



Human health and climate change in Pacific island countries

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Foreword

Climate change in the Pacific is threatening the health of Pacific islanders, as well as economic and social development. Extreme weather events, especially cyclones, floods and droughts, are displacing populations, causing injuries and psychological trauma, and are increasing the risks of infection and malnutrition. Hotter and wetter climates are increasing the risks for vector-borne disease. Disasters related to climate change are disrupting the delivery of health-care services and are increasing the risks of disease and death among vulnerable groups, especially young children, women of reproductive age, older people and people with disabilities.

Pacific island countries and areas are among the most vulnerable in the world to the impacts of climate change. They face a triple burden of disease – communicable diseases, noncommunicable diseases and the health impact of climate change – that causes high morbidity and mortality. Coordinated efforts of many different sectors are urgently needed to build resilience to climate change in the Pacific.

Ministers of health and representatives of Pacific island governments, attending the Eleventh Pacific Health Ministers Meeting in Fiji in April 2015, cited the real and potential impacts of climate variability on health and health systems as an immediate challenge in the Pacific.

Human health and climate change in Pacific island countries, the product of collaboration between WHO and Pacific island countries and areas, assesses health vulnerabilities at the country level due to climate change. The report describes the methodology used to assess country vulnerability and provides evidence-based policy options for health systems and public health.

The report informs and encourages timely action by Member States towards building resilience of health sector to climate change. It targets policy-makers and advisers in various sectors, public health practitioners, scientists and community stakeholders.

Climate change is a defining challenge of our time and could prove to be the most significant human health threat of the 21st century. For future generations in high-risk locations in the Pacific, climate change presents a risk to their survival.

We must act now.



Dr Shin Young-soo, MD, Ph.D.
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Preface

The global community has had a “blind spot” concerning the extent of the risks posed by human-induced climate change to the well-being, health and physical survival of populations. There are many adverse environmental and social impacts associated with climate change, including hotter – and in the tropics more humid – conditions; increases in weather-related disasters; reduced food yields; disruptions to water sufficiency and seasonal rains; changes in the geographical range, seasonality and activity of many infectious disease agents; and mental health disorders in damaged, disrupted or displaced communities. These all carry risks, often serious or fatal, to human health. Under climate change conditions, the health and safety of humans are as vulnerable, eventually if not immediately, as is the health of ecosystems, particular species, soils and pastures, and the chemical profile, vitality and productivity of the oceans.

Communities and governments are, as ever, preoccupied with managing the present and immediate future. Human nature, the inherent conservatism of core culture, the momentum in the prevailing economic system, and the electorally pragmatic, often cynical, behaviour of governments leads them to neither consider nor take action on behalf of the longer-term future a century or more hence. That future is much less knowable and less personally meaningful – other than for familial considerations, usually time limited to children and grandchildren. Besides, taking remedial steps to ensure future sustainability represents an economic cost that can be conveniently deferred to future governments and their constituencies.

Yet science tells us, with increasing certainty, that current trajectories of greenhouse gas emissions will result in human-induced climate change having a long time course, higher average global temperatures than were deemed likely just a decade ago, and that environmental and social conditions will be increasingly affected. Future living conditions will most probably worsen for human societies and populations around the world, and especially for those that are most vulnerable geographically or socioeconomically.

This raises an important caveat about the limits to adaptation, with particular relevance to small island developing states. Take an exaggerated example: if in half a century's time the polar ice-sheets melt faster than has been conservatively estimated by the Intergovernmental Panel on Climate Change (IPCC) and the seas then rise not by 3–4 cm per decade but, plausibly, by three times that rate, will strengthening and heightening the coastal barricades suffice? And could alternative viable crops continue to be found if the arable coastal land becomes seriously salinated? More generally, if all countries were to become preoccupied with shoring up their own defences, and international cooperation and funding then falters, could Pacific island governments afford the necessary hugely increased expenditures on adaptation – and do so without eroding the conditions of daily life, support services and social stability?

The inevitable conclusion is twofold. First, countries everywhere must continue to seek a breakthrough in international decision-making and the truly global management of climate change mitigation, or abatement. Second, adaptation strategies must entail more than running repairs; they should span a range of time horizons, transcend sectoral interests and include high-level intercountry discussion of and commitment to regional adaptation options to lessen the overall burdens of loss, stress and adverse health outcomes. A key to successful adaptation, in the Pacific and beyond, will be a reformed mode of intercountry sharing, compromise and effective joint action.

But adaptation, as necessary and important as it now is, should never be the sole or preferred primary solution. It should, indeed must, be complementary to a huge international effort to head off further climate change as soon as possible. Adaptation can buy us time, lives and health, but it cannot secure a safe and sustainable future for human living, whether in the Pacific or elsewhere.

Professor Emeritus Anthony John McMichael
Australian National University

Authorship and acknowledgements

This report is based on the work carried out by the World Health Organization (WHO) Regional Office for the Western Pacific Division of Pacific Technical Support in Suva, Fiji. The work involved assisting Pacific island countries to assess their vulnerabilities to the health impacts of climate change and plan adaptation strategies to manage such threats. This work was financed in part by the Governments of Japan and the Republic of Korea. The authors gratefully acknowledge the productive collaboration and invaluable contributions of international experts, as well as colleagues from ministries of health and other government and nongovernment sectors in the Pacific island countries that participated in this work. The project was managed by WHO officers Steve Iddings (2010–2012), and Rokho Kim (2013–2015).

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Special note of tribute to Professor Emeritus Anthony John McMichael

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Glossary of terms

Adaptation	Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, public and private adaptation, and autonomous and planned adaptation.
Adaptive capacity	The ability of a system to adjust to climate change (including climate variability and extremes), moderate potential damages, take advantage of opportunities, or respond to consequences.
Biodiversity	The numbers and relative abundance of different genes (genetic diversity), species and ecosystems (communities) in a particular area.
Climate change	Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity.
Co-benefit	A climate change adaptation or mitigation strategy that has additional, positive effects on health or other areas (e.g. reducing air pollution).
Early warning system	The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare to act promptly and appropriately to reduce the possibility of harm or loss.
Exposure	In epidemiology: the process by which an individual, community or ecosystem is affected by contact with a particular object, event or phenomenon (in this case, the effects of climate change); in climate change literature: the presence of people, livelihoods, environmental services and resources, infrastructure and economic, social and cultural assets, in places that could be adversely affected.
Extreme weather event	An event that is rare within its statistical reference distribution at a particular place. By definition, the characteristics of what is called “extreme weather” may vary from place to place.
Food security	A state that prevails when people have secure access to sufficient amounts of safe and nutritious food for normal growth, development, and an active and healthy life.
GIS	Geographical Information System (GIS).

Hazard	The potential occurrence of a natural or human-induced physical event or trend, or physical impact that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision and environmental resources.
Health impact assessment	A systematic process to assess the actual or potential, and direct or indirect, effects on the health of individuals, groups or communities arising from policies, objectives, programmes, plans or activities.
Health risk assessment	The process of estimating the potential impact of a chemical, biological, physical or social agent on a specified human population system under a specific set of conditions and for a certain time frame.
Impacts	Consequences of climate change on natural systems and human health.
Mitigation	The process of reducing the impact of climate change by reducing the driving forces thereof (i.e. reducing greenhouse gas emissions).
Radiative forcing	Radiative forcing is the change in the net, downward minus upward, irradiance (expressed in watts per square metre – W/m ²) at the tropopause or top of atmosphere due to a change in an external driver of climate change, such as a change in the concentration of carbon dioxide or the output of the sun.
Resilience	The capacity of a social–ecological system to cope with a hazardous event or disturbance, responding or reorganizing in ways that maintain its essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation.
Risk	The probability that, in a certain time frame, an adverse outcome will occur in a person, group of people, plants, animals and/or the ecology of a specified area that is exposed to a particular hazardous agent.
Sea-level rise	An increase in the mean level of the ocean.
Sensitivity	The degree to which a system may be affected, either adversely or beneficially, by climate-related stimuli.
Vector-borne disease	Disease that is transmitted between hosts by a vector organism (such as a mosquito or tick).
Vulnerability	The degree to which a system is susceptible to, or unable to cope with, the adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity.

Abbreviations

ADB	Asian Development Bank
AF	Adaptation Fund (of Global Environment Facility)
AOSIS	Alliance of Small Island States
AR5	Fifth Assessment Report (of the IPCC)
CAP	climate-altering pollutant
CASH	Climate Adaptation Strategy for Health
CCAPS	Climate Change Adaptation Plan and Strategy (Kiribati)
CLEWS	climate early warning system
CO₂	carbon dioxide
CSD	climate-sensitive disease
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
DH&SA	Department of Health and Social Affairs
DISMAC	Disaster Management Committee
DoE	Department of Education
DoH	Department of Health
DPS	Division of Pacific Technical Support (WHO)
DPSEEA	driving force–pressure–state–exposure–effect–action
DRM-H	disaster risk management for health
DRM-NAP	Disaster Risk Management National Action Plan (Cook Islands)
DRR	disaster risk reduction
ECP	extended concentration pathway
EEZ	exclusive economic zone
EHU	Environmental Health Unit
ENSO	El Niño Southern Oscillation
EPA	Environmental Protection Agency
EU	European Union
EU GCCA	EU Global Climate Change Alliance
EWARS	early warning and response system
EWS	early warning system
FAO	Food and Agriculture Organization of the United Nations
FEMA	Federal Emergency Management Agency
FRCS	Fiji Red Cross Society
GCCA: PSIS	Global Climate Change Alliance for Pacific Small Island States

GCF	Global Climate Fund
GEF	Global Environment Facility
GHG	greenhouse gas
GIS	geographical information system
GNI	gross national income
HIA	health impact assessment
HIS	health information system
HMD	hydro-meteorological disaster
H-NAP	health component of national adaptation plan
ICCRAHS	Integrating Climate Change Risks in the Agriculture and Health Sectors (Samoa)
ICT	information and communication technology
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
IT	information technology
IWRM	Integrated Water Resources Management
JNAP	Joint National Action Plan (for Disaster Risk Management and Climate Change Adaptation)
KSA	key strategic area
LDC	least developed country
LDCF	Least Developed Countries Fund (of Global Environment Facility)
MDG	Millennium Development Goal
MECDM	Ministry of Environment, Climate Change, Disaster Management and Meteorology (Solomon Islands)
MoH	Ministry of Health
NACCC	National Advisory Committee on Climate Change (Vanuatu)
NAPA	National Adaptation Programme of Action
NCCC	National Climate Change Committee
NCCHAP	National Climate Change and Health Action Plan
NCCP	National Climate Change Policy
NCCPF	National Climate Change Policy Framework
NCD	noncommunicable disease
NEMO	National Emergency Management Office
NESAF	National Environment Strategic Action Framework (Cook Islands)
NGO	nongovernmental organization
NHSP	National Health Strategic Plan
NSDP	National Strategic Development Plan (Cook Islands)
ODA	overseas development assistance
OEPPC	Office of Environmental Planning and Policy Coordination
OHC	oceanic heat content

PACC	Pacific Adaptation to Climate Change
PACCSAP	Pacific Australia Climate Change Science and Adaptation Planning Programme
PALARIS	Palau Automated Land and Resource Information System
PASAP	Pacific Adaptation Strategy Assistance Program
PCCAPHH	Piloting Climate Change Adaptation to Protect Human Health
PICCAP	Pacific Islands Climate Change Assistance Programme
PPM	parts per million
PTSD	post-traumatic stress disorder
RCP	representative concentration pathway
SCCF	Special Climate Change Fund (of Global Environment Facility)
SDG	Sustainable Development Goal
SIDS	small island developing states
SLCP	short-lived climate pollutant
SOP	standard operating procedure
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environmental Programme
SS	syndromic surveillance
SST	sea surface temperature
SWOT	strengths, weaknesses, opportunities, threats
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNOCHA	United Nations Office for Coordination of Humanitarian Affairs
USP	University of the South Pacific
VCA	vulnerability and capacity assessment
WASH	water, sanitation and hygiene
WHO	World Health Organization
WSO	Weather Service Office

Executive summary

Pacific island countries and areas are among the most vulnerable in the world to the impacts of climate change due to the confluence of geographic, demographic and socioeconomic factors, such as low elevation, small populations and scarce resources. For this reason, when Pacific island health ministers held their biennial meeting in Madang, Papua New Guinea, in 2009, they committed to action on climate change and health. Among other actions, they committed to assess health vulnerability due to climate change and to develop national strategies and action plans for health sector adaptation.

This report, *Human health and climate change in Pacific island countries*, targets policy-makers and advisers, health professionals and scientists, community-based organizations and other stakeholders. It presents the outcomes of work carried out by WHO in collaboration with ministries of health in Pacific island countries and areas over the past few years. The report follows up the Madang Commitment, endorsed in 2009 at the biennial Pacific Health Ministers Meeting, by performing vulnerability assessments and preparing the National Climate Change and Health Action Plans (NCCHAPs). Although Pacific island countries and areas were the focus of the report, most findings and recommendations are likely applicable to small island developing states (SIDS) worldwide.

The purpose of this report is to present the most relevant research evidence, situation analyses and recommendations for climate change and health adaptation in Pacific island countries and areas, with the intention of providing a strategic framework and evidence-based policy options required to prevent and manage the impacts of climate change on the health of communities across the Pacific.

The report first summarizes WHO's role in guiding the health sector response to the challenge of climate change globally, and reviews WHO work on climate change and health in the Pacific. The report then reviews the science of climate change and health, as it applies to the Pacific region, using local, regional and global evidence. The fundamental points from the climate change and health literature are: (1) the climate is changing due to human activity, and those changes are affecting human health; (2) these effects are mostly harmful; and (3) the most severe of these effects can be avoided.

Assessing health vulnerabilities and compiling adaptation plans for Pacific island countries and areas involved three stages:

- The first phase involved inception workshops, which brought together country representatives and consultant teams to review the current state of knowledge on climate change and
- The second phase saw the consultant teams visit 13 countries for further stakeholder consultations, as well as examination of the available local data on climate and climate-sensitive diseases. Stakeholders included government and nongovernmental agencies, community representatives and the private sector.

- In the final phase, during return visits to each country, WHO teams assisted country teams in drafting NCCHAPs that reflected key vulnerabilities and adaptation priorities with respect to the country-specific health impacts of climate change.

The vulnerability assessments yielded a list of high-priority climate-sensitive health risks in Pacific island countries and areas, including direct effects such as the health impacts of extreme weather events such as cyclones, flooding, droughts and heatwaves; indirect effects such as waterborne diseases, malnutrition and foodborne diseases, vector-borne diseases, zoonoses, respiratory illness, and disorders of the eyes, ears, skin and other body systems; and diffuse effects such as mental/psychosocial illnesses, noncommunicable diseases (NCDs), pressures on fragile health systems and population displacement.

These vulnerability assessments led to the prioritization of adaptation strategies to tackle the risks to health posed by climate change in each country. The country-specific details of the vulnerability assessments and adaptation plans may be found in the NCCHAPs, and in the relevant chapters of this report.

The report also offers a strategic framework to consolidate health adaptation for governmental and nongovernmental organizations, technical agencies, donors and other organizations to build climate-resilient health systems. As a first step in strengthening public health services, Pacific island countries and areas may consider the following six areas of work: (1) comprehensive assessments of the risks posed by climate variability and change to population health and health systems; (2) integrated environment and health surveillance; (3) delivery of preventive and curative interventions for the effective management of identified climate-sensitive public health concerns; (4) disaster risk management for health (DRM-H) addressing extreme weather events; (5) research; and (6) strengthening of human and institutional capacities and intersectoral coordination.

Adopting the health systems approach, the report emphasizes 10 priority action areas for building climate resilient health systems: (1) governance and policy; (2) capacity development; (3) vulnerability, capacity and adaptation assessment; (4) integrated risk monitoring and early warning; (5) research; (6) essential products and technologies; (7) management of environmental determinants of health; (8) climate-informed health programmes; (9) emergency preparedness and management; and (10) financing.

Adaptation and resilience building are, by their very nature, cross-cutting, whole-of-society and whole-of-government undertakings. Adaptation and resilience building to protect population health require actions beyond the health sector itself. Ensuring a health-in-all-policies approach, health considerations should be incorporated into national policies and plans relevant to climate change.

The *2015 Yanuca Island Declaration on health in Pacific island countries and territories* adopted at the Eleventh Pacific Health Ministers Meeting in Fiji reconfirmed the concern and commitments of the Pacific health ministers about the real and potential impacts of climate variability on health and health systems as an emerging challenge in the Pacific. As the first comprehensive synthesis of the current state of knowledge of health and climate change in Pacific island countries and areas, this report will serve the implementation of decisions made at the Pacific Health Ministers Meeting to addressing climate change impacts on health of island communities across the Pacific.

CHAPTER 1

Introduction

“The issue now is not whether climate change is occurring, but how we can respond most effectively.”

Dr Margaret Chan, WHO Director-General, 2009

There is a global consensus that a number of environmental impacts of climate change have been observed in recent decades. These include, but are not limited to, increasing air and ocean temperatures; widespread melting of snow and ice, combined with thermal expansion of the oceans, thus accelerating sea-level rise; altered rainfall patterns; extended periods of drought; an increase in the frequency of extreme heat events; and an increase in the frequency of extreme weather events and associated impacts on the physical environment and ecosystems, upon which our livelihoods depend. The impacts may be severe, and tropical countries in particular face temperature increases, changes in precipitation patterns, increased heavy rainfall from tropical cyclones and sea-level rise, which may have catastrophic impacts for low-lying Pacific nations (IPCC, 2014).

Climate change is often referred to as a health “risk multiplier”, as its many properties and consequences can trigger or amplify pre-existing health risks (McMichael, 2011). This has particular importance for populations or communities with pre-existing high rates of, for example, childhood diarrhoeal disease, malaria, or undernutrition and child stunting. Changes in climatic conditions affect human health and survival across a wide spectrum of impact types, and most health impacts are anticipated to be unfavourable (IPCC, 2014). The World Health Organization (WHO) estimated that climate change caused approximately 140 000 excess deaths annually around the year 2000 (WHO, 2008a), the majority being in the poorest populations in low- and middle-income countries, where vulnerability is highest.

The mechanisms of adverse health impacts include the direct effects of heatwaves, cold spells and extreme weather events, as well as the less direct effects of a lack of a sufficient quantity and quality of fresh water, impaired nutrition due to compromised food security, an increase in respiratory diseases associated with poor air quality, and an increase in the incidence of communicable diseases, including waterborne and vector-borne diseases. Mental health impacts are also of great importance, spanning depression, grief over losses and post-traumatic stress disorder (PTSD). Health impacts, as with other effects of climate change, are likely to increase over the coming decades (Haines et al., 2006; IPCC, 2007a; McMichael et al., 2008; McMichael, Woodruff & Hales, 2006; WHO, 2009a). The types of health impacts will also change over time, although this will vary globally by geographical region. Where

heatwave-related deaths and diarrhoeal disease in poor and crowded communities are likely to figure early on, the adverse health consequences of declining food yields, changing infectious disease patterns, and the physical and mental toll of displacement and migration will become more prominent over time.

Pacific island countries and areas are, in a number of respects, among the most vulnerable in the world to the impacts of climate change, due to the confluence of geographic, demographic and socioeconomic risk factors such as low elevation, small populations and scarce resources. Small island developing states (SIDS) of the Pacific are therefore likely to experience some of the earliest and most severe impacts of climate change; these effects will include detrimental impacts on various aspects of health and development.

1.1 WHO's role in global climate change and health

The health sector's response to climate change has historically been modest, perhaps because of health professionals' typical requirement for proven causality between exposure and outcome, which is difficult for a long-term phenomenon such as climate change.

Other factors may also have played a role, including puzzlement at the nature of the connection between climate change, its immediate effects and consequential impacts on human health; confusion within the health sector regarding tangible health adaptation strategies; and a lack of access to funding mechanisms for adaptation. In the Pacific, this has meant a reliance on external technical and financial support for most aspects of work related to climate change vulnerability and adaptation, including those related to the health of Pacific island communities in the face of climate change.

The result has been an inadequate level of health sector engagement in the global climate change adaptation process to date. For example, in least developed countries (LDCs) and small island states, while 95% (i.e. 39 out of 41) of reviewed national adaptation programmes of action (NAPAs) make reference to the climate change impacts on health, only 3% of past and current adaptation funding targets health (Manga et al., 2010).

Irrespective of these challenges and recognizing the need to use climate change adaptation funding for health, governments and partner organizations have made a number of recent commitments to respond and adapt to the likely health impacts of climate change. This was most clearly articulated by Member States of WHO in 2008 in the World Health Assembly resolution on Climate Change and Health (WHA61.19), adopted in May 2008, urging Member States to take action, such as developing and integrating health adaptation measures into plans (WHO, 2008b).

The resolution specifically notes the following:

- The net global impact of climate change on human health is anticipated to be negative.
- Vulnerable populations with the least ability to adapt will be the most affected.
- Climate change could jeopardize achievement of the Millennium Development Goals (MDGs).

- Developing solutions to climate change impacts on health is a joint responsibility and developed countries should assist developing countries in this regard.
- A priority in minimizing risk is to strengthen health systems to enable them to respond to anticipated changes in public health needs.
- Member States should be consulted on the preparation of a global climate change and health work plan to scale up and address risks in a practical way.

A global climate change and health work plan was subsequently developed and amended by the Executive Board at its 124th session in November 2008 (WHO, 2008b).

The work plan has three specific aims:

1. **To support** health systems, in particular, in low- and middle-income countries and small island states, to enhance the capacity for assessing and monitoring health vulnerability, risks and impacts due to climate change.
2. **To identify** strategies and actions to protect human health, particularly of the most vulnerable groups.
3. **To share** knowledge and good practices.

In order to achieve these aims, the work plan has the following objectives:

- **Advocacy:** to raise awareness that climate change is a fundamental threat to human health.
- **Partnerships:** to coordinate with partner agencies within the United Nations (UN) system, and ensure that health is properly represented in the climate change agenda.
- **Science and evidence:** to coordinate reviews of the scientific evidence on the links between climate change and health, and develop a global research agenda.
- **Health systems strengthening:** to assist countries to assess their health vulnerabilities and build capacity to reduce health vulnerability to climate change.

In 2010, WHO, building on the process initiated in the African Region and in consultation with Member States, compiled an *Essential Public Health Package to Enhance Climate Change Resilience in Developing Countries*, which included a series of recommendations for health systems in developing countries to achieve a “climate-resilient status”.

The work on climate change and health carried out in the Pacific described in this report complies with the following recommendations of the *Essential Public Health Package to Enhance Climate Change Resilience in Developing Countries* (WHO, 2010):

- conducting a comprehensive climate change and health vulnerability assessment;
- preparedness for, and response to, the public health consequences of extreme weather events, including population displacement;
- an integrated environment and health surveillance system, including meteorological surveillance;
- strengthening country capacities for the delivery of preventive interventions of selected communicable disease control programmes;
- research on local-level health effects of climate change and on locally appropriate adaptation measures; and
- intersectoral coordination and health representation in national and international development, humanitarian and climate policy forums.

For each objective, WHO committed to a number of actions, aiming to provide evidence and support capacity-building and implementation of projects to strengthen the health system response to climate change through activities at the country, regional and headquarters levels. WHO also works to promote the necessary health-in-all-policies approach to climate change adaptation, by ensuring that the health sector's input is appropriately integrated into decisions made primarily by other sectors, such as energy and transport, and that the health sector's voice is well heard within the overall UN response to climate change.

Building on the above-mentioned package and the experience gained across regions, WHO proposed an *Operational Framework for Building Climate-resilient Health Systems* (WHO, 2014a). The framework, which mainly follows the building blocks of health systems, provides practical and actionable guidance for health systems to become better prepared for and capable of protecting health in an unstable and changing climate. More details of the framework are presented in Chapter 8.

In August 2014, WHO convened the First Global Conference on Health and Climate to support Member States in protecting population health from climate change, and in gaining health benefits while mitigating climate change.

1.2 WHO's work on climate change and health in the Pacific region

In response to growing evidence of the health threats posed by climate change and in line with developments at the global level, the WHO Regional Committee for the Western Pacific in September 2008 endorsed the *Regional Framework for Action to Protect Human Health from the Effects of Climate Change in the Asia Pacific Region*, through resolution WPR/RC59.R7 (WHO, 2008c).

This resolution urges Member States:

1. to develop national strategies and plans to incorporate current and projected climate change risks into health policies, plans and programmes to control climate-sensitive health risks and outcomes;
2. to strengthen existing health infrastructure and human resources, as well as surveillance, early warning, and communication and response systems for climate-sensitive risks and diseases;
3. to establish programmes to reduce greenhouse gas (GHG) emissions by the health sector;
4. to assess the health implications of the decisions made on climate change by other sectors, such as urban planning, transport, energy supply, food production and water resources, and advocate for decisions that provide opportunities for improving health;
5. to facilitate the health sector to actively participate in the preparation of national communications and national adaptation programmes of action; and
6. to actively participate in the preparation of a work plan for scaling up WHO's technical support to Member States for assessing and addressing the implications of climate change for health.

Before and after this resolution, Member States have shown considerable commitment to addressing the health risks associated with climate change, and have developed a number of strategies and plans for this purpose. These include the health components of NAPAs

Box 1. Summary of conclusions at the 2014 Global Conference on Health and Climate

The WHO Conference on Health and Climate was held from 27 to 29 August 2014, at WHO headquarters, in Geneva, Switzerland. The deliberations of the conference provided information and guidance to WHO Member States in responding to the health challenges presented by climate change, and input to the revision of WHO's programme in this field. In response to the very strong scientific evidence of the health risks presented by climate change, the conference participants issued a clear warning that without adequate mitigation and adaptation, climate change poses unacceptable risks to global public health. The participants recognized the necessity of strengthening health resilience to climate change, and the opportunity to make very large gains in public health through well-planned mitigation measures. Participants also noted that although significant progress has been made in recent years, there are important weaknesses in the current international health response to climate change. These include relatively weak engagement of the health sector in the international and national policy processes on climate change; a lack of technical capacity to design and implement health adaptation plans or health-promoting mitigation measures; and inadequate financing for the health sector to strengthen climate resilience, or to play its role in health-promoting mitigation policies.

The following needs were identified:

1. Generating and sharing information so as to raise awareness of the links between health and climate, and the potential for enhancing health through climate change mitigation.
2. Supporting the health sector in engaging more actively with the United Nations Framework Convention on Climate Change (UNFCCC) and other relevant international policy mechanisms; and at the national level through the development of the health component of national adaptation plans.
3. Identifying common approaches and metrics for monitoring and evaluation of progress in strengthening health resilience to climate risks, and for measuring, valuing and incentivizing health-promoting mitigation actions in key economic sectors, for example, through actions on short-lived climate pollutants to reduce air pollution.
4. Providing Member States with technical support and capacity development support in key areas, including the development of the health components of national adaptation plans, collection and analysis of climate and health data, and the application of health impact assessment to adaptation and mitigation policies.
5. Promoting research to identify sector policies and measures with best performance in improving health and mitigating climate change.
6. Providing a forum to facilitate information exchange, coordination and collaboration on strengthening health resilience to climate change, and on health-promoting climate change mitigation policies.
7. Providing guidance to the health sector in protecting health services from climate risks, and reducing the carbon emissions of health sector operations.
8. Supporting resource mobilization to build climate resilience in the health sector and promoting healthy mitigation policies, by providing guidance on the available funding opportunities, and providing technical support to countries to develop funding proposals.

There is a need to continue the process of meeting these needs, following the mandates from the World Health Assembly and the UNFCCC, and related processes. This should make use of existing mechanisms, and build on the rapidly emerging experience from around the world.

developed by LDCs, other national climate change plans that include health components, and specific plans and initiatives targeting public health.

In 2009, at the biennial Pacific Health Ministers Meeting in Madang, Papua New Guinea, agenda items included the impact of climate change on health. The ministers, supported by WHO, recognized that Pacific island countries are among the most vulnerable countries in the world to the impacts of climate change and identified several high-priority, climate-sensitive health risks common throughout the region. These included vector-borne, waterborne and foodborne diseases; injuries and deaths from extreme weather events; compromised food security and malnutrition; and the mental health impacts of, among other things, loss of livelihoods and climate change-induced population displacement (WHO & Secretariat for the Pacific Community, 2009).

The ministers committed to action on climate change and health, and recommended that each Pacific island country and area:

- plan and implement studies on health vulnerability due to climate change;
- develop national strategies and action plans for health sector adaptation, as part of national adaptation programmes and national communication reports to the UNFCCC and the Pacific Islands Framework for Action on Climate Change (noting that the national adaptation programmes should be part of national sustainable development strategies);
- increase awareness among policy-makers and the private sector about the impact of climate change on health, the determinants of health, and the livelihoods of islanders;
- mobilize communities to better adapt to the health consequences of climate change, as well as other impacts, applying the healthy settings approach embedded in the Healthy Islands vision;¹
- strengthen national capacity to develop and implement effective interventions to minimize climate change-related health risks and enhance community resilience for adaptation, with special regard for the most vulnerable populations; in particular, reinforce existing programmes and build up the capacity of health and other related sectors in terms of infrastructure, human resources and financial resources;
- assess the health implications of decisions made on climate change by other key sectors, such as energy, agriculture, fisheries, industry, water supply and sanitation, transport, urban and rural planning, and advocate for decisions that would improve health (noting that it is critical that key sectors are engaged in adaptation planning for the health sector); and
- ensure that the support of regional and international agencies is well coordinated and tailored to the priority needs identified by the country.

Leaders of small island developing states (SIDS) adopted in 2014 SIDS Accelerated Modalities of Action [S.A.M.O.A.] Pathway, calling for support for the efforts of SIDS to build resilience to the impacts of climate change and to improve their adaptive capacity through the design and implementation of climate change adaptation measures appropriate to their respective vulnerabilities and economic, environmental and social situations (UN General Assembly, 2014).

In 2015, at the eleventh Pacific Health Ministers Meeting in Yanuca Island, Fiji, the ministers reconfirmed that the real and potential impacts of climate variability on health and health

1. Healthy Islands is an ideal envisioned in 1995 at the first Pacific Health Ministers Meeting on Yanuca Island, Fiji. That vision has served as a unifying theme for health protection and health promotion in the Pacific, and reflects the comprehensive and integrated approach to health that is a hallmark of WHO.

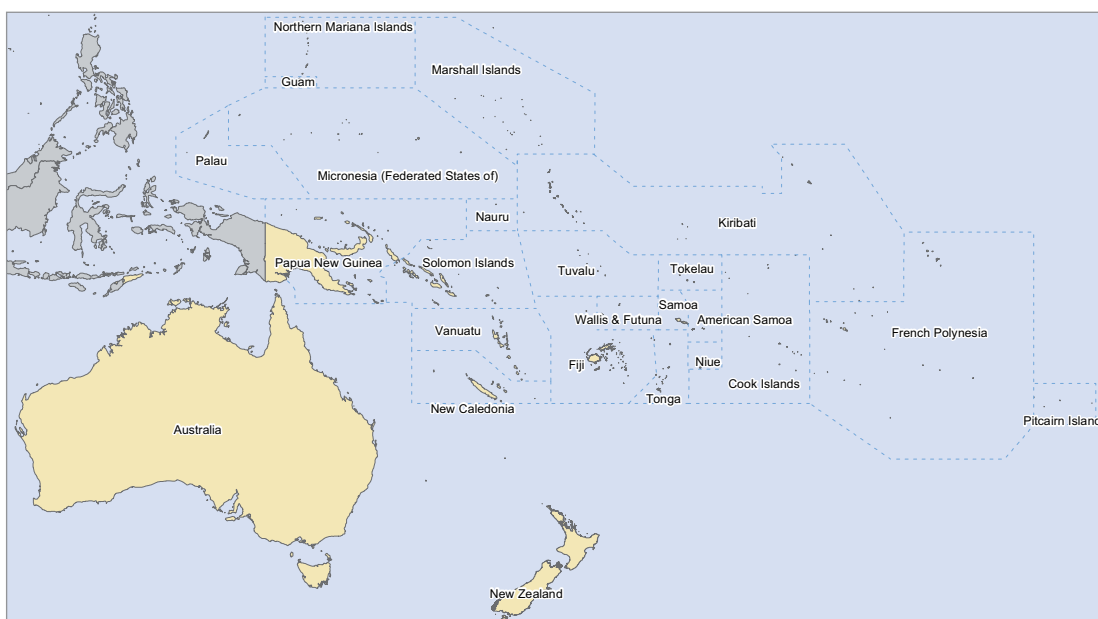
systems represent an immediate challenge in the Pacific. They adopted *2015 Yanuca Declaration on health in Pacific island countries and territories*. The proposed recommendations include activities to ensure that health facilities are resilient to climate change impacts through retrofitting and relocation. Ministers were advised to consider that health is well represented in the national climate change adaptation plan.

It is important to note that the health impacts of climate change had been given some consideration in many Pacific island countries and areas as part of their early work on climate change adaptation, even before these policy documents that specifically address the health impacts of climate change were adopted by the health sector in the region. Much of this had been taking place since the early 1990s, often in the absence of significant inputs from the health sector. As part of their Initial National Communications to the UNFCCC (mostly submitted in the mid-1990s to the first decade of the current century), NAPAs and via regional initiatives such as the Pacific Islands Climate Change Assistance Programme (PICCAP), several countries in the region noted the potential for climate change to impact health, even if the general level of understanding of those effects was limited at that time.

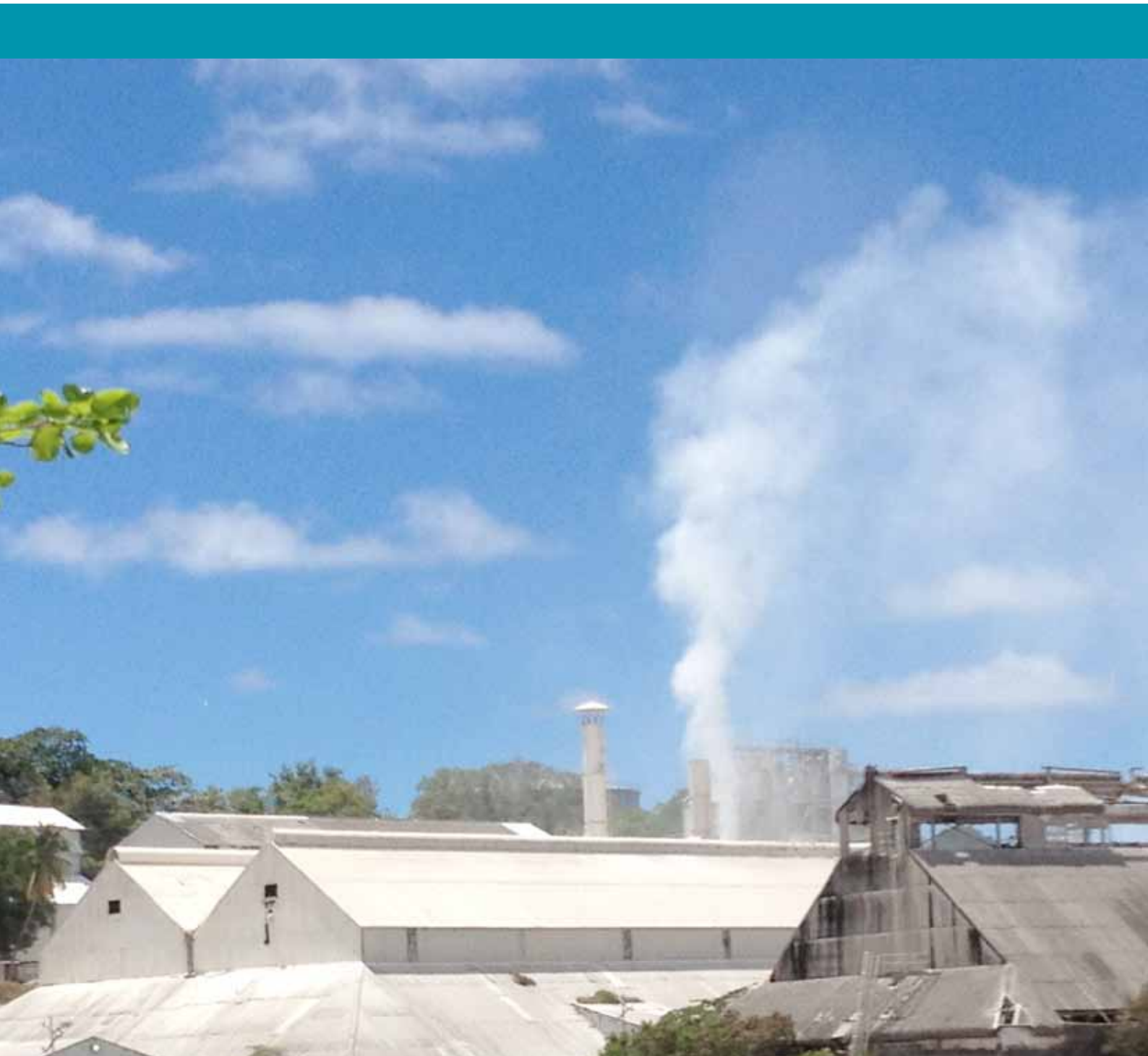
Since 2010, the Division of Pacific Technical Support (DPS) of the WHO Regional Office for the Western Pacific has been assisting Pacific island countries and areas to assess their vulnerability to the health impacts of climate change and plan appropriate adaptation strategies to manage these risks.

The 13 Pacific island countries included in this synthesis report are those that have been directly supported by WHO in climate change and health vulnerability and adaptation work: Cook Islands, Fiji, Kiribati, the Marshall Islands, Micronesia (the Federated States of), Nauru, Niue, Palau, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. This group of countries includes some of the atoll nations that are the most vulnerable in the world to the impacts of climate change (e.g. Kiribati, the Marshall Islands and Tuvalu). Figure 1 shows the island countries and areas of the Pacific region.

Figure 1. Map of Pacific island countries and areas



Source: WHO



CHAPTER 2

Health impacts of climate change: science and evidence

“Climate change could be the biggest global health threat of the twenty-first century. Effects on health of climate change will be felt by most populations in the next decades and put the lives and well-being of billions of people at increased risk.”

The Lancet, 2009

2.1 Climate change science

The Intergovernmental Panel on Climate Change (IPCC) is an international scientific body established at the request of Member States of the United Nations, and its mandate is “to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socioeconomic impacts”.

It has defined “climate change” as an alteration in one or more aspects of the climate, which might refer either to the mean (average) or the variability of the climate, and which persists for an extended period, typically decades or longer. In the IPCC definition, climate change is recognized as being due both to natural processes and to the effects of human activities.

Natural processes that affect the global climate include long-term variations in the orbit of the Earth and in the planet’s rotation, fluctuations in the amount of energy released from the sun and volcanic eruptions that inject heat-reflecting aerosols into the upper atmosphere. Natural cyclical phenomena such as the El Niño Southern Oscillation (ENSO) have a strong effect on climates in many parts of the world, including the Pacific, affecting both temperatures and rainfall.

Human activity is adding more heat-trapping GHGs to the lower atmosphere, including carbon dioxide (CO₂), methane, nitrogen oxides and ozone. These changes arise from burning fossil fuels, land-use changes, agriculture and industrial processes. Emissions of black carbon and other particulate pollution tend to have a mixed effect on local climates, causing some cooling due to reflection of incoming solar radiation, but adding to the “positive” radiative forcing – or “greenhouse effect” – in other ways.

