

# KEY SECTOR ANALYSIS: HEALTH ADAPTATION IN NEPAL



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## List of Abbreviations

ADB	Asian development bank
API	Annual parasitic incidence
ARI	Accute respiratory infection
CBS	Central Bureau of Statistics
DHM	Department of Hydrology and Meteorology
DOHS	Department of Health Services
DWIDP	Department of Water Induced Disaster
IPCC	Inter-Governmental Panel on Climate Change
JE	Japanese Encephalitis
MoEST	Ministry of Environment, Science and Technology
NHRC	Nepal Health Research Council
NPC	National Planning
OPD	Out-patient department
Pf	Plasmodium falciparum
UNFCCC	United Nations Framework Convention on Climate Change
WECS	Water and Energy Commission Secretariat, the Government of Nepal.
WHO	World health organization
WOM	World Meteorological Organization

## **Background**

As Nepal has signed the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, it has to adopt an approach, including water conservation and GHG emissions reduction to mitigate climate change impacts on health.

Available documents show that the number of people having diseases are increasing and that the climate change (rise in temperature and rainfall, decrease in frost days, increase in heat and cold waves) has further aggravated the situation by increasing the vulnerable populations. This report deals with an overview of key sector of health and its major issues, with a focus on adaptation options.

The outcome of this report is being used for a national awareness raising workshop, inviting key decision-makers from line ministries where discussions on the implications of climate change on key sectors including health and national policies are being held. Countries including Nepal will then conduct an assessment of investment and financial flows to address climate change for the key sectors.

## **Health Sector as a Key Sector**

### ***Adaptation Needs***

Climate change impacts on human health are a recently emerged issue and of great concern of the health service planning in Nepal. However, health personnel are not yet aware about it. Influence of climate change on health is not well defined owing to lack of information on their cause and effect relationships and likewise there is extremely limited data on adaptive strategies to change in climatic events.

There is uneven distribution of climatic phenomena like temperature and precipitation across different geographical regions and during various seasons in a year in the country which has direct bearing on the health of the people. Further, like other countries in the world, Nepal has also experienced of warming temperature. It is estimated that there is an annual increase in temperature of 0.06°C due to increase in greenhouse gas. Studies indicate that the warming has been more pronounced in the hills and mountains than in the Tarai plain.<sup>1</sup> A number of possible climate change-related impacts are expected to occur in human health, their livelihoods and the environment in Nepal.

With warming of higher altitudes, it is predicted that there may be an increased spread of lower altitude vector-diseases like malaria, Kala-azar, Japanese encephalitis in such regions.<sup>2</sup> Additional health impacts are also expected from climate impacts on agriculture (reduced nutrition) and water resources (reduction in availability).<sup>3</sup> Adaptation actions are to be taken by individuals, communities or national agencies to cope with these climate impacts at present or anticipating such changes in future in a cost-effective manner.<sup>4</sup>

### **Relevance From an Economic Perspective**

Climate change may have adverse impacts on economic activities or production systems. Nepal's agriculture sector, the principal economic base is affected by climate change. The production of crops has been fluctuated widely as a result of fluctuated weather conditions and other factors. Fluctuation in rice production has occurred because of changes in rainfall. The number of food-deficit districts reached to 41, all from hills and mountains. Central Bureau of Statistics (CBS) (2004) indicates that 31 percent of Nepalese households have food consumption less than adequate. Malnutrition is a serious obstacle to survival, growth and development. Nepal Demographic and Health Survey (2006) showed that 51 percent of children below 5 years of age were affected by stunting (short for their age), which could be a sign of

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<sup>1</sup>Chaulagain 2006.

<sup>2</sup> Alam and Regmi 2004, Dahal 2008.

<sup>3</sup> Dahal 2006, Pradhan 2007.

