REPORT OF THE CAPACITY BUILDING TRAINING WORKSHOP ON REDUCING THE IMPACTS OF CLIMATE EXTREMES ON HEALTH

(Nairobi, Kenya, 11 – 15 February 2002)

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1. INTRODUCTION

1.1 Workshop objectives

The overall objective of the workshop was to build the capacity of the health professionals and climate scientists in the nations of the Greater Horn of Africa (GHA) sub-region on practical applications of climate information and prediction services in the health sector for improved decision-making and better management of health services.

The objective was achieved through lectures, practical demonstrations, laboratory exercises, plenary discussions, and field excursions. In addition, the World Meteorological Organization (WMO) provided the participants with material in form of brochures, Compact Discs (CDs) and other publications containing detailed information on linkages between weather, climate and health.

1.2 Workshop participation/organization

The workshop attracted participants from all countries who are members of the Drought Monitoring Centre, Nairobi (DMCN), i.e. Burundi, Djibouti, Ethiopia, Kenya, Tanzania, Eritrea, Sudan, Rwanda, Somalia, and Uganda. It was initially anticipated that only twenty participants would attend the workshop, namely one participant each from the health and climate sectors from each of the ten countries. However, close to 50 participants came to the workshop reflecting the interest in the relationship between climate and health. The complete list of registered participants is given in Annex II.

The workshop was funded by WMO, and was hosted by DMCN in collaboration with the Kenya Medical Research Institute (KEMRI), the Ministry of Health of Kenya (MoH), Moi University, and the University of Nairobi (UoN).

1.3 Workshop programme

The programme for the workshop is given in Annex I. The major issues addressed within the five sessions of the programme included:

1.3.1 Session I: Introductory presentations and country experiences

This session, which is described in more detail in Section 2, dealt with: Workshop perspectives; WMO Programmes on climate and health; Global climate change and El Niño Southern Oscillation (ENSO): Implications on Africa; and Linking climate and human health: Country presentations.

1.3.2 Session II: Technical Session on ENSO impacts

Session II is summarised in Section 3. The topics discussed are: Use of remote sensing in epidemiology; Potential use of Global Information System (GIS) techniques in the health sector; Impacts of various ENSO phases in the GHA sub-region; Presentation of the lessons learned by Kenya from the recent United Nations Country Case study on the impacts of 1997/98 El Niño - "Once Burnt, Twice Shy"; Applications of climate forecasts in the health sector.

1.3.3 Session III: Applying climate forecasts in the health sector

In Section 4, a brief summary of Session III can be found. The session was concerned with the following: Impacts of climate on acute respiratory infections; Epidemics and climate change; Environmental health management options during extreme climatic events; Predictability of the climate of eastern Africa sub-region; Climates of GHA and health risk mapping with climate indicators; Predicting malaria upsurges in the Kenyan highlands; and Exercises on basic statistical concepts used in climate information and prediction services.

1.3.4 Session IV: Technical Session on climate diagnosis, prediction and verification

This session included an introduction to climate diagnosis, prediction and verification, group work to refine the framework and follow-up Plans of Action, and an excursion to the Kenya Medical Research Institute (KEMRI). Details of the session are given in Section 5.

1.3.5 Session V: Way forward

Major highlights of Session V are presented in Section 6 of this report. The session dealt with: Integration of climate and health in Health Training Programmes; Ways to implement health planning based on knowledge of climate; Capacity building, Problems, gaps and strategies, and Future interactions.

1.4 Official Opening of the Workshop

The director of KMD, Dr Joseph R Mukabana, formally opened the workshop. In his remarks, he observed that a number of diseases are significantly influenced by climate conditions and that water-borne diseases like cholera are generally sensitive to changes in the water cycle. High temperatures enhance the survival of bacteria, viruses and protozoa, and a combination of wet and warm conditions is conducive to the transmission of malaria and Denge fever, among other diseases. The extensive malaria epidemic observed in the GHA in 1997/98 was a good illustration of the association between climate variations and disease outbreaks. 1997/98 also saw the return of some diseases that had not been observed in the region for many decades, e.g. rift valley fever.

