



MDGF 1656

**Strengthening the Philippines
Institutional Capacity to Adapt
to Climate Change**

Health Sector

Book III

Final Report

April 27, 2011

**Institute of Health Policy and
Development Studies**

National Institutes of Health
UP Manila



**MDGF 1656: Conduct of Climate Change Vulnerability
and Impact Assessment Framework,
Development of a Monitoring and Evaluation
Framework/System, and Compendium of Good and
Innovative Climate Change Adaptation Practices
(Health Sector)
Book III**

FINAL REPORT

April 27, 2011

**Institute of Health Policy and Development Studies
National Institutes of Health
University of the Philippines Manila**



INTRODUCTION

Climate change adaptation has now become the focus of research on the matter. It has been agreed upon by governments that mitigation, specifically carbon cutting will help in decreasing the rate at which global temperatures increase but it is adaptation that will help the world now and in the next several years in combating this global burden.

During the early years of climate change research, adaptation focused mainly on sectors that included those that would affect the basic needs of men – food, clothing, and shelter. As such, climate change impacts were identified for the agriculture, water, forestry, marine, and other similar sectors. It was only recently that governments realized the ultimately, it is human health that will be at the downstream of all the impacts of climate change in the aforementioned sectors.

This compendium of good and innovative climate change adaptation options for the health sector has been taken from extensive reviews of literature and actual site visits. Initially, this component of the project, **MDGF 1656: Strengthening the Philippines' Institutional Capacity to Adapt to Climate Change** started with a review of 103 articles, journals, books, and other publications which have been singled out as relevant to the project (See Bibliography 2, Book III Appendix D). Using a subjective method which basically involved much reading and scanning through of each and every article, a total of 35 publications have been decided to be included in this compendium. The articles that will follow have been reviewed individually and have been chosen specifically because **they are, in one way or another, identified as applicable in the Philippine setting.**

Additionally, two notable adaptation options which have been observed and noted by the climate change project team (health sector), led by Dr. Fely Marilyn Lorenzo during the validation visits in the project pilot sites – Rizal, Pangasinan, and Palawan, were included in this compendium. Another adaptation option, the SCW system, which was discovered by Dr. Lorenzo has been added to the initial two adaptations. These three make up a category of adaptation options, which the team highly recommends for consideration by the local and national policy planners and makers alike.

Observed Vulnerabilities in Rizal, Palawan, and Pangasinan

Categories

- A – Individual / Family / Community
- B – Socio-economic Factors
- C – Pathogen Factors
- D – Health System and Infrastructure
- E – National and Local Policy Development
- F – Environmental Policy

AREA	CATEGORY	VULNERABILITY
PANGASINAN	B	No screening measure to monitor or prevent transfer of Malaria carriers to Alaminos
	E	Solid Waste Management Facility (Open Dumpsites) Poor Sanitation along coastal areas
		Water system e.g Mostly level 1 and 2 (outside the “Tourist Area”)
		Contaminated shallow wells
PALAWAN	A	IPs access to health services; also, the reach of the health system to the IP communities
	B	Indoor Residual Spraying -> but there are lapses; done only once a year
		Southern Palawan Provincial Hospital
		Inadequate information dissemination among the IPs re malaria presence
		Precision of Diagnosis e.g typhoid
		IPs access to health services; also, the reach of the health system to the IP communities
	C	Having several naturally occurring breeding sites
	E	Water system e.g Mostly level 1 and 2 in the outskirts of the Poblacion
		Having several naturally occurring breeding sites
	F	Solid Waste Management facility
RIZAL	A	IP Communities in areas vulnerable to flooding and landslides

AREA	CATEGORY	VULNERABILITY
		Human settlements in vulnerable locations
	B	Inadequacy of human resources for the health sector
		In Teresa, there is poor internet access resulting in poor reporting of disease cases (for PIDSR)
	D	Inadequate and inefficient implementation of resettlement policies
		Human settlements in vulnerable locations
	E	IP Communities in areas vulnerable to flooding and landslides
		Human settlements in vulnerable locations
	F	The LGU has no formal linkage with the local PAGASA Synoptic Station

Observed Adaptations in Rizal, Palawan, and Pangasinan

Categories

- A – Individual / Family / Community
- B – Socio-economic Factors
- C – Pathogen Factors
- D – Health System and Infrastructure
- E – National and Local Policy Development
- F – Environmental Policy

AREA	CATEGORY	ADAPTATION
PALAWAN	A	Having barangay microscopists who do early diagnosis and treatment (there are 15 microscopists for all 18 barangays of Brooke's Point)
	B	Best practices for IPs - health education (e.g seminars on malaria) - they have their own IP BHWs in their areas - they are given insecticide treated mosquito nets as well - use of RDTs
	F	Having a Municipal Disaster Coordinating Council
		Having spring developments in several barangays and sitios
		Best practices for IPs: Before given mosquito nets à they are required to clear streams

AREA	CATEGORY	ADAPTATION
		Potable water approaches (SODIS, spring water development, public and private partnership in local water district)
PANGASINAN	A	Zoning and resettlement of high risk groups or informal settlers
	B	Early diagnosis and prompt treatment for dengue
	D	Zoning and resettlement of high risk groups or informal settlers
	E	Sanitary landfill in Bolinao; 2 others in development
	F	Zoning and resettlement of high risk groups or informal settlers
		Decanting (SEARCH AND DESTROY)
		Strengthened Provincial Disaster Coordinating Council
		Floating Toilet Device in Bolinao
		Training for disaster preparedness
		Ordinance No. 2004-02 ("The Comprehensive Solid Waste Management Ordinance" - Bolinao)
		Reforestation
		Purchase orders for additional lifeboats
		Increase in disaster funds
RIZAL	F	Maintaining of a solid waste management facility / MRF
		Planting bamboo to prevent landslides; also, prevent flooding
		Decanting
		Breeding of larvivarous species of fish
		Epidemiologic linking, active case finding, and early diagnosis and treatment

01	
TITLE	Vulnerability and Adaptation to Climate Change in Small Island Developing States
AUTHOR/S	UNFCCC; Dr. Graham Sem
DATE OF PUBLICATION	2007
PLACE OF PUBLICATION	Kingston, Jamaica
PUBLISHER	United Nations Framework Convention on Climate Change
PAGES	37
TYPE OF PUBLICATION	Background paper
ABSTRACT / EXECUTIVE SUMMARY	<p>The climate of small island states is influenced by large ocean-atmosphere interactions such as trade winds, El Niño and the monsoons; tropical cyclones and hurricanes are also important components of the climate, as well as sea-level rise. These climate characteristics, combined with their particular socioeconomic situations make SIDS, among which are 12 LDCs, some of the most vulnerable countries in the world to climate change. This, added to the fact that SIDS produce such extremely low levels of greenhouse gas emissions, means that they will suffer disproportionately from the damaging impacts of climate change.</p> <p>The collection of climate related data is especially important in the case of SIDS since they are highly sensitive to changes in the climate and to sea-level rise and are experiencing the more severe effects of climate change sooner than most other countries. GCOS is currently implementing Regional Action Plans which will help respond to these problems. The Pacific Islands Action Plan was used as a pilot by GCOS therefore many activities have already been implemented. Although less advanced in its implementation, the Action Plan for Latin America and the Caribbean has also prompted activities which will increase the effectiveness of observations in this region.</p> <p>SIDS used both top-down, scenario-driven approaches (some accompanied by regional downscaling techniques), and bottom-up vulnerability based approaches when carrying out their vulnerability and adaptation assessments.</p> <p>Tourism and agriculture, in particular, will be negatively impacted by these changes. Likewise climate change, through these impacts, threatens the achievement of the sustainable development goals contained in the Mauritius Strategy. Responses to climate change and sea-level rise could be coordinated and integrated with existing policies of socio-economic development and environmental conservation to facilitate sustainable development.</p> <p>Other projected impacts include: economic losses from reduced agricultural yields, for example from shortening of the growing season or drought; loss of mangrove forests due to sea-level rise, loss of coral reefs due to bleaching and acidification of the oceans and damage to terrestrial forests due to extreme events; reduction in the size of freshwater lenses and general water resource availability due to decreased rainfall and saltwater intrusion; inundation of settlements and arable land on the coast and reduction in tourism resulting from increases in extreme weather and environmental degradation.</p> <p>SIDS have ongoing projects and projects in the pipeline which will implement adaptation measures to help increase resilience to the impacts of climate change on a global, regional and national level. These projects involve strengthening of institutions, policy and regulations, but also ground-level tasks such as water storage and drought resistant crops. Many follow on from, or are acting in synergy with, projects for the mainstreaming of adaptation. Some completed adaptation projects date back to the 1990s and have published outcomes which can be used as a</p>

	<p>resource for SIDS investigating adaptation approaches.</p> <p>The projects and programmes on issues relating to impacts, vulnerability and adaptation in SIDS are diverse. They are being implemented within the UNFCCC process by other UN agencies which also serve as Global Environment Facility (GEF) implementing agencies (activities include projects sponsored by GEF and non-GEF funded projects) and by multilateral financial institutions and bilateral development assistance agencies.</p> <p>Risk management practices have the potential to greatly help SIDS in preparing for climate change impacts especially in the form of increased extreme events, and organizations and companies are taking actions to decrease risk from natural disasters on SIDS. For example, the Caribbean Hazard Mitigation Capacity Building Programme of CARICOM is helping Caribbean countries to create national hazard vulnerability reduction policies; and the United Insurance Company of Barbados gives financial incentives for homeowners to put preventative measures in place. The Catastrophic Risk Insurance Facility (CRIF) within the World Bank is piloting a scheme for small States to buy parametric insurance coverage against natural disaster risk.</p> <p>There are various multilateral sources of funding for adaptation available which include the GEF Trust Fund, the Special Climate Change Fund, the Least Developed Countries Fund and the Adaptation Fund. Funding is also available through other bilateral and multilateral sources, including those that support the implementation of multilateral environmental agreements such as the Convention on Biological Diversity.</p> <p>In addition, there are international organizations such as UNESCO and UNEP which have regional programmes specifically for SIDS. Such programmes provide useful opportunities for catalyzing additional support for, and synergistic implementation of adaptation activities in SIDS at both the national and regional level.</p>
--	---

