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Mexico, The Caribbean, and Central America: The Impact of Climate Change to 2030:

Geopolitical Implications

This paper does not represent US Government views.

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Mexico, The Caribbean, and Central America: The Impact of Climate Change to 2030: Geopolitical Implications

Prepared jointly by

CENTRA Technology, Inc., and Scitor Corporation

The National Intelligence Council sponsors workshops and research with nongovernmental experts to gain knowledge and insight and to sharpen debate on critical issues. The views expressed in this report do not reflect official US Government positions.

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Scope Note

Following the publication in 2008 of the National Intelligence Assessment on the National Security Implications of Global Climate Change to 2030, the National Intelligence Council (NIC) embarked on a research effort to explore in greater detail the national security implications of climate change in six countries/regions of the world: India, China, Russia, North Africa, Mexico and the Caribbean, and Southeast Asia and the Pacific Island States. For each country/region we are adopting a three-phase approach.

- In the first phase, contracted research explores the latest scientific findings on the impact of climate change in the specific region/country. For Mexico, Central America, and the Caribbean, the Phase I effort was published as a NIC Special Report: ***Mexico, Central America, and the Caribbean: Impact of Climate Change to 2030, A Commissioned Research Report*** (NIC 2009-11), of November 2009.
- In the second phase, a workshop or conference composed of experts from outside the Intelligence Community (IC) determines if anticipated changes from the effects of climate change will force inter- and intra-state migrations, cause economic hardship, or result in increased social tensions or state instability within the country/region. This report is the result of the Phase II effort for Mexico, Central America, and the Caribbean States.
- In the final phase, the NIC Long-Range Analysis Unit (LRAU) will lead an IC effort to identify and summarize for the policy community the anticipated impact on US national security.

In August of 2009, a group of regional experts convened to explore the socio-political challenges, civil and key interest group responses, government responses, and regional and geopolitical implications of climate change on Mexico, Central America, and the Caribbean through 2030. The group of outside experts consisted of economists, political scientists and other social scientists. While the targeted time frame of the analysis was out to 2030, the perceptions of decision makers in 2030 will be colored by expectations about the relative severity of climate changes projected later in the century. The participants accordingly considered climate impacts beyond 2030 where appropriate.

This work is being delivered under the Global Climate Change Research Program contract with the CIA's Office of the Chief Scientist.

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Executive Summary

The National Intelligence Council-sponsored workshop entitled *The Implications of Global Climate Change in Mexico, the Caribbean, and Central America*, held on 31 August 2009, brought together a panel of regional experts to consider the probable effects of climate change on Mexico, the Caribbean, and Central America from a social, political, and economic perspective. The panelists concluded that through 2030 ***climatic changes in the region may aggravate civil unrest and internal conflicts leading to increased migration, and that strong, centralized states, and states with robust civil societies, will likely fare better than others.***

Although the region does not contribute to significant global greenhouse gases, it is highly vulnerable to the effects generated by increasing climate variability. Rising temperatures, rising sea levels, increased rainfall in some places, drought in others, and a greater frequency of extreme weather events such as hurricanes, floods, and heat waves are expected from climate change.

- Temperature rise, both on land and at sea, could affect crop growing patterns as well as the viability of fisheries on which some coastal populations depend.
- Sea level rise has the potential to create economic losses for coastal populations, particularly around ports.
- Rising temperatures, increased rainfall, and population displacement may exacerbate or contribute to the emergence of infectious diseases.

Climate change may increase prospects for conflict in the region. Increased resource scarcity may combine synergistically with weak states and economic inequalities to promote organized insurrection. Civil conflicts are more likely than state-on-state violence, though some internal conflicts may spill across borders.

- Potential inter-state flashpoints include the Dominican Republic and Haiti, the Guatemala-Honduras-Nicaragua zone of instability, and the US-Mexican border.
- In Mexico, water scarcity may intensify community vulnerabilities to water-related diseases and exacerbate social tensions over access to water for agriculture and domestic uses.

Large internal conflicts or large population migrations are unlikely for most states in the region (with the exception of Haiti). While increased migration is likely, it is only part of a range of potential responses, including adaptation, sub-state conflict, and interstate conflict.

- Migratory trends to Mexico and to the United States are likely to continue and may accelerate. A concomitant rise in migrant-related criminality is also likely.
- The adaptive capacities of states and populations within the region vary but the region has historically dealt well with slow-acting climatic changes.

Strong civil society organizations play an important role in moderating the effects of climate change as they provide a means of communication between local people and state actors. The strength of civil society varies among states in the region.

- Mexico and Panama possess robust civil society organizations, environmental and social NGOs, and ethnic organizations.

- Guatemala, Nicaragua, and El Salvador are in the process of rebuilding civil society destroyed by conflict.
- In the case of Haiti, civil society is more present in Diaspora—primarily in the United States and France.

State centralization and control correlate well with emergency preparedness. All states in the region show some capacity to recover from damage caused by extreme weather events.

- Mexico and Cuba appear to have the greatest state-level capacity when it comes to emergency preparedness. In both settings, the armed forces play a role in managing emergency response.
- The smaller Caribbean and Central American states are less prepared to respond to climatic emergencies domestically, and Haiti is the least prepared.

Most states in the region lack the institutional mechanisms to effectively address the long-term threats posed by climate change.