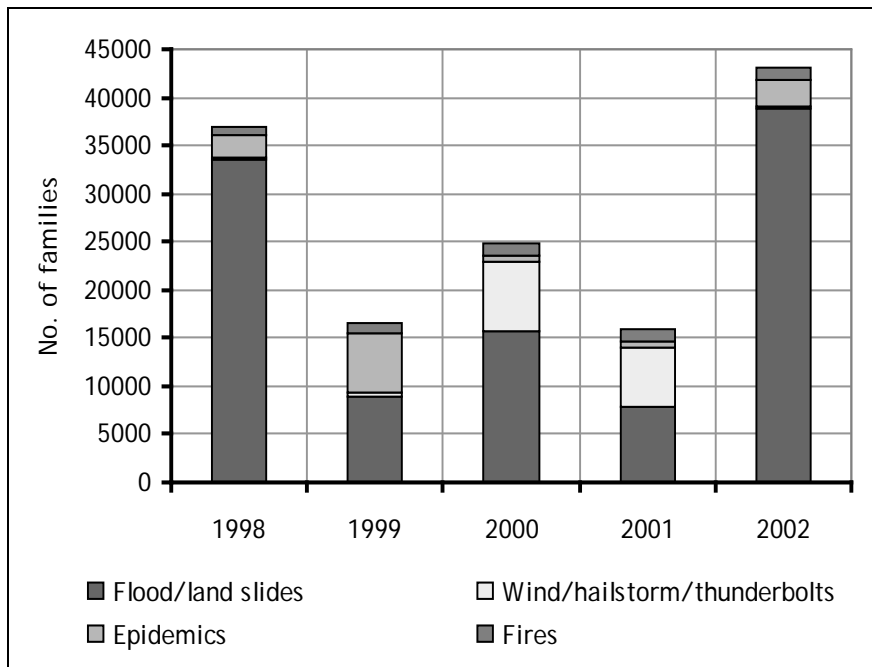
<sup>4</sup> Based on WECS 2005, NPC 2003.

early chronic under nutrition. The survey also found that 36 percent of the children were underweight (low weight for age).

### Social and Other Dimensions

Climate change impacts on social dimensions may include casualties or displacement of people or rehabilitation/resettlement, conflicts in resources, dismantle of social structure, etc. Report of Department of Water Induced Disaster (DWIDP) (2008) indicated that the climate related events like floods, drought, windstorms, and extreme temperature had caused casualties like deaths, injure, homeless, affected, and damaged. The report indicated that those climatic events from 1983 to 2007 had caused casualties of a total of affected families of 1,013,465 (by water-induced and others) and deaths of 22,215 people (by water-induced, epidemic and other). The number of affected families by those climatic events has been fluctuated; with 34 thousands in 1998, declined to 8 thousands in 2001 and again increased to 39 thousands in 2002 (DWIDP 2008) (Fig. 1).

**Fig. 1:** Affected families by climatic events



## Description of Health Sector

### Major Health Impacts of Climate Change

Major health impacts of climate change at the national and sub-national levels are described under the following sections.

#### ***Extreme weather-related health effects***

No data are available on temperature related illness and deaths, but however it can be argued that deaths occur by heat stroke and cold stroke due to extreme temperature events. Cold waves and heat waves have since few years occurred in the Terai, causing illness and even death. DOHS (Department of Health Services) annual reports have shown that the number of morbidity due to heat stroke was greater than that of cold stroke (Table 1). There is greater number of people in the Terai than other two regions suffered from poisonous snake bite during summer hot and rainy season.

The number of cases of snake bites reported were 2,330, 2,953, and 2,153 in 1997, 2004, and 2005 respectively, which were more than fifty percent of the total snake bite cases in the country.

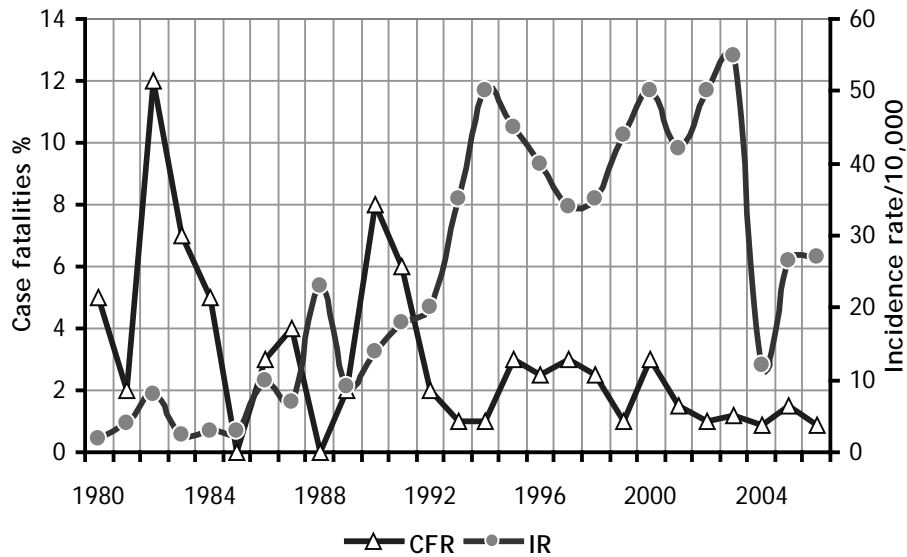
**Table 1:** Morbidity due to extreme temperature events

Stroke	2004	2005	2007
Heat	20	80	60
Cold	9	10	18

*Source:* DOHS health reports 2003, 2005, 2007

Likewise, the vector borne diseases that outbreak during severe or extreme temperature events in the Terai include Kala-azar. Its morbidity (incidence rate/10,000) has increased tremendously from about 5/10,000 in 1984 to 55/10,000 in 2004, while the mortality (case fatalities) has decreased from 12 percent in 1982 to about 3 percent in 2004 and then increased again (Fig. 2).

