

Climate change and its impact on health in Bangladesh

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Introduction

This background paper was prepared for a workshop on Climate Change and Health in Bangladesh, held on 19–20 November 2007 in Dhaka. The workshop was organized jointly by the World Health Organization (WHO) Country Office, Dhaka and the Bangladesh Centre for Advanced Studies (BCAS). The primary objective of this background paper was to facilitate discussion during workshop by providing latest scientific assessment on: climate change and health; burden and distribution of health impact in Bangladesh related to climate change and extreme weather events; existing response mechanisms; and the way forward.

International science and the global picture

The recently-published Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) states clearly that climate change is contributing to the global burden of disease and premature deaths. Since health is the primary goal of sustainable development and includes physical, social and psychological well-being, it is crucial that the health impacts of climate change be understood and properly addressed.

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Climate change affects human health both directly and indirectly. People are exposed directly to changing weather patterns (temperature, precipitation, sea-level rise and more frequent extreme events) and indirectly through changes in the quality of water, air and food, and changes in ecosystems, agriculture, industry, human settlements and the economy. These direct and indirect exposures can cause death, disability and suffering. Health problems increase vulnerability and reduce the capacity of individuals and groups to adapt to climate change. At present the effects of climate change are small but the IPCC has projected a progressive increase in all countries and regions.

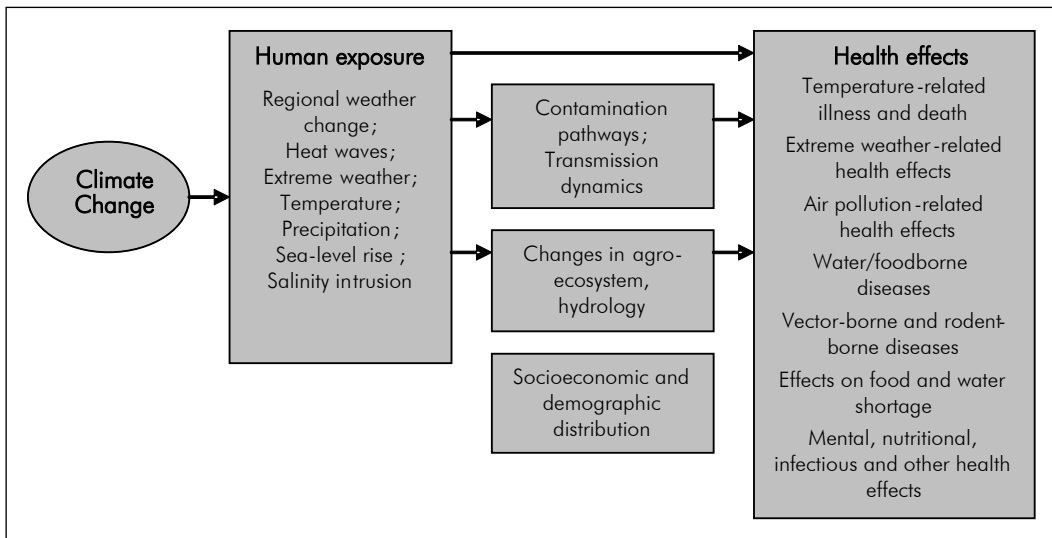
The relationship between climate change and human health is multidimensional, as presented schematically in the diagram on page 23.

The emerging evidence of climate change effects on human health (IPCC 2007) shows that climate change has:

- altered the distribution of some infectious disease vectors;
- altered the seasonal distribution of some allergenic pollen species; and
- increased heat wave-related deaths.

Systematic reviews of empirical studies provide the best evidence for the relationship between health and weather or climate factors, but such formal reviews are rare. The evidence published so far indicates that:

Figure: Relationship between climate change and human health



Source: WHO, 2003

- climate change is affecting the seasonality of some allergenic species as well as the seasonal activity and distribution of some disease vectors;
- climate plays an important role in the seasonal pattern or temporal distribution of malaria, dengue, tick-borne diseases, cholera and other diarrhoeal diseases; and
- heat waves and flooding can have severe and long-lasting effects.

