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Cuba Confronts Climate Change

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ABSTRACT

Among environmental problems, climate change presents the greatest challenges to developing countries, especially island nations. Changes in climate and the resulting effects on human health call for examination of the interactions between environmental and social factors. Important in Cuba's case are soil conditions, food availability, disease burden, ecological changes, extreme weather events, water quality and rising sea levels, all in conjunction with a range of social, cultural, economic and demographic conditions.

KEYWORDS Climate change, health, environment, social factors, Cuba

INTRODUCTION

The 19th and 20th centuries were times of intense economic and social globalization, as well as unprecedented application of scientific knowledge. This resulted in today's proliferation and widespread use of advanced technology that permeates societies worldwide.

In recent decades human activities, particularly fossil fuel combustion, have released ever-greater volumes of greenhouse gases into earth's atmosphere, sufficient to affect global climate. Concentration of atmospheric CO₂ now exceeds 390 parts per million—almost 40% higher than preindustrial levels.[1]

Multiple scientific reports highlight the impact of climate change on natural and human systems on all continents. For example, since the 1980s, increased numbers of floods and droughts have been classified as disasters, with accompanying increases in the total area and number of persons affected as well as the magnitude of the damage caused.[2] Alterations in water systems can also be observed in many regions, with negative effects on the quantity and quality of water resources.[3]

The impact of climate change on human health is also related to people's living conditions, environmental quality and, more generally, the organization and functioning of the societies in which they live. Communities and persons who are marginalized (due to social, economic, cultural, political, institutional or any other reason) are especially vulnerable to climate change, and even to the implications of some adaptive and mitigative responses.[3]

For a small island nation such as Cuba, it is particularly important to identify as precisely as possible the most probable impacts of climate change, and thus determine scientifically-based actions to prevent or reduce their adverse consequences and formulate the necessary adaptive measures. Five decades of social transformations have laid the basis for relatively high resilience and created capacities to undertake the needed measures. Even so, the challenges ahead are great and will require consistent political will, leadership and involvement of all sectors of society to prepare adequately for the onslaught of climate change.

A GLOBAL OVERVIEW

Current evidence suggests that climate change weighs less on human health–disease processes than other major factors, and its effects are not as yet well quantified. Nonetheless, it has already been proven that global warming has contributed to increased mortality from heat and reduced mortality from cold in various regions around the world. It has also been documented that local changes in temperature and rainfall volume have altered distribution of a number of water- and vector-borne diseases.[3] In fact, WHO has been issuing advisories concerning global warming, and the consequent health risks and repercussions already observed. The organization points to examples including the aforementioned increase in disasters associated with extreme weather events, such as floods, and the short- and long-term effects of these and climate variability in general; more deaths related to heat waves; and shifting distribution of infectious diseases, or emerging diseases, related to changes in ecosystems—particularly potentially fatal vector-borne diseases such as malaria.[4]

Increased incidence of natural catastrophes will lead to higher numbers of direct victims as well as indirect victims due to psychological or somatic effects such as cardiovascular conditions, plus damages to housing, potable water and food supply. These last factors in turn will have repercussions on the health status of affected populations.

Relative increases in atmospheric CO₂ could favor growth of many plants but does not necessarily mean a greater abundance of food. Quite the contrary: climate variability will be accompanied by increased agricultural risks, greater water stress and higher peak temperatures, eventually damaging crops. Increased malnutrition and accompanying diseases can be expected if agricultural practices fail to adapt to higher temperatures and shifting patterns of humidity and precipitation. To this scenario should be added obvious adverse effects of violent conflicts likely to arise over basic natural resources such as water, as well as emerging mental health problems associated with these conflicts and other situations of environmental stress.

As a result of steadily rising temperatures, significant increases are expected in the annual number of days with humidex >37.77 °C (humidex: an indicator combining temperature with relative humidity to estimate perceived ambient temperature).[1] particularly dangerous for health of older populations, as has already been observed.