**Fig. 2:** Trend of Kala-azar



The historical evidences in Nepal indicate that prolong droughts and flash floods have triggered disasters, famines and diseases outbreaks. Avalanches, fires, flood and landslides, epidemics, earthquakes, thunderbolts, and wind and hailstorm are the hazards due to climate change. Several people have died and got diarrhoea and dysentery due to consumption of contaminated water. A total of 22,215 people died by the different types of disasters over 25 years (1983 - 2008). Of which, 33.3 and 49.6 percent died by the water induced disaster and epidemics.

### Air pollution-related health effects

Due to extreme cold in the mountains and often occurring cold waves in the Tarai, the rural people living in the poorly ventilated room are used to burn biofuels (wood, dung, agri-residues) for heating and as a result long exposure to such indoor air pollution has caused respiratory diseases like acute respiratory infection (ARI), bronchitis, asthma, etc to them. This has caused particularly to women and their children who spend much time in such kitchen-room. ARI is one of the top five diseases in Nepal.<sup>5</sup> ARI and chronic bronchitis account for 8.72 and 3.04 percent respectively of the total out-patient department (OPD) visits.<sup>6</sup> The mountain has shared 13.65 percent of the total OPD visits, as compared to 10 percent of the Terai. The hospital record shows that the deaths among the children below five years of age by these diseases account for over 30 percent.

<sup>5</sup> Based on MoEST 2004.

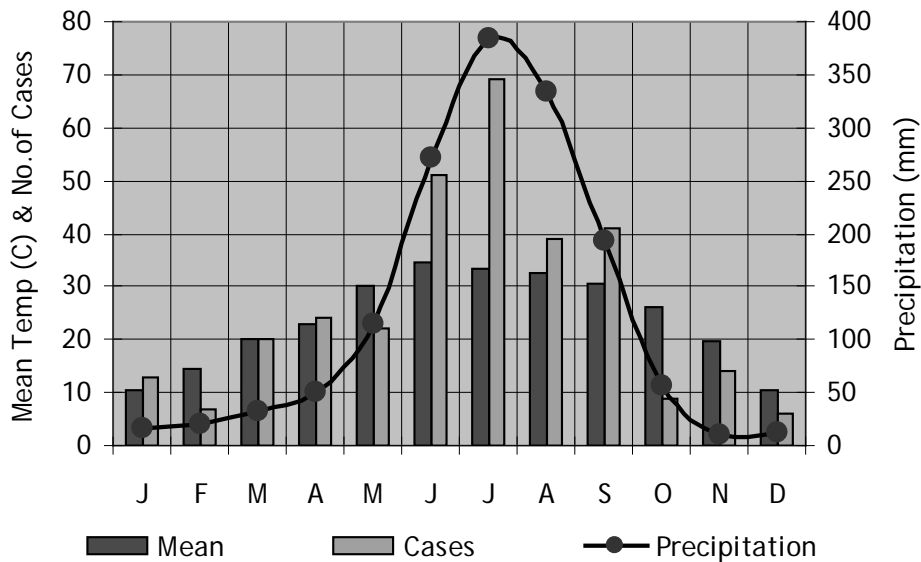
<sup>6</sup> Based on DOHS 2003.



## Water and food borne diseases

Water sources have dried up due to extreme temperature/heat and as a result, the level of water in springs, rivers and groundwater has reduced. Water shortage is the main cause for poor sanitation, water-washed diseases like skin disease, worm infestation, eye infections, etc. Limited and poor quality drinking water also causes to occur typhoid, diarrhoea, dysentery, cryptosporidiosis, giardiasis, amoebiasis, gastritis, jaundice and infectious hepatitis.

