# 19 Small Island States – Canaries in the Coal Mine of Climate Change and Health

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> Islands are the barometers of international environmental policies. The entire world will first witness their success or their failure on our islands.
>
> James Michel's, the President of Seychelles, address to the Rio+20 Conference (D'Offay, 2012)

## 19.1 Introduction

Climate change will bring mixed fortunes to Earth's inhabitants. The inherent interconnectedness of Earth's ecosystems, and their dependence on a stable climate, means that anthropogenic perturbations in the climate system will inevitably disturb the ecosystem services which underpin all human existence. The rate of change in the global climate, and the difficulty in predicting with precision its future effects, thus pose a hazard to our global community's capacity to work and rest, feed and flourish. If some regions do benefit from climate change, such benefits may be comparatively limited in terms of area and population involved. At the other extreme are regions and populations that will experience, precipitously and substantively, the *negative* effects of the numerous manifestations of a warming world.

As they herald the unfolding future for the rest of the planet, highly climate-sensitive regions such as small island developing states (SIDS)[1] are, in effect, the 'canaries in the climate change coal mine'. In this chapter, we detail the drivers of the vulnerability[2] of SIDS to the impacts of climate change and outline some of the key health risks and adaptive options these nations face. Examples and case studies cited will be taken predominantly from Pacific island nations, although their plight will be shared more broadly across developing island nations of the Caribbean and Indian Ocean regions.

## 19.2 Characteristics of Small Island Developing States

SIDS have been variously classified and clustered according to their geographic, political and/or historical characteristics. As an example of the latter, the Indian Ocean Commission (IOC) voices the concerns of its (French-speaking) member states, namely: Comoros, Reunion (France), Madagascar, Mauritius and the Seychelles. The roughly equivalent regional organizations for island countries and territories in the South Pacific and Caribbean are, respectively, the Pacific Islands Forum and the Caribbean Commission (CARICOM). Other, non-regional groupings include the Association of Small Island States (AOSIS) – a relatively

 

influential non-aligned group within the UN – and a conglomeration of Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS) countries.

A list of SIDS, as defined by the UN Office of the High Representative for the Least Developed Countries, Landlocked Countries and Small Island Developing States (UN-OHRLLS), is provided in Table 19.1, along with a number of their key characteristics, which are discussed in more detail below.

## Geography of SIDS

Many SIDS are burdened by extreme isolation, whether due to distance or in combination with the vagaries of travel (e.g. weekly flights from New Zealand to Niue; monthly boats from Samoa to Tokelau); these factors are often compounded by their small size. The tiny Pacific island nations of Tuvalu and Nauru compete for the title of the world's smallest independent countries, with populations of approximately 10,000 each and land areas of less than 27 $km^2$.

The small size of SIDS limits vital natural resources, notably fresh water, food and land for agriculture and settlement. Particularly relevant in the context of climate change, relocation options – either internal or external – are often limited or non-existent. Many SIDS are partly, or entirely, low lying. Kiribati, the Marshall Islands, Tuvalu and the Maldives are exclusively atoll countries,[3] with an average elevation above sea level of only a few metres. Resource scarcity also limits population; many inhabitants live outside SIDS; their remittances are vital to their communities who remain behind.

To ensure access to vital life-sustaining resources, human settlements throughout history have tended to develop close to the sea and fresh water, while agriculture developed on fertile valleys and coastal lands. Urbanization, infrastructure and productive activities are therefore commonly located close to coastal and riverine areas that, while critical for food production, are disaster prone (Kreimer, 2001). This phenomenon is typical for SIDS – in the Caribbean, for example, more than half of the population live within 1.5 km of the coast (Mimura *et al.*, 2007).

## Population and demography of SIDS

Population size and trends constitute another vulnerability of SIDS, whether by nature of being precariously small, too large (relative to the land available) or growing too rapidly.

As can be seen from Table 19.1, most SIDS have small populations; the age structure of many are also skewed toward the young. Such demographic profiles, which usually correspond with high fertility rates, pose challenges with respect to the provision of sufficient infrastructure for education, employment, sanitation and health services (Ware, 2005).

