Climate Change Vulnerability in Sri Lanka

Sector Vulnerability Profile:
Health

Supplementary Document to:
The National Climate Change Adaptation Strategy for Sri Lanka 2011 to 2016

Sector Vulnerability Profile: Health

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Sector Vulnerability Profile on Health

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List of Acronyms and Abbreviation

CC	Climate Change
CCCS	Center for Climate Change Studies
CCS	Climate Change Secretariat
CDM	Clean Development Mechanism
CFE	Caring for the Environment
CFR	Case Fatality Rate
DF	Dengue Fever
DHF	Dengue Hemorrhagic Fever
DMC	Disaster Management Centre
DSD	Divisional Secretariat Division
GIS	Geographic Information System
HMP	Health Master Plan
IDP	Internally Displaced Persons
IPCC	International Panel on Climate Change
IWMI	International Water Management Institute
MCH	Maternal and Child Health
MENR	Ministry of Environment and Natural Resources
MOH	Ministry of Health
MOE	Ministry of Environment
MRI	Medical Research Institute
NBRO	National Building Research Organization
NCSA	National Capacity Needs Self Assessment Project
NGO	Non Government Organizations
RRT	Rapid Response Teams
SNC	Second National Communication
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
WFP	World Food Programme
WHO	World Health Organization

Health

***"Climate change is the biggest global health threat of the 21st century. Effects of climate change on health will affect most populations in the next decades and put the lives and well-being of billions of people at increased risk"* (Castello et al. 2009)[1].It is a measure of social and economic development of the population in a country. Health is the basis for intellectual, physical and spiritual growth; which is a necessity for economic and social development of the country. Sri Lanka has one of the leading healthcare systems among developing countries, and over the years has achieved major gains in maternal and child health services as well as controlling the spread of many communicable diseases. However, there is evidence that climate change contributes immensely to the global burden of disease, deaths and disability. With the looming presence of climate change, Sri Lanka's health sector will have to play a pivotal role in assessing vulnerability and adapting to respond to its potential impacts.**

1.0 Introduction

The government of Sri Lanka makes substantial investments in health. Health services provided by the government include health education and promotion, maternal and child health care, immunization, prevention and control of locally endemic diseases, and prevention, control, and management of common diseases and injuries. Over the past years, Sri Lanka has improved its health indicators especially in maternal and infant mortality and life expectancy. Due to increased life expectancy and changing disease patterns, Sri Lanka now faces a major challenge to provide health services for non-communicable diseases, such as diabetes, cancer, heart diseases, mental health disorders, and injuries. Apart from these issues are the increasing trends in new epidemics - namely the vector, rodent, water and food borne diseases - which may be further exacerbated due to climate change and require increasing attention in this context. Another important concern is the current nutritional status in the country and the potential risks that climate change would pose in aggravating the situation – particularly among the rural poor communities of the country.

Ensuring equity in health care through easy access to high quality and modern health care services especially for lower income groups and the most vulnerable people in the country will be the focus of the government agenda for the health sector (see BOX 1). Under the *Suva Sewana* Programme announced in the Mahinda Chintana, the government is committed to preserve a high quality free health services[2]. The distribution of hospitals and the number of beds by district that currently operate under the Ministry of Health is given in FIGURE 1. The Mahinda Chintana also encourages and supports the development of traditional medicine (Ayurveda) to complement the existing health system.

BOX 1: RECOGNITION OF THE IMPORTANCE OF HEALTH FOR NATIONAL DEVELOPMENT

1. Vision of the *Mahinda Chintana*: A Ten Year Horizon Development Framework[3]:

- To foster a healthier nation that contributes to its economic, social, mental and spiritual well-being
- To ensure the delivery of comprehensive health services, which reduce the disease burden and promote health
- To empower communities towards more active participation in maintaining their health
- To improve human resources for health development and management
- To improve health financing, resource allocation and utilization
- To strengthen stewardship and management functions of the health system

2. The *Randora* National Infrastructure Development Programme[2] targets investments worth Rs. 21,715 Million to ensure the following:

- Safeguarding citizens for prosperous living
- Easy access and better quality health care
- Contributing towards healthier lifestyles

3. The National Action Plan for the *Haritha Lanka* Programme[4], Mission 8 calls to:

- Develop integrated urbanization plans to meet future environmental challenges
- Introduce state-of-the-art integrated solid waste management and hazardous waste management for all urban areas
- Manage urban sewage beneficially, without causing pollution
- Develop healthy and efficient transport networks in urban areas
- Conserve urban wetlands to maintain ecological stability
- Institutionalize actions related to landscape design and promoting establishment of green cities

(See APPENDIX A for details on these policies, plans and more).

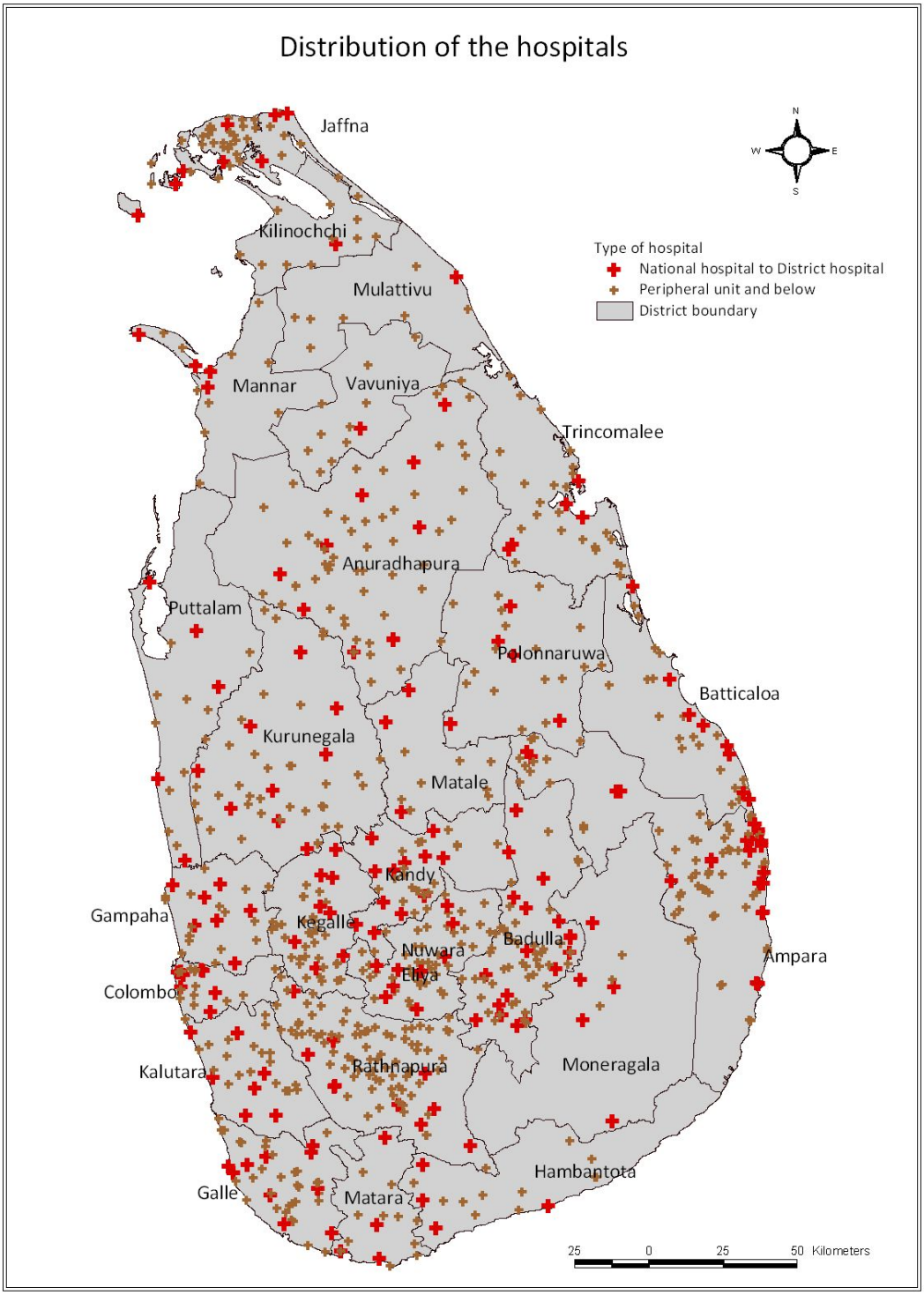


FIGURE 1 Map showing the current distribution of government hospitals across the country by district

Economic considerations

Pathways of exposure of human health to climate variability are twofold. Direct exposure occurs through events such as frequent extreme weather conditions while indirect bearings are exerted through changes in quantity of air, ecosystems, agriculture and livelihood infrastructure, etc.

When ecosystem equilibrium is compromised, social and economic factors such as increasing population densities, can aggravate the negative health outcomes that could emanate from climate change.

Sri Lanka depends on agriculture for food security and has still not reached its optimal potential in terms of nutrition achievements of the population. Climate change is envisaged to have severe impacts in terms of growth and development of children and productivity of older age groups and future generations. The socio economic status of the country is bound to be affected if the main determinants to health, which are affected by climate change, are not addressed.

In order to do so, however, it is necessary to identify the long term implications of climate change on health. Presently, only the current burden is understood and planned for. In order to prepare for climate change, it is important to project the additionalities that climate change would bring to the existing health issues and identify potential new issues. This would allow the health sector to determine the additionalities required in the current response mechanism in place to address these issues.

Environmental considerations

Sri Lanka is vulnerable to climate change factors such as extreme conditions of temperature and rainfall. These conditions will influence the prevailing ecosystem equilibrium with changes in hydrology and agriculture, which will influence microbial contamination pathways. Transmission dynamics of vectors which are common in Sri Lanka are vulnerable to change depending on environmental factors such as temperature, rainfall regimes, sanitation, etc. The broad categories of health outcomes which are anticipated to increase are morbidity and mortality through air pollution, water and food borne diseases, vector and rodent borne diseases and effects of food and water shortages.

The performance of the health sector is heavily dependent on the performance of other sectors including ecosystem services, water, agriculture, fisheries and livestock, urban infrastructure and human settlements. These sectors are addressed in separate Sector Vulnerability Profiles[a]. In dealing with public health issues, the necessity to work in close collaboration with the other sectors is critical.

1.1 Public health concerns influenced by climate change

Climate change may contribute to social disruption, economic decline and displacement of populations and overall decline in human health in certain regions due to effects on agricultural production, water scarcity, extreme weather event, etc. It is therefore essential to have a better understanding of the relationships between climate change and human health along with cross sectoral linkages.

Climate change impacts are significant for the following areas:

- Vector borne diseases–essentially mosquito borne diseases
- Rodent borne[b] diseases
- Food and water borne diseases
- Nutritional status
- Other environment related disorders

[a] Biodiversity and Ecosystem Services SVP, Agriculture and Fisheries SVP, Water SVP and Urban Development, Human Settlements and Economic Infrastructure SVP.
[b] Rodent borne diseases as cited by WHO, 2008

• *Mosquito vector borne diseases*

Vector borne diseases are transmitted through a bite or sting of mainly insects such as mosquitoes and ticks though it could be transmitted by other animals as well. The transmission of vector-borne diseases to humans depends on the pathologic agent; the arthropod vector; and the human host.[5]

The key components that determine the occurrence of vector-borne diseases include (1) the abundance of vectors and intermediate and reservoir hosts; (2) the prevalence of disease-causing pathogens suitably adapted to the vectors and the human or animal host; (3) the local environmental conditions, especially temperature and humidity; and (4) the resilience behavior and immune status of the human population[5]. Climate change may increase the risk of some infectious diseases especially those in warmer areas spread by mosquitoes and other insects – where the climatic conditions will be favourable for the growth of the vector organism.

The main mosquito vector borne diseases in Sri Lanka are dengue fever, malaria (currently controlled), filariasis (endemic in the Western coastal belt with signs of spreading into the interior) and Japanese encephalitis (controlled in endemic areas). Mosquito vector borne diseases have emerged as a serious public health problem in Sri Lanka, particularly dengue fever. Though other vector borne diseases are still prevalent, they are on the decline through successful public health programmes. Dengue is spreading rapidly to newer areas, with outbreaks occurring more frequently and explosively. The prevailing climatic conditions, environmental pollution, rapid urbanization, over-crowding of cities and careless human practices are proving conducive for the rapid breeding of the mosquito vector and the spread of this infection. Dengue transmission simulations have shown high sensitivity to relative humidity and temperature[11]. Dengue transmission simulations have also shown high sensitivity to relative humidity and termperature.[13] The incidence and the number of deaths are presented in FIGURE 2 and **Table 1**.

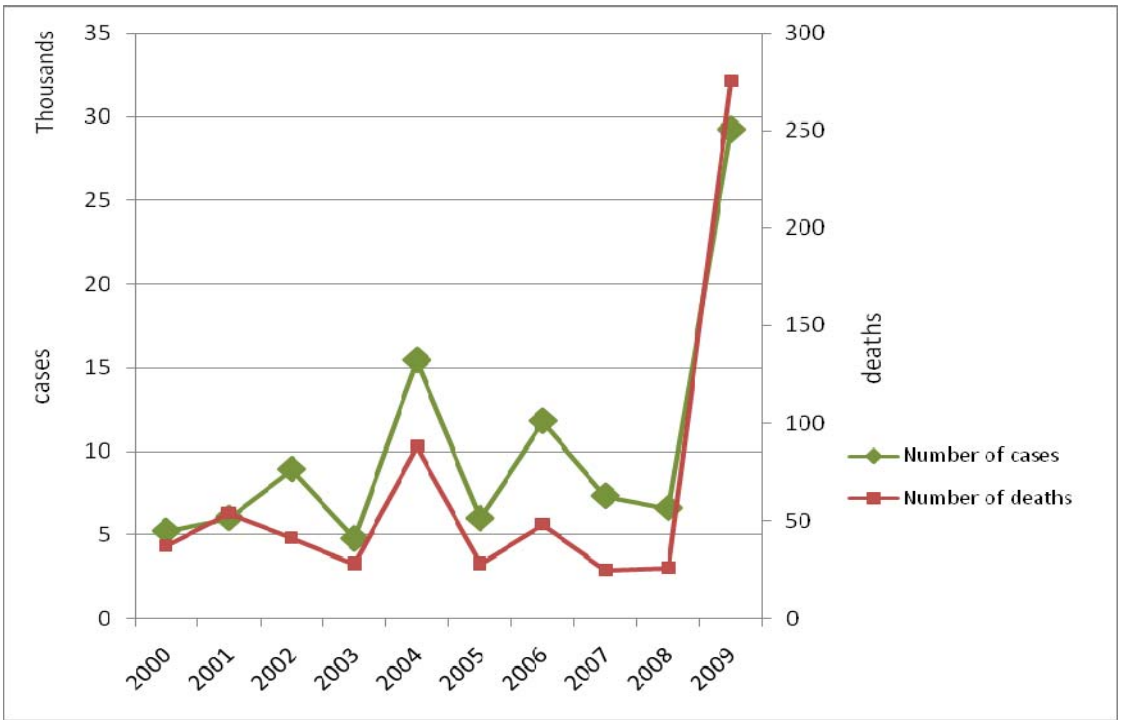
Dengue Fever

Dengue is the most prevalent mosquito-borne viral infection worldwide. Around 100 million cases of dengue fever (DF) and half a million cases of dengue haemorrhagic fever (DHF) are estimated to occur annually[6].The pattern of dengue changed in Sri Lanka after 1989, with an exponential increase in the incidence of DHF[7,8,9,10].

