BUILDING AFRICAN CAPACITY FOR EARLY WARNING AND RESPONSE SYSTEMS THROUGH FORECASTING, PREVENTING AND MANAGING PUBLIC HEALTH EFFECTS OF CLIMATE VARIABILITY AND CHANGE

The International Network on Climate and Health for Africa

Clim-HEALTH Africa

Terms of Reference, Project Brief and Action Plan, 2014–2018
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**ISDR statement on “early warning systems”:** “People-centred early warning systems empower communities to prepare for and confront the power of natural hazards. However, the efficiency of such systems is to be measured in terms of lives saved and reduction in losses, which is directly related to the execution of an anticipated response by the people and institutions once a warning is issued”. [http://www.unisdr.org/2006/ppew/info-resources/docs/ELR_dt_23-25.pdf](http://www.unisdr.org/2006/ppew/info-resources/docs/ELR_dt_23-25.pdf)

**WHO statement on “malaria epidemic early warning systems”:** “Timely detection of cases of illness in a community or region, above the normally expected level, is vital to ensure that health authorities and policymakers are aware of the serious and immediate threat before them and to help them make decisions on effective control measures” (WHO 2001).

**Climate risk management:** Climate risk management is a systematic and coordinated process in which climate information is used to reduce the risks associated with climate variability and change, and to take advantage of opportunities, in order to improve the resilience of social, economic and environmental systems. from: R. Martinez et al, 2012: Improving Climate Risk Management at Local Level – Techniques, Case Studies, Good Practices and Guidelines for World Meteorological Organization Members (published in InTech)
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<td>African Ministerial Conference on Environment</td>
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<td>ClimDev</td>
<td>Climate for Development Programme for Africa</td>
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<td>CTT</td>
<td>Country Task Team</td>
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<td>EWS</td>
<td>Early Warning System</td>
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<td>EWRS</td>
<td>Early Warning and Response System</td>
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<td>GEO</td>
<td>Global Earth Observing System</td>
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<td>GFCS</td>
<td>Global Framework for Climate Services</td>
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<td>HESA</td>
<td>Health and Environment Strategic Alliance</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>IDSR</td>
<td>Integrated Disease Surveillance and Response</td>
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<td>IHR</td>
<td>International Health Regulations</td>
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<td>INDEPTH</td>
<td>International Network for the Demographic Evaluation of Populations and Their Health</td>
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<td>MERIT</td>
<td>Meningitis Environmental Research Information Technologies</td>
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<td>NAP</td>
<td>National Adaptation Plan</td>
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<td>SARS</td>
<td>Severe Acute Respiratory Syndrome</td>
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<td>SAC</td>
<td>Scientific Advisory Committee</td>
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<td>SMS</td>
<td>Shut Managing System</td>
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<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<td>UNFCCC</td>
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<td>ISDR</td>
<td>International Strategy for Disaster Reduction</td>
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<td>WHA</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>WMO</td>
<td>World Meteorological Organization</td>
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Summary

Climate-related public health impacts are especially pronounced in developing countries, which lack the protection of basic infrastructure and public health services. The poorest populations in Africa bear the heaviest burden of infectious diseases transmitted by insect vectors and through poor water and sanitation and unsafe food. These populations are also particularly exposed to the harmful health effects associated with exposure to chemical pollutants in air, water, food and soil. All of these health risks are highly sensitive to extreme weather events and climate variability and are exacerbated by climate change.

Clim-HEALTH Africa is a multistakeholder initiative that responds to the political will of African governments to address climate change in general and its health impacts in particular. The political momentum was provided inter alia by the Libreville Declaration on Health and Environment in Africa, the Luanda Commitment for the implementation of the Libreville Declaration, and the Framework and Plan of Action for Public Health Adaptation to Climate Change in the African Region. This initiative is a tangible contribution to the implementation of the Global Framework for Climate Services, the International Health Regulations and the Climate for Development in Africa Programme (ClimDev-Africa Programme).

The goal of Clim-HEALTH Africa is to strengthen the resilience of African countries and communities through improving the management of the effects on public health of climate variability and planning for resources for response to climate-sensitive health outcomes, moving from the current reactive to a proactive mode. To achieve this goal, Clim-HEALTH Africa works towards the main strategic directions: find, operationalize, Scale-up and sustain. Clim-HEALTH Africa is proposing a five-year project (2014–2018) with the following specific objectives:

- Develop mechanisms and institutional capacities for implementation of climate-based public health early warning and response systems in Africa;
- Develop operational public health early warning and response systems tools for planning and decision-making that address climate-sensitive health impacts;
- Utilize early warning and response systems to support timely response to climate-sensitive diseases and conditions;
- Develop and implement a communication strategy on climate change and health;
- Provide African countries at their request, especially the least developed countries and the small island developing states, priority support on urgent public health issues related to climate change.

The Clim-HEALTH Africa project will be implemented in two phases. Phase 1 will focus on strategic direction 1 and 2, while phase 2 will focus on strategic direction 3. The Clim-HEALTH Africa will support the constitution of national climate and health research and operations teams and undertake capacity building for research and operationalization of early warning and response systems using standardized methodologies and tools. The project will lead to adaptation and testing of existing prediction models in various ecosystems and to development of new models. It will facilitate optimization of the early warning and response systems through health systems research and provide opportunities for African countries to use, scale up and sustain the early warning and response systems, and thereby reduce the casualties, morbidity and mortality associated with climate variability and change.

1 Introduction

Global climate change is now a reality. The earth’s surface temperature has risen by more than 0.8 °C in the past century and by approximately 0.6 °C in the past three decades. The increase in temperature has led to extreme weather events such as floods, droughts and heavier and more frequent storms that have had negative public health impacts on vulnerable populations. In Africa, the health impacts of global warming include increased vulnerability to diseases borne by air, water and vectors, as well as malnutrition. It has been demonstrated that the majority of African countries are ill-prepared to cope with the negative impacts of climate change. These countries lack solid evidence that links health to climate change and the capacity to understand and apply climate and environmental information to decision-making and resource management. They conduct few risk assessments of the health impacts of climate change.

Climate-related public health impacts are especially pronounced in developing countries, which lack the protection
of basic infrastructure and public health services. The poorest populations in Africa bear the heaviest burden of infectious diseases transmitted by insect vectors and through poor water and sanitation and unsafe food. The livelihoods and nutritional security of millions of people on the continent, especially women and children, are heavily dependent on rain-fed agriculture and seasonal water resources. The same populations are also particularly exposed to the harmful health effects of chemical pollutants and other environmental factors through air, water, food and soil. All these health risks are highly sensitive to extreme weather events and climate variability. These risks tend to be exacerbated by climate change including in ecosystem services, which are indispensable to the well-being of all people in the world. An indirect public health impact of climate-induced changes will be observed in the distribution of productive ecosystems and availability of food, water and energy supplies. The distribution of infectious diseases, nutritional status, chemical exposure and patterns of human settlements also will be affected.

Climate services provide critical information for understanding the characteristics of hazards and their changing patterns. Forward-looking predictions and projections enable prevention and planning against climate extremes that can result in disasters or epidemic outbreaks. However, the capacity to use climate information to reduce climate-related risks is limited by knowledge gaps on the linkage between climate and environmental health and by institutional challenges hindering effective response.