Urbanization compounds these population pressures. In 1950, only 8.5% of Pacific islanders lived in urban centres. Mirroring global trends, by 2011 that proportion had risen to almost a quarter. Although total population numbers in SIDS remain small, some urban areas in the Pacific (e.g. Tarawa in Kiribati and Majuro in the Marshall Islands) have population densities in excess of 7000 people/$km^2$ (Pacific Islands Forum Secretariat, 2012). Approximately one-third of households have nine or more inhabitants (SPC Demographic and Health Surveys for Kiribati and RMI, 2007, 2009).

## Economies of SIDS

As Table 19.1 shows, SIDS are generally poor, ranking low on human development indices. Typically, SIDS economies depend on few – often single – industries, such as fishing, agriculture or tourism. This economic fragility exposes SIDS to the impact of global market perturbations, conflict and natural disasters. A single, relatively localized event can devastate a small island state economy for years, as occurred in Niue following Cyclone Heta (when the country was transformed from a net food exporter to being dependent on food imports for 2 years) (Food Secure Pacific Working Group, 2008).

Low levels of monetary wealth also manifest as relative powerlessness among trading partners and in diplomatic negotiations. SIDS are dependent on foreign aid – the largesse, often programme specific and donor driven – of more powerful nations (WHO, 2011). Foreign aid is rarely without obligations, such as to accept

**Table 19.1.** Selected characteristics of small islands states. (Data: UN-OHRLLS, unless otherwise stated, www.unohrlls.org.)

| SIDS[a] | Geography | | Demography | | | Economy | | |
|---|---|---|---|---|---|---|---|---|
| Country | Land area (thousand km$^2$) | Max elevation (m)[b] | Population[c] (thousands) | Per cent of population <15[d] | Life expectancy[c] | Per cap GDP (PPP)[c] (thousands) | HDI (2011) [of 187] | Main industries[e] (per cent of GDP) |
| Antigua and Barbuda | 0.4 | 402 | 90 (2012) | 25.2 | 72.6 | 22 | 60 | T 60% |
| Bahamas | 14 | 63 | 347 | 24 | 74.5 (2010) | 31 | 53 | T 60% |
| Bahrain | 0.7 | 122 | 1248 (2012) | 20.2 | 75.1 | 27 | 42 | P 11% |
| Barbados | 0.4 | 336 | 238 | 18.8 | 76.8 | 24 | 47 | S 80% |
| Belize[g] | 23 | 1124 | 328 | 36.3 | 76 | 8.3 | 93 | T |
| Cape Verde | 4 | 2829 | 501 | 31.9 | 74.2 | 4 | 133 | S |
| Comoros | 2.2 | 2360 | 754 | 42.2 | 61.1 | 1.2 | 162 | A 40% |
| Cuba | 111 | 1974 | 11,254 | 17 | 79.1 | 9.9 | 51 | S |
| Dominica | 0.8 | 1447 | 68 | 22.6 | 77.5 | 13.6 | 81 | A, T |
| Dominican Republic | 48 | 3098 | 10,056 | 29 | 73.4 | 9.3 | 98 | S, A |
| Fiji | 18 | 1324 | 868 | 28.6 | 69.2 | 4.6 | 100 | T, A |
| Grenada | 0.3 | 840 | 105 | 25 | 76 | 13 | 67 | T |
| Guinea-Bissau[g] | 36 | 300 | 1547 | 40.2 | ? | 1.1 | 176 | A |
| Guyana[g] | 215 | 2750 | 756 (2010) | 31.1 | 69.9 | 7.5 | 117 | A, M |
| Haiti | 28 | 2680 | 10,124 | 35.3 | 62.1 | 1.2 | 158 | R, A |
| Jamaica | 11 | 2256 | 2751 | 29.5 | 73.1 | 9 | 79 | S, T |
| Kiribati | 0.8 | 3 (x), 81 (y) | 101 | 33.1 | 68.1 | 6.2 | 122 | Copra, F, R |
| Maldives | 0.3 | 2 | 320 | 21.1 | 76.8 | 8.4 | 109 | T 30% |
| Marshall Islands | 0.2 | 10 | 64 | 37.8 | 72 | 2.5 (2008) | ## | Aid (USA) |
| Federated States of Micronesia | 0.7 | 791 | 112 | 33 | 69 | 2.2 | 116 | A, F |
| Mauritius | 2 | 828 | 1307 | 21.6 | 73.4 | 15 | 77 | A, T, S |
| Nauru | 0.02 | 71 | 10 | 32.7 | 79.9[f] | 5 (2005) | ## | Phosphate |
| Palau | 0.5 | 242 | 21 | 21 | 71.8 | 10 (2009) | 49 | T A, F |
| Papua New Guinea | 463 | 4509 | 7014 | 35.9 | 62.8 | 2.5 | 153 | A, M, P |
| Samoa | 2.9 | 1857 | 184 | 34.7 | 72.2 | 6 | 99 | R, T, A, F |
| Sao Tome and Principe | 1 | 2024 | 168 | 44.4 | 64.7 | 2 | 144 | A (cocoa) |