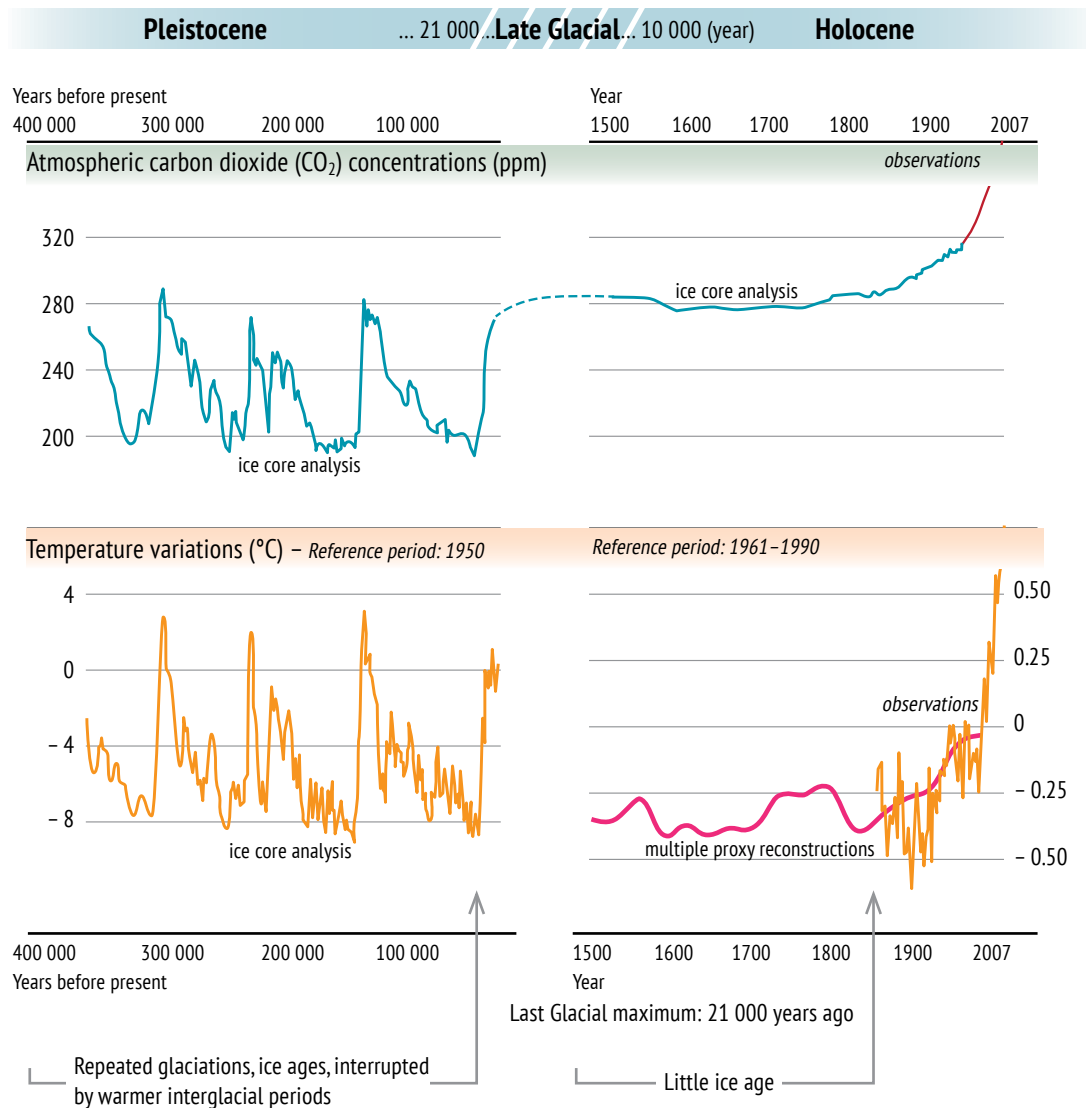
Water vapour is the most significant natural GHG, trapping more energy than the other GHGs. Note that its concentration is itself positively related to surface temperature. The most important human-generated (anthropogenic) GHG is CO₂, whose concentration is increasing as a consequence of human activities. The atmospheric concentration of CO₂ increased from approximately 280 parts per million (ppm) in pre-industrial times to reach 400 ppm for the first time in May 2013 – a 40% increase, mostly in the past half century. The primary source of CO₂ is the combustion of fossil fuels such as oil, coal and gas, with a significant contribution from land-use changes and the burning of plant matter. The likely impacts of these emissions on global climate have been discussed for centuries, with the first attempt to quantify them in the late 19th century (Arrhenius, 1896).

In addition to the increase in CO₂, the atmospheric concentration of methane has more than doubled since pre-industrial times, the concentration of nitrous oxide has increased and human activities have had profound effects on the concentrations of other GHGs (IPCC, 2007b). Over the past century, atmospheric concentrations of CO₂, methane and nitrous oxide have increased to levels that have not occurred in at least the past 800 000 years (Fig. 2). The ocean has absorbed about 30% of the CO₂ released from human activities, causing a measurable increase in the acidity of the oceans.

The Fifth Assessment Report of the IPCC (AR5), published in 2014, reports unequivocal evidence of rising temperatures worldwide (Fig. 3). Since the 1950s, both the atmosphere and oceans have warmed, the amounts of snow and ice have diminished, and sea levels have risen. A feature of AR5 is the emphasis on changes in the oceans: it is evident now that ocean warming dominates the increase in energy retained at the Earth's surface by the lower atmosphere, accounting for more than 90% of the solar energy accumulated between 1971 and 2010. This, and the accelerating melting of landed ice sheets and glaciers, has increased the average annual rate of sea-level rise over the past several decades. This is of particular importance in the Pacific, where virtually all human settlement is on the coast and is exposed directly to storm activity, sea-level rise and changes in marine ecosystems.

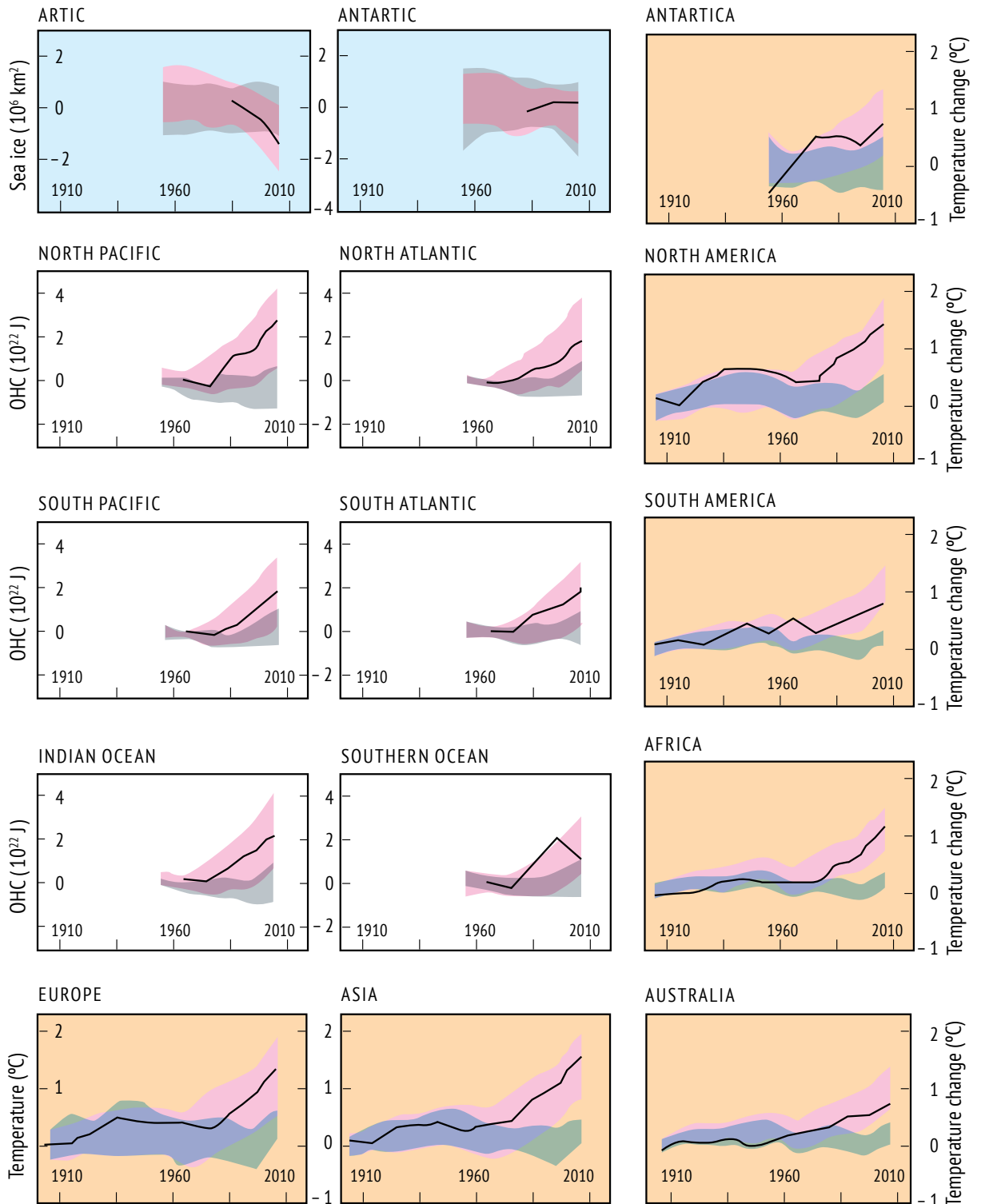
AR5 concludes that it is “extremely likely that human influence has been the dominant cause of the observed warming since the mid-twentieth century”. Looking ahead, the IPCC judges that the rise in average global surface temperature by the end of the 21st century, relative to 1850–1900, will almost certainly exceed 1.5 °C for the plausible scenarios that have been explored; current patterns of energy use and GHG emissions may lead to warming of around 3–4 °C (Fig. 4). However, it is important to recognize that warming will not proceed uniformly, that there will be variability between years and from one decade to another, and that the trends will differ from region to region.

Figure 2. Historical trends in carbon dioxide concentrations and temperature, on a geological and recent time scale



Source: International Environment Forum (http://iefworld.org/climate_what.html)

Figure 3. Modelled recent temperature trends by region and globally



Source: AR5 Working Group I Summary for Policy-makers, 2013

Note: Model-testing by “back-casting” was carried out with anthropogenic forcing included in the model (pink bands) and without (violet bands).

- blue background:* Sea ice, from: $-4 (10^6 \text{ km}^2)$ to $+2 (10^6 \text{ km}^2)$
- yellow background:* Temperature change, from: $-1 (^\circ\text{C})$ to $+2 (^\circ\text{C})$
- white background:* OHC (oceanic heat content), from: $-2 (10^{22} \text{ J})$ to $+4 (10^{22} \text{ J})$

Figure 3. continued GLOBAL AVERAGES

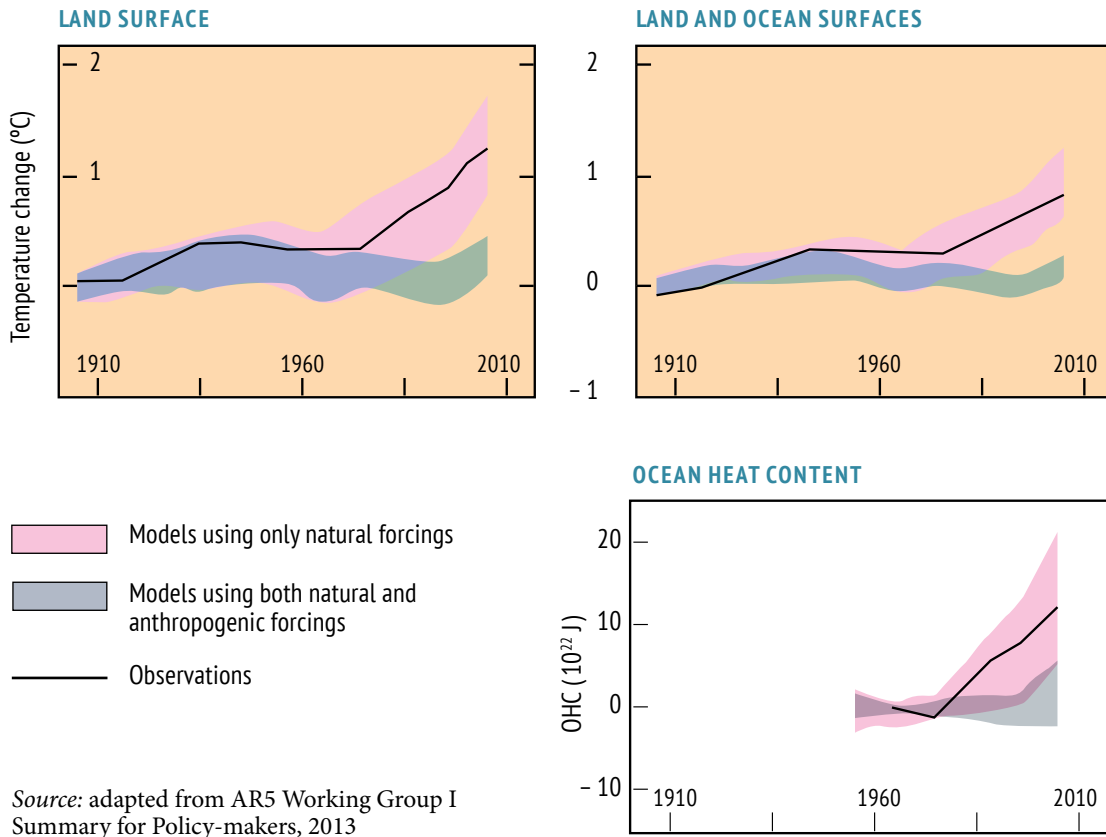
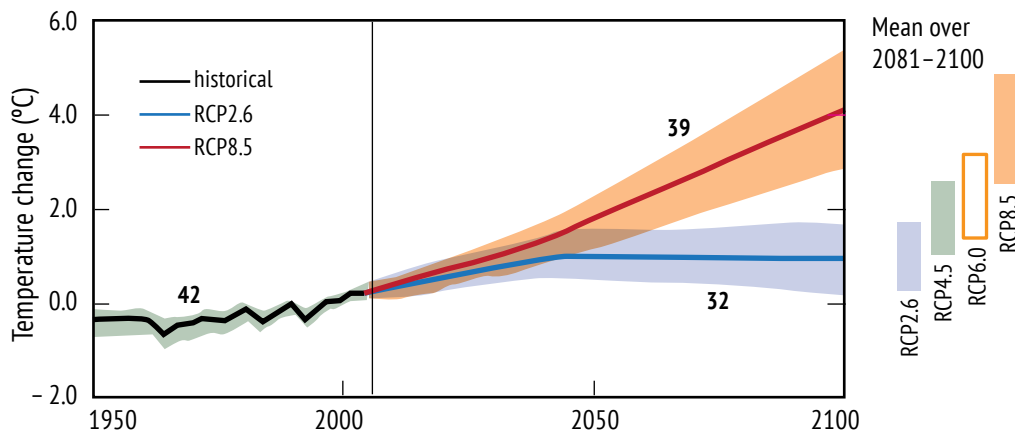


Figure 4. Future trend of global average surface temperature based on four different future climate change scenarios



Source: AR5 Working Group I Summary for Policy-makers, 2013

Note: Model-testing, with and without anthropogenic forcing, based on four different future climate change scenarios, representative concentration pathways (RCPs)

2.2 Climate change in the Pacific

The Pacific Australia Climate Change Science Adaptation and Planning (PACCSAP) programme is a collaboration among the Australian Bureau of Meteorology, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and meteorological services throughout the Pacific. It provides downscaled climate projections for the small island states of the Pacific region (Australian Bureau of Meteorology & CSIRO, 2011). The salient features of the PACCSAP models of climate change projections for the Pacific region are summarized in Box 2 below.²

Box 2. Climate change phenomena in the Pacific predicted by PACCSAP

- 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
- Decrease in sea-surface salinity (i.e. freshening) which, in association with the intensified warming, will make the surface ocean less dense and more stratified
- Accelerating sea-level rise
- Ocean acidification

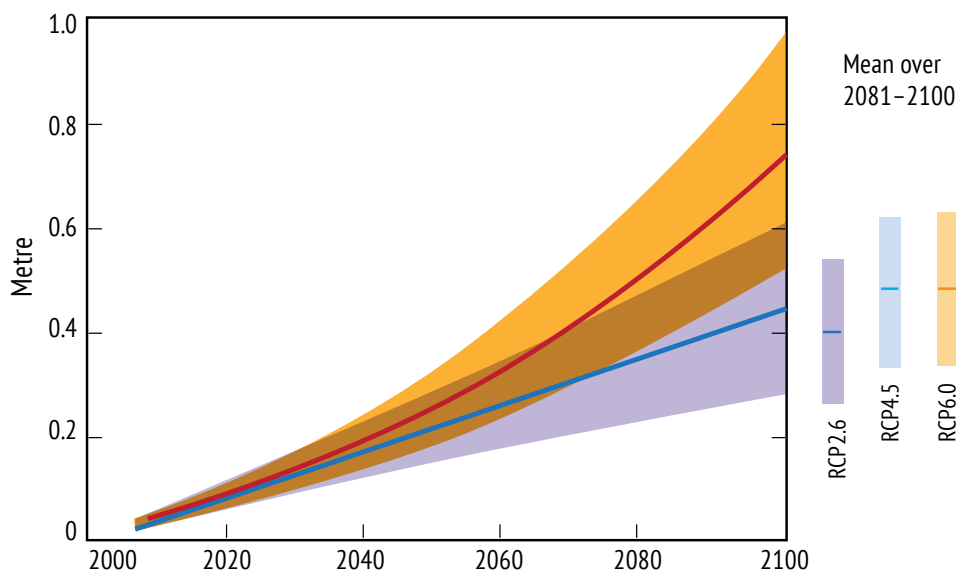
The PACCSAP findings are generally consistent with the AR5 (IPCC, 2014), which highlighted the exquisite vulnerability of SIDS to climate change-induced warming, altered rainfall patterns, increased storm severity and rising seas (IPCC, 2014).

The current maximum elevation of many low-lying atolls in Kiribati, Tuvalu and the Marshall Islands is 2–3 metres above sea level. Given the extreme susceptibility of low-lying island communities in the Pacific to the effects of sea-level rise, the projections shown in Figure 6 are of particular concern with respect to the risk of climate change-induced population displacement and detrimental impacts on land, livelihoods and sovereignty (Campbell, 2014).

Figure 6 refers to representative concentration pathways (RCPs), which are explained in detail in Box 3. The figure describes how emissions may evolve over the course of this century to produce different levels of radiative forcing. The other key determinants of GHG emission trajectories are socioeconomic development and policies to mitigate and/or adapt to climate change. While this report provides an overview of contemporary theory and evidence regarding the health impacts of exposure to climate change (Section 2.3 below), it is also important to note that describing such alternative future consequences for health in the context of these key drivers is an emerging area of climate change and health research (Ebi, 2013; O'Neill et al., 2013).

2. PACCSAP climate projections were derived using output from global climate model simulations of the future climate, performed as part of the international Coupled Model Intercomparison Project (CMIP3). The projections focused on simulations corresponding to three IPCC future scenarios representing B1 (low), A1B (medium) and A2 (high) greenhouse gas emissions, respectively, for three 20-year time periods (centred on 2030, 2055 and 2090). Source: Australian Bureau of Meteorology & CSIRO, 2011.

Figure 5. Global mean sea-level rise projections based on four different future climate change scenarios, representative concentration pathways (RCPs)



Source: AR5 Working Group I Summary for Policy-makers, 2013

Box 3. The representative concentration pathway scenarios

Representative concentration pathways (RCPs) describe the tracks that the global climate may take in the future for given emissions of climate-altering pollutants (CAPs) and changes in land use and land cover. The word “representative” signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. The term “pathway” emphasizes that not only are the long-term concentration levels of interest, but also the trajectory taken over time to reach that outcome.

RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which integrated assessment models produced corresponding emission scenarios. Extended concentration pathways (ECPs) describe extensions of the RCPs from 2100 to 2500, which were calculated using simple rules generated by stakeholder consultations, and do not represent fully consistent scenarios.

Four RCPs produced from integrated assessment models were based on the published literature and are used in the present IPCC Assessment as a basis for the climate projections:

- **RCP 8.5:** one high pathway for which radiative forcing reaches 8.5 W/m² by 2100 and continues to rise subsequently (the corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250);
- **RCP 6.0 and RCP 4.5:** two intermediate stabilization pathways in which radiative forcing is stabilized at approximately 6 W/m² and 4.5 W/m² after 2100 (the corresponding ECPs assuming constant concentrations after 2150); and
- **RCP 2.6:** one pathway where radiative forcing peaks at approximately 3 W/m² around mid-century and then declines (the corresponding ECP assuming constant emissions after 2100).

Source: IPCC, 2013

2.3 The links between climate change and human health

2.3.1 Synthesis of evidence on climate change and health

A rapidly growing body of evidence supports these fundamental premises:

- a. The global climate is undergoing changes that are unprecedented in scale, speed and anticipated duration due to the effects of anthropogenic (i.e. human-influenced) GHG emissions (IPCC AR5, 2013).
- b. Human health is susceptible to changes in climate and weather patterns via multiple, complex pathways (McMichael & Lindgren, 2011; McMichael, 2013).
- c. Some of the effects of climate change on health are already evident and can be estimated (McMichael et al., 2006).
- d. The impacts of climate change on human health are potentially very serious, and the effects will be disproportionately borne by vulnerable populations, in terms of geography (i.e. certain countries and regions within countries); society (i.e. the poor, children, the elderly and those with pre-existing illnesses); and occupation (e.g. agricultural and other outdoor workers) (Kjellstrom, Holmer & Lemke, 2009; WHO 2013).
- e. There are many opportunities to reduce or altogether avoid many of the risks to health that are attributable to climate change.

These key points are summarized in Box 4.

Box 4. Fundamental premises of climate change and health

- The climate is changing primarily due to human activity.
- Climate change affects human health.
- These effects are measurable.
- The effects of climate change on health will be mostly negative.
- The most severe of these effects can be avoided.

Various health disorders and categories of disease are known to be particularly sensitive to variations in climate. The pathways via which these health outcomes can be influenced by climate variability and change are complex, and include direct, indirect and diffuse effects; these are sometimes classified as primary, secondary and tertiary effects (Butler & Harley, 2010). An explanation of these categorizations and examples of each are provided in Table 1.

A model of the pathways between climate change and health is presented in Figure 7, and a more detailed explanation of the links between climate variability and each of the above-mentioned categories of disease is provided in Section 3.4 including, where possible, the evidence linking each of these health problems with climate in the Pacific.

Table 1. Categories of climate change-related risks to health, according to causal pathway

Risk category	Causal pathway
Primary	Direct biological consequences of heatwaves, extreme weather events and temperature-enhanced levels of urban air pollutants.
Secondary	Risks mediated by changes in biophysically and ecologically based processes and systems, particularly food yields, water flows, infectious disease vectors and (for zoonotic diseases) intermediate-host ecology.
Tertiary	More diffuse effects (e.g. mental health problems in failing farm communities, displaced groups, disadvantaged indigenous and minority ethnic groups). Consequences of tension and conflict owing to climate change-related declines in basic resources (water, food, timber, living space).

Source: adapted from McMichael, 2013a

2.3.2 The relative contribution and burden of Pacific island countries with respect to climate change impacts on health

It must be made clear that despite the fact that Pacific island countries and areas are – and will continue to be – among the hardest hit by the impacts of climate change, including the likely detrimental effects on health, these small, developing countries have contributed a negligible amount to the problem of climate change itself. Patz J, et al. compared cumulative CO₂ emissions by country for 1950 to 2000 versus the regional distribution of four climate-sensitive health effects such as malaria, malnutrition, diarrhoea, and inland flood-related fatalities. Their study depicted a very skewed balance between the relative contributions and health consequences of climate change on a global scale between developed countries and developing countries (Patz et al., 2007).

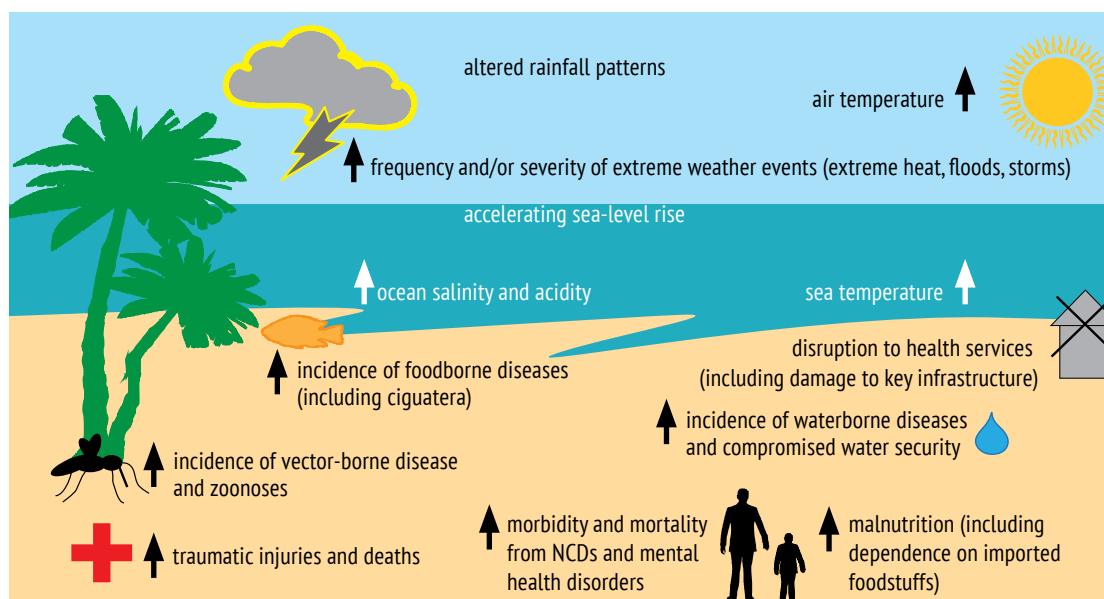
2.3.3 DPSEEA framework for climate change and health

There are several conceptual frameworks for relating environment, health, environmental health and their indicators. The driving force–pressure–state–exposure–effect–action (DPSEEA) framework is one that is more suitable and relevant for climate change and health (Hambling et al., 2011), as it describes the environmental determinants of health from the highest upstream factors to the eventual downstream health outcomes, and identifies key entry points for possible interventions by society.

The most upstream determinants of health originate in driving forces (D), leading to pressures on the environment (P). These pressures contribute to changes in the state (S) of the environment and hence human exposure (E), with potential health effects (E). The framework identifies feasible policy options and other actions (A), hence DPSEEA, at each stage in the causal chain to reduce the eventual adverse health effects. The framework is flexible and open to modification, as national situations differ and scientific knowledge is evolving constantly.

A suggested DPSEEA framework for climate change and health is given in Figure 6. It is important to note that this is a synthesizing diagram, not an alternative method of risk estimation or projection. The causal pathways of the framework provide health sector policy-makers with evidence-based policy options, necessary not only to lead the health sector adaptation at the downstream end but also to influence other sectors for primary prevention (upstream). It is important to use this framework in the context of health-in-all-policies, whole-of-government and whole-of-society approaches in order to maximize the health co-benefits of climate change adaptation, which are discussed in more detail later.

Figure 6. Pathways by which climate change may affect human health in the Pacific islands



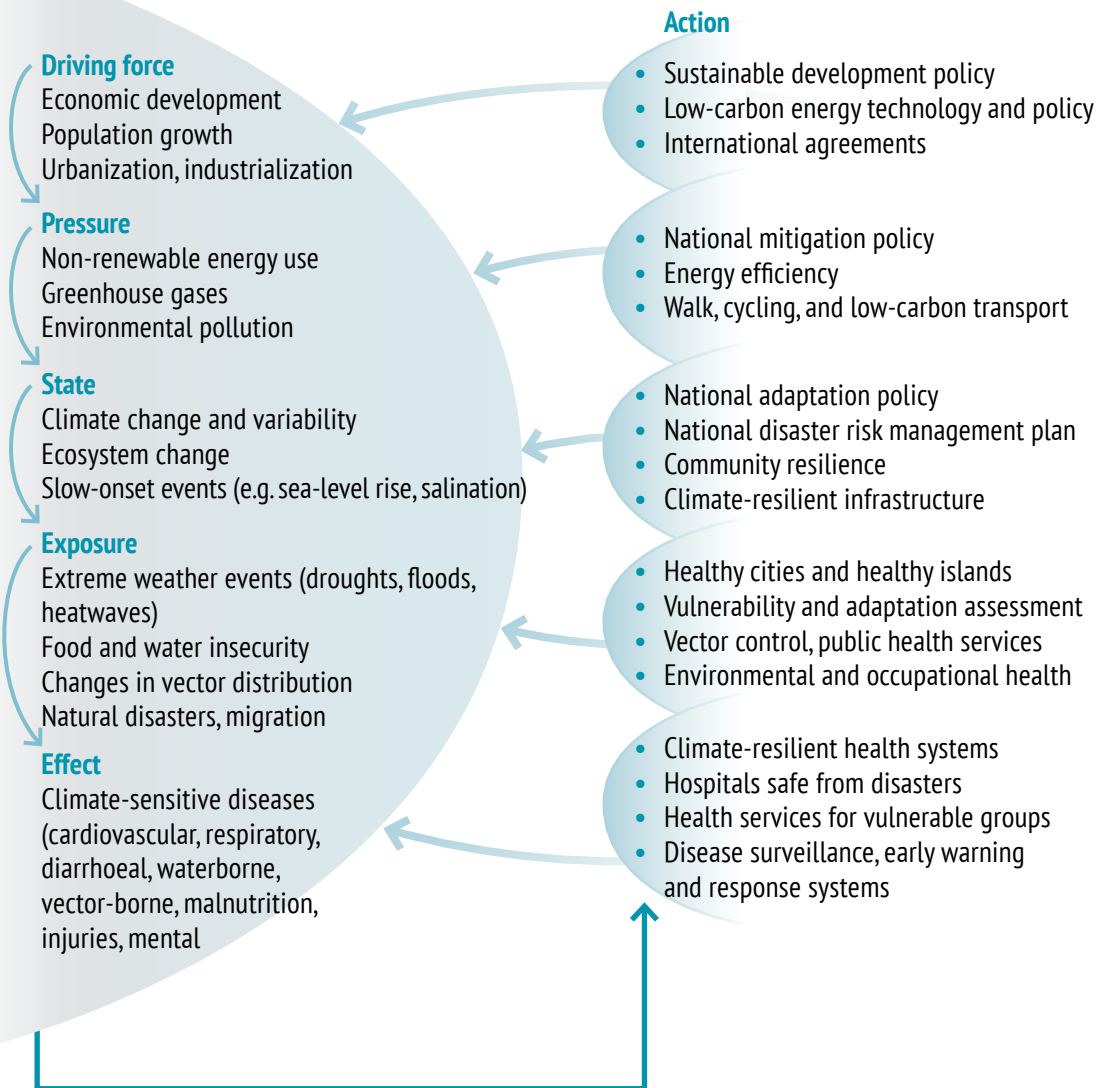
Pathways for health impacts

- direct and indirect exposures
- social disruption
- detrimental impacts on economic and human developments

Mediators of health impacts

- sociopolitical strategies
- environmental measures
- health systems resilience
- economic development

Figure 7. The driving force–pressure–state–exposure–effect–action (DPSEEA) framework for climate change and health



Sources: modified from Kovats et al., 2005; Kjellstrom & McMichael, 2013.



CHAPTER 3

Vulnerabilities of Pacific island countries to the health impacts of climate change

3.1 Assessing climate change and health vulnerability

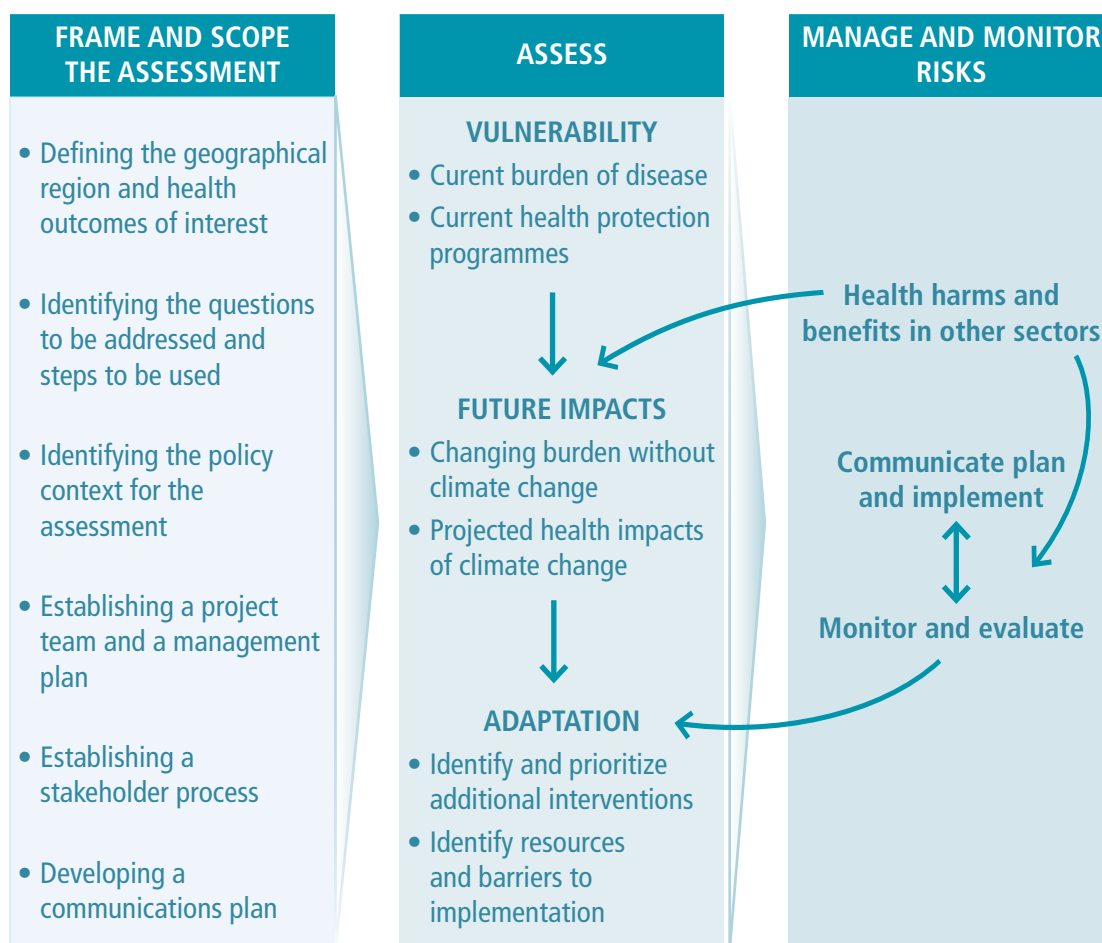
The recommended approaches for carrying out climate change and health vulnerability assessments within a population and recommending adaptation priorities and strategies typically involve several steps (Ebi, Kovats & Menne, 2006).

The key steps are given below:

- determining the scope of the assessment;
- describing the current distribution and burden of climate-sensitive diseases;
- identifying and describing current strategies, policies and measures that reduce the burden of climate-sensitive diseases;
- reviewing the health implications of the potential impact of climate change and variability on other (non-health) sectors;
- estimating the future potential health impact using scenarios of future climate change, population growth and other factors, and describing the related uncertainty;
- assembling the results and drafting a scientific assessment report (note: in the WHO-supported project in Pacific island countries and areas, these reports have taken the form of national climate change and health action plans [NCCHAPs] or the equivalent); and
- identifying additional adaptation policies and measures to reduce potential negative climate-related health effects, including procedures for evaluation following implementation.

A schematic representation of the iterative process of assessing climate change-related health risks is shown in Figure 8.

Figure 8. Overview of the vulnerability and adaptation assessment process



Source: WHO, 2013

As the literature suggests, and as can be seen from the steps described above, this approach depends to a considerable degree on the availability of epidemiological and meteorological data, for example, in describing contemporary burdens of disease and estimating the future impact of climate change on these diseases (Campbell-Lendrum & Woodruff, 2006). This has often proved difficult to put into practice in the Pacific, where the difficulty in obtaining accurate, reliable and sufficient quantitative data necessitates a mixed-methods or semi-quantitative approach to environmental health research, including the assessments of climate change and health vulnerability.

This “middle way”, which incorporates both quantitative and qualitative elements in the assessment of climate change and health vulnerabilities, and which prioritizes pragmatic and feasible adaptation strategies, has proved to be a suitable and pragmatic approach in the small island country context.

Other approaches that have contributed to aspects of vulnerability assessment and adaptation planning processes in some contexts include modifications of the health impact assessment (HIA) framework (Box 5). The HIA approach to climate change vulnerability assessments

includes additional elements such as health equity (Patz et al. 2008), and covers impacts across multiple aspects of society, including, but not limited to, regulation, legislation, ecosystem intervention, research and technological innovation, education, and infrastructure development. The use of HIAs in climate change has undergone successful trials in Australia (Spickett, Brown & Katscherian, 2011a) and elsewhere, and was adapted for the purposes of several of the climate change and health vulnerability assessments conducted in the Pacific, notably those for Nauru, Solomon Islands and Vanuatu (Spickett, Katscherian & McIver, 2013).

Box 5. The modified health impact assessment approach applied to climate change vulnerability assessments

Health impact assessment (HIA) is an analytical approach that facilitates the identification of potential health and health equity issues affected by a given policy or project, and provides possible options to mitigate, prevent or enhance those health outcomes (Quigley et al., 2006).

While HIA is frequently used to understand the health risks and benefits associated with a particular project in a particular setting, its use at the policy level is increasing. When used earlier in the decision-making process, i.e. at the point of articulating high-level policies or strategies, HIA can influence the overall framework that will regulate all activities and projects foreseen under that policy or strategy. Some health issues may be identified and addressed more effectively at the “upstream” or policy level, for example, through the modification of health and safety requirements that would be relevant for an entire sector or industry.

In the case of climate change policies, a more systematic use of HIA to identify and harness opportunities for health co-benefits may have the additional benefit of helping to build wider and longer-lasting support for the implementation of the desired policies. Benefits to the environment that will be realized by reductions in GHG emissions are likely to be diffuse and will be measured at the global level over a much longer time frame than benefits to health, which will be localized and more immediate (and therefore more evident to potential constituencies).

Monitoring and measuring changes in health outcomes associated with a particular climate change policy can also provide a degree of transparency about the extent to which that policy has benefited society. In this way, HIA can often be used to establish an accountability framework for monitoring and measuring the health and/or social performance of climate change policies.

Finally, in this discussion of health vulnerabilities to climate change in the Pacific, it is important to note that the health status of Pacific island communities is generally poor, with average life expectancies 10 years or more below those of developed countries (Taylor, Bampton & Lopez, 2005), and rates of obesity and noncommunicable diseases (NCDs) among the highest in the world (WHO, 2011). Thus, the predominant concern regarding the role of climate change in the context of health in the South Pacific region, at least in the early stage of human-induced climate change, is the potential for it to act as a “multiplier” or “amplifier” of existing health problems, rather than introducing new or uncommon health problems per se.

3.2 Methods used to assess climate change and health vulnerabilities in Pacific island countries

Thirteen Pacific island countries are included in this report. Eleven Pacific island countries – Cook Islands, the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Solomon Islands, Tonga, Tuvalu and Vanuatu – participated in the formal Vulnerability Assessment and Adaptation Planning project led by WHO between 2010 and 2013.

These 11 countries were separated into three groups, roughly based on geography; each group was supported by a team of WHO staff and consultants throughout a three-phase project over two years.

- The first phase involved inception workshops, bringing together country representatives and consultants to review the current state of knowledge on climate change and health, and discuss vulnerabilities and approaches to adaptation appropriate to each country.
- The second phase saw the consultant teams visit each of the countries for further stakeholder consultations – across government and nongovernment agencies, including community representatives and the private sector – as well as examination of the available local data on climate and climate-sensitive diseases.
- In the final phase, during return visits to each country, the WHO teams assisted the country teams in drafting NCCHAPs, reflecting each country's key vulnerabilities and adaptation priorities with respect to the country-specific health impacts of climate change.