- Development agencies including USAID and the Inter-American Development Bank are working with states in the region to gather information and develop tool kits to help governments assess their vulnerabilities and better prepare for the physical, economic, and human toll of extreme weather events.
- The Caribbean Community (CARICOM) has instituted several initiatives to bring governments and NGOs together in productive cooperation.

The United States will probably face ever-increasing pressure to provide humanitarian assistance to neighbors to avoid large numbers of refugees and to reduce the risk of local conflicts that could require US military intervention.

- States in the region may become increasingly inward looking and politically populist in reaction to economic disparity, resource scarcity, or civil conflicts exacerbated by climate change.
- Seeking collaborative and effective regional mechanisms to jointly manage climate change challenges may provide the United States new opportunities for strengthening relations with countries in the region.

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Introduction and Background[1]

Mexico, the countries of the Caribbean, and Central America examined in the Phase I report are at risk from the impacts of climate change in the next 20 years because they will be exposed to a greater range of climate changes and have a relatively weak adaptive capacity when compared to the world at large. Within the region, climate change is evident in increased temperatures, changes in precipitation, and sea level rise—and perhaps in weather variability and natural disaster events. Countries considered for the Phase I effort included Belize, Cuba, the Dominican Republic, Guatemala, Haiti, Honduras, Mexico, Nicaragua, and Panama; Puerto Rico was also discussed.

Steady increases within the region in the number of extreme weather events—hurricanes, storms, and droughts—and their effect on infrastructure, public health, loss of human life and agriculture may be attributable to climate change. The countries reviewed do not yet have a full understanding of the potential impacts of future climatic changes and are not prepared to prevent or reduce those impacts.

Regional leaders are aware of these challenges and have begun to make commitments and agreements that will enhance their understanding of future climate change, their own adaptive capacity, and where critical changes and investments need to be made. Leaders have not addressed the problem from a preventive perspective through policy changes or infrastructure investments because of a lack of systematic analysis that quantifies and qualifies the potential impact to the region, allowing the development of relevant and economically viable options. At present the region is still responding to climate change in a reactive manner.

- Regional leaders realize that leaving the situation "as is" will exacerbate their fragile economies, resources, and adaptive capacity but lack strategic plans to address the issue.
- Most countries in the region are signatories to many multilateral environmental agreements but are only now beginning to implement such agreements.
- There are significant gaps in the ability to fully understand in a systemic way all the dimensions of climate change impacts at the economic, social, and/or environmental level in the region. There are gaps and deficiencies in data, systematic methodologies/analysis, and tools to monitor, share, and track information and events at the local, national, and regional levels.

Efforts are starting to reduce systemic knowledge gaps. There is insufficient funding by regional governments to undertake detailed modeling that would result in information to rank and evaluate the financial viability of potential climate change adaptation projects. Several entities at the national and regional levels are working to develop improved analytical methods and information sharing as well as better data and data availability.

[1] This section is extracted from the Executive Summary of the Phase I report (see Scope Note): ***Mexico, Central America, and the Caribbean: Impact of Climate Change to 2030, A Commissioned Research Report*** (NIC 2009-11), of November 2009. Some of the judgments in this report (Phase II) may differ from the Phase I report.

- In September 2008, the Economic Commission for Latin America and the Caribbean (ECLAC) announced that it would undertake multiple studies to review how climate change is affecting regional economies. Currently, the ECLAC consensus is that climate change is likely to impose serious economic consequences for the Central American and Caribbean regions, making it increasingly difficult to respond to the challenges of poverty reduction, higher human development, and environmental sustainability linked to the attainment of the United Nations Millennium Development Goals.
- Upcoming studies by the ECLAC are expected to contribute to a better understanding of the economic impact of climate change in the region and will outline the costs and benefits of needed related policy responses, both in terms of mitigation and adaptation.

In the Phase I report, information available for a selected set of Mexico, Caribbean, and Central American countries was reviewed to start understanding the projected climate change variability, given certain scenarios to 2030, as well as to start an initial assessment of these countries' current adaptive capacity to reduce such effects.

Very limited modeling and analysis are available for the countries of interest. Because of that, this initial analysis draws heavily on the respective governments' First National Communication to the Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC). These reports to the UNFCCC offer the most comprehensive and comparable information available today. In the case of Mexico, the third communication to the UNFCCC was used to review summary impacts. This report, however, was primarily focused on improving inventories of greenhouse gases across all types and production of energy as well as the greenhouse gases generated by major economic activity.

This review identifies the following high-priority risks:

- *Energy*. Energy resources, production, and use vary widely across the countries under review. As all the countries experience population growth, economic growth, and industrialization, they will increase their need and demand for energy. All the countries under review rely on imported fossil fuels, with the exception of Mexico, which is a net exporter of energy resources. In most of the countries, the largest generator of greenhouse gases is the energy sector. Although they are very small contributors to global emissions, most of the countries will receive economic benefits from increasing use of renewable energy. Most have begun efforts to evaluate and implement small renewable energy projects, such as solar energy in rural areas of El Salvador, wind energy in Nicaragua and Costa Rica, and an intensive effort in the Dominican Republic to evaluate hydro-generated electricity.
- *Agriculture*. The agricultural sector climate-related research for most of the countries in this review is limited. Where research is available, productivity losses are projected for optimistic, moderate, and pessimistic scenarios for some key food crops with estimates that vary from 10 percent to more than 50 percent degradation by the year 2030.
- *Water Resources*. The majority of the population in most of the countries in the review lives in coastal areas, which are highly vulnerable to severe climate changes. As populations

continue to grow in the same areas, increasing water extraction and rising sea levels are expected to have severe impacts on the quantity and quality of water available. Many of these countries' aquifers are open to ocean waters and are already experiencing increased salinity. Rising sea levels will accelerate the deterioration of aquifers and available water resources.