A comparative risk assessment study at regional and global levels was carried out by WHO to quantify the amount of premature morbidity and mortality due to a range of risk factors, including climate change, and to estimate the benefit of interventions to remove or reduce these risk factors. The study found that in 2000, climate change was estimated to have caused the loss of over 160 000 lives annually. (Campbell-Lendrum et al., 2003; Ezzati et al., 2004; McMichael, 2004). The assessment also addressed the level of future burden of climate change that could be avoided by stabilizing greenhouse gas emissions (Campbell-Lendrum et al.,

2003). The health outcomes included in the study were chosen on the basis of their known sensitivity to climate variation, predicted future importance, and availability of quantitative global models (or the feasibility of constructing them). The following health outcomes were included:

- episodes of diarrhoeal disease;
- cases of *Plasmodium falciparum* malaria,
- fatal accidental injuries caused by coastal floods and inland floods/landslides; and
- nonavailability of the recommended daily calorie intake (as an indicator for the prevalence of malnutrition).

The study indicates that the adverse health impacts will be the greatest in low-income countries. Those at greater risk include, in all countries, the urban poor, the elderly and children, traditional societies, subsistence farmers and coastal populations.

Climate change is projected to increase the burden of diarrhoeal diseases in low-income regions by approximately 2% to 5% in 2020. Countries with an annual gross

domestic product per capita of US\$ 6000 or more are assumed to have no additional risk of diarrhoea. Endemic morbidity and mortality due to diarrhoeal disease primarily associated with floods and droughts are expected to rise in East, South and South-East Asia due to projected changes in the hydrological cycle associated with global warming. Furthermore, increase in the coastal water temperature would exacerbate the abundance and/or toxicity of cholera in South Asia.

Dengue is the world's most important vector-borne viral disease. Several studies have reported an association between spatial, temporal or spatiotemporal patterns of dengue and climate (Hales et al., 1999; Corwin et al., 2001; Gagnon et al., 2001; Cazelles et al., 2005). The IPCC report also states that approximately one third of the world's population lives in regions where the climate is suitable for dengue transmission.

Malaria is a complex disease to model – all published models have limited parameters for some of the key factors that influence the geographical range and intensity of malaria transmission. Given this limitation, models project that, particularly in Africa, climate change will be associated with geographical expansions of areas suitable for stable malaria (*Plasmodium falciparum*) in some regions and with contractions in other regions (Tanser et al., 2003; Thomas et al., 2004; Ebi et al., 2005). Some projections also suggest that some regions will experience a longer season of transmission. Although an increase in the number of months per year of transmission does not directly translate into an increase in malaria burden (Reiter et al., 2004), it would have important implications for vector control.

According to IPCC, in order to reduce the health impacts of climate change, adaptive capacity needs to be improved everywhere in the world. Recent impacts of hurricanes and heat waves have shown that

even high-income countries are not well prepared to cope with extreme weather events. The IPCC also suggests that the following measures be taken to address the health impacts of climate change:

- The planning horizon of public health decision-makers is short, as compared to the projected impacts of climate change. Therefore, the current risk-management approaches that focus only on short-term risks will need to be modified.
- A two-tiered approach may be needed, with modifications to incorporate current climate change concerns into ongoing programmes and measures, along with regular evaluations to determine a programme's likely effectiveness to cope with projected climate risks. For example, epidemic malaria is a public-health problem in most areas in Africa, with programmes in place to reduce the morbidity and mortality associated with these epidemics.
- Proactive adaptation strategies, policies and measures need to be implemented by national governments, including ministries of health, and by international organizations such as WHO, and by individuals. Because the range of possible health impacts of climate change is broad and the local situations diverse, the examples that follow are illustrative and not comprehensive.

The IPCC states that future trends in health are relevant to climate change because the health of populations is an important element of adaptive capacity. Infectious diseases could become more prominent if public health systems are not efficient or if new pathogens arise that are resistant to our current methods of disease control, leading to falling life expectancies

and reduced economic productivity. The total number of people at risk, the age structure of the population and the density of settlements are important variables in any projection of the effects of climate change.

