Several non-binding proposals regarding IDPs focus more specifically on climate change displacement. So far, however, none of these proposals is in effect. In June, 2011, the Nansen Conference was convened in Oslo, Norway, to explore the issues of climate change and migration, bringing together representatives of various governments, non-governmental organizations, and scientists and academicians. The United Nations was not formally involved, although the UN High Commissioner for Refugees (UNHCR) was one of the members of the conference's Advisory Board.¹¹⁹ The Nansen Conference issued a set of ten principles (Nansen Principles) which emphasized the duties of states to

¹¹² Kampala Convention, Art. 5.

¹¹³ *Id.* at Art. 1.

¹¹⁴ *Id.* at Art. 9, 2(b).

¹¹⁵ *Id.* at Art. 9, 2(i).

¹¹⁶ *Id.* at Art. 9, 2(k).

¹¹⁷ *Id.* at Art. 9, 2(l).

¹¹⁸ *Id.* at Art. 11, 2.

¹¹⁹ See Jane McAdam, *Creating New Norms on Climate Change, Natural Disasters and Displacement: International Developments 2010–2013*, 29 REFUGEE 11, 15 (2014).

their own populations, but also argued that a “more coherent and consistent approach at the international level” was needed to protect the needs of externally displaced persons from sudden-onset environmental disasters.¹²⁰ The Nansen Conference suggested increasing the role of the UNHCR to address the concerns of climate-change migrants in addition to his long-standing role regarding “refugees,” a term that, as noted above, does not include environmentally displaced persons.¹²¹ Many of the Conference delegates, however, expressed strong reservations about that proposal.¹²² At the UNHCR’s ministerial meeting in December 2011, no international framework regarding protecting environmentally displaced persons was adopted.¹²³ In October 2012, the Norwegian and Swiss governments launched the Nansen Initiative on Disaster-Induced Cross-Border Displacement, under which, from 2013 to 2015, a “series of sub-regional consultations” were to be held, and a non-binding “Protection Agenda” is to be developed.

Subsequently, a number of professors at the University of Limoges, France, prepared a Draft Convention on the International Status of Environmentally-Displaced Persons (Limoges Convention). The most recent version is dated May, 2013. The Limoges Convention defines “environmentally displaced persons” as “individuals, families, groups and populations confronted with a sudden or gradual environmental disaster that inexorably impacts their living conditions, resulting in their forced displacement, at the outset or throughout, from their habitual residence.”¹²⁴ According to the Limoges Convention, all persons and groups “confronted by sudden or gradual environmental degradation that inexorably impacts their living conditions [have] the right to move within or outside their home State.”¹²⁵ Except “in cases of grave and imminent danger,” displacement “can only take place with the consent of the persons concerned.”¹²⁶ The contracting parties to the Limoges Convention must ensure to displaced persons the rights to water, food, health care, “juridical personality,” civil and political rights, and housing. Displaced persons must have the right to move freely, the right to return to their homes, the right to work, the right to education, and the right to maintain their cultural life, religion, and language.¹²⁷ Finally, they must have the right to conserve their nationality.¹²⁸ A proposed National Commission on Environmental Displacements in each contracting state would receive and accept or reject claims for the status of environmental displacement.¹²⁹ The Limoges Convention proposed the creation of a World Agency for Environmentally-Displaced Persons to oversee the application of the Convention¹³⁰ and a World Fund for the Environmentally-Displaced.¹³¹

¹²⁰ Nansen Principles, Principle IX.

¹²¹ McAdam, *supra* note 119, at 16.

¹²² *Id.*

¹²³ *Id.* at 17.

¹²⁴ Limoges Convention, Art. 2.

¹²⁵ *Id.* at Art. 10.

¹²⁶ *Id.* at Art. 11.

¹²⁷ *Id.* at Art. 12.

¹²⁸ *Id.* at Art. 13.

¹²⁹ *Id.* at Art. 16.

¹³⁰ *Id.* at Art. 21.

¹³¹ *Id.* at Art. 23.

Yet another proposal for a framework for addressing environmentally induced internal displacement is the Peninsula Principles on Climate Displacement Within States (Peninsula Principles), issued in August 2013 by an interdisciplinary group of climate change experts from 11 countries meeting on the Mornington Peninsula, in Australia. The Peninsula Principles are based on the principle that environmental IDPs are holders of rights in their persons, homes and lands and that they must be treated accordingly by the relevant authorities.¹³² The Peninsula Principles state that addressing climate displacement requires:

- a. Foresight and planning now, before the numbers of IDPs become overwhelming; and
- b. Identification of lands suitable for relocation of communities that will have to move.¹³³

The Peninsula Principles affirm the priority of protecting people in place and the right of people to remain in their homes as long as possible. Moreover, no relocation should take place without full and informed consent, except in extraordinary circumstances, to protect public health and safety.¹³⁴ The Peninsula Principles also stress the importance of governmental assistance to prevent, prepare for, and respond to environmental displacement, especially for particularly vulnerable populations, such as the elderly, women, ethnic minorities, and those living in poverty.¹³⁵ Government infrastructure should be established proactively to facilitate the state's role in displacement, relocation, and funding.¹³⁶ According to the Peninsula Principles, environmentally displaced persons should be granted the choice to return to their homes where possible and states should assist in that process.¹³⁷

In addition to these efforts to develop standards for the treatment of IDPs, there are a number of bilateral agreements to aid migrants where climate change threatens the existence of entire small island states (SISs). While the focus of this report is on the vast majority of IDPs who remain within their countries, these bilateral agreements can play an important role in assisting residents of the SISs who are unable to remain in their countries.¹³⁸

¹³² Peninsula Principles, Preamble and Principles 3 and 4.

¹³³ *Id.* at Principle 7.

¹³⁴ *Id.* at Principle 10. Affected individuals and groups should be allowed participate in decision-making and implementation.

¹³⁵ *Id.* at Principle 13.

¹³⁶ *Id.*

¹³⁷ *Id.* at Principle 17.

¹³⁸ Some bilateral and regional agreements regarding cross-border environmentally displaced persons and groups already exist. The United States has Compacts of Free Association (COFAs) giving special immigration rights to citizens of the Republic of the Marshall Islands (RMI), the Federated States of Micronesia (FSM), and the Republic of Palau. Citizens of those states may enter, live, and work in the United States without a visa. Although they need to comply with rules of the U.S. Immigration and Naturalization Act on health, criminal history, national security, and public dependency, they do not need to comply with labor qualifications. Once in the United States, they may apply for permanent residency or citizenship. Although the COFAs were not adopted to deal with the effects of climate change, they do provide assistance to citizens of the RMI, FSM, and Palau, all SISs greatly affected by climate change. For

2. Adaptation Requirements for Climate-Related IDPs

The Kampala Convention, the Nansen Principles, the Limoges Convention, and the Peninsula Principles all share essential components that should be included in any national or international adaptation program to protect climate-change IDPs. Among these core program requirements are:

- a. Provision of humanitarian assistance, including food, water, shelter, medical care and education;
- b. Recognition of civic and political rights of displaced persons, including practical ways to participate in elections in their new communities;
- c. Participation of displaced persons in decisions relating to their relocation and to their return to their homes or integration in their new communities;
- d. Recognition of the right of displaced person to maintain their cultural life, religion, and language; and
- e. Recognition of the right of displaced persons to work.

In addition, we believe that all such IDP programs should:

- f. Recognize the need to assist victims of climate change to remain in their home communities for as long as possible;

example, the RMI consists of five islands and 29 coral atolls, with an average elevation of about two meters above sea level. Large numbers of citizens of the RMI, FSM, and Palau live in the United States, especially in Guam, Hawaii, and the Northern Mariana Islands.