- *Migration.* In Central America, an increase in intra-regional migration during the 1980s and 1990s as well as extra-regional migration was the result of social unrest and economic contraction. Future patterns of migration are not expected to change significantly. Moreover, the inability of countries in the region to adapt and recover from severe climate events with major impacts on their economies will continue to promote migration outside the region, in particular to the United States and Canada. The large number of immigrants coming to the United States in the past 20-25 years will facilitate this movement.

Most of the countries under review have submitted their First Communication to the UNFCCC; Mexico has submitted its third. Significant work and analysis needs to be done to fully capture the impact on socio-economic systems and their current ability to recover, adapt, and reduce the effects of climate change.

The great variation of information available for each country reduces the ability to compare the full set of key indicators across all countries in a consistent manner.

Social, Political, and Economic Challenges

The projected primary effects of climate change in Mexico, Central America and the Caribbean include rising temperatures, rising sea levels, increased rainfall in some places, drought in others, and a greater frequency of extreme weather events such as hurricanes, floods, and heat waves. Projected secondary effects include the emergence or re-emergence of infectious diseases, shifting geographic ranges of crops for consumption and export, saltwater contamination of aquifers, and changes to animal habitats and biodiversity, among others.

In the short term, the extent to which these factors may exacerbate social tensions regarding control over and use of natural resources, provoke population movement within and from states, contribute to food scarcity, or lead to pandemic outbreaks will depend on the ability of governments and civil society groups in the affected states to prepare for and respond to emergencies, adapt to geographic and social changes, and develop ways to cooperate and communicate with international partners in emergency situations. In the long term, strengthening policies to contain states' contributions to further global warming through the emission of green house gases and deforestation will be essential.

Meteorological Challenges

Climate experts project that extreme weather events due to higher ocean water and air temperatures, including more frequent hurricanes, increased rainfall, droughts, and heat waves will characterize the effects of climate change in Mexico, Central America, and the Caribbean. Beyond loss of life and economic impacts, extreme weather events can displace people and create the conditions for disease outbreaks. In the Americas, the states that border the Caribbean and Gulf of Mexico bear the brunt of hurricane action.

- In 2008, Hurricane Ike devastated parts of Cuba, Haiti, and Jamaica. Heavy rains in the eastern Mexican state of Tabasco in 2007 covered at least 80 percent of the state with water, provoked a national emergency declaration, and dislocated at least 20,000 people.
- In 2007, Hurricane Felix, a category 5 storm, made landfall on the Nicaraguan Coast. Storms of this intensity could be the norm for future storms.
- In 1998, Hurricane Mitch, the second worst Atlantic hurricane on record, not only destroyed roads and bridges in Honduras, Nicaragua, and Costa Rica but also wreaked havoc in the Caribbean and Mexico. At least 11,000 people are believed to have died, and Mitch is estimated to have caused six billion dollars in damage. Outbreaks of cholera, acute respiratory infections, and dengue fever were also reported.

Mexico and Cuba appear to have the greatest state-level capacity when it comes to emergency preparedness. When Hurricane Mitch hit Central America in 1998, both states responded by sending personnel to help with rescue and reconstruction efforts. In both settings, the armed forces played a role in managing emergency response. Mexico has also engaged in emergency preparedness exercises with the United States and Canada through the former Security and Prosperity Partnership and in the context of the Global Health Security Action Group. However, the smaller Caribbean and Central American states seem to be less prepared to respond to emergencies and extreme weather events domestically; for example, Haiti is heavily reliant on external support for hurricane and flood recovery.

Agricultural Challenges

Mexico, Central American, and Caribbean states have economies with significant agricultural sectors. In many of the states selected for this review, the agricultural land use vis-à-vis total land area varies widely. In 2005, Belize agricultural land was 6 percent of the total land area, reflecting the fact that over 50 percent of GDP comes from the services industry, particularly tourism, compared to Dominican Republic where agricultural land was 70 percent, Costa Rica and Haiti 57 percent, Cuba 60 percent and Mexico 55 percent of total land area. In the past 27 years, all of the states reviewed have maintained relatively stable ratios of agricultural land use to total land area.

The conversion of forests to agricultural use is likely to continue; however, the general projected drying trend in the area is likely to limit the types of viable agricultural crops. Although projected temperature changes may not differ much by season, changes in rainfall will likely lead to extended periods of drought and possible loss of soil fertility during the peak growing season in June, July, and August.

- Projections for productivity losses in Cuba range from 10 to 15 percent for rice, cassava, and corn; five to 10 percent for sugar cane; and 40 to 45 percent for potatoes.
- Coffee production in Veracruz, Mexico is likely to drop over 30 percent by 2020, degrading its economic value to the region.

Projections for other states in the region are similar, though they vary by state and study. Further, the rise in CO_2 levels could result in a fertilizing effect with crops having shorter growing cycles. The salinization of ground water supplies due to climate change and sea-level rise may also threaten agricultural productivity.

Many Central American and Caribbean states have major fishing industries. Climate change is likely to lead to changes in migration patterns and depth of fish stocks with possible negative effects on the fishing industry.

