

**Small Island Developing States:  
Climate and Health Effects**

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**Abstract**

There is a great need to protect public health in Small Island Developing States (SIDS) from the adverse consequences of climate change. SIDS are especially vulnerable to climate change. A major threat is sea level rise. Coastal flooding caused by Hurricane Lenny in the Caribbean in 1999 illustrates the vulnerability of SIDS to sea level rise, which amplifies the effects of storms. Another important threat is changes in rainfall regimes. The serious consequences of a drought in Pacific island countries during the El Niño event of 1997-1998 demonstrate additional vulnerabilities of SIDS.

SIDS also feel the impact of climate changes in other regions of the world. The Caribbean region provides two examples of regional interactions. Low rainfall in West Africa has led to elevated levels of African dust in the Caribbean. Heavy rainfall and river flows in northern South America in 1999 adversely affected the Caribbean marine environment, aiding the spread of a disease that killed many reef fish.

The World Health Organization (WHO), the World Meteorological Organization (WMO), and the United Nations Environment Programme (UNEP) have formed the Inter-Agency Network on Climate and Human Health to address the effect of climate on human health. This Network is sponsoring a series of regional workshops on climate and health in small island countries. The workshop for Pacific island countries was held in Samoa in 2000. The workshop for the Caribbean was held in Barbados in 2002. The Caribbean event also included a conference. The next workshop in the series will be held in the Maldives for island countries in the Indian Ocean region.

**Keywords:** climate change; public health; small island developing state; sea level rise

## 1. The Vulnerability of SIDS to Climate Change

*“Perhaps when the human health costs are appreciated and added to the material costs and damages faced by small island States a new spirit of cooperation and partnership will emerge.” [1]*

*His Excellency Tuiloma Neroni Slade  
Ambassador of Samoa to the United Nations  
Chairman, Alliance of Small Island States  
Barbados, May 21, 2002*

His Excellency Tuiloma Neroni Slade described the vulnerability of SIDS at the WHO conference on *Climate Variability and Change and their Health Effects in the Caribbean* that was held in Barbados in 2002 [1]. He represents the Alliance of Small Island States (AOSIS), which is a coalition of small island and low-lying coastal countries from many regions: Africa, Caribbean, Indian Ocean, Mediterranean, Pacific, and South China Sea [2]. Members of AOSIS share concerns about environment and development, especially their vulnerability to the adverse effects of global climate change.

According to the Intergovernmental Panel on Climate Change (IPCC), sea level rise and changes in rainfall regimes are two of the principal effects of climate change that are most significant for SIDS [3]. These are particularly relevant for issues of public health and are the focus of this presentation.

Why are SIDS so highly vulnerable to the adverse effects of global climate change? Their vulnerability is caused by several geographic, social, and economic factors [3]:

- small physical size;
- being surrounded by large expanses of ocean;
- relative isolation;
- limited natural resources;
- growing population;
- exposure to damaging natural disasters;
- low economic diversification;
- limited funds, human resources, and skills.

## 2. Sea Level Rise

The IPCC projects that sea level will rise by as much as 5 millimeters per year over the next 100 years as a result of global warming induced by greenhouse gas emissions, although regional variation is expected [3]. For SIDS, the major consequences of projected sea level rise are [1]:

- displacement of coastal communities;
- disturbance of agricultural activity;
- coastal erosion, beach loss, and decline in tourism;
- intrusion of sea water into freshwater aquifers.

Long-term rise in sea level interacts with climate and weather phenomena operating on shorter time scales. Storm events can create adverse outcomes, such as storm surges and coastal flooding. Storms already cause severe damage. A higher sea level increases the vulnerability of SIDS to adverse consequences of storms.

The Caribbean island of Dominica provides an example of serious coastal flooding that occurred in November 1999 and generated a response from the Pan American Health Organization (PAHO)'s Program on Emergency Preparedness and Disaster Relief [4]. This flooding was caused by Hurricane Lenny, which affected much of the Eastern Caribbean [5]. The potentially greater impacts of hurricanes and typhoons in the future are cause for concern.

### **3. Changes in Rainfall Regimes**

According to the IPCC, climate models indicate that droughts and floods will occur more frequently in countries and territories of tropical ocean regions by the latter half of the 21st century [3]. Water resources and food are already critical concerns in SIDS. Many island countries are prone to drought and have limited water storage capacity, relying on rainwater in small catchments or freshwater lenses [3].

Limited freshwater resources on SIDS provide a lesson, in microcosm, for the stewardship of freshwater resources in all countries. The management of freshwater resources is generating more interest as a global issue. The United Nations has launched the International Year of Freshwater 2003 [6] and has produced a report on the state of the world's freshwater resources [7]. The strong link between water resources and health is an essential component of a global perspective on ecosystem change and public health [8].

The effects of rainfall regimes on shorter time scales are important in their own right and provide an indication of the impact of long-term climate change. Better

management of the consequences of rainfall regimes on shorter time scales can help with adaptation to long-term climate change.