The effectiveness of the COFAs for climate-change migrants, however, is limited. The COFAs provide no financial assistance to migrants, so that only COFA state citizens with the financial and social resources necessary for migration are able to exercise their rights under the COFAs. Thus, the most vulnerable groups – the poor, the elderly, and those with limited vocational skills – would likely be barred from escaping from the effects of climate change by migrating under the COFAs. Moreover, all migrants under COFAs are subject to regulations limiting the length of their stay in the United States. They could also be deported if they are unable to support themselves in the United States. Finally, the COFAs are unilaterally terminable by any party, with six months of notice.

Other bilateral or regional agreements have been established, particularly by Pacific nations. New Zealand has agreements with Samoa and with Tonga, Kiribati, and Tuvalu (the Pacific Access Category or PAC). A number of Samoan citizens, currently 1,100, are allowed to migrate annually to New Zealand. Such migrants must be between 18 and 45 years old, must have a job offer in New Zealand, must meet minimum health requirements, and must speak English. The Pacific Access Category allows 650 citizens of Tonga, Kiribati, and Tuvalu who meet the same requirements as those for Samoa to migrate to New Zealand annually. In addition, New Zealand allows temporary entry to up to 8,000 workers in horticulture and grape-growing, particularly workers from Pacific Island nations.

Australia developed two similar programs. The Kiribati Australia Nursing Initiative (KANI) was a five-year program offered from 2007 to 2012 for Kiribati young people to study for nursing degrees in Australia. The KANI program was apparently very expensive and appears to be no longer functioning. Australia's Pacific Seasonal Worker Scheme (PSWS) initially ran from 2009 to 2012. It offered visas to up to 2,500 workers from Kiribati, Papua New Guinea, Tonga, and Vanuatu. It was expanded in 2015, removing the annual limit on the number of seasonal workers participating.

- g. Provide for systems for resolving disputes over ownership of property and compensation for loss of property; and
- h. Provide for national or international monitoring of the treatment of IDPs and periodic reports to the international community on the number, conditions and plans for resettlement of IDPs, either in their home communities or elsewhere in their own countries.

Such a comprehensive program for IDPs is not easy to carry out and requires significantly increased resources to meet IDPs' basic needs for food, shelter, clothing and, in all too many cases, security from sexual assault. Beyond these essentials, IDPs need, and are entitled to, education for their children, respect for their real and personal property and the continuing right to participate in elections either in their home communities or new ones to which they relocate. As indicated above, IDPs should also be able to participate in community decisions affecting their lives, register titles to property they own, and find opportunities for compensated employment. Ideally, such provisions could be implemented by strengthening and making enforceable the U.N.'s Guiding Principles as described above and incorporating other key obligations set forth in the Nansen, Limoges and Peninsula Principles and the Kampala Convention among African states.

All of this will require dedicated resources as part of an effective adaptation program aimed at helping IDPs adjust to the impacts of climate change and, wherever feasible, return to more resilient communities in the future. Section III of this report includes our proposal for the source of those resources.

III. FINANCING ADAPTATION

As Sections I and II of this report make clear, effective urban and rural adaptation to the foreseeable impacts of climate change will be extremely costly and far beyond the capacity of the cities and nations most vulnerable to those impacts. This Section III outlines potential funding mechanisms for climate-change adaptations, with particular focus on an international financial transaction tax as a reliable, fair and effective source of that funding.

Many developed countries have pledged to finance developing countries' adaptation to climate change. However, following through on these nonbinding commitments is vital to the developing world's adaptation to climate change. Developed countries have enjoyed most of industrialization's benefits, while its environmental costs have fallen primarily on the developing world. Moreover, the disruption that developed countries themselves are likely to experience as a result of inadequate climate change adaptation measures in developing countries makes the financing of thoughtful and effective climate change adaptation in vulnerable populations a matter of enlightened self-interest for countries with greater resources. The challenges rippling through the Middle East and Europe from the current civil strife in Syria underscore how disruptive the forced migration and resettlement even of relatively small numbers of refugees can

be. Consequently, the conclusion that developed countries have a strong incentive to help developing countries deal with these costs should, in principle, be uncontroversial.

But practical and political obstacles have prevented developed countries from creating sufficient and sustainable funding mechanisms. Above all, adaptation will be expensive: the UNFCCC estimated in 2007 that the financial flow needed by 2030 to cover costs of adaptation would be between \$49 and \$171 billion annually.¹³⁹

Meanwhile, current sources of funding are viewed as grossly inadequate, both in the amount of funding currently available as well as in their ability to generate additional income going forward. Of the \$97 billion in total climate finance available in 2009/2010, only \$4.4 billion was used for adaptation.¹⁴⁰ Nearly all public funding has been limited to direct appropriations from countries' general revenues. And private funding has not played a large role in financing adaptation. Yet observers broadly agree that failure to act now will mean that adaptation costs will continue to increase.¹⁴¹ Accordingly, there is an urgent need for additional funding sources for adaptation. Leaders across the world, including in the United States and New York City, need to find ways to make it happen. Because national budgets are limited, new and additional sources of revenue are needed. The UN Secretary General's High-Level Advisory Group on Climate Change found in 2010 that funding for adaptation will need to come from a variety of sources, both public and private, both existing and new.

This Section presents options to fund climate change adaptation in the developing world, with a focus on the funding mechanism that we believe is the most promising: an international financial transaction microtax (FTM). Part A gives background, including information about developing country needs, developed country obligations, and current sources of funding. Part B presents criteria for evaluating the desirability of new funding sources and Part C discusses potential new sources, including carbon pricing and a tax on international transportation. Part C highlights the advantages of a financial transaction microtax and recommends that leaders begin to focus on implementing an FTM specifically for funding adaptation. Part D makes recommendations regarding the management of adaptation funding.

A. BACKGROUND

1. Developed Country Obligations

Developed countries have pledged to finance developing countries' adaptation to climate change. Following through on this commitment is a moral imperative.

¹³⁹ UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC), INVESTMENT AND FINANCIAL FLOWS TO ADDRESS CLIMATE CHANGE 183 (2007).

¹⁴⁰ LARS CHRISTIANSEN ET AL., UNITED NATIONS ENV'L PROGRAM (UNEP), ACCESSING INTERNATIONAL FUNDING FOR CLIMATE CHANGE ADAPTATION: A GUIDEBOOK FOR DEVELOPING COUNTRIES 6 (2012).

¹⁴¹ See, e.g., MARTIN PARRY ET AL., INT'L INST. FOR ENV'T. AND DEV., ASSESSING THE COSTS OF ADAPTATION TO CLIMATE CHANGE: A REVIEW OF THE UNFCCC AND OTHER RECENT ESTIMATES 12–13 (2009).

The UNFCCC itself recognizes that developed country parties should assist developing country parties in meeting the costs of adaptation to the adverse effects of climate change,¹⁴² but it provides no legally binding obligations in this regard. The Copenhagen Accord, although accepted in principle by most UNFCCC parties, is also non-legally binding. It does, however, contain the first express monetary commitment with respect to adaptation funding:

Paragraph 8: The collective commitment by developed countries is to provide new and additional resources, including forestry and investments through international institutions, approaching USD 30 billion for the period 2010–2012 with balanced allocation between adaptation and mitigation.... In the context of meaningful mitigation actions and transparency on implementation, developed countries commit to a goal of mobilizing jointly USD 100 billion dollars a year by 2020 to address the needs of developing countries. This funding will come from a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance. New multilateral funding for adaptation will be delivered through effective and efficient fund arrangements, with a governance structure providing for equal representation of developed and developing countries. A significant portion of such funding should flow through the Copenhagen Green Climate Fund.