Dengue has significant adverse financial effects in several countries. For example, in Thailand, the financial loss due to dengue has been estimated at about US$ 61 per family, a value that exceeds the average monthly income.[10]Although the economic impact of dengue infections has not been formally assessed in South Asian countries, it is likely to be of similar magnitude as in Thailand.[11,12]

According to data for 2009, Colombo still remains with the highest incidence rate for dengue followed by Trincomalee and Matara districts. The highly urbanized and densely populated Western and Central provinces have remained highly vulnerable to the disease over recent years (see FIGURE 3). This may be due to hyper endemicity and epidemics in these areas. However, it is important to note that there appears to be a significant increase in incidence in the Eastern part of the country. Maps showing incidence numbers by district are given in APPENDIX B. It should be noted that the data in FIGURE 3 does not take into account vector densities.

Age patterns being affected by dengue appear to be changing over time. The reported mean age in 1996 was under 10 to 15 years and in 2006 it had changed to 20 to 25 years. Males have shown a slightly higher rate of incidence attributed to higher exposure to the mosquito vector (Epidemiology Unit, pers. comm. for preparation of this report, 2010).



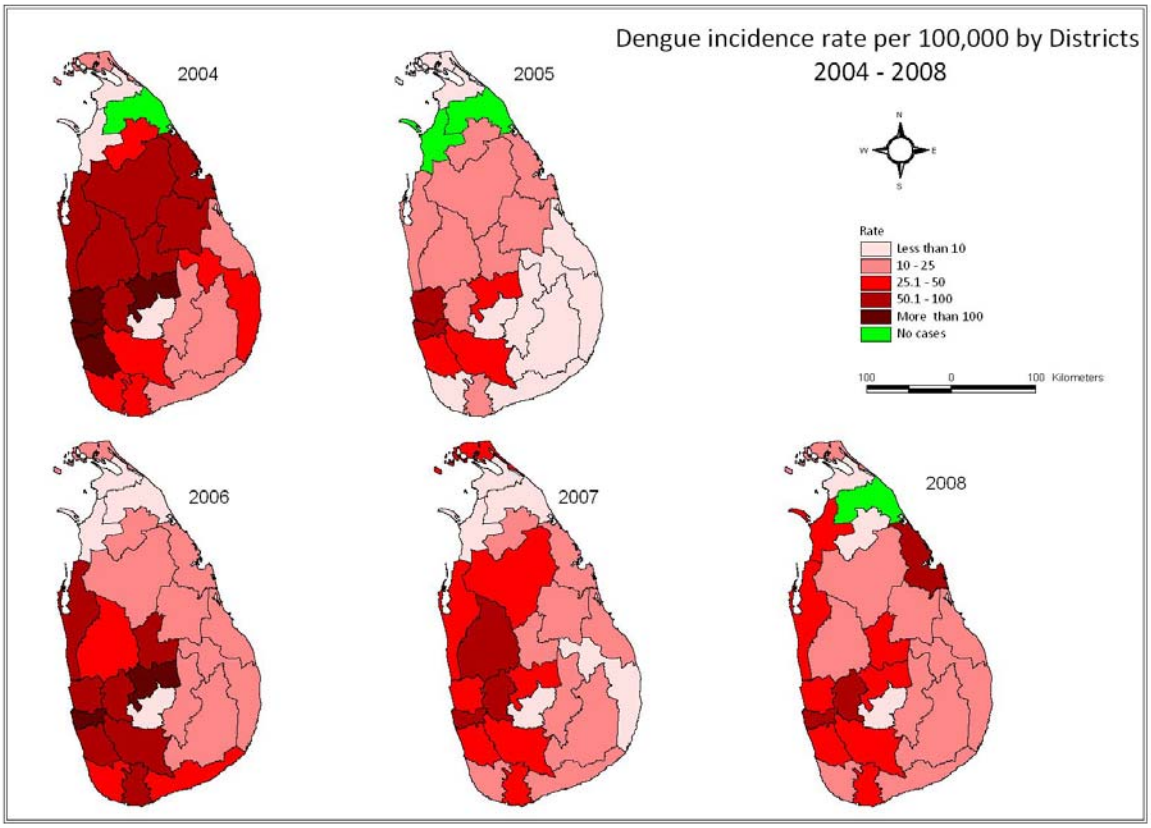
Data source: Epidemiology Unit, 2010 – provided for preparation of this report

FIGURE 2 The number of cases and deaths of dengue reported in Sri Lanka from 2000 to 2009

TABLE 1 Dengue fever incidence from 2000 to 2009

Year	Number of cases	Number of deaths (case fatality rate)	Incidence rate per 100,000 Population
2000	5,203	37 (0.7%)	275
2001	5,986	54 (0.9%)	313
2002	8,931	41 (0.46%)	469
2003	4,749	28 (0.6%)	250
2004	15,463	88 (0.6%)	813
2005	5,965	28 (0.46%)	304
2006	11,792	48 (0.4%)	602
2007	7,320	25 (0.3%)	368
2008	6,590	26 (0.4%)	321
2009	29,243	275 (0.94%)	1,420

Data source: Epidemiology Unit, provided for preparation of this report



Data Source: Epidemiology Unit, provided for preparation of this report

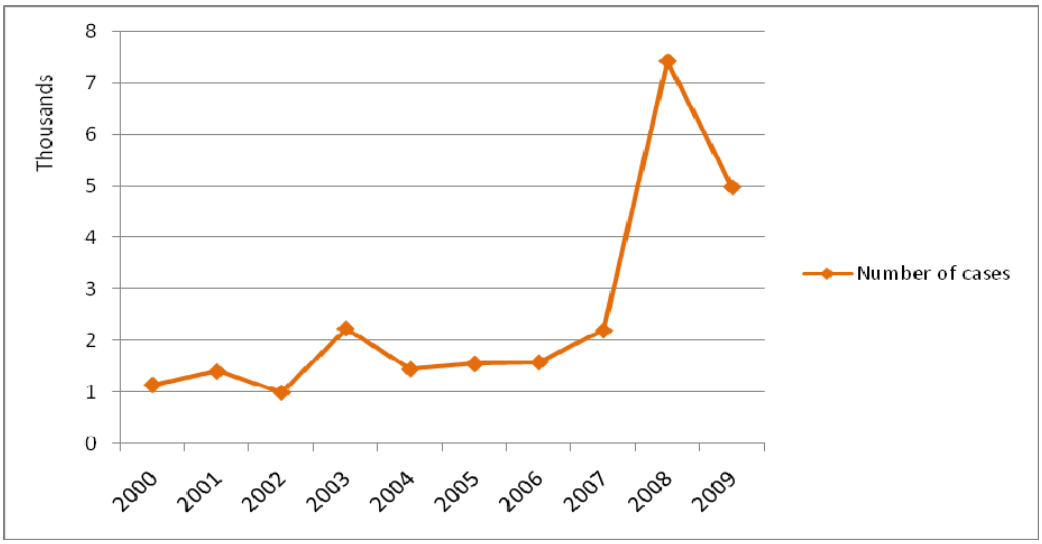
FIGURE 3 Dengue incidence in Sri Lanka by district from 2004 to 2008

Dengue epidemic peaks have been associated with the southwest and northeast monsoons at local levels - although it is difficult to link conclusively at the macro level because rainfall data are often specific to the weather station. The dynamics of dengue in urban areas are quite different, unlike in other areas where a correlation with weather would or could be expected. For example, in Colombo there is sustained transmission at all times which is characteristic of urban areas. In other areas such as Kegalle there will be naïve populations that are exposed to dengue during the rains (Epidemiology Unit, pers.com., 2010).

- ## *Rodent borne diseases*

Rodent borne diseases are those that are carried by rodents such as rats, mice and bats and even cattle. These diseases can be transmitted to humans through animal bites, contact with animal waste, eating food or drinking water contaminated by rodent waste, or through parasites that use rodents and humans as hosts (e.g. fleas and ticks). The main rodent borne disease in Sri Lanka, which is on the rise with predicted increase due to climate change, is leptospirosis. Leptospirosis is the second major communicable disease in Sri Lanka.

The incidence rate for leptospirosis has been in the range of 14 to 20 cases per100,000 population barring epidemic years of 2003 (with 24/100,000) and 2008 (37/100,000) (see FIGURE 4). Incidence rates per 100,000 have been mapped for the country from 2004 to 2008 – see FIGURE 5. Statistics for 2008 show that Matale district has the highest incidence rate followed by Kegalle, Kalutara and Matara districts. The case fatality rate (CFR) between 2004 to 2007 has been in the range of 3.8% - 4.7% while in 2008 the reported CFR was much lower at 2.8%. The actual incidence numbers have been mapped and are given in APPENDIX B.

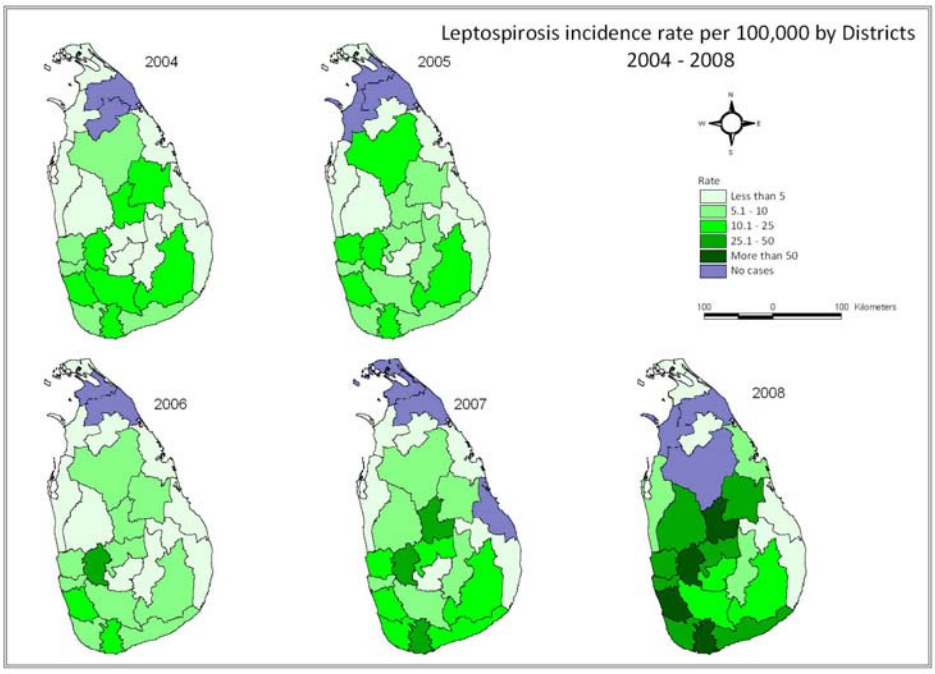


Data Source: Epidemiology Unit, pers.com., 2010 – provided for preparation of this report

FIGURE 4 Incidence (no of cases) of leptospirosis in Sri Lanka from 2000 to 2009

Though the disease is reported throughout the whole year in Sri Lanka, peaks usually correspond to the two main monsoons with some variations seen for epidemic years. Leptospirosis has been high in all 3 districts of the Western province. High incidence was also reported in Kurunegala and Kandy districts in 2000 and again in 2007.

The population groups affected are very clear in leptospirosis – the highly vulnerable age group is between 17 and 49 years, markedly higher in males than in females and those involved in agriculture. Seasonal paddy farmers are the most vulnerable.



Data source: Epidemiology Unit, provided for preparation of this report

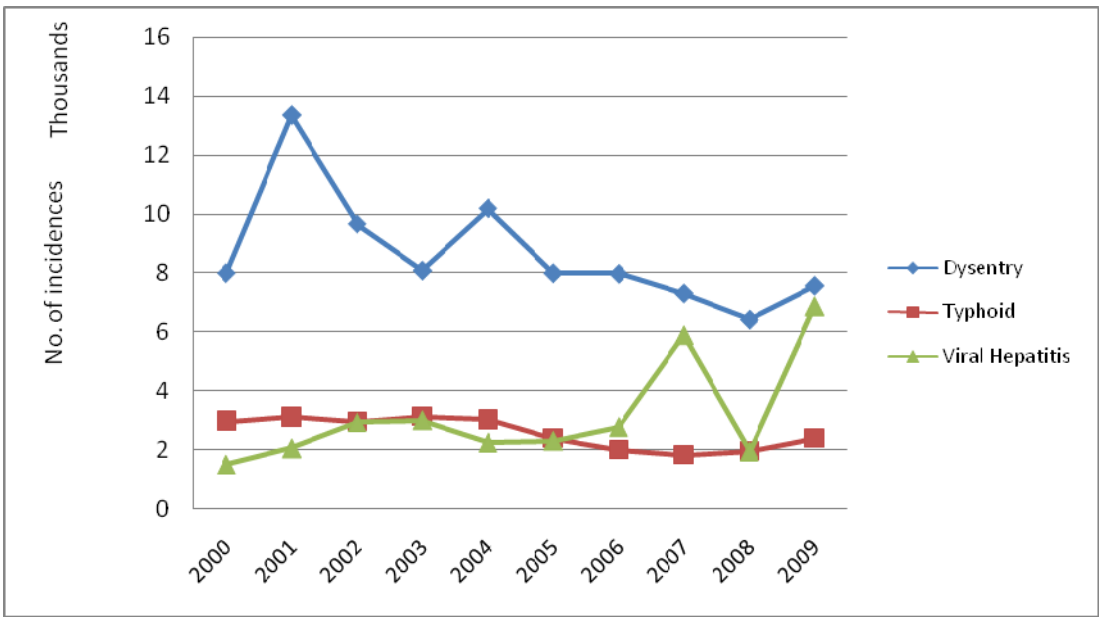
FIGURE 5 Leptospirosis incidence in Sri Lanka by district from 2004 to 2008

- *Food and water-borne illnesses*

Food and water-borne illnesses may be caused by micro-organisms created by growing bacteria or contamination of food and/or water with certain bacteria, viruses or parasites. The main illnesses in this category are typhoid (also known as enteric fever), dysentery, cholera (not reported since 1993), diarrhoea, hepatitis A & B, and polio. Of all the food and water borne diseases currently occurring in Sri Lanka, dysentery is the most prevalent though its incidence is declining (see FIGURE 6).The incidence of viral hepatitis has been relatively low but has been showing peaks more frequently in recent years (i.e. in 2007 and 2009). Typhoid incidence has been fairly constant over the years. FIGURE 7 shows the geographical distribution and the most vulnerable locations to dysentery in the country.