Preliminary discussions were held by the WHO Regional Office for Africa with a number of institutions within and outside Africa. A consensus emerged from the discussions on priorities in international assistance to help African countries to strengthen their resilience to climate change. A number of institutions (Annex 1) agreed to participate in an international collaborative effort to support the development and operationalization of early warning and early response systems for African countries to be able to predict, prevent and manage acute public health effects of climate change. They called this new initiative the International Network for Climate and Health for Africa (Clim-HEALTH Africa).

Clim-HEALTH Africa endeavours to make a direct contribution to the implementation of the Libreville Declaration on Health and Environment in Africa, the Luanda Commitment for the implementation of the Libreville Declaration and the African Union strategy for climate change and health.

2 Terms of reference

2.1 Goal and objectives

The overall goal of Clim-HEALTH Africa is to strengthen the resilience of African countries and communities through improved management of public health effects of climate variability and resource planning for climate-sensitive health outcomes, moving from the current reactive to a proactive mode.

The objectives of Clim-HEALTH Africa are:

- To develop mechanisms and institutional capacity for implementation of climate-based public health early warning and response systems in Africa;
- To develop operational public health early warning and response systems and tools for decision-making that address climate-sensitive health impacts;
- To utilize early warning and response systems to provide timely response to climate-sensitive diseases and conditions;
- To develop and implement a climate change and health communication strategy;
- To provide African countries at their request, and especially the least developed and small island developing states, priority support on urgent public health issues related to climate change.

2.2 Guiding principles

To achieve its objectives, Clim-HEALTH Africa will be guided by the following principles:

Climate-related public health priorities in Africa: Clim-HEALTH Africa is an initiative focusing on climate-
based early warning and response systems for public health priorities in Africa. It is made up of a group of African and international institutions, including UN, academic, government and intergovernmental institutions and international and national nongovernmental organizations.

**Research for development**: The focus of Clim-HEALTH Africa is the production of quality research outputs relevant to practitioners or policy-makers. As a consequence the initiative contributes to the building of African operational research capacity. The systematic communication of research results will enhance access to research outcomes and provide a strong link between research and policy processes. In addition, Clim-HEALTH Africa will translate research outcomes into practice. It is envisaged that Clim-HEALTH Africa will have a portfolio of projects within its overarching research framework.

**Linking research to policy and practice**: Clim-HEALTH Africa will define pertinent research questions in consultation with African countries. Such questions will address Scientific, technical and operational issues relating to early warning and response systems on the ground. Mechanisms will be developed to translate research outcomes into policies and operations.

**Rational and cost-effective decision-making**: Clim-HEALTH Africa intends to develop tools for evidence-based decision-making to facilitate implementation of the most cost-effective interventions.

**Equity, gender sensitivity and sustainability**: Clim-HEALTH Africa will ensure that the principles of equity, gender sensitivity and sustainability are embedded in all its projects.

### 2.3 Scope

Clim-HEALTH Africa was established to provide internationally coordinated support to the WHO Member States in Africa to develop, use, monitor and evaluate public health early warning and response systems in order to effectively respond to public health effects of climate variability and change. This will be achieved through implementation of joint projects as described in the proposal appended to these terms of reference.

### 2.4 Functions

Clim-HEALTH Africa intends to serve as a virtual hub, where expertise is shared in order to develop the capacity of African health and climate communities, institutions, practitioners and negotiators to understand and integrate climate change challenges into policy, socio-economics, planning and programming.

The key functions of Clim-HEALTH Africa are:

- Creation of national and international multisectoral and multidisciplinary teams of climate and health scientists and practitioners;
- Training of teams and other relevant personnel to understand and use climate information for decision-making in public health;
- Building of operational, technical and institutional capacity for modelling and application of scientific models for forecasting public health effects of climate variability;
- Facilitation of the use of harmonized and standardized methodologies, protocols and tools in research and development in climate and health;
- Development of national and international research capacities in the area of climate and health;
- Development of research on climate and health;
- Technical and scientific support of country operational teams in the use of early warning and response systems;
- Advocacy and communication for increased consideration of health issues within the international climate change process;
- Resource mobilization for increased funding to African countries for the sound management of the health effects of climate change;
- Promotion of the dissemination and exchange of information on climate and health.

### 2.5 Beneficiaries

Clim-HEALTH Africa was established in response to requests from WHO Member States to the WHO Director-General in their World Health Assembly Resolution WHA 61.19 and to the WHO Regional Director for Africa through the WHO Regional Committee for Africa Resolution AFR/RC62/R2. Clim-HEALTH Africa is also a response to the request of the African Ministerial Conference on the Environment (AMCEN) in its decision SS4/1, and is a tangible contribution to the World Meteorological Organization (WMO) Global Framework for Climate
Services (GFCS). The beneficiaries of the work of Clim-HEALTH Africa are thus all the WHO Member States in Africa.

2.6 Membership

The members of Clim-HEALTH Africa will be the founding institutions (see Annex 1) and other institutions that formally express interest in membership and are endorsed by the Clim-HEALTH Africa Scientific Advisory Committee (SAC).

2.7 Organizational structure

Clim-HEALTH Africa comprises Scientific Advisory Committee (SAC) and a Coordination.

2.7.1 Scientific Advisory Committee

The Scientific Advisory Committee (SAC) is the advisory and decision-making body of Clim-HEALTH Africa. Its main function is to provide scientific and technical oversight and coordination of Clim HEALTH Africa activities in support of the Libreville Declaration. It will be composed of experts from the founding members of the Network (a chair, a secretary and members). The SAC will be responsible for:

- Strategic guidance for the projects;
- The approval of plan of work and dissemination plans for information and knowledge;
- Approval of budget and financial allocations;
- Modifications to the plan of work, including decisions to discontinue research programmes or to reduce the budget allocated to them;
- Decisions on new members based on agreed criteria;
- Election of its Chair;
- Advocating for increased consideration of health issues within the international climate change process;
- Developing and implementing a resource mobilization strategy;
- Promoting the dissemination and exchange of information on climate and health;

2.7.2 Coordination

The Clim-HEALTH Africa coordinating function will, in the first instance, be facilitated by WHO (through AFRO/PHE). The function will consist of overseeing the day-to-day management of Clim-HEALTH Africa's work: ensuring implementation of SAC decisions within WHO guidelines, convening meetings, drafting plans based on SAC recommendations, administration and budget management, and preparation of progress reports. Specific functions will be:

- To ensure the achievement of project milestones and deliverables;
- To manage the administrative, financial and other non-technical aspects of Clim-HEALTH Africa projects;
- To provide administrative assistance for project implementation;
- To assist SAC for the selection of new partners;
- To prepare the plan of work for approval by SAC;
- To support SAC for the mobilization of financial and other resources.