*Continued*

**Table 19.1.** Continued.

| SIDS[a] | Geography | | Demography | | | Economy | | |
|---|---|---|---|---|---|---|---|---|
| Country | Land area (thousand km$^2$) | Max elevation (m)[b] | Population[c] (thousands) | Per cent of population <15[d] | Life expectancy[c] | Per cap GDP (PPP)[c] (thousands) | HDI (2011) [of 187] | Main industries[e] (per cent of GDP) |
| Singapore[h] | 0.69 | 164 | 5188 | 14 | 81.1 | 60 | 26 | Diverse |
| St Kitts and Nevis | 0.26 | 1156 | 53 | 22.3 | 73.1 | 16 | 72 | T |
| St Lucia | 0.62 | 950 | 176 | 22.2 | 74.6 | 13 | 82 | T |
| St Vincent and Grenadines | 0.39 | 1234 | 109 | 24 | 72.3 | 12 | 85 | A, T |
| Seychelles | 0.46 | 905 | 87 | 21.4 | 73.6 | 25 | 52 | T |
| Solomon Islands | 28 | 2335 | 552 | 37.3 | 67.9 | 3.3 | 142 | A, F, forestry |
| Suriname[g] | 163 | 1230 | 529 | 27.5 | 70.6 | 9.5 | 104 | M |
| Timor-Leste | 15 | 2963 | 1153 | 33.5 | 62.5 | 3.1 | 147 | A, P (recent) |
| Tonga | 0.75 | 1033 | 105 | 36.7 | 72.3 | 7.5 | 90 | A, F |
| Trinidad and Tobago | 5 | 940 | 1346 | 19.5 | 70.1 | 20 | 62 | P |
| Tuvalu | 0.03 | 5 | 10 | 30.2 | 67.2 | 3.4 (2010) | Not ranked | R, trusts, A |
| Vanuatu | 12 | 1877 | 246 | 29.1 | 71 | 2.7 (2009) | 125 | A, F, T |

[a]Only full members of the UN are listed, with the exception of Niue, a full UN member but not a SIDS according to UN-OHRLLS.
[b]Wikipedia.
[c]2011 estimate unless otherwise stated.
[d]Source: CIA World Factbook 2012.
[e]*c.*12% of SIDS GDP is foreign direct investment and development assistance; notable exceptions include Marshall Islands and Kiribati (The Little Data Book on Climate Change 2011; World Bank, 2012).
[f]Some figures provided by UN-OHRLLS differ from national census data.
[g]Majority of land area part of a continent, i.e. not technically an 'island state' in geographic terms.
[h]Singapore is the obvious outlier, raising the question of why it is still classified as a SID. A = agriculture; F = fishing; HDI = Human Development Index; M = mining; P = petroleum; PPP = purchasing power parity; R = remittances; S = services; T = tourism; x = South Tarawa; y = Banaba; ## = no data.

unfair trade treaties or to support the position of 'patron' countries in international fora. After decades of aid, most SIDS remain highly dependent on it. Arguably, pre-existing international inequalities have deepened, highlighting the importance and potential 'combined clout' of the regional alliances mentioned above.