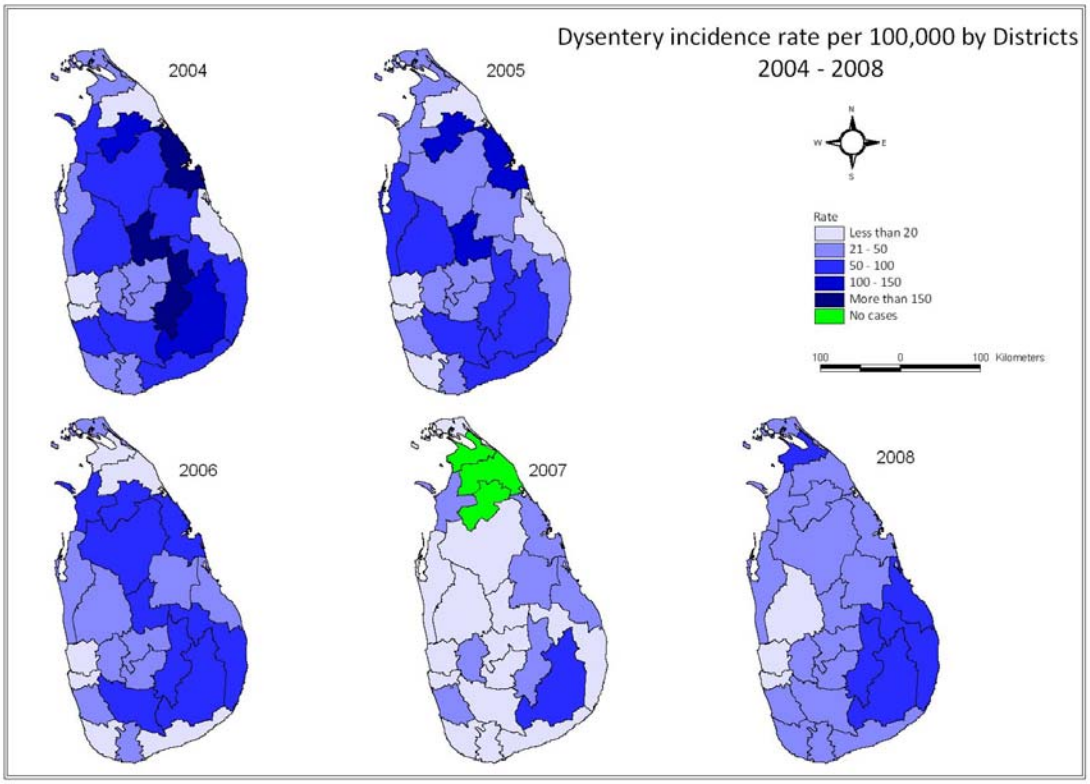
Extreme conditions resulting from climate change induced impacts (floods, land-slides and droughts) are expected to cause more water and food borne diseases. The incidence of dysentery has been declining since 2000. Incidence ranged from 14.2 to 59.8 cases per 100,000 population with the case fatality rate being less than 1%, except in 2005 when it was 1.6%. The incidence rate of dysentery is highest in the Ampara district followed by Moneragala and Kilinochchi districts (see FIGURE 7). The actual incidence numbers have also been mapped and provided in APPENDIX B. Post conflict, the increase in the incidence rate of dysentery may be attributed to the movement of people into previous conflict areas and due to IDPs. Hence some changes may be attributed to demographic changes and not climate change.

The most vulnerable population segments to dysentery are children below 15 years, and affects both male and female populations equally. Vulnerability to the disease is significantly lower in those over 50 years.



Data source: Epidemiology Unit, pers.com., 2010 – provided for preparation of this report

FIGURE 6 Number of cases of dysentery, typhoid and viral hepatitis during the period 2000 to 2009



Data Source: Epidemiology Unit, provided for preparation of this report

FIGURE 7 Dysentery incidence in Sri Lanka by district from 2004 to 2008

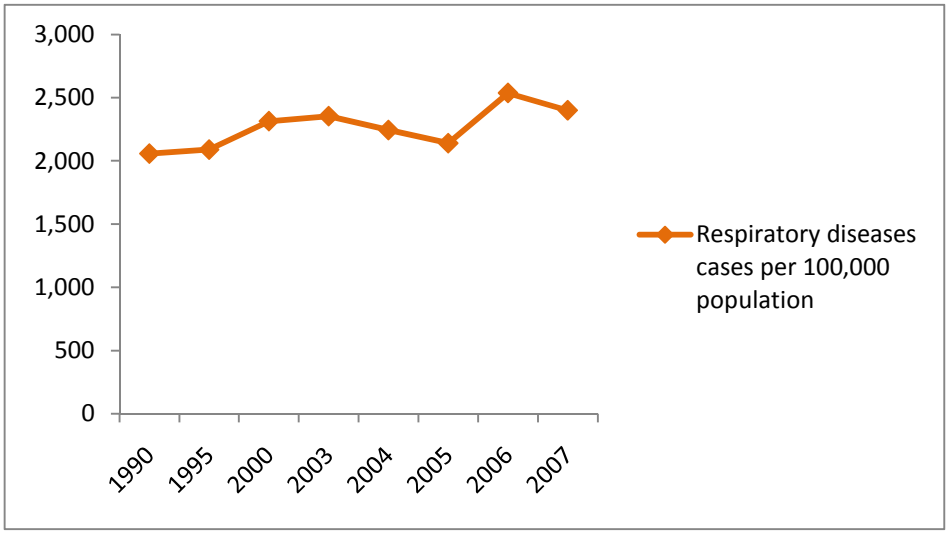
• *Other environment related disorders*

By 2020, respiratory-related diseases are projected to rank among the top 10 causes of poor health globally. Respiratory tract diseases are a common illness and a leading cause of mortality in children of developing countries[14].

Other than the above mentioned diseases there are a range of other environment related disorders including non-communicable diseases. An increase in temperature can potentially exacerbate incidence of heat rashes, heat syncope, heat cramps, heat exhaustion and heat stroke. Respiratory diseases such as asthma and allergies are also expected to increase with increasing temperature by speeding up chemical reactions and consequently worsening pollution from ozone. Heat may also spur pollen production in some plants which could in turn worsen asthma and allergies in some people. Other public health issues such increase in respiratory tract illnesses and cardiovascular illnesses have also been identified to potentially linked to climate change induced changes in atmospheric conditions[14]. See FIGURE 8 for the trend in respiratory disease incidence in the country from 1990-2007.

Other non-communicable diseases that need to be studied in relation to the impacts of climate change in Sri Lanka include heart disease which is also driven by environmental factors/conditions and the likes of chronic kidney disease and cancer (Ministry of Health, pers. com., 2010).

Acute or chronic events such as natural disasters, traumatic events or crowding or isolation cause stressful conditions as well as a major disruption in an individual's day-to-day life and affects their well-being[14]. As such psycho-social stress is another important aspect that needs to be addressed especially with the anticipated increase in disaster events associated with climate change.



Data source: Department of Health, 2007[15]

FIGURE 8 Incidence rate of respiratory disease in Sri Lanka from 1990 to 2007

• *Nutritional status*

A joint WFP, UNICEF and MRI nutrition and food security survey conducted in early 2009 revealed that 20% of Sri Lankan households are food insecure. Malnutrition levels stand at 22% of the under 5 population being underweight, 19% stunted, and 12% wasted.About quarter of the children under 5 years are anemic[16] and nearly 30% suffer from vitamin A deficiency[17]. These findings highlight the continuing importance of nutrition as a public health issue among pre-school children[16].
Among women between 15 and 49 who had a child under 5 years, 17% were underweight, 23% were overweight and a further 7% were considered obese. This category also showed anemia levels of 22%. 16% of pregnant women and 20% of lactating women were anemic. Major regional disparities were also recorded. For example 40% of children under 5 in the former conflict areas are underweight and 47% of children in the same category living on estate plantations are stunted[16].

The nutritional status is a driving factor in human health and is governed by food availability and access to it. Climate change will affect food production, especially cereal crops due to changes in temperature, rainfall patterns, soil moisture and fertility. Situations of food insecurity as a result of climate change would lead to widespread malnutrition and hunger affecting mainly children and pregnant mothers in Sri Lanka[14,16].

In 1990, there were 520 million people at risk of hunger worldwide. With improved technologies and investments this number was predicted to fall to 300 million 2080 in the absence of global warming. With global warming, it is predicted to fall to only 380 million[14].

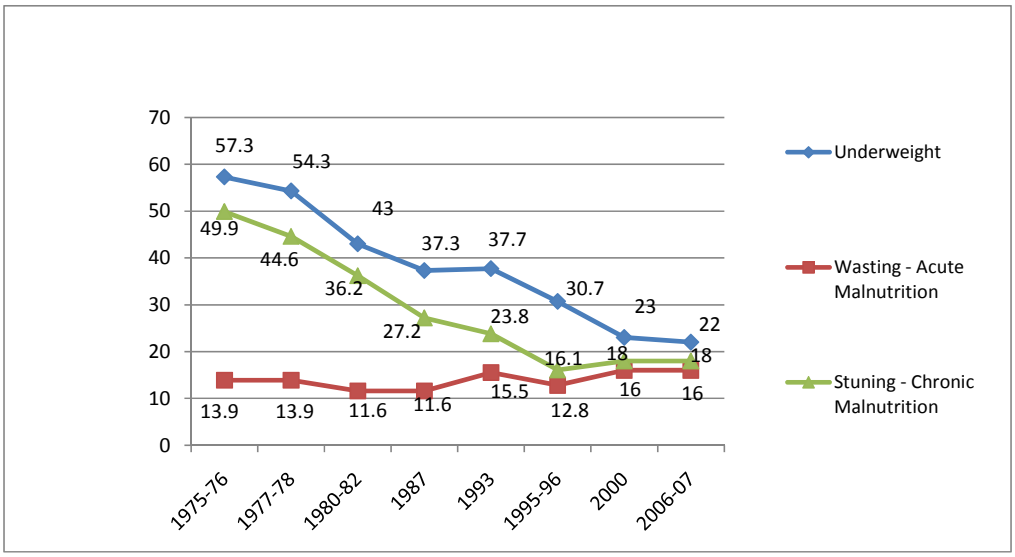
The main nutritional problems among children under five are under-nutrition and micronutrient deficiencies. Under-nutrition can manifest as wasting which is a reflection of acute malnutrition, stunting (are reflections of chronic malnutrition) and underweight which is a combined measure of stunting and wasting (see FIGURE 9). Two of the main micronutrient deficiencies among children are iron deficiency (leading to anaemia) and vitamin A deficiency. In pregnant mothers, the main nutritional problems are underweight and anaemia.

The main nutritional problems prevailing in Sri Lanka are under-nutrition (severe, moderate and mild), Micronutrient malnutrition (anaemia and iron deficiency, vitamin A deficiency, Iodine deficiency), overweight and obesity. All these problems will be exacerbated directly or indirectly with climate change and will hinder the overall development of Sri Lanka.[16]

Traditional rice varieties and tubers

The topic of whether to scale-up traditional rice varieties known to be of higher nutritional value and to have characteristics beneficial to health issues versus the high yielding hybrid varieties is rather controversial at the moment. Since food security is very high on the agenda, high yielding hybrid varieties are being promoted currently, though small scale farming of the traditional varieties are taking place and they are available in the market at higher prices.

In promoting the nutritional value of the staple diet, tubers also should be encouraged in addition to traditional rice varieties (Nutrition Department, pers. comm. during preparation of this report, 2010).



Data Source: Department of Nutrition, MRI.

FIGURE 9 Reported cases of the three main types of malnutrition in Sri Lanka from 1975 to 2007

Of the nutritional issues encountered across the different segments of the population, stunting and underweight rates are significantly higher in the estate population than in the rural and urban areas. The prevalence of all under-nutrition problems have been linked strongly with poverty, while a decline is observed with increasing wealth quintiles. This trend is directly linked with the increase in the expenditure on food as a percentage of the total household expenditure. With increased poverty, there is a move towards consuming less preferred foods and reduced meal sizes[c][16].

1.2 Cross sectoral linkages

In order to address the issues of under-nutrition and vitamin deficiencies, addressing cross sectoral issues are critical as the agriculture and fisheries sector along with the water sector have a pivotal role too. For example, decreasing river flows, rising salinity of estuaries, loss of fish and aquatic plant species and reduction in coastal sediments are likely to damage the fishing industry which is a primary source of protein for coastal and riverside populations[14].

The existing issues related to vector, rodent and food and water borne diseases often arise due to conditions of water logging caused by floods, water scarcity due to droughts, and over-exploitation of available resources (such as water). Sanitation and overall environmental cleanliness are also important factors in the proliferation of these diseases, through the creation of environments that are conducive to their breeding patterns.

[c]The recently completed *Nutrition and Food Security Assessment in Sri Lanka 2009* carried out by MRI in collaboration with UNICEF and WFP provides details on malnutrition across various segments of the population.

Water and food borne diseases are directly linked to the performance of the drinking water sector, and the effectiveness of water resource management and distribution. Such diseases are also directly linked with Sri Lanka's ability to anticipate and effectively respond to disaster events. Similarly, the planning and management of urban settlements, drainage, solid waste, etc. have direct impacts on the spread of food and water borne diseases as well as vector borne diseases. Rodent borne diseases can be clearly linked to the agriculture sector as well as to urban planning, solid waste and drainage sectors.

Repeated occurrences of diseases such as dysentery can impact the nutritional status of communities. The prevalence of under-nutrition in the country can be directly linked with the performance of the fisheries and livestock industries and the agriculture sector (especially hybrid rice varieties). The fisheries sector is known to contribute 55% of the animal protein and 13% of the total protein intake of the country, while the livestock sector's contribution is also substantial. Broader nutrition requirements are directly linked to the agriculture sector. Erratic yields due to climate change affecting farming communities and changes in quantity, quality and pricing of food available can lead to high levels of malnourishment. It will aggravate the acute and chronic under-nutrition among children and mothers - especially micro-nutrient deficiencies.

Efforts to manage key vector, rodent, food and water borne diseases, and malnourishment, therefore, must involve extensive cross-sectoral collaboration. Often, major public health problems result due to issues not addressed in other sectors, and are not necessarily reflective of the performance of the health sector by itself. The need for close collaboration across such a wide range of sectors to achieve results, of course, adds to the complexity of the pressures affecting the health sector. Climate change, in turn, affects the performance of all these other related sectors, compounding the impacts they have on human health.

New settlements and demographic movement should also be managed and guided carefully in minimizing health implications. For example, during the relocation of people during the Mahaweli Development Project, people where moved to areas with patches of uranium which has lead to cases of renal failure (Ministry of Health pers.com.) – therefore preventive action should be practiced in place of reactive action where possible.

2.0 Climate Change Related Issues and Vulnerability

According to the IPCC, ***vulnerability*** is the degree to which a system is susceptible to, or unable to cope with adverse effects of climate change. Vulnerability is a function of the character, magnitude and rate of climate variation and its effects to which a system is exposed, its sensitivity, and its adaptive capacity. ***Exposure*** means the nature and degree to which a system is exposed to significant climatic variations. ***Sensitivity*** is the degree to which a system is affected either adversely or beneficially by climate related stimuli. ***Adaptive capacity*** is the ability of the system to adjust to climate change to moderate potential damages, to take advantage of new opportunities or to cope with the consequences.

Public health is built on sound foundations of basic amenities such as safe potable drinking water, clean air, sufficient and nutritious food, favorable macro and micro environment and good social conditions. Disintegration of these factors as a consequence of climate change threatens the foundation of Sri Lanka's public health.[18]

2.1 Climate change induced threats

See BOX 2 for impacts of climate change on the weather in Sri Lanka and BOX 3 for natural hazards that affect Sri Lanka.

- *Vulnerability to natural hazards*

Possible impacts of sea level rise and coastal flooding:

- Increase in salinity of surface and ground water in coastal areas will affect freshwater availability for communities with regard to domestic use. This will result in reduced sanitary facilities in the area, further exacerbating the current morbidity due to common water and food borne diseases.