Notwithstanding the Copenhagen commitments, the funding currently available for climate change is grossly inadequate. To date, most funding has gone toward efforts to reduce carbon emissions (*mitigation*). Even that funding has been modest, at best. Funding for *adaptation* projects has been trivial and nowhere near what is needed.

The vast majority of funding currently available for adaptation comes from public sources. In 2009/2010, over 90% of funding for adaptation came from public sources, of which bilateral institutions were the largest source.¹⁴³ While private funding has played an important role in developing mitigation projects, to date, it has not played a large role in financing adaptation. This is largely explained by the lack of revenue generation and investment return from what would typically be considered adaptation projects.

The most significant effort so far has been “Fast Start Finance” (FSF), developed countries’ agreement in Copenhagen to raise \$30 billion in climate aid to developing countries in 2010–2012, as a step toward mobilizing \$100 billion per year by 2020. However, this initial effort resulted in just \$5.7 billion (18%) of the \$35 billion provided under it by November 2013 going to adaptation projects, despite the Accord’s promise of a balanced allocation between mitigation and adaptation.¹⁴⁴

¹⁴² Art 4.4 of the UNFCCC provides: The developed country Parties and other developed Parties included in Annex II shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects.

¹⁴³ LARS CHRISTIANSEN ET AL., *supra* note 141, at 6.

¹⁴⁴ SMITA NAKHOODA ET AL., WORLD RESOURCES INSTITUTE, MOBILIZING INTERNATIONAL CLIMATE FINANCE: LESSONS FROM THE FAST-START FINANCE PERIOD 41 (2013), *available at* <http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8687.pdf>; CLIFFORD POLYCARP ET AL., WORLD RESOURCES INSTITUTE, DEVELOPED COUNTRY FAST-START CLIMATE FINANCE PLEDGES: A SUMMARY OF SELF-REPORTED INFORMATION (2012), http://pdf.wri.org/climate_finance_pledges_2012-11-26.pdf. For the primary source of these numbers, see UNFCCC, Submissions on information from developed country Parties on the resources provided to fulfill commitment referred to in decision 1/CP.16, paragraph 95 (2013).

Most countries funded FSF through direct appropriations from general revenues. A notable exemption is Germany, which funded its contribution with revenue from emissions auctioning.

Figure 1: Fast Start Finance Funding: Top Six Contributors¹⁴⁵

Country	Total FSF Contribution	Adaptation Contribution	Source of Adaptation Funding
Japan	\$ 13.2 billion	\$1.2 billion (9%)	Direct Appropriations
European Commission	\$9.2 billion	\$ 2.9 billion (31.5%)	Direct Appropriations
United States	\$ 7.5 billion	\$ 1.13 billion (15%)	Direct Appropriations
United Kingdom	\$2.3 billion	~ 37% ¹⁴⁶	Direct Appropriations
Norway	\$ 1.92 billion	~ 7.5% ¹⁴⁷	Direct Appropriations
Germany	\$ 1.7 billion	\$ 476 million (27%)	ETS Auction Revenue

The U.S. contributed \$7.5 billion to FSF—20% of the total;¹⁴⁸ 64% of the U.S. contribution supports clean-energy projects (i.e., mitigation), while just 15% funds adaptation. Approximately 63% of the U.S. contribution, including all adaptation funding, was in the form of grants (rather than loans or debt relief).¹⁴⁹ Most U.S. funding for adaptation has been channeled through domestic bilateral institutions, mainly the U.S. Agency for International Development (USAID).¹⁵⁰

Germany's contribution is notable because it is the only country to use revenues from an emissions trading system. Germany has “pioneered a unique approach to sourcing FSF” by using auction revenues from the European Union Emission Trading Scheme (EU-ETS).

However, there is an element of uncertainty due to the volatility of the carbon market: at the moment, the EU ETS certificate price remains low as a result of an excess of emission allowances in the markets. This is due to a combination of factors, including the fact that the EU has not increased its GHG reduction targets, which would drive greater demand for allowances, as well as the recent economic crisis, which reduced emissions in many EU countries. Policymakers must continue working towards solutions to these challenges to enhance the viability of German climate finance beyond 2012.¹⁵¹

¹⁴⁵ See SMITA NAKHOODA ET AL., *supra* note 145, at fig. 1; CLIFFORD POLYCARP ET AL., *supra* note 145. For the primary source of these numbers, see UNFCCC, *Submissions on information from developed country Parties on the resources provided to fulfill commitment referred to in decision 1/CP.16, paragraph 95* (2013), <http://unfccc.int/resource/docs/2013/cop19/eng/inf01.pdf>.

¹⁴⁶ This percentage is based on UK's contributions during FY2010-11 only.

¹⁴⁷ Specific numbers are available for Norway's 2010 and 2011 contributions only. Of the \$1.4 billion contributed during that time, \$105 million (7.5%) went toward adaptation.

¹⁴⁸ ABIGAIL JONES ET AL., WORLD RESOURCES INSTITUTE, THE U.S. FAST-START FINANCE CONTRIBUTION: FY12 UPDATE 2 (2013), *available at* http://www.wri.org/sites/default/files/pdf/us_contribution_fast_start_finance_2012_update.pdf; *see also* Taryn Fransen et al., *The U.S. Fast-Start Finance Contribution* (World Research Institute, Working Paper, 2012), *available at* <http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/7663.pdf>.

¹⁴⁹ Taryn Fransen et al., *supra* note 149, at 15.

¹⁵⁰ ABIGAIL JONES ET AL., *supra* note 149, at 3.

¹⁵¹ *Id.* at 17.

Germany also “established a special fund on energy and climate change as a permanent structure outside of the general budget, funding both domestic and international climate action.” This fund “is financed by nearly 100% of the German auctioning revenues from the EU ETS. . . . This has strengthened the political viability of sustained commitment to climate action (as it is not seen to be funded solely from core tax revenues), and has strengthened the transparency of Germany’s climate finance approach to stakeholders within Germany and in the international community.”¹⁵² In 2013, 19% of these funds supported international climate financing, and were channeled primarily through bilateral institutions.¹⁵³

Developed countries have recognized the importance of building strong multilateral institutions to channel adaptation funds and taken steps toward that end. The Green Climate Fund (GCF) was formally established at COP-16, the UN Climate Change Conference in Cancun in 2010, to support adaptation and mitigation projects in developing countries.¹⁵⁴ Intended to be the “central global investment vehicle for climate-change finance,” the GCF will:

channel new and predictable financial resources to developing countries. GCF will catalyze climate finance – both public and private, and at the national, regional and international levels. Its funding will be deeply concessional. The Fund is intended to operate at a larger scale than other comparable funds to promote the paradigm shift towards low-emission and climate-resilient development pathways.

GCF will have a risk appetite that is consistent with its mandate of promoting a paradigm shift in the financing of new investments by governments and private sector in developing countries. It will also operate in a manner that seeks to ensure that countries have full ownership of the activities supported by the Fund. It will place equal emphasis on allocating its resources for adaptation as it is for mitigation, with a focus on the most vulnerable countries.¹⁵⁵

As of December 2014, 22 countries have pledged USD \$10.2 billion to the GCF.¹⁵⁶

The first projects were announced in October 2015.¹⁵⁷ The fund dispersed \$183 million for eight projects in Asia, Africa, and Latin America.”¹⁵⁸ These projects include:

¹⁵² *Id.*

¹⁵³ *Id.* at 10.