2.8 Modus operandi

The modus operandi of Clim-HEALTH Africa will be detailed in the Network agreement, including aspects relating to:

- Eligibility and composition of membership
- Election of key persons
- Frequency of meetings
- Rules and regulations
- Operationalization of functions
- Joint projects
- Annual work plans
- Roles and responsibilities
- Coordination of funding flows
reporting mechanisms
setting up and regular updating of working procedures

3 Project brief

3.1 Current challenges associated with climate change and health

In a world impacted by climate change and variability, climate services provide critical information for understanding the characteristics of hazards and their changing patterns and making forward-looking predictions and projections that enable prevention and planning against climate extremes that can result in disasters or epidemic outbreaks.

3.1.1 How climate affects health

Public health impacts related to climate are especially pronounced in developing countries, which lack the protection of basic infrastructure and public health services. The poorest populations in Africa bear the heaviest burden of infectious diseases transmitted by insect vectors and through poor water and sanitation and unsafe food. The livelihoods and nutrition security of millions of people on the continent, especially girls and women, are heavily dependent on rain-fed agriculture and seasonal water resources. The same populations are also particularly exposed to the harmful health effects associated with exposure to chemical pollutants through air, water, food and soil. All these health risks are highly sensitive to extreme weather events and climate variability and tend to be exacerbated by climate change (WHO/WMO 2012).

Ecosystem services are indispensable for the well-being of all people in the world. Healthy, well-functioning ecosystems enhance natural resilience to the adverse impacts of climate change and reduce the vulnerability of people. Human health is likely to be affected indirectly by climate-induced changes in the distribution of productive ecosystems and availability of food, water and energy supplies. These changes will in turn affect the distribution of infectious diseases, nutritional status, chemical exposure and patterns of human settlement.

3.1.2 Climate and disease

Vector-borne infections, diarrhoeal diseases transmitted through water and food and airborne diseases are some of the most important health burdens of the poorest communities. The burden of infectious diseases is particularly heavy in Africa.

Epidemic forms of these diseases are particularly damaging to health and health services. For example, mortality rates are comparatively higher in malaria epidemics than in endemic situations, and other mosquito-borne epidemic diseases such as dengue and chikungunya can cause high mortality and disrupt control and treatment programmes. Among water- and food-borne diseases, cholera brings high mortality rates with overloading of public health systems. Meningococcal meningitis, associated with dry conditions, causes seasonal epidemics with both acute and long-term health impacts. There is strong evidence that both the spatial distribution and triggering of epidemics of each of these diseases is associated with meteorological conditions interacting with socioeconomic and public health determinants. For example, the meningitis belt in Africa is loosely defined by isohyets with the northern limit set at 300 mm rainfall per year and the southern limit at 1100 mm (Lapeyssonie 1968). The 2008–2009 rainy season in Zimbabwe triggered the worst outbreak of cholera in recent African history, causing more than 92 000 cases and 4000 deaths from August 2008 to June 2009. Climate change is expected to alter, and in many cases exacerbate, the incidence and spatial and seasonal distribution of these and other infectious diseases such as leishmaniasis and tick-borne diseases.

Climate and environmental degradation are also linked with the transmission of diseases from animals to humans and emergence of new diseases. For example, the plague, which is transmitted by fleas that infect rodents such as the common rat, is associated with flooding, which forces the rodents to seek shelter and food from human dwellings (Ogen-Odoi et al. 2006), and with rainfall, an association that has been verified in Uganda (MacMillan et al. 2012), Madagascar and Namibia.

Over time many longstanding diseases such as hepatitis, malaria and measles and newer diseases that have emerged over the last 70 years such as HIV, Nipah, SARS, H5N1 and H1N1 have ‘jumped’ from animals to
humans. Nearly three-quarters of the new zoonotic diseases were caused by pathogens originating in wildlife. New diseases tend to emerge in geographic hot spots, with new evidence that their emergence is linked to factors that intensify animal-human interactions, including climate change, food insecurity, economic growth, and population pressure and behaviour.

3.1.3 Climate and nutrition

Malnutrition remains an underlying cause of half of the approximately 10 million annual deaths in children under age five, as well as generating long-term effects on child development (World Bank 2008). This is partly due to a lack of calories, which leads directly to protein-energy malnutrition, but more importantly is due to the interactive effect of malnutrition, which causes increased susceptibility to infectious diseases such as diarrhoea and malaria.

Extreme weather events as well as seasonal flooding and drought affect crop production and thereby food availability, particularly for subsistence farmers and those who are vulnerable to increases in food prices. Over the long term, higher temperatures and reduced and more variable precipitation associated with climate change are projected to decrease crop production, particularly in Africa, and significantly increase food insecurity and malnutrition.

Food early warning systems are currently being used in Africa and they have recently enabled food security organizations to anticipate and mitigate the impact of severe droughts in the Sahel.

In addition to their effects on food security, weather and climate affect nutritional value and food safety. For example, outbreaks of mycotoxins, which contaminate food supplies and can cause high levels of morbidity and mortality, occur in unusually warm and humid years (Muthomi et al. 2009). Increasingly, noncommunicable diseases associated with environmental threats, including salination of water supplies through the rise of sea level, threaten the health of urban and coastal communities. For example, there is emerging evidence that increased salination of water supplies not only compromises agricultural production but also increases hypertension and miscarriage among pregnant women (Khan and Islam 2011).

3.1.4 Climate and chemicals

In 2004 WHO found that globally 4.9 million deaths (8.3% of the total) and 86 million disability-adjusted life years (5.7% of the total) were attributable to exposure to a group of selected chemicals for which data were available. Children under age 15 years were found to be a highly susceptible group. Public health risks associated with chemicals occur via various exposure pathways including ingestion of contaminated water and food, inhalation of contaminated air or dusts, dermal exposure, foetal exposure during pregnancy and transfer of toxics through breast milk. In addition to identifying the health effects of high exposure levels, toxicological research has revealed mechanisms for a range of diseases in which even very low levels of exposure can influence disease risks. Individuals living in poverty, the elderly and workers, as well as infants and children (including unborn babies), are the most vulnerable and susceptible to the toxic effects of chemicals.

Climate change may alter human chemical exposure through extreme precipitation, drought and increased temperatures. Changes in temperature may affect the transformation and breakdown of chemicals, in some cases contributing to reductions in the effectiveness of vector-control measures. Extreme precipitation affects water quality by increasing runoff of agricultural and industrial chemicals. Drought threatens water quality by increasing the concentration of nonvolatile chemicals and toxic metals. The effect on humans of chemical exposure will vary widely according to the properties of the specific chemicals, chemical combinations, soil and water conditions, wind patterns, topography, land use, level of development, and human population characteristics.

3.2 Justification

3.2.1 Political opportunities

The Libreville Declaration: The African ministers of health and ministers of environment in their 2008 Libreville Declaration on Health and Environment committed themselves “to establish or strengthen systems for health and environment surveillance to allow measurement of interlinked health and environment impacts and to identify emerging risks in order to manage them better”. In addition, to accelerate the implementation of the Libreville Declaration, they undertook in their 2010 Luanda Commitment “to acquire or strengthen by 2014 (i) national core
capacities to forecast and prevent communicable and non-communicable diseases to the extent possible and in a way that contributes significantly to a reduction of their incidence and their related morbidity and mortality especially in children and vulnerable population, and (ii) national core capacities to ensure continued delivery of ecosystems goods and services in support of human health and well-being taking into account climate change”.