Possible impacts of a rise in temperature:

- Extreme effects of temperature anomalies may misbalance the thermo-regulation processes of the body and increase morbidity and mortality depending on the severity of the heat and the vulnerability of the exposed population.
- Increased temperatures may increase air pollutants which can result in increased incidence of respiratory disorders and cardio-vascular diseases. This would have significant implications as Sri Lanka is experiencing epidemiological and demographic transitions showing increasing trends in the number of non-communicable diseases including cardio-vascular and respiratory system illnesses.

Projected temperature rise
According to studies of the climate scenarios for Sri Lanka, the projected average temperature increase by:

- 2025 is 0.4^{0}C
- 2050 is 0.9^{0}C
- 2075 is 1.6^{0}C
- 2100 is 2.4^{0}C

Source: Department of Meteorology, provided for preparation of this report, 2010

BOX 2: IMPACTS OF CLIMATE CHANGE ON THE WEATHER IN SRI LANKA

Increasing temperature

- Air temperature in Sri Lanka has increased by 0.64^{0}C over the past 40 years and 0.97^{0}C over the last 72 years, which revealed a trend for an increase of 0.14^{0}C per decade. However, the assessment of a more recent time band of 22 years has shown a 0.45^{0}C increase over the last 22 years, suggesting a rate of 0.2^{0}C increase per decade.
- Consecutive dry days are increasing in the Dry and Intermediate Zones.
- Ambient temperature (both minimum and maximum) has increased.
- The number of warm days and warm nights have both increased, while the number of cold days and cold nights have both decreased.
- The general warming trend is expected to increase the frequency of extreme hot days.

Rainfall variability

- The precipitation patterns have changed, but conclusive trends are difficult to establish.
- A trend for rainfall decrease has been observed historically over the past 30-40 years, but this is not statistically significant.
- There is a trend for the increase of one day heavy rainfall events.
- An increase in the frequency of extreme rainfall events is anticipated, which would lead to more floods.

Drought

- An increased frequency of dry periods and droughts are expected.

Source: Department of Meteorology, Sri Lanka, provided for preparation of this report (2010).

Possible impacts of changes in rainfall regimes:

Floods

- Increase in flooding due to climate change will cause water logging creating favorable conditions for mosquito breeding, resulting in increased vector (larval and adult) density.
- Floods cause an increase in water logged areas prone to contamination with harmful pathogens such as leptospirosis through urine of rat/mice and buffaloes, and parasites such as amoeba and giardia.
- Floods lead to contamination of sources of drinking water through the spread of pathogens from broken sewers and pit latrines, and open defecating areas of humans and animals.
- Flood can cause chemical contamination of water with agrochemicals and fertilizers due to increased surface run-off during high intensity rainfall, increasing morbidity related to chronic poisoning with pesticides as well as from solid and hazardous waste dumps.
- Floods can result in concentration of internally displaced people in closely confined areas which can lead to multiple health problems such as the spread of watery diarrhea, dysentery, enteric fever, viral hepatitis, etc.
- Floods and changes in rainfall patterns can increase morbidity due to respiratory tract infections (currently a leading cause of hospitalization in Sri Lanka).
- Floods due to displacement, loss of assets and lives can cause psychological stress leading to mental illnesses.

Droughts

- Scarcity of water due to drought conditions leads to poor personal hygiene, and compromises the quality of available water, increasing the risk of water borne diseases.
- Scarcity of water pushes people to store water at home. This may give rise to vector breeding grounds leading to increased morbidity due to dengue even during the drought.
- Rock pools and small collections of water on river beds, due to restriction of river flow, may increase density of malaria vectors.

- Drought affects the availability and affordability of food. Issues related to food security may exacerbate the nutritional disorders among vulnerable populations.
- Increased morbidity related to mental health (stress, anxiety, depression, aggression and at times suicides) due to drought related loss of crops, harvest, livelihood and income.

Landslides

- Human displacement due to landslides may cause concentration of internally displaced people in closely confined areas. This in turn may lead to multiple health problems.
- Breakdown of routine service provision during floods, landslides and other disasters cause disruption to both curative health care and preventive healthcare services, and may cause physical damage to health infrastructure.
- Loss of property, livelihood, loved ones and the need to live as internally displaced population may lead to minor or major mental health problems.
- Increased morbidity and disability due to physical injuries linked to flood and landslides.

Other climate change related vulnerabilities:

- Increased ozone accumulated at ground level exacerbates existing respiratory diseases.
- Increased hospitalizations for pneumonia, increased morbidity due to asthma, chronic obstructive pulmonary diseases, increased premature mortality due to respiratory diseases are all linked with increased particulate matter which may lead to high morbidity and mortality.
- Climate change can generate aero allergens such as pollen leading to increased allergic manifestations.

2.2 Vulnerability enhancing factors

Anthropogenic factors

- Dumping of solid waste creating unhygienic and vector breeding conditions.
- Unplanned solid waste dumps contaminate surface and groundwater.
- Over-extraction of resources such as groundwater degrading water quality.
- Poorly managed agriculture and land use practices affects water quality.
- Unplanned settlements lead to un-sanitary conditions.
- Poorly managed urban infrastructure and services such as drainage and solid waste management result in conditions conducive for the spread of disease.
- Lack of political will and resources to effectively deal with issues due to competing priorities.

Socio-economic factors

- Income insecurity hampers access to appropriate nutrition, sanitation, medical facilities, and induces mental stress, etc.
- Inefficient use of water due to lack of awareness.
- Low nutritional status in low income large families where there are financial constraints.
- Low education levels among poorer communities and lack of awareness on simple sanitation techniques to prevent spread of disease.
- The lack of socio-economic will to adapt and respond to change.
- Low disaster/epidemic response capacity from the health sector due to a lack of a mechanism to do so and a lack of coordination.

BOX 3: IMPACTS OF NATURAL HAZARDS THAT AFFECT SRI LANKA

"Natural hazards occur due to natural phenomena that have a human element, and result in a large number of fatalities and/or large scale damage to property[19]."

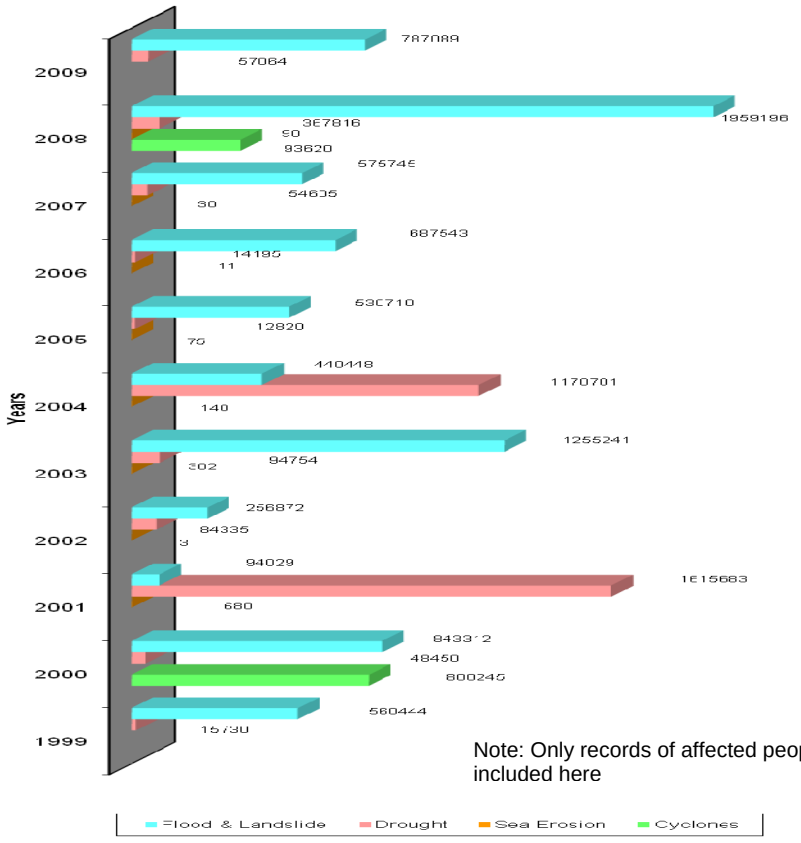
Coastal erosion affects Sri Lanka's beaches and adjacent coastal lands that are constantly subject to erosion, by winds, waves and currents that pound the coast. Available records indicate an average rate of coastal erosion of about 0.5 m/year and an accretion rate of about 0.2 m/year[20].

Landslides have been a frequent problem in Sri Lanka for many decades, and they generally follow heavy rains exceeding a threshold of 125 within 24 hours (NBRO data provided for preparation of this report, 2010)[21].

Floods are associated with extreme rainfall conditions, and occur in almost all river basins in Sri Lanka. Serious flooding frequently occurs in the Kelani, Kalu and Mahaweli river basins. Floods occur mainly in the Wet Zone, in areas having high rainfall, though flooding may sometimes occur in the Dry Zone as well[21].

Drought is the major natural hazard experienced in Sri Lanka, which, despite the lack of a heavy toll on life, has very serious negative impacts on the economic and social life of the country due to considerable expenditure by the government for compensation of crop failure due to drought[21].

Cyclones are less felt in the island than the Indian subcontinent as Sri Lanka is situated outside the cyclone belt. However, several serious cyclones have been felt periodically, with most damage occurring in the northern and eastern parts of the island, and to a lesser degree in some areas of the North Central Province. N*ote: This situation can vary in the future with climate change, although no conclusive data or projections are available for the Sri Lankan context).*



Note: Only records of affected people provided by the DMC have been included here

Source of data for graph: DMC, 2010

Number of people affected by natural disasters

2.3 Mapping climate change vulnerability

A vulnerability mapping exercise, using GIS, was undertaken in order to better understand climate change vulnerability in key sectors in Sri Lanka, building on the IPCC definitions of exposure, sensitivity, and adaptive capacity as defined in section 2.0 above[d]. The analysis is intended for use as a macro level planning tool, to illustrate where sector-specific vulnerability is high, in relative terms, across the nation, and to guide decisions on prioritization and targeting of potential climate change adaptation responses.

General methods

The basic methodology involved in the GIS mapping (used in all SVPs) was to develop indices for exposure, sensitivity, and adaptive capacity relevant to each given sector. These three indices were then combined to create a composite sector-specific vulnerability index. The analysis, which is largely based on publicly available data sources, goes up to a Divisional Secretariat Division (DSD) level of detail. All data for the adaptive capacity and sensitivity indices were from the 2001 National Census, and the Ministry of Health. Data for the North and East were not available. Refer to APPENDIX B for list of data sources used in the mapping exercise.

It must be noted that the mapping exercise itself is preliminary and limited in scope, and should be refined on an ongoing basis, based on detailed data which may become available from various government agencies. It is also noted that relevant agencies are carrying out detailed hazard mapping at the national or regional levels[e].

In the case of the health sector, the causal relationship between exposure events of climate change (temperature change, sea level rise, changing rainfall patterns, etc) and the health impacts considered are not clearly understood. Therefore, an exposure index was not used and vulnerability is assessed based on sensitivity and adaptive capacity indices only.

Health sector data are collected at MOH[f] level. DSD level mapping was not possible for the health sector (as done in other sectors) due to the lack of congruence between DSD and MOH boundaries. DSD and MOH area boundaries are congruent in only three districts, as illustrated in FIGURE 10 below.

[d] IWMI's CC Vulnerability Index as in Eriyagama et al., 2010[22] was used as a starting point and substantially refined for finer grain and sector specific analysis.

[e] For example, the Disaster Management Centre is currently coordinating a detailed risk profiling exercise for the major disaster types, at a much higher level of detail, in collaboration with the Coast Conservation Department, Irrigation Department, the National Building Research Organization, and several others. The maps generated through the DMC exercise would provide much finer grain information for exposure indices.

[f] Medical Officer of Health Area used by the Ministry of Health

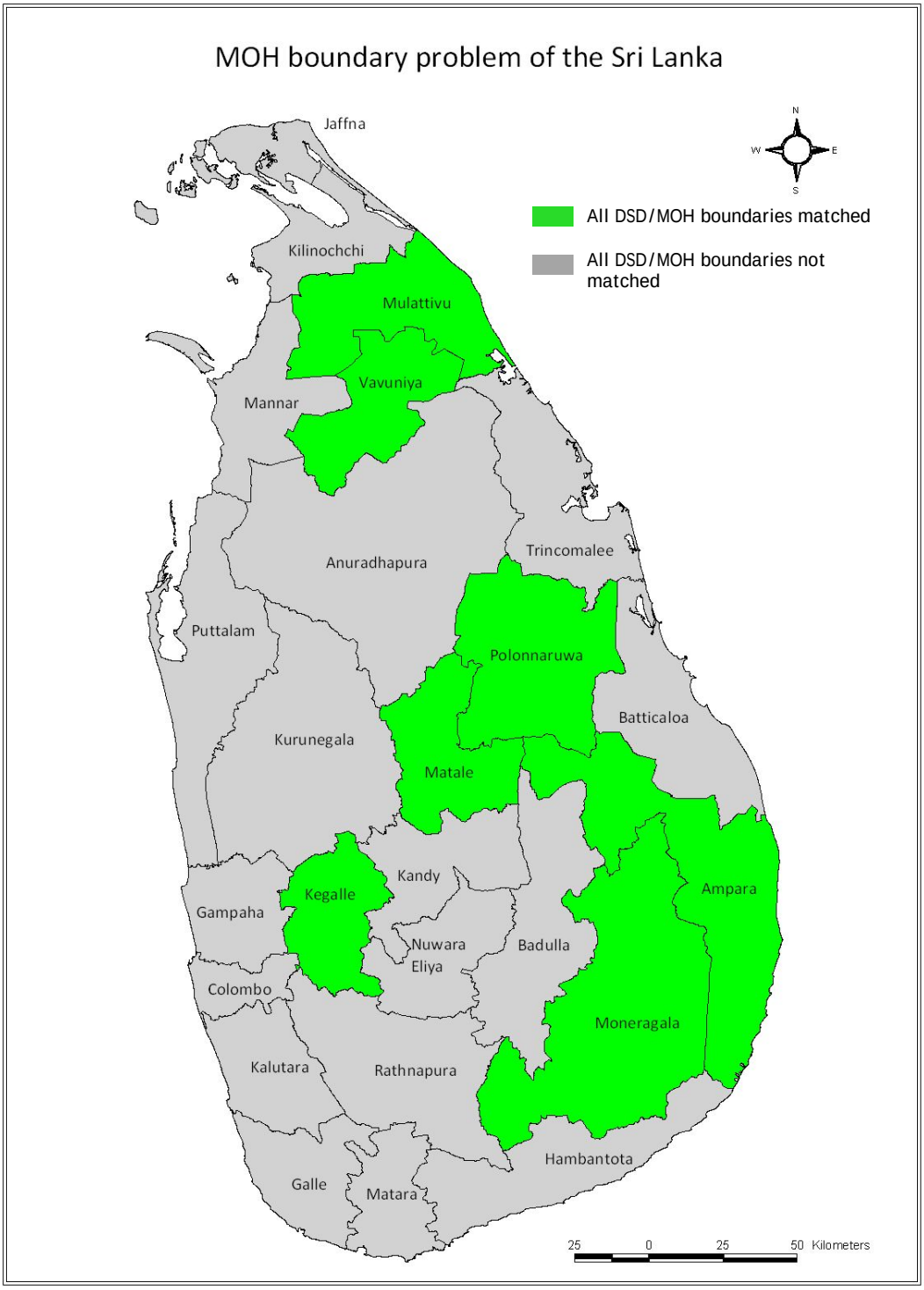


FIGURE 10 Shows the lack of congruence between DSD and MOH boundaries

What the GIS maps foretell

FIGURES 11 TO 13 illustrate the geographic distribution of vulnerability to dengue, leptospirosis and dysentery in the country. The district vulnerability ranking tables and larger scale maps are in APPENDIX B.