Disruption of the natural balance in many ecosystems by multiple factors will promote vector proliferation, and this will be compounded by increased human migration and resulting gaps in epidemiological control. Respiratory problems and allergies are also predicted to rise as a result of increased urban pollution. The latter serves as a reminder that as the world confronts climate change, it is important to deploy adaptive strategies that promote clean, pollution-free environments:[5] WHO estimates that 25% of all diseases have their roots in environmental factors.[6]

Consideration of social conditions is vital in confronting climate change, since these are associated with virtually all health and dis-

ease processes—from the classic examples of infectious diseases to the more complex and multifactorial chronic non-communicable diseases. Such social determinants were described by WHO's Commission on Social Determinants of Health as “the circumstances in which people grow, live, work, and age, [...] in turn, shaped by political, social, and economic forces.” The report also stressed the importance of bringing together the health equity and climate change agendas.[5] This is particularly relevant, given that a number of studies have concluded that environmental injustice, poverty and lack of individual empowerment are key factors in increasing people's vulnerability, especially that of women and children.[6] Thus, any strategic assessment of the health effects of climate change must also address health's social determinants, as well as the possibilities of actively influencing them, to obtain and sustain the best possible population health indicators. In general, climate change makes actions on social determinants of health more urgent, especially to protect vulnerable populations and communities.[6]

The UK's chief scientist, John Beddington, alerted the world to an alarming global “perfect storm” of problems by 2030, by which time he predicted demand for food will grow by 50%, water 30% and energy 50%.[7] Each of these problems will be compounded by the impact of climate change.

Analysis of all these factors and their interrelation points to essential principles for action on the social determinants of health while confronting challenges presented by climate change: adoption of values incorporating social justice, sustainability and health equity; political commitment at the highest levels of government; development of working intersectoral partnerships; empowerment of individuals and families; community participation; and continuous monitoring of progress.[8] In this complex context, health must be accorded its full value—its outcomes and the ways it is achieved recognized as indicators of society's wellbeing. Health inequities cannot be resolved without concerted political, economic and social effort on all fronts.

While the well-known maxim *think globally, act locally* does not absolve developed countries of their responsibility for creating global-scale problems or their moral obligation to help solve them, it does point to the need to analyze the particular conditions of each geographic area. The global challenges to health inherent in the environmental predicament are manifest in specific issues, requiring national and local approaches and solutions. This is also true for Cuba, where geographic, demographic and social features combine to create a unique scenario.

THE CASE OF CUBA

Cuba has certain social policies and achievements, as well as coordinated scientific research capacities, which place it on a better footing than some developing countries when it comes to facing the health and related challenges presented by climate change.

The 2014 UNDP Human Development Report ranks Cuba as a high human-development country, its human development index 44th, one of the highest in Latin America and the Caribbean.[9] In 2013, Cuba had one physician for every 137 inhabitants; its infant mortality rate was 4.2 per 1000 live births and its under-five mortality rate 5.7 per 1000 live births.[9] The Constitution and Public Health Law have provided the basis for a single, government-run public health system that provides services that are universal, accessible and free of charge. Education is also public and free, in line with policies that explicitly aim to improve social as well as economic development,

eliminate inequities and defend equal rights for all citizens to basic food, health, education and adequate income.[10]

The public health system aims to promote healthy living, prevent and treat diseases, and provide rehabilitation. Health-related social policy aims to reduce inequities and ensure universal access to all health programs, with particular attention to the needs of population groups identified as vulnerable. Between 1959 and 2009 life expectancy rose by 15 years[11] and has continued to rise, reaching 79.3 years in 2013.[9] Chronic non-communicable diseases are responsible for 84% of deaths, while 8% are due to infectious diseases, maternal causes, perinatal complications and nutritional conditions.[10]

In 2006–2010, total health spending rose from 7.7% to 11.9% of GDP.[10] A substantial portion of annual public spending is also allocated to environmental protection, rising from 390.8 million pesos in 2009 to 517.3 million pesos in 2013. Of this, 230.4 million pesos were allocated to water management, 44% of the total environmental budget.[12]

In recent periods, the country has already had to address important environmental and climatic problems. For example, extreme weather events have become a primary concern. In 2008, successive lashings by four hurricanes (Fay, Gustav, Ike and Paloma) damaged 647,111 dwellings, 84,737 of which were completely destroyed. Economic losses were estimated at 9.76 billion pesos.[13] The country has also suffered extreme drought, with effects on croplands and availability of water, as well as increased danger from fires. In 2013, 388 forest fires were reported, destroying a total of 4279 hectares of forest. It is noteworthy that loss of human life from these extreme events has been low, in part due to effective warning and protection systems adopted by Civil Defense, informed by scientists at various centers, including the National Meteorology Institute.