More often than not a time lag is observed between the occurrence of a specific climate event and the disease outbreak. Timely availability of accurate climate information can therefore provide crucial information regarding the likely occurrence of certain diseases. He advised the workshop to come up with sound recommendations that could enable the health and climate sectors in the GHA develop sound policies for factoring climate information in the planning and development of health delivery services in the GHA sub-region.

Mr Paul Llansó, Chief of the World Climate Applications Division (WCD) of the World Climate Programme (WCP) of WMO, and Professor Laban A. Ogallo, the co-ordinator of DMCN, also addressed the opening session.

Mr Llansó thanked the directors of KMD and DMCN for hosting the workshop. He noted that Prof Ogallo had been asking for WMO assistance in conducting this workshop for nearly a year, and he thanked Prof Ogallo for significant help in determining the location, the participants, and the resources for the workshop. He

remarked on the considerable efforts of all the staff in arranging the travel of the participants and the provision of excellent facilities.

Over the last decade, the scientific community has learned much about climate change and its expected impacts on many sectors. The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2001) can be regarded as the most authoritative resource on the subject.

A partnership has been established between the World Health Organization (WHO), the United Nations Environment Programme (UNEP) and WMO in addressing climate and health issues in the past decade. In 1999, 185 countries around the globe celebrated the World Meteorological Day themed "Weather, Climate and Health" that year. The partner agencies also collaborated to support the pilot Showcase Projects that implemented Heat/Health Warning Systems in Rome and Shanghai. Perhaps the best-known work to come from the partnership is the book "Climate Change and Human Health" by McMichael et al. (1996). During the last four years, the agencies had agreed on expanding work to focus on capacity building activities, information exchange, and research promotion, all focused on the benefits of national and local health uses of climatic and environmental information. The objective of this workshop was to address all the focus areas and to expand upon the lessons learned in a similar workshop held in Niamey, Niger, in 2001. The workshop can be regarded as a significant event in the establishment of the WMO Commission for Climatology's expansion beyond its primary focus on heat-related health issues, to include climate-related infectious diseases. He noted that the needs in applying research results in operation are great, there are potentially significant gains for populations, and there is increasing willingness among governments and donors to consider and support this.

Mr Llansó concluded by thanking the hosts and the participants for committing in this way to support progress in the knowledge of the relationship of climate to diseases and in the application of it.

Prof. Ogallo thanked WMO for giving DMCN an opportunity to host such an important workshop. According to him, DMCN has putting a lot of emphasis on enhancing the application of climate information, in particular in the health sector. The centre has therefore conducted several workshops for users of climate information in the health sector, and has supported a few pilot projects on specific applications of climate information in the health sector. The eighth climate outlook forum in the GHA (GHACOF8), which took place in August 2001, was devoted to climate and health challenges in the region. Prof. Ogallo thanked the director of KMD for the department's continued support that made the successful hosting of many meetings possible. He pointed out DMCN's willingness to host future follow-up workshops and related activities.

2 INTRODUCTORY PRESENTATIONS AND COUNTRY EXPERIENCES

2.1 Workshop Perspectives

Prof. L. A. Ogallo, DMCN

Prof. Ogallo outlined the objectives and perspectives of the workshop and then facilitated the introduction of all those present for the workshop. He also introduced the external facilitators from WMO, the London School of Hygiene and Tropical Medicine, and the Tyndall Centre for Climate Change Research of the University of East Anglia.

2.2 WMO programmes on climate and health

Mr Paul Llansó, WMO

Mr Llansó explained how WMO programmes on climate and health incorporate the findings of the IPCC and work through Permanent Representatives (PRs) with WMO in each country. Their overall goal is to apply climate information and prediction services to support human health and well-being. The IPCC is mainly responsible for conducting the scientific assessment of knowledge about global change, impacts, and mitigation issues.

The long-term objectives of the programmes are:

- Development of climate services: these are services for national sustainable development and methods of adapting to and mitigating the adverse impacts of climate and its variations;
- Increasing awareness of potential benefits, in particular emphasizing public safety and welfare;
- Development of practical methods and technologies including climate prediction products; and
- Collaboration of WMO and WHO in the running of climate and health courses.