The sensitivity index	The adaptive capacity
• Average incidence rate for dengue fever (2004 – 2008)	• % completed secondary education • % above poverty line • # of hospital beds • # of hospitals
Raw data sources: Population and Housing Census, 2001; Epidemiology Unit; Ministry of Health, provided for preparation of this report, 2010	

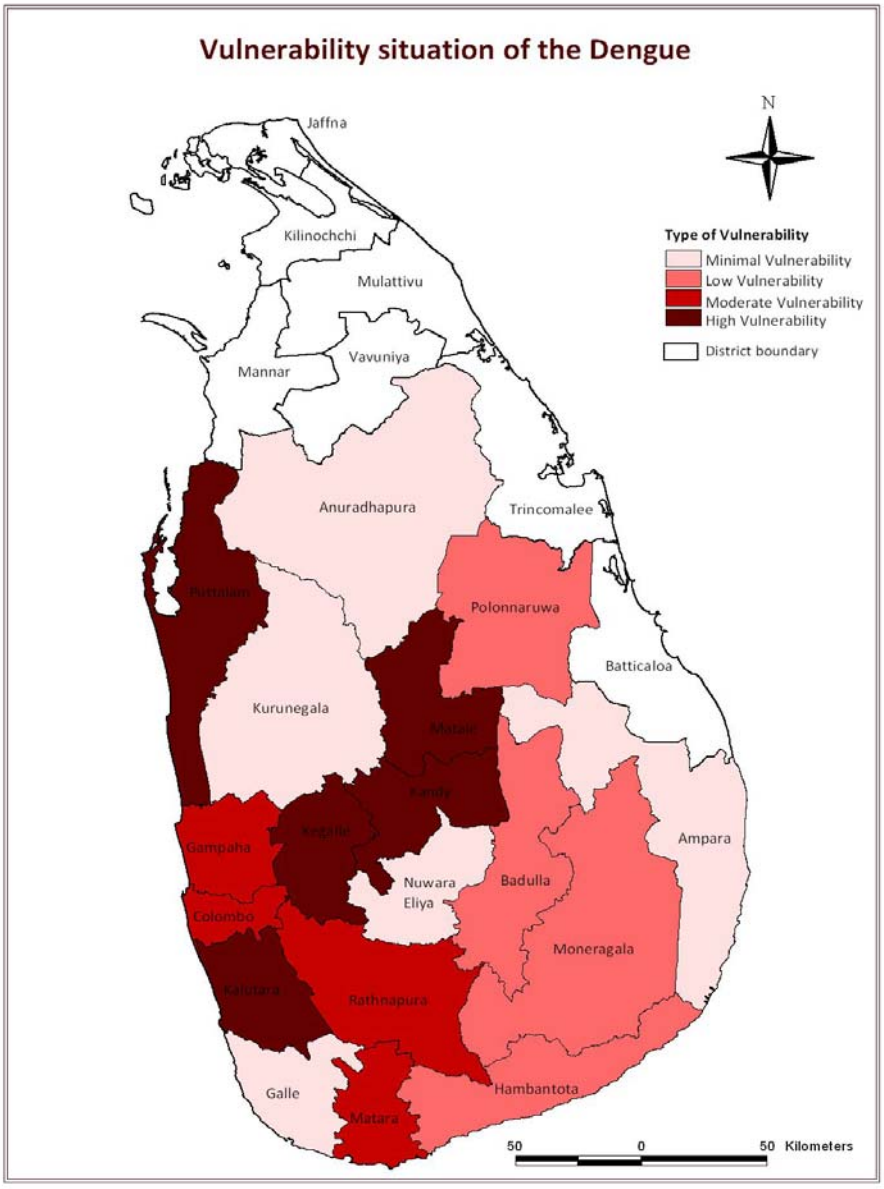


FIGURE 11 The vulnerability to dengue in Sri Lanka by district (all data necessary were not available for the North and East)

The sensitivity index	The adaptive capacity
• Average incidence rate for Leptospirosis (2004 – 2008)	• % completed secondary education • % above poverty line • # of hospital beds • # of hospitals
Raw data sources: Population and Housing Census, 2001; Epidemiology Unit; Ministry of Health, provided for preparation of this report, 2010	

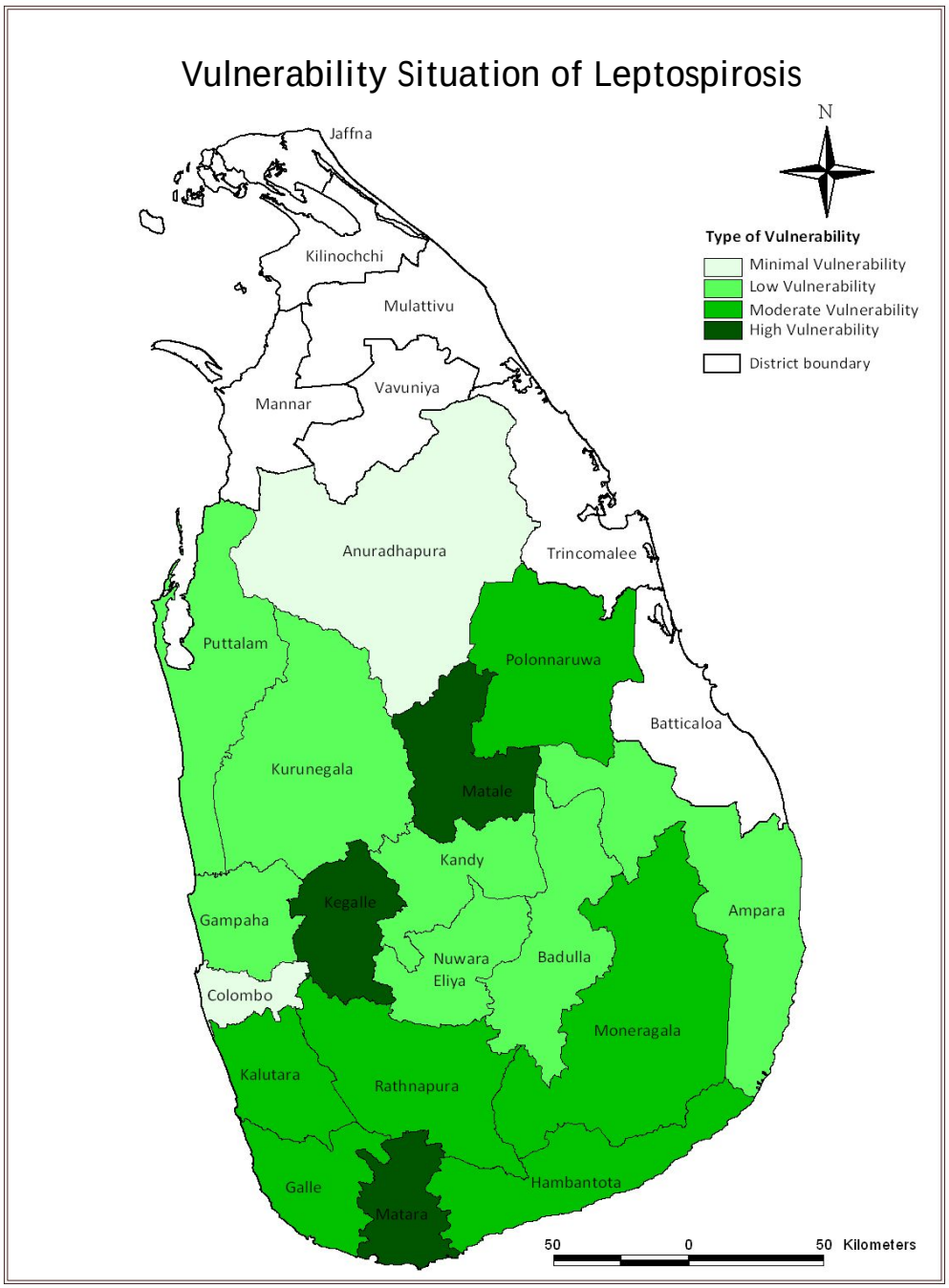


FIGURE 12 The vulnerability to leptospirosis in Sri Lanka by district (*all data necessary were not available for the North and East*)

The sensitivity index	The adaptive capacity
• Average incidence rate for Dysentery (2004 – 2008)	• % completed secondary education • % above poverty line • # of hospital beds • # of hospitals
Raw data sources: Population and Housing Census, 2001; Epidemiology Unit; Ministry of Health, provided for preparation of this report, 2010	

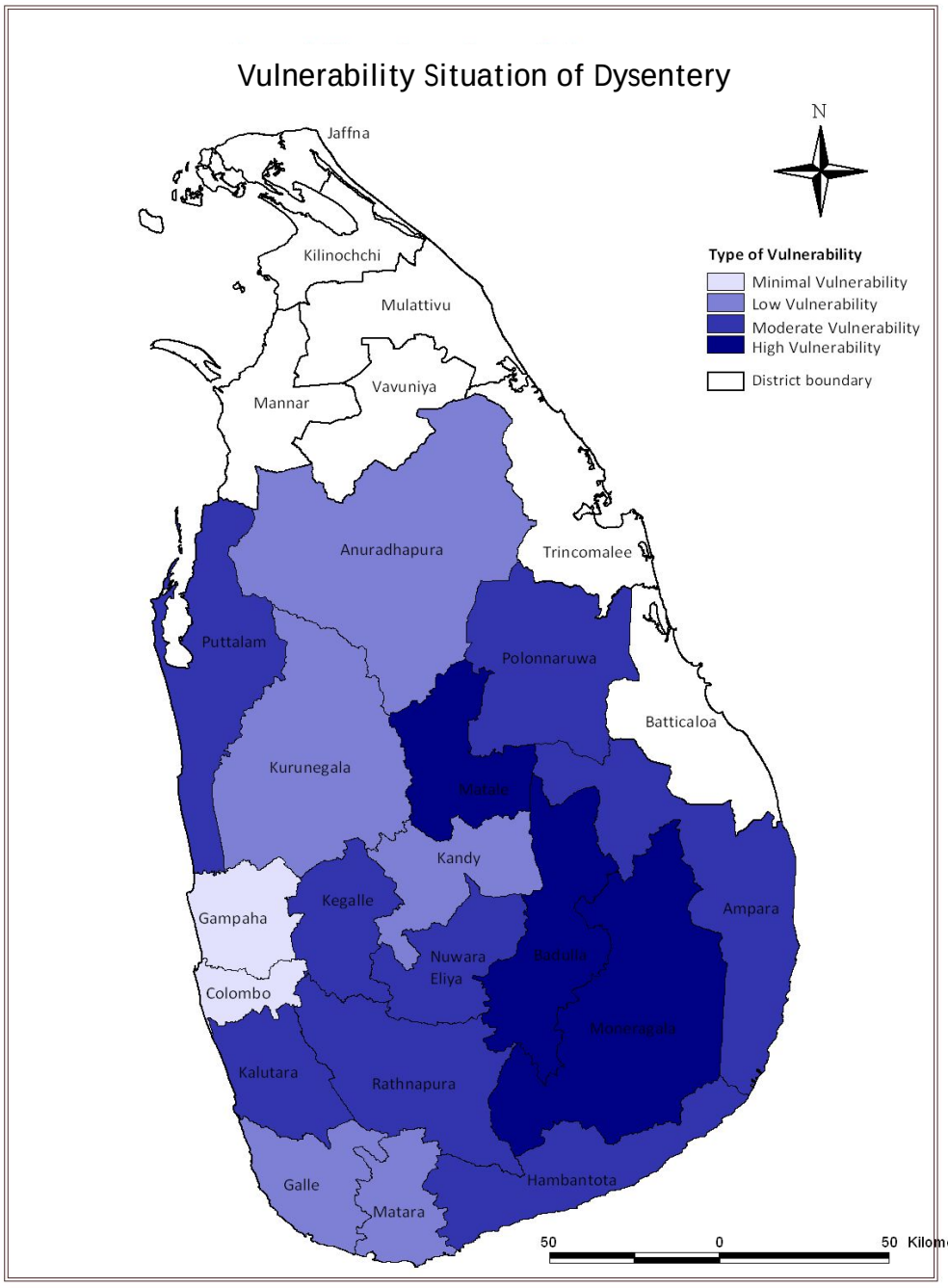


FIGURE 13 The vulnerability to dysentery in Sri Lanka by district (all data necessary not were available for the North and East)

3.0 Institutional and Policy Framework

3.1 Institutional set up[g]

The main institutions and agencies that have an impact on management of the health sector in the country are given in **Table 2**.

TABLE 2 Institutions and agencies with impact on the health sector

Ministries	Key Agencies	Other Agencies
• Central Ministry of Health and Provincial Ministries of Health	• Department of Health Services -Epidemiology Unit -Environmental and Occupational Health -Medical Research Institute -Anti-Malaria Campaign -Anti-Filaria Campaign -National Dengue Control Unit • National Health Council • Family Health Bureau • Health Education Bureau	• State Pharmaceutical Corporation • State Pharmaceutical Manufacturing Corporation • All National, Teaching and Specified Government Hospitals • Sri Lanka Medical Council • Private Hospital Regulatory Body • Association of Private Hospitals
• Ministry of Higher Education	• Medical faculties of the Universities	
• Ministry of Education		
• Ministry of Indigenous Medicine	• Department of Ayurveda • Sri Lanka Ayurvedic Drugs Corporation	• Ayurveda Teaching Hospitals • Ayurvedic Medical Council • Ayurvedic College and Hospital Board • Bandaranaike Memorial Ayurveda Research Institute
• Ministry of Disaster Management	• National Disaster Management Council • Disaster Management Centre	• National Disaster Relief Services Centre • Department of Meteorology • National Building Research Organization
• Ministry of Environment		• Central Environmental Authority
• Ministry of Child Development & Women's Affairs	• National Child Protection Authority	
• Ministry of Agriculture	• Department of Agriculture • Department of Agrarian Development	• Institute of Post-harvest Technology • Hector Kobbekaduwa Agrarian Research and Training Centre
• Ministry of Irrigation & Water Resources Management	• Water Resources Board	• Irrigation Department
• Ministry of Water Supply & Drainage	• National Water Supply and Drainage Board (NWS&DB)	
• Ministry of Media • Ministry of Provincial Councils and Local Authorities	• Local Authorities	• Justice system and legal authorities including police

[g] This section has been validated at the workshop to prepare the Water SVP and reflect the views of the many stakeholders consulted during the SVP development process.

The free healthcare system provided by the government aims to ensure easy access to quality and modern healthcare services for all with emphasis on the needs of the poorer and most vulnerable population segments. The Ministry of Health has a strong ground level health services network to support public health requirements through the free services provided by Public Health Midwives (PHM), Public Health Inspectors, and the Medical Officers of Health/Divisional Health Officers. Networks such as the Maternal and Child Health (MCH) programme coordinated by the Family Health Bureau further strengthen the available services especially for women and children. Traditional medicine as well as private sector health developments are encouraged and promoted in complimenting the free national healthcare system.

Apart from the state agencies several UN Agencies, International NGOs, local NGOs, and bilateral and multilateral agencies are also involved in the health sector actively.