Mexico, the Central American states, and the Dominican Republic are engaged in free trade agreements with the United States, and some of the Caribbean states have established trade pacts with the European Union. These agreements regarding the flow of goods, including agricultural products and foodstuffs, may reduce some populations' reliance on locally grown crops. However, climate change is likely to negatively affect the fortunes of subsistence farmers, such as those in Mexico, Haiti, Guatemala, who are not engaged in commercial agricultural activities.

Coastal and Maritime Challenges

Climate change scenarios project that sea levels will rise, a phenomenon which could be a significant factor for the Caribbean islands and for coastal communities in Mexico and Central America. Sea level rise has the potential to create economic losses for coastal populations, particularly ports that could not only experience population dislocations but also shifts in commercial traffic.

The small islands of the Caribbean will probably experience a warming over the next century that may be somewhat smaller than the global annual mean warming. Projections for temperature increases in the Caribbean at the end of the 21st century range from 1.4 ºC to 3.2 ºC with a median of 2.0 ºC. This level of warming is still likely to lead to significant sea level rise, deterioration of coastal areas and erosion of beaches, and increased invasion of non-native species, while reduced water resources could lead to an inadequacy of fresh water to meet

demand during low rainfall periods. The amount of sea level rise is not likely to be uniform due to geographical differences in the islands. Extensive geographical, topographical, ecological, sociological, and population density information, gathered into a detailed geographic information system (GIS), is required before predictions are possible.

A rise in sea levels could also aggregate social tensions in many of the regional states. European or mestizo settlers have traditionally pushed indigenous populations in Mexico and Central America away from the most productive land to coastal areas or mountainous zones. Were sea level rise to provoke population movement, settled indigenous populations could experience further pressure from dislocated populations to move toward even less productive soil. This could further intensify emigration from marginal communities, creating conditions in which men migrate to more lucrative areas to seek access to land or income, while women and children bear the responsibility of maintaining the household and become vulnerable to further land-grabbing efforts.

Having suffered centuries of racial discrimination, often at the hands of state officials, socially marginal communities, including indigenous populations and those of African descent, may be cautious about official efforts to relocate them or mediate conflicts among communities. This is certainly the case in Mexico and Guatemala and most likely holds true for some Caribbean communities, as well. Collective action focused on the needs of indigenous peoples has characterized political movements in both states, although the extent to which such movements might gather greater support in the future is unclear.

Hydrologic Challenges

Depletion of aquifers and reduced rainfall in some areas will contribute to water scarcity, which may intensify community vulnerabilities to water-related diseases and exacerbate social tensions over access to water for agriculture and domestic uses. In Mexico, conflicts over water use have created tensions in local communities throughout the state, provoking marches, blockades, and efforts to take over institutions.

Mexico City is experiencing severe water scarcity and aquifer depletion. The city already sits on drained lakes, exacerbating infrastructure vulnerable to seismic activity. With a population of more than 20 million, the city must pump water from great distances and has had to ration water at least three times in 2009. Informal urban settlements rarely count on regular water service, and residents of such neighborhoods may have even more restricted access to water with rationing in effect. Irregular supply limits users' access to water for hygienic purposes and can lead to contamination when pipes are not flushed out on a regular basis.

Water scarcity can lead to tensions between states as well. It has already created conflicts between Mexico and the United States over the Rio Grande, as well as Mexico and Guatemala over the Usumacinta River. Most of the states in Central America share some form of water boundary, suggesting that measures must be put in place to resolve conflicts at state and community levels.

Demographic and Public Health Challenges

Mexico, Central America, and the Caribbean states all continue to experience population growth, albeit at somewhat different rates, leading to an increase in food demand. Most of the states in these regions depend greatly on agricultural production. Variations in crop yields, food crops, and cash crops present major challenges.

Increased rainfall, sea level rise, drought, and extreme weather events may provoke populations to migrate to more suitable habitats. The arrival of environmental migrants to existing settlements may provoke tensions with local populations and competition over scarce resources. Migration may also lead to the separation of families, with males leaving home to seek income-generating opportunities, placing the burden of household maintenance on women and older children.

Rising temperatures, increased rainfall, and the movement of populations into new areas may exacerbate or contribute to the emergence (or re-emergence) of infectious diseases, including diarrheal disease and acute respiratory disease, as well as vector-borne diseases such as dengue fever, malaria, leptospirosis, and Chagas disease.

- Since 1990 the region has experienced a series of re-emerging diseases following severe climatic events such as floods, hurricanes, and droughts.
- There is evidence of increases in several communicable diseases, such as dengue, malaria, and Hantavirus pulmonary syndrome; and the reemergence of a large host of infectious diseases following years in which there were El Niño/Southern Oscillation (ENSO) events.

While Mexico, Costa Rica, and Cuba have relatively strong health systems, many of the Central American and Caribbean states' health systems are weaker. The migration of health professionals from Mexico, the Caribbean, and Central America to the United States and Canada, and the fact that so many people do not have access to health care, creates vulnerabilities. Health systems in the region are already burdened by the increasing toll of chronic disease and will need to develop tools to anticipate climate-related outbreaks and develop lab capacity and response to address problems.