## 19.3 Health Status of SIDS

The majority of SIDS are poor, tropical countries and suffer from both 'old world' infectious diseases, such as malaria, tuberculosis, pneumonia and diarrhoea, and more modern epidemics, such as Human Immunodeficiency Virus (HIV). Like other developing countries, many SIDS are also experiencing the 'epidemiological transition', whereby non-communicable diseases (NCDs) (e.g. diabetes, circulatory diseases and cancer) are overtaking infectious diseases as leading causes of illness and death.

NCDs now account for 75% of all deaths in the Pacific region (Asian Development Bank, 2011). This burden is particularly problematic for SIDS, killing at a younger age in low- and middle-income countries, with 29% of NCD deaths occurring under the age of 60, compared to 13% in high-income countries (WHO, 2011). NCDs thus act to impede economic growth and prosperity, compounding the effects of disasters and young demographic structures.

In the Pacific, this burden is expected to become even greater, due in part to the outmigration of skilled people, including those who could provide desperately needed health care, both preventive and curative (Pacific Islands Health Officers Association, 2010).

The health status of impoverished people is substantially determined by nutrition, which is often limited in range and quality (Hanna, 2013). Global food prices have remained high since 2008. Some agricultural crops in SIDS are already showing signs of stress under current climatic conditions, such as in Vanuatu (Reti, 2007). Decreasing island food yields worsens food stress imposed by rising import prices, and the greatest toll is borne by the poorest households, due to their relatively high expenditure on food (Food Secure Pacific Working Group, 2008). Urbanization potentially exacerbates food insecurity, as urban dwellers can rarely supplement food supplies by subsistence farming or fishing, as rural poor often can (Miskelly *et al.*, 2011).

Poor, hungry people have little capacity to absorb price spikes and variable availability, which drives shifts towards cheaper, nutrient-poor alternatives such as noodles, mutton flaps and turkey tails – all common fare in the Pacific (von Grebmer *et al.*, 2011). Nutritional risks arise as fresh foods are, in general, the most nutrient rich. An estimated 27% of the population in the Pacific island region is undernourished, contributing to high maternal mortality (Asian Development Bank, 2011), intensifying an intergenerational health deficit which includes developmental delay, cognitive impairment and decreased economic productivity (Hanna, 2013). According to the 'thrifty phenotype hypothesis'[4] (Hales and Barker, 2001), undernutrition during pregnancy predisposes to altered metabolic conditions in later life (Eberle and Ament, 2012). Risks incurred include harmful serum lipid profiles, high glucose concentrations and elevated blood pressure, which impart adverse lifelong health consequences (Victora *et al.*, 2008).

On the other hand, many small island states have an extraordinary dependence on fish for food security and animal protein, particularly in rural areas (Bell *et al.*, 2011). Acidification and ocean warming, in combination with overfishing, are stressors on marine life that threaten biogeochemical cycles and the goods and services the ocean ecosystems provide (Plymouth Marine Laboratory, 2012).

## 19.4 SIDS and Natural Disasters

Analysis of natural hazards and vulnerability research, patterned with development, social and political factors, generates the World Risk Index, which indicates the probability that a country or region will be affected by a disaster (Alliance Development Networks, 2012). On a per capita basis, Oceania has the highest incidence of 'environmental disasters' (Mahany and Keim, 2012). Their disproportionately high vulnerability relates not only to event frequency and severity but also to national coping capacity.

**Box 19.1**

The vulnerability of SIDS to natural disasters is not limited to hydrometeorological phenomena such as tropical storms, droughts and floods; many also endure geophysical disasters such as earthquakes, volcanic eruptions, tsunamis and landslides. The harm of these events slows, and may even reverse, progress toward the Millennium Development Goals (MDGs) (Hanna, 2013).