The approach adopted by these 11 countries was essentially a “mixed methods” one, with a quantitative, statistical analysis favoured in some countries (the Marshall Islands, the Federated States of Micronesia and Palau), and a more qualitative, consultative, interview-based approach in others (Cook Islands, Kiribati, Niue, Samoa, Tonga and Tuvalu). Three countries (Nauru, Solomon Islands and Vanuatu) focused more specifically on a modified HIA approach described in the section above.

Samoa's climate change and health assessment work incorporated a model combining physical, spiritual, mental and other aspects of vulnerability and resilience, the outcomes of which are elaborated further in Chapter 5.

Fiji has been engaged for several years in a seven-country global project (along with Barbados, Bhutan, China, Jordan, Kenya and Uzbekistan), supported by WHO and the United Nations Development Programme (UNDP) with funding from the Global Environment Facility (GEF), entitled Piloting Climate Change Adaptation to Protect Human Health (PCCAPHH). The majority of the analytical work on the PCCAPHH project to date has focused on the construction of a climate-based early warning system (EWS) to provide timely information about possible epidemics of four high-priority climate-sensitive infectious diseases. Details of this and other core activities of the PCCAPHH project are provided in Chapter 5, along with discussion of other climate change and health-related priorities in Fiji.

The process of performing the vulnerability and adaptation assessments described above, while broadly similar across all countries, was nevertheless unique for each country, reflecting the methods and expertise of the consultant groups, the availability of climate and health data, and the particular priorities of the stakeholders, and climate change and health teams

in each country. It should be re-emphasized, however, that the overarching framework applied to the vulnerability assessment and adaptation planning process in all Pacific island countries and areas resembled that described in Section 3.1.

In the context of strengthening health systems in relation to climate change adaptation, issues of equity and access are cross-cutting and of paramount importance (Friel et al., 2008; Patz et al., 2008). Therefore, a common and recurring theme throughout this climate change and health vulnerability assessment and adaptation planning work was the imperative to consider the specific needs of vulnerable groups, such as young children, the elderly, those in poverty, those with pre-existing illnesses and disabilities, those in certain geographical locations such as coastal villages, and people engaged in certain occupations, such as fishing, agriculture or construction.

A strong feature of this work in Pacific island countries was the qualitative element, largely carried out via engagement with stakeholders in each country. This was particularly important, given the very small populations in question, with under-resourced health systems and health professional capacities stretched to the extreme. While in many cases health data were incomplete, of uncertain quality, or missing altogether, health sector colleagues and other stakeholders engaged willingly in the discussions, debates and consensus-building that are a vital part of national assessments and plans. This characteristic of climate change and health work in the Pacific, where precision was lacking and uncertainty large, meant that the adaptation planning process favoured a “no/low regrets” approach, whereby the plans for health adaptation aimed “to increase the capacity of society to manage climate risks with a view to reducing the vulnerability of households and maintain or increase the opportunities for sustainable development” (Heltberg, Siegel & Jorgensen, 2009). This approach is consistent with that recommended for smaller and/or developing countries and weaker health systems (Wardekker et al., 2012).

In relation to the consensus-building approach to the vulnerability assessment used in several Pacific island countries, many of the NCCHAPs include a “likelihood-versus-consequence” matrix as a tool used to rank priorities with respect to climate-sensitive health risks, rationalize resources and focus the activities of the health sector on the most urgent adaptation activities. This matrix is shown in Table 2. In the use of this matrix, each climate-sensitive health risk was considered in terms of the *likelihood* of the burden of disease increasing with climate change³ and the *impact* of such an increased health burden occurring (considering also the resilience or coping capacity of the community and health sector to manage such consequences).

Table 2. Matrix of the risks posed by climate change, cross-classified by their likelihood and their impact (on health)

Likelihood	Impact (considering consequence and coping capacity)				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	Medium
Rare	Low	Low	Low	Low	Medium

Source: Adapted from McMichael, 2013a

3. In general, a 20-year time frame was used for the purposes of these risk assessments, i.e. impacts were considered in terms of their likelihood and consequences attributable to climate change up to the year 2030.

3.3 Summary of climate-sensitive health risks identified in Pacific island countries

Table 3 summarizes the climate-sensitive health risks prioritized in each country's vulnerability assessment. It is important to note that different processes were used in each country to ascertain the climate change-attributable risks to health in Table 3, and understand that this table is intended to provide only an indication of the current priorities of each of the Pacific island countries with respect to climate-sensitive health risks. Many Pacific island countries had a long list of climate-sensitive health risks requiring consideration of adaptation; only the highest-priority issues have been included in this summary table. These priorities may change with time and as new information becomes available, and the summary list provided is not intended to be exhaustive.

Table 3. Highest priority climate-sensitive health risks in Pacific island countries

CLIMATE-SENSITIVE HEALTH RISK	COUNTRY												
	Cook Islands	Fiji	Kiribati	Marshall Islands	Micronesia (Federated States)	Nauru	Niue	Palau	Samoa	Solomon Islands	Tonga	Tuvalu	Vanuatu
Direct effects													
Health impacts of extreme weather events ¹	X	X		X	X	X	X	X	X	X	X	X	X
Heat-related illness ²	X					X	X			X			X
Indirect effects													
Water security & safety (including waterborne diseases) ³	X	X	X	X	X	X	X	X	X	X	X	X	X
Food security & safety (including malnutrition & foodborne diseases) ⁴	X	X	X	X	X	X	X		X	X	X	X	X
Vector-borne diseases ⁵	X	X	X	X	X	X	X	X	X	X	X	X	X
Zoonoses ⁶		X			X			X					
Respiratory illness ⁷	X			X	X	X	X	X		X		X	X
Disorders of the eyes, ears, skin and other body systems ⁸		X		X			X			X		X	X
Diffuse effects													
Disorders of mental/ psychosocial health ^{a,9}		X		X	X	X		X		X		X	X
Noncommunicable diseases (NCDs) ^{a,10}		X		X	X		X	X		X	X	X	X
Health systems problems ^{a,11}		X	X										
Population pressures ¹²			X										

- a. A number of climate-sensitive health risks may be considered to cut across categories – for example, there may be direct mental health consequences of extreme weather events; NCDs may be affected indirectly through disruption of food supplies, or more diffusely through sociopolitical strategies related to climate change, industry and trade; health systems problems may be directly affected by extreme weather events as well as via the broader impact of climate change on development.

Notes on Table 3:

1. While this was typically taken to mean traumatic injuries and deaths, it may also be assumed to include the psychosocial impacts of extreme events.
2. Including occupational exposure to hotter working conditions.
3. This category encompasses waterborne infections causing diarrhoeal illness, as well as typhoid fever, and also includes problems such as sea-level rise-induced salination of potable water supplies.
4. Including food insecurity, foodborne diseases causing diarrhoeal illness and ciguatera (“fish poisoning”).
5. Including, but not limited to, dengue fever and malaria; noting that these two diseases occur in some, but not all, Pacific island countries (e.g. malaria is currently limited to Solomon Islands and Vanuatu).
6. The primary zoonosis of concern in most Pacific island countries is leptospirosis.
7. Including infections, obstructive airways disease (e.g. asthma) and the pulmonary effects of heat and air pollution.
8. This category includes a range of health problems, from skin infections and cataracts to sexually transmitted infections that were of concern in various Pacific island countries in the context of climate change.
9. Includes the unspecified detrimental effects of social disruption, e.g. loss of life, land or livelihoods due to climate change-related phenomena; this category may include, inter alia, depression, anxiety and post-traumatic stress disorder.
10. While NCDs is a non-specific term, in this context it primarily refers to circulatory diseases (e.g. cardiovascular disease, cerebrovascular disease, hypertension, etc.) as well as endocrine disorders such as diabetes; in some Pacific island countries, this was also taken to include cancers and mental health disorders.
11. Including compromised access to health services, damage to health infrastructure and additional strain on scarce resources (e.g. for climate-sensitive disease surveillance).
12. Includes the possibility of climate change-induced resettlement, and the effect of climate change-induced sea-level rise in exacerbating overcrowding.

An important issue to note is that it proved difficult – and often impossible – to ascertain the *detectable* and *attributable* effects of climate variability and change on health indicators, e.g. incidence of climate-sensitive diseases (CSDs) in most Pacific island countries, due to the lack of suitable data for statistical analysis. On the occasions when this process was possible during the vulnerability assessment for a country, this information is presented in the respective country subchapter.

For more detail regarding the processes by which these lists were derived, the rationale for including each of the climate-sensitive health risks and the ranking of these risks according to their perceived priority, refer to section 3.2, the country subchapters (Chapter 5).

3.4 Categories of climate-sensitive health risks in Pacific island countries

As can be seen from Table 3, the majority of the climate change and health priorities identified in Pacific island countries largely reflect the long-held concerns of experts in the field of climate change and health: issues such as increasing incidence of food-borne, waterborne and vector-borne diseases and more dramatic health impacts of heat extremes and natural disasters hark back to some of the earliest work on climate change conducted by WHO in the late 1980s (WHO, 1990).

In the next section, each of these main categories of climate-sensitive health risks will be reviewed with reference to the evidence linking the disease with climate variability and change, and the rationale for including each category of health risk in the vulnerability assessments for Pacific island countries. It is important to note that many of these health risks are interrelated, such as malnutrition and diarrhoeal diseases, so they must be considered together as well as separately.

3.4.1 Health impacts of extreme weather events

The destructive and socially disruptive impact of more frequent and/or severe extreme weather events is one of the clearest pathways by which climate change may affect human health. By both directly increasing the risk of traumatic injuries and deaths due to amplifying events such as tropical storms (cyclones) and floods, and indirectly increasing the risk of a range of health effects resulting from such events (such as compromised supply and safety of food and water, and the short- and long-term mental health consequences of disasters), climate change is likely to contribute substantially to the health burden of future hydro-meteorological disasters in the Pacific region (Field et al., 2012; Mahany & Keim, 2012; Schipper & Pelling, 2006; van Aalst, 2006).

In Fiji, the impacts of recent tropical storms and floods were investigated in terms of their association with epidemics of climate-sensitive infectious diseases. A data analysis of Ba subdivision of Fiji suggested that there was a strong relationship between these extreme weather events and outbreaks of dengue fever and diarrhoeal disease (Table 4; McIver et al., 2012).

Table 4. Odds ratios of climate-sensitive disease (CSD) outbreaks in the month following extreme weather events in Ba subdivision, Fiji

Extreme weather event	Odds ratio (OR)* of CSD outbreak in the month following the event
Drought	Dengue fever: OR = 5.17 Diarrhoeal disease: OR = 9.0
Floods caused by tropical depressions	Dengue fever: OR = 10.57
All floods	Diarrhoeal disease: OR = 3.5

* Odds ratios provide an estimate of the relative magnitude of the risk of outbreak. All results displayed are significant at the $P \leq 0.05$ level

Source: McIver et al., 2012

3.4.2 Heat-related illnesses

The health impacts of heat, and the increasing burden of heat-related illness in the context of climate change, are major concerns for many countries (Huang, Barnett & Xu 2013; Kovats & Hajat, 2008; Williams et al., 2013; Xu et al., 2014). It is likely that the majority of the

increased burden of heat-related illness due to climate change will be borne by those least able to adapt; these include children, the elderly, people with chronic illnesses or disability, and people in certain occupations such as farmers and factory workers (Kjellstrom, Holmer & Lemke, 2009; Lundgren et al., 2013; Tong et al., 2014; Xu et al., 2013).

While most of the concern about, and research into, the health effects of heat and likely impacts of climate change have been focused on temperate countries, there is growing interest in the likely effects of increasing ambient temperatures on health in tropical countries (Tawatsupa et al., 2014). A research project is currently under way investigating the association between temperature and mortality in Fiji, which may yield important lessons for other Pacific island countries and areas as they consider their adaptation priorities.

3.4.3 Water safety, water security and waterborne diseases

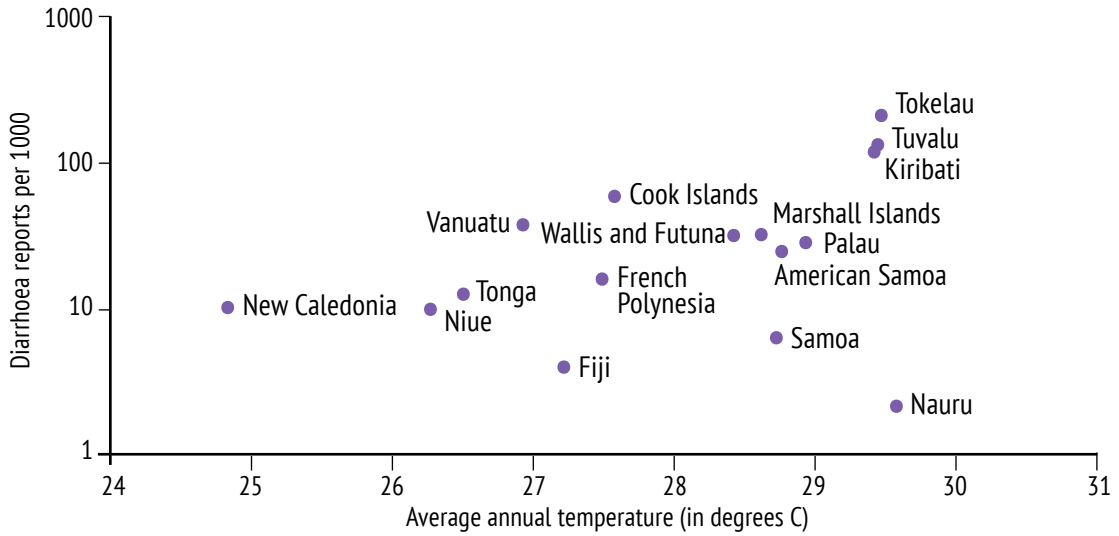
Water insecurity, or water stress, is a major concern in the context of climate change in the Pacific, particularly with respect to altered rainfall patterns and more severe extreme weather events such as droughts and floods (Cashman, Nurse & John, 2009; McMichael & Lindgren, 2011). Rapidly growing demand, land-use change leading to deforestation, urbanization and tourism are already placing significant strain on the limited freshwater reserves in small island environments (IPCC, 2014). The atoll countries (Kiribati, the Marshall Islands, Nauru, Tuvalu and Tokelau) are particularly susceptible to water insecurity from climate change, being dependent on rainwater and, in some cases, freshwater aquifers. The potential for sea-level rise-induced salination of potable water sources has substantial implications for health, including the prospect of increasing or exacerbating hypertension, which is already problematic in the context of NCDs and a risk to maternal and child health during pregnancy (Khan et al., 2011).

The potential for waterborne infectious diseases to increase with climate change has been described at length in the scientific literature (Braks & Husman, 2013; Cann et al., 2013; Funari, Manganeli & Sinisi, 2012; Hunter, 2003). Water may transmit disease via contamination with bacteria, viruses and/or protozoa (Leclerc, Schwartzbrod & Dei-Cas, 2002); the risk of contamination by these pathogens increases with temperature, extremes of rainfall (scarcity and abundance, manifested at worst by droughts and floods) and during natural disasters, including via the displacement, crowding and disordered behaviours of affected people and communities (Brown & Murray, 2013; Cann et al., 2013).

In terms of the overall burden of ill health, diarrhoeal illness is the most significant category of waterborne disease. Diarrhoeal illness has been shown to be sensitive to changes in climatic conditions, such as temperature, rainfall and humidity, around the world, including in the Pacific. Figure 10 depicts the positive correlation between annual average temperature and rates of diarrhoeal disease notifications in Pacific island countries and areas (Singh et al., 2001).

With respect to rainfall, the relationship between monthly precipitation and childhood diarrhoea was investigated as part of the WHO-supported PCCAPHH project in Fiji. The findings of this analysis demonstrated a typical U-shaped relationship between rainfall and diarrhoea incidence in Suva, indicating that the number of diarrhoea cases tends to increase with extremes of rainfall, i.e. either very dry or very wet conditions (Fig. 11) (McIver et al., 2012).

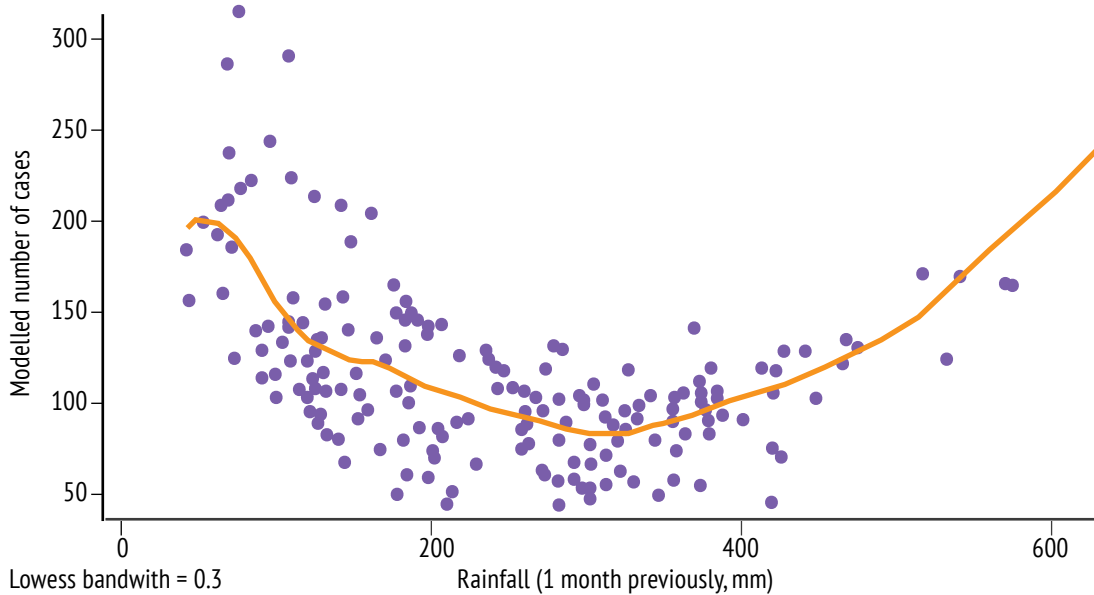
Figure 9. Annual average temperature and average reporting rates for diarrhoeal disease, Pacific islands (1986–1994)



Note: $r^2 = 0.49$; $P < 0.05$

Source: Singh et al., 2001

Figure 10. Monthly cases of diarrhoea (dots) versus monthly rainfall (line) of previous month in Suva (Fiji)



Source: McIver et al. 2012

Note: Figure based on a time-series Poisson regression model. The solid orange line is a Lowess smooth illustrating a typical “U-shaped” relationship.

3.4.4 Food safety, food security, malnutrition and foodborne diseases

Climate change and variability may have an impact on the occurrence of food safety hazards at various stages of the food chain, from primary production through to consumption. There are multiple pathways through which climate-related factors may impact food safety, including changes in temperature and precipitation patterns, increased frequency and intensity of extreme weather events, ocean warming and acidification, and changes in contaminants' transport pathways, among others (Tirado et al., 2010).

The prospect of climate change-induced changes in food supply, including detrimental impacts on domestic agriculture and fisheries, has long been considered to be one of the major risks posed by climate change on human health (Costello et al., 2009). In the Pacific, the Asian Development Bank (ADB) has described the problem thus: "Climate change in the Pacific ... will have both direct and indirect effects on food security. The most direct effect, particularly in the smaller atoll countries, will be further reduction of already declining agricultural output per capita as a result of increasing natural disasters and rising sea level in the longer term" (ADB, 2011). It must be noted that agriculture is marginal in many Pacific islands, and transport and fuel costs are high; climate change is likely to further exacerbate existing problems of food insecurity (Carter, 2012). A 2008 report by the Food and Agriculture Organization of the United Nations (FAO) points out that "addressing the challenges of food security by taking into account current and future changes in climate is critical to reducing poverty and food insecurity" (FAO, 2008).

Malnutrition – especially under-nutrition – is a particularly common problem of childhood in many developing countries, including Pacific island countries and areas. It is strongly linked with communicable disease risk and has profound implications for child health and development; thus the potential for climate change to exacerbate these may have severe consequences for Pacific island communities (Lovell, 2011). The phenomenon of "overnutrition", or consumption of excess energy-dense foodstuffs (particularly imported products), is also problematic in many Pacific island countries and areas, and is closely related to the issue of climate change and NCDs.

The potential impacts of climate change on foodborne diseases relate largely to the effects of rising temperatures, which are likely to increase the burden of certain pathogens, such as bacteria, in food along the pathway from preparation and handling to cooking, serving and storing. Several authors have made reference to the potential increased risk of pathological contaminants in food in warmer conditions, including *Salmonella* (the pathogen responsible for causing both salmonella food poisoning and the more serious typhoid fever, which may be spread by food or water), *Shigella*, *Campylobacter*, *Escherichia coli* and a range of viruses (Britton et al., 2010; D'Souza et al., 2004; El-Fadel et al., 2012; Kovats et al., 2004).

Both foodborne and waterborne pathogens may cause diarrhoeal disease; the real concern for this to increase in warmer and/or wetter conditions has been demonstrated in a number of studies, both in the Pacific region (Singh et al., 2001) and elsewhere (Checkley et al., 2000; Wu et al., 2013). In developing countries overall, it has been inferred that warming of 1 °C may be expected to be associated with an increase in diarrhoea of 5% (WHO, 2004). Diarrhoeal diseases are discussed in further detail in the subsequent section on waterborne diseases.

Another foodborne illness of concern in the context of climate change in the Pacific is ciguatera. Ciguatera is a toxidrome, caused by a toxic dinoflagellate organism that bioaccumulates in the marine food chain and is caused by consumption of contaminated reef

fish.⁴ The incidence of ciguatera has been linked to sea surface temperatures and ENSO cycles (Hales et al., 1999a; Llewellyn, 2010; Skinner et al., 2011). Pacific island countries have among the highest rates of ciguatera in the world, and there is evidence that the incidence of ciguatera in Pacific island countries has risen over the past few decades (Skinner et al., 2011). Table 5 compares the incidence of ciguatera in Pacific island countries between two 10-year periods (1973–1983 and 1998–2008).

Table 5. The changing rates of ciguatera in Pacific island countries (cases per 100 000 population per year)

Pacific islands	1973–1983		1998–2008		Δ Rank
	Incidence	Rank	Incidence	Rank	
Cook Islands	2	16	1453	2	> 1.5
French Polynesia	565	2	344	3	< 1
Fiji	17	11	144	8	> 3
Guam	8	14	2	14	0
State of Hawaii	NR		3	18	NA
Kiribati	393	4	314	7	< 3
Marshall Islands	282	5	416	4	> 1
Micronesia (Federated States of)	2	16	NR		NA
Nauru	11	13	0	16	< 3
New Caledonia	148	6	10	12	< 6
Niue	84	8	333	6	> 2
North Mariana	130	7	56	10	< 3
Palau	0	18	5	13	> 4
Samoa	57	9	2	15	< 6
Tokelau	995	1	1554	1	0
Tonga	17	12	29	11	> 1
Tuvalu	462	3	83	9	< 6
Vanuatu	22	10	397	5	> 5
Wallis and Futuna	5	15	0	16	< 2

Source: Skinner et al., 2011

3.4.5 Vector-borne diseases and zoonoses

There is an abundance of literature on the links between climate, climate variability and the incidence of diseases transmitted by insect vectors (Erickson et al., 2012; Ermert et al., 2012; Hales et al., 1999a; Thai & Anders, 2011; Tong et al., 2008; Yamana & Eltahir, 2013). This is true also for diseases, such as leptospirosis, transmitted from animals such as rodents and domestic livestock (Desvars et al., 2011; Sakundarno et al., 2014). For most of these diseases, the risk posed by climate change relates to the increased geographical spread of the vector/

4. It is important to note that, in the majority of the notifiable disease surveillance systems used in the Pacific, there is no specific case definition for ciguatera, as opposed to “fish poisoning”, which may refer to simple food poisoning from improperly cooked or stored fish, meaning that the distinction between these two different clinical entities is probably often blurred. This is compounded by the fact that ciguatera is a clinical diagnosis, i.e. there is currently no reliable laboratory test available to confirm ciguatera in humans, although there is for fish.

host (e.g. warmer and wetter conditions may favour the distribution of mosquito populations inland and upland), changing seasonality and/or the potential for greater exposure of humans to the vector/host organisms (e.g. the increased proximity to rodents during floods) (Estrada-Peña et al., 2014; Morin, Comrie & Ernst, 2013). Of these diseases, the most relevant to the Pacific are malaria, dengue fever, leptospirosis and, to a lesser extent, lymphatic filariasis and rarer arboviruses such as chikungunya and Zika virus.

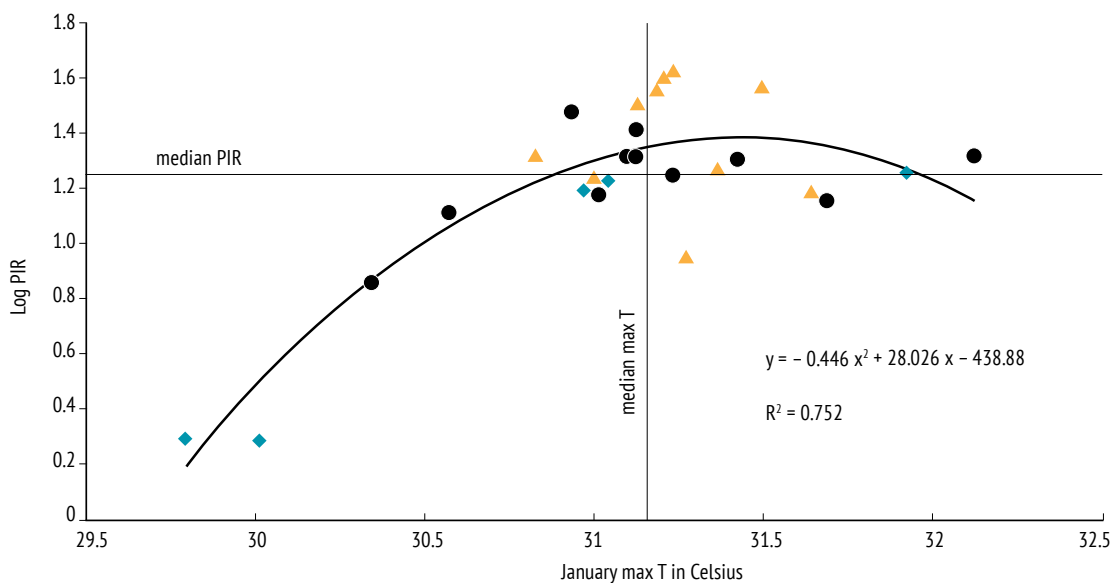
The relationship between malaria and climate, and the possible implications of climate change for the spread of malaria have attracted significant global research attention for many years (Martens et al., 1995). In the Pacific, the limited research on climate change and malaria to date includes some analysis of the relationship between temperature and malaria incidence in Solomon Islands (Fig. 11), suggesting that there is an ideal temperature range for malaria (a finding which is in line with research elsewhere); more detailed analysis of climate and malaria in Solomon Islands is under way.

Recent modelling of the potential spread of malaria due to climate change suggests that, in many regions, the climate will become more suitable, and the net proportion of the global population at risk from malaria will increase over the course of this century (Caminade et al., 2014).

Modelling of the potential spread of dengue fever due to climate change suggests that the global population at risk of dengue fever may increase by one to two billion people by the end of this century, due to the possible effects of climate change on humidity alone (Hales et al., 2002).

Models of both dengue and malaria suggest that socioeconomic development will at least partly offset the adverse effects of global climate change on these diseases (Aström et al., 2012; Béguin et al., 2011; Colón-González et al., 2013; Liu-Helmersson et al., 2014).

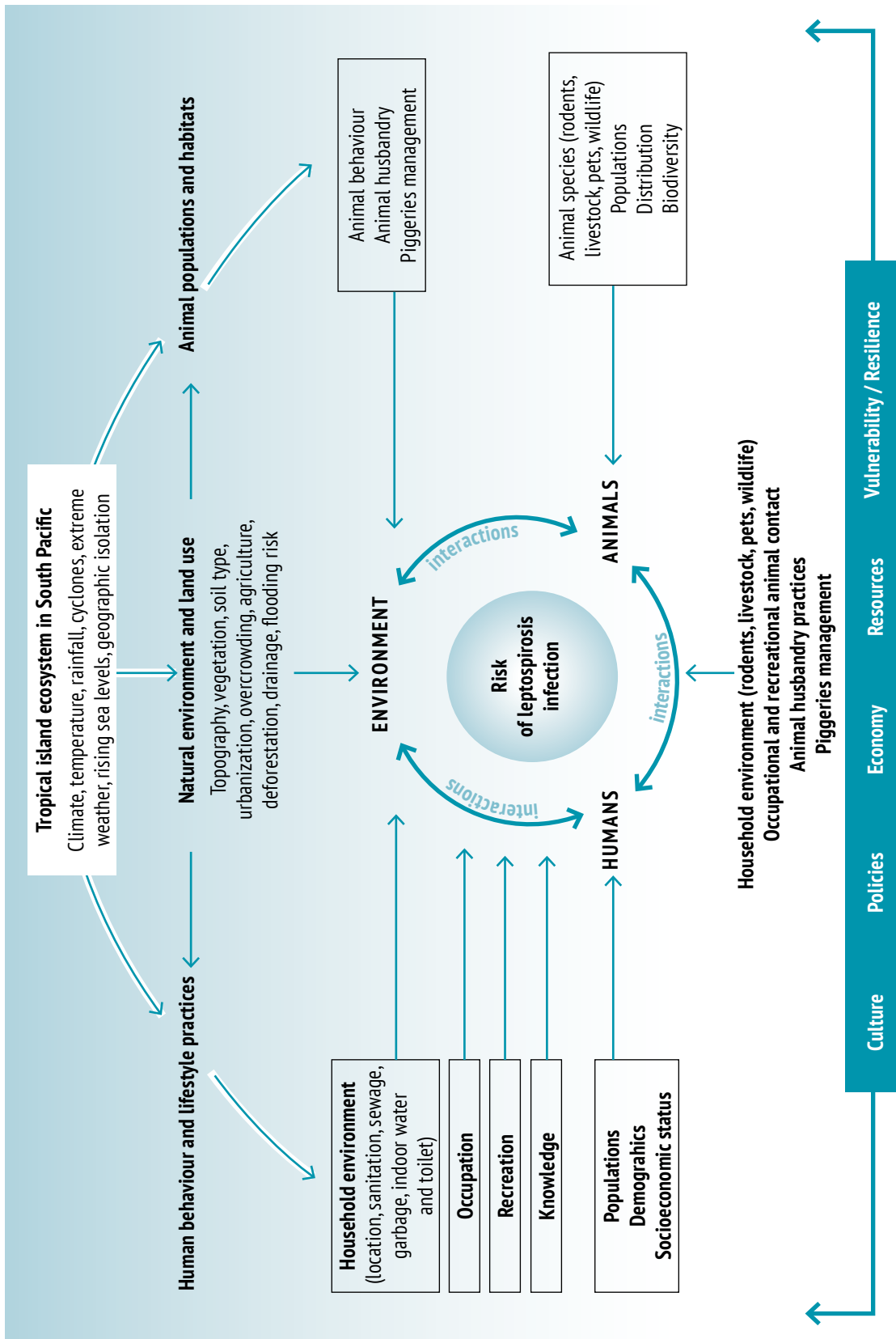
Figure 11. The relationship between maximum temperature in January and malaria transmission from February to May in the Solomon Islands



Source: Abawi et al., 2011

Note: Malaria transmission is expressed in terms of log parasitological incidence rate (PIR), an indirect measure of the rate of malaria infection in humans. Triangles indicate El Niño, diamonds La Niña and circles non-ENSO years

Figure 12. Conceptual framework of the human–animal–environment interface for leptospirosis in American Samoa

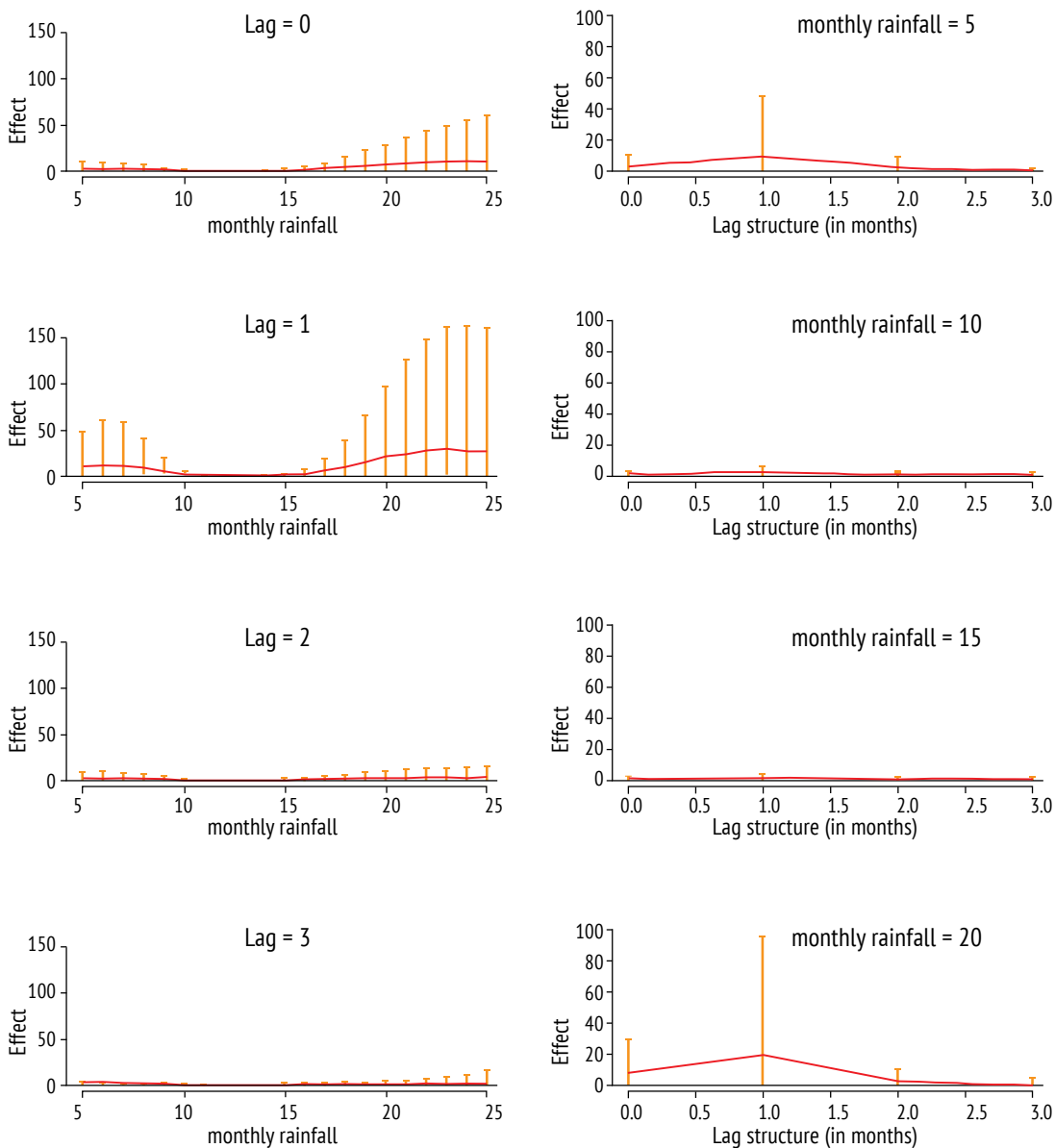


Source: Lau & Jagals, 2012

In the case of leptospirosis, the complex interactions among humans, animals and the environment, including climate factors, in transmission of the infection in the Pacific island context are shown in Figure 12. This also illustrates well the need for multisectoral awareness and participation in prevention strategies, and the difficulty of modelling likely future risks and rates of diseases with complex ecology.

The relationship between rainfall and leptospirosis incidence in Palau is displayed in Figure 13, which suggests that leptospirosis in Palau appears to be worst in the weeks following a high rainfall month – 20 inches or more. This apparent temporal lag in leptospirosis cases following rainfall concurs with other similar studies conducted in tropical regions (Lhomme et al., 1996).

Figure 13. Relationship between levels of rainfall (in inches), lag structure (in months) and the number of leptospirosis cases (effect) in Palau



Source: Palau NCCHAP, 2011

Note: Relationships are driven from distributed lag non-linear modelling, suggesting that there may be a threshold effect for leptospirosis cases one month following heavy rainfall.

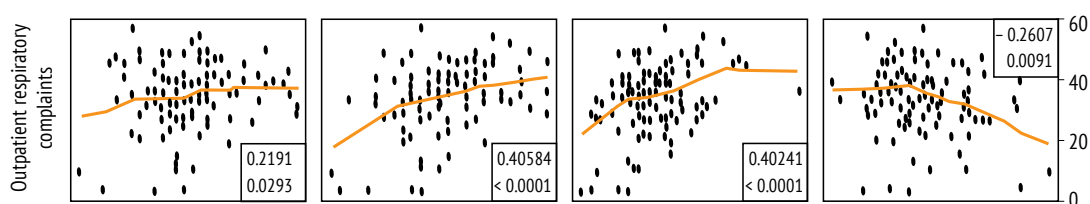
3.4.6 Respiratory diseases

A range of respiratory illnesses may be exacerbated by altered weather patterns attributable to climate change, including infections such as influenza, pneumonia and tuberculosis (Curseu et al., 2010; Gilbert, Slingenberg & Xiao, 2008), obstructive airways diseases (e.g. asthma) and allergies (Beggs & Bambrick, 2005; Rice et al., 2014). Individuals with pre-existing respiratory diseases and other illnesses, those living in overcrowded conditions – conducive to the spread of respiratory droplets – and vulnerable groups such as children are at increased risk (Jouret, 2013; Paynter et al., 2010; Takaro, 2013). Climate change also affects weather patterns, which may increase the morbidity and mortality associated with air pollution (Sujaritpong et al., 2014), particularly for those with pre-existing cardiopulmonary conditions (Spickett, Brown & Rumchev, 2011).

Climate variables have also been associated with respiratory illness in the Pacific region, as shown in Figure 14, from the vulnerability assessment work conducted in the Marshall Islands, which suggested that patients presented to the outpatient clinic on Majuro with respiratory complaints more often in hotter weather, and less often with increasing rainfall, although the reasons for this apparent association were unclear.

Both ambient (outdoor) and household (indoor) air pollution generated by combustion in industry, urban transport and cooking cause respiratory and other diseases, which can be fatal. It is well known that local weather conditions and air pollution are interdependent. While most SIDS in the Pacific are largely spared the enormous health burden of air pollution as compared to other developing countries, there are nevertheless “hotspots” of air pollution in the Pacific, which may be associated with respiratory ill health. The damage caused by the use of solid-fuel fires for cooking, emission from motor vehicles in urbanized areas and phosphate dust (specific to Nauru) can potentially be exacerbated by climate change (Sujaritpong et al., 2014).

Figure 14. Relationship between monthly climate variables and cases of outpatient cases of respiratory complaints, derived from time-series analyses for Majuro, Marshall Islands



Source: The Marshall Islands NCCCHAP, 2011

Note: Upper number in small box is regression coefficient, and lower number in small box is its P-value.

3.4.7 Mental health

The slowly expanding literature on the topic of climate change and mental health suggests that mental health is sensitive to climate-related events such as droughts and floods (Berry, Bowen & Kjellstrom, 2010; Cunsolo et al., 2013; Fritze et al., 2008; Reynolds et al., 2010). Such impacts – anxiety, depression, excess worry, PTSD, survivor guilt and “solastalgia” (the

distress experienced by people affected by environmental change) – may have already been observed in many places, and the burden of these mental health problems is significant (Albrecht et al. 2007; McNamara & Westoby 2011; Willox et al., 2012). In the Pacific, where the identity and culture of communities are closely linked to local environments, changes in those environments may contribute to a change in cultural practices and identity, with potentially negative impacts on mental health (Adger et al., 2012).