Burden and distribution of disease: Bangladesh scenario

Bangladesh is vulnerable to outbreaks of infectious, waterborne and other types of diseases (World Bank, 2000). Records show that the incidence of malaria increased from 1556 cases in 1971 to 15 375 in 1981, and from 30 282 cases in 1991 to 42 012 in 2004 (WHO, 2006). Other diseases such as diarrhoea and dysentery, etc. are also on the rise especially during the summer months. It has been predicted that the combination of higher temperatures and potential increase in summer precipitation may cause the spread of many infectious diseases [Ministry of Environment and Forests (MoEF), Bangladesh]. Climate change also brings about additional stresses like dehydration, malnutrition and heat-related morbidity especially among children and the elderly. These problems are thought to be closely interlinked with water supply, sanitation and food production. Climate change has already been linked to land degradation, freshwater decline, biodiversity loss and ecosystem decline, and stratospheric ozone depletion. Changes in the above factors may have a direct or indirect impact on human health as well.

Bangladesh also carries the burden of high population, natural disasters and diminishing and polluted natural resources. The added burden of increased health problems, possibly due to climate change and climate variability, will push back its developmental achievements.

Public health depends on safe drinking water, sufficient food, secure shelter and good social conditions. A changing climate is

likely to affect all of these conditions. The health effects of a rapidly-changing climate are likely to be overwhelmingly negative, particularly in the poorest communities.

Some of the health effects of climate change include:

- **Increasing frequency of heat waves:** Recent analyses show that human-induced climate change contributed significantly to the occurrence of the European summer heat wave of 2003 and of 2007. This has implications for Bangladesh since the elderly and children suffer the most from increased temperatures. Even though no formal study on increase of heat waves in Bangladesh has been undertaken, we are already observing yearly trends in rise in temperatures. The health impacts associated with heat waves are heat stroke, dehydration and aggravation of cardiovascular diseases in elderly people. It is also to be noted that Bangladesh does not have records on illnesses and deaths related to heat waves. However, it was generally observed that prevalence of diarrhoeal diseases increased during extreme temperatures and heat waves, particularly in children.
- **Variable precipitation patterns:** Changes in precipitation patterns are likely to compromise the supply of fresh water, thus increasing the risk of waterborne diseases. They are also associated with floods and water-logging that increase the incidence of diarrhoea, cholera and skin and eye diseases. Agricultural production and food security are also linked directly to precipitation patterns – this impacts the nutritional status of the population.
- **Malnutrition:** Rising temperatures and variable precipitation are likely to

decrease agricultural production, thereby increasing the risk of malnutrition. Malnutrition will further increase the vulnerability of those affected to infectious and water- and vector-borne diseases.

- **Vector-borne diseases:** Changes in climate are likely to lengthen the transmission seasons of important vector-borne diseases, and alter their geographic range. Already, dengue is a regular disease in the major cities of Dhaka and Chittagong.
- **Rising sea levels:** These increase the risk of coastal flooding, and may necessitate population displacement, and cause many other health-related problems such as cholera, diarrhoea, malnutrition and skin diseases, etc. More than half of the world's population now lives within 60 km of the sea. Some of the most vulnerable regions are the Nile delta in Egypt, the Ganges-Brahmaputra delta in Bangladesh, and many small islands, such as Maldives, and the Marshall Islands and Tuvalu in the Pacific Ocean.

In Bangladesh, millions of people suffer from diarrhoea, skin diseases, malaria, mental disorders and dengue, etc. A recent study carried out jointly by the BCAS and the National Institute of Preventive and Social Medicine (NIPSOM) in 2007 indicated that the annual incidence of diarrhoea was 28 41 273 cases during the period 1988–2005 and that of skin diseases was 26 23 092 cases during 1998–1996. Other health problems such as malnutrition, hypertension and kala-azar also affect people of different regions of the country. The following table shows the incidence of some of the major climate-sensitive diseases and their trend during the last few decades.

Table: Incidence of some of the major climate-sensitive diseases occurring during the last few decades in Bangladesh

Diseases	Total cases per period	Period	Average annual cases
Diarrhoea	48 302 636	1988–2005	2 842 273
Skin diseases	23 697 833	1988–1996	2 623 092
Malaria	1 018 671	1974–2004	33 956
Mental disorders	201 881	1988–1996	22 431
Dengue	19 830	1999–2005	3305

Source: Data modified from WHO, 2006; Director-General, Health (Bangladesh); 1996, 1997; MoEF, 2005

Overall assessment of the disease burden in Bangladesh

Since the country's independence more than 30 years ago, the Government of Bangladesh has invested substantially in the institutionalization and strengthening of health and family planning services, with special attention to rural areas, and is committed to the key health-for-all (HFA) and primary health care (PHC) approaches. Over the last 30 years there has been substantial improvement in the health status of the people. However, despite these improvements, much still remains to be done. Mortality rates, especially infant and maternal, continue to be unacceptably high. The quality of life of the general population is still very low. Low calorie intake continues to result in malnutrition, particularly in women and children. Diarrhoeal disease continues to be the major killer. Communicable and poverty-related diseases that are preventable still dominate the top ten causes of morbidity.