## 19.5 Climate Change Impacts on SIDS

The Australian Bureau of Meteorology, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and meteorological services around the Pacific region have collaborated to provide downscaled climate projections for South Pacific SIDS (Australian Bureau of Meteorology and CSIRO, 2011). The main projections arising from this work to date include:

- increased ambient air and sea surface temperatures;
- more frequent extremely hot days and warm nights;
- increases in annual mean rainfall in specific areas and widespread increase in the number of heavy and extreme rain days;
- increased aridity from greater evapotranspiration;
- decreased sea surface salinity (i.e. freshening), which, in association with intensified warming, makes the surface ocean less dense and more stratified;
- sea level rise;
- ocean acidification.

These findings are generally consistent with those of the Intergovernmental Panel on Climate Change (IPCC) which, in its chapter on small islands in its Fourth and Fifth Assessment Reports, highlights the exquisite vulnerability of SIDS to warming induced by climate change, altered rainfall patterns, increased storm severity and rising seas (Mimura *et al.*, 2007, Nurse *et al.*, 2014). Climatic changes present significant concerns for large countries, but SIDS face the prospect of existential threats to land, livelihoods and perhaps even sovereignty due to rising seas and coastal inundation. A realistic threat exists that some may prove uninhabitable in the long term, due to loss of habitable, arable land and secure supplies of food and water. Rainwater harvesting and technical adaptations such as energy-intensive desalination plants may not fully protect SIDS from a less 'water-secure' future.

## 19.6 Climate Change and Health in SIDS

In 2009, the Commonwealth Health Ministers identified climate change as:

> . . . among the most serious challenges facing Pacific Island countries and territories, threatening every aspect of their environment, social and economic development, and political and human security. . . . For some of the 22 member countries and territories of the Pacific Community, it is a question of survival, and for all of them, a time for action.
>
> (Rodgers *et al.*, 2009)

### Assessing the vulnerabilities of SIDS to the health impacts of climate change

Butler and Harley's triphasic categorization of the population health consequences of climate change (Butler and Harley, 2010) applies well to SIDS. 'Primary effects' include direct injury and health problems arising from extreme weather events (EWEs) such as storms and floods. Other less direct, 'secondary' manifestations include water- and food-borne diseases; or altered distributions of arthropod vectors, intermediate hosts and pathogens, which alter the epidemiology of many infectious diseases that occur as a result of climatic variation. Of particular relevance to SIDS are the more severe, protracted future health consequences of climate change, classified as 'tertiary effects'. These include widespread and lingering economic disadvantage following EWEs or environmental degradation, such as loss of freshwater supplies or arable land.

When whole communities are exposed to catastrophic episodes which overwhelm their recovery capacity, conflict and large-scale migration can result (McMichael *et al.*, 2012). Cascading negative alterations to lifestyle attributable to climate change are likely also to impact mental health severely, arising, to various degrees, from any of those three categories of effects (Berry *et al.*, 2010). A summary of the assessments of the likely health impacts of climate change in Pacific SIDS, carried out by the World Health Organization (WHO) between 2010 and 2013 in collaboration with the health sector in each country, is presented in Table 19.2.

In addition to the priority risks to health identified in Table 19.2, other, more subtle, threats are posed by climate change to the health of island communities. A singular example of this island-specific vulnerability is the potential for sea level rise as an additional driver of overcrowding in atoll communities. This, in turn, may amplify infectious disease transmission in atoll countries such as Kiribati, Tuvalu and the Marshall Islands, all of which experience high rates of contagious diseases (such as diarrhoeal illness and tuberculosis), together with a high prevalence of diabetes and smoking.

Another plausible health risk is the exacerbation of the burden of NCDs. Though not unique to SIDS, the prospect of hotter, more humid conditions decreasing people's ability or willingness to exercise or perform outdoor work (Hanna *et al.*, 2011a), coupled with the compromised food security and the effects on NCDs of heat stress, is a potent potpourri (McIver and Hanna, in press).