As we move forward, integrated research projects from dozens of scientific centers become even more essential to protecting lives and developing coherent strategies to improve the environment and address adverse effects of climate change in general. A 2009 study identified important environmental factors already suffering in Cuba:

- erosion, impoverishment, compaction, salinization, contamination and changes in use of soils
- diminished quality and quantity of inland surface and groundwater and quality of marine and coastal waters
- changes in biological diversity, fragmentation or loss of habitats/ecosystems
- increased air acidity, particulate quantity and N₂O and SO₂ concentrations.[14]

Cuba is also not exempt from the rising global trend in acute diarrheal and respiratory infections, as well as variations in their seasonal and interseasonal patterns, which in our case corresponds to climate variations also associated with increases and differing patterns observed in foci of *Aedes aegypti* mosquitoes that transmit dengue.[15]

CUBAN PROSPECTS AND PROPOSALS FOR CONFRONTING CLIMATE CHANGE

Environmental problems arising from climate change are urgent and call for immediate action; they present a major challenge for developing countries, especially island nations such as Cuba,

CUBA: FACT SHEET ON ENVIRONMENT, CLIMATE CHANGE AND HEALTH

Geographic features: 110,922 km² archipelago, includes

- Island of Cuba
- Isle of Youth
- >1600 islands, islets and keys

Island of Cuba: length 1250 km, width 31–191 km, northern coast 3209 km, southern coast 2537 km; located between 19°49'36" and 23°17'09" north latitude and between 74°07'52" and 84°54'57" west longitude, just south of Tropic of Cancer

Climate

Tropical, climate variability tempered by Gulf Stream

Two seasons: rainy season (May–October) and dry (November–April)

Annual average temperature: 24 °C–26 °C

1951–2008: +0.9 °C; in dry season;

+2.0 °C (December–February quarter: +2.4 °C);

quarter June–August: +0.8 °C

Minimum temperature: +1.9 °C; December–February quarter: +2.6 °C

Maximum temperature: +0 °C; but higher percentage of days with maximum temperature ≥30 °C

Annual average rainfall

- 1931–1960: 1375 mm
- 1961–2007: 1335 mm (western region 1437 mm; central 1308 mm; eastern region 1279 mm)

Renewable energy sources (2008): 19.9% of total primary energy production in country

Coastal zones and marine resources

- Rise in average sea level 1966–2009: 1.43 mm/year
- Estimated rise by 2028: 23 mm
- Estimated rise by 2043: 34 mm
- Beaches: coastline receding: 1.2 m/year
- Coral reefs: 8% healthy; 23% deteriorated; 69% extremely deteriorated; % of bottom covered with coral declining 1.6% annually

Extreme weather events with greatest disaster risk

- **Hurricanes:** 0–4 per year, average one every two years
Increasing hurricane activity since 1996
Nine hurricanes in 2001–2008, seven of which were intense (grade 4–5, Saffir–Simpson scale)
- **Droughts:** frequency of years with moderate and severe droughts doubled during 1961–1990 compared with 1931–1960
 - Periods with significant drought: 1960–1963, 1967–1969, 1974–1976, 1983–1986, 1993, 1994, 1998, 2000, May 2003–May 2005 (particularly intense in eastern provinces), 2008
- **Coastal flooding:** increased over last three decades

Major environmental challenges

- **Soil degradation:** 65% of soils with less <50% of potential yield because of erosion (2.5 million hectares); high degree of acidity (3.4 million hectares); high salinity and sodicity (1 million hectares); compaction (2.5 million hectares); drainage problems (2.7 million hectares)
- **Effects of forest cover:** (despite rise in forest index from 14.1% in 1959 to 25.7% in 2008) Problems: irrational use for many

years; seed source; lack of and deficiencies in management plans

- **Pollution of water, land and air:** consequence of industrial facilities concentrated in urban zones; lack of financial resources for treatment, use and reuse of residuals; increase in soluble salt levels in groundwater; infrequent sampling and determination of heavy metals and organic compounds in inland waters; inadequate monitoring of emissions into atmosphere, soil quality
- **Loss of biological diversity:** transformation, fragmentation or destruction of habitat due to deforestation, inadequate fishing, farming and soil preparation practices; degradation and pollution of soil, water and air; introduction of invasive foreign species; insufficient regulation and control mechanisms to prevent and sanction illegal activities; climate change itself
- **Water shortages:** water reserves 32,463 hm³ (down 15% compared with 1931–1972)
 - estimated 2050: 27,446 hm³
 - estimated 2100: 14,332 hm³