The government is aware of the situation, as well as of the major shortcomings that need to be addressed, such as development of an efficient project management mechanism

across the health system; improvement in the logistics of drug supplies and equipment to health facilities at district and lower levels; improvement in the production and quality of human resources; a system to ensure regular maintenance and upkeep of existing health facilities; and development of a comprehensive plan to improve and ensure the quality of health resources.

Bangladesh's response to its existing disease burden

Health policies and strategies

The cornerstone of Bangladesh's national health policy is the Health and Population Sector Strategy (HPSS) which was introduced in 1998. The priority of the strategy is to ensure universal accessibility to and equity in health care, with particular attention to the rural population. The Maternal and Child Health (MCH) programme receives priority in the public sector while "reproductive health" has recently become a priority concern. Moreover, government's financial allocation for health has also improved. Efforts are being made to develop a package of essential services based on the priority needs of clients, to be delivered from a static service point, rather than through door-to-door visits by community health workers. This will be a major shift in strategy that will require complete reorganization of the existing service structure. Such reorganization is expected to reduce costs and increase efficiency as well as meet peoples' demands. Privatization of medical care at the tertiary level, on a selective basis, is also being considered. The progress being made towards achievement of the health-related Millennium Development Goals (MDGs) is given below:

Intersectoral cooperation: Intersectoral committees have been formed at different levels ranging from the national level to the periphery, depending on the need for cooperation. At national level, for example, the nutrition and population councils are

chaired by the Prime Minister. At district and *thana* levels, intersectoral coordination committees have been organized, while at the lowest administrative level (union), intersectoral committees have been formed, e.g. for water and sanitation projects.

Organization of the health system: Committees have been formed, including an inter-ministerial committee, to integrate/merge the health and family planning departments. Functionally, health and family planning personnel work closely at *thana*, union and outreach levels, but a dichotomy exists at district and national levels. As a result, greater decentralization of management is being considered.

Managerial process: The government decided to formulate a national health policy in 1997, for which a health policy committee and five subcommittees were formed. This resulted in a change from a "top-down" planning process for health to a participatory approach involving the stakeholders in the health sector. The first product that was formulated utilizing this approach was the health sector perspective plan. A new approach to programme implementation, which is product-oriented and emphasizes on "outputs" rather than "inputs" is being tried out with WHO's assistance. Decentralization of the management process is also being considered.

Health information system: Weekly epidemiological surveillance and outbreak control reporting system for selected communicable diseases have been initiated throughout the country. The routine Health Management Information System (HMIS) is functioning with some limitation, though activities have been undertaken to strengthen it. Information support is not yet adequate. The use of data remains limited. Strengthening of the HMIS through training, use of existing data collection tools, and establishment of information networks with computer support has been planned.

Community action: The roles of the individual, family and community are emphasized in the intensified action programme for PHC implementation, which involves decentralized planning at *thana* and union levels. A total of 12 districts (86 *thanas*) are now covered under the intensified PHC programme. Through intersectoral collaboration and community participation, a joint action plan has been implemented involving 60 000 village health volunteers (one each for 50 households). The participation of teachers and religious leaders is encouraged. The information department and mass media inputs are also utilized to support information, education and communication (IEC) activities.

Emergency preparedness: Currently, there is no legislation in the country that underpins the management of natural disasters at national and sub-national levels. In the absence of any legislation, the Ministry of Disaster Management and Relief in 1997 issued revised "standing orders for disasters." These "orders" provide guidelines and instructions to various line departments and ministries. There are separate "standing orders" for different hierarchical levels of the health sector, which include coordination committees; contingency plans for manpower deployment, essential medical relief supplies and maintaining a database; training in emergency preparedness and response; a communication network; and budgetary allocation for emergency management. A draft "Disaster Management Act" is currently under review.