Fig. 3: Typhoid cases and Temperature & Precipitation



Studies indicate that heavy rainfall events transport terrestrial microbiological agents into drinking-water sources resulting in outbreaks of these infectious diseases. Incidence of diarrhoeal diseases per 1000 new cases children under 5 years of age has increased consistently from 131 in 1995 to 204 in 2005 and slightly declined to 185 in 2006, while case fatality rate has decreased remarkably from 2.56/1000 new cases in 1995 to 0.17 in 2006. Further, morbidity with an average of over 3.3 episodes per child has been recorded. Likewise, there has been an increased trend of typhoid fever, from over 400 cases in 2001 to nearly 1000 cases in 2005. A hospital record in 2005 has shown a close relationship between temperature and precipitation and typhoid cases; both climatic phenomena have risen during four months (June-September) and meanwhile typhoid cases of children under 5 years of age were among the highest (ranged from 270 to 193/1000 new cases), while in the winter months, the cases have lowest along with low temperature and rainfall.

<sup>7</sup> Based on IPCC 1996, 2001.

<sup>8</sup> Based on DoHS 2007.

<sup>9</sup> Shrestha et al 2007.

## Vector borne diseases

Vector borne diseases including encephalitis, *Japanese Encephalitis* (JE), leishmaniasis, malaria and Kala-azar (*Visceral leishmaniasis*) seem to have occurred in warmer districts of Nepal. The most common species of malaria parasite are *Plasmodium vivax* and harmful species, *P. falciparum*. These diseases occur due to favourable environment for breeding vectors created by increasing impounding waters, increased temperature and poor surroundings. In 1965 the cases of both diseases have been recorded as 1.39 annual parasitic incidence (API)/1000 risk populations and *P. falciparum* (Pf) with 28.3 percent of total malaria parasites, which are fluctuated in the following years (Table 2). A study in Pakistan has indicated that an increment of *P. falciparum* linked with increased temperature. Over 5.5 million people are believed to be at risk from Kala-azar (*Visceral leishmaniasis*) disease and is an endemic disease in 12 eastern Terai districts of Nepal. JE was first reported in Nepal in 1978. This disease is found in 24 districts, including all 20 Terai and 4 adjoining hill districts. Peak JE cases are found in August (midst of high temperature, precipitation and humidity) that has been consistent in all three years (Fig. 4). Other vector diseases such as lymphatic filariasis is endemic in 60 districts, while dengue case has appeared in Nepal only since 2001.

**Table 2:** Malaria: morbidity

Year	API/1000	Pf %
1965	1.39	28.25
1970	0.49	7.7
1975		24.09
1980	1.73	7.08
1985	3.9	17.91
1990	1.9	8.1
1995	0.6	3.8
2000	0.6	5.7
2005	0.25	10.75
2007	0.28	24.5

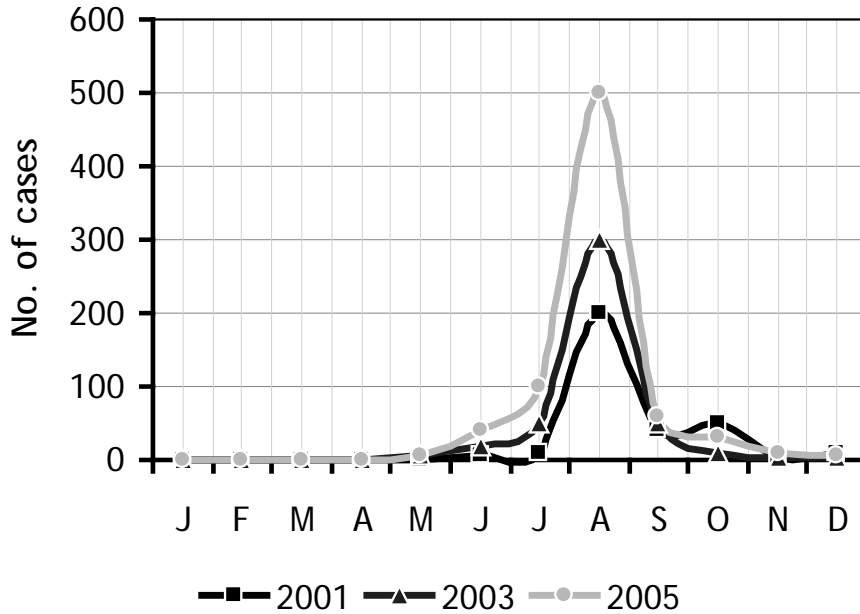
Source: DOHS – annual reports.

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<sup>10</sup> Based on DoHS 2005.

<sup>11</sup> Based on WHO 2005.