Economic and Energy Challenges

Since 1990, the region has experienced large disparities in states' GDPs. Some low values have been the result of economic contraction coupled with political unrest, capital flight, migration of the better-educated segment of the population, and the loss of foreign investments as experienced by Guatemala, El Salvador, Nicaragua, and Haiti from the late 1970s through the 1990s. The socio-political challenges of the 1980s and increases in extreme weather events in the 1990s had adverse effects on the fragile economies of the region. Instability in the economies exacerbated by the absence of law has greatly reduced the opportunity for recovery. States such as El Salvador, Guatemala, and Nicaragua were directly affected by civil unrest and increased weather-related natural disasters, while their neighboring states had to cope with an increase in migrating population because of the difficulties associated with war and natural disasters. These same states have also been severely affected by hurricanes, floods, and tropical storms in the past two decades.

The potential for resource scarcity, especially water, to negatively affect the economies in the region is highly probable. Many states have agriculture-based economies whose potential negative impact can be assumed. However, states with growing manufacturing sectors—

Mexico, El Salvador, Costa Rica, and Guatemala—also face challenges from scarcity in addition to increased competition from China and other regions. Tourism may also decrease along with remittances from immigrant populations abroad as those regions face their own economic troubles.

The states in the region, which have mostly fossil fuel-based economies, are mostly net importers of sources for energy production. Since 1984 they have continued to increase their overall energy consumption. With the exception of Mexico, primary and secondary energy production has remained below total annual consumption. Primary energy production refers to the production of energy products or sources found in their natural states, such as wood, natural gas, bagasse, and hydroelectricity. It also includes the amount of fuel extracted and the energy consumed in the production process and the supply to energy producers and conversion. Secondary energy production includes products or sources that are the result of conversion of primary energy products such as all those derived from petroleum refining, kerosene, and diesel.

As economies grow and the process of industrialization continues, most states in the region will remain highly vulnerable to variable petroleum base supply and cost as experienced in the past few years. Mexico is the only state in the region that is a net exporter of energy resources, though this is likely to change within the next decade. Between 1990 and 2007, regional energy consumption increased 158 percent. Moreover, Costa Rica, Nicaragua, and the Dominican Republic increased consumption by about 200 percent while Panama increased by 288 percent in the same period. Energy consumption is expected to increase as population and economies continue to grow.

Energy supply composition across the states remains predominantly based on petroleum, with the exceptions of Haiti, Nicaragua, and Honduras. Interestingly, these are the three states with the lowest annual GDP growth rates within the group from 1990 to 2007. On the other hand, Costa Rica, Cuba, Panama, and the Dominican Republic, who experienced the largest annual GDP growth rates in the same period, also have the largest shares of oil-based energy supply.

With the exception of Mexico, all states are net importers of petroleum-based products. Oil-based energy supply remains significant in particular in the case of the Dominican Republic, where it accounted for 74 percent of total energy supply in 2005 and 79 percent in 2002. Island nations such as Cuba, Puerto Rico, Haiti, and the Dominican Republic remain particularly vulnerable to the supply of petroleum-based energy products, since the raw material must be brought to the islands by ship for refining and processing. The recent discovery of oil reserves off the coast of Cuba should provide some improvement, but to what extent remains unclear. Hydroenergy plays a significant role only in Costa Rica, where it accounts for 18 to 24 percent of supply; for the rest of the states it ranged from 0.1 percent in Cuba to 9.8 percent for Panama.

Civil and Key Interest Group Responses

Potential Responses

Evidence from previous post-disaster research challenges the idea that full-scaled "flight-or-fight" responses are likely for populations in most states in the region, with the notable exception of Haiti, at least as a direct response to the impacts of climate change alone. Rather than limited to "flight-or-fight," there are a range of responses to climate change-induced hazards that may or may not be adapted at varying spatial, organizational, and temporal scales.

Innovation/Intensification/Adaptation. Historically, people and societies have been able to respond to natural hazards and human-generated alterations in the socio-ecological system by adopting innovative (innovation/adaptation) and non-innovative (intensification) changes to ensure economic survival. Adjustments to living and livelihood patterns can stress people and governments but probably significantly less than the alternatives that follow below. Adjustments will be geared toward relevant stressors in the different states under consideration and can range from wholesale agricultural alterations in the crop or techniques to improve construction of buildings to withstand extreme climatic conditions. Hurricanes and other storms demand technological adjustments, while slower-acting change processes such as warming or changes in precipitation may respond well to modifications of existing production techniques. These adjustments are most likely the least socially, economically, and politically disruptive responses to climate change and will be aided by strong civil society institutions due to their ability to moderate relationships between localities and regions and central governments.

Abandonment/Migration. Many people in the region currently use temporary or permanent migration as a coping mechanism for socio-economic stressors brought on by economic or political hardship and occasionally by climate related phenomena. Large groups of people have previously relocated due to changes in resource availability, among other reasons. In worst-case scenarios, large-scale migration might occur out of areas and perhaps across international borders. This migration could place more pressure on an already stressed system and potentially lead to internal or international conflict. There are, however, many moderate migratory activities that can take place—such as rural to urban and rural to rural—all within a single country. States in the region have been urbanizing rapidly since the end of the Second World War, as has international migration. Slow-acting climate change processes may signal almost imperceptible increases in movement while faster acting change can challenge socio-ecological resilience.

New migrants, often representing the extremely poor, may pose a threat to the existing social order and potentially give rise to violent backlash. Criminal elements such as narcotic traffickers and smugglers often accompany migrants, exacerbating existing tensions between and within states. Recent examples of migration in the region include Haitians to the Dominican Republic; Guatemalans to Mexico and Belize; Salvadorans, Mexicans, Haitians, and Dominicans to the United States; and Nicaraguans and Panamanians to Costa Rica. Except for the 1969 Soccer War between El Salvador and Honduras, these movements resulted in muted violence, usually at the individual or occasionally community level.