Given the mounting evidence of the link between climate change and mental health, and given their particular vulnerability to many impacts of climate change including natural disasters, people in Pacific island countries and areas are likely to be at high risk for mental illnesses attributable to climate change. This is particularly of concern in atoll communities and those whose lands and livelihood are imperilled by acute natural disasters and sea-level rise.

3.4.8 Noncommunicable diseases

One important area of emerging concern – and a climate change exposure–impact pathway largely missing from the conceptual models to date – is the potential for climate change to exacerbate the existing and rapidly increasing burden of NCDs. NCDs were among the top priorities in terms of climate change and health in several Pacific island countries and areas, and many participants in the vulnerability assessment and adaptation planning process around the Pacific were firm in their belief that climate change would lead to a worsening of the NCD crisis.

The literature exploring the links between climate change and NCDs is scant, and has hitherto tended to focus on the pathways between heat and/or extreme weather events and acute exacerbations of existing disease (Friel et al., 2011; Kjellstrom & McMichael, 2013). Some research into the links between climate change and NCDs in the Pacific context is taking place, and some qualitative assessments of the problem have been conducted via a WHO-led survey (Box 6).

Island countries in the Pacific region have among the highest rates of obesity and related NCDs, such as hypertension, dyslipidaemia and Type 2 diabetes in the world (WHO, 2011). Concern about this trend has led some countries to take extraordinary measures, such as the Government of Palau declaring a state of emergency in an attempt to access a wider range of resources to tackle the problem. At least some Pacific island countries and areas see climate change as a potential additional driver of NCD risk, for example, by further worsening the conditions for domestic agriculture – due to rising temperatures, variable rainfall, salinization of soil and other factors – and by decreasing willingness or ability to exercise or perform outdoor work in hotter and/or wetter conditions. Population displacement caused by climate change may increase urbanization in Pacific island countries and areas, and drive adverse changes in diet and physical activity, further increasing the burden of NCDs.

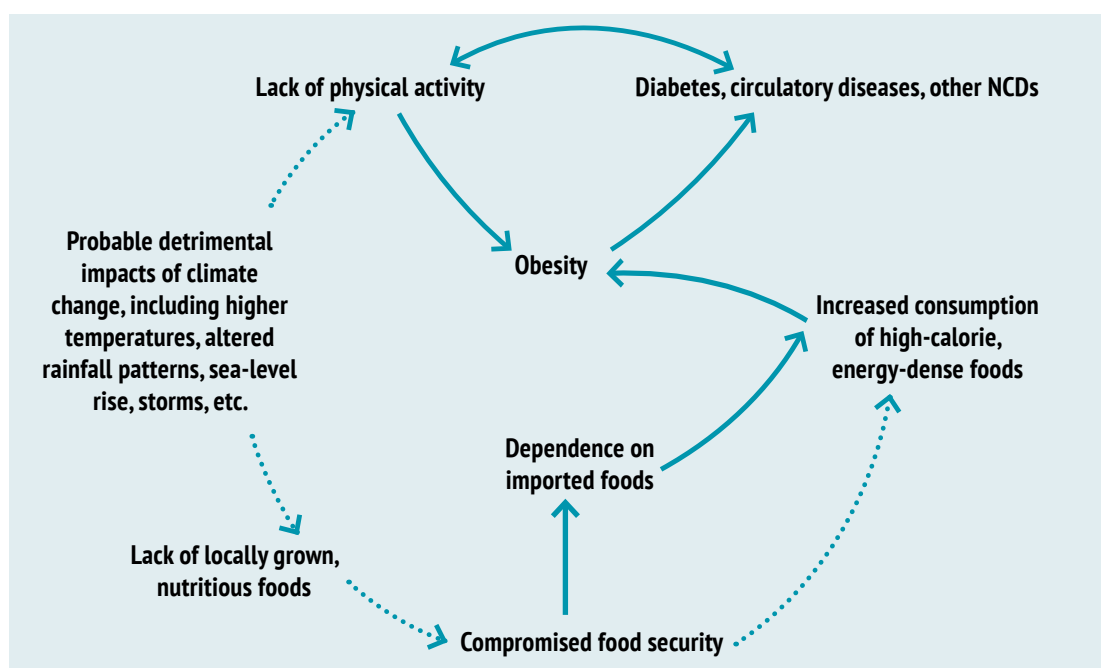
These slower, more insidious pathways by which climate change may impact on NCDs, and the potential for climate change to contribute to new cases of NCDs rather than merely exacerbating the morbidity and mortality of existing diseases, are summarized in Figure 15.

Box 6. Climate change and NCDs in the Pacific

In 2012, staff from the WHO Division of Pacific Technical Support moderated a forum on climate change and NCDs via the Pacific Solution Exchange (<http://www.solutionexchange-un.net/pacific/pacific-about.php>). In response to the question “What is your experience or perception of the ways in which climate change may be affecting NCDs (heart disease, diabetes, cancer, obesity, etc.) in your Pacific community?” members shared many personal stories and experiences of climate change impacting on community NCD rates. In Tokelau, according to one respondent: “...the combined impact of climate change and health issues is more than a concern for our people – they’re issues of everyday survival”. Other Pacific nations cited similar stories. A repeated frustration by respondents was the tendency, after a natural disaster such as a flood where root crops were damaged, for villagers to rely on temporary food sources such as rice, canned food and frozen food but then these “become a habit and before realizing it this now is a way of life”. Purchasing and eating more processed foods rather than growing vegetables “can cause people not to work in their gardens, not doing physical activity... and be lazy, hence increasing their risk factors for NCDs”.

Interestingly, it was contested that “the increase in health issues like heart disease is not being caused by climate change – it’s always been hot and there’s always been flooding and coastal erosion – but (now there is) more because of increasing urbanization and a health system that needs improving”. This evolved into a useful discussion on whether the combination of climate change, urbanization and the consumption of processed foods resulted in the “hike” in NCDs in the Pacific. There was, however, a common call for better education to quell the increase in NCDs, regardless of whether the cause is climate change or urbanization, as “...to change the mind-set of communities (regarding preventive action on NCDs), community empowerment is critical”.

Figure 15. Conceptual model summarizing the pathways between climate change and NCDs (dotted arrows represent hypothetical links)



3.4.9 Disruption of health services

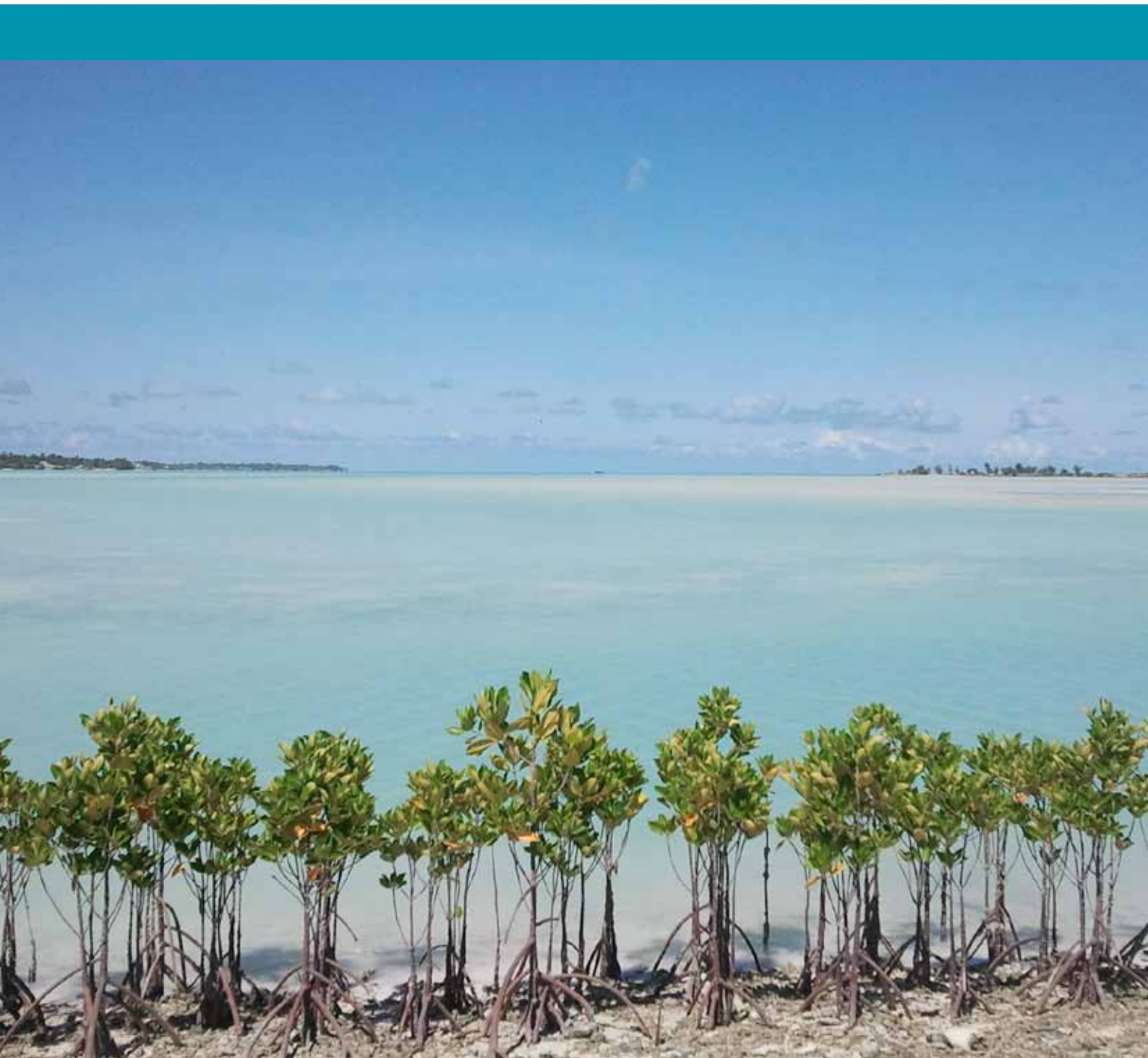
Another critical vulnerability due to climate change in the Pacific relates to health infrastructure. Many health facilities – including some of the largest referral hospitals in the region – are positioned in low-lying and/or coastal locations, and are thus highly susceptible to sea-level rise, particularly high tides (often called king tides) and storm surges, in addition to the increasing threat posed by tropical storms and floods. Niue’s hospital was completely destroyed by the extreme conditions related to tropical Cyclone Heta in 2004, and the National Referral Hospital of Solomon Islands was damaged by the flash floods in 2014. Health service delivery was completely or partially disrupted by Cyclone Pam in 2015 mainly due to damaged health facilities, health workers being over extended or unable to report for work because they were taking care of their families, and reduced water and energy supplies.

In addition to the physical damage to health infrastructure, hydro-meteorological disasters such as storms and floods have profound effects on the health workforce. A SWOT (strengths, weaknesses, opportunities, threats) analysis of the health sector’s response to the massive flood events in Fiji in early 2012 revealed that the health staff in the affected areas performed admirably under extreme conditions, including travelling to clinics in boats and emergency vehicles to treat patients and staff clinics non-stop to meet the extraordinary demand. Working in such hardship conditions is clearly unsustainable and ensuring a workforce “surge capacity” is a key element of health systems adaptation in the Pacific.

3.4.10 Population pressures

Climate change, particularly sea-level rise, has the potential to interact with high fertility rates, increasing population densities and overcrowding, particularly in land-poor atoll countries such as Kiribati, the Marshall Islands and Tuvalu, thus increasing the likelihood and urgency of internal population movement or out-migration (Smith & McNamara, 2014). While migration may be considered an effective adaptation strategy by some, these are processes that nevertheless entail additional potential health and social problems for both source and recipient communities (Locke, 2009; McMichael, Barnett & McMichael, 2012; Reuveny, 2007; Ware, 2005). It must be noted that migration is often seen as a source of strength for Pacific communities because of the extra resources that can be accessed in host countries or communities, but when displacement is forced and rapid, the balance of gains and losses may tip towards the negative.

The AR5 chapter on Small Islands reports: “On Majuro atoll (the Marshall Islands), rapid urban development and the abandonment of traditional settlement patterns has resulted in movement from less vulnerable to more vulnerable locations on the island. Likewise, geophysical studies of Fongafale Island, the capital of Tuvalu, show that engineering works during World War II, and rapid development and population growth since independence, has led to the settlement of inappropriate shoreline and swampland areas, leaving communities in heightened conditions of vulnerability. Ascribing direct climate change impacts in such disturbed environments is problematic due to the existing multiple lines of stress on the island’s biophysical and social systems. However, it is clear that such pre-existing conditions of vulnerability add to the threat of climate change in such locations” (Small Islands, Chapter 29. IPCC, 2014).



CHAPTER 4

Health adaptation strategies for Pacific island countries

4.1 Defining “adaptation” in the context of climate change and health

There are a number of generic definitions of “adaptation” in relation to climate change, most of which make reference to an adjustment in natural or human systems to a changing environment. The definition preferred here is: “The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects.” (IPCC Glossary, 2014)

In the context of climate change and health in SIDS in the Pacific region, adaptation is related to health systems strengthening and more broadly “health resilience building”. Most of the urgent steps that need to be taken to reduce harm caused by climate change relate to core public and environmental health functions. However, the nature of adaptation goes beyond “business as usual” within the health sector. Adaptation at the national level typically requires cross-sectoral collaboration; health adaptation is no exception. In relation to health, adaptation also implies taking into account the effects on health of mitigation/adaptation activities in other sectors. Another way of putting this is to seek a health-in-all-policies approach.

In the developing country context, and particularly for SIDS, improvement and expansion of public, environmental and primary health services in the context of national climate change adaptation should be considered as a part of the national adaptation package. Significant adjustments to current programmes and implementation of new policies and measures, often on a much broader front, are required to address future risks, which are expected to be much larger and possibly outside the capacity of the health sector to manage.

At this point it is also important to note that, throughout their history, Pacific communities have long demonstrated a high degree of resilience to environmental changes. While it may be argued that such resilience has the potential to protect, to some degree, against the

disruptive influence of climate change, it must be repeated that the rate, scale and impact of climate change in modern human history are unprecedented. Therefore, previously evolved protective measures and existing capacities are unlikely to be sufficient to address the new challenges of climate change.

4.2 Adaptation to the health impacts of climate change in the Pacific context

Since 2010, the WHO Division of Pacific Technical Support (DPS) collaborated with the Pacific island countries to develop climate change and health adaptation plans that address the health impacts of climate change in the Pacific context.

The approach to adaptation planning for climate change and health in Pacific island countries included a number of elements adapted from the theory and practice of climate change and health adaptation (McMichael & Kovats, 2000), taking into account the lessons learnt from adaptation planning in developed countries (Panic & Ford, 2013), adaptation in the context of infectious diseases (Ebi et al., 2012) and the application of an HIA approach to adaptation (Spickett et al., 2011a).

Adaptation measures in most Pacific island countries were considered according to the following categories:

- legislative/regulatory,
- public education/communication,
- surveillance/monitoring,
- ecosystem intervention,
- infrastructure development,
- technological/engineering responses,
- medical intervention, and
- research/further information.

Each adaptation measure was considered in relation to the following:

- relevance for each Pacific island country;
- current capacity, inclusive of vulnerable groups/regions within each island;
- how adaptations could be implemented in each Pacific island country (adjustment/modification of existing measures or the development of new measures); and
- identification of sectors that would be involved in the development and implementation of the adaptation strategies.

For those countries that used a likelihood-versus-consequence approach to ranking climate-sensitive health risks (Table 3), the adaptation priorities accorded to each of these threats corresponds to a level of urgency of action, as outlined in Table 6.

Table 6. Types of action required for each level of risk posed by climate change to health

Risk levels for health	Description of management action
Extreme	Risks require urgent attention at the most senior level.
High	Risks are the most severe that can be managed by the community in the absence of action at the highest levels of society.
Medium	Risks can be expected to be part of normal circumstances but maintained under review by appropriate sectors.
Low	Risks will be maintained under review but it is expected that existing controls will be sufficient and no further action will be required to treat them unless they become more severe.

Overall, the sum of the adaptation strategies planned in Pacific island countries may be considered to contribute to the building of climate-resilient health systems; before proceeding to further discussion on this, the reader is directed to Box 7, which defines “health system”. It is important to note that health system has a much broader meaning than health-care system. Climate change policies that tackle the environmental determinants of health to protect and promote population health are a part of a climate-resilient health system.

Box 7. What is a health system?

A health system consists of all organizations, people and actions whose primary intent is to promote, restore or maintain health. This includes efforts to influence the determinants of health as well as more direct health-improving activities. A health system is therefore more than the pyramid of publicly owned facilities that deliver personal health services. It includes, for example, a mother caring for a sick child at home, private providers, behaviour-change programmes, vector-control campaigns, health insurance organizations, occupational health and safety legislation. It includes intersectoral action by health staff; for example, encouraging the ministry of education to promote education among females, a well-known determinant of better health.

The term health system is often misunderstood as “health-care system” which has a much narrower meaning. That is why service delivery, one of the six pillars of a health system, is not the same as health-care service delivery. Investments in education, housing, transport, water and sanitation, improved governance, or environmental policy and climate change adaptation can all benefit health. Actions by other sectors can also have adverse effects on health, something that is recognized by the growing requirement for health impact assessments. Considering the health co-benefits of climate change mitigation and adaptation, climate change policies at the national level may affect a health system, even though they are typically not considered to constitute part of a health-care system.

Source: WHO, 2007

4.3 Climate-resilient health systems in Pacific island countries

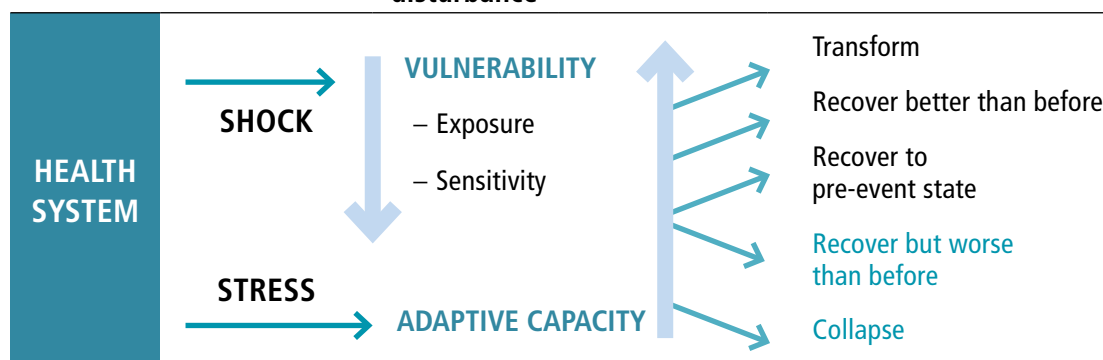
A climate-resilient health system is “a health system that is capable to anticipate, respond to, cope with, recover from and adapt to climate-related shocks and stress, so as to bring sustained improvements in population health, despite an unstable climate”.⁵

The concept of resilience of health systems is depicted in Figure 16. Efforts at building resilience to climate change take a systemic approach by focusing on the system-wide capacities needed to address climate-specific health risks. Resilience building is comprehensive and applicable to all climate-related health risks; it supports an all-hazards approach to risk management by strengthening capacities that are useful for managing a range of health risks, from disease outbreaks to health emergencies; it enables cross-sectoral collaboration for prevention and management; and empowers communities to play a role in assessment and responses.

The process of building resilience occurs in two principal ways: by reducing vulnerability, and developing specific system capacities that augment opportunities available and improve decision-making. A climate-resilient health system is better prepared, responsive, adaptive, and more agile and efficient in responding to and recovering from the impacts of climate change.

Figure 16. The concept of resilience in the context of health system stressors

1. Context	2. Challenge, disturbance	3. Capacity to deal with disturbance	4. Choices, opportunities	5. Outcome, options
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Resilience = Decreased vulnerability + Increased capacity, improved choices and opportunities

Source: Guillemot J. Draft summary of Operational framework for building climate resilience (working paper of 22 October 2013).

5. Guillemot J. Draft summary of Operational framework for building climate resilience (working paper of 22 October 2013).

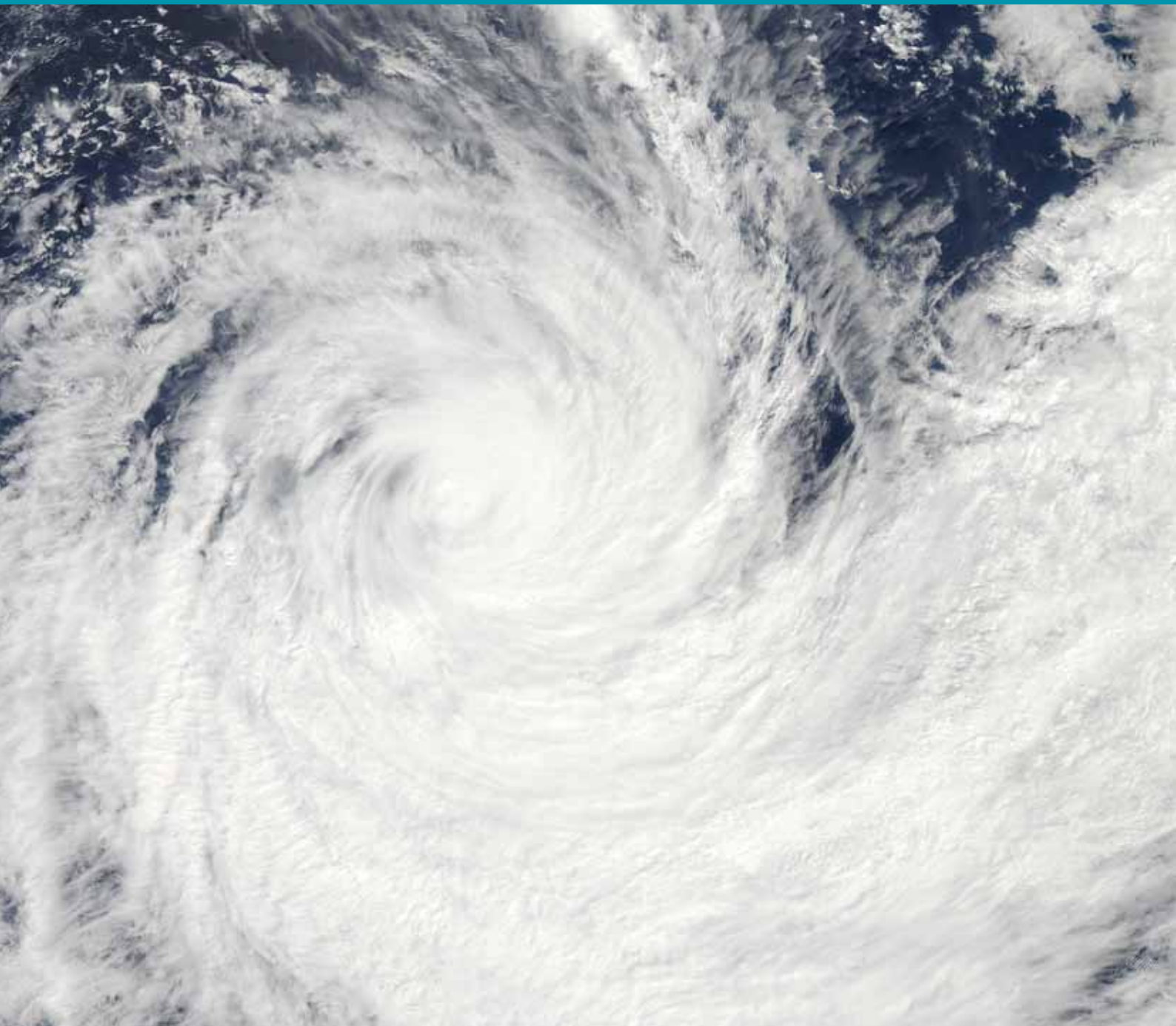
Adaptation and building climate resilience are closely related but not synonymous. Adaptation refers to strategies and measures developed and implemented in response to identified and predicted risks. Many adaptation responses can help to build resilience. More detail regarding the specific adaptation activities planned for each Pacific island country can be found in the country-specific subchapters (Chapter 5).

It is vital to note that there are a number of overarching, large-scale priorities for health adaptation in the Pacific region, including issues that are not universally reflected in the country-specific subchapters or in the NCCHAPs. Box 8 outlines several of these key adaptation measures that apply to most Pacific island countries and areas, albeit not necessarily in order of priority.

A final, important note is that adaptation strategies and priorities differ in terms of their timelines and levels of urgency. Some measures, such as improving surveillance and water, sanitation and hygiene (WASH) facilities, are urgent and feasible in the near term; others, such as climate-proofing infrastructure, may take years to complete, and then require ongoing maintenance and upgrading; other activities, such as improving food and water security, may have time horizons of several decades.

Box 8. High-priority health adaptation measures in Pacific island countries

- Ensuring that health and safety considerations are incorporated into adaptation activities across sectors (health-in-all-policies approach)
- Improving the safety and security of food and water sources
- Improving sanitation and hygiene facilities
- Increasing resources for health emergency risk management
- Developing climate-based early warning systems
- Climate-proofing key health and safety infrastructure
- Enhancing surveillance targeting climate-sensitive diseases and their risk sources, including improving baseline data collection and evaluation, digitization of health records, dissemination of relevant information, training and increased human resources
- Conducting applied environmental epidemiological research focusing on climate-sensitive diseases
- New and improved communication pathways among the health sector, meteorology/climate services and other stakeholders



CHAPTER 5

Country-specific health vulnerability assessments and adaptation plans in the Pacific region

In the following section, each of the climate change-related health vulnerabilities and adaptation plans of the Pacific island countries are detailed as follows:

1. Background to climate change and health

The context of climate change and health in each country is described, identifying the key agencies, institutions and policies involved, and previous work related to health vulnerability analysis and adaptation planning.

2. Key climate-sensitive health risks

The key threats posed by climate change to health in each country are summarized, along with a description of the methodology employed to identify those risks.

3. Adaptation themes and activities

A list of adaptation strategies and specific activities are outlined for each country, in relation to the priority climate-sensitive health risks identified in the vulnerability analysis.

4. Recommendations

Each country subchapter concludes with a list of recommendations, based on those outlined in the respective NCCHAP, along with some additional suggestions based on the expert consensus of the authors of this report.



5.1 Cook Islands

5.1.1 Background

The national vision of Cook Islands is: “To enjoy the highest quality of life consistent with the aspirations of our people, and in harmony with our culture and environment”, and the main planning document for Cook Islands is the *National Strategic Development Plan (NSDP)*, “Te Kaveinga Nui – Living the Cook Islands Vision: a 2020 Challenge”.

The objective of the NSDP is “to build a sustainable future that meets our economic management, environment integrity, social stability, and our Cook Islands Maori culture, and the needs of our future generations”.

The NSDP strategies are national priorities. While none of the strategic goals explicitly reference climate change, Goal 4: “Sustainable use and management of our environment and natural resources”; Goal 5: “Strengthened and affordable basic infrastructure, transport and utilities to support national development”; and Goal 6: “A safe, secure and resilient community”; have particular relevance. The NSDP, furthermore, is aligned with the nation’s regional and international commitments such as the Pacific Plan, MDGs and other multilateral environmental agreements, such as, among others, the UNFCCC and the Biodiversity Convention.

The *National Environment Strategic Action Framework 2005–2009* (NESAF) is referenced in the NSDP and provides guidance and direction for achieving sustainable social and economic progress in Cook Islands. This includes using its natural resources and environment wisely. The third goal of the NESAF is to increase resilience by strengthening national capacities for climate change, variability, adaptation and mitigation. In addition, the *Cook Islands Disaster Risk Management National Action Plan* provides policy direction on both preparation and risk reduction for disasters, as well as response, recovery and rehabilitation when they occur.

The Cook Islands NCCHAP aligns specifically with the NSDP, NESAF and, most importantly, with the crossing-cutting *Joint National Action Plan for Disaster Risk Management and Climate Change Adaptation (2011–2015)*, or JNAP, as well as other cross-sectoral plans such as the *Cyclone Recovery Reconstruction Plan*.

5.1.2 Key climate-sensitive health risks

Consultations with stakeholders and community members as part of the joint Ministry of Health/WHO climate change and health vulnerability and adaptation planning project, and the process of compiling the Cook Islands Second National Communication to the UNFCCC, identified the following list of priority CSDs in Cook Islands:

- vector-borne diseases (e.g. dengue fever),
- waterborne diseases (causing diarrhoeal illness),
- fish poisoning (ciguatera),
- heat-related illness,
- respiratory diseases, and
- health impacts of extreme events such as cyclones.

In addition, it is possible that climate change will contribute to exacerbating the burden of mental health problems and NCDs in Cook Islands.

5.1.3 Adaptation themes and activities

The adaptation priorities for Cook Islands relate directly to the above-mentioned climate-sensitive health risks. Specific strategies discussed in the NCCHAP are summarized in Table 7.

Table 7. Adaptation strategies related to priority climate-sensitive health risks in Cook Islands

DENGUE FEVER

- Consider stricter quarantine controls (e.g. for travellers from islands with outbreaks); this may be possible at the level of island by-laws (noting that epidemics spread easily between the islands at present).
- Improve training opportunities for vector control officers (requires funding and expanded training attachment opportunities; currently limited to clinical training, rather than preventive health).
- Seek resources for a public health laboratory (for mosquito identification as well as food and water testing).
- Research needs:
 - investigate local relationships between the mosquito population, dengue fever and climatic factors (temperature, rainfall, etc.), which would enable more focused preventive activities to mitigate the impact of outbreaks; and
 - monitor resistance to insecticides/larvicides.

DIARRHOEAL DISEASE

- Provide specific up-skilling opportunities for Health Protection Unit personnel, e.g. specialized food/water technicians.
- Conduct enhanced surveillance, particularly of known “hotspots” on each island.
- Improve household sanitation practices.
- Consider internal exchange/training opportunities for Health Protection Officers for capacity-building in the context of climate change.

CIGUATERA

- Increase health promotion and surveillance of cases.
- Consider high-risk groups (e.g. tourists, the poor, less educated); develop pamphlet for tourists, distribute to hotels, etc.

HEAT-RELATED ILLNESSES

- Plant trees to reduce heat and glare.
- Target high-risk groups (young children, older people, those with pre-existing illnesses and certain occupations: fishermen, pearl divers, outdoor workers, etc.) with education and protective measures.
- Ensure adequate household ventilation.
- Consider insulation and the benefits of thatched roofs rather than corrugated iron.

RESPIRATORY ILLNESSES

- Conduct research on the relationship between respiratory problems and climatic factors.
- Consider strategies to control speeding vehicles on outer islands (to limit dust).

HEALTH IMPACTS OF EXTREME WEATHER EVENTS

- Improve physical coastal protection (prevent erosion).
- Increase the regularity and improve quality of disaster response simulation training/drills.
- Improve stockpiling (preparation, storage) of medications, supplies, personal protective equipment, life jackets, lights/torches, etc. (including outer islands).
- Improve debriefing, evaluation and response following each disaster (and dissemination of information/ lessons learnt/recommendations for improvement).
- Improve collaboration with disaster risk management and response agencies in the country.
- Improve Internet access to outer islands for purposes of providing reliable and timely disaster information.

MENTAL HEALTH PROBLEMS

- Increase awareness and capacity of health sector to respond to mental health consequences of disasters such as cyclones (anecdotally, behaviours change dramatically after cyclones on the outer islands, e.g. looting, sexual activity, violence, eating habits).
- Improve training in counselling services.
- Recruit/train mental health specialists (nurses, medical officers, psychologists, counsellors, etc.).

Ensure adequate and consistent supply of medications (e.g. antipsychotics) to outer islands.

NONCOMMUNICABLE DISEASES

- Recognize link with food security; aim to ensure adequate supply of nutritious foods (preferably locally grown, less energy-dense).
- Raise awareness of risks to health of increasingly sedentary lifestyle, particularly in hotter weather; and benefits to health (and environment) of reducing motorized transport (increase walking, riding of bicycles).
- Consider subsidizing bicycles and promoting traditional ways of life (e.g. paddling canoes).
- Consider novel economic incentives/penalties, e.g. taxes for unhealthy foods; subsidies for health foods; fines/differential payment scales for NCD patients according to level of compliance (in an effort to increase accountability/ personal responsibility).

Source: Cook Islands NCCHAP, 2012

5.1.4 Recommendations

The main recommendations in the Cook Islands NCCHAP are as follows:

- The work plan template for implementation of climate change and health adaptation activities should be reviewed at the highest levels within the Ministry of Health (urgently, then reviewed on at least an annual basis) in order to plan in terms of priority, feasibility, costs and possible partners.
- The climate change and health vulnerability and adaptation assessment, including the list of climate-sensitive health risks and the range of adaptation options, should be incorporated into the high-level policy documents and plans that guide health and climate change activities in Cook Islands (e.g. the *Strategic Plan for Health*, JNAP, the *National Climate Change Policy* and future National Communications to the UNFCCC).
- Serious consideration should be given to the benefits of a public health laboratory, which could conduct its own testing of water and food samples, as well as identification and counting of mosquitoes and larvae.
- Serious consideration should be given to the health “co-benefits” – that is, benefiting health and reducing GHG emissions – of reducing motorized transport and increasing personal modes of transportation, such as bicycles, which could be subsidized.
- Correlation of local health and climate data should be undertaken to provide a more detailed, localized understanding of the relationship between climatic factors, such as temperature, rainfall and humidity, and health outcomes, such as diarrhoeal disease, respiratory disease, hospital admissions for heart, lung and kidney diseases, etc.
 - This type of analysis may prove useful for putting in place early warning system mechanisms, e.g. for heatwaves, epidemics of dengue fever, diarrhoea, etc.
 - Health data for notifiable diseases are available in electronic format for most of the islands, aggregated by month, back to 1995; the corresponding climate data are also available).
- Urgent attention should also be given to strengthening primary health-care systems so that they are better prepared to deal with the health implications of forecasted changes in climate.



5.2 Federated States of Micronesia

5.2.1 Background

Climate change and health considerations have been included in several key high-level projects and policy frameworks in the Federated States of Micronesia, including the *Nationwide Climate Change Policy (2009)* and the *Second National Communication to the UNFCCC*. The NSDP for 2003–2023 specifically states:

Climate variability and change, including sea-level rise, are important determinants of health and of growing concern in the Federated States of Micronesia (as it is in all Pacific Island countries). The impacts are mostly adverse. Climate variability and change can result in reduced quality and quantity of water supplies, loss of coastal resources, reduction in ecosystem productivity and a decline in agricultural productivity. Potential health impacts which have been identified include: vector-borne diseases (such as dengue fever and malaria), waterborne diseases (such as viral and bacterial diarrhoea), diseases related to toxic algae (such as ciguatera fish poisoning, which is important in the Federated States of Micronesia where the protein source is predominantly fish), foodborne diseases, food security and nutrition, heat stress, air pollution, and extreme weather and climate events (such as cyclones, high tides, droughts and storm surges). Especially on atoll islands of the Federated States of Micronesia, storm surges can result in injury and drowning. The adverse impacts of many of these events will be exacerbated by sea-level rise. Thus, climate change should be an important consideration when assessing environmental health issues and the consequential priorities for the health of people in the Federated States of Micronesia.

Extensive consultations with stakeholders in the Federated States of Micronesia between June 2010 and July 2011 revealed a list of health concerns considered to be sensitive to changes in climate, summarized below.

5.2.2 Key climate-sensitive health risks

The following are key climate-sensitive health risks in the Pacific:

- Vector-borne diseases (dengue fever, Zika virus)
- Zoonotic infections (primarily leptospirosis);
- Foodborne and waterborne diseases^{1,2}
- Respiratory diseases³

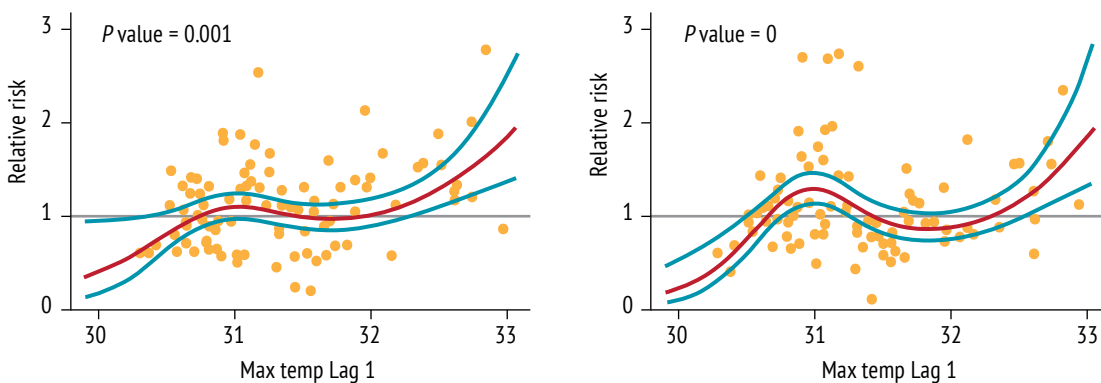
- Morbidity and mortality from extreme weather events
- NCDs
- Malnutrition
- Mental health
- Ciguatera (fish poisoning)⁴

Discussions with stakeholders in the Federated States of Micronesia also identified groups vulnerable to the health impacts of climate change, including children and women; it was recommended that adaptation strategies for these groups be given particular priority.

Analysis of the available climate and health data in the Federated States of Micronesia revealed several significant associations that have implications for future climate change-attributable burdens of disease in the Federated States of Micronesia; two of these findings for Pohnpei state are described below.

Time series of monthly averages of daily hospital inpatient data and the corresponding climate data show some suggestive evidence of an increase in the number of cases of respiratory disease and diarrhoeal illness in Pohnpei at a monthly maximum temperature threshold of $\geq 32-33^{\circ}\text{C}$ (Fig. 18). The peak effect appears to be at a lag of approximately one month (i.e. the health outcomes manifest several weeks following the environmental condition in question; in this case, monthly maximum temperature).

Figure 17. Relationship between the relative risk (RR) of respiratory disease (left) and diarrhoeal disease (right) and the previous month's temperature in Pohnpei, Federated States of Micronesia



Source: Federated States of Micronesia NCCAP, 2011

Note: Temperature in degrees Celsius. Relationship is derived from time-series analysis

1. A small study conducted by the ADB as part of a broader “climate-proofing” project in 2005 looked at the relationship between climate variables and admissions of patients with diarrhoea to Pohnpei Hospital, and found that outbreaks of gastroenteritis were partly associated with prolonged periods of low rainfall followed by a heavy rainfall event.
2. An investigation of a cholera outbreak in Chuuk in the 1980s concluded that transmission occurred primarily via foods contaminated by food-handlers inside homes, and noted that the traditional practice of allowing food to sit at warm room temperatures for extended periods allowed rapid multiplication of the organism.
3. The above-mentioned ADB “climate-proofing” project also found that influenza outbreaks in Pohnpei were partly associated with rapidly increasing mean daily temperature ranges (the difference between the mean daily maximum and minimum temperatures) in the short term; as opposed to the longer-term decrease in temperature ranges being seen with climate change around the globe.
4. A study of ciguatera in Yap State in 2001 revealed not only a probable high-risk fish species (*Plectropomus leopardus* or *Variola louti*, known locally as “lap-lap”) but also a potential antidote to the toxin. Residents of Ulithi atoll have apparently been using the extract from a local plant (*Messerschmidia argentea*, known to the locals as “lippi”) as an effective treatment for fish poisoning. Further study of this local remedy should be an international research priority; some related work is reportedly under way in New Caledonia.