SUMMARY

- Tropical cyclone intensities could increase 5 to 10 per cent by about 2020 whereas the peak precipitation rates are likely to increase by 25 per cent in response to increases in maximum and mean tropical cyclone intensities.
- The increases in surface air temperatures have been greater in the Pacific than global rates of warming.
- Water pollution is one of the major problems facing small islands; poor water quality affects human health and the incidence of water-borne diseases. Owing to factors such as limited size, geology and topography, water resources in small islands are extremely vulnerable to changes and variations in climate, especially in rainfall
- **ADAPTATION OPTIONS**
 - Most adaptation initiatives in SIDS have involved enabling activities
 - Vulnerability Assessment
 - Adaptation Assessment
 - Mainstreaming of CC into government policies
 - Flood risk analysis with land zoning and flood mitigation actions
 - Creating of land use plans and corresponding enforcement strategies
 - Strengthening of institutional capacity to enforce land zoning restrictions
 - Providing for scientific and engineering services required to assess vulnerabilities and define priorities, then retrofitting buildings
 - Integrating adaptation into population and resettlement programs
 - Prevention and removal of maladaptive practices
 - (Public) Awareness raising and enforcement

ANNOTATION

The article focuses on the vulnerabilities of and adaptations for small island developing states (SIDS), which include among others, the Fiji Islands, Kiribati, Maldives, and numerous other island-countries that dot the Pacific, Indian, and the Atlantic Oceans. The Philippines is not included in this group simply because it is too big and it is actually composed of thousands of small and big islands. Nevertheless, the vulnerabilities identified in some island states, for example the threats of coral bleaching and sea level rise, are also observed in the Philippines. **Likewise, adaptation strategies identified in SIDS may also be applicable in the Philippine setting especially considering that most of these island states are tropical countries as well.** For example, the article mentioned the conduction of preliminary V&A impact assessments and improvement of the water system. These adaptations are generic in nature but may be applicable as well in the Philippines. However, the article did not identify any adaptation strategy that may be directly relevant to health. The closest to health that it did identify are those concerning water system improvements and water conservation.

02	
TITLE	Public Health: Adapting to Climate Change
AUTHOR/S	Jonathan Samet
DATE OF PUBLICATION	March 2010
PLACE OF PUBLICATION	Washington, DC, USA
PUBLISHER	Resources for the Future
PAGES	15
TYPE OF PUBLICATION	Policy Brief
ABSTRACT	<p>As defined by the Intergovernmental Panel on Climate Change, adaptation includes a set of actions to moderate harm or exploit beneficial opportunities in response to climate change. To date, little research has addressed public policy options to frame the nation's approach to adapt to a changing climate. In light of scientific evidence of extreme and unpredictable climate change, prudent policy requires consideration of what to do if markets and people fail to anticipate these changes, or are constrained in their ability to react. This issue brief is one in a series that results from the second phase of a domestic adaptation research project conducted by Resources for the Future. The briefs are primarily intended for use by decisionmakers in confronting the complex and difficult task of effectively adapting the United States to climate change impacts, but may also offer insight and value to scholars and the general public. This research was supported by a grant from the Smith-Richardson Foundation.</p> <p>Policy Recommendations SHORT-TERM POLICIES</p> <p>Climate change poses a threat to human health; it already causing excess mortality and morbidity through heat-related deaths and changing patterns of infectious diseases. Climate change does not create new health problems but may worsen known clinical problems and alter geographic patterns of disease occurrence. Public health programs in many countries already target the problems that are directly linked to climate change. Consequently, policy recommendations related to climate change and public health reflect the need to sustain and refine current measures to enhance their sensitivity to climate change. Policy actions related to climate change and health should:</p> <ol style="list-style-type: none"> 1. Make certain that existing public health surveillance systems are sufficiently comprehensive and sensitive to detect potential effects of climate change on health; 2. Assure specifically that infectious disease surveillance systems can detect potential "signature" diseases that may affect the United States consequent to climate change; 3. Establish and implement heat warning systems and take steps to increase public awareness of consequences of heat exposure; 4. Enhance awareness of climate change and health among public health and medical practitioners; and 5. Alert practitioners and their patients to the potential for changes in patterns of exposure to aeroallergens that exacerbate allergic diseases like asthma and allergic rhinitis ("hay fever").

SUMMARY

- Protecting human health is the 'bottom line' of climate change strategies (WHO, 2009, 3).
- Climate change will not introduce new causes of morbidity and mortality, but will change the factors--such as disease vectors and environmental exposures—that affect the occurrence of morbidity and premature mortality.
- Climate change may affect health by direct and indirect pathways (Metz et al. 2007).

- Exposures resulting directly from climate change, such as increased frequency of heat waves;
 - Exposures following indirectly from climate change, such as scarcity of water and increased transmission of infectious diseases because of climate change's influence on vectors; and
 - Societal and economic disruption that could affect health through population displacement, conflict, interruption of safe food and water supplies, and failure of governments to assure environmental quality. Some direct and indirect threats are already the target of control programs embedded in public health and medical systems, themselves vulnerable to disruptive social, economic, and environmental conditions.
- Vector-borne diseases are of greatest concern with regard to potential adverse consequences of climate change. Environmental conditions that promote a vector or extend its geographic range increase the potential for infection by the agent. Warming may also expand the geographic area where an infectious agent is present.

- **ADAPTATION OPTIONS**

- Intensifying public health Surveillance
 - As part of the approach to identifying and mitigating public health problems, surveillance involves more than passively collecting data; it is grounded in process, such that the surveying organization analyzes data, reviews findings, and takes action when needed (Teutsch and Churchill 2000). If intervention is undertaken, the continued monitoring provides a way to track its consequences.
- Temperature Warning Systems
 - Heat watch systems have been implemented and proven effective (Ebi and Schmier 2005). The approach involves the characterization of conditions in a particular locale that are likely to produce dangerous heat stress and trigger an aggressive protective response from public health and municipal authorities.
- Air-conditioning
 - Housing style and the use of air conditioning can lessen the impact of heat waves. The availability of air conditioning reduces the risk of mortality during a heat wave. As a longer-run strategy, increased use of air conditioning in homes would be expected to protect against heat-associated mortality, although the strategy has associated costs of implementation and the electric power to support the air conditioning.
- Improvement of Clinical Care
 - Medical care is a further mitigating factor for the adverse impact of climate change on health. Effective treatment strategies are available for heat stress, allergic diseases, and many infectious diseases with transmission affected by climate change. In fact, at the level of the individual patient, no signature exists for identifying those individuals whose health has been adversely affected by climate change. A further key role for clinicians is to recognize the occurrence of sentinel cases that signal a possible outbreak or an emerging illness. The first cases of AIDS, for example, were recognized in the United States in 1981 because clinicians noticed the occurrence of a cluster of cases of *Pneumocystis carinii* pneumonia in gay men with immunocompromise (Centers for Disease Control and Prevention 1981). Clinicians are an integral element of surveillance, a role better filled if they are alerted to the potential consequences of climate change and the possibility of emerging infections.

ANNOTATION

The article, which is a policy brief produced by Resources for the Future provides a general but comprehensive view of climate change and climate change adaptation in many sectors, particularly in health. It also provides short term policy recommendations which could be helpful to local and national policy makers. By introducing first the issue of climate change and how it can affect the health of a population, the article is able to stimulate the reader's mind making one read further and eventually arriving at adaptation suggestions for reducing the impact of climate change on health. It must be noted that the article actually uses evidence-based data to support the suggested adaptation strategies. The article does not cite adaptation options for the focal diseases (Malaria, Dengue, Cholera, Typhoid, and Leptospirosis) but it does provide, ***intensifying public health surveillance*** as an adaptation. It also cites ***improvement of clinical (medical) care*** as an adaptation. The rest of the adaptations cited focuses on minimizing the effects of heat wave, which is a direct consequence of climate change that usually occurs in temperate countries.

03	
TITLE	Climate Change and Public Health in Indonesia - Impacts and Adaptation
AUTHOR/S	Budi Haryanto
DATE OF PUBLICATION	3 December 2009
PLACE OF PUBLICATION	Melbourne, Australia
PUBLISHER	Nautilus Institute
PAGES	12
TYPE OF PUBLICATION	Essay
SYNOPSIS	Budi Haryanto of the University of Indonesia reviews expected global health impacts of climate change, and then outlines both direct and indirect health impacts specific to Indonesia. After setting out specific drivers of the climate change-health nexus in Indonesia, Haryanto summarises the range of current Indonesian research on health impacts. He then sets out adaptation issues and a method for approaching health adaptation assessment. Haryanto concludes by proposing a suite of adaptation measures, including health early warning systems; improved disaster response; capacity building for government, private sector, and civil society on managing prevention and control climate change on human health; empowering public health services system for disease prevention and control; and generating epidemiology and medical research to identify approaches for breaking disease transmission chains.