3.2 Key policies and legislations that govern the sector

TABLE 3 Key legislation, policy and plans governing the health sector

Main legislations governing the Health sector	Other legislations having impact on the Health sector	Key policies/plans/strategies governing the Health sector
• Health Services Act, No.12 of 1952 and several Amendments Law No. 3 of 1977	• Medical Wants Ordinance, No. 9 of 1912 and several Amendments, Act No. 46 of 1957, Law No. 28 of 1974	• Health Master Plan 2006-2017
• National Environmental Act No. 47 of 1980 and the amendments: Act No. 56 of 1988 and Act No. 53 of 2000	• National Child Protection Act No. 50 of 1998	• National Dengue Action Plan 2004-2009
• Quarantine and Prevention of Diseases Ordinance, No. 3 of 1897 and several Amendments	• Contagious Diseases Ordinance, No. 8 of 1866, No. 3 of 1946	• Environmental Health Policy (DRAFT)
• Vaccination Ordinance, No. 20 of 1886, Act No. 12 of 1952	• Disease (Laborers) Ordinance, No. 10 of 1912, Act No. 12 of 1952	• National Environmental Policy 2003 and Caring for the Environment Action Plan 2008-2012
• Suburban Dairies and Laundries Ordinance, No. 38 of 1908, Act No. 12 of 1952	• Mental Diseases Ordinance, No. 1 of 1873	• The Solid Waste Management Strategy of 2000
• Municipal Dairies and Laundries Ordinance No. 1 of 1896, Act No. 12 of 1952	• Nursing Homes (Regulations) Act No. 16 of 1949 and several Amendments	• National Environmental Policy of 2003
• Prevention of Mosquito Breeding Act, No.11 of 2008	• Water Resources Board Act No. 29 of 1964 and subsequent Act No. 42 of 1999	• Health Sector Disaster Preparedness Plan
	• Housing and Town Improvement Ordinance, No. 19 of 1950	

4.0 Current Policies/Plans/Strategies and Actions that Support Climate Change Adaptation

Adaptation **is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Having come to terms with the fact that many climate change sensitive diseases are current public health issues in the country, it is necessary to adopt measures that promote managing these public health problems in a more aggressive manner.**

In Sri Lanka the incidence of vector borne diseases such as dengue continue to rise whilst others are curtailed. Leptospirosis is another major health issue that needs to be actively addressed. Morbidity due to diarrhoeal/water-borne diseases also remains high to date. Irrespective of the impact of climate change on the incidence of these diseases, there are well defined primary, secondary and tertiary preventive measures aimed at minimizing the disease burden, deaths and disabilities. These measures are worth considering as currently existing measures, which can be stepped up in Sri Lanka's effort to adapt to climate change.

4.1 Measures to ensure sustainable development

Landmark actions taken by Sri Lanka in response to climate change are given in BOX 4.

- *Support from policies and plans*

Ongoing monitoring programs

The overall strategy of assessment of the burden of priority diseases in the country by the health sector reviews the situation of these diseases. Information with regard to public health issues are already available over a long period of time and they provide the baseline for comparative purposes for vector borne, rodent borne, diarrhoeal and respiratory tract diseases which are the main diseases currently linked to climate change in Sri Lanka.

Policies and plans aimed at reducing public health issues

Policies aimed at reducing the incidence and impacts of these diseases have been initiated and implemented by development of strategies and action plans. Such plans include:

- National Dengue Control action plan
- District Diarrhoeal Disease control plan
- District Leptospirosis control plan
- Response system plans

These have been implemented through a range of activities taken up at provincial, district and divisional levels.

BOX 4: LANDMARK ACTIONS TAKEN BY SRI LANKA IN RESPONSE TO CLIMATE CHANGE

- Ratification of the United Nations Framework Convention on Climate Change (1992) on 23.11.1993 followed by the Montreal Protocol (on substances that deplete the ozone layer) and the Kyoto Protocol (which commits countries (i.e. mainly Annex I parties) to reduce their collective emissions of greenhouse gases).
- Establishment of a Climate Change Secretariat (CCS) within the MENR to facilitate, formulate and implement projects and programmes at national level with regard to climate change.
- Preparation of an inventory of green-house gases (2000) followed by an update which is ongoing.
- Establishment of a separate Climate Change Division within the Ministry of Environment and Natural Resources.
- Establishment of a Centre for Climate Change Studies (CCCS) in 2000, under the Department of Meteorology, to conduct research, monitor climate change, and provide the general public with current information on climate change and allied issues.
- Preparation of the Initial National Communication on Climate Change under the UNFCCC in 2000 by the MOE, which indicated the sectors most vulnerable to climate change and subsequent impacts, the sectors that most contribute to climate change, and the required mitigation options and adaptation responses.
- Initiation of the second National Communication on Climate Change under the UNFCCC which is ongoing.
- Addressing national capacity needs to implement the UNFCCC through the National Capacity Needs Self Assessment Project (NCSA) and preparation of the NCSA Action Plan based on a thematic assessment of existing capacity to address climate change, by the MENR.
- Formulation of a CDM Policy (at draft stage) and establishment of a CDM centre at the University of Peradeniya and Moratuwa.

The National Policy on Nutrition

Though there have been far reaching achievements in health, one area where the optimal realization has not been achieved is nutrition. Therefore a comprehensive National Policy on Nutrition has been formulated with the objective of strategizing and implementing a national action plan addressing issues related to nutrition. Other adaptation measures related to current and projected nutrition problems are:

- Short term adaptation measures for nutritional issues during the acute phase
- Supplementary food to children with or vulnerable to moderate acute malnutrition
- Therapeutic food supply to needy children
- Treatment of severe acute malnutrition in the curative health sector
- Using the Maternal and Child Health (MCH) network to assess vulnerability

Other necessary actions identified are:

- Identify the most vulnerable population groups with the climate change
- Monitor the food price effect with the climate change closely – surveillance system
- Targeting the existing supplementary feeding programmes
- Set up emergency feeding programmes for needy population with the climate change.

The National Environment Policy (NEP) and Caring for the Environment (CFE) Action Plan 2008-2012[23]

The National Environment Policy of 2003 was declared to set a course of action that would steer the country between the needs of development and the necessity to protect the environment which is provided through the CFE Action Plans. Health aspects were captured in CFE 2003-2007 under its 5th sector – health, sanitation, and urban development. CFE II (2008 – 2012) analyses the implementation of CFE 2003-2007 and proposed remedies as well as novel action under different strategies within a key sector to tackle the environmental issues in a sustainable manner. The NEP identifies the need for clean potable water, awareness creation on various aspects for health and sanitation, better urban planning and facilities to counter health issues amongst other interventions.

- *Support from projects and institutional programmes*

Establishment of the health sector disaster preparedness and response system

Establishment of district disaster management units have smoothened the operation of the district health sector as epidemics of diseases are categorized under disasters. Under the same concept, the health sector disaster preparedness and response system has been established by the Ministry of Health to mitigate the health implications of natural and man-made disasters. This system helps coordinate health related activities during a disaster event with the district disaster management units.

Under the disaster preparedness and response system, the following have been established:

- A National steering committee
- A National task force on health sector disaster preparedness
- National/sub national/institutional focal points
- Operational Units on health sector disaster preparedness
- National plan of health sector disaster preparedness and response (has been implemented)
- Emergency operation room for disaster preparedness

Awareness and capacity building

Epidemiology Unit of the Department of Health Services under the Ministry of Health conducts education programmes for Medical Officers of Health, Field Epidemiologists, under-graduates of the Faculties of Medicine and post-graduate students at the Post-Graduate Institute of Health. In support of these programmes curricula have been developed incorporating climate change and health for M.Sc. community medical students. The Epidemiology and the Environmental and Occupational units have been conducting training programs at village level on the control of dysentery, dengue and other mosquito borne-diseases whilst educating them on the changing climate change scenario. The Department of Health Services has been developing posters, brochures, leaflets, weekly epidemiology reports and booklets on emerging and re-emerging health consequences related to climate change for distribution among the general public.

The assessment and monitoring of the capacity for management, mitigation and prevention of climate change sensitive diseases and emergency preparedness and response of various categories of health workers are conducted regularly. Based on these assessments, various capacity building programmes on emerging and re-emerging diseases of national priority, including climate change sensitive diseases such as dengue, malaria, leptospirosis, acute respiratory infections, and diarrhoeal diseases have been launched[18,24].

4.2 Addressing disaster events

Policies have been already formulated with regard to management of disasters and associated health issues. In support of this, disease surveillance systems and management information systems have been strengthened. The country is networked to global early warning systems and the regional data base of communicable diseases of the Regional Office for South East Asia of the World Health Organization. Partnerships have also been established with other collaborative global networks of disease surveillance and control such as the Dengue Net and Pediatric Dengue Vaccine Initiative.

Given the probability of disasters due to changing climatic factors and emergence of various diseases, districts have been requested to operationalize the concept of preparedness for emerging and re-emerging diseases as an anticipatory adaptation measure. Provincial and district administrators have been requested to establish Rapid Response Teams (RRT) at district and provincial level. Technical Officers have been trained in preparedness and response. They have been demonstrated the need for “in-built response mechanisms” to attend any health related event which needs rapid response.

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Appendices

Appendix A
Key Policies and Regulations Governing the Health Sector

National Health Policy

The broad aim of the health policy is

- To increase life expectancy by reducing preventable deaths due to both communicable and non-communicable diseases
- To improve the quality of life

In this respect the government has identified the following diseases/health problems as priority areas needing focused attention:

Maternal and child Health problems, adolescent health, malnutrition & nutritional deficiencies, problems of the elderly, malaria, oral health, bowel disease, respiratory disease, mental health problems, physical disabilities, deliberate self-harm/suicide, accidents, rabies, coronary heart disease, hypertension, diabetes, cerebrovascular disease, renal disease, malignancies, STD/HIV-AIDS, substance abuse and problems related to the family unit. This includes the diseases resulted from climatic change impacts.

Health Master Plan

The Health Master Plan (HMP) aims to build on the successes and experiences of the past, and address the challenges of today and tomorrow, based on recognition that Sri Lanka is facing a health transition. These challenges include: changing demographics and disease patterns, limited resources, increased demand and expectations by the public, the need for equity and the development of a management ethos that ensures good governance and value for money in delivering quality services.

Strategic objectives of the HMP are:

- To ensure the delivery of comprehensive health services, which reduce the disease, burden and promote health
- To empower communities (including households) towards more active participation in maintaining their health
- To improve the management of human resources for health
- To improve health financing, resource allocation and utilization
- To strengthen stewardship and management functions of the health system

Mahinda Chintana: Vision for a New Sri Lanka, A Ten Year Horizon Development Framework 2006-2016

Under the "*Suwa Sevana*" programme in the Mahinda Chintana the government is committed to preserve the free health services and ensures that the citizens receive the benefits of the health service.

Broad areas covered under "*Suwa Sevana*" are:

- Preventive and curative services
- Drugs and pharmaceuticals
- Health information
- Health insurance
- Human resources development
- Indigenous systems of medicines (ISM)

The indicators and targets in the Mahinda Chintana relating to health sector.

Indicators	Base Line (2006)	Target by 2016
Health Status		
Maternal mortality ratio/100,000 live births	45	20
Infant mortality rate/1000 live birth	11.8	7
% of preschool children under weight	25	15
Prevalence of low birth weight	16	8
Prevalence of pregnant mothers with BMI less 18.5	25	
Annual parasite index for malaria	2.6	0
Deaths from dengue	29	0
Health Resources		
Doctors/population ratio (/100,000)		
Number of nurses trained	5000	25000
Per capita expenditure for patients		
% of public expenditure on health		
% of health institutions having free access to the central database	NA	100
Number of hospitals operating quality management units	10	All THs
% provincial/district/institutional planning units in full capacity		100
% of hospital managers undergone training in middle-level management		100

Randora **National Infrastructure Development Programme**

Investments in the health sector total Rs.27,715 Million. Under this selected health care institutions will be strengthened, introducing effective and affordable technologies to the state health care system in order to increase the quality of the health care system.

- Intravenous Solution Manufacturing Plant
- Kurunegala teaching hospital
- Anuradhapura hospital
- Godagama hospital
- Hambantota hospital
- Tertiary care epilepsy centre, Colombo national hospital

Action Plan for *Haritha Lanka* Programme

Increase health surveillance by health authorities in more vulnerable provinces to monitor increase of heat related diseases.

National Policy on Nutrition

A comprehensive National Policy on Nutrition has been formulated with the objective of strategizing and implementing a national action plan addressing issues related to nutrition. It focuses on the following:

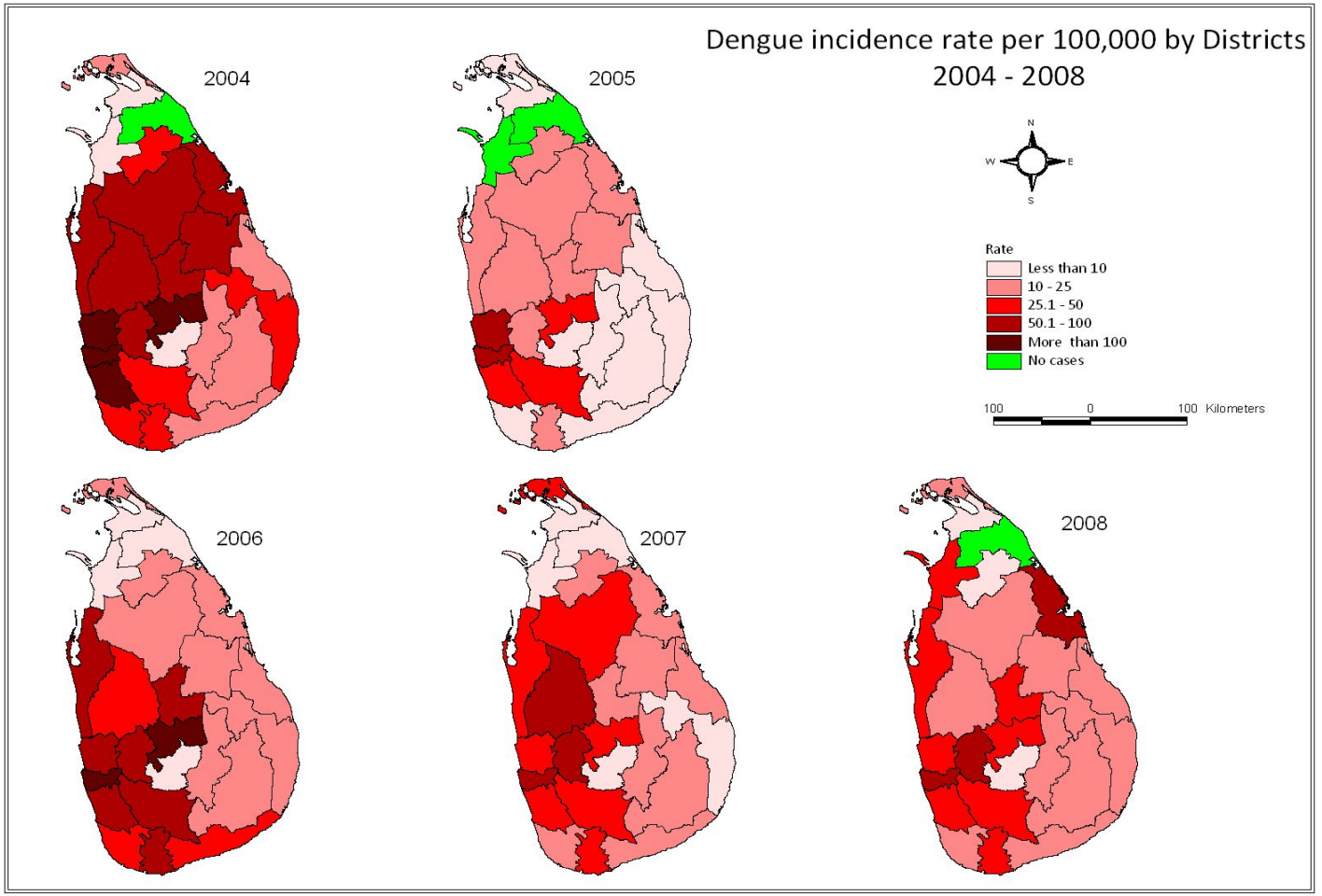
- Short term adaptation measures for nutritional issues during the acute phase
- Supplementary food to children with or vulnerable to moderate acute malnutrition
- Therapeutic food supply to needy children
- Treatment of severe acute malnutrition in the curative health sector
- Using Maternal and Child Health (MCH) network to assess vulnerability