5.2.3 Adaptation themes and activities

A range of adaptation strategies to manage these climate change-related risks to health in the Federated States of Micronesia are outlined in Table 8.

Table 8. Potential adaptation strategies to deal with climate-sensitive health risks in the Federated States of Micronesia

VECTOR-BORNE DISEASES (e.g. arboviral infections – dengue, Zika)

- Distribute mosquito nets.
- Conduct an updated survey of mosquito populations; consider parallel or combined survey of rats and ants (linked to transmission of zoonotic infections and impact on food security); focus on high-risk breeding sites (e.g. ports).
- Conduct a community awareness campaign (e.g. about pooled water around the home) and environmental clean-up.
- Train local environmental health officers in mosquito surveillance and developing vector control techniques.

WATERBORNE DIARRHOEAL PATHOGENS

- Provide disinfection/treatment kits for communities.
- Conduct a community awareness programme.
- Expand existing programmes to outer islands.
- Chlorinate/treat community/household water systems (note: link in with Safe Household Water Treatment & Storage programme).
- Improve water sources, water quality and water safety planning – urban and rural; note differences in supply between states (state versus municipal).
- Consider use of household test kits (e.g. hydrogen sulphide, or H₂S).
- Conduct research into link between waterborne diseases and sakau (kava drinking).
- Link adaptation activities related to water safety with current/future water policies.
- Conduct ongoing certification of laboratory and water/sanitation technicians.
- Review each state's rural sanitation programme; consider expanding beyond sanitation/sewerage (used in response to cholera outbreaks from the 1980s through to 2000). Explore opportunities for incorporation of successful strategies of this programme into current and future water safety programmes.

MALNUTRITION (UNDERNUTRITION)

- Increase domestic agriculture production; decrease dependence while improving the quality of imported food products.
- Support trials of drought- and salt-resistant crops, recognizing the importance of local knowledge and traditional practices with respect to healthy, local, nutritious foods that may be particularly resilient to climate change (e.g. pandanus).
- Consider importing proven resistant crops in vulnerable areas.
- Prepare emergency relief funds (for crop failures).
- Support research/development into aquaculture.
- Link with Food Security Policy, Pacific Adaptation Strategy Assistance Programme (PASAP) projects.
Note: projects in Chuuk state including managing artificial taro patches.

ZOOONOTIC INFECTIONS (e.g. leptospirosis, avian influenza)

- Conduct a survey of domesticated animals (e.g. pigs).
- Strengthen laws/policies regarding hog-raising (i.e. consider regulations/standards).
- Conduct a health promotion campaign (hygiene & sanitation, safe swimming, personal protective equipment) (note: previous community awareness campaign performed – could use same/updated materials).
- Train health professionals on accurate and timely diagnosis (improve case definition, laboratory diagnostic capacity).
- Consider value of mass vaccination of animals.
- Evaluate Environmental Protection Agency (EPA)/Environmental Health Initiative (2007) in Chuuk clearing trees around houses (to reduce rats), testing water and moving pigs away from household water sources in an effort to reduce water contamination, diarrhoeal illness and leptospirosis.
- Enforce legislation/regulations regarding domestic animals (e.g. prevent pigs from contaminating water supplies).
- Support EPA plans to test waste disposal systems for pigpens.

OBESITY, CIRCULATORY DISEASE, DIABETES AND RELATED NCDs

- Link with current and future NCD programmes.
- Increase awareness of the link between climate change and NCDs.

MENTAL HEALTH

- Offer training in crisis counselling (use existing networks, e.g. churches).
- Prioritize recruitment and training of new counsellors and mental health professionals.
- Improve telephone/online support; consider online diagnostic psychiatric support.

RESPIRATORY DISEASES (including asthma, influenza, TB)

- Strengthen the existing syndromic surveillance system.
- Train health professionals in sample collection
- liaise with the tuberculosis programme; consider indirect impacts of climate change, e.g. overcrowding.
- Emphasize public education/health promotion (hygiene, reducing transmission).
- Ensure appropriate immunization coverage (e.g. influenza).

SKIN DISEASE

- Educate the public and health professionals.
- Conduct health promotion.
- Take protection against ultraviolet rays.

POVERTY, SOCIOECONOMIC DISADVANTAGE

- Conduct research exploring the relationship between poverty, disadvantaged populations and climate-sensitive health risks.
- Improve poverty-reduction strategies.

TRAUMATIC INJURIES AND DEATHS

- Establish effective extreme weather early warning systems.
- Conduct community emergency preparedness training.

TRAUMATIC INJURIES AND DEATHS (continued)

- Improve coordination with public health and Hospital Emergency Preparedness Programme activities, National Disaster Coordination Office, Federal Emergency Management Agency, United States Agency for International Development.
- Review and strengthen response/relief capabilities.
- Review reports from previous severe events to identify key gaps/weaknesses in preparedness, planning and response.

CIGUATERA (fish poisoning, harmful algal blooms)

- Educate the community.
- Conduct research into specific fish carriers in the Federated States of Micronesia and appropriate treatment strategies; (e.g. possible antidote in Yap) and environmental conditions that induce harmful algal blooms.
- Conduct research and record traditional knowledge on safe seafood eating practices.

Source: Federated States of Micronesia NCCHAP, 2011

5.2.4 Recommendations

A summary of key findings and recommendations from the Federated States of Micronesia NCCHAP is as follows:

SUMMARY OF KEY POINTS

- Vector-borne and waterborne diseases, and malnutrition/food security represent the most serious climate-sensitive health risks to the Federated States of Micronesia.
- There is a lack of recent, high-quality, peer-reviewed public and environmental health research in the Federated States of Micronesia and the Micronesian region, including research into the health impacts of climate change.
- The available health data are incomplete.
- The process of data recording, collection and analysis needs significant improvement in the Federated States of Micronesia.
- Human resources in health information systems, biostatistics, epidemiology and public health need to be increased (involves recruitment of new staff, training and enhancing the skills of current staff).
- Effective project management and implementation of climate change and health projects will require high-level buy-in, cross-sectoral cooperation and interagency support.

RECOMMENDATIONS

- The adaptation strategies listed in Table 8 should be reviewed, discussed and considered for implementation.
- The importance of community engagement and involvement with adaptation activities should be emphasized.
- The initial focus should be on diseases considered to be “high risk” with respect to climate change in the Federated States of Micronesia (vector-borne and waterborne illnesses and malnutrition/food security)
- The Federated States of Micronesia EpiNET team should mainstream climate change and health issues into their programme activities, with the Environmental Health Coordinator acting as the key contact for climate change and health. Inputs should be taken from representatives of the Office of Environment and Emergency Management, Weather Service Office, and other national agencies and offices as needed.
- Public education, health promotion and effective health communication are high priorities for future public health planning and resourcing in anticipation of climate change.
- Health professionals should be provided with education and training related to climate change and health.
- The health information/data collection system should be improved. This should include the current biostatistics reporting system and ongoing assurance of quality control.
- Health personnel should be recruited and/or trained in biostatistics and epidemiological analysis. The Syndromic Surveillance Officer for WHO’s syndromic surveillance system in the Federated States of Micronesia may be able to support training of other health information staff in this field, or even, in the short term at least, take on some extra responsibilities within the health statistics section of the Department of Health and Social Affairs.
- The health sector should work closely with other agencies, sectors and nongovernmental organizations on existing and future climate change policies, frameworks and projects in the Federated States of Micronesia.
- Participation of other sectors in climate change-related projects should be actively encouraged.
- The health sector, particularly public health, should be acknowledged as a key stakeholder in climate change adaptation activities in the Federated States of Micronesia.
- Consideration should be given to reducing the carbon emissions of the health sector as part of a broader climate change mitigation strategy for the Federated States of Micronesia.
- Acknowledgement should be made of the health co-benefits inherent in a variety of climate change adaptation and mitigation strategies such as:
 - reducing air pollution;
 - consumption of locally grown, nutritious foods;

- increasing personal energy expenditure (e.g. walking, cycling);
 - reducing energy consumption and fuel-dependent transport; and
 - increasing the use of renewable energy sources, which includes both long-term cost savings and benefits to health.
- Increased training, recruitment and retention of health professionals (doctors, nurses and allied health workers) should continue to be of the highest priority for the Federated States of Micronesia as a general health systems strengthening measure, as well as in anticipation of the health impacts of climate change.
 - The NCCHAP document should link in directly with the Nationwide Climate Change Policy and be referenced in the Second National Communication to the UNFCCC; it should also link with other climate change activities in the Federated States of Micronesia (for example, those led by the Office of Environment and Emergency Management, and the climate change projects and plans related to gender, youth and other groups) and important policies such as the food, water and energy policies.
 - The NCCHAP document should be presented for endorsement to the President, Congress and Cabinet.



5.3 Fiji

5.3.1 Background

Fiji is one of seven countries involved in a four-year global project to enhance the capacity of the health sector to respond effectively to CSDs. The project, *Piloting Climate Change Adaptations to Protect Human Health (PCCAPHH)*, commenced in 2010 and is a partnership between the Fiji Ministry of Health, WHO, the Fiji Red Cross Society (FRCS) and UNDP, with funding from GEF.

PCCAPHH seeks to enhance the capacity of the health sector to respond effectively to climate-sensitive communicable diseases through three key desired outcomes (PCCAPHH, 2011):

- Outcome 1:** An early warning system provides reliable information on the likely incidence of CSDs in pilot sites.
- Outcome 2:** The capacity of health sector institutions to respond to CSDs has been improved, based on the early warning information provided.
- Outcome 3:** Health adaptation activities are piloted in areas of heightened health risks due to climate change.

In addition to the PCCAPHH project, the Fiji Ministry of Health, through its *Health Emergencies and Disaster Management Action Plan*, seeks to enhance the resilience of health facilities against the impacts of extreme events and climate change. Furthermore, the current draft Health Protection Decree seeks to incorporate climate change impacts into HIAs. At the national level, Fiji has a *National Climate Change Policy* – five of its eight objectives seek to reduce the vulnerability of Fiji's population, health systems and health determinants to the impacts of climate change. Finally, Fiji's Second National Communication to the UNFCCC includes a substantial section on climate change and health priorities for Fiji, including current and projected impacts on all aspects of health in Fiji and priorities for adaptation.

5.3.2 Key climate-sensitive health risks

The priorities for Fiji's PCCAPHH project are dengue fever, diarrhoeal diseases, leptospirosis and typhoid fever.

PCCAPHH used Poisson regression models to analyse monthly climate and communicable disease notifications from 1995 to 2009 among selected subdivisions. Some of the key results of this analysis are presented in Table 9.

In addition to the four CSDs prioritized in PCCAPHH, there are a number of other climate-sensitive health risks of concern in Fiji. These include the following:

- malnutrition,
- NCD-related illnesses,
- psychological impacts, and
- decreased access to health services (which often occurs in the setting of natural disasters).

5.3.3 Adaptation themes and activities

PCCAPHH has initiated, or is supporting, a number of activities within the Fiji Ministry of Health to reduce the incidence of the priority CSDs. In addition, the main project partner, FRCS – contracted to implement Outcome Three of the project – has carried out surveys and health adaptation activities in vulnerable communities.

The adaptation activities being carried out by Ministry of Health, WHO and PCCAPHH partners include the following:

- **Institutional strengthening and capacity-building:**
 - a. streamlining and improving the timeliness of disease reporting systems, including the National Notifiable Disease Surveillance System;
 - b. computerization of disease notification and investigation systems for faster case detection and effective disease control, which also includes revision of pathology forms to include date of onset of symptoms, patient address and other contact details;
 - c. mainstreaming health adaptation through the inclusion of specific outputs in the Ministry of Health's *2014 Annual Corporate Plan* and revision of the *2010–2015 Ministry of Health Strategic Plan*;
 - d. training for key Ministry of Health staff, including the epidemiologist, surveillance officer and information technology (IT) staff on ArcGIS and statistical analysis software (Stata);
 - e. capacity-building of Ministry of Health staff through learning by doing, for instance, through participation and data analysis in the project Technical Working Group;
 - f. supervision of masters-degree students by the project scientific consultant;
 - g. awareness-raising activities through general climate change training, and production and dissemination of communication materials;
 - h. establishment of novel institutional linkages between the Ministry of Health, the Fiji Meteorological Service, the Fiji Lands Information Systems unit at the Department of Lands and the Geographical Information System (GIS) department at the University of the South Pacific;

Table 9. Relationship between monthly climate variables and monthly cases of climate-sensitive diseases (1995–2009)

Disease	Subdivision	Climate variables/model ^a	Strength of association (pseudo-r ² value) ^b
Dengue	Ba	Rainfall- lag 1,2,3	0.3, 0.27, 0.32
		Maxtemp- lag 0,1,2,3	0.29, 0.38, 0.32, 0.29
	Mintemp- lag 2	0.25	
	Humidity-lag 1	0.34	
	Model: rainfall, maxtemp, humidity at lag- 1	0.39	
	Bua	Rainfall- lag 0,1,2	0.4, 0.3, 0.37
		Maxtemp- lag 0,2,3	0.37, 0.33, 0.31
	Mintemp- lag 0,1,2,3	0.35, 0.30, 0.32, 0.31	
	Humidity-lag 0	0.33	
	Model: rainfall, maxtemp, mintemp at lag- 0	0.52	
	Lautoka	Rainfall- lag 1	0.42
		Maxtemp- lag 1	0.53
Mintemp- lag 1	0.27		
Model: with the 3 lagged climate variables above	0.54		
Suva	Rainfall- lag 2	0.47	
	Maxtemp- lag 3	0.50	
Mintemp- lag 0.2	0.57, 0.52		
Humidity-lag 2	0.47		
Model: with all 4 climvar's at lag- 2	0.6		
Diarrhoeal illness	Ba	Rainfall- lag 1	0.1
		Maxtemp- lag 3	0.06
	Mintemp- lag 3	0.07	
	Humidity-lag 1	0.14	
	Model: with all 4 lagged climvar's above	0.17	
	Bua	Rainfall- lag 0	0.12
		Maxtemp- lag 0,1,2	all ~ 0.10
	Mintemp- lag 0–3	all ~ 0.10	
	Humidity-lag 2	0.12	
Model: rainfall, maxtemp, mintemp at lag- 0	0.13		
Suva	Rainfall- lag 1	~ 0.4	
	Maxtemp- lag 1	~ 0.4	
Mintemp- lag 1	~ 0.4		
Model: 3 climvar's above at lag- 3	0.41		
Leptospirosis	Ba	Rainfall- lag 2	0.3
		Maxtemp- lag 1,2	0.32, 0.30
	Humidity-lag 1,2	0.3, 0.3	
	Model: rainfall lag - 2, mintemp lag- 1	0.35	
	Bua	Rainfall- lag 0,2,3	0.42, 0.4, 0.48
Maxtemp- lag 0,3		0.38, 0.45	
Mintemp- lag 0,1,2,3	0.4 (all)		
Humidity-lag 0,1	0.45, 0.40		
Model: rainfall, maxtemp, mintemp at lag- 3	0.59		
Typhoid	Ba	Rainfall- lag 1,2,3	0.47, 0.63, 0.49
		Maxtemp- lag 0,3	0.47, 0.49
	Mintemp- lag 1,2,3	0.46, 0.52, 0.46	
	Humidity-lag 0,1,2,3	0.48, 0.46, 0.47, 0.5	
	Model: rainfall,, mintemp at lag- 2	0.66	
	Bua	Rainfall- lag 0	0.35
Mintemp- lag 0,3	0.36, 0.36		
Humidity-lag 3	0.35		

Source: McIver et al., 2012

a. The “model” line in each row gives the correlation coefficient for the “best” model combining the climate variables at monthly lags, which give the highest correlation coefficient.

b. All results displayed significant to the $P \leq 0.05$ level.

- i. conducting further capacity-building through disaster risk reduction and management training in pilot subdivisions and curriculum development with relevant tertiary institutions;
- j. negotiating with academic institutions to include climate change and health in relevant curricula; and
- k. encouraging and facilitating publication or documentation of climate change and health activities.

● **Community health adaptation**

FRCS is undertaking a number of pilot community health adaptation activities in two pilot subdivisions:

- a. an intensive vulnerability and capacity assessment survey, covering nearly 1500 households in the pilot subdivisions;
- b. using the results of the above survey, a train-the-trainers manual was developed for Red Cross volunteers;
- c. development of community change tools, including posters and flash cards, to be used by the Red Cross volunteers to train communities on the links between climate variables and CSDs, disease prevention methods and the importance of early presentation to clinics; and
- d. future activities include implementation of the above materials in communities, enabling communities to develop their own health adaptation plans and monitoring and evaluation of results, for example, through “most significant change” stories.

In addition to PCCAPHH adaptation activities, the following other adaptation interventions are required in the health and other sectors to increase the resilience of populations against climate-sensitive health risks.

● **Health sector adaptation measures**

Many adaptation options for the health sector involve strengthening existing disease surveillance, monitoring and control measures, while others require systematically incorporating climate information in health planning and interventions. Some health adaptation measures for Fiji include the following:

- conduct ongoing health vulnerability assessments for communicable diseases and NCDs, and for safety and accessibility of health facilities/health care;
- improve access to primary health care;
- conduct integrated vector management by building or strengthening partnerships with relevant stakeholders;
- facilitate rapid and accurate disease notification followed by an appropriate timely response.
- identify and protect the health of the most vulnerable members of society (the elderly, disabled, women, children, and the poor);
- vaccinate people against diseases such as typhoid fever, and livestock and pets against diseases such as leptospirosis;
- provide ongoing education and training on climate change, disaster risk reduction, community health adaptation, etc.; and
- incorporate climate change into existing health policies and plans;

● Natural disaster-specific measures

- Strengthen disaster risk reduction, recovery and response programmes. This includes standard operating procedures and adequate resources for health staff and facilities (funding, personal protective equipment, food rations, electricity, water and communications).
- Climate-proof health infrastructure. This includes relocating health facilities if they are in vulnerable areas, ensuring that facilities have back-up or renewable electricity, water (e.g. installation of water tanks), sufficient drugs and supplies during natural disasters, and undertaking regular repair and maintenance.
- Improve coordination among intersectoral partners, for example, Disaster Management Committees (DISMAC) and the United Nations Humanitarian Assistance group.
- Develop or strengthen early warning systems. One promising option that is being considered is to link training of communities on CSDs to seasonal forecasts. For example, if lower-than-normal rainfall is forecast in the coming months, more emphasis might be placed on adequate, safe water storage for rural communities.

● Adaptation in other sectors – water, energy, agriculture, rural development, housing, environment, community empowerment and livelihoods

WHO argues that human health should be the bottom line of all adaptation activities and programmes (WHO, 2009). A healthy population is a resilient population and, for these reasons, all development sectors in Fiji can improve human health outcomes through their adaptation activities. Some priority sectoral and intersectoral adaptation measures are as follows:

- Ensure clean drinking water, improved sanitation and household disinfection, especially in areas where the incidence of waterborne diseases is higher.
- Improve social indicators such as education, women’s empowerment, housing and equitable access to development opportunities.
- Improve economic indicators such as employment rate, alternative livelihoods and access to markets.
- Enhance community resilience against climate change and disasters.
- Encourage agricultural diversification and sustainable agriculture and discourage farming in marginal areas.
- The natural environment is a source of food, shelter, medicine, clean water and air. It also acts as a buffer against extreme climate events like floods and cyclones. Moreover, an unpolluted environment is safe for human habitation whereas an altered environment may create conditions for disease microbes and vectors to spread. For these reasons, ecosystems must be protected from unsustainable use.
- Local mitigation measures such as increased use of public transportation, walking/cycling instead of using fossil-fuel powered transport, use of efficient wood stoves that emit less smoke create co-benefits for health while reducing GHG emissions.
- Explore and plan for the development of “green health facilities” with inclusion of renewable energy, sustainable waste management and other innovative “green” initiatives.

5.3.4 Recommendations

PCCAPHH has provided funding and a focal point for climate change adaptation in the health sector over the past three years. It is now necessary to build on the success of the project with further international funding. A permanent focal point within a climate change unit established in the Ministry of Health and supported by WHO would provide much-needed continuity and institutional memory in this complex and fast-moving field.

There is a need to scale up institutional support for environmental health generally and climate and health in particular. Community interventions need to be continued, evaluated and improved over the next several years. Capacity also needs to be built at the tertiary training level, starting with the development of relevant curricula at training institutions.

Existing data from the national census, surveillance systems and environmental monitoring need to be unified, analysed and improved. This would be facilitated by the development of national standards for data management and memoranda of understanding among Government departments.

It is also important that the scope of Fiji's climate change and health adaptation work be broadened beyond the immediate priorities of PCCAPHH, to address some of the other climate-sensitive health risks in Fiji identified above.



5.4 Kiribati

5.4.1 Background

Kiribati is one of the leaders in climate change adaptation in the Pacific region. Work began on Kiribati's *National Adaptation Programme of Action (NAPA)* in 2004 and was completed in 2007. The Kiribati Adaptation Programme also commenced in 2003–2004 and is now in its third phase, with priority given to activities in the areas of freshwater supply and coastal protection.

In the meantime, Kiribati also developed a *Climate Change Adaptation Plan and Strategy (CCAPS)*, which is now being updated in the form of a *National Framework for Climate Change and Climate Change Adaptation*. Kiribati is also currently working on its Second National Communication to the UNFCCC, and its activities in the climate change arena align with its priorities under the *Kiribati Development Plan 2008–2011*.

Kiribati's NAPA specifically considers the health impacts of climate change, noting that: "Human health is the recipient of all downstream effects of the impacts of climate change on other sectors, such as agriculture, fisheries, water supply, coastal areas, biodiversity resources and waste management" (NAPA, 2007). Some of the examples of CSDs mentioned in the NAPA include diarrhoeal disease, dengue fever and fish poisoning; mention is also made of the issue of high population density, which is particularly problematic on South Tarawa atoll.

5.4.2 Key climate-sensitive health risks

To determine the priorities for the Kiribati NCCHAP, the focus was on conditions that were strongly linked to changes in climate, which would add substantially to the burden of disease in Kiribati, and where there was good information on interventions that were likely to make a difference. In consultation with health stakeholders from a number of fields (environmental health, communicable diseases, NCDs, nutrition and mental health) and climate change and health experts involved in the WHO-supported project, the following shortlist of priority areas for climate change and health planning and adaptation in Kiribati was identified:

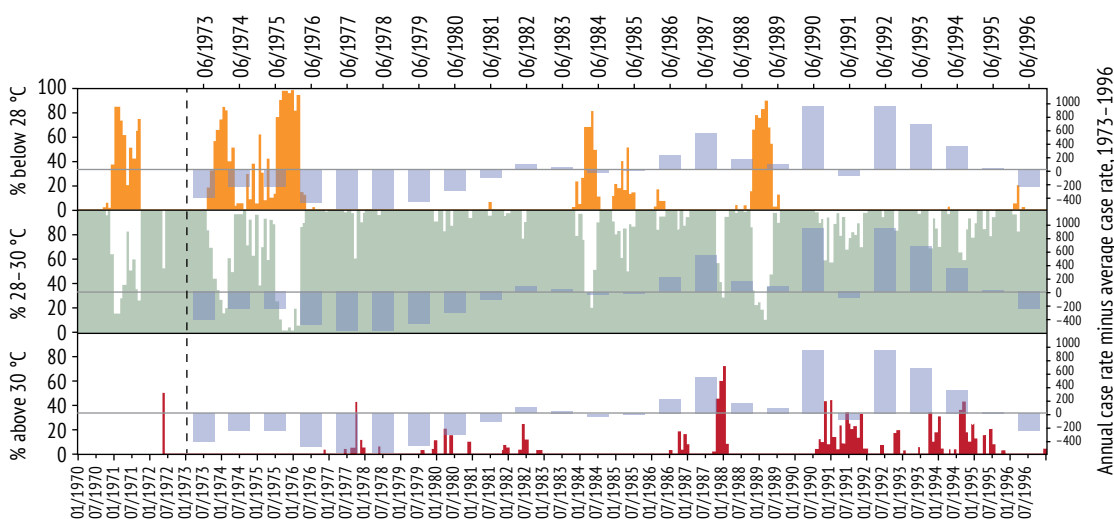
- water safety and waterborne diseases,
- food safety and foodborne diseases, and
- vector-borne diseases.

Disease surveillance was also identified as a priority, given its vital role as a tool for climate change adaptation in general.

A lower-priority, but nevertheless significant, climate-sensitive health risk in Kiribati is the potential for changing oceanic conditions (e.g. temperature, salinity and acidity) to affect the bio-accumulation of ciguatera toxin in reef fish (Chan et al., 2011). While it is unclear precisely what the effects of climate change on ciguatera will be in the Pacific region, there is reason to believe that warmer oceans may increase the rates of the disease, at least until a critical, higher temperature threshold is reached.

Figure 18 below depicts the relationship between the temperature of the ocean and lagoons surrounding Kiribati and the rates of ciguatera fish poisoning (shown as grey bars) in Kiribati from the 1970s to 1990s. Ciguatera was reported less frequently in Kiribati between 1973 and 1985 (a period of relatively cooler ocean temperatures, shown as blue lines in the upper part of Figure 18) than in the following decade. In the 1980s and early 1990s, the seas were more commonly in the “warm” category (above 30 °C – red bars in the lower part of Figure 18), with a corresponding increase in ciguatera cases.

Figure 18. Relationship between sea surface temperature (SST) and ciguatera rates in Kiribati



Source: Llewellyn, 2010

Note: Temperature in degrees Celsius. Relationship is derived from time-series analysis. Ciguatera case rates are presented by subtracting the long-term average of the dataset from each annual case rate value (grey histogram bars). This shows the variations in ciguatera intensity around the average ciguatera load for Kiribati. Overlaid upon the ciguatera case rate series is the percentage of the Kiribati exclusive economic zone (EEZ) that was below, between and above the SST band of 28 and 30 °C (Orange, green and red bars, respectively). SST data are for 1970–1996 and ciguatera case rate data from 1973–1996.

5.4.3 Adaptation themes and activities

Table 10 provides a brief overview of the adaptation strategies planned in relation to the priority climate-sensitive health risks identified in Kiribati. Further detail can be found in the Kiribati NCCHAP.

One key strategy identified as part of the adaptation work plan for Kiribati is related to the construction of a dedicated environmental health laboratory. This strategy has been prioritized as part of the climate change adaptation project in Kiribati funded by the European Union (EU) and implemented by the Secretariat of the Pacific Community (SPC).

Table 10. Adaptation strategies related to priority climate-sensitive health risks in Kiribati

WATERBORNE DIARRHOEAL PATHOGENS

- Improve scheduled water monitoring, increase frequency of testing and monitor a wider range of water sources.
- Improve technical capacity by ensuring a constant supply of reagents for scheduled tests and requests.
- Improve public awareness on water safety.

FOOD SAFETY & FOODBORNE DISEASES

- Improve frequency of the food inspection regimen.
- Prevent delays in food being released from the port.
- Build capacity for Environmental Health Unit staff in food testing and analysis.
- Maintain food handler trainings and increase public awareness on food safety.

VECTOR-BORNE DISEASES

- Enhance surveillance, train staff, invest in appropriate equipment for mosquito surveys, and identification and control activities.

DISEASE SURVEILLANCE

- Build capacity of clinic nurses in public health, environmental health, disease surveillance and primary care.
- Provide specific training for data surveillance officers in environmental epidemiological techniques.
- Update syndromic surveillance system tools and consider including other conditions that are of local importance.

Source: Kiribati NCCHAP, 2011

5.4.4 Recommendations

The main recommendations arising from the climate change and health vulnerability and adaptation project in Kiribati were as follows (Kiribati NCCHAP, 2011):

- There are common themes that run through the work plans for the priority topics, and these deserve particular attention, including strengthening disease surveillance,

improving transport for staff to carry out environmental testing, training in testing and analysis, equipment, and workspace.

- The Environmental Health Unit (EHU) of the Ministry of Health and Medical Services should continue to be the lead agency for climate change and health activities in Kiribati for the time being, with the Chief Health Inspector as the focal point, with requests for support from other departments, ministries and regional agencies as required.
- Work should commence as soon as possible on the health sector strengthening activities outlined in the work plans; this may include consideration of applications for funding, grants and/or technical assistance for implementation of specific activities.
- The NCCHAP should be presented to the national Cabinet for endorsement, recognizing that this document is the health sector's contribution towards climate change adaptation planning in Kiribati.
- The NCCHAP document should be reviewed by the EHU in 12 months, to assess progress on the work plan and update priority activities as required.
- At the first review of the NCCHAP, the EHU should revisit issues that were identified in the plan as important, but lacked sufficient evidence of links with climate change to warrant being treated as priorities in the NCCHAP, including mental health and malnutrition.
- It is recommended that the National Water and Sanitation Steering Committee revive the Water Quality Subcommittee, review the terms of reference of this body, and ensure that the subcommittee meets regularly with representation from all the agencies involved in measuring and promoting water quality.
- The Health Information Unit should work with the fisheries authorities to explore the feasibility of collecting additional information on sources of fish poisoning from patients who present to clinics and hospitals.
- To better understand the present climate-related health risks and guide adaptation in the future, the Health Information Unit should work with external advisers to extend the analysis of existing climate and health data.

Note: Since the finalization of the NCCHAP, the health sector in Kiribati has made significant advances with respect to adaptation, courtesy of the EU-funded Global Climate Change Alliance: Pacific Small Island States Project, which is being implemented by SPC. The NCCHAP formed the foundation of this ongoing work, which focuses on climate-sensitive disease surveillance, water safety and waterborne diseases.



5.5 Marshall Islands

5.5.1 Background

A significant amount of activity and planning has been taking place over several years within the climate change arena in the Marshall Islands. The Marshall Islands has a National Climate Change Committee (NCCC), chaired by the Marshall Islands Chief Secretary, which includes the Secretary of Health and the secretaries of several other government agencies.

In 2010, an in-depth interagency consultation process led to the development of *The Marshall Islands Climate Change Roadmap*, which in early 2011 gave rise to *The Marshall Islands National Climate Change Policy Framework* (NCCPF). The vision of the NCCPF is to “build the resilience of the people of the Marshall Islands to climate change” and its overall aim is as follows:

Foster and guide a national plan of action to address the current and short-, medium- and long-term effects of climate change, ensuring to the greatest possible extent that the quality of life of the people of the Marshall Islands and opportunities for sustainable development are not compromised.

The NCCPF in turn led to the development of *The Marshall Islands Joint National Action Plan for Climate Change Adaptation and Disaster Risk Management* (JNAP), which links with the objectives outlined in the Marshall Islands’ Strategic Development Plan entitled *Vision 2018*, including that of developing “...a contingency/adaptation plan to counter the emerging threats resulting from the adverse effects of climate change, including a National Disaster Plan”.

The JNAP is a matrix of objectives, actions and outputs, which are grouped into six goals that broadly correspond to those listed in the NCCPF. The health impacts of climate change are considered under JNAP Goal 5 – Enhanced local livelihoods and community resilience – specifically Objective 5.3 calls on stakeholders to: “Address the issue of climate-related health impacts, including socioeconomic impacts.” The two actions listed for this objective are:

- 5.5.1 Conduct assessment on the potential impact of climate change on health, including vector-borne diseases such as dengue fever; and
- 5.5.2 Provide institutional strengthening of the health sector on the issue of climate change and other risks relating to health.

The NCCHAP for the Marshall Islands is intended to be the instrument by which the Ministry of Health contributes to the JNAP, and in doing so addresses the two actions above.

5.5.2 Key climate-sensitive health risks

Consultation with climate and health stakeholders over the course of the joint Ministry of Health–WHO project in 2010–2011 generated a list of key health concerns for the Marshall Islands:

- diarrhoeal disease,
- malnutrition,
- vector-borne diseases,⁶
- ciguatera (fish poisoning),
- mental health,
- respiratory disease,
- NCDs,
- injuries and deaths from extreme weather events, and
- other diseases (eye disease, skin disease, radiation-induced illnesses⁷).

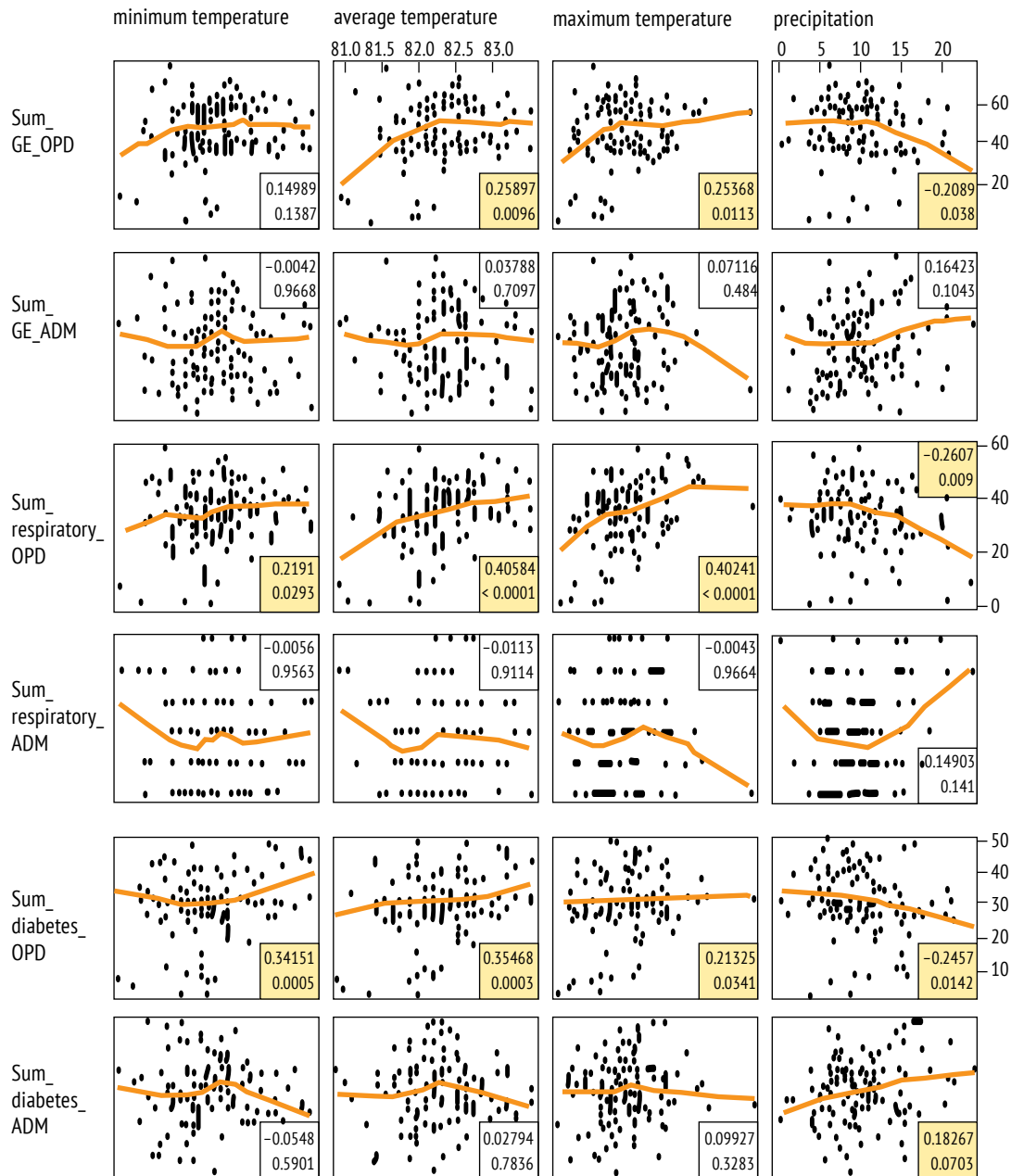
Analysis of the available climate and health data in the Marshall Islands revealed some interesting associations between monthly climate variables and hospital presentations and admissions for patients with diabetes, gastroenteritis and respiratory disease, which are displayed in Figure 19.

To summarize these findings, it appears that higher temperatures on Majuro are associated with more frequent cases of gastroenteritis, respiratory complaints and health problems related to diabetes. The effect of rainfall seems to be mixed, with higher rainfall associated with fewer cases of gastroenteritis and respiratory complaints, but with paradoxical effects on diabetes – fewer outpatient cases and more hospital admissions, indicating the likelihood of a complex interaction between patients with diabetes and their environments, as would be expected, compared to diseases like gastroenteritis, where the environment and climate typically play a clearer role.

6. The historical absence of severe epidemics of vector-borne diseases in the Marshall Islands had given rise to a popular belief that the Marshallese were immune to many such risks to health (Note: this misconception arose during the stakeholder consultations held as part of this climate change and health project, when participants, including Ministry of Health staff, expressed the belief that the Marshallese people were intrinsically immune to dengue fever). This fallacy has unfortunately been demonstrated in devastating fashion – in December 2011, the Marshall Islands experienced a severe dengue epidemic, the first major outbreak recorded by the Marshall Islands Ministry of Health (although unpublished data from the United States Centers for Disease Control and Prevention suggests that smaller outbreaks may have occurred in 1989, 1990 and 2004).

7. Marshallese communities are also understandably concerned about radiation-induced illnesses, given their unique exposure history (from American nuclear weapons testing in the 1940s and 1950s). While there is a plausible link between this exposure and the higher-than-normal rates of thyroid cancer in the exposed population (now elderly) in the Marshall Islands, it seems unlikely that climate change will significantly exacerbate the risk of radiation illnesses (beyond that of “background” environmental exposure from the sun, space, etc.) in the absence of further nuclear events.

Figure 19. Relationship between weather variables (monthly minimum, average and maximum temperatures in degrees Fahrenheit) and monthly outpatient presentations and hospital admissions in Majuro, Marshall Islands



Source: the Marshall Islands NCCHAP, 2011

Key – GE: gastroenteritis; OPD: outpatient department presentations; ADM: hospital admissions

Note: Relationship is derived from time-series regression of monthly climate and disease data (2000–2009).

5.5.3 Adaptation themes and activities

The adaptation strategies and activities planned for the Marshall Islands correspond directly with the above-mentioned priority climate-sensitive health risks; many of these planned adaptation measures overlap with those contained in the Marshall Islands Ministry of Health draft Strategic Development Plan. The challenge for the Marshall Islands, therefore, is to identify which elements of these plans may be considered “additive”, and thus suitable for adaptation funding, and prioritized accordingly.

5.5.4 Recommendations

- Implementation of the adaptation strategies listed in the NCCHAP should be reviewed, discussed and considered.
- A group of key individuals should be identified within the Ministry of Health who would be responsible for implementing the activities listed in the NCCHAP, as well as reviewing and updating the NCCHAP document as necessary.
- Regular meetings should take place to discuss evolving knowledge, priorities and strategies in relation to CSDs in the Marshall Islands.
- The importance of community engagement and involvement with adaptation activities should be emphasized.
- The initial focus should be on diseases considered to be high risk with respect to climate change in the Marshall Islands.
- Public education, health promotion and effective health communication are high priorities for future public health planning and resourcing in anticipation of climate change.
- Health professionals should be provided with education and training related to climate change and health.
- The health information/data collection system should be improved.
- Extra personnel should be recruited and/or trained in environmental health (including vector-borne disease control), biostatistics and epidemiological analysis.
- Active participation should be encouraged of other sectors in climate change-related projects.
- The health sector, particularly public health, should be acknowledged as a key stakeholder in climate change adaptation activities in the Marshall Islands.
- Consideration should be given to reducing the carbon emissions of the health sector as part of a broader climate change mitigation strategy for the Marshall Islands.
- Mass purchase of bicycles for the population should be considered – this strategy would have significant positive impacts on mitigation as well as far-reaching co-benefits for health.