Sub-state Conflict. The states in the region have varying experience with internal conflict throughout their histories. Four states—Guatemala, Nicaragua, Haiti, and Mexico—have had or currently have significant conflict-related, political ideologies fueled by drastic economic inequalities, while Honduras, Belize, and the Dominican Republic have remained relatively peaceful over the last 25 years. None of these conflicts can claim climate change as a necessary or sufficient condition for conflict. Increased resource scarcity, however, may combine synergistically with weak states and economic inequalities leading to organized insurrection. Groups already organized for conflict (though not resource conflict *per se*) include Mexico's Zapatistas (other similar movements exist across Mexico), Mexico's drug cartels, and loosely organized gangs like MS-13 in Central America.

Interstate Conflict. There exist precedents for cases of interstate conflict related to resource issues, among other reasons, and there is the potential for more to occur especially as migration and intra-state conflict stress developing-state governments. In the region of Mexico, Central

America, and the Caribbean, four major drivers of resource scarcity could lead to increased interstate violence: Agricultural land loss or degradation, forest loss and degradation, fresh water depletion or pollution, and fisheries depletion.

Adaptive Capacity

Most estimates of vulnerability rely on easily attainable statistics—economic capacity, human capital, and environmental capacity—that ignore less quantifiable but important factors on how human-natural systems interrelate, namely social interaction. Such estimates fail to recognize the enormous adaptive capacity most societies possess under the right social conditions.

At the local level, adaptation may result from individual or group innovation but appears unlikely to be widespread without governmental and civil society cooperation. Civil society in the region has a long, if uneven history. States like Mexico possess robust civil society organizations such as the Catholic Church, environmental and social non-governmental organizations (NGOs), and ethnic organizations. Other states such as Guatemala are in the process of rebuilding civil society, much of which was targeted during that state's civil war. In some cases, such as Haiti, civil society may be more present in migration destinations—primarily the United States and France—due to internal problems with Haitian social and economic interactions.

It is in enhancing adaptive capacity that civil society may play its most important role. In most of the region, important state functions such as environmental management, food distribution, and health care have been ceded to civil society of a religious, environmental, or ethnic nature.

- The Mexican NGO PRONATURA, or international NGOs, manage most parks and reserves in Mexico due to the state's inability to pay for and monitor environmental conditions.
- Haitian food distribution networks are largely based on the role of the Catholic clergy and laity or the increasing number of non-Catholic, Christian organizations.
- Domestic and international NGOs in Guatemala communicate ethnic demands and concerns to the state.

Development agencies including USAID and the Inter-American Development Bank are working with states in the region to gather information and develop tool kits to help governments assess their vulnerabilities and better prepare for the physical, economic, and human toll of extreme weather events. Additionally, the Caribbean Community (CARICOM) has instituted several initiatives to bring governments and NGOs together in productive cooperation.

- The Instituto de Nutrición de Centroamérica y Panamá (INCAP), based in Guatemala, provides advice and technical support to governments working to resolve nutrition problems associated with food scarcity. Under nutrition continues to be a challenge for some populations in Mexico, Central America, and the Caribbean, even as problems related to obesity, diabetes, and cardiovascular disease are beginning to pose economic and social challenges to regional health systems.
- In the Caribbean, CARICOM representatives agreed to establish the Caribbean Public Health Agency (CARPHA) to improve disease surveillance in the region.
- Belize hosts the CARICOM Caribbean Community Climate Change Research Center, which serves as a regional repository for climate data and conducts research on the projected effects of global warming in the region. The Center also provides climate change data to member

states to help them prepare for the United Nations Framework Convention on Climate Change (UNFCC) Conference of Parties in Copenhagen in December of 2009. Given that the states in the region do not significantly contribute to global warming, the Center provides considerable economic data charting the effects of warming on states' economies and the projected effects.

- The Caribbean Environmental Health Institute (CEHI), a CARICOM entity based in St. Lucia, provides technical assistance on water safety plans and on water-related climate planning throughout the region.
- A partnership involving the Pan American Health Organization, the International Water Association, and the Asociación Inter-Americano de Ingenieros Sanitarios (AIDIS) is introducing states to water safety to facilitate water quality planning at the catchment level, with experts from Honduras, Mexico, and Jamaica playing key roles in the organization.

In addition, the goals of many civil society organizations focus on capacity building at the local level. Knowledge dissemination (education) and production (research) carried out locally promises to enhance adaptive capacity through increased recognition of problems associated with climate change, alternative economic activities, and ability to communicate with the government when problems arise. This capacity building can be aided by international cooperation with international NGOs, government agencies, and private enterprise from the United States and elsewhere.

In those states with high levels of political pluralism, civil liberties, and participation (Panama, Mexico), civil society has the potential to play a positive role in mitigating the impacts of climate change. Weaker democracies, such as Guatemala, Nicaragua, and El Salvador, or Honduras, continue to strive to recover from civil war or natural disaster. It is difficult to predict how strongly centralized states (Cuba) or chronically disorganized states (Haiti) will be able to adapt to the predicted changes associated with climate change. Should adaptive capacities fail to meet the needs of climatic challenges, large-scale flight is likely with the United States and Mexico bearing the largest immigration burdens. In the case of Haiti, this is a near certainty.