Mr Llansó provided the participants with the CD-ROM "MIASMA 1.0" on the modelling of health impacts of climate change, which was created and donated by Dr Pim Martens, University of Maastricht, Netherlands.

2.3 Global climate change and ENSO: Implications on Africa

Dr Mike Hulme, Tyndall Centre for Climate Change Research

According to IPCC assessments, a continuous upward trend is registered in the temperature observations between 1900 and 2000. This upward trend can to a large part be attributed to the emission of Greenhouse Gases (GHGs). However, while the globally averaged temperature has risen, continuous data collected from four African countries indicates a drop in temperature in Ethiopia and southern Africa. Concerning precipitation, contrasting rainfall patterns have been experienced in different countries of Africa during the last century. Prospects for future change indicate precipitation has a strong correlation with temperature (IPCC, 2001).

Conclusions:

- Humans are altering global climate and will continue to do so;
- There is clear evidence of climate change in Africa;
- Attributing observed African rainfall and ENSO changes to human pollution is still problematic;
- Future rainfall changes are more ambiguous, with drying in Southern Africa perhaps the most robust; and
- Changes in ENSO will remain important for regions within Africa.

2.4 Linking climate and human health

Dr Jonathan Cox, London School of Hygiene and Tropical Medicine

Direct and indirect effects of climate on health are distinguished. However, the effects sometimes overlap and coincide. Health impacts can be either good or bad, or both. The criteria for assessing links between ENSO, climate, and human health are based on the following factors:

- Climatological evidence of direct effects or teleconnections with meteorological variables of interest;
- Biological plausibility of direct or indirect effects of weather exposure on human health;
- Statistical evidence based on representative disease data of sufficient quantity and quality; and
- Level of evidence sufficient to change practical approaches to disease prevention and control.

Health Effects of Natural Disasters

Natural disasters affect over 100 million and kill over 140,000 people each year on a global scale (International Federation of Red Cross and Red Crescent Societies (IFRC) estimates).

These disasters come in any of the following forms:

i) Drought: Severe drought often leads to famine and increase in cases of malnutrition through food scarcity, increased susceptibility to diseases, poor hygiene practices due to water shortages and greater risk to fire outbreaks;
ii) Forest fires: have direct impacts (burns, smoke inhalation etc.); and
iii) Floods: direct impact (water and vector borne diseases).

Malaria is the vector borne disease most sensitive to climate variability. Rainfall, humidity and temperature influence the disease. The Mapping Malaria Risk in Africa (MARA) project has used this information to produce malaria distribution models in Africa. Rift valley fever was a problem triggered by the El Niño induced rains of 1997/98. Among the water borne diseases, cholera was a big problem in Kenya and Tanzania during the 1997/98 El Niño rains.

2.5 Country presentations

2.5.1 Uganda

The important parameters of climate variability with regard to health impacts are mainly rainfall and temperature, which may either be excessive or too low. Impacts of excessive rainfall in Uganda include, among others, diarrhoea diseases such as cholera, typhoid and dysentery, malaria, starvation, respiratory tract infections and measles. The excessive rains can also lead to the internal displacement of people leaving them shelter-less, without proper sanitation, and prone to violence. The poor sanitation aids in the outbreak of the diseases mentioned above, and the inclination towards violence may lead to a spread of sexually transmitted diseases due to rape. Too little rain leads to drought associated with starvation, malnutrition, and unreliable water supply, which may cause diarrhoea and skin diseases.

Excessive temperatures are associated with:

- Heat stroke, especially for the armed forces;
- Discomfort;
- Shortage of water supply;
- Epidemics of meningitis; and
- Promotion of the spread of certain vector diseases like malaria, sleeping sickness.

2.5.2 Tanzania

A press conference was held one month after GHACOF8. Media and government officials were present. The forecast was highlighted in almost all the daily newspapers, as well as on the radio and television. The rainfall situation was as predicted with almost two thirds of the country, i.e. the south-west, western and lake zone receiving near normal to above normal rains, and the north-east regions receiving below normal rains. Following GHACOF8, top government officials including the Prime Minister asked people in the drought prone areas to cultivate drought-resistant crops such as yams, cassava and sorghum.