- Acknowledgement should be made of the health co-benefits inherent in a variety of climate change adaptation and mitigation strategies such as:
 - reducing air pollution,
 - consumption of locally grown, nutritious foods,
 - increasing personal energy expenditure (e.g. walking, cycling),
 - reducing energy consumption, and
 - reducing fuel-dependent transport.
- Increased training, recruitment and retention of health professionals (doctors, nurses and allied health workers) should continue to be among the highest priorities for the Marshall Islands as a general health systems strengthening measure, as well as in anticipation of the health impacts of climate change.
- The existing Ministry of Health *Strategic Development Plan (2012–2014)* should be revisited to include objectives/activities/impacts on preparedness and responsiveness to the health risks of climate change.
- The Ministry of Health should collaborate with external agencies such as the Office of Environmental Planning and Policy Coordination (OEPPC), Weather Service Office (WSO), Environment Protection Agency, Ministry of Environment and other necessary agencies on adaptation strategies aimed at avoiding the most serious health impacts of climate change.
- The NCCHAP should be integrated into the Marshall Islands National Development Plan, the Ministry of Health *Strategic Development Plan (2012–2014)*, the JNAP, the second National Communication to the UNFCCC, and other national, high-level policies, projects and frameworks.
- The NCCHAP should be presented for endorsement to the Minister of Health and the Parliament of the Marshall Islands.



5.6 Nauru

5.6.1 Background

Nauru may be considered one of the Pacific's most vulnerable countries to the impacts of climate change on health, given its confluence of geographical, historical, economic and demographic risks.

As a single, raised coral atoll with insecure freshwater supplies, and given the ecological damage caused to the island from extensive phosphate mining, Nauru has a unique set of physical characteristics that make it particularly vulnerable to extreme weather events such as drought. It is also uncertain what effect rising temperatures and changing wind patterns will have on the phosphate dust still prevalent throughout the island. In addition, Nauru's fragile economy and the poor health status of its citizens – who are among the most overweight in the Pacific, with correspondingly low life expectancies – suggest that the impacts attributable to climate change on nutrition, including declining agriculture and fisheries, as well as dependence on food imports, will further exacerbate the burden of poor health experienced by Nauruans.

In the 2009 revision of Nauru's *National Sustainable Development Strategy* for 2005–2025, climate change is recognized as one of the most significant challenges with respect to the country's development. The impacts of climate change on health are recognized as part of this challenge: "For Nauru, climate change will undermine our food and water security, erode our coastlines, damage our marine ecosystems, and tax our public health system". This concern is reflected in Nauru's NAPA, which identifies human health as one of six key vulnerabilities, along with water resources, agriculture, fisheries and marine resources, coastal zones and disaster management. In the area of health, the NAPA has proposed adaptation activities related to safe, secure, and affordable supplies of water and food.

5.6.2 Key climate-sensitive health risks

In Nauru, the process of assessing climate change and health vulnerabilities, and planning adaptation strategies, utilized a modified HIA approach (Spickett, Brown & Katscherian, 2011), which provided for the prediction of potential impacts of climate change on health

based on a single possible scenario of future climatic conditions and biophysical changes in Nauru. The process used in this investigation is expected to form the basis for updates in the development of strategies for mitigation and adaptation with respect to the health impacts of climate change in Nauru, as more information becomes available on the predicted changes to climatic parameters.

This HIA approach, in turn, used a likelihood-versus-consequence model to stratify the relative prioritization of climate-sensitive health risks in Nauru (Table 3 and see the related discussion in sections 3.1 and 3.2). This process yielded the following table of potential health impacts of climate change in Nauru, ranked according to the risk each impact was considered to represent (Table 11).

Table 11. Ranking of climate-sensitive health risks in Nauru

Potential impacts	Consequence	Likelihood	Risk
Poor air quality	Major	Almost certain	Extreme
Compromised food security	Major	Almost certain	Extreme
Injuries and deaths from extreme weather events	Major	Likely	High
Water insecurity	Major	Likely	High
Waterborne disease	Major	Likely	High
Foodborne disease	Major	Likely	High
Vector-borne disease	Major	Possible	High
Social issues	Moderate	Almost certain	High
Heat-related illness	Minor	Almost certain	Medium

5.6.3 Adaptation themes and activities

The adaptation planning process in Nauru considered each of the above-mentioned climate-sensitive health risks in terms of the following headings:

- legislative (acts) or regulatory (regulations and other legal tools),
- public education or communication,
- surveillance and monitoring,
- ecosystem intervention,
- infrastructure development,
- technological/engineering,
- health intervention, and
- research/further information.

The full list of potential adaptation strategies for Nauru can be found in the NCCHAP (Nauru NCCHAP, 2012), which in turn relate to the recommendations listed below.

5.6.4 Recommendations

In Nauru, a series of recommendations was made as part of the NCCHAP process, which is provided in detail below, under the headings of Strategic directions, Government responses, Community involvement, and Specific activities/Projects.

● **Strategic directions**

- The NCCHAP should be presented to the Project Steering Committee, National Development Committee and Cabinet for high-level endorsement.
- All of the adaptation activities outlined in the NCCHAP should be given serious consideration with respect to implementation, particularly for those health issues thought to represent extreme and high risks.
- Climate change and health issues and adaptation plans should be incorporated into future revisions of the *National Sustainable Development Strategy* and *National Health Strategic Plan*.
- Climate change and health issues should be incorporated into the upcoming revision of the Public Health Act.
- The health aspects of Nauru's NAPA should incorporate the vulnerability and risk analysis, and adaptation opportunities identified in this document.
- The health impacts of climate change should be mainstreamed into all future policies and plans (as per international protocols for mainstreaming of climate change considerations across sectors).

● **Government responses**

- Priority should be given to finalizing the key documents awaiting endorsement by the Government (Public Health Act; Environment Act; Food Safety Regulations; Water, Sanitation and Hygiene Policy; Master Land Use Plan).
- A focal point/officer for climate change and health should be appointed, who would:
 - ideally be from within the Ministry of Health or the Ministry of Commerce, Industry and Environment, or alternatively recruited specifically for this task; and
 - be responsible for oversight of climate change and health adaptation activities in Nauru, including liaising with activities in other key sectors.
- Consideration should be given to the establishment of a Food Security Task Force.
- The activities of the Pacific Adaptation to Climate Change (PACC) and Integrated Water Resources Management (IWRM) projects should be strongly supported, including:
 - evaluation of the demonstration/pilot projects;
 - expansion of these projects if they prove successful; and
 - consideration of funding and human and material resources post-2013 when funding for these programmes is due to expire.
- Support should be given to the medical records unit of the Ministry of Health in strengthening health information systems (data collection, collation, analysis) and improving its capacity in the areas of biostatistics and epidemiology.
- The Environmental Health team should be supported in the establishment of a vector-borne disease control unit ("Mosquito Lab"):
 - the roles of this unit would ideally comprise performing entomological surveys (including species identification), monitoring mosquito populations, conducting surveillance for introduced species, and educating communities regarding elimination of breeding sites;

- this will entail sourcing of funds, recruitment and training of staff, purchase of equipment, etc.
 - Review and, if necessary, establish infrastructure and improve emergency preparedness plans for future environmental and climatic disasters.
- **Community involvement**
 - Consider appointing community “climate change champions”, a role that could be combined with the proposed “water champions”.
 - These individuals could educate their communities regarding climate change health risks and adaptation, and perform basic monitoring roles, e.g. food and water safety, vector breeding site control.
 - This programme could link with existing Community Council and/or Youth Council structures and could utilize novel media, e.g. cartoons, theatre, etc.
 - Community education, health promotion and raising awareness with respect to public and environmental health, including climate change and health issues, are fundamental to progress.
- **Specific activities/projects**
 - An epidemiological study of air quality and respiratory illness should be undertaken in Nauru, including:
 - air quality sampling (for pollutants, particulate matter and airborne pathogens); and
 - temporal pattern and geographical distribution of patients presenting with respiratory illnesses, in particular, allergic rhinitis, asthma and lower respiratory tract infections, to the outpatient clinics and hospital admissions of patients with asthma.
 - An epidemiological study of climate and health data should be undertaken, including correlation of weekly and/or monthly climate data, at least temperature and rainfall, with the corresponding health data, outpatient presentations and/or inpatient admissions for selected climate-sensitive diseases, e.g. diarrhoeal disease.
 - Case definitions used by health professionals for selected climate-sensitive diseases, e.g. dengue fever, should be reviewed and, if necessary, clarified or updated. Note links with WHO’s syndromic surveillance system for critical syndromes of epidemiological importance: acute fever and rash, influenza-like illness, diarrhoeal illness and prolonged fever.
 - Climate change considerations, including their health impacts, should be incorporated into school curricula.



5.7 Niue

5.7.1 Background

The health impacts of climate change were considered in Niue’s Initial National Communication to the UNFCCC in 2000. This important document listed the key health risks from climate change as they were perceived at that time, including vector-borne diseases – such as dengue fever and lymphatic filariasis – diarrhoeal and respiratory illnesses, ciguatera (fish poisoning), and the health impacts of extreme weather events such as cyclones and droughts.

Since that time, Niue has developed a National Climate Change Policy (NCCP, 2009), which identified health as a vulnerable sector, along with water, energy, infrastructure, tourism, natural ecosystems, fisheries, forestry and agriculture. The NCCP also calls for the development and implementation of appropriate adaptations to reduce vulnerabilities in each sector. Implementation of the NCCP is to be guided by Niue’s JNAP.

5.7.2 Key climate-sensitive health risks

Climate change issues have also been considered in the *National Health Strategic Plan* (NHSP, 2011–2021), in which it is recommended that a health sector-specific plan for climate change and disaster preparedness and response be developed, which was addressed by the subsequent *Climate Change and Health Plan*, compiled by WHO and the Niue Department of Health. This document lays out the priority climate-sensitive health risks for Niue:

- vector-borne diseases,
- ciguatera,
- diarrhoeal illnesses,
- respiratory disease,
- heat-related illnesses,
- NCDs,
- injuries and deaths from extreme weather events, and
- skin infections/infestations.

5.7.3 Adaptation themes and activities

Table 12 summarizes the adaptation strategies described in Niue's NCCHAP. The full list of activities can be found in the NCCHAP document (Niue NCCHAP, 2012).

Table 12. Adaptation strategies related to priority climate-sensitive health risks in Niue

VECTOR-BORNE DISEASES

- Control mosquito populations.
- Improve public awareness of ways to decrease the risk of transmission.
- Ensure adequate clinical capacity to manage outbreaks.
- Improve communication and coordination between clinical and environmental health teams.

CIGUATERA

- Identify local fish species that are prone to causing ciguatera.
- Improve public awareness of the risk of ciguatera toxicity.
- Ensure up-to-date, evidence-based clinical management of ciguatera cases.
- Improve communication between health and other agencies (e.g. Fisheries).

DIARRHOEAL ILLNESS

- Improve public awareness regarding the possible increased risk of diarrhoeal disease in future.
- Ensure safe water and food supplies.
- Improve communication between health and other agencies (e.g. Environment, Agriculture).

RESPIRATORY DISEASE

- Ensure appropriate immunization coverage.
- Improve knowledge on links between environment/climate and respiratory disease.

HEAT-RELATED ILLNESS

- Improve public awareness of the risks and impact of heat-related illness.
- Ensure adequate cooling in households and public buildings.

NONCOMMUNICABLE DISEASES

- Ensure that climate change considerations are incorporated into NCD programmes.

HEALTH IMPACTS OF EXTREME WEATHER EVENTS

- Ensure that consideration of both health and climate change effects are incorporated into the National Disaster Plan.
- Provide regular training in disaster response (for the health sector).

SKIN INFECTIONS/ INFESTATIONS

- Improve public awareness of the risk for and management of skin conditions (particularly in children).
- Prevent complications of skin infections/infestations.

Source: Niue NCCHAP, 2012

5.7.4 Recommendations

- The activities and strategies related to climate-sensitive health risks detailed in the Niue NCCHAP should be prioritized according to urgency and feasibility, and included in the annual work plans of the Department of Health.
- The NCCHAP should be reviewed and updated on a regular basis to incorporate new information and reflect contemporary concerns.
- The Director of Health should remain the focal point for climate change and health, and the lead person responsible for reviewing and implementing this plan, unless and until another appropriate individual within the Department of Health is nominated for this role.
- The contents of the NCCHAP, namely, the key climate-sensitive health risks and proposed adaptation strategies, should be strongly considered for inclusion in Niue's JNAP and the Second (and subsequent) National Communications to the UNFCCC (and future revisions of the NCCP and NHSP).
- The NCCHAP should be used as evidence of a thorough climate change and health vulnerability and adaptation assessment while approaching donors and other agencies for funding and technical support for health systems strengthening and/or climate change adaptation.
- Prompt consideration should be given to the respective costs and feasibility of the activities outlined above as the NCCHAP moves towards endorsement and implementation.
- Improving health information system (HIS) capacity is an overarching priority for the Department of Health:
 - Improved collection, coding, storage and analysis of health data are imperative for appropriate strategic planning for the health sector.
 - This measure will necessarily include training of staff in health data management.
 - The burden of health problems in Niue should be reviewed and quantified as precisely as possible as a matter of priority (note the recent completion of the NCD STEPwise survey) in order to better inform health policy planning.
- Education, awareness-raising and health promotion activities are crucial for improving the resilience of individuals and communities in Niue to the health impacts of climate change.
 - Health promotion activities aimed at reducing the risk of dengue fever (e.g. elimination of mosquito breeding sites; personal and household protective measures against mosquito bites), diarrhoeal disease (hygiene, sanitation, food storage and handling) and ciguatera (identifying high-risk fish species and fishing practices) would be relatively easy and cheap to implement in the short term.
 - School education campaigns and curriculum learning areas related to climate change should be reviewed and updated, if necessary, to include consideration of health impacts (link PACC project activities with the Department of Education).

- Improved communication and collaboration between agencies (e.g. Department of Health and the departments of Agriculture, Fisheries and Forestry in areas of food security, nutrition and ciguatera; Department of Health and Department of Education in community environmental health) should be prioritized in order to streamline activities, share information and resources, and avoid duplication of work.
- Future research activities could include the following:
 - Correlation of health with climate data – in the future, when sufficient health data are available – would be a useful exercise in determining local relationships between climatic factors, such as temperature and rainfall, and health outcomes, e.g. respiratory infections, exacerbations of asthma and episodes of diarrhoeal disease in young children.



5.8 Palau

5.8.1 Background

Our Palauan livelihoods are closely linked with the fish from our reefs and our staple taro that thrives on narrow coastal plains. Our ability to feed ourselves our nutritious traditional fare is now at risk. Our deep seas, coral reefs and coastal gardens that for centuries have nourished our people are severely threatened and with that our health, culture and our very survival. Our island nation calls for our concerted attention and support as the Health of the People is under threat from climate change – the unwanted gift from the developed world.

– Palau NCCHAP, 2011

Climate change adaptation activities in Palau are led by the Pacific Adaptation to Climate Change (PACC) project, which incorporated the WHO-led climate change and health vulnerability and adaptation assessment project, thus resulting in a concerted team effort and implementation of the following country-level actions, as articulated in the 2009 PACC project proposal:

- mobilization of communities to better adapt to the health consequences of climate change, as well as other impacts, applying the approach embedded in the Pacific region's Healthy Islands vision;
- strengthening of national capacity to develop and implement effective interventions to minimize climate-related health risks and enhance community resilience for adaptation, with special regard for the most vulnerable populations; in particular, reinforce existing programmes and build up the capacity of health and other related sectors in terms of infrastructure, human resources and financial resources; and
- assessment of the health implications of decisions made on climate change by other key sectors, such as energy, agriculture, fisheries, industry, water supply and sanitation, transport, urban and rural planning, and advocate for decisions that would improve health, noting that it is critical that key sectors are engaged in adaptation planning for the health sector.

5.8.2 Key climate-sensitive health risks

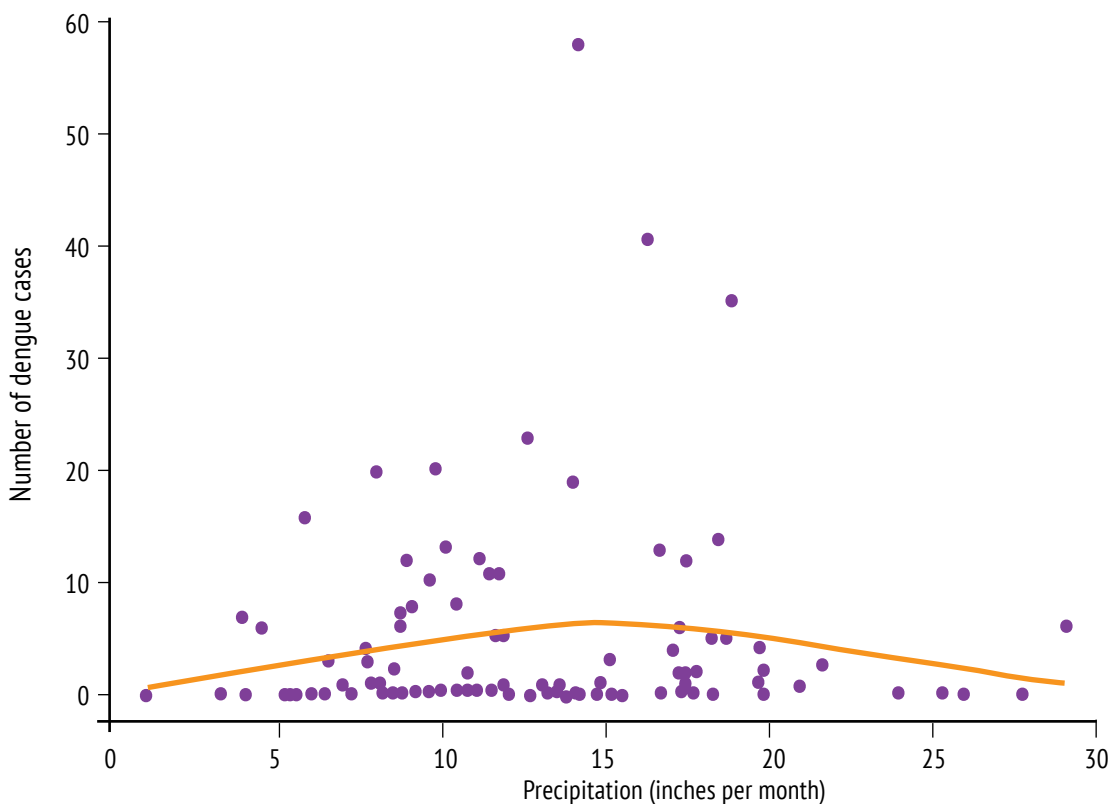
The assessment of Palau's climate-sensitive health risks identified the following priority areas:

- vector-borne diseases,
- zoonoses (particularly leptospirosis),
- gastroenteritis,
- respiratory disease,
- NCDs,
- injuries and deaths from extreme weather events, and
- mental and social health impacts.

Analysis of the available climate and climate-sensitive disease data, focusing on dengue fever and leptospirosis, yielded some useful results that may help the health sector and communities to anticipate outbreaks of these diseases based on climatic conditions (Figures 13 & 20 and Section 3.4.5).

Figure 20 shows the relationship between the monthly precipitation in Palau and dengue fever cases. Although the data are sparse, there appears to be an “ideal” rainfall window for dengue in Palau. The precipitation per se may not cause dengue fever, but heavier precipitation up to 15 inches per month would provide the vectors with the opportunity to multiply.

Figure 20. Relationship between monthly precipitation and number of dengue cases in Palau



Source: Palau NCCHAP, 2011

Note: Relationship is derived from distributed lag non-linear modelling of monthly climate and disease notification data, 2002–2010 (orange line = line of best fit).

5.8.3 Adaptation themes and activities

A range of adaptation strategies to manage these climate change-related risks to health in Palau are outlined in Table 13. Detailed adaptation plans can be found in the Palau NCCHAP.

Table 13. Climate change and health needs and adaptation strategies for Palau

VECTOR-BORNE DISEASES (specifically dengue)

- Improve vector control in hotspots, e.g. Malakal sewage treatment plant.
- Support/strengthen mosquito sentinel site surveys; expand to more sites.
- Implement plans to provide regular public information updates about mosquito control, e.g. “pupae per person” reports for individual hamlets.
- Provide dengue test kits for all outpatient clinics.

ZOOBOTIC INFECTIONS (specifically leptospirosis)

- Provide leptospirosis test kits for all outpatient clinics.
- Improve household-level rodent-control strategies.

GASTROENTERITIS

- Water and sanitation standards are relatively high in Palau at present; could concentrate on other issues with respect to capacity-building, e.g. diagnostics.

RESPIRATORY DISEASE (e.g. asthma, respiratory infections)

- Reduce outdoor and indoor air pollutants (including cigarette smoke, linked with NCD/tobacco control programmes).
- Support acquisition of air quality testing equipment.

NCDs (including, but not limited to obesity, circulatory disease, diabetes)

- Significant efforts already under way with respect to strengthening food security in Palau, note PACC project activities related to fish, crab and clam aquaculture; experimentation with drought- and salt-tolerant taro, note Palau Automated Land and Resource Information System (PALARIS) projects and work on the Palau National Policy on Sustainable Land Use.
- Link with other Ministry of Health NCD programmes, note the “Declaration of State of Health Emergency on NCDs in Palau”; emphasize link between climate change and NCDs.
- Consider the need for adequate cooling in residential and work environments, paying particular attention to the elderly, those with pre-existing illnesses, and certain occupations, e.g. outdoor workers – farmers, construction workers, etc.
- Consider public early warning system for extreme heat events; liaise with the Weather Service Office.

TRAUMATIC INJURIES AND DEATHS

- Consider ways in which the National Emergency Management Office (NEMO) and Public Works (for water) can be supported/strengthened, perhaps with additional emphasis on the health implications of natural disasters.
- Focus on community disaster action plans (NEMO) and water security contingency planning (Public Works).
- The Ministry of Health should pursue plans regarding safe storage of medical supplies, equipment, etc., surge capacity planning.
- Belau National Hospital is highly vulnerable to extreme weather events – need to also consider impacts on physical infrastructure.

MENTAL HEALTH

- Emphasize the link between healthy environment and mental/social health.
- Strengthen the Ministry of Health's social and spiritual health programmes.
- Support training of mental health professionals.
- Consider telehealth services for mental health, e.g. online psychiatry support for health professionals in Palau.

Source: Palau NCCHAP, 2011

5.8.4 Recommendations

- The Bureau of Public Health, led by the Office of the Director, should be the agency responsible for leading the implementation of the adaptation strategies outlined in this document, as well as liaising with relevant stakeholders and reviewing and updating this plan on a regular basis, e.g. annually.
- The Ministry of Health should pay particular attention to building capacity in the following areas:
 - reporting, coding, storage, analysis and dissemination of health data,
 - recruitment and training of health personnel in biostatistics and epidemiology,
 - public health, primary health care, environmental health and laboratory facilities, and
 - health research, including public and environmental health.
- The Ministry of Health should encourage other government sectors to develop sector-specific climate change action plans, which could combine to form a National Climate Change Adaptation Plan for Palau.
- Strong consideration should be given to developing environmental warning systems to protect health, for example for heatwaves, storms or even disease-specific alerts such as when conditions are ideal for dengue fever or leptospirosis.
 - This will entail the development of a closer relationship between the Ministry of Health and WSO.
 - These plans should include appropriate responses to such events.
- Recognition must be given to the fact that, despite the very small contribution that Palau has made to the problem of human-induced climate change, it nevertheless needs to reduce its own carbon emissions to contribute towards global mitigation strategies.
- Acknowledgement should be made of the health co-benefits inherent in a variety of climate change adaptation and mitigation strategies such as:
 - reducing air pollution,
 - consumption of locally grown, nutritious foods,
 - increasing personal energy expenditure, e.g. walking, cycling,
 - reducing energy consumption, and
 - reducing fuel-dependent transport.



5.9 Samoa

5.9.1 Background

Samoa's health sector is vulnerable to hazards like tropical cyclones, floods and droughts. Samoa has experienced an increase in the frequency of cyclones in the past two decades, such as cyclones Heta, Ofa and Val, and Cyclone Evan in 2012.

The *Climate Synthesis Report for Samoa* has assessed the current vulnerability and potential increase in climate hazards and associated risks of the critical sectors including health. In relation to this, a list of priority activities was identified under Samoa's *National Adaptation Plan of Action (NAPA)* in 2005 outlining nine immediate and urgent project-based priority activities in order from 1–9. Health was ranked third given the urgent need of adaptation to climate change impacts.

Following this work, the Government of Samoa proposed an integrated approach to address climate change impacts in the agriculture and health sectors with a project called Integrating Climate Change Risks into the Agriculture and Health Sectors in Samoa (ICCAHSS). The project focused on the enhancement of technical capabilities in the Samoa Meteorology Division to monitor climate trends and provide timely and accurate climate risk and early warning information to agricultural extension and public health services.

There is evidence that not many programmes are addressing climate change and health. Gaps have been identified in terms of the insufficiency of skills for psychological support following disasters, as well as poor documentation of vulnerable groups during disasters, such as the disabled. To improve resilience to climate change, adaptation measures needed to be in place by the health sector to further strengthen the health system. In relation to this, the *Health Sector Plan 2008–2018* midterm review was conducted in 2013, and the following climate change and health-related priorities were considered along with other priorities. These priorities were reaffirmed by the health sector in early 2014 and included two climate health-related priorities as follows:

1. health impacts of climate change and disasters,
2. emerging & re-emerging communicable diseases and neglected tropical diseases.

Building on this work, in 2013, a *Climate Adaptation Strategy for Health (CASH)* was developed by the Ministry of Health for the health sector. The reports used as the basis of CASH are the *Health Risk Analysis* and the *Assessment Report on Climate Change Risks to Health at*

District Hospitals, in addition to WHO technical reports, the Health Sector Plan and Ministry of Health strategic directions. CASH follows the latest technical briefing of *Strengthening Health Resilience to Climate Change* (WHO, 2014b). It operates on five key strategic areas (KSAs) that are crucial to emphasize the continued investment in primary health care and essential public health services, which helps to reduce population and health system vulnerability to climate change. Furthermore, the health sector has also finalized its CASH work programme with specific activities under the five KSAs listed below:

- KSA 1: Health governance, policy and management
- KSA 2: Cross-sectoral collaboration and partnership
- KSA 3: Capacity development
- KSA 4: Vulnerability and adaptation assessment
- KSA 5: Cross-sectoral prevention and risk management

5.9.2 Key climate-sensitive health risks

Samoa is already subject to a number of climate-sensitive health problems that are inadequately addressed, and Samoa's vulnerability to these may be increased as a result of climate change. As part of the finalization process of the CASH, the health sector identified important climate-sensitive health risks that should be considered in climate change adaptation planning. Major health risks related to climate change in Samoa include the following:

- vector-borne diseases,
- waterborne and foodborne diseases,
- malnutrition,
- NCDs,
- mental health,
- injuries,
- maternal and child health, and
- extreme climate events.

These climate-sensitive health risks are elaborated further in Table 14 of the *Climate Adaptation Strategy for Health*, Samoa Ministry of Health, 2014.

Table 14. Climate-sensitive health risks in Samoa

Health risk	Extreme climate events	Waterborne and foodborne communicable disease	Vector-borne disease	Malnutrition	NCDs	Heat effects
Likelihood	2–3	3	2–3	3	3	Unknown
No. of people	3	3	2	3	3	
Geographical area ^a	3	3	2	3	3	
Severity of impact	2	1	2	2	3	
Vulnerable groups	Children, older people, women, coastal areas	Children, < 5 years, older people, immuno-suppressed, tourists	Tourists, everybody	Children	Everyone	
Limitations/needs/gaps		Changing behaviour	Funding, attitudes, human resources	Financial, seasonal local foods, living costs, affordability, awareness	Cost of living high	
Costs to address	3	3	3	3	3	
Time frame to implement ^b	1–3	Potentially 1, with will	2	2	3	
Time frame for benefits ^b	1	2 (5–10 years)	1	2	3	

Source: Climate Adaptation Strategy for Health, Ministry of Health Samoa, 2014

Key for Table 14: Health risk and adaptation matrix, developed in consultation with stakeholders. 1 = Low (or small^a or short^b), 2 = Medium, 3 = High (or large^a or long^b), depending on the issue in question, i.e. a higher number means the health risk is very likely, will affect many people, over a large geographical area, with very severe outcomes (e.g. death), is expensive to address, and will take a long time to implement an adaptation programme, and observe any subsequent benefits.

Notes on Table 14: It was agreed that the health impacts of extreme events, waterborne and foodborne communicable diseases, vector-borne diseases and malnutrition were important priorities for climate change adaptation. NCDs could potentially be accommodated under the “malnutrition” category, but this is a problem of over-nutrition (consumption of large quantities of overly energy-dense foods), generally of greatest concern in adulthood, rather than under-nutrition, generally a concern among young children and the usual target of programmes to address malnutrition. Heat-related morbidity and mortality may become an increasing concern in Samoa, especially with the high prevalence of chronic disease. Prioritizing adaptation strategies to address the health impacts of climate change should take into account the likelihood and extent of the problem and how feasible it is to address. A more detailed analysis would require more data on baseline risks, for example, in order to determine future likelihood and burden.

5.9.3 Adaptation themes and activities

Climate change and health involve cross-cutting issues with other sectors, and therefore cross-sectoral prevention and climate risk management is a critical part of health prevention since many climate-related health risks are determined by conditions in other sectors. While disaster risk management and response in Samoa are well developed, there is considerable need to better understand how climate variability and change affect health outcomes, including outside the context of extreme events usually considered in disaster plans. Capacity to respond through public awareness to familiar events such as flooding and droughts can be limited by availability of adequate human resources. Therefore, current capacity to continuously monitor, prevent and respond to communicable and NCDs needs to be strengthened.

The following areas were identified as the adaptation needs during consultations with the public health sector and key partners for Samoa's *Climate Adaptation Strategy for Health*.

A. Surveillance, testing and reporting

Communicable disease surveillance guidelines are implemented but a lack of human resources is a major challenge. Laboratory testing for diagnoses for communicable diseases is minimal. An improvement in the capacity for diagnosis has been identified by the public health sector as a high priority in order to identify and respond to potential outbreaks in a timely manner.

B. Data collection, research and technical expertise

The constant updating of climate information and the sharing of data enable the identification a link between health and weather and climate events, thus monitoring and surveillance activities.

C. Information sharing and early warning systems

Upgrading of early warning systems and better information sharing are important for improving preparedness, especially to better prepare for extreme climate events. Early warnings need to be understandable, believable and timely in order for appropriate mitigation action to be put in place.

The Climate Early Warning Systems (CLEWS) was developed to provide information services to all sectors to inform planning and operations, assist in disaster risk reduction initiatives, and increase the resilience of the health sector. There is still a need to strengthen the collaboration of these sectors in order to provide high-quality scientific data and deliver effective and efficient climate information to service providers. There is a need to strengthen the capacity of the health sector to provide a climate health early warning system tailored to stakeholders and communities to better respond and adapt.

D. Awareness and capacity-building

Ongoing multimedia awareness about climate change is a priority. As there is a need for the public to become aware of the significant causes of climate-sensitive diseases and preventive measures, community engagement on these issues should be emphasized in health promotion and educational programmes.

Improving the capacity of individuals and households, through education and consultation, to respond to the health risks posed by climate change was seen as essential, especially in rural areas where assistance during an event may be delayed.

Building capacity for human resources using the Health Impact Assessment (HIA) will allow the Ministry of Health to analyse updated data on human resources for health and the response in relation to climate change and health risks.

E. Communication

The potential for mobile phone companies to play a significant role in adaptation in Samoa is considerable. Mobile phones are widely used in all parts of the country, with two main providers. The tsunami warning system includes mass messaging, and this could also potentially be employed for extreme climate events. Taking this further, mass communication – or communications targeted to a specific area – could be used to raise awareness about, for example, contaminated or a shortage of water. There is potential for mobile phone companies to disseminate information, with health sector engagement. Social media, such as Twitter and Facebook, can be utilized, as well as the Feso'otai Centres.

F. Water and sanitation

Improving ecological health more generally, such as reducing deforestation, was noted as important for increasing environmental resilience and reducing climate-sensitive health risks.

Adaptation preparedness should include strategies to plan for and respond to more geographically widespread events that may require shipping in freshwater from unaffected areas or transferring personnel or patients.

G. Safety

Climate change causes risks to population safety and health, and it is important to consider HIAs, Environmental Impact Assessments, and Emergency and Disaster Plans for safety purposes. Having a safe place for community members to gather in during or following an extreme weather event is a priority. This could be located near or at the district hospital and be used as an emergency store for food and water and to provide shelter for approximately 300 people. Such a facility could also be used as a health education or resource centre for the local community.

H. Monitoring and evaluation

The importance of considering the wider implications of any adaptation activity prior to implementation and evaluating the impacts of activities after implementation were noted as necessary to identify actions that work best, are sustainable, and that minimize adverse and unintended consequences. Including an evaluation component and situational analysis into any adaptation project is essential in order to assess efficacy and cost-effectiveness, and to develop and improve the programme. Needs may vary among areas, as might climate, behaviours and other contexts. Adaptation activities should include consultations with stakeholders in their planning and development, implementation and evaluation.

Monitoring of climate change and disaster risk management outcome indicators is one of the roles of the Ministry of Health. This will allow the health sector to anticipate outbreaks and emergencies related to climatic conditions.

Many of the adaptation needs identified above relate to data and information. A lack of data was noted as a significant limitation across sectors. Data are required to establish baseline relationships between, for example, climate variables and health outcomes, in order to estimate future risks, plan appropriate adaptation activities and evaluate the impacts of such activities. Improved laboratory testing and surveillance is a high priority, as are research projects to establish baselines and trends in climate-sensitive health risks. A process for sharing information across sectors would improve understanding of the responsibilities and relationships of various sectors and add value to research. Increasing capacity – technical expertise, for example, in research and monitoring, as well as in community resilience – was also identified as an important need.

5.9.4 Recommendations

The strengthening of health resilience to climate change in Samoa will operate from five KSAs as mentioned above. Within these KSAs, and taking into account the eight adaptation needs identified, the main highlighted recommendations are:

- mainstream climate change considerations into all health sector activities;
- strengthen community health education and health promotion, food and water safety, hygiene, sanitation, hazardous waste management from health-care facilities, vector control, breastfeeding, nutrition and psychosocial support;
- strengthen communicable disease surveillance and control, especially as this relates to climate-sensitive diseases;
- strengthen NCD surveillance including mental health and injuries in order to predetermine a proactive response in times of disasters;
- conduct further research linking health and climate information, including CLEWS, early warning and response system (EWARS), GIS and HIS, climate risk maps;
- consider the effect of climate change on future health risks, especially those identified in HIAs and risks related to water and food supplies, sanitation and vector control, NCDs including nutrition, psychosocial issues and mental health; and
- consider the review of outcome indicators on risk management and response to disasters, emergencies and climate change in the revised *Health Sector Plan 2008–2018*.

The Ministry of Health is the lead agency for the health sector and is the national focal point for monitoring the *Climate Adaptation Strategy for Health*.

The need to strengthen health information and surveillance systems is important for better decision-making, including for health adaptation. A key focus is the need to build staff capacity in the analysis and use of existing information and ability to produce reports.



5.10 Solomon Islands

5.10.1 Background

Even before commencement of the joint WHO–Solomon Islands Ministry of Health and Medical Services project on climate change and health vulnerability and adaptation, a considerable amount of activity and planning had been taking place within the climate change arena.

The majority of climate change-related activities in Solomon Islands has been led by the Ministry of Environment, Climate Change, Disaster Management and Meteorology. One of the key references for such activities is the November 2008 Solomon Islands *National Adaptation Programme of Action* (NAPA), which ranks health alongside agriculture and food security, water and human settlements as the priority sectors for climate change adaptation. Along with the Second National Communication to the UNFCCC, to be submitted in the near future, and the 2012 National Climate Change Policy, these high-level policy documents lay the foundation for adaptation and mitigation strategies to protect communities of Solomon Islands from climate change.

5.10.2 Key climate-sensitive health risks

The climate change and health vulnerability assessment carried out in Solomon Islands was based on an HIA framework (Box 5 & Table 3 and see the discussion in sections 3.1 and 3.2).

The process described above gave rise to the Solomon Islands NCCHAP, the key points from which are outlined in this section.

The range of health problems that may be affected by climate change in Solomon Islands include, but are not limited to, the list provided in Table 15, ranked according to the “likelihood-versus-consequence” matrix described above.

Table 15. Climate change and health risks in Solomon Islands

Risk category	Health issue
Extreme	Vector-borne diseases Respiratory diseases
High	Waterborne diseases Malnutrition NCDs (e.g. obesity, diabetes) Foodborne diseases Other infections and/or re-emerging diseases (e.g. leptospirosis, leprosy) Traumatic injuries and deaths
Medium	Circulatory disease Mental health issues Temperature-related illnesses Eye, ear and skin conditions
Low	Sexually transmitted infections

The identification of priority climate-sensitive health risks in Solomon Islands tended to emphasize the main public health risks that are dominant in a society in the stages of epidemiological transition. They show a mix of communicable disease risks and some of the health problems associated within a society with an excess intake of a high-energy diet and an increasingly sedentary lifestyle.

With respect to the risk categorization process, it is important to recognize that it was beyond the scope of the project and, in many instances, beyond the capacity of available information, to carry out a quantitative assessment of risks. The levels of uncertainty surrounding consequences and/or the likelihood of potential health impacts are high, particularly for indirect impacts.

5.10.3 Adaptation themes and activities

Adaptation measures related to the priority climate-sensitive health risks summarized in Table 15 were categorized using the following headings:

- legislative or regulatory,
- public education and communication,
- surveillance and monitoring,
- ecosystem intervention,
- infrastructure development,
- technological or engineering,
- health intervention, and
- research/information.

Adaptations for the extreme- and high-risk categories are recommended for priority consideration through a whole-of-government approach. The next stage would be implementation of the adaptation measures in each of the separate areas by a lead agency or sector together with other relevant sectors.

Subsequent responses should determine whether each of the proposed adaptations requires further justification and can be implemented readily or if further analysis is required to determine more details about the nature of the risk and hence the most appropriate response actions. Some risks may need to be accepted if there is no cost-effective adaptation measure or the risk is considered less significant.

5.10.4 Recommendations

The Solomon Islands NCCHAP contains detailed recommendations for adaptation related to the highest-priority, climate-sensitive health risks identified in the vulnerability assessment. In implementing the adaptation strategies outlined in the Solomon Islands NCCHAP, the following factors will need to be considered:

- the need for increased capacity in human resources, equipment and other support;
- the establishment of a Climate Change and Health Secretariat or a Climate Change and Health Unit within the Ministry of Health to oversee the implementation of the Solomon Islands NCCHAP and to strengthen collaboration with other sectors, which is currently weak;
- the need for further information on specific health impacts (i.e. the manner in which the health issue will likely be affected by climate change) and sharing of information between Pacific island countries and areas on lessons learnt and best practices related to climate change and health adaptation;
- the need for adequate baseline data on the health status of communities likely to be affected;
- the need for intersectoral collaboration; and
- the need for improved standards, legislative review and better enforcement of current regulations.

The climate change and health vulnerability assessment and adaptation planning process is expected to form the basis for updates in the development of strategies for mitigation and adaptation with respect to the health impacts of climate changes in Solomon Islands, as more information becomes available on the predicted changes to climatic parameters and adverse impacts on human health.



5.11 Tonga

5.11.1 Background

The key processes that drive climate change adaptation activities in Tonga are the *Joint National Action Plan (JNAP)* and the *Second National Communication to the UNFCCC*. The current JNAP builds on previous work on climate change vulnerability and adaptation in Tonga, including:

- Tonga’s Initial National Communication to the UNFCCC (2005);
- *Climate Change Thematic Assessment Report* (National Capacity Self Assessment Project, 2007);
- *National Climate Change Policy* (2006); and
- community and stakeholder consultations.