¹⁵⁴ <http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=17>

¹⁵⁵ GREEN CLIMATE FUND (2014), <http://news.gcfund.org/download/PDF/introducing-the-GCF.pdf>

¹⁵⁶ Press Release, Green Climate Fund, GCF Set to Allocate Resources Before Paris Climate Change Conference (Mar. 26, 2015), http://www.gcfund.org/fileadmin/00_customer/documents/Press/GCF_Press_Release_2015_03_26_accreditation_entities.pdf

¹⁵⁷ Eric J Lynman, *Green Climate Fund Names Seven Bodies to Disperse Funds, but Little Cash in Hand*, BLOOMBERG BNA (Mar. 27, 2015), http://news.bna.com/deln/DELNWB/split_display.adp?fedfid=65688376&vname=dennotallissues&jd=a0g4g3k0h6&split=0.

- “Building the resilience of wetlands in the province of Datem del Marañón in Peru (\$6.2 million).”
- “Scaling up the use of modernized climate information and early warning systems in Malawi (\$12.3 million).”
- “Increasing the resilience of ecosystems and communities through the restoration of the productive bases of salinized lands in Senegal (\$7.6 million).”
- “Climate-resilient infrastructure mainstreaming in Bangladesh (\$40 million).”
- “The KawiSafi Ventures Fund in Eastern Africa (\$25 million) which aims to invest in SMEs dedicated to green energy, mainly solar-energy systems.”
- “An Energy Efficiency Green Bond in Latin America and the Caribbean (\$217 million).”
- “Supporting vulnerable communities in Maldives to manage climate change-induced water shortages (\$23.6 million).”
- “Urban water supply and wastewater management project in Fiji (\$31 million).”¹⁵⁹

The GCF’s executive director, Hela Cheikhrouhou, has said that evaluating projects takes time and that she hopes that more significant funding will be released in March 2016.¹⁶⁰

Other multilateral funds have been established specifically to fund climate change adaptation, including the following:

- The Adaptation Fund was established in 2001 by UNFCCC parties to finance adaptation projects in developing countries.¹⁶¹ It began operations in 2007. In addition to voluntary contributions, the fund is also financed by a 2% levy on emission credits issued in connection with “clean development mechanism” projects under the Kyoto Protocol. To date, the

¹⁵⁸ Karl Mathiesen, *UN Climate Fund Releases \$183m to Tackle Global Warming*, THE GUARDIAN (Nov. 6 2015), <http://www.theguardian.com/environment/2015/nov/06/uns-climate-fund-release-183m-to-tackle-global-warming>.

¹⁵⁹ *The First Eight Projects Financed by the Green Climate Fund*, U.N. CONFERENCE ON CLIMATE CHANGE, <http://www.cop21.gouv.fr/en/the-first-eight-projects-financed-by-the-green-climate-fund/> (last visited Nov. 18, 2015).

¹⁶⁰ Karl Mathiesen, *supra* note 159.

¹⁶¹ *About*, ADAPTATION FUND, http://www.adaptation-fund.org/sites/default/files/AFB.B.11.Inf_.3%20Background%20of%20the%20Adaptation%20Fund.final_0.pdf (last visited Nov. 18, 2015).

Adaptation Fund has allocated \$265 million to adaptation projects in developing countries.¹⁶²

- The Special Climate Change Fund (SCCF) was established in 2001 to finance projects relating to adaptation, technology transfer and capacity building, energy, transport, industry, agriculture, forestry and waste management, and economic diversification.¹⁶³ As of August 2014, \$347.71 million has been pledged to the SCCF, of which \$333.75 million has been paid.¹⁶⁴
- The Least Developed Countries Fund (LDCF) was established under the UNFCCC in 2011 to support a work program to assist Least Developed Country Parties (LDCs) to carry out, inter alia, the preparation and implementation of national adaptation programs of action (NAPAs). As of August 2014, \$915.16 million had been pledged to the LDCF, of which \$872.63 million had been paid.¹⁶⁵
- The Pilot Program for Climate Resilience, which forms part of the Climate Investment Funds, is a \$1.2 billion program to assist developing countries in integrating climate resilience into development planning, as well as offering additional funding to support public and private sector investments for implementation.¹⁶⁶

A number of other funds exist outside the UNFCCC framework. They are managed by bilateral and multilateral agencies and banks and offer revenue for adaptation projects. They include the African Development Fund (managed by the African Development Bank) and the Global Climate Change Alliance (managed by the EU).¹⁶⁷ In total, as of June 2015, around \$35 billion has been pledged to such funds, with under \$20 billion having been deposited.¹⁶⁸ Only \$1 billion has been disbursed.¹⁶⁹ Around \$3.5 billion has been pledged for funds that are focused on adaptation, with most

¹⁶² *Id.*

¹⁶³ *Special Climate Change Fund (SCCF)*, GLOBAL ENV'T. FACILITY, <http://www.thegef.org/gef/SCCF> (last visited Nov. 18, 2015).

¹⁶⁴ GLOBAL ENVIRONMENT FACILITY, PROGRESS REPORT ON THE LEAST DEVELOPED COUNTRIES FUND AND THE SPECIAL CLIMATE CHANGE FUND, at iii (2014), *available at* https://www.thegef.org/gef/sites/thegef.org/files/documents/GEF-LDCF.SCCF_.17-03,%20Progress%20Report%20on%20the%20LDCF%20and%20the%20SCCF,%202014-10-08.pdf.

¹⁶⁵ Global Environment Facility (October 8, 2014), Progress Report on the Least Developed Countries Fund and the Special Climate Change Fund https://www.thegef.org/gef/sites/thegef.org/files/documents/GEF-LDCF.SCCF_.17-03,%20Progress%20Report%20on%20the%20LDCF%20and%20the%20SCCF,%202014-10-08.pdf

¹⁶⁶ *Pilot Program for Climate Resilience*, CLIMATE INVESTMENT FUNDS, <https://www.climateinvestmentfunds.org/cif/node/4> (last visited Nov. 18, 2015).

¹⁶⁷ For a further discussion of the funds, see generally LARS CHRISTIANSEN ET AL., *supra* note 141.

¹⁶⁸ <http://www.climatefundsupdate.org/data>

¹⁶⁹ <http://www.climatefundsupdate.org/global-trends/size-spending>

of the \$3.5 billion having been deposited.¹⁷⁰ However, under \$500 million has been disbursed.¹⁷¹

B. POTENTIAL SOURCES FOR CLIMATE ADAPTATION FINANCING

As the NYCBA stated in 2012:

Financing adaptation should not be left to the vagaries of *ad hoc* negotiations, pledges, and collections. Otherwise, the ability of affected countries and populations to plan for and respond to climate-change adaptation in a timely and cost-effective way will be profoundly compromised.

A relatively neutral, largely self-executing mechanism, such as some form of tax, appears to be an effective way to generate reliably the financing needed for a wide range of essential adaptation measures. While the details of transferring funds raised, effectively managing and administering the funds collected, and maintaining the funds at appropriate levels will require critical attention, any funding for such purposes will pose similar issues. The key first step will be to design a reliable fundraising mechanism capable of garnering broad support (e.g., perhaps a micro-tax on a wide range of international transactions).¹⁷²

For this reason, annual budget contributions, which are supported by traditional sources such as income taxes, are a sub-optimal way to fund adaptation. The World Bank elaborates:

The possibilities for funding climate finance by traditional sources are limited, in principle, only by so-called Laffer curve effects—limits, that is, on the maximum possible revenue that can be raised—and by countries’ willingness to cut other spending. This makes it hard to meaningfully assess the additional revenue that could be raised from such sources, which can also be expected to reflect the significant fiscal pressures that many advanced countries face. Precisely how any additional (net) revenue might best be raised will of course also depend on countries’ circumstances and preferences.¹⁷³

In short, direct appropriations are subject to short-term political pressures and do not provide a reliable long-term funding mechanism. The Task Force believes that the

¹⁷⁰ <http://www.climatefundsupdate.org/global-trends/size-spending>

¹⁷¹ <http://www.climatefundsupdate.org/global-trends/size-spending>

¹⁷² NYC BAR ASSOCIATION, STATEMENT ON RIO + 20 OUTCOME DOCUMENT “THE FUTURE WE WANT” (2012), *available at* <http://www2.nycbar.org/pdf/report/uploads/20072313-StatementonRio--TheFutureWeWant.pdf>.