Health research and technology: Three organizations, namely the Bangladesh Medical Research Council (BMRC), the Institute for Cholera and Diarrhoeal Disease Research, Bangladesh (ICDDR), and Essential National Health Research (ENHR) carry out biomedical and operational research. They undertake training and provide research grants. Many of their research findings are helpful in making policy decisions. Research units have also been opened by BMRC in medical colleges. Field

study stations have been established by BMRC and ICDDR. The BMRC has reorganized itself internally to cope with the growing demands of young researchers. Literature search systems in BMRC and ICDDR have been modernized.

Health systems research (HSR) is not handled as a separate, independent entity. Individual faculty members and other relevant people have been trained in HSR, but there is no coordination among researchers. Health training institutions are yet to include HSR in their curricula. Research culture is just developing in Bangladesh, hence there is no effective critical mass of researchers to form a strong advocacy group. Coordination and networking among researchers and funding agencies are yet to be developed.

Health services

Health education and promotion: Educational support to national health programmes has been provided by the Health Education Bureau (HEB). In recent years emphasis has been on school health education, hospital health education and coordination with nongovernmental organizations (NGOs). Constraints include the lack of a national IEC strategy, the low priority given to health education by health services, underutilization of health education officers, and lack of opportunities for professional advancement of those working in health education. Some issues under consideration are the inclusion of a health education component in the new national health policy and strengthening of coordination among HEB, ongoing government health programmes and NGOs.

Prevention and control of locally endemic diseases

Dengue: Dengue was an unfamiliar disease in Bangladesh till its outbreak in the summer of 2000. It started as an acute febrile illness in three major cities of Bangladesh (Dhaka,

Chittagong and Khulna) with the highest incidence being in the Dhaka district. People of all ages and both sexes are susceptible to dengue. The infection can lead to the fatal dengue shock syndrome (DSS). This vector-borne disease is transmitted by certain species of *Aedes* mosquito. *Aedes aegypti* and *Aedes albopictus* are peri-domestic mosquitoes that lay eggs in small collections of clean water such as in flower vases and pots. Usually dengue transmission occurs during the rainy season. Bangladesh never experienced a serious epidemic of dengue until 2000. However, scattered studies did indicate sporadic cases over the last few years preceding 2000.

Since July 2000 onwards, dengue and DHF cases have been reported in Dhaka and other major cities in the country. As of 2004, a total of 16 388 dengue cases were reported of which 210 were fatal. The case fatality rate (CFR) was 1.28%. The Director-General, Health Services has taken initiatives to develop national guidelines by adapting the WHO guidelines according to local needs. The objective of the guidelines is to control transmission of dengue fever and DHF, reduce morbidity and prevent deaths.

Malaria: In 1992 an epidemiological follow-up found that the resistance of *Plasmodium falciparum* to a number of antimalarial drugs was increasing and that in relation to 1982 the number of malaria cases had doubled. The government introduced a National Guideline for Treatment of Malaria in 1994, which was revised in 2004. Statistics from 2001 to 2005 show a marked increase in the proportion of *Plasmodium falciparum* cases every year. WHO declared that malaria could not be eradicated and subsequently a new strategy for malaria control was launched. The new strategy is being implemented gradually. It emphasizes disease control aspects and endorses the four technical elements (early diagnosis, prompt treatment, recognition of treatment failures and management of severe and complicated cases

in hospitals). Emphasis is also placed on malaria surveillance, preparedness for control of malaria outbreaks/epidemics and introduction of insecticide-impregnated bednets. The main constraint is the reduced capacity of the core technical unit for control of vector-borne diseases to take on activities countrywide (MIS, DG-Health, 2007).

Other diseases: Kala-azar has re-emerged since the cessation of dichlorodiphenyl-trichloroethane (DDT) spraying operations. At least 20 million people in more than 27 districts are at risk. The estimated cumulative disease-specific burden is 35 000 cases. Under the project for integrated control of vector-borne diseases, an emergency plan for the control of kala-azar was initiated in 1994–1995 in 22 *thanas* of 11 districts (population five million). The plan was successful and further expansion is now being planned. At least 8000 kala-azar patients have been successfully treated to date. The major constraint is similar to that faced in the control of malaria.