The Framework for Public Health Adaptation to Climate Change in the African Region: WHO, in collaboration with UNEP and with the support of the African Development Bank, led the development of a Framework for Public Health Adaptation to Climate Change in the African Region. The Framework was endorsed in September 2011 by the ministers of health of the WHO African Region at the 61st Session of the Regional Committee for Africa (Resolution AFR/RC61/R2). It was adopted by the African ministers of environment at the 4th Special Session of the African Ministerial Conference on Environment (Decision SS4/1).

In early 2012, a plan of action for the period 2012–2016 was prepared to support the implementation of the Framework. It was endorsed by 38 African countries. The project that is the subject of this report is a direct response to the stated objectives of the Framework and its action plan to provide a scientifically founded and evidence-based coordinated response to the needs of African countries to adapt to climate change.

National adaptation programmes (NAPs): Created under the global United Nations Framework Convention on Climate Change (UNFCCC) agenda, the NAP process aims to provide support for medium- and long-term adaptation planning with a special focus on the least developed countries. WHO is currently supporting countries to plan the health component of their national adaptation programmes, which include early warning and response systems as a key element of the plans to build resilience of health systems and communities to the adverse health effects of climate variability and change.

Global Framework for Climate Services: Recognizing the growing need to support decision-making with science-based climate information and predictions in climate-sensitive sectors or activities, the heads of state and government ministers present at the Third World Climate Conference decided to establish the Global Framework for Climate Services (GFCS). GFCS aims to catalyse efforts to facilitate the management of risks and opportunities arising from climate variability and change and adaptation needs.

GFCS is built upon five pillars essential to address the whole climate services value chain from production to effective use, namely, the user interface platform; climate service information system; observations and monitoring; research, modelling and prediction; and capacity development. For these to be realized GFCS will promote institutional and disciplinary interactions and partnerships, building on the strengths of the various stakeholders. To address the needs of the public health communities for climate products and information, the user interface platform and the research, modelling and prediction components of GFCS will address the gaps in knowledge and work towards developing and endorsing the methods and tools needed to produce reliable climate and climate health information and forecasts on various time scales. One goal of the operational components of GFCS is to support effective climate risk management, which will require continual flow of information and its routine application on all time frames ranging from the present scale to the century scale, and will need to include analysis and assessment of historical climate information. A major development in climate services in Africa is the creation of ClimDev-Africa.

ClimDev-Africa: The Climate for Development in Africa Programme (ClimDev-Africa Programme) is an initiative of the African Union Commission, the United Nations Economic Commission for Africa (UNECA) and the African Development Bank (AfDB) and is mandated at the highest level by African leaders. This programme was established to create a solid foundation for the African response to climate change. The ClimDev-Africa work plan organizes activities into three results areas:

- Widely available climate information, and information packaging and dissemination;
- Quality analysis for decision support and management practice;
- Informed decision-making, awareness and advocacy.

Through activities in each of the results areas, ClimDev-Africa aims to construct a solid foundation in Africa for the response to climate change based on the (i) building a solid Science and observational infrastructure; (ii) enabling strong working partnerships involving government institutions, the private sector, the civil society and vulnerable communities; and (iii) creating and strengthening knowledge frameworks to support and integrate the actions required to address climate change and development across Africa.
International Health Regulations, 2005: International Health Regulations, 2005 (IHR) were adopted by the WHO World Assembly in 2005 and came into force on 15 June 2007. The goal of IHR is to improve global health security. IHR provide an opportunity and global platform for early detection of any outbreak and improved public health surveillance and response capacities. Clim-HEALTH Africa will contribute to the implementation of IHR and other efforts related to international health security.

3.2.2 Technical and training opportunities

Advances in climate sciences, computing and telecommunications now allow generation of forecasts ranging from a few hours to many years and climate projections. In addition, country-led integration of observations and global products has provided a new opportunity for user communities to access high quality information at the national level. These new capabilities allow the production and delivery of services whose application offers great benefits for many socioeconomic sectors that are climate sensitive. In addition, new field-based epidemiological data-gathering tools, including Shut Managing System and rapid diagnostic kits, have dramatically improved the opportunity for increasing resilience of communities to weather and climate-related health emergencies if information is integrated and presented in an actionable manner to proactive decision-makers.

Integrating climate knowledge and information into epidemiological training: There are several training opportunities for integration of climate change. These include the field epidemiology and laboratory training programmes, which are the most elaborate training programmes for developing competencies in field epidemiology, and the current IHR international courses developed by WHO and partners, which support Member States in their effort to strengthen their surveillance, alertness and response to public health events.

Integrated Disease Surveillance and Response: Countries in the WHO African Region are implementing the Integrated Disease Surveillance and Response (IDSR) strategy. IDSR focuses on a selected number of diseases including epidemic and climate-sensitive diseases such as malaria and cholera. IDSR data are being used to assess the impact of climate on meningitis epidemics in the Sahel (Perez et al. submitted) and malaria in Eritrea and Ethiopia (Graves et al. 2008, Thomson et al. 2012). So far limited attempts have been made to integrate environmental data with public health data generated by IDSR implementation for comprehensive and simultaneous action on both disease determinants and their outcomes. This has delayed epidemic detection and response. IDSR implementation is facing several challenges, one of which is the difficulties to provide timely data for immediate decision-making. The use of climate signals that precede disease outbreaks would vastly improve the decision-making process and that way improve the interventions.

Advancing current and developing new early warning systems: A number of early warning systems to forecast adverse health events in Africa have been developed building on the experience of the famine early warning community (Buchanan-Smith et al. 1995). However, other needs have come up including those for nutrition. Most work has been undertaken in the context of malaria, where WHO established a framework for early warning systems for the prevention and control of epidemics (WHO 2001). The office of the Southern Africa Malaria Control unit of WHO used that framework to establish malaria early warning systems in southern Africa (DaSilva 2004). A component of early warning and response systems is the creation of predictive models that incorporate climate information, such as that of Githeko et al. (2001) that was developed to provide early warning of epidemics in the East African highlands. That model and others that are based on routine monitoring of rainfall and temperature have a potential lead time of two to three months between the predictions and the onset of the epidemics, owing to the nature of the epidemic curve. Similar efforts have been developed in Ethiopia with funding from Norway. Such lead times can be extended to four to five months using seasonal climate forecasts (Thomson et al. 2006). Other early warning systems currently used in Africa include those of Anyamba et al. (2006) for Rift Valley fever. Research associated with the MERIT (Meningitis Environmental Research Information Technologies) initiative is being undertaken to develop early warning systems for meningitis and cholera (Fernández et al. 2009). A number of these activities have been initiated or strengthened, including EWS on cholera, through the international coordination mechanism of GEO.