¹⁷³ WORLD BANK, MOBILIZING CLIMATE FINANCE: A PAPER PREPARED AT THE REQUEST OF G20 FINANCE MINISTERS 24 (2011), *available at* <http://www.imf.org/external/np/g20/pdf/110411c.pdf>. For a more detailed discussion about using traditional domestic sources to fund climate finance, see generally INTERNATIONAL MONETARY FUND, PROMISING DOMESTIC FISCAL INSTRUMENTS FOR CLIMATE FINANCE (2011), *available at* <http://www.imf.org/external/np/g20/pdf/110411b.pdf>.

funding mechanism should be self-executing and earmarked for climate-change adaptation.

1. Carbon Pricing

“Carbon pricing” refers to a carbon tax or an emission trading system with auctioning of allowances. Carbon pricing is very important to mobilizing climate finance and has advantages. From an efficiency perspective, carbon pricing is superior to mobilizing traditional revenue sources, such as income taxes, because it corrects an unaddressed market failure—excessive global emissions of GHGs—by pricing emissions.¹⁷⁴ It thereby incentivizes mitigation efforts and investment in emissions-saving technology. The World Bank estimates that a price of \$25/ton would reduce global emissions by 10%.

Carbon pricing also has high revenue potential, and in most cases would be a new and additional source. The revenue potential “depends on the volume of the carbon market, the carbon price and the percentage of emission allowances auctioned and the resulting revenues set aside for international climate finance.”¹⁷⁵ The UN Secretary-General’s High-Level Advisory Group on Climate Change Financing (AGF) assumes a carbon price of \$25/ton, and that between 2% and 10% of the total market size would be auctioned and allocated for international climate finance.¹⁷⁶ With these assumptions, carbon pricing can raise \$8-38 billion annually by 2020. The World Bank estimates that a carbon price of \$25/ton with 10 percent allocated to climate finance, would raise \$25 billion in 2020.¹⁷⁷ The economic costs of carbon pricing would be modest – about 0.03 percent of GDP on average – so long as domestically retained revenues are applied productively.¹⁷⁸ And there would be no effect on developing countries.¹⁷⁹

However, several drawbacks of carbon pricing lead the Task Force to conclude that it is currently not a reliable or politically acceptable potential revenue source for climate adaptation, particularly in developing countries. Carbon pricing is regressive; it raises prices of energy (and carbon-intensive goods) for low-income households. As a result, proposals typically suggest returning revenue to low-income households in the form of tax credits or through broader fiscal measures, such as raising personal income tax thresholds.¹⁸⁰ Consequently, carbon pricing in practice can be revenue-neutral. In addition, carbon pricing has not, as a practical matter, generated significant revenue, and it has faced political challenges in almost all countries where a carbon tax has been

¹⁷⁴ WORLD BANK, *supra* note 170, at 14.

¹⁷⁵ REPORT OF THE SECRETARY-GENERAL’S HIGH-LEVEL ADVISORY GROUP ON CLIMATE CHANGE FINANCING (2010), http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF_reports/AGF_Final_Report.pdf [Hereinafter “AGF”], at 27.

¹⁷⁶ *Id.*

¹⁷⁷ WORLD BANK, *supra* note 170, at 14–15.

¹⁷⁸ *Id.* at 15.

¹⁷⁹ *Id.*

¹⁸⁰ *Id.* at 16.

proposed. The Task Force therefore questions its reliability as a long-term funding mechanism for adaptation in developing countries.

The U.S., for one, has been utterly incapable of implementing carbon pricing due to widespread political opposition to climate-related taxes that are perceived to impact the general population, consumers, small businesses, or even “the economy” generally.

The EU emissions trading system is the world’s largest and has been moderately successful at raising revenue. In 2013, only 40% of allowances were auctioned, although this figure is expected to increase to up to 50% by 2020. In 2013, total revenues across Europe were USD 3.94 billion. Most of this money—approximately USD 3.29 billion—was used for climate-related efforts in member states, including investments in “energy efficiency, renewables, research and sustainable transport.”¹⁸¹ Little has been allocated to adaptation outside of the EU.

Revenue-raising carbon taxes have not caught on. Australia instituted a carbon tax in 2012 but repealed it two years later, in 2014.¹⁸² Where carbon taxes have been implemented, they generally have been revenue-neutral. For example, British Columbia, Canada’s third largest province, has “the most significant carbon tax in the Western Hemisphere, by far,” but it “funds more than a billion dollars’ worth of cuts in individual and business taxes annually, while a tax credit protects low-income households who might not benefit from the tax.”¹⁸³

There is thus little indication that carbon pricing would provide significant, reliable capital flows for long-term adaptation in developing countries. While the Task Force supports carbon pricing, it does not believe that it can be relied on to fund such adaptation.

2. International Transportation Pricing

Instituting taxes, fuel charges, or an emissions trading scheme on international aviation and maritime transportation is a promising potential revenue source, from a theoretical perspective. It would be efficient because these emissions-generating activities are “currently taxed relatively lightly from an environmental perspective: unlike domestic transportation fuels, they are subject to no excise tax that can reflect environmental damages in fuel prices.”¹⁸⁴ Such changes also have high revenue potential. According to the World Bank, a charge of \$25/ton of CO₂ on fuels used for international transportation would raise almost \$40 billion in 2020 (\$12 billion from international aviation and at least \$25 billion from international maritime transport). But pricing international transportation has an effect on developing countries, which could be

¹⁸¹ *Climate Action: Auctioning*, EUROPEAN COMMISSION, http://ec.europa.eu/clima/policies/ets/cap/auctioning/index_en.htm (last visited Nov. 18, 2015).

¹⁸² *Where Carbon Is Taxed*, CARBON TAX CENTER, <http://www.carbontax.org/where-carbon-is-taxed/> (last visited Nov. 18, 2015).

¹⁸³ *Id.*

¹⁸⁴ WORLD BANK, *supra* note 170, at 17. For a more detailed treatment of this potential source, see generally INTERNATIONAL MONETARY FUND, *supra* note 170.

offset with an explicit compensation scheme. If 40% of the gross revenues were used for compensation, \$22 billion would remain for international climate finance and other purposes.¹⁸⁵ AGF has a similar estimate.¹⁸⁶

Political support for an international transportation tax, which historically has been controversial, has been growing in recent meetings of the parties to the UNFCCC. There are some indications that, at least in the airline field, the International Air Transport Association is considering a small carbon charge on international air transport, with the proceeds allocated in large part to reducing deforestation under the UN's REDD Plus program. While this program is also important and merits support, it would contribute only modestly to adaptation efforts.