Climate-sensitive diseases in Cuba

- Severe respiratory infections: change in bimodal and trimodal seasonal distribution and tendency to increase in March, June–August and October–November
- Acute diarrheal diseases: change in seasonal pattern, displacement of seasonal epidemic peak
- Viral hepatitis: more frequent epidemics and shift in seasonal pattern
- Chicken pox: displacement of high season and rising trend
- Dengue (number of foci of *A. aegypti*): upward trend; risk of dengue transmission, with two-year cycles
- Viral meningitis
- Pneumococcal meningitis: increase in number of cases and shifts in geographic distribution estimated for 2015–2020
- Bacterial meningitis: increased number of cases estimated for 2015–2020
- Malaria: estimated for 2015–2020: predicted re-emergence of disease and increased risk

Examples of measures taken

- Environmental protection spending (% of total public spending): increase from 41.9 million pesos (1.8%) in 1998 to 335.6 million pesos (6.4%) in 2008
- Mandatory CITMA environmental license for approval of any investment
- Investments to supply water: from 1998 to 2008, access to running water rose from 7,987,012 to 8,142,300 inhabitants; sewage service from 3,999,600 to 4,119,500
- Progressive depopulation of extremely fragile areas and resettlement of inhabitants; no new construction of residential housing, factories or hotels in low-lying zones
- Comprehensive coastal management programs to preserve vulnerable coastal ecosystems
- Development of aquaculture to reduce pressure on reef ecosystems from fishing activities
- Reforestation of mangrove areas; promotion of reforestation with native species in coastal zones
- Increased environmental education
- Road and other construction perpendicular to coastline to avoid interruption of water flow
- Protection of natural elements of coastal areas such as mangrove forests, beaches and coral reefs

Source: Planos, *Impacto del Cambio Climático y Medidas de Adaptación en Cuba* [15]

CITMA: Ministry of Science, Technology and the Environment


which approaches the issues of climate change mitigation and adaptation from the perspective of an archipelago. A collaborative study involving more than 130 Cuban experts in different disciplines and from different scientific centers has resulted in a seminal report that contends that climate variability, changes in climate, and effects on human health can only be understood by examining interactions among various environmental components, which in turn affect epidemiological patterns. It offers evidence-based prediction of medium- and long-term climate change impact in Cuba and recommendations for adaptive measures.[15] As a result, several scenarios have been created for specific time horizons and combinations of principal factors considered (including, for example, estimated sea level in 2050 and in 2100 and its likely impact on coastal areas, especially heavily populated ones).

The research contained in this report is the basis for the most recent edition of the National Climate Change Program. Several years ago the program was approved at the highest level of government and has been systematically reviewed and updated since then, based on results noted and changing conditions. The main national-level impacts expected and corresponding adaptive measures are identified. Priority factors include land degradation, access to potable drinking water and varying effects on biodiversity, as well as environmental pollution from mining and industrial activity in some regions. In addition, data from multiple studies have been evaluated and integrated to estimate municipal-level danger, vulnerability and risk related to phenomena such as strong winds, intense rain, and inland incursion of seawater.

The recent research also reveals that climate variations are associated with ecological and socio-economic changes that promote

epidemiological shifts affecting the health system, its planning for prevention and services, and which can result in different patterns of vulnerability than those observed thus far.[16] Evidence also indicates there may be an increase in incidence of water- and food-borne diseases (acute diarrheal, viral hepatitis); as well as acute respiratory diseases, meningitis, and vector-borne diseases (dengue, malaria and others), as a result of changing vector populations, with the associated threat of outbreaks and epidemics.[15]

We must confront the effects of climate change at the same time as we must predict and take maximum preventive measures to minimize the danger of air, soil, and water pollution invariably linked to the country's expanding industrial and production capacities. Maintaining Cuba's hitherto favorable health indicators will demand concerted and consistent management of such environmental impacts of economic growth, growth in turn needed to sustain and extend advances in health and education—essential components of wellbeing and comprehensive human development. Many adaptive measures recommended for Cuba have already been implemented or are about to be launched, although they may require adjustments, synchronization or more detailed projections (see box).[16] The evidence base must be continually updated and our scientific and technological capacity augmented in order to systematically add to it—and, when necessary, to introduce new environmentally sound approaches into production facilities being built or developed.

Finally, our ultimate success in protecting our people and environment in the face of climate change will depend on the vital role the public is called upon to play, contributing actively to the urgent preventive and corrective measures needed to address these challenges. 

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