SUMMARY

- The health impacts of known weather and climate changes are as follows:
 1. Cardiovascular respiratory mortality and heat stroke mortality:
 - Short-term increases in mortality during heat-waves
 - V- and J-shaped relationship between temperature and mortality in populations in temperate climates
 - Deaths from heat stroke increase during heat waves
 2. Allergic rhinitis:
 - Weather affects the distribution, seasonality and production of aeroallergens
 3. Respiratory and cardiovascular diseases and mortality:
 - Weather affects concentrations of harmful air pollutants
 4. Deaths and injuries:
 - Floods, landslides and windstorms cause death and injuries
 5. Infectious diseases and mental disorders:
 - Flooding disrupts water supply and sanitation systems and may damage transport systems and health care infrastructure
 - Floods may provide breeding sites for mosquito vectors and lead to outbreaks of disease
 - Floods may increase post-traumatic stress disorders
 6. Starvation, malnutrition and diarrhea and respiratory diseases:
 - Drought reduces water availability for hygiene
 - Drought increases the risk of forest fires
 - Drought reduces food availability in populations that are highly dependent on household agricultural productivity and/or economically weak

- 7. **Mosquito, tick-borne diseases and rodent-borne diseases:**
 - Higher temperatures shorten the development time of pathogens in vectors and (such as malaria, dengue, tick-borne encephalitis and Lyme diseases) increase the potential transmission to humans
 - Each vector species has specific climate conditions (temperature and humidity) necessary to be sufficiently abundant to maintain transmission
- 8. Malnutrition and undernutrition:
 - Climate change may decrease food supplies (crop yields and fish stocks) or access to food supplies
- 9. **Waterborne and foodborne diseases:**
 - Survival of disease-causing organisms is related to temperature
 - Climate conditions affect water availability and quality
 - Extreme rainfall can affect the transport of disease-causing organisms into the water supply
- In Indonesia, cases of malaria, dengue, diarrhea and cholera are predicted to increase as temperatures rise and water becomes contaminated, affecting scores of poor populations that do not have the resources to cope.
- This spreading of disease may not be controlled directly even by manipulating or modifying the environment. Analysis of each of these steps (infection process) allows a logical determination of vulnerability and subsequent development of adaptive measures that aim to decrease vulnerability.
- Noted effects of Climate Change in Indonesia:
 - Direct effects
 1. Increase in injuries associated with extreme weather events
 - Indirect effects
 1. Increase in vector borne diseases (malaria, dengue, filariasis) associated with increase in temperature, rainfall, humidity, and vector density.
 2. Increase in water borne diseases (diarrhea, cholera, typhoid, leptospirosis) associated with a decrease in water quality and water supply as well as floods and droughts.
 3. Increase in malnutrition cases related to food production and land use shifts
 4. Increase in cardio cerebral vascular diseases, hypertension, and mental disorders associated with urban stress, life style, displacements and conflicts.
 5. Increase in influenza (ARI) and respiratory diseases (asthma, pneumonia) associated with increasing of air pollution outdoor as well as indoor
 6. Increase in food borne diseases is associated with contamination, food handling, and poverty
- **ADAPTATIONS**
 - An **assessment of coping capacity** is necessary to determine current vulnerability and to plan appropriate adaptations. Assessment of coping capacity at all levels and for all relevant sectors will provide a thorough understanding of what is needed for management of potential health impacts from climate change.
 1. One approach to vulnerability and adaptation assessment is through a Health impact assessment, which includes:
 - An evaluation of the impact of climate variability and change in a range of areas and populations, especially among vulnerable populations and, when possible, to determine the attributable burden of weather and climate, including extreme events, to climate-sensitive diseases;
 - An evaluation of possible threshold effects;
 - An evaluation of the effects of multiple stresses, including changes in socioeconomic systems;

- An evaluation of uncertainty and its implications for risk management;
 - An evaluation of the effects of reducing emissions, such as by comparing the impact under scenarios with business-as-usual and stabilization of emissions; and
 - An evaluation of coping capacity, especially under different socioeconomic futures and in the context of sustainable development.
- **Assessment of vulnerability and adaptation** uses similar concepts to those used in a health impact assessment. The following steps are commonly used for assessing vulnerability and adaptation of climate change health impacts:
 1. Determine scope of assessment
 2. Describe the associations between disease outcomes and climate variability and change
 3. Identify and describe current strategies, policies and measures that reduce the burden of climate-sensitive diseases
 4. Review the health implications of the potential impact of climate variability and change on other sectors
 5. Estimate the future potential health impact
- The adaptation focus for climate change on human health generated by the World Health Organization (WHO) and adopted by the Government of Indonesia (GOI) comprises the following points:
 1. Health security
 2. Strengthening health systems
 3. Health development
 4. Evidence and information
 5. Delivery
 6. Partnership
- National Program of Adaptation and Mitigation for Health Sector (GOI):
 1. Infectious disease surveillance
 2. Health action in emergencies
 3. Safe drinking water
 4. Integrated vector management
 5. Environmental health capacity building
 6. Healthy public policy (healthy housing, school, forest, industry, city)
- In order to bridge the GOI response and action for climate change adaptation especially on human health, several preliminary steps and or scenarios should be generated to assure the maximum efforts and significant results. They should at least include:
 1. Empowering a ecological-disease surveillance system and developing a public health early warning system
 2. Development of a response to disaster effects of climate change
 3. Enhancing capacity building for government, private sector, and civil society on managing prevention and control climate change on human health
 4. Increasing political awareness of the relationship between climate change and human health
 5. Empowering public health services system for disease prevention and control
 6. Generating epidemiology and medical research to identify approaches for breaking disease transmission chains
 7. Preventing and eradicating climate change vector-related diseases

ANNOTATION

The article as a whole explains briefly how climate change affects health and how the Government of Indonesia intends to address these climate change related health impacts. The article starts by defining climate change and its impacts on human health. The impacts mentioned are briefly stated but comprehensive and multi-system in nature. It then proceeds with the explanation on how the current climate changes can produce the previously mentioned impacts on health in Indonesia. It then goes to the explanation of Indonesia's planned public health adaptation, which focuses much on the necessity of undergoing first a vulnerability / impact assessment before responding to the impacts so as to come up with appropriate adaptations. It enumerates the steps involved in implementing a vulnerability assessment and provides a brief explanation for each step. The article then concludes with the foci of adaptation generated by the WHO and adopted by the Indonesian government and a list of preliminary steps that should be generated to assure maximum effort and significant results. **The highlight of the article is the step by step explanation of vulnerability assessment, which presumably can be done in any setting including the Philippines.**

TITLE	Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change
AUTHOR/S	Secretariat of the Convention on Biological Diversity
YEAR OF PUBLICATION	2009
PLACE OF PUBLICATION	Montreal, Quebec, Canada
PUBLISHER	Secretariat of the Convention on Biological Diversity
PAGES	126
TYPE OF PUBLICATION	Report
ABSTRACT	N/A

Summary

- With regard to climate change adaptation, healthy, intact ecosystems have long provided critical ecosystem services, providing people with food and shelter, protecting communities from drought and floods, and building the basis of much of our traditional knowledge, innovations and practices. As climate change threatens food security, increases exposure to natural disasters and changes the very nature of the environment in which we live, these ecosystem services will become even more important and valued.
- Ecosystem-based adaptation, which integrates the use of biodiversity and ecosystem services into an overall adaptation strategy, can be cost-effective and generate social, economic and cultural co-benefits and contribute to the conservation of biodiversity
- For the health sector it mentioned the following adaptation strategy:
 1. Drainage of wetlands to eliminate breeding sites of disease-bearing vectors like mosquitoes
 2. Management of wetland breeding sites (mosquitoes)
 3. Introduction of (larvivarous) fish in natural and artificial ponds and wetlands to control vector larvae.
 4. Chemical control of vector borne diseases like mosquitoes (e.g. use of insecticides)
 5. Bio-larvicide control of vector borne diseases like mosquitoes

ANNOTATION

The article provided general information concerning the integration of biodiversity and climate change mitigation and adaptation. It also mentioned adaptation options to address Increase and spread of vector borne diseases.

Most of the adaptation strategies mentioned in the article can be applied in the Philippines. Actually, the mentioned adaptation strategies in the article are already being implemented.

05	
TITLE	Assessment of adaptation practices, options, constraints and capacity
AUTHOR/S	Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit and K. Takahashi,
YEAR OF PUBLICATION	2007
PLACE OF PUBLICATION	Cambridge, UK
PUBLISHER	Cambridge University Press
PAGES	717-743
TYPE OF PUBLICATION	Book

SUMMARY

- Societies have a long record of adapting to the impacts of weather and climate through a range of practices that include crop diversification, irrigation, water management, disaster risk management, and insurance. But climate change poses novel risks often outside the range of experience, such as impacts related to drought, heatwaves, accelerated glacier retreat and hurricane intensity
- Adaptation measures that also consider climate change are being implemented, on a limited basis, in both developed and developing countries. These measures are undertaken by a range of public and private actors through policies, investments in infrastructure and technologies, and behavioural change. Examples of adaptations to observed changes in climate include partial drainage of the Tsho Rolpa glacial lake (Nepal); changes in livelihood strategies in response to permafrost melt by the Inuit in Nunavut (Canada); and increased use of artificial snow-making by the Alpine ski industry (Europe, Australia and North America). A limited but growing set of adaptation measures also explicitly considers scenarios of future climate change. Examples include consideration of sea-level rise in design of infrastructure such as the Confederation Bridge (Canada) and in coastal zone management (United States and the Netherlands).
- There is a long record of practices to adapt to the impacts of weather as well as natural climate variability on seasonal to interannual time-scales – particularly to the El Niño-Southern Oscillation (ENSO). These include **proactive measures such as crop and livelihood diversification, seasonal climate forecasting, community-based disaster risk reduction, famine early warning systems, insurance, water storage, supplementary irrigation** and so on. They also include reactive or ex-poste adaptations, for example, emergency response, disaster recovery, and migration (Sperling and Szekely, 2005). Recent reviews indicate that a 'wait and see' or reactive approach is often inefficient and could be particularly unsuccessful in addressing irreversible damages, such as species extinction or unrecoverable ecosystem damages, that may result from climate change (Smith, 1997; Easterling et al., 2004).
- In this chapter, adaptation practices refer to actual adjustments, or changes in decision environments, which might ultimately enhance resilience or reduce vulnerability to observed or expected changes in climate. Investment in coastal protection infrastructure to reduce vulnerability to storm surges and anticipated sea-level rise is an example of actual adjustments. Meanwhile, the development of climate risk screening guidelines, which might make downstream development projects more resilient to climate risks (Burton and van Aalst, 2004; ADB, 2005), is an example of changes in the policy environment.