JNAP aligns with Tonga’s *National Strategic Planning Framework (2009–2014)* as well as the *Pacific Islands Framework for Action on Climate Change (2006–2015)* and incorporates a multidisciplinary team led by a secretariat, which sits within the Ministry of Environment and Climate Change. The Tonga Ministry of Health is one of the contributors to the JNAP Technical Working Group.

Health was identified as one of eight critical sectors with respect to climate change vulnerability in Tonga in JNAP.

5.11.2 Key climate-sensitive health risks

Some of the potential health impacts of climate change in Tonga have been identified in previous vulnerability assessments, including JNAP.

The key climate-sensitive health risks for Tonga identified during the WHO-supported vulnerability assessment and adaptation planning project include the following:

- water safety/security and diarrhoeal diseases,
- food safety/security,
- vector-borne diseases, specifically dengue fever,
- nutrition and its links with NCDs, and
- injuries, deaths and damage to infrastructure from extreme weather events (tropical storms, floods and other climate-related disasters).

5.11.3 Adaptation themes and activities

Adaptation strategies in Tonga were considered under the following headings:

- Legislative or regulatory
- Public education and communication
- Surveillance and monitoring
- Ecosystem intervention
- Infrastructure development
- Technological or engineering
- Health intervention
- Research/information

Table 16 lists some suggestions for adaptation options related to food and water safety/security, which are the top two climate change and health priorities identified in Tonga in relation to the above-mentioned adaptation themes.

Table 16. Areas for consideration of adaptation options for climate change and health in Tonga

Area for consideration	Water safety/security	Food safety/security
Legislative/regulatory	Establish/review water safety plans that conform to international/WHO standards and are resilient to disasters. Clarify division of responsibility between the Ministry of Health and community water committees. Establish standard operating procedures (SOPs) for health inspectors related to water safety.	Lobby the Government to approve the Food Bill. Review and improve food safety, hygiene, handling and service standards; ensure appropriate enforcement capabilities. Establish SOPs for health inspectors related to food safety.
Public education/communication	Review/extend health promotion campaigns regarding safe water practices in rural communities.	Educate the public regarding safe food handling/service practices (including for traditional cultural/feasting purposes), particularly in the context of climate change (rising ambient temperatures and increased risk of pathogenic contamination).
Surveillance and monitoring	Regularly test and treat rural water supplies, including rainwater harvesting infrastructure.	Recruit/train health inspectors in specific food safety inspection techniques.
Ecosystem intervention	Inspect improved and unimproved water supplies, particularly in rural areas, for sources of contamination, with consideration of appropriate interventions (revegetation, restriction of access by animals, etc.).	Investigate opportunities for development of drought- and salt-resistant crops.

Table 16. Areas for consideration of adaptation options for climate change and health in Tonga
(continued)

Area for consideration	Water safety/security	Food safety/security
Infrastructure development	Ensure adequate water-testing facilities in the outer islands. Consider the value of investing in transport for health inspectors to perform their duties in remote areas.	Ensure adequate refrigeration and heating facilities for food storage and service.
Technological/engineering	Review and maintain standards for testing and treatment of water supplies.	Develop capacity for testing of food for contamination.
Health intervention	Train public health inspectors, village water committees in water safety plans (surveys, testing, treatment, standards, etc.). Note: training could be with “attachment” (e.g. to Australia, Fiji, New Zealand); use model of entomology training. Extend routine testing/treatment services to the outer islands, currently constrained by finances.	Provide training for food vendors/handlers and health inspectors. Improve outbreak investigation capacity within the Ministry of Health. Improve diagnostic capacity to identify pathogenic organisms in outbreaks (e.g. of infectious gastroenteritis/food poisoning).
Research/further information	Use water testing data/results to evaluate the efficacy of water safety plans. Consider establishing/expanding online training programmes for environmental health (e.g. through the Fiji National University and/or the Pacific Open Learning Health Network).	Investigate the effects of local foodstuffs and environmental conditions on nutrition (both malnutrition and over-nutrition/NCDs). Consider establishing/expanding online training programmes for environmental health (e.g. through the Fiji National University and/or the Pacific Open Learning Health Network).

5.11.4 Recommendations

It is intended that the WHO-supported climate change and health vulnerability assessment and adaptation planning process, which was collated into a *Climate Change and Health Report* for the Tonga Ministry of Health, complement both the earlier work done by the Ministry of Health in relation to climate change and health, and the Ministry of Health's other contributions towards JNAP and Second National Communication to the UNFCCC processes. In considering the Ministry of Health *Climate Change and Health Report*, it is hoped that the health components of both these important documents may be strengthened and implementation of activities related to the climate-sensitive health risks described above be given the utmost priority.

The specific recommendations in the Tonga *Climate Change and Health Report* are given below:

- The contents of the report should be added to recent submissions by the Ministry of Health to the JNAP Secretariat for inclusion in the final Second National Communication to the UNFCCC.
- The contents of the report should be reviewed for future revisions of the JNAP, with consideration of implementing activities related to the climate-sensitive health risks detailed above.
- Environmental health issues, including consideration of the health impacts of climate change, should be included in the next and future editions of the Tonga's health report.
- Consideration should be given to carrying out research projects related to climate change and health (specifically) and environmental epidemiology, more broadly, as suggested above.
- The role of the Disaster Officer should be clarified, particularly as to whether this person would be responsible for pursuing and monitoring the progress of activities related to climate change and health adaptation, or those related to disasters only.
- In relation to the above point, a focal point for climate change and health within the Ministry of Health should be identified, particularly following the departure of the current head of Environmental Health.
- Consideration should be given to strengthening the capacity of the Environmental Health Unit (EHU) in general and in specific areas such as food safety, vector control, water safety, etc.
- Consideration should also be given to the potential merits of sub-specialization within the EHU, e.g. having dedicated health inspectors for food safety and water safety, as well as vector control.
- Consideration should be given, at an appropriate juncture, to the other climate change and health risks (respiratory disease, heat-related illnesses, ciguatera, etc.) beyond those prioritized in earlier stages of this climate change and health vulnerability and adaptation assessment process.
- Extra attention should be given to quantification of climate change and health issues (burden of disease, links between climate and health outcomes, estimation of future climate change-attributable disease burden) in future revisions of JNAP and the Third National Communication to the UNFCCC.



5.12 Tuvalu

5.12.1 Background

The climate change and health vulnerability assessment and adaptation planning project in Tuvalu gave rise to the Ministry of Health work plan, *Managing the Health Impacts of Climate Change in Tuvalu (2012)*.

This document is the end-product of the climate change and health vulnerability and adaptation assessment for Tuvalu. Its format is that of a work plan for the Tuvalu Ministry of Health, though it is also specifically intended to align with the high-level policies and frameworks that guide both health planning and climate change adaptation in Tuvalu (e.g. the Ministry of Health *Strategic Health Plan 2009–2019*, the *National Climate Change Policy 2012–2021*, the *National Strategic Action Plan for Climate Change and Disaster Risk Management 2012–2016* and the *National Adaptation Programme of Action, 2007*).

5.12.2 Key climate-sensitive health risks

A range of CSDs was considered as part of this climate change and health adaptation planning project in Tuvalu. In order to rationalize resources and prioritize the activities of the health sector, these CSDs were considered in terms of the relative risk each represents in the context of climate change, according to the likelihood-versus-impact model described in section 3.2 and Table 3. The resulting list of CSDs ranked according to the risk each represents due to climate change in Tuvalu is displayed in Table 17 below.

Table 17. Ranking of climate-sensitive diseases according to risk in Tuvalu

Climate-sensitive disease	Risk (of increasing burden of disease with climate change)
Diarrhoeal disease (due to contaminated food and/or water)	High
Respiratory disease (infective and obstructive)	High
Compromised food security (with impacts on nutrition and NCDs)	Medium–high

Table 17. Ranking of climate-sensitive diseases according to risk in Tuvalu (continued)

Climate-sensitive disease	Risk (of increasing burden of disease with climate change)
Vector-borne diseases	Medium
Mental health/psychological problems	Medium
Injuries and deaths from extreme weather events	Medium
Fish poisoning (ciguatera)	Low-medium
Skin infections/infestations	Low

5.12.3 Adaptation themes and activities

Potential strategies to manage the above-mentioned climate-sensitive health risks are outlined in Table 18 below.

Table 18. Climate change and health adaptation strategies for Tuvalu

Climate-sensitive health risk	Strategies/work plan activities (to address gaps/shortfalls)
Diarrhoeal disease (waterborne and foodborne diseases)	<p>Upgrade microbiology laboratory facilities (human resources, equipment, building renovation) to also be used for water testing:</p> <ul style="list-style-type: none"> – Align with plans to improve laboratory facilities and diagnostic capacity at Princess Margaret Hospital. <p>Improve planning, ordering and shipment of medical supplies by considering ordering in bulk and in advance (will require cooperation between the Ministry of Health and Ministry of Finance).</p> <p>Enforce the Food Safety Act – provide training/education to retailers, report unsafe practices.</p> <p>Ensure proper implementation of the building code, with respect to sanitation.</p> <p>Consider a proposal to train more staff in environmental health and food and nutrition (2013 training programme at Fiji National University), including WASH activities in Funafuti and outer islands:</p> <ul style="list-style-type: none"> – May be useful to coordinate with the Public Works Department, as it is responsible for management of septic waste, for purposes of education/training. <p>Consider sources of funding for a sewage treatment plant by the Government.</p> <p>Provide training in coding:</p> <ul style="list-style-type: none"> - Clarify case definitions and streamline disease codes to avoid duplication/ambiguity (e.g. diarrhoea, gastroenteritis and food poisoning may all represent the same syndrome/underlying diagnosis). <p>Build the capacity of health information systems.</p> <p>Improve timeliness of reporting from the outer islands:</p> <ul style="list-style-type: none"> – Collate by month and island, particularly important for CSDs such as diarrhoeal disease, respiratory infections, etc. <p>Note the importance of health promotion/public education, not least to ensure that health and hygiene messages taught to schoolchildren are reinforced at home.</p>

Table 18. Climate change and health adaptation strategies for Tuvalu (*continued*)

Climate-sensitive health risk	Strategies/work plan activities (to address gaps/shortfalls)
Respiratory disease, infective and obstructive	<p>Upgrade laboratory facilities and ordering of supplies (see above).</p> <p>Address the overcrowding issue through the Tuvalu Population Policy.</p> <p>Consider incorporation of pneumococcal vaccine into the immunization schedule; funds may be available for low-income countries from the global programme.</p> <p>Clarify case definitions and streamline coding, avoid duplication and ambiguity, e.g. cough, acute respiratory infection, influenza, pneumonia are all separate at present.</p> <p>Monitor for trends (including seasonal trends).</p>
Compromised food security and impact on nutrition and NCDs	<p>Consider taxation/subsidies or other incentives to promote healthy food options.</p> <p>Implement the NCD plan.</p> <p>The Ministry of Health needs to play a more active role in discussions and programmes related to food supply/security.</p> <p>The Ministry of Health should support the Agriculture Department in assisting households with providing information/expertise/equipment for home gardening; note issues related to lack of space for gardens.</p> <p>Ensure appropriate monitoring of child malnutrition:</p> <ul style="list-style-type: none"> - maternal and child health clinic infant weight/height, - school entry height and weight, - collation of child weight/height data, and - guidelines for diagnosis and coding of under-nutrition. <p>Conduct health promotion campaigns targeting nutrition/healthy food choices, including healthy cooking, food preparation techniques and behaviour change in communities.</p>
Morbidity from extreme weather events (cyclones, storm surges, floods, extreme heat/rainfall events, droughts)	<p>Conduct health promotion/community education programmes related to the health impacts of disasters.</p> <p>Improve coordination between agencies in disaster planning.</p> <p>Ensure appropriate health inputs into national disaster planning (risk reduction and response).</p> <p>Develop/refine disaster early warning systems (coordinate with the Meteorology Service).</p> <p>Aim for each health facility to have a disaster response plan developed and implemented; liaise with Island Disaster Committees.</p> <p>Provide extra training for health staff in disaster planning and response.</p> <p>Have an essential supplies list of drugs for each health facility.</p>
Mental health/psychological issues	<p>Provide extra training for health professionals to manage the psychological consequences of climate change, noting that the issues are likely to be somewhat different from the “usual” mental health problems managed by the Ministry of Health.</p>

Table 18. Climate change and health adaptation strategies for Tuvalu (continued)

Climate-sensitive health risk	Strategies/work plan activities (to address gaps/shortfalls)
Vector-borne diseases	<p>Improve training of public health staff in appropriate health quarantine control strategies in ports.</p> <p>Strengthen health promotion campaigns, targeting mosquito population control and individual protective behaviours, i.e. to avoid mosquito bites.</p> <p>Provide refresher training for health professionals on vector-borne diseases, using updated protocols, guidelines, etc.</p> <p>Review shipping and airport border control guidelines and processes – ensure adequate measures to prevent introduction of new vector species.</p>
Fish poisoning (ciguatera)	<p>The Ministry of Health needs to work with the Fisheries Department on health promotion campaigns educating the public about ciguatera fish species and other risk factors, e.g. conditions of reef, location of fisheries:</p> <p>– monitor the progress of research in New Caledonia investigating traditional Pacific methods of treating ciguatera (e.g. plants in Yap, Federated States of Micronesia,</p>
Skin infections/infestations	<p>Educate health professionals and the community regarding high-risk conditions and the importance of early, appropriate management to avoid complications.</p>

5.12.4 Recommendations

- The adaptation strategies and activities outlined in Table 18 should be considered for implementation in the near future according to their feasibility and the risk represented by each climate-sensitive health issue, as well as considerations of cost versus benefit.
- An example of a highly feasible and relatively low-cost project may be a health promotion campaign targeting ciguatera, despite the fact that this represents a lower risk in terms of climate change.
- The Climate Change and Health Work Plan should be subjected to regular review and updating by the Ministry of Health, led by the Chief Public Health Officer, in consultation with stakeholders and project partners, and amended to incorporate new information as required.
- The Ministry of Health should consider incorporation of the activities/strategies outlined above into the Ministry of Health Annual Work Plan for each year, with revision and updating for subsequent years.
- High priority should be given to activities that fall within the domains of environmental health, especially those related to water and sanitation, food/nutrition and vector-borne disease surveillance and control, and health information systems.
- Consideration should be given to revising/updating the health information management system to clarify case definitions and review disease codes, specifically to avoid duplication and ambiguity – see examples for diarrhoeal and respiratory illnesses in Table 18.

- The Ministry of Health should coordinate more closely with the Department of Environment to consider areas of overlapping responsibility, collaboration, and sources of funding and technical support for projects that have health implications, e.g. activities related to water safety and food security.
- The health issues outlined in this plan, as well as the suggested strategies to manage these risks, should be considered for incorporation in Tuvalu's Second National Communication to the UNFCCC and future revisions of NAPA, the *National Strategic Action Plan for Climate Change and Disaster Risk Management*, the *Strategic Health Plan*, and other high-level health and climate change policy frameworks.
- The Ministry of Health should collaborate with the Tuvalu Meteorology Service in correlating monthly climate data with cases of CSDs, e.g. diarrhoeal, respiratory illnesses in an attempt to discern "tipping points" or thresholds with respect to disease outbreaks, e.g. in relation to heat or rainfall.



5.13 Vanuatu

5.13.1 Background

A substantial amount of activity and planning has been taking place within the climate change arena in Vanuatu over the past two decades. The National Advisory Committee on Climate Change (NACCC), first established in 1989 – then re-established in 1997 after a hiatus – is the chief body for climate change planning, adaptation and implementation in Vanuatu. NACCC includes high-level representation from Government ministries, including health and key technical staff from several ministries that together form the Climate Change Core Team for Vanuatu.

As far back as 1999, in Vanuatu's Initial National Communication to the UNFCCC, specific mention was made of the potential for climate change-attributable health impacts to occur, particularly in relation to malaria, waterborne diseases and heat-related illnesses.

More recently, the health impacts of climate change in Vanuatu were outlined in the Vanuatu NAPA, 2007:

The health sector in Vanuatu is likely to be severely impacted due to the projected climate changes. Malaria is already endemic to certain areas of Vanuatu and there is some evidence to suggest that these areas are extending southwards. Other tropical and vector-borne diseases, such as dengue, and water-related diseases such as dysentery and diarrhoea are also likely to increase. Other problems associated with the increased temperature, such as contamination of food and heat stress, are likely to be exacerbated.

The NAPA also noted that “Vanuatu is experiencing increased population pressures due to the high rate of population growth. This is clearly impacting on the availability of land for agriculture and sustenance, and has serious implications for food security, nutrition and health” and that, in addition “...the effects of climate change on agriculture production, human health and well-being will have the consequences of decreasing national income while increasing key social and infrastructure costs. This negative economic impact will affect all levels: individual, household, community, private and government sector” (Vanuatu NAPA, 2007).

It is also worth noting that, as part of the NAPA consultation process, participants reported that the impacts of climate change were already being felt in certain areas, including health, as evidenced by the following quote: “...significant input by relevant government agencies

and provincial governments, nongovernmental organizations and communities identified that water, coastal zone resources, agriculture and health sectors were those that are already affected under current climatic conditions. Any future climate change will further aggravate impacts currently being observed or experienced by those sectors” (Vanuatu NAPA, 2007).

5.13.2 Key climate-sensitive health risks

The WHO-led climate change and health vulnerability assessment and adaptation planning project in Vanuatu involved the ranking of climate-sensitive health risks according to the likelihood-versus-consequence model described earlier (Table 3 and sections 3.1 and 3.2). The process by which these rankings were decided was mainly consultative, and the final decisions were made by the Vanuatu Climate Change and Health Working Group, with guidance from the WHO Consultant and technical teams. The results are displayed in Table 19.

Table 19. Climate-sensitive health risks in Vanuatu

Risk category	Health issue
Extreme	Waterborne diseases Foodborne diseases
High	Vector-borne diseases Malnutrition NCDs Temperature-related illnesses Occupation-related illnesses
Medium	Respiratory infections Skin conditions Eye diseases Mental health disorders Traumatic injuries and deaths

5.13.3 Adaptation themes and activities

Adaptation measures related to the priority climate-sensitive health risks summarized in Table 19 were categorized using the following headings:

- Legislative or regulatory
- Public education and communication
- Surveillance and monitoring
- Ecosystem intervention
- Infrastructure development
- Technological or engineering
- Health intervention
- Research/information

A detailed list of adaptation strategies and activities under these headings can be found in the Vanuatu NCCHAP (2011).

The adaptations for the extreme and high-risk categories are recommended for priority consideration through a whole-of-government approach. The next stage would be implementation of the adaptation measures in each of the separate areas by a lead agency or sector together with other relevant sectors.

Subsequent responses should determine whether each of the proposed adaptations requires further justification and can be implemented readily or if further analysis is required to determine more details about the nature of the risk and hence the most appropriate response actions. Some risks may need to be accepted if there is no cost-effective adaptation measure or the risk is considered less significant.

5.13.4 Recommendations

In implementing the adaptation strategies outlined in the Vanuatu NCCHAP, the following factors will need to be considered:

- the need for increased capacity in human resources, equipment and other support;
- the need for further information on specific health impacts, i.e. the manner in which the health issue will likely be affected by climate change;
- the need for adequate baseline data on the health status of communities likely to be affected;
- the need for intersectoral collaboration; and
- the need for improved standards and better enforcement of current regulations.

The climate change and health vulnerability assessment and adaptation planning process for Vanuatu will need to be repeated, probably in a modified form, as new information on the monitoring of climate parameters, predicted climate changes and the predicted adverse impacts on human health become available.

CHAPTER 6

Situation analysis of climate change and health adaptation in Pacific island countries and areas

This chapter summarizes key opportunities, challenges and common priorities for adaptation in Pacific island countries and areas. In doing so, the chapter draws upon the detailed adaptation plans in each country's National Climate Change and Health Action Plan (NCCHAP), which has been summarized in the previous chapter.

6.1 Opportunities and comparative advantage for health adaptation

The context of climate change and health in each country is described, identifying the key agencies, institutions and policies involved, and previous work related to health vulnerability analyses and adaptation planning.

Despite the challenges described in other sections of this report, there are unique opportunities for improving health sector resilience in the Pacific. As far as adaptation is concerned, most Pacific island countries and areas have a comparative advantage despite their high vulnerability to the impacts of climate change.

The first of these, though tragic, is the visibility and tangibility of climate change in the Pacific islands, where skepticism about climate change is therefore inconceivable – and unaffordable. This clarity and urgency lends itself to strong public and political support for adaptation efforts, both from within the region and elsewhere in the world. While some Pacific island countries and areas are the “canaries in the coal mine of climate change”, their very visible vulnerability should be a means by which to harness the resources necessary to manage such threats to health and society.

A movement that is already being admirably advanced by Pacific island countries and areas is that of international advocacy on mitigation and adaptation action, and influencing the

international political agenda on these issues (Jaschik, 2014). The Alliance of Small Island States (AOSIS), of which most Pacific island countries are members, is one of the loudest voices on the global climate change stage. This prominent advocacy role should invite, if not demand, increased support from developed countries. “The ability of small islands to undertake adaptation and mitigation programs, and their effectiveness, can be substantially strengthened through appropriate assistance from the international community,” according to the Intergovernmental Panel on Climate Change (IPCC, 2014).

Another special opportunity for adaptation lies in the fact that nearly all Pacific island countries and areas now have completed NCCHAPs or equivalent plans. Further to the NAPA process, these health sector-driven plans represent strong and evidence-based contributions to national adaptation planning processes – the health component of National Adaptation Plans, or H-NAPs, which should attract financial and technical support for the health sector.

Perhaps the most prominent of the comparative advantages, paradoxically, is the small size of many Pacific island countries and areas. This enables a degree of familiarity and proximity between individuals and agencies, which would not be possible in more populous countries. A pertinent example of this is the unprecedented level of cooperation between the health and environment sectors in the climate change and health vulnerability assessment and adaptation planning process in a number of Pacific island countries and areas. This level of close multisectoral cooperation was often relatively easy and quick to achieve in Pacific island countries and areas due to the small populations and close family and community connections. This phenomenon is an excellent example of the value and utility of “social capital” in the context of climate change action (Adger, 2001).

This cross-sectoral collaboration also forged some novel institutional linkages, for example, between public and environmental health units and meteorology services in several countries. These evolving linkages may enable innovative adaptation strategies such as climate-based early warning systems for epidemics of CSDs. Unlike in countries with large populations, it is possible in Pacific island countries and areas to adopt an integrated approach to climate change adaptation, disaster risk management and environmental health, effectively and efficiently.

Last but not the least, a huge opportunity lies in the potential convergence of climate change and sustainable development. This nexus of interlinked issues can be clearly seen in Pacific island countries and areas. The launch of a post-2015 development agenda and the Sustainable Development Goals (SDGs) within the United Nations framework may offer Pacific island countries and areas a chance to strengthen both climate change adaptation and development processes in a sustainable and synergistic manner (Leong, 2013). As the IPCC AR5 chapter on small island states highlights: “Adaptation to climate change generates larger benefit to small islands when delivered in conjunction with other development activities, such as disaster risk reduction and community-based approaches to development” (IPCC, 2014).

6.2 Challenges in strengthening health systems to manage the health impacts of climate change

The climate change and health vulnerability assessment and adaptation planning process, as recently carried out in the Pacific region and described in this report, revealed various critical gaps and shortfalls in health systems, which were common to most Pacific island countries and areas. Several of the most prominent of these are discussed below, under the headings of Data, Information systems, Human resources, Technical capacity, Infrastructure and Financial constraints.

It is important to note that, when discussing strategies to improve the ability of communities, civil society, government agencies, nongovernmental organizations, international organizations and the health sector to cope with the impacts of climate change, there is a substantial overlap between development (i.e. improvements that should take place as a matter of course regardless of climate change) and adaptation (i.e. additional measures taken specifically to address the threats posed by climate change, including slow-onset events). Health systems development aiming at improving resilience to climate change must be considered as an adaptation measure, going beyond “business as usual”. In reality, it is often impossible to differentiate development from adaptation measures and vice versa.

Data

The health impacts of climate change and the effectiveness of adaptation measures can be documented only if accurate and reliable health data are available over long periods of time, at least decades, for studies of descriptive and analytical epidemiology. Unfortunately, such data are incomplete in many Pacific island countries and areas due to very limited human and institutional capacities to collect and manage health data. For instance, most Pacific island countries and areas rely on incomplete paper records rather than electronic medical or health records. On the other hand, most Pacific island countries and areas do have electronic data on weather and climate over long-term periods, typically several decades. As a means of health systems development, and as an adaptation measure for the health sector, the digitization of medical and health data must be carried out in most Pacific island countries and areas, with the necessary funding and provision of human resources, training and key infrastructure. These health data must then be integrated with environmental and socioeconomic datasets to underpin the development of decision support tools related to effective health adaptation (Fleming et al., 2014).

Information systems

In addition to data, health information systems (HIS) in the Pacific region are far below the standard of developed countries; this is a high-priority area of health systems development identified by the health sector and donors in the region. Equipment, technical capacity, reliable

electricity and Internet connections, and IT support are all needed. Many of these aspects of HIS are lacking in Pacific island countries and areas, although there are many examples of countries updating (e.g. Fiji) and modernizing (e.g. Tonga) their processes of collecting, storing and analysing health information. In the context of climate change and health research and adaptation, it is imperative that such health information be available for sharing among key stakeholders, for example, via collaboration with meteorology services for the purposes of climate-based early warning systems for epidemics of infectious diseases; for reliable and timely surveillance of climate-sensitive diseases, monitoring pharmacy logistics and distribution; and for understanding long-term health trends.

Human resources

A constant challenge for the health sector (among others) in Pacific island countries and areas is the recruitment and retention of a health workforce capable of meeting the demands of a SIDS. With the majority of the workforce required to travel abroad to study and train at one or more times during their career, and with relatively low levels of remuneration for highly technical health-care related work in many Pacific island countries and areas, it is understandable, but unacceptable, that “brain drain” affects the health sector more than most other areas of public service. Health workforce centralization and urbanization are additional problems. Financial incentives and the local provision of education, training and continuing professional development are two obvious strategies that may attract health personnel, and enable them to remain in their own country for longer periods of time. Although it must be conceded that these measures alone will probably prove insufficient in the face of higher pay and better work conditions in other, wealthier countries in the region, climate change adaptation funding provides an important extra avenue of potential resourcing to build a health workforce capable of addressing the health impacts of climate change through primary, secondary and tertiary prevention measures.

Technical capacity

The risks posed by climate change to human health are still not well understood by either the public or the wider community of researchers. Not surprisingly, it has taken decades for the international health community to reach some broad consensus regarding the key issues and requirements for health protection related to climate change. It is both vital and now urgent that this technical expertise be passed on to health professionals in developing countries, including the highly vulnerable Pacific island countries and areas, in order to build the capacity of these health sectors to explore, understand, anticipate and minimize the health impacts of climate change in their communities. Specific areas of technical capacity-building required in Pacific island countries and areas for adaptation include disease surveillance, primary health care, applied environmental epidemiology (analytical techniques and synthesis of relevant information), public and environmental health services (including safe drinking-water supply, food safety and vector control), disaster risk management (preparedness, response and recovery) and the use of meteorological data in predicting risks of CSDs (climate-based early warning systems).

Infrastructure

Key infrastructure that is currently insufficient or lacking in most Pacific island countries and areas, but required for health sector adaptation to climate change, include but are not limited to the following:

- reliable power and water supply, and Internet connection;
- disaster-proof and climate-resilient hospitals and health facilities;
- information and communication technology (ICT), including computers and relevant software;
- transport for public and environmental health personnel; and
- laboratory, surveillance and diagnostic equipment.

Financial constraints

All of the challenges above, and others not explicitly mentioned, will obviously require funding, whether from internal revenue or external support. Some possible avenues of external funding for health sector-relevant adaptation are discussed in the following section. It is worth reiterating at this point that the climate change impacts suffered by Pacific islands are, to all intents and purposes, the result of disproportionately immense GHG emissions of developed countries. From the principles of “polluters pay” and the “precautionary principle”, it would be only fair that those wealthy developed countries responsible for the anthropogenic causes of climate change be expected to provide financial and other assistance for adaptation to and development of the small island states of the Pacific. Therefore, Pacific island countries and areas are encouraged to utilize the special funds for climate change adaptation in developing countries.

6.3 Common priorities for health adaptation identified by Pacific island countries and areas

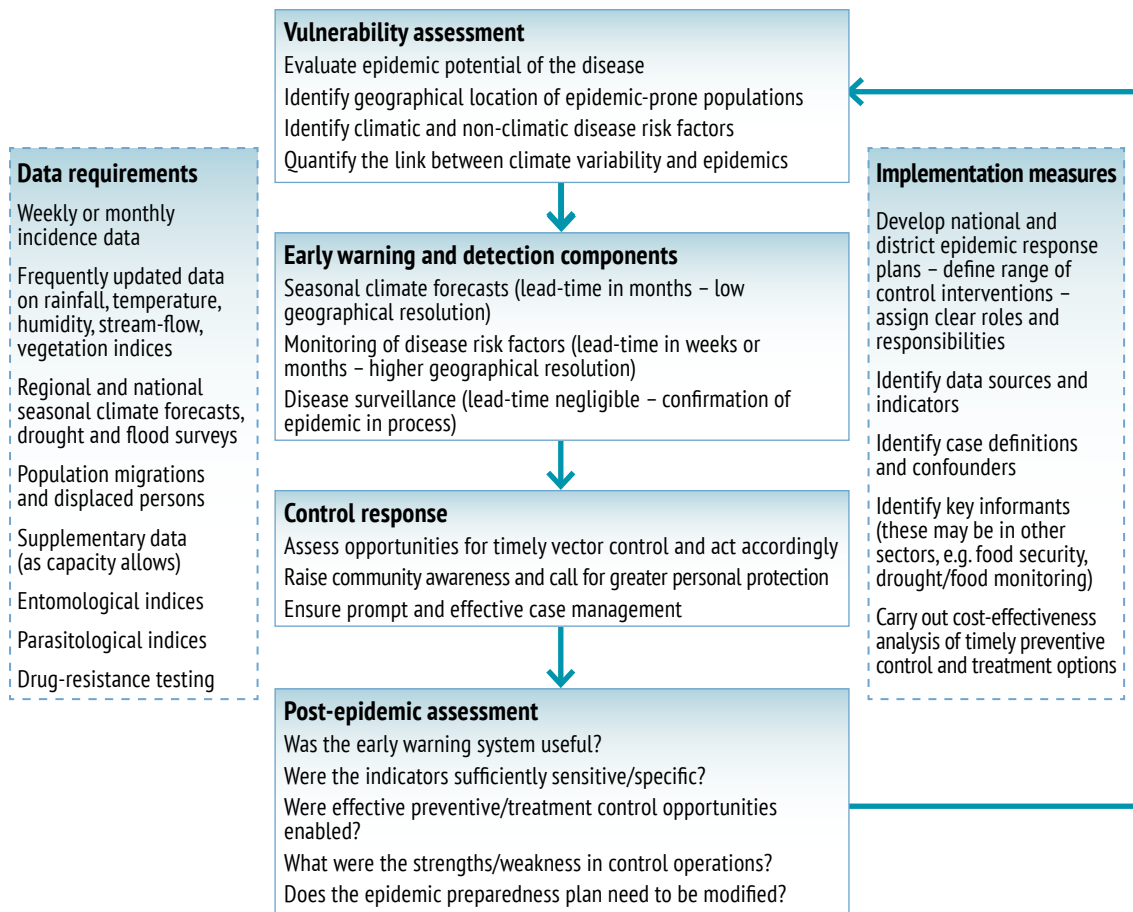
From a regional perspective, some common priorities identified in the national action plans of Pacific island countries and areas include the following:

- performing the vulnerability assessment and adaptation planning processes periodically and updating the NCCHAPs, to reflect improved knowledge and information regarding climate-sensitive health risks and appropriate management strategies (WHO, 2013);
- aligning climate change and health with activities and ongoing improvements in disaster risk management, food security and WASH;
- mainstreaming consideration of climate change and health into existing public health systems, while ensuring that such mainstreaming does not lead to dilution, diversion or diminution of the urgency of the targeted activities;
- improving understanding of the relationship and diverse causal pathways between climate variability and CSDs;

- exploring the hitherto neglected areas of climate change and health research in the Pacific, including climate change impacts on heat-related illnesses, mental health and NCDs, as well as on communicable diseases; and
- developing climate-based early warning systems.

With respect to the latter point on early warning systems, it must be recognized that this is a highly technical and specialized area requiring expert support for the underlying analysis and mechanisms of implementation. WHO has developed guidelines for the use of climate to predict infectious disease epidemics – a framework and reference for this process are provided in Figure 21.

Figure 21. Framework for developing early warning systems for climate-sensitive diseases



Source: Kuhn et al., 2005

CHAPTER 7

Future directions for climate change and health adaptation in Pacific island countries and areas

7.1 Key considerations in setting health adaptation priorities

The immediate priorities for Pacific island countries and areas with respect to health adaptation to climate change must take into account a range of factors. The consensus of the experts involved in WHO's work on climate change and health in the Pacific in recent years is that the following factors are among the most important for consideration: policy, evidence, feasibility, cost-effectiveness and potential avenues of external support.

Policy

All measures related to health adaptation must be grounded in strong policy and governance structures, which are indicators of the capacity of national commitments to address the health impacts of climate change (Lesnikowski et al., 2013). Recent research in several Pacific island countries and areas demonstrates that a lack of clear policies constrains adaptive capacity (Gero et al., 2014).

Evidence

It is vitally important to ensure that the iterative process of climate change and health vulnerability assessment and adaptation planning be guided by data and scientific evidence, in addition to expert opinion and informed consensus. The imperative for ongoing and increasingly sophisticated research on climate change and health should incorporate the following (McMichael, 2013b):

- improving understanding of the range and subtleties of natural climatic influences on the health and social stability of societies and populations – an understanding which must be informed by history (Kirch, 1997);

- avoiding the tendency to focus on simple questions amenable to existing, conventional research methods; and
- developing confidence, skills and commitment to working in a more genuinely interdisciplinary milieu in relation to the long-term forecasting of likely, albeit still uncertain, risks to human health.

Feasibility

The proposed adaptation measures must consider the implications on financial and human resources of the country or community in question. Of course, not all adaptation measures for all climate-sensitive health risks could or should be undertaken simultaneously. This necessitates a procedure for ranking or stratifying priorities according to perceived risk (see the preceding discussions on likelihood versus impact), benefit, achievability and cost. Serious consideration and priority in the short term should be given to cost-effective interventions with proven benefits, such as securing supplies of safe drinking water and improving hygiene and sanitation facilities (Prüss-Ustün & Corvalán, 2007). Proposals for ambitious adaptation measures should always be coupled with correspondingly massive investment in human and institutional capacities in order to avoid unexpected constraints of financial and human resources within the country or community.

Cost-effectiveness

There is little doubt that the adaptation measures required to manage the additional health burden attributable to climate change will incur additional costs. As an example, a global estimate of the cost of “treating” the global burden of climate change-related diarrhoeal disease, malnutrition and malaria in the year 2030 was in the order of US\$ 4–12 billion – a large sum roughly equivalent to the current total overseas health development assistance budget (Ebi, 2008).

The proposed adaptation measures should be undertaken with consideration of an appropriate cost–benefit analysis. The substantial costs involved may be largely offset by the savings incurred via proactive intervention in the field of adaptation, thus avoiding the probable costs of managing the future climate change-attributable disease burden (Markandya & Chiabai, 2009). As the authors of the latter reference put it: “The case for making these expenditures is strong, on economic as well as moral grounds.” WHO has considered the cost-effectiveness of health-related adaptation measures and prepared a tool (WHO, 2013) for use by Member States, which – noting the challenges involved in determining whether a health outcome can be attributed to climate change – may be able to assist with:

- estimating the costs of health damage due to climate change at the national and sub-national levels;
- estimating the costs of health-relevant adaptation to climate change at the national and subnational levels; and
- comparing the cost of health damage averted with the cost of adaptation measures, in order to reach conclusions on value for money.

In the Pacific context, there may be an opportunity to learn from the collaborative efforts of Caribbean island nations in structuring a regional fund for investment, expenditure and

insurance, which could be used for cross-sectoral adaptation, through a health-in-all-sectors approach.

Avenues of external support

It certainly seems clear that developing countries, including Pacific island countries and areas, will find it difficult, if not impossible, to continue on their paths of development and implement appropriate adaptation measures to protect their communities against the health impacts of climate change without substantial external financial and technical support. It thus behoves other countries – particularly wealthy, developed countries that are those ultimately most responsible for anthropogenic climate change – to fulfil their obligations and commitments, both moral and official, in providing the urgent financial assistance required for adaptation in developing countries such as the small island states of the Pacific.

Table 20 highlights potential sources of funding for climate change adaptation, which can be considered by the governments and civil societies of Pacific island countries and areas, as of 2014. This list is not exhaustive; it gives some indications of previous, current and possible future resources for health adaptation in the Pacific region. Some specific examples of contemporary project support are described in Chapter 6.

There may also be opportunities arising from overlaps between health-relevant climate change adaptation and other development agendas (e.g. for chronic diseases, tuberculosis, malaria, child health), although it is important that these business-as-usual activities, and the funds that support them do not divert important and much-needed funding away from health sector adaptation to climate change.

The Green Climate Fund (GCF) is a significant and ambitious contribution to the global efforts towards attaining the goals set by the international community to combat climate change. It will provide support to developing countries to limit or reduce their GHG emissions and to adapt to the impacts of climate change, taking into account the needs of those developing countries particularly vulnerable to the adverse effects of climate change, such as Pacific island countries and areas. The GCF is intended to be the main fund for global climate change financing in the context of mobilizing US\$ 100 billion by 2020. It is very important for the health sectors of Pacific island countries and areas to be well informed about, and be able to utilize, the funding opportunities for health adaptation in the coming years and decades.

7.2 Present and future support of WHO for health adaptation activities in the Pacific

There are encouraging signs that climate change and health adaptation are gathering pace in the Pacific region. This momentum is visible at the community, national, regional and global levels. Two prime examples of WHO's leadership in climate change and health in the Pacific region are provided below.