Disease impacts:

The coastal areas faced an acute shortage of water making most people desperate enough to use water from any available source. The water shortage led to cholera outbreaks in one of the districts of Dar-es-Salaam. Malaria incidence was normal due to few breeding places. The western part of Tanzania received near normal rainfall. Kigoma on the eastern shores of Lake Tanganyika also faced an outbreak of cholera due to flood-contaminated water sources.

2.5.3 Ethiopia

The country has observed a change in disease patterns during the past few decades. Malaria has become almost endemic where it had unheard of before. Meningitis has long stopped being predictable with respect to the areas as well as the time the disease can be cited as the primary cause of death.

2.5.4 Sudan

The country experiences all types of weather. Bilhazia, malaria and tuberculosis compose the major health problems in the country. Information on weather and climate has never been factored into health planning.

2.5.5 Djibouti

Malaria is a major problem in the country. There is an upsurge of malaria during the month of May due to a rise in temperature.

2.5.6 Burundi

The country has not experienced an epidemic of malaria in the last decade. In 1997, a serious cholera outbreak occurred, but the peak has already been passed. Dysentery illness has been on the upward trend.

2.5.7 Kenya

Variations in climate have an impact on the distribution of malaria vectors, diarrhoea infections, acute respiratory infections (ARI) and nutritional disorders. Evidently, rainfall, humidity and temperature data are among others important for planning health programmes and climate related disease interventions. However, there is a need to undertake interdisciplinary research on the direct effects of extreme weather/climate events to bolster the use of fixed climatological data and information that are currently used. Capacity building amongst health professionals needs to be supported and extended down to supervisory and operational health personnel at the province and

district levels. Periodical weather and climate information is particularly useful to the following programmes in the health sector:

- Food safety and nutrition;
- Control of ARI and water-related diseases;
- Communicable and vector borne disease control and integrated disease surveillance and response;
- Environmental sanitation;
- Healthy cities;
- Disaster preparedness and response;
- Domestic water quality and pollution control;
- Health education;
- Health training institutions; and
- Health programmes planning.

A number of case studies were carried out in Kenya covering diverse topics, for example Vector Ecology and Climate in Kenya, and Impacts of extreme climate anomalies on human nutrition. The major highlight among the Kenyan case studies was the "Once Burned, Twice Shy?" study which focussed on the Lessons Learned from the 1997-98 El Niño. Results of this study are presented in Section 3.4.

3 TECHNICAL SESSION ON ENSO IMPACTS

3.1 Remote sensing in epidemiology

Dr Jonathan Cox, London School of Hygiene and Tropical Medicine

During the discussions and recommendations it became clear that it was difficult to obtain satellite information due to restrictions on access and lack of funds necessary for purchasing. However, assistance to acquire such remote sensing data can be sought from WMO or NASA through appropriate project proposals.

3.2 Potential use of GIS techniques in the health sector

Mr Erick Khamala, Regional Centre for Mapping of Resources for Development (RCMRD)

The objective of the RCMRD in Nairobi, Kenya, is to develop, process, archive and disseminate geo-spatial data and information as well as to promote their standardisation and harmonisation to be used in the decision-making in sustainable development. Currently, the centre serves 15 member states that are free to send enquiries to the RCMRD.

The centre provides training programmes on GIS for periods of three weeks or three months. The installation of a GIS, though, is expensive and costly due to expensive hardware, software, the collection of quality data and the use of remote sensing data. Another matter of expense may be the continuous utilisation of the unit at ministries etc. Therefore, it is advisable to utilise the RCMRD since it already has at its disposal facilities and highly trained personnel.

3.3 Impacts of various ENSO phases in the GHA sub-region

Prof. L. A. Ogallo and Mr Joseph Mutemi, DMCN

It is now evident that the systematic intervals of El Niño are being broken due to human interference in the environment/natural systems. For ENSO, the degree of predictability

is high, although a variety of changes can either decrease or increase the intensity of the effects caused by natural disasters, e.g. tropical cyclones.