Although these models have existed for several years, their wide application and use by national public health programmes to manage disease outbreaks and epidemics have remained very limited. One of the underlying issues is the applicability of the modelling systems in various ecosystems for diseases other than malaria. Applied research is required to adapt the existing models for application in different climate variability and change scenarios, taking into consideration other environmental factors that may prevail in these local ecosystems.
African countries more than other countries need to use early warning and early response systems to forecast, prevent and manage public health impacts of climate variability and change. However, currently only a limited number of institutions specialize in climate services, especially with a focus supporting such public health functions. Only a very few African scientists have worked to develop predictive models. In contrast many institutions in the United States and Europe have a longstanding history in the development of climate science, technology and weather services, including their application in public health.

3.3 Goal

The goal of the Clim-HEALTH Africa is to strengthen the resilience of African countries and communities through improved management of public health effects of climate variability and resource planning for climate-sensitive health outcomes, moving from the current reactive to a proactive mode.

3.4 Strategic Directions

The work of Clim-HEALTH Africa will follow the 3 main strategic directions below:

(i) Find: Development and field-testing of real-time forecasts and climate-informed planning methods for national decision-making to address climate-sensitive health impacts (find);

(ii) Operationalize: Translation of research outcomes from real-time forecasting and climate risk management to timely support and deployment of essential environmental and public health interventions to mitigate the short- and medium-term impacts of climate-sensitive diseases and conditions;

(iii) Scale-up and sustain: Scaling up and sustaining the use of early warning and early response systems to prevent and mitigate public health impacts of climate variability and change in Africa.

3.5 Outputs

The expected outputs of the project are:

- Databases, historical epidemiological data, communities maps, and tested and validated models;
- Strengthened research capacity in Africa and elsewhere through specific research and training programmes at master’s and doctoral levels;
- Strengthened operational capacities of public health programmes for surveillance, early detection and response to climate-sensitive health conditions;
- Protocols, guidelines and operational systems integrated with existing planning processes;
- Evidence of improved timeliness of preparedness for cost-effective responses to the effects of extreme weather events;
- Establishment of links with existing initiatives, engagement of stakeholders and use of recommendations to prioritize actions;
- Strengthened national epidemiological and climate data collection infrastructure;
- Strengthened national capacity for climate data analysis and use in public health decision-making;
- Mapping of geographic areas most at risk of climate-sensitive epidemics or outbreaks due to climate variability;
- Creation of new models and improvement of existing models applied to predict epidemics or outbreaks of climate-sensitive diseases.

3.6 Project implementation

The Clim-HEALTH Africa initiative will be implemented in two phases:

**Phase 1** will focus on delivering on strategic directions 1 and 2, that is to (i) develop forecasts and climate-based

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1 A systematic and coordinated process in which climate information is used to reduce the risks associated with climate variability and change, and to take advantage of opportunities, in order to improve the resilience of social, economic and environmental systems.
planning methods for decision-making on climate-sensitive health impacts; and (ii) translate research outcomes forecasting and climate risk management to support timely deployment of essential environmental and public health interventions to mitigate the short- and medium-term impacts of climate-sensitive diseases and conditions;

**Phase 2** will deliver on strategic direction 3, that is to scale up and sustain the use of early warning and early response systems to prevent and mitigate public health impacts of climate variability and change in Africa.

This project brief focuses on Phase 1, whose specific objectives are:

- To develop mechanisms and institutional capacity for implementation of climate-based public health early warning and response systems in Africa;
- To develop operational early warning system tools for climate-based planning and decision-making that address climate-sensitive health impacts;
- To utilize the early warning systems to support timely response to climate-sensitive diseases and conditions;
- To develop and implement a communication strategy for climate change and health in Africa.

### 3.7 Major activities

#### 3.7.1 Constitution of national teams

At the national level, the initiative will require a multidisciplinary team bringing together various public health and meteorology experts and biostatisticians. Short-term training will be required for the teams on basic knowledge of disease transmission, the role of climate and environment in disease transmission, the process of climate change and variability, statistics, computer data management, and basic computer programming. Each country will need to have a climate and human health research group.

#### 3.7.1 Standardization of methodologies and protocols

The project, especially its research component, will require that all methodologies, protocols and working procedures be standardized or harmonized to ensure consistency and comparability of results throughout the project cycle and between study sites. To that end and as a first step thematic working groups in the different areas of work will be constituted to establish working standards wherever that will be necessary. In the second step, specific workshops and training of researchers on the agreed methodologies, protocols and procedures will be undertaken before the initiation of the project’s research activities.

#### 3.7.2 Selection of priority areas and data collection, collation and analysis

The project will identify priority areas in vulnerable ecosystems and collect available disease data going back as far as 20 years. Identification of priority areas will be based on the following criteria:

- availability of long-term historical data
- significant prevalence or incidence of at least one climate-sensitive disease or climate-sensitive risk factor
- identified vulnerable populations

In each project site available climate data will be collated, curated and computerized. Meteorological stations with long-term data will be accessed and automatic stations for the collection of new data installed. Climate data outputs will be generated for use as baseline data for the development, field-testing or validation of the various models. A similar approach will be used with epidemiological data, using health facility records and other relevant sources of information, such as the health information systems or formal publications. Demographic analysis will be conducted to clearly identify and characterize vulnerable population groups by type of climate-sensitive disease or condition.

#### 3.7.3 Adaptation and testing of existing models in various ecosystems and settings and development of new models

This project will support and supplement IDSR as well as develop intervention strategies that will allow minimizing of negative impacts of climate variability on public health and that use the early epidemic or outbreak predictive
models. The project will support the development of a central database for climate and public health. Each country will integrate all climate and health data into its surveillance systems. It will integrate climate information with epidemiological data and demographic data. Statistical analyses will be carried out to understand the underlying association between climate or non-climatic variables and the variations in disease incidence in populations.

The project will first consider existing predictive models and undertake the necessary research to adapt and validate the data in areas where both long-term historical climate data will be available, such as those sites where strong historical demographic and health data already exist and are analysed by the INDEPTH Network (2012).

Research will subsequently be undertaken to develop additional predictive models and early warning and early response systems for other climate-sensitive diseases and conditions, including projections on malnutrition and the impact of climate variability and change on increased exposure to chemicals.

3.7.4 Health systems research for operationizing and optimizing early warning and response systems

An early warning system is understood to be the mathematical model and the set of procedures under which it operates to predict the occurrence of an event. Therefore, once the models are developed, field-tested and validated it will be essential to understand very clearly the functioning of the local health systems where they will be applied. Specific knowledge will be generated on all relative aspects of the health systems, including the decision-making processes, key strategic and operational actors at all levels, procedures for allocation of resources, processes for planning of interventions, supervision, and monitoring and evaluation. Such understanding will be required to design operating procedures for effective use of the models, taking into account the specificities of the local context.

3.7.5 Development and field-testing of operational procedures for decision-making for timely deployment of interventions

Based on the knowledge generated, operating procedures will be designed and operationalization of the early warning and response systems initiated. To that end a large-scale, real-life situation will be sought for the application of the systems. Linkages will be established with national disaster risk-reduction committees to participate in field-testing and rolling out of the model. This will ensure that in the event of an epidemic all the necessary preparedness actions and resources will be in place to provide an adequate response.

3.7.6 Cost-effectiveness and cost-benefit analysis of early warning and response systems

For the early warning and response systems to be sustained over time they will have to be proven as cost-effective. This implies that at the very least their application will result in cost savings on resources that could have been used to manage the adverse effects of climate events.