## 19.7 Climate Change and Health Adaptation Options

Despite the many challenges inherent in the attempts to avert the most serious impacts of climate change on the health of island communities, there is cause for cautious optimism. Humans have managed to inhabit most of Earth's landmass, across vastly diverse environments. This success is directly attributable to human ingenuity, adaptability and technology. Small economies, on isolated islands, are not a new phenomenon. Similarly, island nations have long endured exposures to climatic extremes, responding with ingenious strategies for survival and recovery.

Communities develop their lifestyles, agriculture and cultural practices in response to

**Table 19.2.** Climate change and health vulnerabilities of Pacific island countries (source: McIver, 2012).

| Country | Main climate-sensitive health issues |
|---|---|
| Cook Islands | Dengue fever, diarrhoeal disease |
| Federated States of Micronesia | Water- and mosquito-borne diseases, malnutrition |
| Fiji | Dengue fever, typhoid fever, leptospirosis, diarrhoeal disease |
| Kiribati | Food (safety, security, food-borne diseases), water (safety, security, water-borne diseases) and vector-borne diseases |
| Nauru | Air quality, food security, non-communicable diseases (NCDs) |
| Niue | Vector-borne diseases, ciguatera, diarrhoeal disease, respiratory disease, heat-related illness, NCDs, trauma from extreme weather events |
| Palau | Vector-borne diseases, zoonotic infections, gastroenteritis, respiratory disease, NCDs, trauma from extreme weather events, mental health issues |
| Republic of the Marshall Islands | Food-, water- and vector-borne (dengue) diseases, respiratory diseases, malnutrition |
| Solomon Islands | Vector-borne diseases (malaria), respiratory diseases |
| Tonga | Diarrhoeal diseases, vector-borne diseases (dengue), food security/nutrition, non-communicable diseases, injuries and deaths from extreme weather events |
| Tuvalu | Diarrhoeal disease, respiratory disease, compromised food security and impacts on NCDs |
| Vanuatu | Food- and water-borne diseases |

their natural environment, including extreme fluctuations that occur infrequently (Hanna, 2011). While these cultural practices are enduring, they are not static. Ecosystems also change, responding to natural and human-induced interventions. Long-term population survival is determined by the capacity to develop effective resource utilization and management. SIDS have been striving toward this end; yet, with climate change, the goal posts are moving.

Essentially, there are three major forms of climate change adaptive options: (i) to boost local capacity; (ii) to share hardships and responses; or (iii) ultimately, to relocate.

## 19.8 Boosting Local Capacity

Education for all, food self-sufficiency, effective sanitation, safe drinking water and effective affordable primary health care are all aims of strengthened public health systems. These are key climate change adaptation strategies (McMichael *et al.*, 2003; Ebi *et al.*, 2005; WHO, 2010; McIver, 2012; Hanna, 2013).

Adaptation strategies should combine heightened protection of communities and vulnerable groups (e.g. improved disease surveillance and effective early warning systems for epidemics and EWEs) with strategies that render populations and habitats more climate-proof in the long run (e.g. improved water supplies and sanitation systems, sustainable food systems and heat- and storm-tolerant infrastructure) (Hanna *et al.*, 2011b). Raising the standard of these fundamentals – particularly for poor and otherwise disadvantaged communities – unquestionably fits with building resilience and exemplifies a 'no regrets' approach. Other basic population health issues identified as critical climate change adaptation strategies for low-income countries such as SIDS include gender equality and improved reproductive health, which usually corresponds with slowing population growth[5] (Bryant *et al.*, 2009).