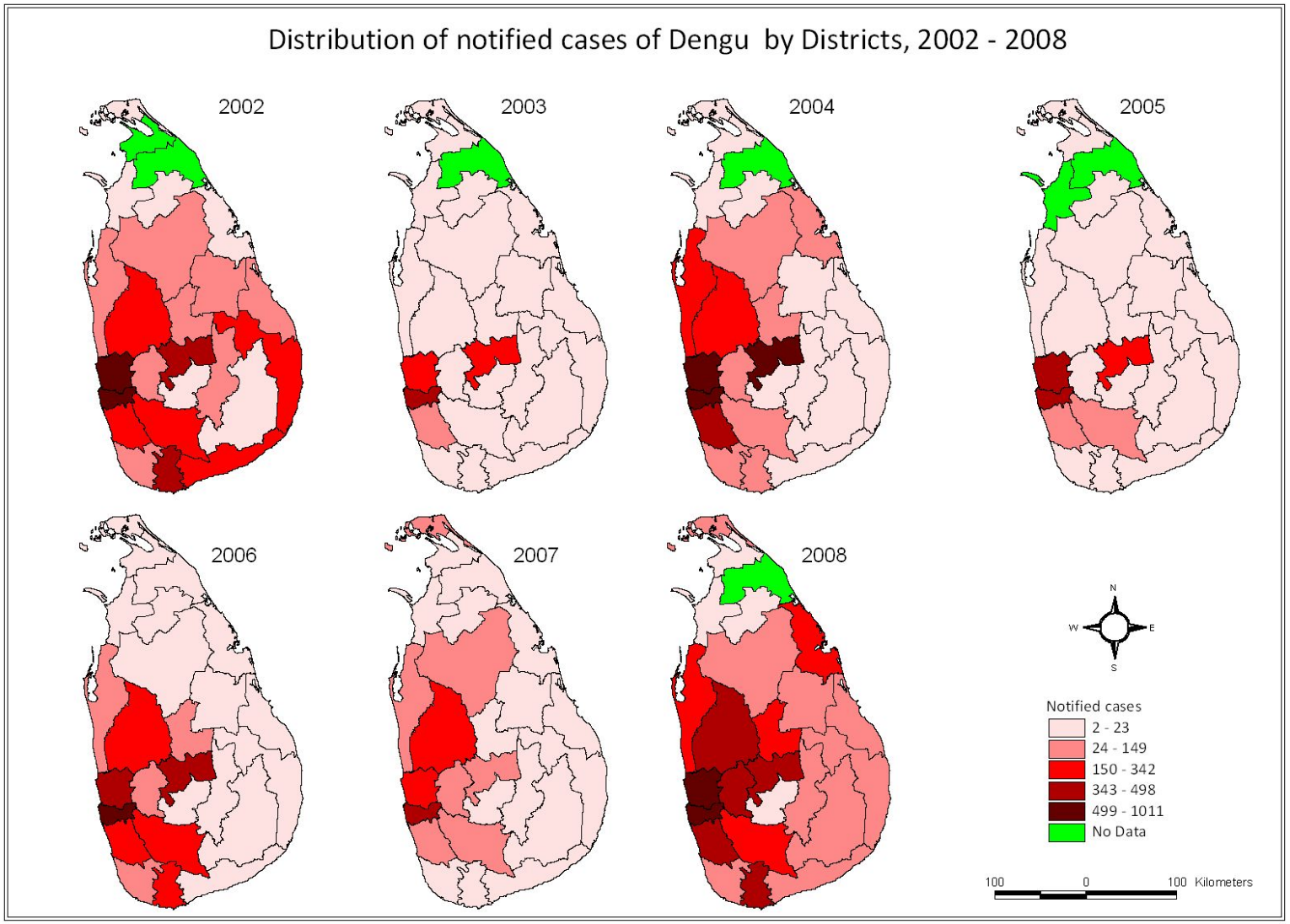
The National Policy on Nutrition sets out a range of adaptation measures of which the following are highlighted as prioritized adaptation measures:

- Advocacy for the political leadership and health administrators
- Formulation of policies and a strategic plan of action for adaptation and mitigation of climate change sensitive health outcomes
- Mobilizing adequate financial resources for implementation of the action plan
- Applied research on climate change and health outcomes
- Strengthening existing public health services, revising its scope, re-orientation and expansion services to focus on current concerns of climate change
- Development of curative health services to adequately cater to the stretched need of additional burden of diseases sensitive to climate change
- Awareness on climate change sensitive health outcomes and capacity building of the health staff to mitigate the negative health effects of climate change

Appendix B
GIS Vulnerability Maps

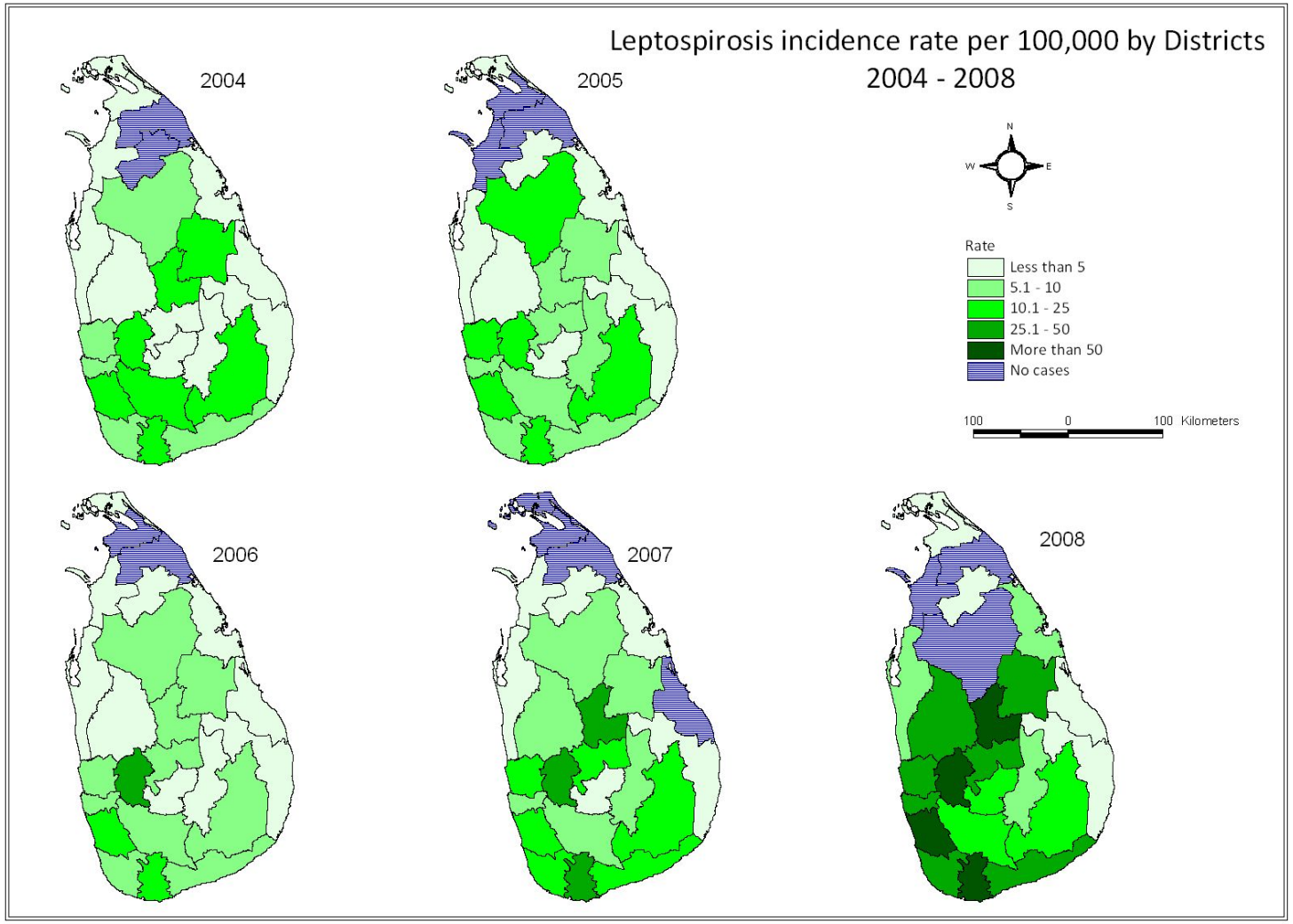
Dengue Fever

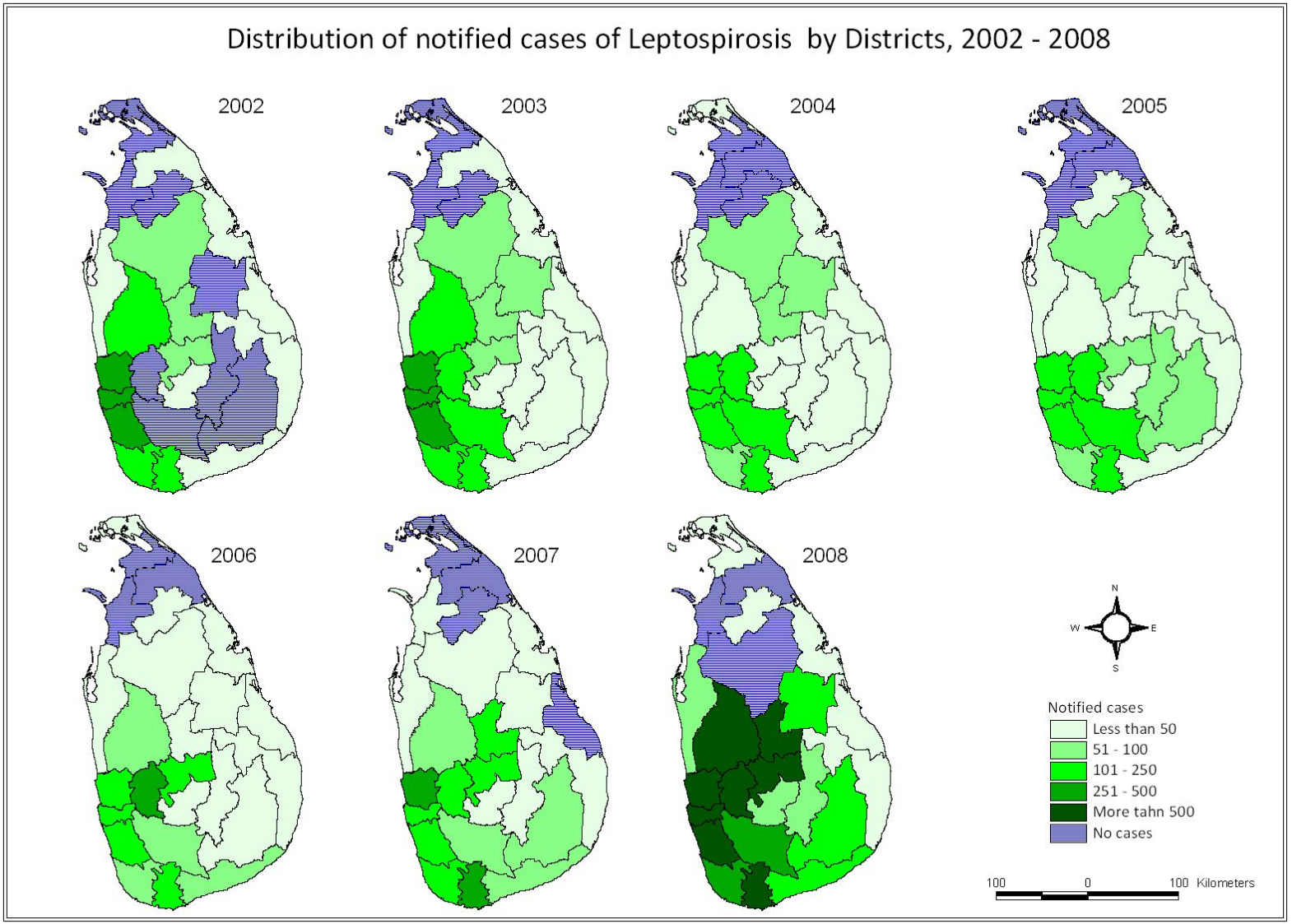



Distribution of notified cases of Dengu by Districts, 2002 - 2008
2002
2003
2004
2005
2006
2007
2008
N
W
E
S
Notified cases
2 - 23
24 - 149
150 - 342
343 - 498
499 - 1011
No Data
100
0
100 Kilometers