ANNOTATION

This chapter cited several adaptation options that are currently being implemented in some countries. It is presented in a table format that gives examples of adaptation initiatives by region, undertaken relative to present climate risks, including conditions associated with climate change. The country Philippines is included in that table where in issues on floods and drought were tackled. The adaptation options mentioned were as follows: **Adjustment of silvicultural treatment schedules to suit climate variations; shift to drought resistant crops; use of shallow tube wells; rotation method of irrigation during water shortage; construction of water impounding basins; construction of fire lines and controlled burning; adoption of soil and water conservation measures for upland farming.** Not much adaptation strategies about CC and health were mentioned.

06	
TITLE	Climate change and malaria in India.
AUTHOR/S	Sumana Bhattacharya ¹ , C. Sharma, R. C. Dhiman ¹ and A. P. Mitra
YEAR OF PUBLICATION	2005
PLACE OF PUBLICATION	
PUBLISHER	
JOURNAL	CURRENT SCIENCE
Volume	90
PAGES	369-375.
TYPE OF PUBLICATION	Journal Article

SUMMARY

- CLIMATE signals observed over India in the last 100 years show an increasing trend in surface temperature by 0.3°C, a change in the spatial pattern of rainfall with respect to normal and occurrence of more intense and frequent extreme temperature, rainfall and cyclone events¹. As a result, there is a growing concern about the changing pattern of some of the diseases over the years, across India that are directly influenced by the variable climate. Malaria, a vector-borne disease, falls under this category and is the focus of the study.
- Malaria affects 40% of the world population spread over 92 countries¹⁹. Despite extensive measures taken since the early fifties in India, both by the central government and state governments to combat the debilitating disease, it has become endemic in the central, south eastern and north eastern parts of the country.
- Adaptation to climate change is a key concern now, especially considering the fact that the climate projections and the likely anticipated changes in the existing disease conditions are highly uncertain, and the capacities to adapt to the adverse impacts of climate change may not be sufficient.
- We need to strengthen our present capacities devised to combat the adverse effects of the current climate variability and develop new capabilities. One small measure in this direction has been taken in this paper whereby the **India-specific transmission windows have been developed for the transmissions of *P. vivax* and *P. falciparum*.**
- Some of the measures that can be envisaged at this juncture which can help to reduce the vulnerability to malaria under climate change conditions, may include:
 - Improve medical health services
 - Greater accessibility to medical health services
 - Identification of vulnerable areas by developing vector-specific regional maps
 - Development of a robust predictive model linking climate and incidence
 - Improved surveillance and monitoring systems
 - Improved infrastructure to avoid breeding
 - Develop Integrated Environmental Management Plans
 - Public education.

ANNOTATION

The focus in this paper is to understand the likely influence of climate change on vector production and malaria transmission in India. A set of transmission windows typical to India have been developed, in terms of different temperature ranges for a particular range of relative humidity, by analyzing the present climate trends and corresponding malaria incidences.

07	
TITLE	Adaptation to Climate Change: international policy options
AUTHOR/S	Burton, I., E. Diringer, and J. Smith
YEAR OF PUBLICATION	2006
PLACE OF PUBLICATION	Virginia
PUBLISHER	The Pew Center on Global Climate Change
PAGES	1-23
TYPE OF PUBLICATION	Report

SUMMARY

- Three approaches were stated in this article that suggests ways they can serve as complementary elements of a comprehensive international adaptation effort. One fundamental challenge in mobilizing such an effort is bridging the seeming gap between political and policy contexts
- Adaptation has become an issue for the international community by virtue of climate change: the onset of human-induced climate impacts presents not only significant new risks and needs, but also difficult issues of global equity. However, the new adaptation challenges presented by climate change must be understood within the broader context of climate risk generally, and against a backdrop of rising vulnerability driven by other forces. Such a perspective likewise suggests that the most effective adaptation strategies will in many cases be those addressing climate risk generally. From a policy perspective, then, much of the action necessary is in processes and venues traditionally far removed from the issue of climate change. Yet from a political perspective, the strongest drivers—and, hence, the greatest prospect for achieving the necessary political momentum—are in the climate change arena.

ANNOTATION

- This report states that an effective adaptation response requires a wide array of measures and strategies.
- Three broad approaches are described here:
 - **Adaptation under the UNFCCC**—Strengthening mechanisms and support for proactive adaptation under the Convention by facilitating comprehensive national strategies and committing reliable funding for high-priority implementation projects.
 - **Integration with development**—Factoring adaptation into development assistance through measures such as mandatory climate risk assessments for projects financed by multilateral and bilateral lenders.
 - **Climate “insurance”**—Committing funds to support climate relief or insurance-type approaches in vulnerable countries for losses resulting from both climate change and climate variability.
- These adaptation practices would be very helpful and would strengthen the Philippines’ adaptation to climate change.

08	
TITLE	Adaptation to Climate Change and Managing Disaster Risk in the Caribbean and South-East Asia
AUTHOR/S	Caribbean Disaster Emergency Response Agency
YEAR OF PUBLICATION	2003
PLACE OF PUBLICATION	Barbados
PUBLISHER	Caribbean Disaster Emergency Response Agency
PAGES	1-49
TYPE OF PUBLICATION	Report

SUMMARY

- This report is one of the outcomes of the *Seminar on Climate Change and Severe Weather Events in the Caribbean and Asia*, held in Barbados at the Grand Barbados Beach Resort on July 24-25, 2003. It was sponsored by the Inter-American Development Bank through its Japan Programme, co-sponsored by the Asian Disaster Preparedness Center and organized by the Caribbean Disaster Emergency Response Agency, in collaboration with the Adaptation to Climate Change in the Caribbean Project. Presentations made at the seminar were based on six case studies carried out in the Caribbean and Southeast Asia. In the tourism sector, studies were conducted in the Bahamas and Thailand; studies on agriculture and fisheries were carried out in East Timor and Belize, respectively; and the urban water case studies were undertaken in Jamaica and the Philippines.
- The seminar was in response to the recognition by the International Panel on Climate Change that small-island and low-lying states are amongst those that will be most seriously impacted by climate change. It provided a forum in which experts from the Southeast Asian and Caribbean regions discussed the current impacts of climate variability and the potential impacts of climate change on four critical economic sectors. The specialists then compared adaptation strategies and made recommendations for future actions. This report seeks to present a summary of the vulnerabilities identified in each sector, share the best adaptation practices developed in the individual countries, and present the recommendations for each sector.
- The case studies on the urban water sectors in Jamaica and Metro Manila, Philippines were presented by Mrs. Eleanor Jones and Dr. Aida José, respectively. Like many other parts of the world, Jamaica and the Philippines have experienced the significant pull of urban centers, and their growing urbanization has been characterized by urban sprawl and inadequate social infrastructure. Rapid industrialization and population growth in urban centers have out-paced the ability of authorities to plan for and provide the necessary amenities, particularly water. This situation will only be exacerbated by the expected changes in future rainfall and temperature patterns, as well as the potential of climate variability and change to affect the occurrence of flooding, droughts, and the frequency and severity of tropical cyclonic systems, including hurricanes and tropical storms

Current Coping Mechanisms in Jamaica

Local coping strategies

- Rudimentary early warning systems - Established in some flood-prone areas where rising water levels are demarcated and the achievement of a predetermined level is used as a warning for evacuation of an area.

- Water catchments - Built in rural communities where areas of slope are paved to induce runoff into a cistern, which serves as storage for a farm or even a community.
- Collection drums - Used for rainwater storage and serve as limited supply sources; serve as back up when the public supply fails, or when storms or drought cause water lock-offs and loss of infrastructure.
- Relocation - Not a preferred option, as most residents of hazard-prone areas prefer to return after floodwaters have receded and resume cropping when water returns after a drought.

Availability and use of forecast information

- Doppler Radar
 - Installed by the Meteorological Office of Jamaica in 1999, it enables a more targeted real-time forecast as imagery reveals the location and intensity of rainfall and assists in tracking showers. It has improved hurricane forecasting as tracking is enhanced when the hurricane system enters the radar range.
- Satellite telecommunications
 - The link was upgraded in 1995 and the receiving equipment enables a faster communication link with the Global Area Forecast Centre.

Existing policies, programmes and initiatives for managing climate risk

- Office of Disaster Preparedness and Emergency Management
 - Vulnerability Reduction project in the Rio Grande Valley of Portland, Jamaica.
- National Water Commission
 - Budgetary allocations for repairs, but transaction costs for mitigation measures currently exceed the financial capability of the Commission in some instances.
 - Development of hazard information and incorporation into development planning and decision-making as another initiative for managing climate risk.
 - Improved efficiency of water use in the public system. Water supply upgrading programs are being implemented in the urban and rural sectors.
- Ministry of Land and Environment
 - Watershed Management Council; Watershed Protection Act is administered by the National Environment and Planning Agency.