Given the probability that El Niño may occur, the governments in the region are now well aware and prepared for the consequences. For example, Kenya has established the National Operations Centre (NOC), which is responsible for all disaster-related issues no matter whether the disasters are caused by humans or occur naturally such as droughts and flooding. The operations centre compared and analysed reports from newspapers, many of which appeared not to be true but only sensational. However, the newspaper reports, although not always truthful, helped publicise the effects of El Niño.

3.4 Kenya Country Case Study: "Once Burnt, Twice Shy?" – Lessons learned from the 1997/98 El Niño

3.4.1 Impacts on water resources

Prof. F. Mutua, UoN

In his presentation, Prof. Mutua observed that there was no regional collaboration in hydrological forecasting, and also that no request had been made to WMO regarding hydrological forecasting. The relationship between the meteorological and water departments of the countries within the region requires improvement and strengthening. For instance, KMD provides weather information to the water department but the Ministry of Water is unwilling to pay for the information. DMCN has therefore recommended the integration of other key institutions in the NOC to improve the co-operation between the institutions. At the moment, the water department is still unable to prepare water-related forecasts for the nation.

3.4.2 Impacts on agriculture

Mr A. S. Musili and Mr B. A. Lijoh, Ministry of Agriculture

The effect of the El Niño event most clearly demonstrated itself in the fact that approximately 50,000 calves had to be slaughtered to save the mother cows.

In the past, the NOC has been under the control of the army, but there are considerations to transfer the responsibility to a different ministry. Membership in the NOC is planned to widen to include other key stakeholders such as the Agriculture and Livestock sectors.

3.4.3 Impacts on health

Dr S. Kisia, UoN

The Ministry of Health has learned that warnings were not taken seriously and that the NOC conformed to a mode of operations that does not adhere to Early Warning Systems (EWSs). As a recommendation, surveillance and data collection should be strengthened.

3.4.4 Impacts on transport and communication

Dr C. Oludhe, UoN

The case study was a big lesson learned. In response to the findings of the study, the El Niño Roads Recovery Project has been established. One of its recommendations is that the government should improve the quality of the roads constructed.

4 APPLYING CLIMATE FORECASTS IN THE HEALTH SECTOR

The exercises conducted by the participants were the main highlight of the day. They dealt with the interpretation of the basic statistical concepts used in climate information and prediction services. Specifically, interpretation of climate outlooks in terms of terciles was considered. Examples related to health aspects that are directly influenced by climate as well as exercises on the classification of health related data into above, near and below normal were studied. Simulated forecasts were generated stochastically and results presented to the users to enhance their understanding.

5 TECHNICAL SESSION ON CLIMATE DIAGNOSIS, PREDICTION AND VERIFICATION

After a tour of the DMCN, the climate scientists were joined by the participants from the health sector for a group work exercise in planning a multi-disciplinary project on reducing the impacts of climate extremes on health in the GHA sub-region.

The exercise looked at issues such as the highest priority health outcome for individual countries and what's known about climate relationship to that health outcome. Health lessons learned from the use of GHA-COF8 products were also considered in the exercise. Finally the health and climate groups formulated the preliminary national action plans which included the prerequisite, operational and implementation components.

5.1 Lessons learned from the field excursion to KEMRI

Participants were taken on a trip to KEMRI Headquarters in Nairobi. The tour, which was organised by KEMRI, was conducted on Friday morning and started with an address and welcoming by the director of KEMRI, Dr. Dave Koech. After the director's address participants were shown around the Institute's main research facilities with a focus on the ones that specifically deal with research on diseases caused by climate and weather fluctuations.

KEMRI is the largest research institute of its kind in Sub-Saharan Africa. The ASHMOTO initiative (Japan initiative) identified KEMRI as a training centre for parasitic disease control in Eastern, Central and Southern Africa.

Recent achievements recorded by the centre are the development of their own HIV and Hepatitis B diagnostic kits. A lot of work has been done on HIV control as well as in the area of tropical diseases notably malaria, schistosomiasis and lesmaniasis, which all have a direct bearing with weather and climate change.