3.7.7 Implementation strategy: a multistakeholder approach

The development and operationalization of the early warning and response systems requires that many scientific disciplines be connected, such as climate science, meteorology, demography, epidemiology, statistics, computer science, public health, social sciences, health economics etc. Various organizations are working in one or more of these disciplines but it is rare that a single organization will have all the necessary competencies to develop and apply early warning systems. Therefore a multistakeholder approach involving multidisciplinary and transdisciplinary teams is to be used to deliver on the project objectives. In this context, each organization that is a member of the Network will have a specific role based on its area of expertise or mandate and taking into account its comparative advantage. This will allow synergy and complementarity. The project will build on existing initiatives such as GFCS, ClimDev-Africa, HESA, IDSR, One Health Initiative, IHR, etc. and contribute to the achievement of their objectives.

Capacity building will be a key component in this project. There is a shortage of climate and health scientists in Africa to support the fast-moving climate change and health agenda. Therefore, efforts will be made to offer
hands-on training courses to public health practitioners so that as early warning and response systems are developed and field-tested there will be operational capacity in the countries to understand and use them effectively.

One key strategy of this project is the development of a doctoral programme to breed a new generation of young African and non-African climate and health scientists. To this end, the project will create hubs based at technical and scientific institutions that will be part of the Network. Ideally each hub will specialize in one project theme and will host a number of doctoral research topics defined to deliver on the project objectives. The best candidates will be selected from applicants by an ad-hoc Scientific committee. A small grant scheme will provide the selected candidates a stipend and funds for their project activities. Supervisors will be senior scientists belonging to the Network member institutions. Resources will be made available so that the supervisory role can be conducted effectively. An exchange of students between institutions for short periods is envisaged. The project will have a five-year action plan and will develop annual workplans.

### 3.7.8 Beneficiaries

The beneficiaries will be all African countries. Ministries of health and ministries of environment have created health and environment strategic alliances and have established country coordination mechanisms known as country task teams. These teams will be the main technical coordination bodies at the country level. The country task teams (CTT) will serve as the interface between the beneficiary governments and the national technical institutions that will be identified as implementing institutions at the country level. It is considered, given the specificity of the work to be implemented, that the ministries of health and their public health programmes will not have the appropriate environment or adequate capacity to be directly involved in project implementation. Therefore they will be requested to delegate the functions required for project implementation to a relevant research or academic institution.

### Action plan 2014–2018

<table>
<thead>
<tr>
<th>Specific objectives and outputs</th>
<th>Activities</th>
<th>Responsible</th>
<th>Budget (USD)</th>
<th>Time frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific Objective 1: To develop mechanisms and institutional capacities for implementation of climate informed public health EWRS in Africa</td>
<td>Output 1.1. Clim-HEALTH Africa is formally established</td>
<td>1.1.1 Develop and reach consensus on the terms of reference and modus operandi agreed upon by founding institutions</td>
<td>60 000</td>
<td>1.1.1 Year 1</td>
</tr>
<tr>
<td></td>
<td>1.1.2 Develop a proposal for the establishment of Clim-HEALTH Africa</td>
<td>1.1.2 Coordination and founding institutions</td>
<td>1.1.2 Year 1</td>
<td></td>
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<tr>
<td></td>
<td>1.1.3 Draw up letters of commitment defining roles and responsibilities of Network members (MoUs) as needed</td>
<td>1.1.3 Coordination</td>
<td>1.1.3 Year 1</td>
<td></td>
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<tr>
<td></td>
<td>1.1.4 Establish a SAC</td>
<td>1.1.4 Coordination</td>
<td>1.1.4 Year 1</td>
<td></td>
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<tr>
<td></td>
<td>1.1.5 Map international and national initiatives, including information on Network members’ capabilities and involvement of relevant stakeholders in existing processes (e.g. GFCS, NAPs, IHR, DRR, IDSR)</td>
<td>1.1.5 Coordination and founding institutions</td>
<td>1.1.5 Year 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.6 Design and implement a monitoring and evaluation framework</td>
<td>1.1.6 Coordination and founding institutions</td>
<td>1.1.6 Years 2 to 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1.7 Design and implement a reporting framework and frequency</td>
<td>1.1.7 Coordination and founding institutions</td>
<td>1.1.7 Years 1 to 5</td>
<td></td>
</tr>
</tbody>
</table>
### Output 1.2. National capacity developed to ensure that EWRS are integrated into national surveillance systems.
- 1.3. A community of scientists, technical experts and decision-makers that works collaboratively to create and implement the EWRS established

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible Parties</th>
<th>Year(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2.1. Advise relevant national institutions to assign appropriate staff to country teams</td>
<td>1.2.1. WHO</td>
<td>2,200,000</td>
</tr>
<tr>
<td>1.2.2. Establish multidisciplinary country teams at the national level</td>
<td>1.2.2. WHO</td>
<td>1.2.2. Year 1</td>
</tr>
<tr>
<td>1.2.3. Define and prioritize country needs relating to data, tools training, etc.</td>
<td>1.2.3. Country teams</td>
<td>1.2.3. Year 1</td>
</tr>
<tr>
<td>1.2.4. Develop and use training modules for country teams</td>
<td>1.2.4. IRI, NOAA, other Network members, country teams</td>
<td>1.2.4. Years 1 to 5</td>
</tr>
<tr>
<td>1.2.5. Facilitate access to available financial resources</td>
<td>1.2.5. Network</td>
<td>1.2.5. Years 1 to 5</td>
</tr>
<tr>
<td>1.2.6. Recommend revision of national surveillance systems to incorporate environmental factors into the early years</td>
<td>1.2.6. WHO</td>
<td>1.2.6. Years 2 to 5</td>
</tr>
</tbody>
</table>

### Output 1.4. Collaborative research needed to improve effectiveness and utilization of EWRS conducted

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible Parties</th>
<th>Year(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4.1. Identify research gaps from pilot projects and country needs assessments</td>
<td>1.4.1 Network, PhD students, country teams</td>
<td>4,040,000</td>
</tr>
<tr>
<td>1.4.2. Develop and conduct collaborative research</td>
<td>1.4.2 Network, PhD students, country teams</td>
<td>1.4.2 Years 2 to 5</td>
</tr>
<tr>
<td>1.4.3 Disseminate research results and seek buy-in of country stakeholders</td>
<td>1.4.3 WHO, Network, PhD students, country teams</td>
<td>1.4.3 Years 2 to 5</td>
</tr>
</tbody>
</table>

### Specific Objective 2: To develop operational public health early warning system tools for climate informed planning and decision-making that address climate-sensitive health impacts