**Fig. 4:** Monthly trend of Japanese Encephalitis Cases



**Mental, nutritional, infectious and other health diseases**

Earlier section has dealt with climate change and nutritional deficiency diseases. Other infectious diseases such as skin disease, which is also due to bathing in polluted water, is the largest with 17.53 percent of all OPD visits in Nepal. This disease is more acute with nearly 23 percent of all OPD visits in the Terai than in the hills and mountains. The cases with Chromoblastomycosis, chronic fungal infection, are also seen predominantly in middle-aged male farmers and those from rural areas of Nepal.<sup>12</sup> The etiology has not been studied in Nepal. A hospital based study indicated that majority of the patients were diagnosed having fungal infections with peak in summer and low in winter, which were due to seasonality with temperature change, humidity change, among other factors. Other diseases like mental disorder exist in Nepal, but there is no study about the causes of this disease due to climate change.

**Scenario Based Models and Future Effects**

The infrastructure/services and the information systems required may be considered for the scenario based models for addressing climate change health impacts. There are six broad facilities/infrastructure and systems in response to climate impact health hazards. They are such as:

<sup>12</sup> Pradhan 2007.

<sup>13</sup> Jha 2007.

- (i) early warning systems for floods, landslides, fire, earthquakes,
- (ii) adequate weather recording stations throughout the country,
- (iii) preparedness for health hazard management,
- (iv) well equipped health services,
- (v) health personnel particularly in the remote areas, and
- (vi) health information base system.

Efforts to address those six basic facilities are made on the part of the government. However, they are either limited or lacked in different parts of the country. In absence of and/or lack of those facilities and systems, the health hazards are assumed to increase.

As a consequence, the future effects are likely that the vulnerable populations in terms of health will increase; human resources will decline; production and productivity activities will diminish; more capital resources and investment will require; and finally gap between poor and rich will be further widen.

Though all six frameworks stated above are equally important, preparedness for health hazard management appears to be relatively more important to be adopted immediately, and then followed by others in accordance of levels of importance.

### **Populations Currently Affected and Potential Adverse Effects**

The climate change related diseases such as vector-borne (malaria, lymphatic filariasis, JE, Kala-azar), water-borne (diarrhoea, skin, typhoid), air-borne (ARI), and others and their currently affected populations are described in the preceding sections. Risk populations by these diseases are estimated based on their current occurrence in the districts and district-population, which are shown in Table 3. Those diseases which have appeared in different parts of Nepal are believed to be due to extreme temperature event. Two types of communities such as those who are living on the banks of the rivers, over the steep slopes, and in slums and squatter settlements, as well as remote areas (in terms of health services) and secondly, the poor, women and children, disabled, and refugees are the most health risk populations or vulnerable groups by those diseases.<sup>14</sup>

Potential adverse effects of the climate change may be seen in discomfortness, physiological stress, weak immunity, prolong ill health, and/or eventual death. The consequences may worsen the problems, leading to a deterioration in social and economic lives.

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<sup>14</sup> See also WHO 2000, 2005, WHO/WMO 1996.

**Table 3:** Climate change related diseases and risk populations

<b>Diseases</b>	<b>No. of Risk District</b>	<b>Risk population (%)</b>
Malaria	65	91.6
Filariasis	60	87.0
JE	24	53.9
Kala-Azar	12	29.7
Dengue	NA	NA

*Source:* DOHS 2007: Annual Health Report.

## Proposed Adaptation Measures for the Health Sector

### Potential Adaptation Measures

Since the very beginning, though local communities at different spatial locations in Nepal have been adapting natural and human systems to differences in climate and its seasons and many social and economic systems including agriculture, forestry, industry, livestock, water resources, transportation, human health, settlements, etc have evolved to accommodate some deviations from “normal” conditions, they are inadequate, insufficient and improper to the climate extremes. Therefore, planned adaptations such as preventive and reactive measures are to be undertaken before impacts occur as given in Figure 5.