State Responses

The region of Mexico, Central America, and the Caribbean lags most other major regions as an emitter of greenhouse gases that are believed to contribute to global warming, yet it is on the frontlines of the potential consequences, including mega-storms, droughts, and impacts on agriculture, eco-systems, and epidemiology. This blunt disparity is even greater for the small and micro-economies that make up most of Central America and the Caribbean. The region's relative paralysis and reactive approach to climate change may be driven primarily by other demands for their scarce resources, and a recognition that limiting carbon emissions within the region will barely impact the overall trajectory of global climate change.

Any effective effort to combat the host of climatic threats to the region must overcome other challenges in the region to include weak institutions, inadequate or deteriorating infrastructure, pollution, unmanaged deforestation, high levels of poverty, overcrowding of urban areas, and inefficient means of agricultural production. If fishermen and subsistence farmers are unable to earn a living through traditional activities because of global warming, they will need to learn new ways of generating income to support their families. It will be important for governments and development agencies to help such populations identify alternative livelihoods.

International Efforts

It is currently unclear how effective regional and international bodies can be, though several exist in many of the states in question. In many cases, state governments have partnered with international NGOs as a means of interstate cooperation and coordination.

- Health Ministers cooperate through the Sistema de Integración de Centroamérica (SICA) and CARICOM, and health is a recurrent theme at the Summits of the Americas.
- For the Caribbean states, participation in the United Nations Small Island Developing States Network has enabled some governments to gather information about the projected effects of sea level rise and to anticipate the changes that will affect their territories. Through their involvement in CARICOM processes, governments in the Caribbean participate in regional discussions about climate change preparedness and adaptation.
- Mexico, along with Canada and the United States, is a member of the Global Health Security Action Group (GHSAG) and has worked with Canada and the United States to develop mutual assistance protocols in the event of a public health emergency.

States in the region have also undertaken their own initiatives alone and in conjunction with neighbors.

- In 2008, Mexico's President Felipe Calderón proposed the establishment of a global "Green Fund" to provide support to states seeking to develop their capacities to adapt to climate change scenarios.
- In 2004, Mexico hosted the fourth World Water Forum, making a special effort to highlight water issues in the region.
- Mexico and Guatemala established an International Commission on Limits and Waters in 1961 that may serve as an example to others.

Mexico and Cuba have the greatest potential to play a global leadership role in combating climate change, although the small-island states of the English-speaking Caribbean may be galvanized to collective action and use their disproportionate vulnerability to climate change to help shape the debate. While most of the states in this region may lack the institutional mechanisms to effectively address the threats posed by climate change, Mexico can credibly claim sufficient resources to do so. Cuba, meanwhile, has thus far demonstrated great institutional capacity to deal with near-term threats such as hurricanes but is otherwise subject to similar constraints as its neighboring states.

Cuba and Haiti

Cuba and Haiti offer good case studies for the region. Both are post-revolutionary, low-technology, and low-income societies. Cuba has a highly centralized sociopolitical structure, formed mostly around the military, while Haiti is highly decentralized. These two cases highlight the range of state capacity for much of the region.

Cuba has a well-structured system of research programs that covers a wide variety of problems focused on understanding the economic, technical, intellectual, and cultural development of the state. The country has the capacity to mobilize its population in advance of hurricanes that periodically strike the island. The Cuban military is the organizational core of the state, marshaling human and political capital through its networks. Its one million-strong *Milicia Territorial* is in charge of natural disasters and has operated with amazing efficiency, as is

evident from the extremely low human toll during the most severe storms. In 2004, two hurricanes (Charley and Ivan) and a prolonged drought caused $3 billion in losses, 33 percent more than the earnings from tourism that year, and with virtually no loss of life.

Despite these strengths, Cuba lacks any significant capacity to recover from storm damage. Reasons for this include:

- Cuba has been unable to generate sufficient internal resources to invest for a sustained recovery.
- Cuba's international credit-worthiness is poor; there is limited access to external credits and loans.
- It is impossible to restrict consumption further to divert resources to investment as consumption is already depressed.
- The enterprise management reform process (*perfeccionamiento empresarial*) is new and very slow in implementation and therefore the central control of enterprises and government functions remains.
- Political and social structural impacts hamper reconstructive efforts such as the decline in real wages, increase in disguised unemployment, steeper income stratification, and resource and wealth hoarded by the elites.

Worrying demographic trends further hamper Cuba's ability to address recovery and development issues. Cuba's population is declining due to low fertility, out-migration, and a dramatically aging population. Migratory trends have drastically altered the ethnic makeup of Cuba—70 percent of the Cuban population is black, mostly of Jamaican origin, up from 30 percent 60 years ago, and migration into the cities has resulted in extreme over crowding. Havana, which represents 0.67 percent of the nation's land mass, comprises 25 percent of the nation's population.

Haiti, on the other hand, is already a failed state, and faces an ecological crisis. There is virtually no state presence outside of Port-au-Prince, where 90 percent of all government employees live and work, leaving the rest of the country in the hands of non-governmental organizations. The Haitian government is among the weakest in the world in terms of providing essential public services.

Both the Haitian and Cuban cases contain lessons for states attempting to contend with the deleterious effects of climate change:

- Excessive state control and centralization of decisionmaking such as exists in Cuba might well work to prepare the populace in the face of natural disasters, but proves much less efficient in helping that state recover from the damages caused by those disasters.
- Complete decentralization and minimal state involvement, as in Haiti, neither prepares the populace nor has the capacity to recover after the storms.