Economic diversification and sustainable development

- Planning Institute of Jamaica
 - A Sustainable Development Unit has been established in the Planning Institute of Jamaica. The National Disaster Mitigation plan is integral to planning and policy programs.

Capacity building initiatives

- National and local institutions
 - The initiatives are for institutional systems, human resources and tertiary programs. Enhancement of preparedness, response and mitigation capacity has been recognized as essential to minimizing human suffering, social and economic dislocation and repeated losses.

ANNOTATION

This publication brings together good practices identified through presentations and case studies prepared for the seminar, with a focus on practices that are both relevant and transferable between the regions.

TITLE	National Adaptation Programme of Action: Republic of the Sudan
AUTHOR/S	Ministry of Environment and Physical Development Higher Council for Environment and Natural Resources
YEAR OF PUBLICATION	2007
PLACE OF PUBLICATION	Sudan
PUBLISHER	Ministry of Environment and Physical Development Higher Council for Environment and Natural Resources
PAGES	
TYPE OF PUBLICATION	Report

SUMMARY

Adaptation to climate change is a very compelling subject for the people of Sudan, burdened as they already are with devastating and recurring droughts, as well as severe hardships in the ability to coping with even current climatic variability. It is no overstatement to declare at the outset of this important document that our ability to adapt to the projected changes in climate will be a critical factor upon which the future prosperity – perhaps even the survival - of thousands of Sudanese communities depends.

For Sudan, climate change is not merely an environmental issue defined by precipitation and temperature projections. It represents a serious sustainable development problem that affects its citizens who are spread across many vulnerable communities. It will require concerted action and financial support, within and beyond the borders of Sudan.

The process for preparing our National Adaptation Programme of Action has been very helpful in achieving a better understanding of the links between adaptation to climate change and our government's ongoing efforts at poverty alleviation.

Goals and Objectives of Sudan's NAPA Process (agriculture, water resources, and public health):

- Widespread representation of local stakeholders in the NAPA consultation process;
- Identification of comprehensive set of potential adaptation strategies, projects, and programmes;
- Development of country-driven criteria to evaluate and prioritize adaptation measures;
- Characterization of a set of urgent and immediate adaptation initiatives
- Recommendation of a set of broader adaptation activities, including capacity building, policy reforms, and institution integration.

Key Adaptation Activities in Public Health:

- Improve community sanitation and medical services, including capacities for diagnosis and treatment;
- Building of community awareness regarding preventative measures for malaria, meningitis, and leishmaniasis;
- Introduction of preventive measures to restrict malaria transmission such as mosquito nets, treatment/drying up of breeding sites;

- Introduction of early disease diagnosis and treatment programmes for malaria, meningitis, and leishmaniasis;
- Improvement of irrigation system management so as to reduce breeding sites; and
- Provision of alternative water supply systems for domestic use that do not involve open standing water areas

For the public health sector, the following recommendations are offered:

- Coordination among institutions working on environmental issues (agriculture, water, physical planning etc.) regarding the formulation of development projects;
- Political support for the different health programmes and activities, particularly those related to the control and eradication of malaria;
- Adoption of long term plans that consider impacts of climate change;
- Consideration of appropriate health laws and policies to implement upon formulation and implementation of developmental projects;
- Encouragement of scientific research and accounting for its findings in the formulation of policies and plans;
- Coordination among related authorities to reduce adverse impacts of development projects;
- Enhance implementation of health legislation;
- Support programmes that deal with environmental awareness;
- Improve coordination within the Ministry of Health and with other government authorities, working national and international NGOs, and local communities' organizations; and
- Provide environmental training at all levels

ANNOTATION

This reference provides Sudan's adaptation program for climate change. It represents the collective efforts of government agencies, community leaders, rural households, NGO's. It is also presented in the reference key adaptation activities in Public Health. It also showed the criteria they used to evaluate adaptation projects

10	
TITLE	National Adaptation Programme of Action : Gambia
AUTHOR/S	Jallow, B. P.
YEAR OF PUBLICATION	2007
PLACE OF PUBLICATION	Gambia
PUBLISHER	Department of State for Forestry & the Environment.
PAGES	
TYPE OF PUBLICATION	Report

SUMMARY

Health care in the Gambia is delivered at government dispensaries/hospitals, approved non-governmental dispensaries, registered private clinics/hospitals, and by traditional healers. The number of inhabitants per physician in different administrative districts across the country varies between 2,600 and 10,000 (Source: HMIS, Department of State for Health). Although health statistics compiled at government health facilities are not climate-indexed, malaria stands out as a major public health concern.

In general, people have a wide choice of strategies for coping with direct effects of climate variability including extreme temperatures. Living through seasonal heat waves involves the **use of shading, hand fans, electrical fans and air-conditioning (for those who can afford it)**. **Change in building codes and materials, and interior decorations serve to insulate dwellings from freezing exterior temperatures**. **Vitamin supplements and appropriate seasonal clothing provide further safeguards against cold-related ailments** 'Rolling Back Malaria' involves both preventive and therapeutic measures. (Conteh *et al.*, 2005). **Quinine derivatives are sold over-the-counter, whilst natural mosquito repellent incense (*Hyptis suaveolus* leaves, *Daniella oliveri* bark) and pyrethroid insecticides (slow-burning mosquito coils, aerosol sprays) are available in corner shops/local markets and from ambulant traders**. **Bed nets are also commonly used, with permethrin-treated nets slowly gaining greater popularity through awareness campaigns, subsidized costs, and linkage with post-natal services and national immunization programmes for children**. It may be useful however to highlight the risk of contracting malaria from sleeping or staying long hours outdoors. There is a high probability that the surge of malaria cases from an average 25,000 cases per year to 76,000 in 2004 (Source: HMIS, Department of State for Health) is due to sleeping or staying outdoors without taking necessary precautions.

Drinking water wells recently contaminated by flooding (in 1999, 2002, and 2005) are decontaminated by **dewatering the well and disinfecting its shaft**. Water in the well is subsequently tested for the presence of pathogens before being declared fit for drinking. In cases where structural integrity of wells is a major issue, new wells that conform to standard design (WSWG, 1995) are sunk as a replacement. Relief/Emergency water supplies are provided during this period.

ADAPTATION

- Environmental sanitation
- *Vaccination programmes*
- Improved water management
- Public awareness creation
- Provision of drugs and medical supplies
- Clean technology
- Public transport
- Testing programmes/Quarantine
- Training of disease surveillance personnel

ANNOTATION

This NAPA report presented general adaptation practices regarding health and climate change. The adaptation practices are very much applicable in the country as they are implemented in a developing country like the Philippines.

11	
TITLE	National Adaptation Plan Of Action (Napa): Republic Of Burundi
AUTHOR/S	Kayitesi, O
YEAR OF PUBLICATION	2007
PLACE OF PUBLICATION	Bujumbura
PUBLISHER	Ministry For Land Management, Tourism And Environment
PAGES	85
TYPE OF PUBLICATION	Report

SUMMARY

Practices of adaptation to the adverse effects of climate variations always existed in the history of Burundi. Vis-à-vis famine, the population moves towards areas less affected by the extreme events (dryness, invasion of locusts, etc.) where they can find some food. In these areas, the displaced people offer their services in the form of labour and receive in turn foodstuffs. Once the situation returns to normal, they return to their original places.

Options are proposed for adaptation to periods of rainfall deficit coupled with the subsequent dryness, and others concern the adaptation to periods of precipitations above the normal, but much of the actions are valid in both situations.

ADAPTATION

Adaptation Practices:

1. Reinforce the management of existing protected areas and include in protected areas the natural ecosystems identified as being threatened and vulnerable;
2. Safeguard existing woodlots and reforest the stripped areas;
3. Install mechanisms to control erosion in sensitive areas;
4. Control the river dynamics of watercourses and torrents in Muminwa, including the city of Bujumbura;
5. Popularize short cycle and dryness resistant food crops;
6. Popularize rainwater harvesting techniques for agricultural or domestic use;
7. Identify and popularize improved techniques for use of wood and new renewable energies;
8. Increase the number of hydropower micro stations;
9. Establish and protect strategic buffer zones in Lake Tanganyika floodplain and around the lakes of Bugesera;
10. Identify and popularize the breeding of species adapted to local climate conditions;
11. Popularize zero-grazing techniques;
12. Identify and popularize dryness resistant forest species;
13. **Train and inform the decision makers and other partners, including the local communities on the methods of adaptation to climate variability;**
14. **Improve seasonal early warning climate forecasts.**

Adaptation Option Health Sector:

1. Promotion of basic hygiene and sanitation with access to drinking water
2. Communication for the change of behavior
3. Accessibility to treatment in the event of climate change-related disasters
4. Installation of a prevention and early warning system
5. Promotion of insecticide-treated mosquito nets (ITNs)
6. Intra-domiciliary insecticide-treatment in the event of epidemics due to climate change

ANNOTATION

This reference presents adaptation to periods of rainfall deficit coupled with the dryness, and other concerns the adaptation to periods of precipitations above the normal, but much of the adaptations are valid for both situation. The adaptation activities it mentioned may be applied to the Philippines.