## 19.9 Cooperative Responses

Improved disaster risk management – reducing risk and improving response, recovery and rehabilitation – will be key to reducing the substantial health impacts of disasters in SIDS attributable to climate change. The Hyogo Framework for Action (for disaster risk reduction) 2005–2015 identified the development of financial risk-sharing mechanisms, particularly insurance and reinsurance against disasters as a priority action for highly vulnerable SIDS (ISDR Scientific and Technical Committee, 2009). The concept of mutual assistance in disaster risk management and response is gaining traction. An example is the Caribbean Catastrophe Risk Insurance Scheme (CCRIS), where, on average, at least one major hurricane and numerous tropical storms cross the Caribbean each year, causing annual aggregate economic losses of US$613 million (World Bank, 2012). Under CCRIS, small island countries in the region all contribute to a disaster insurance pool, which is 'topped up' by developed countries and international financial institutions (World Bank, 2012).

A different type of cooperation can be seen in the approach taken by several Pacific Island countries (PICs), along with a range of other developing countries, in combining climate change adaptation with disaster risk reduction at the national level. The resulting 'Joint National Action Plans' provide a streamlined platform for practical implementation and sourcing of financial support, in acknowledgement of the shared risks and management strategies for the parallel threats posed by disasters and other climate change phenomena.

The sharing of information and 'best practices', including the use of information and communication technologies (ICT), is another promising area for SIDS collaboration. Knowledge management platforms like SIDSnet, the Islands Communication Network and the University Consortium of Small Island States play an important role for these purposes (UNESCO, 2012). Specific to climate change and health, a recent online discussion forum hosted by the Pacific Solution Exchange yielded fascinating views, both novel and traditional, on the link between climate change and NCDs in the Pacific, as well as on their management.

## 19.10 Relocation

The ambivalent attitude of many Pacific islanders toward relocation reflects a natural aversion to contemplate this drastic measure. While voluntary

migration offers potential benefits to SIDS, forced migration due to climate change is likely to harm mental health and culture.

In addition, studies suggest that following relocation, migrants continue to face many problems, including landlessness, unemployment, homelessness, social marginalization, food insecurity, reduced access to common-property resources and increased morbidity (Barnett and O'Neill, 2012).

## 19.11 External Support Requirements

Climate change poses enormous threats to the health, and indeed survival of SIDS populations. Addressing such threats will likely exceed the internal resources of these countries. Consensus exists that the primary external assistance required by SIDS is for larger, wealthier countries to reduce, immediately and significantly, and then reverse their carbon emissions. Today, obsessed with conventionally defined economic growth and an addiction to fossil fuels, most developed and rapidly developing countries continue to reveal the low priority of mitigation.

This negligence contrasts with that of some SIDS. As one example, Tokelu is on track to achieve 100% renewable energy, via solar energy and locally sourced palm oil.

While mitigation must remain the overarching international priority, SIDS must focus on adaptation. For this to occur, wealthier countries and international institutions must rapidly scale up their support for these processes.

With external assistance, the five Member States of the Indian Ocean Commission launched the ACCLIMATE Project in 2008 to help strengthen coping capacity. The project aimed to create a regional climate profile and to define, for each country, vulnerability by 12 key sectors (including health, food security, fresh water, biodiversity and infrastructure) (D'Offay, 2012). This has been followed by a Regional Adaptation Strategy that includes health as one of four main priority areas.

In the Caribbean, the Regional Framework for Achieving Development Resilient to Climate Change found that some countries spent 30–40% of foreign exchange earnings on fossil fuels. Reducing the cost of energy, in particular for the poorest of those countries, became a key priority. Adaptation projects can incorporate regional approaches to accelerate the transition to low-carbon energy, complementing work on adaptation and resilience (Ellis *et al.*, 2013).

There is a clear and urgent need to develop an overarching framework for addressing the public health adaptive needs in SIDS as climate change intensifies. Mechanisms for inter-institutional coordination with the health sector are often lacking; however, the work conducted by WHO in the northern Micronesian region of the Pacific demonstrated some novel and important linkages between health and other sectors. Several PICs have included climate change adaptation in their national health policies and plans, and more than a dozen now have specific National Climate Change and Health Action Plans (NCCHAPs) (or equivalent) (McIver, 2012).