**Figure 5:** Adaptation measures to climate change events/impacts and implementation

Diseases/climate change events	Adaptation measures	Target groups/implementation methods
Malaria	<ul style="list-style-type: none"> <li>Public awareness about extreme events, surrounding environments, disease cycle</li> <li>Compulsory use of bednet</li> <li>Effective surveillance system</li> <li>Improvement in drainage/ sewerage system</li> <li>Medication</li> </ul>	<ul style="list-style-type: none"> <li>Health service providers and local communities few days before &amp; beginning weeks of the season for awareness</li> <li>Transparent monitoring system</li> <li>More research for alternative approaches for controlling possible disease outbreak</li> </ul>
JE	<ul style="list-style-type: none"> <li>Public awareness about extreme events, surrounding environments, disease cycle</li> <li>Effective surveillance system</li> <li>Improve drainage system</li> <li>Medication</li> </ul>	<ul style="list-style-type: none"> <li>JE mass vaccination campaign for children &amp; high risk groups</li> <li>Participation of affected groups</li> <li>Transparent monitoring system</li> <li>More research for controlling possible disease outbreak</li> </ul>
Kala-azar	<ul style="list-style-type: none"> <li>Public awareness about extreme events, surrounding environments, disease cycle</li> <li>Effective surveillance system</li> <li>Improvement in drainage/ sewerage system</li> <li>Medication</li> </ul>	<ul style="list-style-type: none"> <li>Protection of risk population (highly selective) with Indoor Residual Spraying (IRS)</li> <li>IEC materials be distributed adequately</li> <li>Dipstick test (K39) be introduced in health service units</li> </ul>
Lymphatic filariasis	<ul style="list-style-type: none"> <li>Public awareness about extreme events, surrounding environments, disease cycle</li> <li>Effective surveillance system</li> <li>Improvement in drainage system</li> <li>Medication</li> </ul>	<ul style="list-style-type: none"> <li>Morbidity management component needs to be addressed</li> <li>Monitoring of the activities be performed regularly &amp; efficiently</li> <li>More research requires to be conducted</li> </ul>
Dengue	<ul style="list-style-type: none"> <li>Public awareness about extreme events, surrounding environments,</li> </ul>	<ul style="list-style-type: none"> <li>Disesae transmission cycle be shared in the areas</li> </ul>

	disease cycle <ul style="list-style-type: none"> <li>• Effective surveillance system</li> <li>• Improve drainage system</li> <li>• Medication</li> </ul>	<ul style="list-style-type: none"> <li>• Waste management activities be strictly adopted in affected areas</li> <li>• More research be conducted</li> </ul>
Diarrhoea	<ul style="list-style-type: none"> <li>• Safe water supply</li> <li>• Use of toilets for ending open defecation</li> <li>• Awareness about handwashing practices</li> <li>• Medication – jeevan jal</li> </ul>	<ul style="list-style-type: none"> <li>• Access to health service locations be improved by building roads, bridges over major rivers</li> <li>• Health services be improved by providing its service unit at 3 km distance (national standard)</li> </ul>
ARI	<ul style="list-style-type: none"> <li>• Reduce smokes/aerosols by encouraging mass/electric modes of transportation</li> <li>• Extensive coverage/use of ICS with chimneys &amp; ventilation</li> <li>• Encourage use of bio-gas plants for domestic energy supply</li> <li>• Awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Expansion of community forestry programme across the country &amp; effective use of M&amp;E system</li> <li>• Reduce excessive use of fossil fuels</li> <li>• School curriculum</li> <li>• Adopt alternative energy sources</li> </ul>
Heat stress	<ul style="list-style-type: none"> <li>• Early warning system</li> <li>• Increase greenery areas &amp; water bodies (pond, swimming pool)</li> <li>• Medication</li> </ul>	<ul style="list-style-type: none"> <li>• Investigation of areas for greenery and construction of water reservoirs (ponds and swimming pools &amp; air moving)</li> </ul>
Cold wave	<ul style="list-style-type: none"> <li>• Early warning system</li> <li>• Eco-friendly houses</li> <li>• Treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Construction of public buildings for mass heating system during extreme cold</li> </ul>

*Notes:*

- (i) Reduction of public expenditure on unproductive expenses like office set up/interior, expensive motor-cars, as well as employees unnecessarily at different levels, and
- (ii) Establishment of early weather and hydrological stations and forecasting system through modern technologies like satellite receiving stations, remote sensing, and others.

### **Operation Costs to Address Adverse Effects**

The adaptive measures to address adverse effects are already provided in Table 5 and therefore operation costs are to be made with appropriate methods.

Operation costs may vary by activities/measures, nature or magnitude, locations and organizations (non-governmental, community based or government). Available documents indicate that cost effective operation may be from involving related NGOs and/or community based organizations, which also seem to be effective to involve local communities in the activities concerned. Therefore, the next step is that the national team should decide to allocate costs to the selected measures, scale of expense, distribution by locations, etc in a participatory manner.

## **Key Issues in Assessing Investment and Financial Flows**

The issues in assessing investment and financial flows to address climate change adaptation in the health sector may be described under the followings:

### **Data Availability and other Relevant Information Constraints**

The data and information on climatic events and health impacts in both soft and hard forms is limited, which poses the crucial problem and challenge for health planning in Nepal. Whatever available, they are either scanty or generated for specific project purposes and therefore cover limited areas. Owing to lack of adequate information, most of the planning and decision making are in ad-hoc basis and as a result no desirable short- as well as long- terms are being achieved. Followings are the basic constraints with regard to climate change events and health impacts