3. Other Proposals

A number of commentators have identified other new and additional sources, including redirection of fossil fuel subsidies. Currently, developed countries subsidize fossil fuels through a number of mechanisms, many of which are inefficient and wasteful. Some of these subsidies could be redirected to climate finance, particularly for domestic renewable energy start-ups. This allocation may be politically feasible because it is budget-neutral. However, fossil fuel support in developed countries systems is "extraordinarily complex."¹⁸⁷ Subsidized fossil fuels amounted to approximately \$40-60 billion per year in 2005-2010, and involves more than 250 support mechanisms.¹⁸⁸ According to the World Bank, "assuming . . . that as a result of reforms 10-20 percent of the current value of support were redirected to public climate finance, this would yield on the order of \$4-12 billion per year."¹⁸⁹ The AGF arrives at a similar figure of \$3-8 billion, but notes a high level of uncertainty in this estimate.¹⁹⁰ In any case, it seems highly unlikely that these funds would be directed in significant measure to adaptation programs in developing countries.

C. THE TASK FORCE'S RECOMMENDATION: A FINANCIAL TRANSACTION MICROTAX

A financial transaction microtax (FTM) is a fee levied on trades of financial instruments. An FTM may apply to a single instrument (*e.g.*, to foreign exchange transactions, often known as currency transaction taxes or a so-called "Tobin Tax") or may apply to multiple financial instruments (*e.g.*, a tax on all transactions in equity, debt, and derivatives markets as well as currency trades).

¹⁸⁵ WORLD BANK, *supra* note 170, at 17-18.

¹⁸⁶ AGF estimates that, at a carbon price of \$25/t, \$10 billion can be raised, assuming no net incidence on developing countries and earmarking between 25 and 50 percent of total revenues. AGF, *supra* note 172, at 28.

¹⁸⁷ WORLD BANK, *supra* note 170, at 22.

¹⁸⁸ *Id.* at 22-23.

¹⁸⁹ *Id.* at 22.

¹⁹⁰ AGF, *supra* note 172, at 29-30.

An FTM is most commonly a fraction of a percentage, generally between 0.001% and 0.1% of the value of the relevant transaction. As elaborated below, even very low-rate FTMs have substantial revenue potential. An FTM can be multilateral or unilateral. A multilateral FTM would be more efficient and raise more revenue. However, international coordination is difficult. Unilateral FTMs are feasible, and exist in many countries.

FTMs are practical. They can be designed and implemented cheaply, as they already form part of the financial landscape, with a number of countries having already introduced a form of FTM. Once implemented, FTMs have low administrative and compliance costs. Most importantly, an FTM would be reliable in the long run because it would not depend on annual fiscal appropriations.

The Task Force supports a low-rate tax on financial instruments. Even at a very low rate, an FTM would be a high revenue source of funding for adaptation measures. In the United States, it would be a new and additional source.¹⁹¹ A small global FTM directed to climate adaptation would also be a new and additional source.

As with any major new policy, there are challenges. There is some uncertainty as to the overall impact that an FTM would have on the efficiency of financial markets and the economy more generally. We know that an FTM would increase the cost of trading financial instruments very slightly and therefore likely reduce trading volume to some degree. Although some financial institutions oppose FTMs, other institutions and leaders support them. The academic discussion is similarly divided, as noted below. History and experience suggest that FTMs are not unduly distortive of the market, particularly when compared with other taxes.

We believe that the impact of the suggested FTM should be studied closely. We conclude that an exchange-initiated FTM with a low rate, phased in over time, would raise substantial revenue for climate adaptation, with minimum distortions. Over time, the FTM's empirical impact can be studied and adjustments made accordingly.

1. High Revenue Potential

An FTM has high revenue potential because the tax base is enormous. Therefore, even at a low rate, an FTM can raise substantial revenue.¹⁹² A domestic FTM in the U.S., applied to a broad base of financial instruments, has substantial revenue potential—about

¹⁹¹ AGF Staff Document: Work Stream 5 on Financial Transaction Tax (FTM), http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGF_reports/Work_Stream_5_Financial%20Transaction%20Tax.pdf

¹⁹² Leonard E. Burman et al, *Financial Transaction Taxes in Theory and Practice* 34 (Tax Policy Center, Working Paper, 2015), available at <http://www.taxpolicycenter.org/UploadedPDF/2000287-Financial-Transaction-Taxes-in-Theory-and-Practice.pdf>.

\$50 billion annually.¹⁹³ This assumes a 0.1 percent rate on all securities, including derivatives, bonds, treasury securities, and stocks.

Of course, a multilateral FTM would raise substantially more revenue. Schulmeister (2008) estimates that a global tax of only .01% on all stocks, bonds, and derivatives would raise between \$202 billion and \$266 billion annually. The Austrian Institute for Economic Research estimates that a global transaction tax of 0.1% could yield between \$410 billion and \$1,060 billion per year, depending on the reduction in trading volume.¹⁹⁴

A multilateral “Tobin” Tax would also raise significant revenue. The UN High Level Working Group on Climate Financing estimated in 2010 that the revenue potential from a global FTM on financial transactions (i.e., a Tobin Tax) at a rate of 0.001% to 0.01% would be between US\$2 billion and US\$27 billion in 2020.¹⁹⁵ The North-South Institute has a similar estimate, finding that at a level of 0.005%, a tax on currency transactions on all major currencies in dealer markets would yield \$33 billion annually.

The revenue potential of a FTM is therefore substantial and could make a meaningful contribution to adaptation funding on a continuing basis, without relying on the shifting political winds of individual countries. Moreover, FTMs are widely viewed as progressive. Initially, the cost of implementing an FTM would be borne by existing asset holders. In the U.S., the top 1 percent of households held almost two-thirds of all financial securities in 2010. Once implemented, the long-run burden would fall on owners of capital, who get slightly lower after-tax rates of return, and, to a lesser degree, the economy generally because productivity-enhancing capital could become slightly scarcer.¹⁹⁶ This is a more mixed distribution.

2. Practicality

Design and implementation costs for an FTM are low. The mechanisms for assessment and collection already exist, and there is strong evidence that once implemented, administrative costs and compliance costs will be low.

Key design features are a low rate applied to a broad array of financial instruments. Although a multilateral FTM is preferable, a unilateral FTM is also feasible.

3. Historical Experience

Many FTMs operate today. They generally are viewed as successful in raising revenue and not unduly distortive.

¹⁹³ *Id.*

¹⁹⁴ That could be enough to meet anticipated adaptation needs and still permit some significant funds to be directed toward renewable energy subsidies in developing countries.

¹⁹⁵ AGF, *supra* note 172, at 62.

¹⁹⁶ *See id.* at 37.

Many major financial centers, with the United States as a notable exception, impose an FTM today. According to the Institute for Policy Studies, as of January 2015 more than 30 countries have some form of FTM, including the United Kingdom, South Africa, Hong Kong, Singapore, Switzerland, and India.¹⁹⁷

The United Kingdom's stamp duty reserve tax (which applies a 0.5% levy to trades of equities and certain equity derivatives and a 1.5% levy on transfers to non-EU depository receipt and clearance services systems), for example, has generated on average the equivalent of 0.3% of GDP since 2000.¹⁹⁸ For the financial year 2013/2014 this equated to approximately £2.8 billion.¹⁹⁹

Brazil is the only G20 country that levies a Tobin Tax on foreign exchange.²⁰⁰

Sweden's historical example indicates that an FTM must be carefully designed and its rate low.