<table>
<thead>
<tr>
<th>Output 2.1. Protocols and methodologies standardized</th>
<th>Activity</th>
<th>Responsible Parties</th>
<th>Year(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1. Establish thematic expert working groups in different health areas, e.g. malaria, meningitis, heat stress, cholera</td>
<td>2.1.1. malaria institutions including MRTC, Mali, KEMRI, NIMR, IRI, WHO and others; Heat Stress-MRC/SA; cholera institutions including Berg-en-Dal Group (CSIR, NOAA), WHO and others; meningitis institutions including MERIT SAC (WHO, HCF, IRI), and other supporting institutions (ACMAD, IRI, INDEPTH, NOAA, NOGUCHI)</td>
<td>3,200,000</td>
<td>2.1.1 Year 1</td>
</tr>
<tr>
<td>2.1.2. Organize thematic workshops by pilot project to review and standardize methods and protocols for demographic, meteorological and epidemiological studies as well as for modelling, following the WHO EWS framework, which includes vulnerability, forecasting, environmental monitoring and surveillance</td>
<td>2.1.2 same as 2.1.1</td>
<td>2.1.2 Years 1 to 3</td>
<td></td>
</tr>
<tr>
<td>2.1.3. Provide standardized methods and protocols to country teams</td>
<td>2.1.3 WHO, SAC</td>
<td>2.1.3 Years 2 to 5</td>
<td></td>
</tr>
<tr>
<td>2.1.4. Organize briefing and training sessions for project teams including staff and researchers on standardized methods and protocols</td>
<td>2.1.4 same as 2.1.1</td>
<td>2.1.4 Years 2 to 5</td>
<td></td>
</tr>
</tbody>
</table>
Output 2.2. Priority pilot projects identified and implemented

2.2.1. Assess existing early warning systems for health topics identified in 2.1.1

2.2.2 Establish selection criteria for identification of project countries and sites

2.2.3 Select project site

2.2.4 Assess vulnerability of site population to adverse health effects of climate change and variability

2.2.5 Develop project plans, including assessment of infrastructure and resource needs

2.2.6 Undertake integrated baseline data collection, analysis and management

2.2.7 Undertake additional project data collection

2.2.8 Develop and test data integration and other relevant information technologies

Output 2.3. Existing models adapted and tested in various ecosystems and settings and new models developed as part of the pilot projects

2.3.1. Assess and evaluate existing models

2.3.2 Adapt existing models or develop new models

2.3.3. Initiate testing and validation of models based on agreed standard methods and protocols

2.3.4. Complete validation and finalization of models

2.3.5. Identify critical climate and earth observation requirements for feedback to climate and earth observation communities (GEO, NOAA, NASA, IRI, CEOS, national met agencies, etc.)

2.3.6 Identify critical climate forecast, time and spatial scales for operational needs

2.3.7 Develop a central database for climate and public health

2.3.8. Integrate climate and health data into current national surveillance systems

2.4. Next generation of African experts on climate-informed EWRS research capacity strengthened at national and international levels

2.4.1. Establish a multidisciplinary advisory group within the Scientific committee for the PhD programme

2.4.2. Define PhD topics to be addressed by the pilot projects and hubs

2.4.3. Initiate a call for applications in African countries and institutions and non-African institutions that are members of the Network

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<table>
<thead>
<tr>
<th>Output 2.2. Priority pilot projects identified and implemented</th>
<th>2.2.1. Assess existing early warning systems for health topics identified in 2.1.1</th>
<th>2.2.1. As in 2.1.1, country teams, project teams</th>
<th>840 000</th>
<th>2.2.1 Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.2 Establish selection criteria for identification of project countries and sites</td>
<td>2.2.2 SAC, Coordination and Network</td>
<td>2.2.2 SAC, 2.2.4 WHO, country teams, project teams</td>
<td></td>
<td>2.2.2 Years 1 to 2</td>
</tr>
<tr>
<td>2.2.3 Select project site</td>
<td>2.2.3 Coordination, Network, country teams, project teams</td>
<td></td>
<td></td>
<td>2.2.3 Year 2</td>
</tr>
<tr>
<td>2.2.4 Assess vulnerability of site population to adverse health effects of climate change and variability</td>
<td>2.2.4 Coordination, Network, country teams, project teams</td>
<td></td>
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<td>2.2.4 Years 1 to 2</td>
</tr>
<tr>
<td>2.2.5 Develop project plans, including assessment of infrastructure and resource needs</td>
<td>2.2.5 Network, country teams, project teams</td>
<td></td>
<td></td>
<td>2.2.5 Years 2 to 5</td>
</tr>
<tr>
<td>2.2.6 Undertake integrated baseline data collection, analysis and management</td>
<td>2.2.6 Same as 2.1.1, country teams, project teams</td>
<td></td>
<td></td>
<td>2.2.6 Years 2 to 5</td>
</tr>
<tr>
<td>2.2.7 Undertake additional project data collection</td>
<td>2.2.7 Same as 2.1.1, country teams, project teams</td>
<td></td>
<td></td>
<td>2.2.7 Years 2 to 5</td>
</tr>
<tr>
<td>2.2.8 Develop and test data integration and other relevant information technologies</td>
<td>2.2.8 Same as 2.1.1, country teams, project teams</td>
<td></td>
<td></td>
<td>2.2.8 Years 2 to 5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output 2.3. Existing models adapted and tested in various ecosystems and settings and new models developed as part of the pilot projects</th>
<th>2.3.1. Assess and evaluate existing models</th>
<th>2.3.1 Same as 2.1.1, country teams, project teams</th>
<th>3 400 000</th>
<th>2.3.1 Years 2 to 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.3.2 Adapt existing models or develop new models</td>
<td>2.3.2 Same as 2.1.1</td>
<td></td>
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<td>2.3.2 Years 2 to 3</td>
</tr>
<tr>
<td>2.3.3. Initiate testing and validation of models based on agreed standard methods and protocols</td>
<td>2.3.3 Same as 2.1.1, country teams, project teams</td>
<td></td>
<td></td>
<td>2.3.3 Years 3 to 4</td>
</tr>
<tr>
<td>2.3.4. Complete validation and finalization of models</td>
<td>2.3.4 Same as 2.1.1, country teams, project teams</td>
<td></td>
<td></td>
<td>2.3.4 Years 4 to 5</td>
</tr>
<tr>
<td>2.3.5. Identify critical climate and earth observation requirements for feedback to climate and earth observation communities (GEO, NOAA, NASA, IRI, CEOS, national met agencies, etc.)</td>
<td>2.3.5 Country teams, project teams</td>
<td></td>
<td></td>
<td>2.3.5 Years 3 to 5</td>
</tr>
<tr>
<td>2.3.6 Identify critical climate forecast, time and spatial scales for operational needs</td>
<td>2.3.6 Country teams, project teams</td>
<td></td>
<td></td>
<td>2.3.6 Years 4 to 5</td>
</tr>
<tr>
<td>2.3.7 Develop a central database for climate and public health</td>
<td>2.3.7 WHO, IRI data library</td>
<td></td>
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<td>2.3.7 Years 3 to 5</td>
</tr>
<tr>
<td>2.3.8. Integrate climate and health data into current national surveillance systems</td>
<td>2.3.8 Country teams, project teams; same as 2.1.1</td>
<td></td>
<td></td>
<td>2.3.8 Years 4 to 5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.4. Next generation of African experts on climate-informed EWRS research capacity strengthened at national and international levels</th>
<th>2.4.1. Establish a multidisciplinary advisory group within the Scientific committee for the PhD programme</th>
<th>2.4.1 SAC, Coordination</th>
<th>3 000 000</th>
<th>2.4.1 Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4.2. Define PhD topics to be addressed by the pilot projects and hubs</td>
<td>2.4.2 SAC, Coordination</td>
<td></td>
<td></td>
<td>2.4.2 Years 1 to 2</td>
</tr>
<tr>
<td>2.4.3. Initiate a call for applications in African countries and institutions and non-African institutions that are members of the Network</td>
<td>2.4.3 SAC, Coordination</td>
<td></td>
<td></td>
<td>2.4.3 Year 2</td>
</tr>
</tbody>
</table>
2.4.4. Select and assign students to the various topics and institutions
2.4.4 SAC, Coordination, expert reviewers
2.4.4 Year 2