Table 20. Matrix of climate change and health funding sources in the Pacific region

Donor	Area/scope of funding	Type of funding	Eligible countries	Current Pacific recipients
GEF Special Climate Change Fund (SCCF)	Adaptation Disaster risk reduction (DRR), human health impacts, vector control, infrastructure, water resources management Mainstreaming, capacity building, awareness raising	Grants SCCF-A for adaptation; SCCF-B for technology transfer	All Pacific SIDS	Fiji PCCAPHH project
GEF Least Developed Countries Fund (LDCF)	Adaptation Support national adaptation programme of action (NAPA) implementation, if health identified as priority, or via other priority sectors	Grants	LDCs–Kiribati, Samoa, Solomon Islands, Tuvalu, Vanuatu	Solomon Islands (water), Samoa (tourism-reliant communities, forestry), Kiribati (resilience to variability and hazards)
GEF Adaptation Fund (AF)	Adaptation (attributable to climate change, “concrete” projects) Health outcomes with sufficient informational links to climate change, monitoring of disease vectors, early warning systems, DRR, establishing regional centres for response to these events	Grants	Developing countries that are party to the Kyoto Protocol and particularly vulnerable (SIDS and LDCs)	Papua New Guinea (community resilience to floods), Cook Islands (resilience building), Samoa (resilience of coastal communities), Solomon Islands (resilience in food and agriculture)
World Bank Pilot Programme for Climate Resilience	Adaptation Mainstreaming climate-resilience development in all sectors	Grants and highly concessional financing for investments (near 0% interest with up to 75% grant component)	LDCs and SIDS	Regional (DRR)
EU Global Climate Change Alliance (EU GCCA)	Adaptation plans in non-LDCs, NAPA implementation in LDCs, adaptation in water sector DRR – improved climate monitoring and forecasting, preparedness measures based on data	Grant, overseas development assistance (ODA), technical assistance	LDCs, SIDS (must be EU/World Bank member)	University of the South Pacific (USP), Secretariat of the Pacific Community (SPC), Vanuatu (DRR)

Table 20. Matrix of climate change and health funding sources in the Pacific region (continued)

Donor	Area/scope of funding	Type of funding	Eligible countries	Current Pacific recipients
ADB Climate Change Fund	Climate resilience, especially water and sanitation Climate-proofing health projects Mainstreaming climate change into development plans	Co-financing, grant, technical assistance	Cook Islands, Fiji, Kiribati, the Marshall Islands, Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu	Climate Proofing: Solomon Islands (transport), Regional (DRR), Cook Islands (Avatiu port), Palau (Climate Change Adaptation Plan – including water)
World Bank International Development Association	Overall – reduce poverty, promote growth, reduce inequalities, improve living conditions Adaptation and mitigation Climate programme (water and energy); projects that tie adaptation and mitigation	Grant, loan, technical assistance	Countries with gross national income (GNI)/capital ≤US\$ 1135, with some exceptions	Samoa (emerging health challenges, cyclone-resilient buildings), Tonga (cyclone preparedness)
Global Facility for Disaster Reduction and Recovery	Adaptation DRR, recovery, risk financing and insurance, capacity building		Priority countries – the Marshall Islands, Papua New Guinea, Solomon Islands, Vanuatu	
New Zealand (NZ) Partnerships for International Development Fund	Sustainable economic development Improved access to social and development services – health, education, water, sanitation, DRR, safe communities Priority to projects that promote gender equity, environmental protection and human rights		Pacific island countries (75% of funds), but in partnership with New Zealand registered business, nongovernmental organization, government, academic institution	
Australian Aid Asia Pacific Community-based Adaptation Small Grants Programme	Priority adaptation measures	Grants	14 Pacific island countries	

7.2.1 Piloting Climate Change Adaptation to Protect Human Health in Fiji

WHO, along with UNDP, launched in 2010 the first global project on public health adaptation to climate change. This series of pilot projects aims to “increase adaptive capacity of national health system institutions, including field practitioners, to respond to climate-sensitive health risks”. This project is executed by ministries of health and other relevant national partners in the Barbados, Bhutan, China, Fiji, Kenya, Jordan and Uzbekistan. The experiences and sharing of lessons from this project will significantly contribute to identification of best practices to address the health risks associated with climate variability and change. All country projects share four aims: to enhance systems of early warning and early action; build capacity of national actors; pilot specific health risk reduction interventions; and document and share lessons learnt in addressing the health risks associated with climate change in their area.

In Fiji, the Ministry of Health is supported to build adaptation capacity to monitor, assess and respond to hydro-meteorological disasters (HMDs) and CSDs, and thus reduce the health risks associated with climate change and variability. The project is managed under the existing organizational framework of the Ministry of Health, in particular, the Division of Public Health. A Climate Change Coordinator within the Health Planning and Development Unit coordinates the Fiji project under the guidance of the Deputy Secretary for Public Health. WHO and other stakeholders provide technical guidance through the National Steering Committee chaired by the Permanent Secretary of Health.

The following activities are being implemented until 2015:

- Mainstreaming and planning – CSDs need to be incorporated in the strategic planning stages of the Ministry of Health and specifically reflected in the national health outcomes as well as the disaster preparedness plans and the national contingency plans for drought and floods.
- Evaluation – national policies and plans have to be evaluated with specific attention to watershed and water resource management.
- Assessment – environmental and health impact assessments should be incorporated as an integral part of new land and infrastructure development approval, so as to address potential health issues, including those associated with climate change.
- Response – surveillance and response programmes for CSDs should be intensified during HMDs and other disasters, and rapid and effective responses enhanced, with specific attention to psychosocial intervention.

The greatest potential national health benefit of the proposed project is having a functional HIS that is capable of generating early warning systems for CSDs.

Other linked benefits include the following:

- enabling field practitioners to carry out required interventions as per guidelines for early warning and response, and psychological first aid;
- creating awareness among communities, so as to increase resilience to climate change and variability;
- strengthening both interdisciplinary collaboration and communication within all levels of the Ministry of Health;
- strengthening intersectoral collaboration at all levels with other key government agencies such as the Fiji Meteorological Service and the National Disaster Management Office; and

- increasing the understanding of climate-sensitive health and adaptation issues by the health workforce, with concurrent integration into public health policy and intervention programmes.

7.2.2 Adaptation to climate change risks in the health sector of Pacific island countries and areas

The Pacific health ministers reiterated their concern regarding the health risks of climate change at their biennial meeting in Apia, Samoa, in 2013, and recommended adaptation activities to coordinate, implement and strengthen health systems with the leadership of health ministries.

Collaborations with least-developed countries

The WHO Division of Pacific Technical Support (DPS) is working with the UNDP Pacific Office and four of the LDCs in the Pacific (Kiribati, Solomon Islands, Tuvalu and Vanuatu) to launch a project on Building Resilience of Health Systems in Pacific Island LDCs to Climate Change supported by the Global Environmental Facility (GEF) LDC Fund (LDCF). The LDCF was established to address the special needs of the LDCs by GEF under the Climate Convention. Specifically, the LDCF was mandated with financing the preparation and implementation of NAPAs, which are based on existing information, in order to identify a country's priorities for adaptation actions. Health is a priority sector for adaptation in all four Pacific LDCs, as stated in their NAPAs (Table 21). These concerns about the health impacts of climate variability and change were further elaborated in the NCCHAPs for Pacific island countries and areas, as mentioned in Chapter 5.

Table 21. Overview of health risks of climate change identified in the NAPAs of Pacific LDCs

Pacific LDC	Health priorities identified in NAPA (year published)
Kiribati	Diarrhoeal disease, dengue fever, fish poisoning, social disruption (compounding of population pressures) and health impacts of extreme weather events (2007)
Solomon Islands	Malaria, mental illness, malnutrition, diarrhoea, acute respiratory infections, tuberculosis, leprosy, NCDs and social problems (e.g. placing additional burden on women and children) (2008)
Tuvalu	Vector-borne diseases; waterborne diseases (2007)
Vanuatu	Vector-borne diseases; waterborne diseases; foodborne diseases; heat-related illnesses (2007)

Health sector adaptation in the LDCs supported by the LDCF will aim at enhancing the capacity of national and local health system institutions, personnel and local communities to manage health risks induced by climate variability and change. Four expected outcomes of the project will be as follows: (1) governance of health system and institutional capacities strengthened by mainstreaming climate-related risk and resilience aspects into health

policy frameworks; (2) capacities of health system institutions and personnel strengthened in managing health information and weather/climate early warning systems; (3) improved coverage and quality of health services addressing climate-related diseases, and reduced climate-induced disruptions in the function of health care facilities; and (4) enhanced South-South cooperation fostering knowledge exchange, the provision of technical assistance and scientific advisory, and the integration of national health policy frames and related adaptation plans with ongoing National Adaptation Plan-related processes.

Collaborations with Pacific island countries and areas that are not LDCs

WHO DPS will collaborate with Pacific island countries and areas that are not LDCs to develop and implement a multinational project that can be supported by the Special Climate Change Fund (SCCF). The SCCF was established to support adaptation and technology transfer in all developing country parties to the UNFCCC. There are two active funding windows under the SCCF: Adaptation window (SCCF-A) and Technology Transfer window (SCCF-B). The SCCF supports both long- and short-term adaptation activities, including those of the health sector. The expected outcomes and outputs of the SCCF project will be guided by the NCCHAPs of Pacific island countries and areas developed in 2010–2013 and summarized in Chapter 5, and the essential public health package for health sector adaptation described in Chapter 8.

Both the LDCF and SCCF projects mentioned above will make use of the comparative advantage of UNDP in supporting climate change adaptation activities across a wide range of sectors, and the technical expertise of WHO in assessing risks to health from climate change and defining appropriate responses. The strong presence of both organizations helps to support implementation at the country level. The involvement of WHO and UNDP offices at the country, regional and headquarters levels will ensure consistency with, and support for, the UNDP focus on climate-resilient development, and implementation of the WHO global and national work plans on health protection from climate change.

7.3 Regional climate change and health activities led by other international organizations

It is also important to note that several other regional and international organizations are making pioneering contributions towards climate change and health adaptation in the Pacific region. The following are only a few examples of such cooperation.

The Secretariat of the Pacific Community (SPC) is implementing a range of important activities under the EU-funded Global Climate Change Alliance for Pacific Small Island States (GCCA:PSIS) project, including the above-mentioned health adaptation work in Kiribati, based on the NCCHAP and focusing on capacity building in the areas of surveillance and prevention of CSDs.

The International Federation of Red Cross and Red Crescent Societies (IFRC) is engaged in vital climate change and health work in the community, including health promotion and community education activities in Fiji and elsewhere in the Pacific region.

L'institut Pasteur and partners from L'institut de recherche pour le développement are involved in a multicentre study on climate and dengue fever in the Pacific, as part of the AeDenPac project, which has already led to the compilation of a potential climate-based early warning system for dengue fever epidemics in Noumea, New Caledonia (Descloux et al., 2012)

7.4 Climate change mitigation and the localized co-benefits for health

Finally, attention and recognition must be given to the fundamental benefits of mitigation⁸ and the resultant near-term co-benefits to the health of the community or population undertaking the mitigation action.

While the point has already been made that Pacific island countries and areas have contributed relatively little to the global carbon footprint, there remains an imperative to engage in international efforts to slow, halt and reverse GHG emissions, including short-lived climate pollutants, discussed later. Pacific island countries and areas may, in some respects, be at a comparative advantage when it comes to the use of renewable energy sources, such as solar, to supply small populations across geographically distant islands. Some Pacific island countries and areas, such as Fiji and Tokelau, are already making great strides towards the use of a majority of renewable energy sources, which both demonstrates leadership in tackling global emission targets and shames the hitherto limited mitigation efforts of far larger and more intensively polluting countries.

Short-lived climate pollutants (SLCPs) such as black carbon (soot) and methane are responsible for a substantial fraction of global warming. Black carbon is a major component of health-harming particulate emissions, which are an increasingly severe problem in many developing countries. Small and fine particulate pollution (PM₁₀ and PM_{2.5}) as well as ground-level ozone (O₃) are among the key pollutants responsible for respiratory and cardiovascular diseases and cancers. Along with directly harmful health effects, ozone reduces agricultural productivity, which is important for food security; and black carbon and other air pollutants have significant impacts on ecosystems.

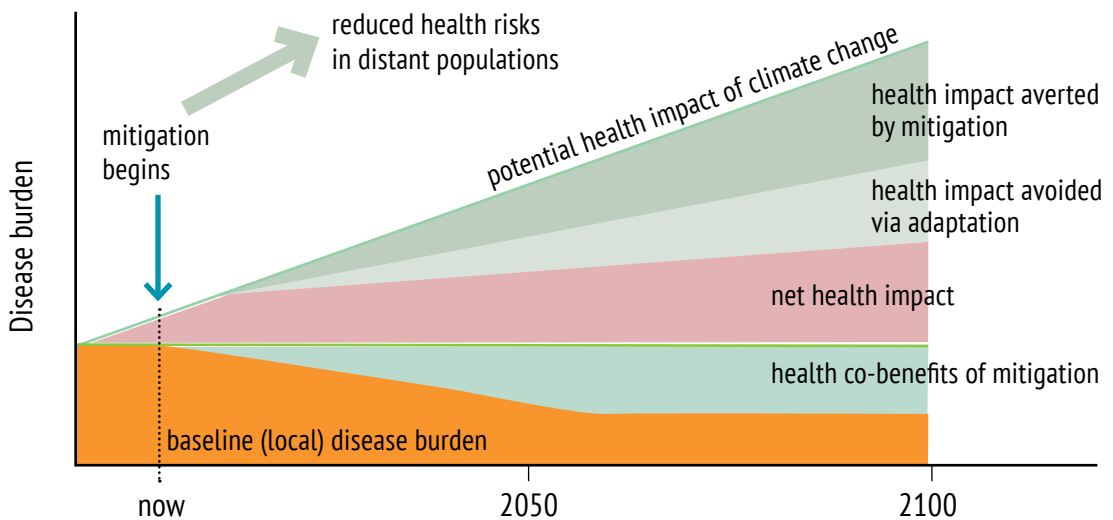
Therefore, arresting or abating the climate change process, for example, by reducing fossil energy consumption and the use of motorized transport, and changing agricultural and consumption practices, can have substantial beneficial effects on health. These beneficial effects of mitigation policies on health are known as co-benefits (Ganten, Haines & Souhami, 2010). This term has also been applied to the collateral benefits of certain adaptation measures, including those which increase social capital and improve infrastructure (Cheng & Berry, 2013).

8. Having already defined mitigation (see Glossary), it is worth pointing out that this term can be ambiguous, given its use in other contexts, both related and unrelated to climate change (e.g. mitigate impacts, mitigate costs). It could thus be argued that it may be more useful to speak of “arresting” or “abating” climate change.

Obvious co-benefits include a decrease in the burden of respiratory disease with decreasing air pollution and the beneficial effects of foregoing motorized forms of transport in preference of walking and cycling. As the authors of a study on policies related to climate change mitigation and improving health put it: “The challenge faced by society in moving to cleaner, healthier, more sustainable patterns of energy use is comparable to great public health challenges of earlier generations, and its successful achievement will require bold and visionary leadership, which we predict would result in substantial benefits to global health both in the short and long terms” (Haines et al., 2007).

A diagrammatic representation of the difference between adaptation and mitigation in terms of their respective effects on future climate change-attributable health burdens, and the role and potential of co-benefits, is provided in Figure 22.

Figure 22. Reducing the health impacts of climate change via primary prevention (mitigation), secondary prevention (adaptation) and the role of co-benefits



Source: McMichael & Lindgren, 2011

CHAPTER 8

Recommendations

The effects of climate change on health are already tangible in the Pacific, and have emerged as a huge challenge for the population and health systems of Pacific island countries and areas. A new advocacy and public health movement is needed urgently to bring together governments, international agencies, nongovernmental organizations, communities and academics from all disciplines to adapt to the effects of climate change on health.

In climate-vulnerable Pacific island countries and areas, it is of paramount importance for governments to take effective and timely measures to tackle the environmental and social determinants of health, including poverty and inequity reduction. The good news is that many of the projected impacts on health are preventable and amendable through a combination of public health interventions in the short term, support for adaptation measures in health-related sectors such as water and disaster management, and a long-term strategy to reduce the human impacts on climate (Campbell-Lendrum, Corvalán & Neira, 2007).

As much as the issues of climate change and health are complicated and cross-cutting, whole-of-government or whole-of-society approaches are needed. It is important for the leaders of Pacific island countries and areas to recognize health as a central issue of national adaptation plans. For the health sector response to climate change, the ministries of health may consider the following conceptual and operational frameworks for strengthening the essential public health package and building climate-resilient health systems.

8.1 Strengthening the essential public health package for climate change adaptation

WHO developed an *Essential Public Health Package to Enhance Climate Change Adaptation in Developing Countries*, which can be applied to Pacific islands countries and areas in health sector adaptation to climate variability and change. The following six focus areas were suggested as a minimum requirement for health ministries to manage the effects of climate change, given in Box 9 (WHO, 2010).

Box 9. Six elements of an essential public health package for climate change adaptation (adopted from WHO, 2010)

1. Comprehensive assessments of the risks posed by climate variability and change to population health and health systems
2. Integrated environment and health surveillance
3. Delivery of preventive and curative interventions for the effective management of identified climate-sensitive public health concerns
4. Disaster risk management for health addressing extreme weather events
5. Research
6. Strengthening of human and institutional capacities and intersectoral coordination

8.1.1 Comprehensive assessments of the risks to population health and health systems

In most Pacific island countries and areas, there is weak, limited and fragmented information and understanding of the vulnerability of countries to climate change. It is recommended that the governments of Pacific island countries and areas use the WHO guidelines and tools for assessing the risks posed by climate variability and change. These include tools for assessing health systems and public health vulnerability and adaptation, as well as other tools for assessing health risk, hazard and emergency capacity.

The assessments should aim at establishing the baseline situation of existing population vulnerability to climate-sensitive health risks and the degree to which health systems can effectively respond and manage these risks. These assessments will serve as an important first step in the enhancement of health and health sector resilience to climate change, and will take into consideration the risks posed by projected long-term climate change. They will also be undertaken taking into account substantive analyses in other sectors, such as agriculture, water, disaster management, which may have been carried out already by countries, including National Communications to the UNFCCC. The NCCHAPs of Pacific island countries and areas developed in 2010–2013 in collaboration with WHO can be seen as an initial assessment of public health vulnerabilities and adaptation. Hence, continuous updates and implementation of the NCCHAPs are recommended.

8.1.2 Integrated environment and health surveillance

Timely decision-making and actions to predict and prevent the negative health effects of extreme weather events and environmental degradation, including those exacerbated by climate change, are still unsatisfactory in many Pacific island countries and areas. This is due in large part to fragmentation of surveillance activities, insufficient coordination among the various established systems, low capacity to appropriately interpret integrated data, and an inability of these systems to provide timely data for immediate decision-making. Further to their risk and vulnerability assessments, and as a second step in the resilience-

building process, countries need to strengthen functional integrated environment and health surveillance systems. Even though there are disease surveillance systems on vector-borne, foodborne and waterborne diseases, they are not linked to the monitoring data on vector surveillance, food safety and water quality.

The objectives are to make timely and evidence-based decisions for effective management of environmental risks to human health by predicting and enabling the prevention of increases in the incidence of environmentally linked ill health and disease. An essential function of the system will be to track climate and environmental changes that affect the determinants of health. These systems will have to use a standardized set of environment and health indicators, including appropriate meteorological variables, and procedures to generate the required information for decision-makers and managers. The integrated environment and health surveillance system will therefore build on current integrated disease surveillance systems and expand them to incorporate key environmental indicators, including meteorological and climate data. Epidemic surveillance and preparedness for diseases that could emerge in new locations or populations due to climate and environmental changes will be an integral part of this system. Digitization of climate, environment, medical and public health records would be an essential requirement for a timely and reliable surveillance system based on electronic health records.

8.1.3 Delivery of preventive and curative interventions

Vulnerability assessments and integrated surveillance systems have the ability to provide national public health authorities with climate, environment and epidemiological information on climate-sensitive public health concerns among vulnerable communities. However, it can be anticipated from the currently available country reports that foodborne, vector-borne, waterborne and rodent-borne diseases, especially diarrhoea, ciguatera, dengue and leptospirosis, are among the most climate-sensitive public health conditions identified by Pacific island countries and areas for immediate action. According to their respective local epidemiological circumstances and based on the conclusions of their vulnerability assessments, Pacific island countries and areas need to prioritize public health programmes that require immediate strengthening to effectively limit potential increases in the incidence of CSDs. Such prioritization needs to be constantly reassessed based on evidence generated continuously by the integrated environment and health information system.

Pacific island countries and areas will then be able to reduce the incidence of the disease conditions by implementing:

- integrated vector management to reduce the incidence of dengue and other vector-borne diseases;
- water safety plans, chlorination and water quality management to reduce the incidence of waterborne diseases;
- regulatory interventions to check air pollution to reduce the incidence of cardiovascular and respiratory diseases;
- food safety and nutrient supplementation during disasters; and
- other preventive interventions that are appropriate to local conditions for climate-sensitive public health conditions.

8.1.4 Disaster risk management for health addressing extreme weather events

The capacity of Pacific island countries and areas to manage the risks of health emergencies is variable. Climate-smart disaster risk management for health (DRM-H) is a core part of building climate resilience. National and community health emergency management systems will have to be further developed in order to manage the health emergency risks associated with climate-related hazards. Only a few Pacific island countries and areas have already developed national plans and established mechanisms to respond to health emergencies related to the occurrence of natural disasters. The full spectrum of DRM-H, including risk prevention, preparedness, response and recovery from the health consequences of extreme weather events such as drought, extreme temperatures, cyclones or floods will have to be implemented in that context.

To this end, Pacific island countries and areas will need to review and, where necessary, update their capacities to ensure that the health sector can deal effectively with the identified climate-sensitive hazards. Pacific island countries and areas may consider adopting the Joint National Action Plan (JNAP) on DRM and climate change adaptation, if possible. The *Western Pacific Regional Framework for Action for Disaster Risk Management for Health* endorsed by the Regional Committee for the Western Pacific in October 2014 provides comprehensive guidance for strengthening DRM-H. Pacific island countries and areas are recommended to actively participate in and benefit from the Pacific cooperation processes such as the Pacific Humanitarian Team coordinated by the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA) and the *Strategy for Climate and Disaster Resilient Development in the Pacific* being developed by the United Nations Office for Disaster Risk Reduction (UNISDR), SPC and Secretariat of the Pacific Regional Environment Programme (SPREP). Key actions will include the following:

- implementation of the *Western Pacific Regional Framework for Action for Disaster Risk Management for Health*, including health emergency management policies;
- legislative frameworks and programmes on DRM-H, including guidance for receiving and coordinating foreign medical teams during disasters;
- simulation exercises and improvement of emergency response and recovery plans;
- development and deployment of climate-based early warning systems for health;
- prevention and control of communicable diseases; improving reproductive, mental and environmental health; provision of psychosocial support, nutrition and emergency feeding; and management of fatalities during disasters;
- human resource development programmes for DRM-H, including training and education;
- community-based health risk reduction programmes, including primary health care, first aid, health education and risk communication, early warning, local emergency response planning;
- structural, non-structural and functional safety of hospitals (such as climate-proofing, water, sanitation and waste management), resilient and prepared hospital programmes, including health facilities, critical infrastructure, stockpiling of essential materials and ensuring a sustainable health workforce in times of crisis (i.e. surge capacity) in line with the Safe Hospital Initiative of WHO; and
- integrated data management and surveillance systems supported by digitized health records.

8.1.5 Research

The extent to which the policy-makers of Pacific island countries and areas understand the effects of climate change on the health of local populations depends on the availability of evidence and documentation produced in their home countries. Each country will need to develop and implement a research agenda with two major objectives: (i) to better and comprehensively understand the health effects of climate change in the Pacific; and (ii) to generate and disseminate knowledge on locally appropriate adaptation measures while gaining momentum with respect to mitigation measures.

These research aims involve three key dimensions (McMichael & Lindgren, 2011):

- studying the health impacts of recent and historical variations and trends in climatic variables;
- seeking evidence for the effect of climate variability and adaptation measures in the changing rates of CSDs; and
- modelling future climate change-attributable health risks.

8.1.6 Strengthening core human and institutional capacities and intersectoral coordination

Countries will be able to implement the above interventions in a reliable and effective manner only if the necessary core human and institutional capacities are in place. Gaps in these capacities at the country level must be identified and national capacity-building action plans prepared as part of future NAPAs. Institutional coordination mechanisms will need to be established to ensure country ownership under the stewardship of ministries of health. Such mechanisms will be responsible for planning, monitoring and evaluating the national plans of action for implementation of the proposed public health package. These mechanisms will also be responsible for ensuring intersectoral coordination and health representation in national and international development, humanitarian and UNFCCC policy forums.

Given the wide spectrum of the public health consequences of climate change, the complexity of these effects, and the skills required to implement, monitor and evaluate the interventions proposed in this essential package, it is recommended that a specific coordination mechanism be established for climate change and health at the level of ministries of health. Membership will be expanded beyond the relevant departments of the Ministry of Health to include representation from other sectors such as environment, agriculture, meteorological services, research, industry, etc., with a view to providing guidance to those sectors for their improved contribution to sustainable reductions in health risks.

8.2 Building climate-resilient health systems⁹

The health systems of SIDS are vulnerable to climate variability and change. Therefore, it is important for the health sector of Pacific island countries and areas to build the climate resilience of health systems by reducing vulnerability and improving the capacity of the health system. The resilience-building approach to health systems can improve the overall performance of the health system resulting in better protection and promotion of population health. Climate resilience should be built into all aspects of the health system – leadership and governance, human resources, information resources, essential medical products and technologies, financing and service delivery – in order to be effective and sustainable.

8.2.1 Whole-of-government, health-in-all-policies and community-based approach

The climate resilience of the health system can be built through a continuing process of reducing vulnerability and strengthening capacity to meet the challenges of any type and severity of climate variability. It should be noted that effective and efficient protection and promotion of population health is not possible without adopting a whole-of-government approach to the social and environmental determinants of health, such as water and sanitation, energy, food and agriculture, environment, transport, education and urban planning. Therefore, collaboration and coordination between the health and non-health sectors is crucial for building climate-resilient health systems. In this context, the Ministry of Health should be empowered to take the leadership by adopting the health-in-all policies approach. At the same time, each community should be empowered to take timely and effective measures to protect and promote the health and well-being of the community members, considering the specific nature of community resilience and vulnerability.

8.2.2 Strengthening the six building blocks of health systems for climate resilience

The following six building blocks of health systems should reflect the specificities of climate variability and change.

8.2.2.1 Governance and policy

Guidance is provided on the different issues that need to be considered to advance the resilience of health governance, policies and cross-sectoral collaboration. Cross-sectoral collaboration aims to promote both a shared vision and to design coherent policies.

8.2.2.2 Capacity development

The technical and professional capacity of health personnel and organizational capacity should be strengthened to effectively identify, prevent and manage the health risks posed

9. As of 2014, WHO is developing an operational framework to build climate-resilient health systems, which is based on the building blocks of the health system (communication with Ms Elena Villalobos of WHO headquarters).

by climate variability and change. In addition, awareness should be enhanced on the links between climate change and health among policy-makers, senior staff, the media and communities.

8.2.2.3 Information and early warning systems

Generation and dissemination of objective evidence and information are instrumental to understanding the local and national context-specific climate-sensitive health impacts, paying particular attention to vulnerable populations and the available adaptation options. Integrated disease surveillance and early warning systems are promoted as a way to monitor climate change impacts, vulnerability and response capacity. Therefore, research on health impacts of and health sector adaptation to climate variability and change should be promoted at the local and national levels as well as at the global level.

8.2.2.4 Essential products and technologies

It is important to ensure that state-of-the-art technologies are adopted for preventive and curative interventions to climate-sensitive diseases as a way to increase resilience.

8.2.2.5 Financing

There is a need to integrate climate change considerations in traditional funding mechanisms for health. At the same time, the funding opportunities for climate change adaptation need to be utilized for enhancing the resilience of health systems to climate variability and change.

8.2.2.6 Service delivery

Both preventive and curative services targeting climate-sensitive health risks (e.g. water and sanitation, vector control, food safety, disaster risk reduction) need to be scaled up to be able to deal with climate change impacts in a sustainable way.

8.2.3 Ten action areas for building climate resilience

Based on the above-mentioned building blocks of the health system and lessons learnt from WHO's regional and national experiences in developing climate and health policies, the following 10 action areas are considered essential for building climate-resilient health systems. These components are the keys not only to mainstream climate change within the health sector for climate resilience, but also to provide the health component of national adaptation plans (H-NAPs). Examples of concrete action points under each component are provided below.

8.2.3.1 Governance and policy

- Focal point on climate change and health designated within the Ministry of Health with specific programme of action and budget allocated;
- Climate change and health focal points or units work in collaboration with relevant climate-sensitive health programmes, e.g. vector-borne diseases, nutrition, infectious diseases, disaster risk reduction to build the resilience of the programmes;

- NCCHAP and/or H-NAP developed and adopted;
- Agreements, e.g. memorandum of understanding, memorandum of agreement, between the Ministry of Health and main stakeholders at the national level (e.g. Meteorological Services, ministries of Environment, Food and Agriculture, Energy, Transport, Planning) signed, which include concrete roles and responsibilities in relation to protecting health from climate change;
- Health representation ensured in main climate change processes at national, regional and global levels, e.g. UNFCCC meetings and Conference of the Parties, NAP, national communications to the UNFCCC;
- Main policies and strategies from health-determining sectors reflect climate change and health considerations both in relation to adaptation, e.g. climate-resilient water safety plans, and mitigation, e.g. health co-benefits in transport policies; and
- HIAs conducted for new mitigation and adaptation policies and programmes in all climate-sensitive sectors, in accordance with Article 4.1.f of the UNFCCC.

8.2.3.2 Capacity development

- Training courses on different topics related to climate change and health conducted targeting health personnel;
- Curricula on climate change and health developed and imparted at secondary and/or tertiary levels;
- Contingency plans for the deployment of sufficient health personnel in case of outbreaks developed at the respective level, i.e. national, provincial, local;
- Realistic and innovative human resources capacity-building plans developed, which address human resource and institutional capacity gaps identified in relevant conducted assessments, e.g. capacity or vulnerability and adaptation assessments;
- Contingencies, adaptation costs, and potential losses and damages from climate change are incorporated by management staff into investment plans;
- An internal and external communication plan developed and implemented, including the development of knowledge products to raise awareness of health and climate change, and response options targeting different audiences such as health professionals and decision-makers, communities, the media and other sectors; and
- Health professionals, the media and community leaders trained in risk communication, including communication of uncertainty.

8.2.3.3 Vulnerability, capacity and adaptation assessment

- Baseline climate-sensitive health conditions established, which allow the monitoring of changing health status and risk conditions;
- HIAs for key adaptation and mitigation policies and programmes of health-determining sectors conducted;
- Baselines on existing health infrastructure and capacity established;
- Most vulnerable populations and areas to the health risks of climate change identified;
- Assessment results used to prioritize allocation of resources; and
- Plan defined and mechanism established for iterative review of health vulnerability and adaptation options available.

8.2.3.4 Integrated risk monitoring and early warning

- Early detection tools, e.g. rapid diagnostics, syndromic surveillance used to identify changing incidence and early action triggered;
- Geographical and seasonal distribution of health risks and outcomes, i.e. risk mapping, tracked;
- Early warning systems for relevant extreme weather events and climate-sensitive diseases, e.g. malaria early warning systems, zoonotic diseases, undernutrition, established;
- Indicators on climate change impacts, vulnerability, response capacity, emergency preparedness capacity, and climate and environmental variables included in relevant monitoring systems at national level and reported over time;
- Periodic review for improvements or deterioration of capacity gaps identified in vulnerability and adaptation assessments conducted;
- Health impacts of main environmental determinants of health monitored by health sector; and
- Effective communication strategy developed and implemented on climate risks to health, outlining the scope of information to be included for diverse audiences, e.g. media, public, health personnel and other sectors, as well as events, who should communicate, and the means of communication.

8.2.3.5 Research

- National research agenda on climate change and health defined through the organization of a stakeholder forum, which involves representatives from the Ministry of Health, research institutions, nongovernmental organizations and the private sector;
- Databases on climate change and health, and rosters of local experts established;
- Climate change and health knowledge management networks established;
- Training on health impacts of climate change and health vulnerability and adaptation assessment conducted targeting public health research institutions;
- Proposal for funding advanced degree programme on climate change and health submitted and funded by relevant research funding organization;
- Research findings used to inform planning, policy and stakeholder groups; and
- Policy- and decision-makers included in the conduct of vulnerability assessments.

8.2.3.6 Essential products and technologies

- Health facilities at all levels have access to and use sustainable energy and water supplies;
- Impact of health sector on the environment assessed, and appropriate mechanisms to monitor carbon emissions and environmental impacts developed;
- New technologies such as digitized health records, e-Health and telemedicine for satellite imagery used to improve health service delivery in remote communities and outer islands; and
- Training in pharmaceutical use during extreme heat conditions provided.

8.2.3.7 Management of environmental determinants of health

- Quality standards and regulations on key environmental determinants of health – air quality, water quality, food quality, housing safety, waste management – revised and enforced so as to reflect broader ranges of expected climate conditions;

- Building regulations and waste management infrastructure promoted, which are both environmentally sustainable and resistant to locally likely extreme events;
- Joint assessment, monitoring and regulation of climate risks to health promoted, e.g. conduct of HIAs for policies and programmes in other sectors, including transport, agriculture, energy; and
- Joint multisectoral risk management approaches to health risks undertaken in relation to disasters, water, waste, food and air pollution, e.g. food safety, diarrhoeal disease control, integrated vector management, and interagency risk communication.

8.2.3.8 Climate-informed health programmes

- Information gathered on seasonal trends used to plan preventive measures for those most at risk, e.g. diarrheal diseases or vector-borne diseases; and
- Relevant public health programmes and activities taking into consideration short-term influences, i.e. seasonal trends and long-term climate change in their operations, e.g. vector surveillance and control to prevent dengue and chikungunya.

8.2.3.9 Emergency preparedness and management

- Climate-sensitive health risks included under national disaster reduction strategy and plans;
- Evacuation plans defined and implemented in case of need;
- Risk management mainstreamed into development processes;
- Incentive mechanisms promoted for individual actions to reduce exposure;
- Current health-care and public health infrastructure, including water supply and waste disposal and sanitation, are appropriately located and adequately robust to be safe and remain functional under the stress of extreme weather;
- Climate-resilient building codes for health and public health infrastructure developed;
- New health-care and public health infrastructure located, designed, built and operated with the current and future climate in mind;
- Capacity of local communities to identify risks, prevent exposure to hazards and take action to save lives in emergencies strengthened;
- Civil society and community groups empowered through participation, dialogue and information exchange, thus strengthening community-based risk reduction; and
- National all-hazards health emergency and disaster risk management programmes, capacity assessments and risk assessments developed and implemented, which account for short- and long-term climate trends.

8.2.3.10 Financing

- Projects and programmes on building health system resilience submitted to and funding granted by the main international climate change funds, e.g. Adaptation Fund, SCCF, LDCF, Green Climate Fund, bilateral donors;
- Climate variability and change considerations included in proposals on malaria presented to and granted by the Global Fund to Fight AIDS, Tuberculosis and Malaria; and
- Health impacts of climate change monitored in programmes funded through financial mechanisms specific to health-determining sectors.

8.3 Resource mobilization for health adaptation in the Pacific islands countries and areas

When we discuss recommendations on addressing the impacts of climate change on health, it should be noted that most Pacific island countries and areas do not have sufficient human and financial resources to implement the above-mentioned essential public health packages. SIDS in the Pacific will need massive investments and continuing support in the form of climate financing to implement the recommendations. In this context, it should be noted that most SIDS are not responsible for the massive emission of GHGs over the past centuries and at present; they are not expected to be responsible for such emissions in the coming decades. For instance, the Pacific islands as a whole account for 0.03% of the global emissions of CO₂ from fuel combustion despite having approximately 0.12% of the world's population (IPCC, 2014).

Countries responsible for the anthropogenic causes of global climate change, which has endangered the environment, health, well-being and future of Pacific populations, are indeed the industrialized and rapidly industrializing countries. It could be argued that, according to the principle of “polluters pay”, those countries that caused anthropogenic climate change should provide technical assistance and financial resources to SIDS that need to adapt to the impacts of climate change. In addition, the natural resources of most Pacific islands had been exploited by colonizing countries for centuries before gaining independence. In any case, for the sake of justice and fairness, financial support through a global climate finance mechanism and bilateral aid of industrialized and rapidly industrializing countries for Pacific island countries struggling with climate change are urgently needed.

Currently, the largest contributor to international financing for climate change in developing countries is the EU. In particular, the EU's GCCA initiative provides technical and financial support to developing countries to integrate climate change into their development policies and budgets, and implement projects that address climate change on the ground, including the health sector. A massive amount of future international funding for climate change would be available through the Green Climate Fund, which is expected to mobilize US\$ 100 billion by 2020. In order to access these international finances and play a leadership role in the development of projects, programmes, policies and other initiatives to build public health resilience to climate change, it is recommended that the health sector leaders of Pacific island countries and areas utilize the NCCHAPs as the evidence base and guide for successful climate funding applications.



CHAPTER 9

Conclusions

Climate change is one of the defining challenges of our time, and probably constitutes one of the most significant global health threats of the 21st century (Costello et al. 2009). It is hoped that the science, evidence and recommendations contained in this report will provide a clearer path towards effective adaptation and mitigation to avoid the most serious impacts of climate change on the health of island communities across the Pacific.

For decades, WHO has published a series of reports on climate change and has participated in review processes, such as the IPCC. These activities have outlined four key characteristics of the health risks generated by a warming and more variable climate.

First, these hazards are diverse, global and probably irreversible over human time scales. They range from increased risks of extreme weather, such as fatal heatwaves, floods and storms, to less dramatic but potentially more wide-ranging effects on infectious disease dynamics, shifts to long-term drought conditions in many regions, melting of glaciers that supply freshwater to large population centres, and sea level increases leading to salination of sources of drinking water and soil for agriculture.

Second, the health impacts of climate change are potentially huge. Many of the most important global killers are highly sensitive to climatic conditions. Malaria, diarrhoea and malnutrition together cause more than 3 million deaths each year.

Third, these risks are inequitable in that the GHGs that cause climate change originate mainly from developed countries, but the health risks are concentrated in the poorest nations, which have contributed the least to the root of problem.

Finally, many of the projected impacts on health are avoidable through a combination of public health interventions in the short term, support for adaptation measures in health-related sectors such as agriculture and water management, and a long-term strategy to reduce the human impacts on climate.

This synthesis report presents the key findings and outputs of WHO's work on climate change and health in the years since the Sixty-first World Health Assembly and fifty-ninth session of the WHO Regional Committee for the Western Pacific, both in 2008, and various biennial meetings of Pacific health ministers at which resolutions were adopted to address the detrimental impacts of climate change and health.

Since 2010, the Division of Pacific Technical Support (DPS) of the WHO Regional Office for the Western Pacific has been assisting Pacific island countries and areas to assess their vulnerabilities to the health impacts of climate change and plan appropriate adaptation strategies to manage these risks.

The small island states of the Pacific are among the most vulnerable in the world to the impacts of climate change, including the likely substantial detrimental effects on human health. The work undertaken by WHO, in collaboration with ministries of health and other cross-sectoral partners in over a dozen Pacific island countries and areas, has led to the identification and prioritization of a number of key climate-sensitive health risks in the region. These include, but are not limited to foodborne, vector-borne and waterborne diseases and zoonotic infections; traumatic injuries and deaths; malnutrition; exacerbation of the morbidity and mortality due to NCDs; disorders of mental health; and other diseases, including those affecting the respiratory tract, eyes, ears and skin. Climate change is also likely to cause social disruption, as island communities stand to lose their lands and livelihoods in the face of rising seas, more extreme weather events, and declining agricultural yields and fish stocks, and become increasingly dependent on migration, food imports and external economic support for survival. These impacts are, to some extent at least, modifiable through the urgent and effective implementation of adaptation measures aimed at minimizing these risks to health, as well as through strategies to arrest and abate, or mitigate, the process of climate change itself.

Adaptation is, by its very nature, a cross-cutting, whole-of-society and whole-of-government undertaking. Adaptation to protect population health will henceforth require actions beyond the health sector itself. Ensuring a health-in-all-policies approach to adaptation and development will contribute to ensuring that health considerations are incorporated into national policies and plans relevant to climate change.

The evidence and observations summarized in this report send a very powerful message to leaders, policy-makers and people in Pacific island countries and areas. They were generated through multi-year collaborations between WHO and Member States, assessing each country's unique vulnerabilities to the likely impacts of climate change, and planning appropriate adaptation measures to manage those risks.

This report is the first comprehensive synthesis of the current state of knowledge of health and climate change in the Pacific islands. This work is not, and will never be, complete. Managing the health risks of climate change requires regular revision of adaptation plans to take into account the experiences gained through the implementation of adaptation options; new knowledge and understanding of climate change and health processes, pathways and risks; and changes in institutional structures, economic development, technology, demographics and other aspects of Pacific societies.

Climate change is the defining challenge of our era and poses the greatest threat to global health in our generation. But our response to climate change – and its impact on health – could be the greatest health opportunity of the 21st century (Watts et al. 2015). Health professionals and health leaders are called on to support the growing movement for a cleaner, more sustainable and healthier future (Chan, 2015). For Pacific island countries and areas highly vulnerable to the impacts of climate change, an urgent response is needed to protect the health and well-being of human populations. The very survival of future generations in the Pacific depends on actions we take now.

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