"In 1984 Sweden enacted a tax on both the purchase and sale of domestic equities at a rate of 0.5 percent, resulting in a 1 percent tax per round-trip. Round trip transactions in stock options were taxed at 2 percent. In addition, the exercise of an option was treated as a transaction in the underlying stock and, thus, was subject to an additional 1 percent round-trip charge. These rates were doubled in 1986, and then in 1989 the levy was extended to fixed-income securities (including on government debt and corresponding derivatives) which were taxed at a maximum rate of 0.15 percent of the underlying notional or cash amount. . . . The tax generated little revenue . . . but led to a massive migration of stock trading volume from Stockholm to other financial centers. The tax also resulted in a sharp drop in trading volume for Swedish government bills and bonds as investors shifted to nontaxed domestic substitutes." ²⁰¹

Given these failures, Sweden's FTM was abolished by 1991.

The United States had an FTM in the form of a 0.02% tax on sales and transfers of stock from 1914 to 1966, with revenue used, in part, to stimulate the economy and employment during the Great Depression.²⁰² A stock transfer tax separately operated in

¹⁹⁷ *The Financial Transactions Tax: Seven Frequently Asked Questions*, INST. FOR POLICY STUDIES, <http://www.ips-dc.org/financial-transactions-tax-seven-frequently-asked-questions/> (last visited on Nov. 18, 2015).

¹⁹⁸ Thornton Matheson, *Tax Financial Transactions: Issues and Evidence* 36 (IMF Working Paper WP/11/54 2011); see also *Overview of Taxes on Financial Transaction within the EU-UK*, KPMG (July 28, 2013), <https://home.kpmg.com/xx/en/home/insights/2013/07/uk-overview-taxes.html>.

¹⁹⁹ HM Revenue & Customs, *UK Stamp Tax Statistics 2013–2014* 10 (2014), available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/358908/AnnualStampTaxes-Release-Sep14.pdf.

²⁰⁰ Matheson, *supra* note 198, at 9.

²⁰¹ John D. Brondolo, *Taxing Financial Transactions: An Assessment of Administrative Feasibility* 17 (IMF Working Paper WP/11/185 2011).

²⁰² CTR. FOR ECONOMIC AND POLICY RESEARCH, *FACTS AND MYTHS ABOUT A FINANCIAL SPECULATION TAX 1* (2011), available at <http://www.cepr.net/documents/fst-facts-myths-12-10.pdf>.

New York from 1905 to 1981 was also introduced to generate revenue during the difficult economic times.²⁰³

Although the U.S. does not currently have an FTM, under Section 31 of the Securities Exchange Act of 1934, the Securities and Exchange Commission (SEC) levies a fee to fund its operation that is, in effect, a *very* small tax on exchange-traded instruments. Section 31 requires self-regulatory organizations such as FINRA and national exchanges to pay transaction fees to the SEC based on the trading volume on their markets.²⁰⁴ The self-regulatory organizations, in turn, “require their broker-dealer members to pay a share of these fees.” Broker-dealers then “impose fees on their customers that provide the funds to pay the fees owed to their SROs.” This is functionally equivalent to a tax. The SEC levy is designed to raise a specific total amount set by Congress. The rate is thus adjusted annually or semiannually to account for changes in trading volume. The current rate is 0.00184%.²⁰⁵ The SEC collects approximately \$1.3 billion annually.²⁰⁶

4. Acceptability and Current Developments

In both Europe and the United States, FTMs have received increasing attention as potential revenue sources.

a. Europe

Eleven countries of the European Union have agreed to implement a form of FTM by January 2016, though the precise rate and scope of the tax are still being negotiated and implementation may be delayed to 2017.²⁰⁷ The EU example illustrates a second issue: political support for an FTM is not enough; there must also be support for using revenue to fund climate change adaptation. Although the EU FTM was initially proposed to fund international development, fighting epidemics, and climate change, under the current proposal, revenues will “go to national budgets, to be used like other tax revenues

²⁰³ MAXIM SHVEDOV, CONG. RESEARCH SERV., RL32266, TRANSACTION TAX: GENERAL OVERVIEW 2 (2004), *available at* http://app1.hkicpa.org.hk/professionaltax/transaction/submissions/GST_Final_FSTB_App3.pdf; see generally Robert Pollin & James Heintz, *Evaluation of a Proposal to Reinstate the New York Stock Transfer Tax*, 46 CHALLENGE 71 (2003); NYC INDEPENDENT BUDGET OFFICE, REVIEWING THE NEW YORK STOCK TRANSFER TAX: REVENUES AND RISK (2003), *available at* <http://www.ibo.nyc.ny.us/iboreports/stocktransfertax.pdf>.

²⁰⁴ “SEC FEE”—Section 31 Transaction Fees, U.S. SEC. AND EXCH. COMM’N, <http://www.sec.gov/answers/sec31.htm> (last visited Nov. 18, 2015).

²⁰⁵ See *SEC Fee Rates and Options Regulatory Fee (ORF)*, TRADERSTATUS.COM, <http://www.traderstatus.com/secfeerates.htm> (last visited Nov. 18, 2015).

²⁰⁶ Raymond James & Assocs., *How the SEC Taxes Equities Trading*, BARRON’S (Feb. 11, 2014), <http://online.barrons.com/articles/SB50001424053111903506304579376983062557004>.

²⁰⁷ The eleven countries are: Germany, France, Spain, Italy, Belgium, Austria, Portugal, Greece, Estonia, Slovakia and Slovenia. See *Update 1-INTERVIEW-Financial Transaction Tax Unlikely Before 2017-Austria Finmin*, REUTERS (May 8, 2015), <http://www.reuters.com/article/2015/05/08/eu-tax-idUSL5N0XZ35A20150508>.

– to reduce debt or invest in growth and jobs, for example.”²⁰⁸ Only French president François Hollande has promised to use FTM revenues for climate change.²⁰⁹

b. United States

In the United States, there has been little movement for an FTM. The Obama Administration has in the past opposed an FTM.²¹⁰ Congressional proposals have garnered little to no momentum.²¹¹ However, influential U.S. business leaders and policymakers, including Warren Buffet, George Soros, Lawrence Summers, and Paul Volcker, among many others, have expressed support for an FTM.²¹² Several investors in 2009 signed on to a paper by the Aspen Institute proposing to encourage long-term focus among investors, including the proposal to “implement an excise tax in ways that are designed to discourage excessive share trading and encourage longer-term share ownership.”²¹³ Investors who have publicly supported an FTM include: John Bogle (retired founder of the Vanguard Group), Warren Buffet (Berkshire Hathaway), Steven Denning (General Atlantic), Jack Ehnes (California State Teachers' Retirement System), John Wilcox (Teachers Insurance and Annuity Association – College Retirement Equities Fund), Ash Williams (Florida State Board of Administration),²¹⁴ and George Soros (Soros Fund Management), among others.²¹⁵

5. Efficiency

There is some uncertainty as to the overall impact that an FTM would have on the efficiency of financial markets. It is generally understood that an FTM would raise

²⁰⁸ European Commission, Taxing Financial Institutions – Making It Work (Feb. 14, 2013), http://ec.europa.eu/news/economy/130214_en.htm

²⁰⁹ Cécile Barbière, *Holland Will “Use FTT to Fight Climate Change,”* EURACTIV.COM (Samuel White trans., Jan. 8, 2015), <http://www.euractiv.com/sections/development-policy/hollande-will-use-fft-fight-climate-change-311098>.

²¹⁰ Anna Yukhananov & Kim Dixon, *Lew Says U.S. Still Opposed to Financial Transaction Tax*, REUTERS (Vicki Allen ed., Apr. 11, 2013), <http://www.reuters.com/article/2013/04/11/us-usa-tax-lew-idUSBRE93A0NR20130411>.