Eighteen million people in 12 districts are considered to be at risk of filariasis. A revised strategy for the elimination of filariasis is being pilot-tested in one district. This strategy involves administering a single dose of ivermectin with albendazole yearly for a period of three years to the total population in the district.

Prevention, control and management of common diseases and injuries

Acute respiratory infection (ARI) accounts for about 145 000 (33%) deaths annually among children less than five years of age (ICDDRDB 1994). Forty to sixty per cent of outdoor visits and 30-40% of indoor admissions are attributed to ARI. The programme for the control of ARI continues to be implemented on a phased basis according to the recommended WHO strategies.

Though diarrhoeal diseases continue to be responsible for significant morbidity and mortality, the current strategies have reduced mortality considerably. Multi-sectoral partners are involved in mobilizing the community regarding correct home-based care and timely referral. The availability of oral rehydration solution (ORS) has increased through the formation of ORS depots in the community. Constraints include inappropriate use of anthelmintics and anti-diarrhoeals, especially in the private sector and underutilization of health facilities.

Policy and institutional strategy

The HPSS (introduced in 1998), which forms the basis for the future national health policy, is based on several key principles: greater orientation to client needs, especially women; improved quality, efficiency and equity of government health services; provision of a package of essential health services; expanded private sector role in providing health and population services; and a one-stop shopping via co-location of services.

Some of the main objectives of the new strategy are to:

- allocate more resources to support services for the poor, and for vulnerable groups (women and children);
- unify the bifurcated health and family planning service delivery system;
- achieve an appropriate balance between the public and private sector in the financing and provision of services; and
- decentralize management through devolution of authority.

The following activities have been identified to achieve the above-mentioned objectives:

- Deliver an “essential services package” to the whole population

with the aim of maximizing health benefits, relative to per capita expenditures.

- The service delivery mechanism should be unified, restructured and decentralized at both *thana* and hospital levels. Other services, particularly at the hospital level, are proposed to be provided through partnerships with or by commissioning the services of NGOs and private, not-for-profit hospitals. The public sector hospital services delivery will be improved through greater autonomy of management, local-level accountability, “cost-recovery”, fee retention and utilization, as well as a “drug-revolving” fund. Integrated support systems should be strengthened. A sector-wide approach to manage the health sector be introduced, rather than having a series of projects with their own funding, management, implementation and reporting arrangements. In view of the potential resource gap between sectoral resources and projected sectoral expenditures, increased reliance on “cost recovery” for public sector services will be considered.
- Health insurance coverage in urban Bangladesh is proposed to be increased through development of a health insurance scheme for government employees and for employees of state-owned enterprises. At the Centre, health services will be more integrated, while at lower levels, they will be decentralized. Hospital-level services will be improved.
- The policy and regulatory framework will be strengthened. Existing policies will be reviewed and revised for improving accessibility, affordability and quality of services and for further improving affordability, quality and

safety of drugs, as well as the rational use of drugs.

- New policies on public and private sectoral mix and financing of services will be developed.

The way forward

The following are some of the possible measures that Bangladesh should take to reduce the health impacts from climate change:

- Waterborne diseases are a major public health problem in Bangladesh. Therefore, changes in climate will increase their incidence. To address such problems and to reduce the possibility of incidences of climate-sensitive diseases, initiatives such as taking policy decisions; undertaking scientific research to confirm earlier findings; and building institutional capacity to handle adverse consequences of climate change, need to be considered.
- Government agencies (e.g. Director-General, Health) should initiate surveillance measures for climate-sensitive diseases separately or include a separate component for such measures in the existing national disease surveillance programme.
- The government should develop a dataset for climate-sensitive diseases,

as well as vector data based on geographical distribution to facilitate further research and prediction.

- Health professionals need to be trained on climate change and its impacts on human health to deal with future adversity.
- The government in association with NGOs/research organizations working on climate change and health issues may initiate training programmes for health professionals.
- Awareness programmes on climate change impacts on human health would build the community's resilience.
- Considering all the relevant climate and non-climate factors, appropriate adaptation strategies to deal with climate change should be developed. A Climate Change Cell (CCC) can initiate developing such strategies in association with relevant partners and governmental/nongovernmental organizations.
- Improve water supply and sanitation management.
- Protect water resources.
- Improve hygienic practices at individual and community levels.

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