TITLE	Community-Based Adaptation to the Health Impacts of Climate Change.
AUTHOR/S	Kristie L. Ebi, Jan C. Semenza
YEAR OF PUBLICATION	2008
PLACE OF PUBLICATION	
PUBLISHER	American Journal of Preventive Medicine
PAGES	501-507
TYPE OF PUBLICATION	Review Article

SUMMARY

The effects of and responses to the health impacts of climate change will affect individuals, communities, and societies. Effectively preparing for and responding to current and projected climate change requires ongoing assessment and action, not a one-time assessment of risks and interventions. To promote resilience to climate change and other community stressors, a stepwise course of action is proposed for community-based adaptation that engages stakeholders in a proactive problem solving process to enhance social capital across local and national levels. In addition to grassroots actions undertaken at the community level, reducing vulnerability to current and projected climate change will require top-down interventions implemented by public health organizations and agencies.

ADAPTATION

Public Health Adaptation to Climate Change:

1. Primary prevention aims to reduce exposures projected to occur with climate change, such as redesigning cities to reduce urban heat islands, thereby increasing resilience to rising temperatures and more frequent and intense heatwaves.
2. Secondary prevention aims to prevent the onset of adverse health outcomes, including approaches such as strengthening disease surveillance programs to provide early intelligence of the emergence or re-emergence of vectorborne diseases.
3. Tertiary prevention consists of measures (often treatment) to reduce long-term impairment and disability and to minimize suffering caused by existing disease.

Community-Based Adaptation to Climate Change

1. Installing green roofs
2. Increasing urban vegetation
3. Planting trees in parking strips or abandoned lots
4. Constructing trellises for hanging gardens
5. Built hanging gardens, fountains, planter boxes on the street corners.
6. Public education programs be designed to inform people about actions to minimize climate change risks

ANNOTATION

This reference is useful as it provides adaptation measures that can be implemented the public health sector and the community. It also provides guidelines on how to involve communities in adaptation programs. These practices may be applied in the Philippines

TITLE	National Adaptation Programme of Action (NAPA): Republic of Maldives.
AUTHOR/S	Lubna Moosa
YEAR OF PUBLICATION	2006
PLACE OF PUBLICATION	Maldives
PUBLISHER	Ministry of Environment, Energy and Water
PAGES	1-114
TYPE OF PUBLICATION	Report

SUMMARY

The Maldives is among the most vulnerable to predicted climate change and non-action is not an option for the country. The number of scientific and technical assessments undertaken in the country since 1987 has reiterated the need for long-term adaptation to climate change. Since the commencement of sea wall construction around the capital Male' in September 1988 the government has implemented several projects aimed at adaptation to environmental threats.

The Maldives played an important role in the negotiations that led to the United Nations Framework Convention on Climate Change (UNFCCC) and was the first to sign the Kyoto Protocol to the UNFCCC. The Maldives submitted the First National Communication (FNC) to the UNFCCC in 2001 following the implementation of the Maldives GHG Inventory and Vulnerability Assessment: A Climate Change Enabling Activity. The FNC contained mitigation and adaptation measures and the project profiles for continuing climate change adaptation and mitigation process. This is the first National Adaptation Programme of Action (NAPA) developed to communicate the most urgent and immediate adaptation needs of the Maldives as stipulated under UNFCCC Decision 28/CP.7. NAPA was prepared with support from the Global Environment Facility (GEF) and United Nations Development Programme (UNDP). Preparation of NAPA began in October 2004 and the process was halted because of the South Asian tsunami of December 2004. NAPA work recommenced in February 2006.

Human Health

- Strengthen regulatory and institutional capacity for vector control.
- Streamline the planning of healthcare services and strengthen medical emergency response.
- Promote healthy lifestyles, healthy islands and healthy buildings.
- Strengthen the capacity for healthcare delivery.
- Undertake research and disseminate information on climate change related diseases.
- Increase nutrition promotion campaigns.

ANNOTATION

This reference presents long term adaptations to climate change. Adaptation measures are somewhat general. On the health sector side it presented a short list of strategies. Several projects aimed at adaptation to environmental threats. Its long term strategies could be adapted here in the Philippines

TITLE	Climate Change Futures: Health, Ecological and Economic Dimensions
AUTHOR/S	Pamela Anderson, J. B., Ulisses Confalonieri, Douglas Causey, Nathan Chan, Kristie L. Ebi, Jonathan H. Epstein, J. Scott Greene, Ray Hayes,, L. S. K. Eileen Hofmann, Tord Kjellstrom, Rebecca Lincoln, Anthony J. McMichael, Charles McNeill, David Mills, Avaleigh Milne, Alan, et al.
YEAR OF PUBLICATION	2005
PLACE OF PUBLICATION	Switzerland
PUBLISHER	The Center for Health and the Global Environment, Harvard Medical School.
PAGES	126
TYPE OF PUBLICATION	Book

SUMMARY

Climate is the context for life on earth. Global climate change and the ripples of that change will affect every aspect of life, from municipal budgets for snowplowing to the spread of disease. Climate is already changing, and quite rapidly. With rare unanimity, the scientific community warns of more abrupt and greater change in the future.

Many in the business community have begun to understand the risks that lie ahead. Insurers and reinsurers find themselves on the front lines of this challenge since the very viability of their industry rests on the proper appreciation of risk. In the case of climate, however, the bewildering complexity of the changes and feedbacks set in motion by a changing climate defy a narrow focus on sectors. For example, the effects of hurricanes can extend far beyond coastal properties to the heartland through their impact on offshore drilling and oil prices. Imagining the cascade of effects of climate change calls for a new approach to assessing risk.

The worst-case scenarios would portray events so disruptive to human enterprise as to be meaningless if viewed in simple economic terms. On the other hand, some scenarios are far more positive (depending on how society reacts to the threat of change). In addition to examining current trends in events and costs, and exploring case studies of some of the crucial health problems facing society and the natural systems around us, "Climate Change Futures: Health, Ecological and Economic Dimensions" uses scenarios to organize the vast, fluid possibilities of a planetary scale threat in a manner intended to be useful to policymakers, business leaders and individuals. Most discussions of climate impacts and scenarios stay close to the natural sciences, with scant notice of the potential economic consequences. In addition, the technical literature often "stovepipes" issues, zeroing in on specific types of events in isolation from the real world mosaic of interrelated vulnerabilities, events and impacts. The impacts of climate change cross national borders and disciplinary lines, and can cascade through many sectors. For this reason we all have a stake in adapting to and slowing the rate of climate change. Thus, sound policymaking demands the attention and commitment of all.

Malaria success project by an Australia-based mining company (BHP Billiton) at Mozambique

Relevant statements are as follows:

- It gave all its workers mosquito nets and free medicine, and sprayed the construction site and workers' houses with insecticide.
- The Lubombo Spatial Development Initiative - In the three years since house-to-house insecticide spraying, surveillance and state-of-the-art treatment began, malaria incidence dropped in one South African province by 96 percent. In the area around the aluminum smelter, 76 percent fewer children now carry the malaria parasite. The Lubombo initiative is

probably the best antimalaria program in the world, an example for other countries that rolling back malaria is possible and cost-effective.

- The Lubombo initiative hires and trains local workers, who spray houses with insecticide once or twice a year, covering their communities on foot. People who get malaria are cured with a new combination of drugs that costs about USD 1.40 per cure for adults, abandoning the commonly used medicines that cost only pennies but have lost their effectiveness.

The specific recommendations of this study for the combat of malaria are as follows:

- Preventing deforestation is the most significant environmental intervention for limiting the spread of malaria.
- In urban areas, environmental modifications (for example, culverts and drainage ditches), if properly maintained, can be important in the control of transmission.
- Using new knowledge about the interactions between climate and disease, 14 southern African countries, including Mozambique, have established the Southern African Regional Climate Outlook Forum (SARCOF), to make use of seasonal forecasts to develop Health Early Warning Systems, plan public health interventions and allocate resources. Regional efforts like SARCOF have the potential to greatly reduce the intensity of malaria outbreaks, and such cooperative programs should be encouraged and supported.
- Global initiatives have been developed to reduce the morbidity and mortality from malaria. The World Health Organization's "Roll-Back-Malaria" program and the Global Fund to Fight AIDS, Tuberculosis and Malaria have generated many programs to control malaria. The campaigns include community use of pesticide- impregnated bed nets (sometimes sold through "social marketing" schemes, elsewhere distributed free), pesticide (DDT or pyrethrins) spraying of houses, and mass treatment programs to interrupt transmission. The combination of approaches can be effective — if the programs are sustained. The long-term health, ecological, resistance-generating impacts and economic costs of pesticides used for control are always of concern.

ANNOTATION

This reference presented specific recommendations to fight malaria and are useful and adoptable in the Philippines.

TITLE	Climate Change National Adaptation Programme Of Action (Napa) Of Ethiopia
AUTHOR/S	Tadege, A.
YEAR OF PUBLICATION	2007
PLACE OF PUBLICATION	Addis Ababa Ethiopia
PUBLISHER	National Meteorological Agency
PAGES	96
TYPE OF PUBLICATION	Report

SUMMARY

There are now strong evidences, which show that the earth's climate is changing mainly as a result of the increasing concentration of greenhouse gases in the atmosphere that are emitted from various human activities. According to the recent Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. IPCC has also concluded that more climate change is on the way resulting from past, current, and future greenhouse gas emissions with its potential adverse impacts on socio-economic development of nations.

Developing countries in general and least developed countries like Ethiopia in particular are more vulnerable to the adverse impacts of climate variability and change. This is due to their low adaptive capacity and high sensitivity of their socio-economic systems to climate variability and change. Sensitivity and adaptive capacity also vary between sectors and geographic locations, time and social, economic and environmental considerations within a country.

Current climate variability is already imposing a significant challenge to Ethiopia by affecting food security, water and energy supply, poverty reduction and sustainable development efforts, as well as by causing natural resource degradation and natural disasters. For example the impacts of past droughts such as that of the 1972/73, 1984 and 2002/03 are still fresh in the memories of many Ethiopians. Floods in 2006 caused substantial human life and property loss in many parts of the country. These challenges are likely to be exacerbated by anthropogenic climate change. In this context, planning and implementing climate change adaptation policies, measures and strategies in Ethiopia will be necessary.