2.4.5. Identify supervisors
2.4.5 SAC, Coordination, PhD students, academic institutions
2.4.5 Year 2

2.4.6. Ensure provision of resources for the PHD programme, including supervisory activities
2.4.6 Coordination, academic institutions, country
2.4.6 Years 2 to 5

2.4.7. Provide equipment, supplies and technical resources to country teams
2.4.7 same as 2.4.6
2.4.7 Years 2 to 5

2.4.8. Ensure provision of resources for the PHD programme, including supervisory activities
2.4.8 Coordination, academic institutions, country
2.4.8 Years 2 to 5

2.5.1. Establish criteria and identify potential reference centres
2.5.1 WHO, SAC, Network
2.5.1 Year 3 or 4

2.5.2 Develop country hosting agreement and plan of action
2.5.2 WHO, Network, country teams
2.5.2 Years 3 to 4

2.5.3. Mobilize human and financial resources
2.5.3 WHO, SAC, Network, countries
2.5.3 Years 4 to 5

2.5.4. Establish technical and Scientific hubs based at institutions that are part of the Network
2.5.4 WHO, SAC, Network, countries
2.5.4 Years 4 to 5

Specific Objective 3: Utilize early warning systems to support timely response to climate-sensitive diseases and conditions

Output 3.1. Health system strengthened to operationalize and optimize the use of EWRS
3.1.1. Assess existing capacities and needs of national health systems to add climate-informed EWRS into existing surveillance and response systems
3.1.1 WHO, SAC, Network, country teams, project teams
600 000
3.1.1 Years 3 to 5

3.1.2 Coordination, Network, country teams, project teams
3.1.2 Year 3

3.1.3 Coordination, WHO, donors, Network, country teams, project teams, recipient countries
3.1.3 Year 3

3.1.4 Coordination, country teams, project teams, recipient countries
3.1.4 Years 3 to 5

3.1.5 Coordination, recipient countries, donors
3.1.5 Years 3 to 5

3.1.5 Monitor implementation process and use of resources in recipient countries

Output 3.2. EWRS operationalized and scaled up
3.2.1. Develop standard operating procedures to implement and institutionalize early warning systems
3.2.1 WHO, SAC, country teams, project teams
4 200 000
3.2.1 Year 4

3.2.2 Organize national dissemination workshops with stakeholders, e.g. DRR committees, with focus to include mapping of relevant initiatives at the national level to ensure adequate linkages
3.2.2 WHO, SAC, relevant ministries and institutions
3.2.2 Years 4 to 5

3.2.3. Train relevant government teams in the use of the EWRS
3.2.3 WHO, SAC, country teams, project teams, recipient countries
3.2.3 Years 4 to 5

3.2.4 Formally transfer to pilot projects implementation of EWRS among operational entities
3.2.4 WHO, SAC countries
3.2.4 Year 5

3.2.5. Develop, field-test and implement procedures for activating national preparedness and response actions in case of alerts
3.2.5 WHO, Coordination, countries
3.2.5 Years 3 to 5
### Output 3.3. EWRS evaluated

3.3.1. Define evaluation criteria  
3.3.1 WHO, SAC, Coordination, Network, country teams, project teams, countries  
200 000  
3.3.1 Years 2 to 3

3.3.2. Undertake analysis of cost-effectiveness, cost-to-benefit, impact, user satisfaction and sustainability  
3.3.2 WHO, Coordination, countries, external expert group  
3.3.2 Years 5 to 6

### Objective 4: Develop and implement a communication strategy for the Network

<table>
<thead>
<tr>
<th>Output 4.1. Communication plan developed and implemented</th>
<th>4.1.1 Develop and disseminate communication materials for specific target audiences and identify appropriate communication channels, e.g. web, press, publications, etc.</th>
<th>4.1.1 WHO, Coordination, Network, external communications expert</th>
<th>400 000</th>
<th>4.1.1 Years 1 to 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.1.2 Organize regular meetings involving the Network and stakeholders</td>
<td>4.1.2 Coordination</td>
<td>4.1.2 Years 1 to 5</td>
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<tr>
<td></td>
<td>4.1.3 Engage with other partners such as GEO, GFCS and WMO</td>
<td>4.1.3 WHO, SAC, SAC, Network</td>
<td>4.1.3 Years 1 to 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.1.4 Provide regular briefings to donors</td>
<td>4.1.4 Coordination</td>
<td>4.1.4 Years 1 to 5</td>
<td></td>
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<tr>
<td></td>
<td>4.1.5 Make presentations at Scientific meetings and policy colloquia</td>
<td>4.1.5 SAC, Coordination, Network, country teams, project teams, countries, PhD students</td>
<td>4.1.5 Years 1 to 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.1.6 Organize high-level advocacy meetings</td>
<td>4.1.6 WHO, SAC</td>
<td>4.1.6 Years 1 to 5</td>
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<td></td>
<td>4.1.7 Disseminate best practices to other countries or projects</td>
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<td>4.1.7 Years 4 to 5</td>
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</tr>
</tbody>
</table>

**Output 4.2 A functional Coordination for Clim-HEALTH Africa**

4.2.1 Recruit staff (one coordinator and one assistant)  
6 500 000  
Years 1 to 5

4.2.2 Running costs  

**Total Budget**  
30 920 000
Annex 1: Founding institutions of Clim-HEALTH Africa

African Centre of Meteorological Applications for Development (ACMAD)
Biotechnology Centre, University of Yaoundé I, Cameroon
Kenya Medical Research Institute (KEMRI), Kenya
International Network for the Demographic Evaluation of Populations and Their Health (INDEPTH)
International Research Institute for Climate and Society (IRI), Columbia University, USA
Malaria Research and Training Centre (MRTC), University of Bamako, Mali
Medical Research Council (MRC), South Africa
National Institute for Medical Research (NIMR), Tanzania
Noguchi Memorial Institute for Medical Research, Accra, Ghana
National Aeronautics and Space Administration (NASA), USA
National Oceanic and Atmospheric Administration (NOAA), USA
United Nations Environment Programme (UNEP)
World Health Organization (WHO)
World Meteorological Organization (WMO)
References


Thomson MC et al. Development of climate analysis section for the President’s Malaria Initiative impact evaluation, Reports for Ethiopia and Tanzania, President’s Malaria Initiative USAID Report: IRI, August 2012.


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