The focus must now shift toward implementation of these plans, enabled by substantial sustained assistance. An example of progress in implementing such plans is in Kiribati, where the NCCHAP has attracted health sector-specific funding via the European Union Global Climate Change Alliance for Small Island States mechanism (McIver *et al.*, 2013). Similar opportunities may be available to other SIDS, and the potential advantages of 'clubbing together' to source funding, carry out activities and address common priorities (e.g. vector-borne diseases, malnutrition, mental health) should be made clear.

Finally, there are yawning gaps in knowledge regarding the health impacts of climate change in SIDS and how the local and global communities may best manage them. The focus to date of the majority of climate change and health research has been on infectious diseases. While these pose significant hazards to island communities in the context of climate change, it is plausible that climate change-attributable increases in the burden of NCDs and mental health disorders are of equivalent or greater concern (McIver and Hanna, in press).

## 19.12 Summary and Recommendations

This chapter's leading quote by James Michel, describing islands as the 'barometers of international environmental policies' (D'Offay, 2012),

is a blunt reminder of the grave future that looms due to global fossil fuel addiction. The day when the first SID is totally and forever abandoned will be a tragic occasion for our species. Will developed countries then act aggressively to reduce atmospheric $CO_2$ emissions? Or, will they procrastinate until the next nation is forced to migrate, or the next? Island communities forced to abandon their homes and cultures will exemplify an exceedingly selfish global culture, seemingly ignorant that we have only one planet and that our collective folly is rapidly converting it into a hot and nasty place, increasingly unsuitable for human habitation. Many children born in 2015 in rich countries will have life expectancies of 85 years. Their parents will anticipate them to be alive in 2100. However, today's climate trajectories and projections suggest that their world will be 4–6°C warmer. Their survival to 2100 may be precarious.

The pathway toward and beyond 2100 will be shaped by our collective efforts. In addition to mitigation, substantial improvements can be achieved with careful planning. Climate change amplifies the imperative to invest in tackling fundamental population health challenges such as the MDGs. In addition to actions within the health sector, reducing the climate change-related health risks for SIDS requires intersectoral collaboration to increase access to clean water and sanitation; improve the management of precious water and food resources; increase resilience to extreme events; and strengthen social capital, gender equality and education. There needs also to be increased support for community organizations and investments in information, monitoring and early warning systems, including to remote areas.

Climate vulnerability assessments must be conducted appropriately and integrated into health planning and policy documents. Upskilling of the health workforce in climate risks increases the likelihood that climate-orientated health information is absorbed and that pro-health responses are adopted. This requires comprehensive, multisectoral climate risk management programmes that can implement these priorities holistically and ensure their sustainability. We again stress that SIDS cannot execute climate change adaptation options without a reliable stream of external funding. Finally, we remark that while such external funding seems like more of the same old aid, it needs to be delivered and used in genuine ways that enhance independence.

## Notes

[1] Small Island Developing States (SIDS) were recognized as a distinct group of developing countries facing specific social, economic and environmental vulnerabilities at the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, held in Rio de Janeiro, Brazil (3–14 June 1992).
[2] Vulnerability to climate change is defined by the IPCC as 'the degree to which a community, individual or the environment is susceptible to and unable to cope with adverse effects of climate change' (UNFCCC, 2011, Glossary of climate change acronyms. UN Framework Convention on Climate Change).
[3] An atoll is a coral reef that partially or completely encircles a lagoon. Atoll countries are those made up exclusively of atolls.
[4] This expands the Barker Hypothesis, published in 1995, 'Low birth weight are at greater risk of developing coronary heart disease'. It proposes that the epidemiological associations between poor fetal and infant growth, and the subsequent development of type 2 diabetes and the metabolic syndrome, result from the effects of poor nutrition in early life, which produce permanent changes in glucose–insulin metabolism.
[5] Population control measures are advocated using only human rights based means – such as improved education (especially for girls); provision and increased enforcement of women's rights; and the provision of adequate family planning services.

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