Adaptation is recognized as a critical response to the impacts of climate change, because current agreements to limit emissions, even if implemented, will not stabilize atmospheric concentrations of greenhouse gases and climate change. Adaptation can reduce present and future losses from climate variability and change. It is neither a one-off intervention nor a stand-alone activity. It is rather a process that needs to be incorporated in the overall development planning, including the design and implementation of projects and programs across relevant sectors.

Human health

- Establish and strengthen surveillance system
- Promote integrated vector control approach
- Improve ecosystem management, which are sensitive to malaria invasion
- Strengthening research in the health sector
- Educating the public about malaria and its control and encourage the use of malaria bed nets
- Encouraging utilization of climate and meteorological information in the planning of malaria control

- Developing effective malaria drugs
- Establish climate and health awareness, training and research programs
- Establish climate and health data base for analysis of climate and health information and make available for village communities
- Establish early warning surveillance system program that will enable communities to adapt to potential out breaks of diseases
- Avail the required capacity for the realization of National Five year Strategic Plan for malaria Prevention and Control

Summary of potential adaptation options proposed by the regional consultative workshops:

- Improved health services & health facilities, provision of medicines, use of mosquito nets, health extension, environmental and personal hygiene & sanitation
- Research on the tradition coping mechanism of climatic hazards, dissemination of endogenous knowledge and encourage efficient & traditional medication

ANNOTATION

This reference presents a substantial list of adaptation practices to climate change in the health sector. Its adaptation strategies are quite general in nature though. What good though is that some of the practices may be applied to the Philippines.

16	
TITLE	National Adaptation Programmes Of Action
AUTHOR/S	UNFCCC
YEAR OF PUBLICATION	2006
PLACE OF PUBLICATION	Bonn, Germany.
PUBLISHER	UNFCCC
PAGES	36 and 44
TYPE OF PUBLICATION	Report

SUMMARY

This is a compilation of NAPA in relation to the health sector. Here are some of the countries worth looking at:

Vector-borne Diseases:

Samoa

- Reinforcement of the alert system and management of endemic climate hazards;
- Distribution of treated mosquito nets;
- Treating mosquitoes' hidings with pesticides;
- Equipment of health centers with material, drugs and well-trained staff;

Maldives

- Conduct training on Integrated Vector Management principles to health care personnel
- Develop the capacity for early diagnosis and establish effective disease and vector surveillance system for planning and response
- Educate community on elimination of vector breeding grounds and other vector control measures

ANNOTATION

Like the other NAPA's the adaptation practices presented are very applicable here in the Philippines. The practices suites the country's needs and issue regarding climate change.

TITLE	Floods: Climate Change and Adaptation Strategies for Human Health.
AUTHOR/S	WHO
YEAR OF PUBLICATION	2002
PLACE OF PUBLICATION	London, United Kingdom
PUBLISHER	WHO
PAGES	1-52
TYPE OF PUBLICATION	Report

SUMMARY

Land Use, Zoning And Risk Assessment

- Uses should be adapted to the hazards in the immediate and in the potential (dyke-protected) flood plains. Furthermore, preventive measures against possible adverse ecological consequences, such as water and soil pollution, should be taken.
- Non-structural prevention and protection should include zoning, based on hydrological and risk assessment studies. Identification and mapping of hazards and high-risk areas should be integrated into land-use planning policies.
- Specific activities and uses in designated areas should be subject to administrative permits or authorizations. Restrictions and prohibitions should be based on risk assessments.
- Where this is not yet the case, and where necessary, immediate flood plains should be identified and designated by law. In steep river valleys in hilly and mountainous areas, flash floods can cause mudflows and landslides with devastating effects. These effects can be further aggravated by human settlements and installations on the river banks. Structural protection measures, such as channeling, in these areas should be carefully selected and adopted on a case-by-case basis.
- When identifying and designating areas that are prone to flooding, it should be borne in mind that they may require multi-purpose and/or cross-sectoral action such as flood protection, nature conservation and protection, protection of specific habitats and protection of sources of drinking-water supply. It is, therefore, necessary to consider everything that is in need of protection.

Recommendations to policy makers

Policy makers:

- a. Should become aware of the need to maintain the natural balance as a basis for flood protection without expecting all flood problems to be solved in this way;
- b. Should, moreover, recognize the need to limit land uses in areas under threat of flooding;
- c. Should become aware of the need to strengthen the law to ensure that limitations on use are actually enforced;
- d. Should avoid giving the impression that flood problems can be solved by action elsewhere alone;
- e. Should avoid making any promises to flood victims if the required financing is not available.

Recommendations to governmental authorities

Staff of governmental authorities should be informed and properly trained to:

- a. Consistently apply the existing laws by enforcing limitations on land use and other uses in areas threatened by flooding, landslides or dam failures;
- b. Assist in drawing up action plans for natural water retention, technical flood protection and more far-reaching precautionary action in rivers under threat of flooding;
- c. Where necessary, designate flood plains and try to keep these areas empty;

- d. Assist in upgrading flood notification and advance-warning systems in line with technological advances;
- e. Review the framework for elemental damage control insurance in dialogue with the insurance industry;
- f. Take measures to promote the natural development of watercourses; in watercourses passing through urban areas maintain the watercourses and their banks to ensure proper conditions for swift water run-off when floods strike.

Recommendations to municipal and local authorities

Staff of municipal and local authorities should be informed and properly trained so as to enable them to:

- a. Review land use and construction plans in the light of flood risks as well as risks of landslides and dam failures;
- b. Initiate and carry out measures to allow rainwater leakage in construction areas and create financial incentives for this;
- c. Provide information on risks of flooding, landslides and dam failures, in particular in the protected areas;
- d. Draw up and regularly update flood warning and action plans for risks posed by flooding and.

ANNOTATION

This reference contains substantial material about practices for policy makers and government authorities to adapt for floods. The Philippines being prone to flooding could very much use and adopt practices recommended in this reference.

TITLE	Human health impacts from climate variability and climate change in the Hindu Kush-Himalaya Region : A report of an Interregional Workshop, India
AUTHOR/S	WHO
YEAR OF PUBLICATION	2005
PLACE OF PUBLICATION	India
PUBLISHER	WHO
URL	http://www.searo.who.int/en/Section23/Section1001/Section1110_11692.htm
PAGE	28-31 (Conclusions and recommendations)
TYPE OF PUBLICATION	Online article

SUMMARY

The World Health Organization, the World Meteorological Organization, the United Nations Environment Programme, and the United Nations Development Programme organized an inter-regional workshop on Human Health Impacts from Climate Variability and Climate Change in the Hindu Kush-Himalaya Region. Held in Mukteshwar, India from 3rd to 7th October 2005, the objectives of the workshop were to:

- Inform government organizations, nongovernmental organizations and other relevant stakeholders about the impacts of climate variability and long-term climate change in mountain regions, and in the Hindu Kush-Himalaya region in particular;
- Identify specific human health risks linked to climate variability and change in the Himalayan mountain regions and identify vulnerable populations;
- Propose strategies for integrating health with relevant sectors (e.g. water resources, agriculture, forestry), interdisciplinary research and projects oriented towards action, and inter-country cooperation; and
- Achieve consensus on a draft framework for national action in the Hindu Kush-Himalayan mountain region.

ADAPTATIONS

- Adaptation measures are urgently needed to address the projected health impacts of climate variability and change in mountain regions. At a minimum, the existing infrastructure and interventions designed to minimize climate sensitive health determinants and outcomes need to be strengthened.
- Ensure that the human health risks of climate variability and change are addressed in national emergency preparedness response plans.
- Use a systems-based approach to develop adaptation options that increase resilience to the full range of drivers that affect population health.
- Adaptations should be:
 - implemented over the short, medium, or longterm
 - specific to the local health determinants and outcomes of concern
 - facilitate the development of communitybased resource management, and
 - determine the costs and benefits of different interventions.
- Promote sustainable water resource use and management to prevent, mitigate, and adapt to the forthcoming water scarcity. Ecological sanitation solutions should be considered.
- As the estimated health impacts of climate variability and change are common to many mountain regions, regional collaboration is required to:
 - effectively and efficiently address cross-border hazards (for example, vector surveillance and control)

- develop and install early warning systems for flash floods and glacier lake floods (including the collection, analysis, and exchange of data); and
 - improve disaster management and community preparedness and adaptation.
- Create, promote, and strengthen national, regional, and international working groups, nongovernmental organizations, and civil society, to develop appropriate adaptation options.
- Ensure that appropriate sectors, regions, and disciplines are included.

ANNOTATION

This article provides short general practices regarding health and climate change. India's practices for adaptation climate change are applicable in the country

Innovative Climate Change Adaptation Options (Health Sector)

1. Solar Water Disinfection (SODIS)

Solar Water Disinfection (SODIS) is a simple, environmentally sustainable, low-cost solution for drinking water treatment at household level for people consuming microbiologically contaminated raw water. Through the use of solar energy, it improves the quality of drinking water by destroying microorganisms that cause water-borne diseases. These pathogenic microorganisms are susceptible to two effects of sunlight: 1) radiation in the spectrum of UV-A light (wavelength 320-400nm) and 2) heat (increased water temperature). SODIS takes advantage of the synergy of these two effects, as their combined effect is much greater than the sum of the single effects. Thus, the mortality of the microorganisms increases with more simultaneous exposure to temperature and UV-A light.