- There exist limited stations for recording data on weather, hydrological and environmental phenomena. They now are available only for major urban areas. Rugged topography, remoteness and drudgery of movements have further aggravated the problems of gathering data.
- There is lack of integrated concept between climatic events and human health and therefore it is difficult to establish cause and effect relationships between them.
- Four governmental organizations such as the Ministry of Health and Population, the Ministry of Environment, Science and Technology, the Ministry of Water Resources, and the Ministry of Home have directly and indirectly dealt with the data collection of climatic events and health. But there is lack of integration and coordination to link the data nature, size, quality and methods among those four agencies.
- The most general constraint will all those four organizations is the very limited budget allocated for establishing data base, as well as limited research activities to generate information on the climate phenomena and health. Few studies so far been completed on adaptation measures to weather and climate related disasters, climate change impacts, climate extreme indices and indicators for monitoring, regional climate modeling, glacier risk reduction, etc do not provide adequate information for climate change adaptive measures.

### **Financial Flows**

The total health budget flow has increased in 2007, compared with the last few years. The budget is shared by two major agencies such as government and donor. Till the year 2005, the government had lion share in the total health budget flow. Since 2007, the donor share has surpassed the government share (Table 4).



**Table 4:** Trend of annual budget flow in health sector by agencies

<b>Budget (000 US\$)</b>	<b>2001</b>	<b>2003</b>	<b>2005</b>	<b>2007</b>
National total	1,405,524	1,442,254	1,573,097	2,026,934
Health total	73,112	71,089	92,302	130,002
% Health budget	5.2	4.9	5.9	6.4
Health budget under DoHS	51,778	45,635	63,507	109,938
Nepal Government % share	74.5	74.8	55.1	42.3
Donor % share	25.5	25.2	44.9	57.7

Among the different items under the health sector, four diseases related to climate change impacts on health diseases are expanded programme of immunization (EPI), diarrhea, avian influenza, and epidemiology. Of these, EPI is the most sensitive/priority disease that shares 30 percent, followed by epidemiology with 5.6 percent budget allocations in the total health sector financial flow.<sup>15</sup>

### **Proposed Methodological Approach of the I&FF assessment for the Health Sector**

The human health is the main concern of sensitive system and its other aspects, as well as of climate impacts framework and therefore the issues of health sector including health measures undertaken by the government of Nepal are crucial. Improvement in the existing health service system is the utmost requirement. This involves two important aspects of health services such as the number and spatial distribution of health service units (HSU) and types of health delivery services. First, the number of current HSUs is extremely low and they are spatially concentrated in relatively more accessible area while the remote rural areas are far away from such service. The national standard parameter for a health service unit (health posts, health centres, hospitals or ayurvedic centres) is determined at 1 hour walking distance or 3 km (i.e., 20 minutes average walking distance/1 km) from a village.<sup>16</sup> This means that the number of HSUs requires to be increased to 49,060 across the country. At present there are 4,439 health service units of all types. Secondly, there exist three types of health delivery service systems such as preventive, promotive, and curative, as adopted by the national health sector. The main objective of the current national health service programme is to improve the health outcomes by expanding access to and increasing the use of Essential Health Care Services, especially for the majority of poor communities. The preventive and promotive health delivery service systems, including the provision of safe drinking water and breathing in clean air should receive the first priority.

<sup>15</sup> DoHS 2007, ADB 2008.

<sup>16</sup> Based on NPC 2007.

Approach to creating community awareness to vector and air-borne diseases coupled with continuous monitoring system should be widespread, as well as an effective adaptive measure to prevent their occurrences. For instance, three diseases like malaria, Kala-azar and JE are found to have occurred mainly in the Terai region of Nepal. They spread through mosquitoes that flourish well in hot (up to 40°C) and polluted stagnant wetlands. The cleanliness of the surrounding living area is the most important requirement for adaptation. Further, Nepal has already experienced the emergence of chemical resistant mosquitoes, despite effective use of spraying insecticides. Hence to find and adopt alternative approaches to cure and eliminate these diseases should be based on in-depth research works.

### **Modelling and Scenario Limitations and/or Assumptions for the I&FF assessment**

The ability of human systems to adapt to and cope with the events caused by climate change depends on the factors like wealth, technology, education, information, skills, infrastructure, access to resources, and management capabilities. However, the people are highly variable in their endowments with these attributes. As Nepal is one of the poorest countries in the world, it has definitely weak capacity to adapt and is more vulnerable to climate change damages. This condition is most extreme among the poorest groups. Lack of information is the most crucial problem to reduce uncertainties or estimates of possible consequences of climate change. Secondly, improvement of systems and methods for long-term monitoring and understanding the consequences of climate change and other stresses on human and natural systems is required.