Appendix B 2

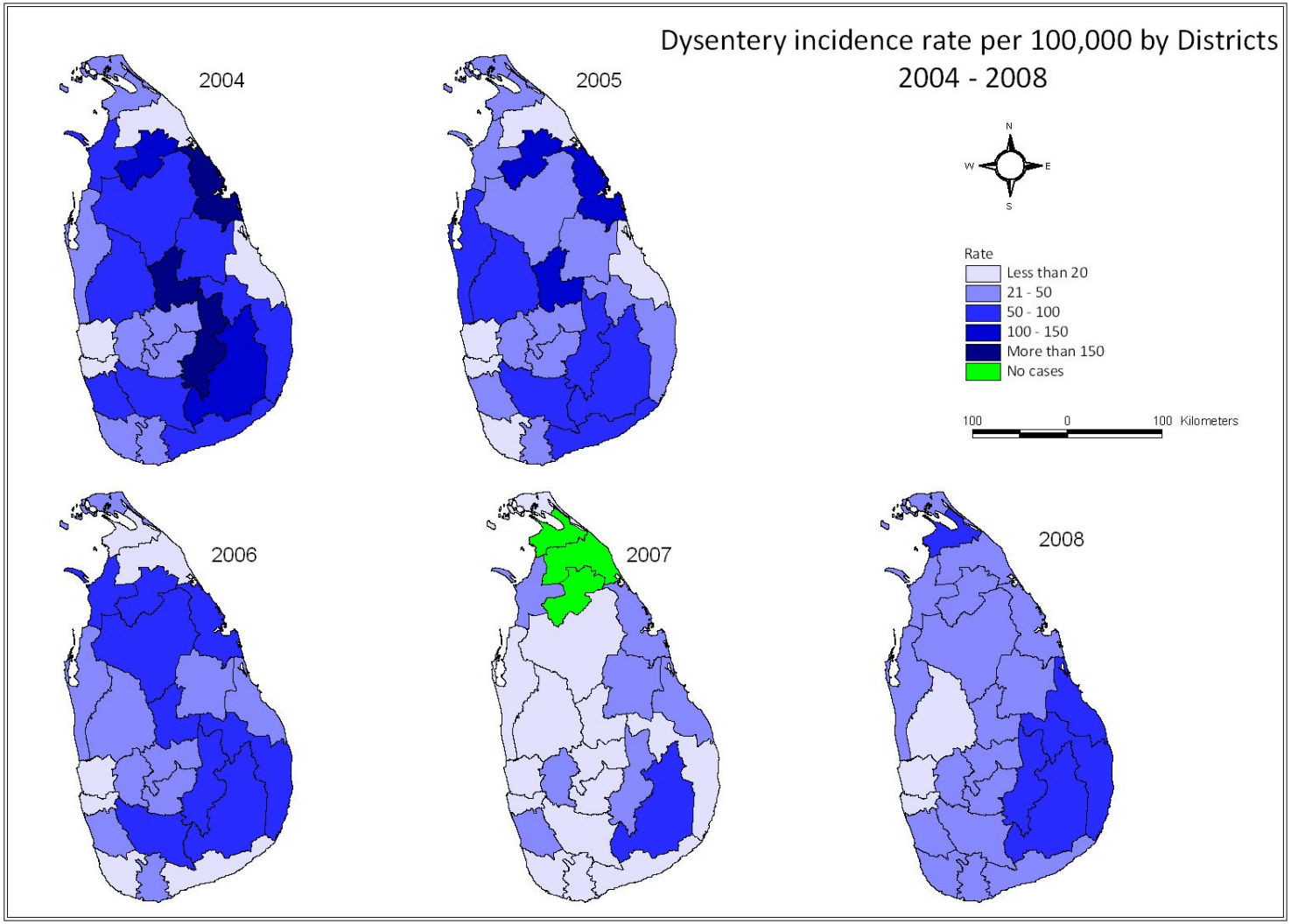
Leptospirosis

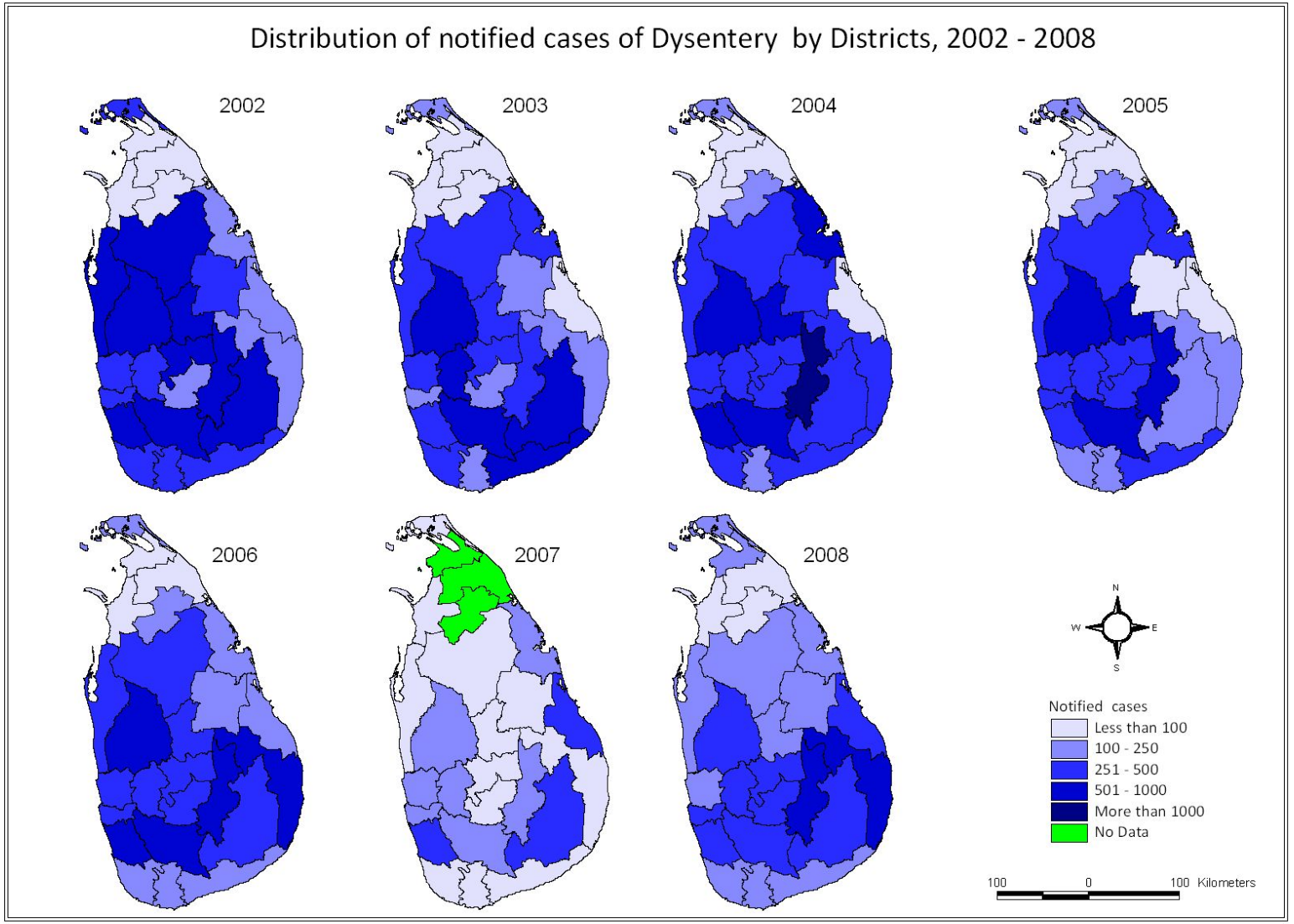



Distribution of notified cases of Leptospirosis by Districts, 2002 - 2008
2002
2003
2004
2005
2006
2007
2008
N
W
E
S
Notified cases
Less than 50
51 - 100
101 - 250
251 - 500
More tahn 500
No cases
100
0
100 Kilometers

Appendix B 4

Dysentery


Dysentery incidence rate per 100,000 by Districts
2004 - 2008
2004
2005
2006
2007
2008
N
W
E
S
Rate
Less than 20
21 - 50
50 - 100
100 - 150
More than 150
No cases
100
0
100 Kilometers


Distribution of notified cases of Dysentery by Districts, 2002 - 2008
2002
2003
2004
2005
2006
2007
2008
N
W
E
S
Notified cases
Less than 100
100 - 250
251 - 500
501 - 1000
More than 1000
No Data
100
0
100 Kilometers

Appendix C
Key State Agencies Involved in the Health Sector

Department of Health under the Ministry of Health

The mission of the Ministry of Health is to contribute to social and economic development of Sri Lanka by achieving the highest attainable health status through promotive, preventive, curative and rehabilitative services of high quality made available and accessible to people of Sri Lanka. The following units under the Ministry of Health would potentially play an important role in adaptation to climate change.

- Epidemiology Unit
- Environmental and Occupational Health Bureau
- Medical Research Institute
- Anti-Malaria Campaign
- Anti-Filaria Campaign
- National Dengue Control Unit
- National Health Council

Department of Ayurveda

The government of Sri Lanka recognized this system as an alternative system of health care by establishing a Department of Ayurveda under the Ministry of Indigenous Medicine. Presently the Ministry of Indigenous Medicine and the Department of Ayurveda are responsible for the development of the indigenous system, including training, registration, research, hospital care and production of Ayurveda drugs.

Sri Lanka Ayurvedic Drugs Corporation

This is the only state sponsored organization in Sri Lanka for the manufacture and sale of Ayurvedic drugs. The Corporation was established in 1969 by order under the Industrial Corporations Act No. 49 of 1957 made by the then Minister of Industries and Fisheries.

The main objectives of the Corporation are:

Carrying out the activities of manufacture, sale and distribution of Ayurvedic drugs and pharmaceuticals and Ayurvedic medicinal preparations; Import of Ayurveda, Siddha and Unani (both raw and manufactured drugs) and sale and distribution of these drugs;Pharmacological and pharmaceutical research in Ayurvedic drugs; Maintaining Ayurvedic herbaria and production of indigenous varieties of Ayurvedic herbs required for the manufacture of drugs.

Ayurvedic Medical Council

This is constituted under section II (I) of Ayurveda Act No. 31 of 1961 as amended by Ayurveda (Amendment) Law No. 7 of 1977. The Act provides for a Council of a maximum of 18 members consisting of ex-officio president of the Council. The Registrar who also functions as the Secretary to the Council is appointed by the Council itself.

The Ayurvedic Medical Council is the authority responsible for recommending to the Minister whether any ayurvedic teaching Institution should be approved by him for the purpose of the Ayurveda Act, registration of Ayurveda practitioners, pharmacists and nurses and the cancellation or suspension of such registration, making rules for the regulation and control of professional conduct of Ayurvedic practitioners, pharmacists and nurses.

Appendix D
Country Profile in Brief

Population status
Sri Lanka is a multi-ethnic, multi-religious secular state, with a total population of over 20.4 million and a population density of 326 persons per km^2. The Wet Zone, with a very high biological diversity, and more favourable climate and better socio-economic considerations than the water scarce Dry Zone, contains about two thirds of the country's population despite its coverage of less than a third of the island. The population in Sri Lanka is still predominantly rural as only about 20% of the population live in urban areas.

Healthcare and life expectancy
Sri Lanka has achieved remarkable progress in health and social welfare relative to other low income countries and its neighbouring South Asian counterparts as shown by a Human Development Index (HDI) of 0.759 in 2007. This is due to a large share of public expenditure being redistributed to households perceived to be in need in the form of free education and health services, as well as food subsidies and subsidized credit to improve living standards.

Sri Lanka has relatively high standards of health care, and the national health indicators are comparable with those of developed countries. The Government of Sri Lanka provides free health care services through a network of western and traditional health care institutions including hospitals, dispensaries and health units located in all parts of the country. There is also significant enhancement of health services for women and children through pre- and post-natal care nutritional programmes. Sri Lanka's consistent decline in maternal mortality for over 5 decades is attributed to a wide network of maternal services which is integrated with childcare. The life expectancy at birth for males and females is respectively 70.3 and 77.9 years. Infant mortality rates are low at 10 (per '000), while under five mortality at 14 (per 1,000) live births is the lowest for the WHO South East Asian region.

Education
The net enrolment ratio in primary education exceeds 98%, and the country has an island-wide network of schools which include public, private and religious education centers. Education was made compulsory for all children between the ages of 5-14 in 1997 and is free of charge to all students in state schools since 1945. Hence, Sri Lanka has a high adult literacy rate of 92.5%. Sri Lanka has 15 universities, six postgraduate institutions and about seven institutions affiliated to the universities which offer Bachelor's Degree courses in specialised fields. University education is a public sector monopoly as yet and free of charge, except for the Open University which is open to students of any age and with varying basic educational backgrounds.

Status of women
Men and women are granted equal status and rights under the Constitution of Sri Lanka and Sri Lankan women - including women in the rural areas - have a comparatively better status than their counterparts in many developing countries. Gender wise the literacy rate is 94.5% for males and 90.6% for females. Sri Lanka has achieved gender equality in primary and secondary education in the generations that had access to free education. Overall there has been a perceptible upward social mobility in the status of women since gaining independence in 1948, mainly due to increased access to free education, economic opportunities for employment in the industrial sector and migrant domestic employment overseas. Sri Lanka's Gender Development Index (GDI) in 2007 was 0.756 but the Gender Empowerment Measure (GEM) was only 0.389.

Housing and lifestyles
Lifestyles are changing in Sri Lanka with increased household income, and household consumption is shifting from food (as in the past) to communication, education, recreation, housing and utilities. The average household size is at present 4.1 persons. About 79% of households now own a radio or TV and 36% own a refrigerator. Household access to motorized transport and telephone facilities stand at 22% and 25% of households respectively. The demand for houses and urban infrastructure is increasing. About 75% of the population outside the north and east live in houses with more than three rooms, and over 72% of houses throughout the island comprise modern building and roofing materials such as bricks and cement for walls and tiles or asbestos for roofing; about 77% of households have sanitary and toilet facilities, 86% have electricity and 84.8% of households have access to safe water – although only about 35.5% have access to pipe-borne water. Consequently

much of the rural population still depend mainly on well water, water from forest streams, reservoirs, canals and streams which become contaminated with faecal matter and other pollutants.

Economic trends and poverty

Per capita income in Sri Lanka exceeded US$2000 in 2009, but very high regional disparities remain. According to government figures, 15 percent of Sri Lankans live below the official poverty line of Rs 3,087 a month. The country's commitment to alleviating poverty is reflected in Sri Lanka's macroeconomic policies which are pro-growth and pro-poor while continuing to uphold market based economic policies. The economic policies of the country also encourage foreign investments by providing foreign exchange and employment opportunities to catalyze the development process. Overall, the country's monetary and fiscal policies are geared towards improving macroeconomic stability by enhancing development, increasing investment and poverty reduction. The country's economic growth and poverty alleviation programmes focus on regionally balanced growth with rural and small and medium private sector development with the medium-term objective of macroeconomic stability and a regionally balanced economic growth rate of about 6-8 percent**.** Being an open economy, open market operations prevail with considerable individual freedom. This has to some degree had a positive impact on the environment.

Importance of bio-resources for economic development

Sri Lanka's diverse bio resources serve to maintain a range of economic activities within the island. Foremost among these are agriculture, the marine and brackish water fishery and tourism. Agriculture, forestry and fisheries had contributed only about 12% of the GDP. The fisheries sector provides direct employment to about 208,731 people, and sustenance to at least 2.5 million. Fish also constitutes the top source of animal protein for Sri Lankans. Sri Lanka's rich biodiversity offers ample potential to support the government's current tourism related policy aimed at maximizing potential for nature-based tourism and cultural tourism.

Industrial growth

Sri Lanka has been gradually changing from an agricultural based economy to an industrial based one over the last few decades and presently follows a liberalized industrial policy. At present industry comprises 28.6% of the GDP. Sri Lanka has been promoting the development of private sector-led, export-oriented industries with sufficient diversification in relation to both products and geographical location. However, relatively little attention has been paid in the past to ensure environmentally sustainable economic growth.

Adapted from the Country Profile in Brief from the 4th National Report to the Convention on Biological Diversity as updated with data from Central Bank (2010), Human Development Report 2009, UNDP; Household Income and Expenditure Survey, 2005, Department of Census and Statistics.

Appendix E
List of Persons/Institutions Consulted

The Consulting team has attempted to consult a broad range of stakeholders throughout the SVP preparation process through working group discussions and individual consultations. All consulted across sectors are given below.

Government Organizations (GOs)

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MTV/AMIC	Mr. Asoka Dias	Director
Sunday Times	Mr. Malaka Rodgrio	Freelance Journalist
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National Climate Change Adaptation Strategy for Sri Lanka 2011-2016

Information, Education and Communications Strategy for Climate Change Adaptation in Sri Lanka

NCCAS Brochures

Compilation of Climate Change Adaptation Project Concept Notes

Sector Vulnerability Profiles:

- Urban Develoment, Human Settlements and Economic Infrastructure
- Agriculture and Fisheries
- Water
- Health
- Biodiversity and Ecosystem Services

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