²¹¹ See MARK P. KEIGHTLEY, CONG. RESEARCH SERV., R41192, A SECURITIES TRANSACTIONS TAX: FINANCIAL MARKETS AND REVENUE EFFECTS 1 (2012) (collecting proposals from the 112th Congress to “impose a three-basis-point (0.03%) tax on non-consumer transactions involving stocks, bonds, futures, options swaps, and credit default swaps” and noting opposition from members of Congress and skepticism from then-Treasury Secretary Timothy Geithner). Earlier this year, the Democratic leadership in the House of Representatives announced support for an FTM as part of a broader tax reform plan, and one Senator recently called for “a targeted financial transactions tax to target risky activity like high-frequency trading.” Opposition was immediate and strong, and the Democratic proposal is not expected to be enacted in the foreseeable future.

²¹² See generally, CTR. FOR ECON. AND POLICY RESEARCH, STATEMENTS OF SUPPORT FOR A FINANCIAL TRANSACTION TAX (FTT) (2013) (listing 71 opinion leaders, economists, financial experts, political leaders, groups and institutions that support an FTM).

²¹³ THE ASPEN INST. BUS. AND SOC’Y PROGRAM, OVERCOMING SHORT-TERMISM: A CALL FOR A MORE RESPONSIBLE APPROACH TO INVESTMENT AND BUSINESS MANAGEMENT 3 (2009), available at https://www.aspeninstitute.org/sites/default/files/content/docs/pubs/overcome_short_state0909_0.pdf.

²¹⁴ *Id.*

²¹⁵ CTR. FOR ECON. AND POLICY RESEARCH, *supra* note 212.

transaction costs, and thus reduce trading volume, particularly short-term trading,²¹⁶ lower asset prices,²¹⁷ and raise the cost of capital (but not by much).²¹⁸ Proponents believe that this would discourage disruptive trading practices, such as high frequency trading and excessive short-term speculation, by reducing the profitability of such trading, and thereby reduce waste, volatility, and mispricing.²¹⁹ Critics argue that FTMs will actually distort markets and increase volatility, result in lower asset prices, increase businesses' cost of capital, and damage economic growth as financial institutions move to FTM-free jurisdictions (thereby reducing revenue generated by the FTM) or pass through costs to the ultimate consumer of the transaction. However, we believe that the diverse views in the academic and professional communities, and the historical experience described above, demonstrate that the distortive effect of a low-rate, well-designed FTM, if any, would be minimal. Thus, rather than undercut the case in favor of an FTM, efficiency concerns merely highlight the importance of ensuring that an FTM is well designed.

6. Financing Conclusions

A low-rate FTM applied to a broad base of financial instruments can have a meaningful impact on the developing world's ability to adapt to climate change. FTMs have high revenue potential and reliability. A low-rate FTM can be accomplished with minimum distortions and phased in over time, studied and adjusted accordingly. A multilateral FTM would be more efficient and generate more revenue than a unilateral FTM, though unilateral FTMs are feasible.

We recognize that developing, negotiating and implementing a broad worldwide FTM could prove to be challenging and time-consuming. In the interim, comparable FTMs could be implemented on a market-by-market basis in exchanges around the world without becoming entangled in multilateral state negotiations. An appropriately small microtax would have minimal risk of significant market distortions, and the beneficial public purposes of the FTM should make any residual risks palatable. If encouraged by support from responsible investment groups, such moves by the world's principal exchanges could lead to groundbreaking movement in other exchanges and, as experience evolves, problems that are identified may be addressed. The biggest challenge to exchange-driven FTMs is asset-substitution risk, since most derivatives are not currently traded on exchanges. This suggests that an exchange-driven FTM must have a low enough rate to avoid significant market distortion.

²¹⁶ Matheson, *supra* note 198, at 13.

²¹⁷ *Id.* at 14.

²¹⁸ *Id.*

²¹⁹ For a further overview of arguments for a FTT, see generally PRICEWATERHOUSECOOPERS UK, FINANCIAL TRANSACTION TAX: THE IMPACTS AND THE ARGUMENTS: A LITERATURE REVIEW (2013), available at http://www.foa.co.uk/admin/tiny_mce/jscripts/tiny_mce/plugins/filemanager/files/Regulation/Position_Papers/FTT_Literature_Review_FINAL_211113.PDF.

D. MANAGEMENT OF ADAPTATION FUNDING

While obtaining adaptation funding is a fundamental issue, similarly fundamental is the management of any funding ultimately obtained. As discussed above, there are currently a number of funds organized under the UNFCCC framework that manage funds for, among others, adaptation projects. The main source of revenue for these funds has traditionally been voluntary national contributions or pledges from member states of the UNFCCC. These funds are then distributed in a variety of ways. Generally money is disbursed for projects/programs after being assessed by the relevant board within the fund against criteria. For the Adaptation Fund and Green Climate Fund, the relevant boards of these funds accredit entities, public or private, which then submit proposals to the board for their consideration against a set of criteria. For the Special Climate Change Fund and Least Developed Countries Fund, it is the Global Environment Facility (“GEF”) that distributes the funds.²²⁰ Projects are screened by the GEF Secretariat and Scientific and Technical Advisory Panel.

There has been some historic disagreement between developed and developing countries under the UNFCCC regarding how revenues for adaptation should be managed and distributed.²²¹ To help resolve this, the UNFCCC parties established the Green Climate Fund, whose board is made of an equal number from developing and developed countries. Access to the fund is through entities that are accredited by the board. To be accredited, the entities must meet robust fiduciary standards and environmental and social safeguards. After accreditation, the relevant entity can submit proposals for funding. The relevant proposal is then assessed against activity-specific criteria, including the contribution of the program/project to increased climate-resilient sustainable development, the number of direct beneficiaries from the program and the ability of the program/project to address the needs of the vulnerable people and groups.²²²

²²⁰ *Project Types and Programmatic Approach*, GLOBAL ENVIRONMENTAL FACILITY, http://www.thegef.org/gef/project_types.

²²¹ Nicola Peart, *Dispute in Climate Change Adaptation Finance—Towards a Convergent Outcome for the COP-15*, 18 EUR. ENERGY & ENVIRONMENTAL LAW REVIEW 307, 307–333 (2009).

²²² http://www.gcfund.org/fileadmin/00_customer/documents/MOB201503-9th/07_-_Further_Development_of_the_Initial_Investment_Framework_20150223_fin.pdf

CONCLUSION

Despite the commitments made at the COP21 meeting in Paris to reduce (or "mitigate") GHG emissions, climate change will continue to exacerbate already severe conditions for urban residents, farmers and internally displaced persons (IDPs) throughout the developing world. Unless confronted promptly, effectively and on a sustained basis, these conditions will make portions of major cities (and in some cases entire cities) uninhabitable and agricultural areas unproductive, undermining fundamental rights and the rule of law for tens (perhaps hundreds) of millions of people and creating explosive conditions that threaten social stability and democracy in many regions of the world.

To avoid these consequences, meaningful climate-related adaptation must be seen as an urgent priority, particularly in those developing countries that are likely to be the principal victims of climate change, are least responsible for its causes and have the fewest resources to respond to its impacts. Effective urban and rural adaptation will require comprehensive science-based planning, active community participation, expanded infrastructure, reformed title registration, improved judicial institutions and large amounts of financial assistance from the international community.

Among the available sources of that assistance, we believe the most promising is an international financial transaction microtax ("FTM"), which could provide significant funds on the sustained basis necessary to permit eligible local, regional and national governments to plan and implement the multi-year projects required in cities, on farms and among IDPs in their countries. While this proposal may prove controversial, we believe it essential to permit developing countries to have the ability to adapt successfully to a changing world that threatens not only the global environment but also a social order based on law and fundamental human rights.

Task Force On Climate Adaptation

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