SODIS is ideal for disinfection of small quantities of water with low turbidity. Placed in transparent plastic bottles, contaminated water is exposed to full sunlight for 6 hours to destroy the pathogens. Water with more than 50% cloudiness must be exposed for 2 consecutive days in order to be safe for consumption. Treatment time can be reduced to one hour if water temperatures exceed 50°C, and treatment efficiency can be improved if the plastic bottles are exposed on sunlight-reflecting surfaces such as aluminum or corrugated iron sheets.

By destroying pathogens present in drinking water, SODIS reduces the occurrence of enteric diseases such as **infectious diarrhea** (from bacterial infections with enteropathogenic *Escherichia coli*), **dysentery** (watery diarrhoea from bacterial infections with *Salmonella* or *Shigella*), **dysentery** (from parasitic infection with *Giardia lamblia* ("Giardiasis") or *Entamoeba histolytica* ("Amoebiasis")), and **cholera** (from bacterial infection with *Vibrio cholera*).

2. Floating Toilet Device

The Floating Toilet Device is a project of the Center for Health Development of Ilocos, in collaboration with hon. Mayor Alfonso Celeste, officials, and the fish pen owners association of the municipality of Bolinao. Drinking water contaminated with fecal matter and vibrio cholera has been strongly associated with numerous cases of cholera in the 2004 outbreak in Pangasinan. The lack of LGU programs and projects related to water supply and sanitation led to the re-emergence of the cholera outbreak in 2008. The lack of investment in such programs and projects has been identified by the DOH as one of the major environmental factors that contributed to the persistence of cholera in the province of Pangasinan.

As a long term solution to end the cholera epidemic cycle, the Cholera Containment Strategy and the environmental sustainability projects under it were employed. Households living near bodies of water were considered as a major drawback in the containment strategy. For the purpose of preventing the contamination of water sources, the technology of floating sanitary toilets was developed and piloted in the municipality of Bolinao, Pangasinan.

3. Solar-powered Clean Water System (SCW System)

Water disinfection through the Solar-powered Clean Water (SCW) System, developed by the Ateneo Innovation Center, involves the use of ultraviolet irradiation to destroy microorganisms in collected rainwater. The UV lamps are powered by solar energy, which is collected by solar panels and stored in batteries.

The SCW System is being applied as a method of domestic wastewater treatment in Calaca, Batangas. For this community with a population of 700, the initial recommendation is to build 2 sets of 6 water cleaning stations. The following parameters serve as a basis for this design:

- Houses are still being constructed.
- The rate of effective UV (ultraviolet) irradiation and ceramic filter is at most 2 liters per minute (120 liters in a day).
- The duration of UV operation is 4 hours a day.

Labor and part devices of an SCW System are estimated at Php 50,000. The Ateneo Innovation Center can provide training for maintenance of the system. On the other hand, design and construction of the rainwater tank and collection system will be done separately by an independent contractor.

Bibliography 2

Annotations

1. **Guha-Sapir, D., and Schimmer, B.** (2005). Dengue fever: changing paradigms for a changing epidemiology. Biomed Central Ltd: Brussels, Belgium.
2. **Haryanto, B.** (2009). Climate change and public health in indonesia - impacts and adaptation. Nautilus Institute: Melbourne, Australia.
3. **Institute of Development Studies.** (2006). Overcoming the barriers: mainstreaming climate change adaptation in developing countries. Tearfund: Wales, United Kingdom.
4. **Samet, J.** (2010). Public health: adapting to climate change. Resources for the Future: Washington D.C., USA.
5. **Smit, B., Pilifosova, O., et al.** (2001). Adaptation to climate change in the context of sustainable development and equity. Cambridge University Press: Massachusetts, USA.
6. **UNFCCC.** (2007). Vulnerability and Adaptation to Climate Change in Small Island Developing States. United Nations Framework Convention for Climate Change: Kingston, Jamaica.
7. **WHO.** (2000). Climate change and human health: impact and adaptation. World Health Organization: Geneva, Switzerland.
8. **WHO.** (2002). Floods: climate change and adaptation strategies for human health. World Health Organization: Copenhagen, Denmark.
9. **Secretariat of the Convention on Biological Diversity.** (2009). Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. Secretariat of the Convention on Biological Diversity: Quebec, Canada.
10. **Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit and K. Takahash.**(2007).Assessment of adaptation practices, options, constraints and capacity. *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 717-743.
11. **McMichael, A.J., Corvalán, C.F., Ebi, K.L., Githeko, A.K., Scheraga, J.D., Woodward A.**(2003). Climate change and human health: risk and responses. Geneva: World Health Organization.
12. **Bhattacharya, S.** (2006). Climate change and malaria in india. *Current Science*, 90, 3, 369-375.
13. **Burton, I., E. Diringier, and J. Smith.**(2006). Adaptation to climate change: international policy options. Virginia: The Pew Center on Global Climate Change.

14. **Joan L. Aron, C. F. C., and Harry Philippeaux** .(2003). Climate variability and change and their health effects in the Caribbean: information for adaptation planning in the health sector. St. Philip, Barbados, West Indies: World Health Organization.
15. **Duque, I. F. T.** (2009). Interim guidelines on the prevention of leptospirosis through the use of prophylaxis in areas affected by floods. DOH: Sta. Cruz, Manila, Department Memorandum No. 2009-0250: 10.
16. **Gizouli, I. E.** (2007). National adaptation Programme of Action. Republic of the Sudan Ministry of Environment and Physical Development Higher Council for Environment and Natural Resources.
17. **Jallow, B. P.** (2007). National Adaptation Programme of Action: Gambia. Department of State for Forestry & the Environment: Gambia.
18. **Katrin Kuhn, D. C.-L., Andy Haines, and Jonathan Cox.** (2005). Using climate to predict infectious disease epidemics. Geneva, Switzerland: World Health Organization.
19. **Kayitesi, O.** (2007). National adaptation plan of action. Bujumbura, Burundi: *Ministry For Land Management, Tourism And Environment*.
20. **Kristie L. Ebi, N. D. L., and Carlos Corvalan.** (2006). Climate variability and change and their potential health effects in small island states: information for adaptation planning in the health sector. *Environmental Health Perspectives* 114(12), 7.
21. **Kristie L. Ebi, a. J. C. S.** (2008). Community-based adaptation to the health impacts of climate change. *American Journal of Preventive Medicine*, 35(5), 7.
22. **Lubna Moosa, S. S.** (2006). National adaptation programme of action. Republic of Maldives. Maldives, Ministry of Environment, Energy and Water.
23. **Pamela Anderson, J. B., Ulisses Confalonieri, Douglas Causey, Nathan Chan, Kristie L. Ebi, Jonathan H. Epstein, J. Scott Greene, Ray Hayes,, L. S. K. Eileen Hofmann, Tord Kjellstrom, Rebecca Lincoln, Anthony J. McMichael, Charles McNeill, David Mills, Avaleigh Milne, Alan, et al.** (2005). Climate change futures: health, ecological and economic dimensions. Switzerland: The Center for Health and the Global Environment, Harvard Medical School.
24. **Schimmer, D. G.-S. a. B.** (2005). Dengue fever: new paradigms for a changing epidemiology. *Emerging Themes in Epidemiology* 2(1), 10.
25. **Sluijs, S. D. a. J. v. d.** (2007). Uncertainty and climate change adaptation - a scoping study. Utrecht: Copernicus Institute for Sustainable Development and Innovation, Department of Science Technology and Society. 88.
26. **Smit, B., O.Pilifosova, I. Burton, B. Challenger, S. Huq, R. Klein, Yohe, G.** (2001). Adaptation to climate change in the context of sustainable development and equity. In J. McCarthy, O. Canziani, N. Leary, D. Dokken, and K. White (eds), *Climate Change 2001: Impacts, Adaptation and Vulnerability*, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, USA.

27. **Center for Science in the Earth System at the University of Washington.**(2007). Preparing for climate change: a guidebook for local, regional and state governments. King County, Washington.
28. **Tadege, A.** (2007). Climate change national adaptation programme of action of Ethiopia, Addis Ababa Ethiopia. National Meteorological Agency. 96.
29. **UNFCCC.** (2006). National Adaptation Programmes Of Action. UNFCCC: Bonn, Germany. 36 and 44.
30. **Vergara, J. Q. W. a. J. M. V.** (2009). Malaria prevalence and knowledge, attitudes, and practices (KAP) surveys in priority project provinces. Cubao, Philippines: Resources, Environment, and Economics Center for Studies, Inc.
31. **WHO .**(2002). Floods: climate change and adaptation strategies for human health. London, United Kingdom: World Health Organization Regional Office for Europe.
32. **WHO Regional Office for Europe.** (2003). Methods for assessing human health vulnerability and public health adaptation to climate change. Health and Global Environmental Change Series No. 1. Copenhagen: WHO Regional Office for Europe.
33. **WHO,** (2005). Using climate to predict infectious disease epidemics. <<http://www.who.int/globalchange/publications/infectdiseases/en/index.html>>
34. **WHO .**(2006). Human health impacts from climate variability and climate change in the hindu kush himalaya region : a report of an interregional workshop, India, 2005. Retrieved from http://www.searo.who.int/en/Section23/Section1001/Section1110_11692.htm
35. **Tun-Lin W., Nam, A. L., Rebollar-Téllez, V.S. E., Morrison, A.C., Barbazan, P., Cote, M. Midega, J. Sanchez, F. Manrique-Saide, P., Kroeger, Nathan, A. Meheus, M.B. F., and Petzold, M .**(2009). Reducing costs and operational constraints of dengue vector control by targeting productive breeding places: a multi-country non-inferiority cluster randomized trial. *Tropical Medicine International Health*, 14(9),11.