Regional Implications

Should the societies in question fail to properly adapt to climate change, increased migration and competition for scarce resources may raise tensions between neighboring states to the point of conflict. Civil conflicts are more likely than state-on-state violence, though some conflicts may straddle this divide. Of the potential areas of future conflict exacerbated by the effects of climate change, three merit special attention:

The Dominican Republic and Haiti. There are multiple signs that the future trajectory of this relationship is unsustainable with the potential for an escalation in violence. Vastly different levels of development (with per capita GDP estimated at $8,100 versus $1,300 in 2008 in purchasing power parity terms), explosive population growth, unfettered out-migration from Haiti to the Dominican Republic, and deepening racial and cultural tensions all raise the risk of violent conflict. This could take the form of civil unrest in Haiti or actions taken against Haitians by the Dominican military. The fact that Hispaniola sits in a major storm path also raises the possibility of hurricane-induced catastrophe affecting one or both nations.

The Guatemala-Honduras-Nicaragua Zone of Instability. Although not as dire as the situation on Hispaniola, the Guatemala-Honduras-Nicaragua axis poses another regional flashpoint for many of the same reasons. The three states will likely experience rapid population growth against the backdrop of comparatively low levels of development (respectively $5,200, $4,400, and $2,900 in 2008 per capita GDP, figures which contrast sharply with Mexico at $14,200, and are lower than Belize at $8,600, and El Salvador at $6,200). Given the low adaptive capacity generally assessed for these states, and the projected population growth, extensive out-migration from Belize may combine with pressures on Mexico's southern border to provoke conflict. The relative exposure of Honduras and Nicaragua to powerful Caribbean storms further heightens the potential for disruption.

The US-Mexican Border. **Increases in the frequency and scale of natural disasters caused from climate change could have a threat multiplier effect on immigration to the United States. US immigration is principally rooted in issues of economic deprivation and disparity.** If certain areas of Mexico, Central America, and the Caribbean become uninhabitable—either due to rising sea levels and temperatures, or because traditional agricultural and water resources cannot be sustained—then pressure on the US-Mexican border will increase. The potential for new climate-related epidemics may also affect the prerogatives for border security. The US-Mexican border may emerge as a future flashpoint, not as an area directly affected by climate change, but rather as a force to contend with the intensified migratory patterns that result.

Overall Foreign Policy Implications

The region's relative impotence in shaping the future trajectory of global climate change, coupled with the likelihood that it will bear the brunt of some of the most severe repercussions, will likely exacerbate several troubling tendencies in the region's politics. In Central America and the Caribbean, these include populist measures to control domestic natural resources, greater suspicion and skepticism towards the United States, Europe, and traditionally dominant powers, and greater orientation towards powerful southern neighbors such as Brazil and Venezuela. Insofar as the predicted rapid growth of China and India contribute to high levels of carbon emissions, this may lead to a diminution of these states' relative authority and popularity.

If Mexico ceases to be a net oil exporter and does not harness the economic potential of new technologies, then it may falter as a regional force as well. This may result in Mexico, Central America, and the Caribbean becoming increasingly inward looking, consumed by internal problems, and remaining at the margins of global action on climate change.

In relations with the United States they will remain vigilant. The United States is the single greatest determinant of change in the region—from water division issues with Mexico to political hegemony and aid support. If the United States seeks collaborative and effective regional mechanisms to jointly manage the challenges of climate change, this may provide a new opportunity for strengthening relations.

The implications for US foreign policy are great:

- Providing ever-increasing humanitarian assistance to neighbors in need.
- Avoiding catastrophic waves of refugees.
- Avoiding the need to intervene militarily as so often done in the Caribbean.
- Gathering goodwill in this area of scientific expertise, goodwill that should be advantageous in serving other US geopolitical and national security purposes.

Cuba represents a potential US partner once Fidel Castro is no longer in power. Cuban doctors have lived and worked throughout the region, creating a goodwill network along with bolstering the local medical systems. Cuba's medical and pharmaceutical resources in the region are second only to the United States, and already well in place. The United States could partner with Cuba in the creation of a rapid deployment humanitarian force, using Cuban resources and US funds. The first step would be direct talks between the US and Cuban militaries, as the Cuban military is the most organized force in the state and has access to US forces through proximity at the Guantanamo Naval Base.

Additionally, the United States should partner with Mexico to contain carbon emissions and directly address climate change challenges. Having established relationships and plans in place will be essential in dealing with whatever is to come.

Climate Change Negotiations

In approaching climate change negotiations with Mexico, Central American, and the Caribbean states, the United States needs to bear in mind that in many cases governments in the region may lack the capacity or will to deliver on their policy promises. Moreover, with the exception of Mexico, most of the states in question are not significant greenhouse gas emitters. Belize is even a net remover of greenhouse gasses. Although the states of the region may readily sign on to a climate change agreement, their ability to affect global climate change is limited.

Mexico, along with India, China, and Brazil, feels that it represents the interests of the developing world. Mexico has the ability to take a global leadership position on climate change, more so than with its regional neighbors. It may sign a climate change agreement but likely will be unable to enforce it effectively.

CONFERENCE REPORT

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GEOPOLITICAL IMPLICATIONS

This paper does not represent US Government views.