Many studies of climate and health focus on the El Niño-Southern Oscillation (ENSO), which is a series of oceanic and atmospheric changes affecting global weather that tends to cycle every two to seven years [9]. The El Niño phase of the ENSO cycle (the warm phase) is associated with a warming of the central and eastern equatorial Pacific Ocean. The El Niño phase is the best understood part of the ENSO cycle, showing consistent associations with unusual patterns of rainfall (wet or dry) and temperature (warm or cool) in some parts of the world.

The drought caused by El Niño in western Pacific islands in 1997-1998 demonstrates the importance of shifts in rainfall regimes for public health in SIDS. Some of the problems caused by the drought were [10]:

- increased incidence of skin disease in the Federated States of Micronesia and the Marshall Islands;
- local air quality problems from wildfires on Guam, Pohnpei, Yap, and Palau;
- agricultural losses that led to food relief shipments in Pohnpei, Chuuk, and Yap.

Forecasting of the El Niño-induced drought led to some advance preparation that mitigated some of the difficulties [10]. A public information campaign in the region encouraged people to boil water, emphasizing the increased risk of acquiring water-borne illness from diminishing supplies of surface water. The incidence of diarrhea among children at the Pohnpei state hospital actually declined. There was also a concerted effort to conserve water and to improve water storage facilities in the region.

Preliminary work has begun on systematically comparing climate and health effects in the islands of the Pacific and the Caribbean [1]. Many kinds of diseases in these regions are sensitive to climate (e.g., mosquito-borne dengue fever, water- and food-borne diarrheal disease, and ciguatera fish poisoning).

#### **4. Regional Interactions**

SIDS may feel the impact of climate changes in other regions of the world. The Caribbean region provides two examples of regional interactions.

Satellites can detect massive transport of African dust across the Atlantic to the Caribbean, which is associated with drought conditions in West Africa [1, 11]. Bacteria, fungi, and spores have been found in this dust. Investigators are studying linkages with

human illnesses, such as asthma, and other impacts on coral ecosystems, agriculture, and livestock.

Heavy rainfall and river flows in northern South America in 1999 adversely affected the Caribbean marine environment and contributed to a major fish kill [1, 12]. Reef fish from Trinidad and Tobago to Barbados died at unusually high rates during the period from July to October of 1999. The freshwater bacterium *Streptococcus iniae* was isolated from dead and dying fish. During that period, heavy rainfall in northern South America caused large quantities of fresh water from the Amazon and Orinoco river basins to be swept into the southeastern portion of the Caribbean Sea, generating low salinities, higher temperatures, and reverse currents that facilitated the spread of disease.

## 5. The Public Health Response

*“Ministries of Health should play a central role in this response -- but should also remember that finding enduring solutions will depend on inter-sectoral communication and convergence.” [1]*

*Professor Tony McMichael  
Director, National Centre of Epidemiology  
and Population Health  
Australian National University  
Barbados, May 21, 2002*

Professor Tony McMichael of Australian National University emphasized the importance of inter-sectoral cooperation in addressing climate-related health problems at the WHO conference on *Climate Variability and Change and their Health Effects in the Caribbean* that was held in Barbados in 2002 [1]. The fundamental need to collaborate across sectors led WHO to join with WMO and UNEP to form the Inter-Agency Network on Climate and Human Health to address the effect of climate on human health [13].

This Network is sponsoring a series of regional workshops on climate and health in small island countries. The workshop for Pacific island countries was held in Samoa in 2000. The workshop for the Caribbean was held in Barbados in 2002. The Caribbean

meeting included a conference as well. The next workshop in the series will be held in the Maldives for island countries in the Indian Ocean region.

Regional offices of WHO, WMO, and UNEP have been critical for planning and support. In Samoa, the WHO Regional Office for the Western Pacific and the WMO Subregional Office for the South Pacific were instrumental. In Barbados, PAHO headquarters and its Office for Caribbean Program Coordination played a central role. UNEP's Regional Office for Latin America and the Caribbean made arrangements to involve departments of the environment in the region. The planning for the Maldives workshop depends on the WHO Regional Office for South-East Asia.

The Barbados meeting demonstrates the diverse partners that the public health sector must work with. What follows is a list of the principal partners.

- Barbados Government Ministries
  - Ministry of Health
  - Ministry of Physical Development and Environment
- Regional Caribbean Organizations
  - Project on Caribbean Planning for Adaptation to Global Climate Change
  - Caribbean Environmental Health Institute
  - Caribbean Epidemiology Centre
  - Caribbean Institute of Meteorology and Hydrology
- U.S. Donor Agencies
  - Environmental Protection Agency
  - National Oceanic and Atmospheric Administration
  - National Aeronautics and Space Administration
- Canadian Donor Agencies
  - Health Canada
  - Environment Canada

What are the next steps? The final report of the Barbados meeting is just appearing [1]. As noted above, a workshop is in planning for the Indian Ocean region. Previous workshop participants have made recommendations about follow-on activities for enhancing awareness, using data, and strengthening institutions. WHO, WMO, and UNEP will continue to coordinate sharing of information and networking of regional organizations. Another initiative is the preparation of guidelines for vulnerability and

adaptation assessments of health impacts of climate change. Future developments will be posted on the WHO website for climate and health [13].

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