## **Proposed Approaches/Recommendations**

### **Institutional Arrangements**

In the changed political context, health services network including regional/federal, district /local level, and community level with essential facilities for the health services delivery should be established and their function and responsibility should be autonomous.

Public and private sectors for health service delivery should work as a complementary way. However, public sector should formulate policy measures and create environment in such a way that private sector is involved for effective delivery of health services.

The health organization should work in a coordinated/integrated manner with other agencies like Ministry of Environment, Science and Technology (MoEST) and Department of Hydrology and Meteorology (DHM), Department of Water Supply and Sewerage. MoEST is the focal point for UNFCCC, while DHM is the focal point of Inter-Governmental Panel on Climate Change (IPCC).

The health sector requires to formulate short-term (5 years) and long-term (6-10 years) plannings to address issues concerning climate change and health impacts. The short-term planning may include development of surveillance and monitoring systems, safe water supply, sanitation (end open defecation), use of alternative energy sources, set up weather stations, resettlement, increase greenery, etc, while the infrastructure and facilities, early warning system, etc may come under long-term planning. Awareness and dissemination, medication, preparedness, monitoring and evaluation should be a part of continuous process. The issues should be identified based on research and participatory workshops.

### **Key Stakeholders and Co-ordination Scheme**

The organizations that are directly deal with climate change and health impacts may be grouped into government, semi-government, non-government, civil society, international, and private sector. All these organizations are stakeholders.

- Government Sector: (a) Ministry of Health and Population- Department of Health Services, Nepal Health Research Council (NHRC) – climate impact human health and diseases; (b) Ministry of Environment, Science and Technology- Department of Hydrology and Meteorology (DHM) and Water Energy Commission Secretariat (WECS) - hydrological and meteorological forecasts for public and mountaineering, energy production and consumption by fuel type; (c) Ministry of Home – climate related disasters, security and emergency responses, and (d) Department of Water Induced Disaster Prevention (DWIDP) - disaster preparedness for natural hazards.

- Semi-Governmental Sector: (a) National Trust for Nature Conservation, Biogas Support Program and AEPC; (b) Universities' departments of meteorology, geography, public health, environmental science, geology, etc.
- Non-Governmental/International Organizations include (a) World Health Organization, UNESCO, UNDP; (b) World Bank, ADB (c) WWF, IUCN, ICIMOD, Winrock International, CARE Nepal, (d) JICA, SNV, USAID, DFID.
- Civil Societies: (a) Red Cross Society (b) INSEC, (c) Local Organizations-
- Private Sector: agencies/corporate organizations dealing with climate and health.

The Ministry of Health and Population (MoHP) should be a lead agency to deal with the climate and health matters and co-ordinate all the activities with those organizations stated above. The Ministry of Environment, Science and Technology should be the co-lead agency in this context. A Steering Committee of Climate Change and Health Impacts, led by the MoHP together with MoEST as subcoordinator should be formed. Other agencies should be the members of the committee. The following activities should perform to address the issues in climate change and health impacts:

- (i) Research and Human Resources Development,
- (ii) Data base and communication,
- (iii) Meetings, conference and workshops,
- (iv) Policy measures and programmes formulation and implementation,
- (v) Information and dissemination, and (vi) Monitoring and evaluation

### **National Sources of Finance and Investment for the Health Sector**

Some efforts have already made by the health sector to explore financial sources and investment in improving quality of health services. They are as follows:

- Draft work plan is prepared for assessing investment and financial flows to address climate change adaptation in the health sector.
- Commitments are spelled out to mobilize the national and international resources and to explore alternative concepts such as health insurance, user charges, and revolving drug schemes.
- Managing the human, financial and physical resources effectively in collaboration among the government, private and non-government sectors.

Above efforts are very much relevant to generate financial resource toward climate change impacts on health and therefore the health sector should involve sincerely to achieve those efforts. In addition, MoHP and MoEST as principal related ministries need to allocate substantial proportion of annual budget. Other government agencies as stated above should also allocate financial resource to invest in the health related to climate change impacts. The government's efforts are to involve the INGOs as stated above to get financial supports to climate change activities and technical and logistic

matters. The proposed Steering Committee of Climate Change and Health Impacts should work to avoid duplication of programmes and activities among the government sectors.

### **Recommendations**

Adaptive measures, target groups and implementation methods for diseases caused by climate change events have been provided in preceding section. Likewise, six major facilities and infrastructure and systems in response to climate impact health hazards have also already been given. Following major recommendations are to be undertaken for adaptation to climate change impacts:

- Establish cause and effect relationships between climate change and health
- Provide adaptive strategies to change in climatic events

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