The institute is fast expanding with a number of centres, including:

i) Centre for Biotechnology Research and Development based in Nairobi;
ii) Centre for Clinical Research based in Nairobi;
iii) Centre for Geographic Medicine Research – Coast based in Kilifi;
iv) Centre for Leprosy and other Skin Diseases Research based in Alupe;
v) Centre for Microbiology based in Nairobi;
vi) Centre for Public Health Research based in Nairobi;
vii) Centre for Respiratory Diseases Research based in Nairobi;
viii) Centre for Traditional Medicine and Drug Research based in Nairobi;
ix) Centre for Vector Biology and Control Research based in Kisumu; and
x) Centre for Virus Research based in Nairobi.

KEMRI is planning to have a production unit for its research findings and its products in the near future. A model that will be able to predict malaria epidemics in the country is in an advanced stage of development. This is an initiative of the institute to make use of climate and weather information in planning for effective control of this endemic vector-borne disease.

6 RECOMMENDATIONS AND WAY FORWARD

The major recommendations from the workshop addressed among many others the lack of skilled human resources, lack of awareness on the part of the users, lack of political will and commitment, and lack of Early Warning Systems (EWSs).

6.1 Lack of expertise

The following gaps were identified as being responsible for lack of expertise:

- Insufficient scientific evidence-based knowledge of relationships between climate and various diseases;
- Inadequate training on the impacts of climate change and variability (extreme events) on health;
- Inadequate coverage of climate and health subjects in the curriculum of the relevant existing institutions; and
- Insufficient financial resources for the purchase of the relevant equipment and facilitation of relevant training.

Strategy for solving problem No. 1:

- Integrate relevant training needs in the curriculum of the relevant existing training institutions;
- Engage national Meteorological Service representatives in a multi-disciplinary team and charge them with the assembling of meteorological data, and the interpretation of data and analyses;
- Engage national Public Health Service representatives in a multi-disciplinary team and charge them with the assembling of health data, and the interpretation of data and analyses;
- Mobilise financial resources for the relevant equipment and training; and
- Establish research projects on the influence of climate on priority health outcomes.

6.2 Lack of awareness on the part of the users

The following gap was identified as responsible for lack of awareness:

- Poor or inadequate content and focus of the information contained in the climate predictions or forecasts.

Strategy for solving problem No. 2:

- Repackage the information coupled with effective communication.

6.3 Lack of political will and commitment

The following gap was found to be responsible for problem No. 3:

- Inadequate Sensitisation.

Strategy for solving problem No. 3:

- Conduct consensus or sensitisation meetings with the political leaders.

6.4 Lack of Early Warning Systems (EWSs)

The following gaps were identified as being responsible for lack of EWSs:

- Lack of basic information on surveillance for human health and infrastructure like databases or the Internet to organise and share such information; and
- Absence of strong surveillance systems.

Strategy for solving problem No. 4:

- Improve the reporting system(s) as part of the process for establishing EWSs;
- Explore partnerships with relevant national and regional EWS structures; and
- Explore use of GIS, either with direct internal GIS units, or in association with existing national or regional organizations.

6.5 Follow-up actions

The participants of the workshop suggested the items listed below as follow-up actions:

- A similar workshop to review progress of previous interactions;
- Enhancement of the interaction between climate scientists and health experts;
- Implementation of national action plans by multi-disciplinary teams comprised of the NMHS, the Public Health Administration, and other relevant organizations and institutions; and
- Maintaining regular communication among the group by:
    i) E-mail;
    ii) Telephone;
    iii) Fax;
    iv) Weather Bulletin;
    v) Provision of information to the Bulletin of DMCN; and
    vi) Establishment of a web page and posting of lecture notes and national action plans.

REFERENCES

IPCC (2001). *Climate Change 2001*. Cambridge University Press.

McMichael, A. J., Haines, A., Slooff, R., and Kovats, S. (Ed.) (1996). *Climate Change and Human Health*. Horley Studios Redhill, UK, 297 pp.

ANNEX I

Workshop Programme

Monday, February 11, 2002

08:00 - 09:00	Registration
09:00 - 10:00	OFFICIAL OPENING CEREMONY Keynote Presentation on Health problems associated with Climate in Kenya – *Dr Dave Koech, KEMRI (Director)*
10:00 - 10:30	*Coffee Break/Refreshments*
SESSION I:	**INTRODUCTION AND COUNTRY PRESENTATIONS** *Chairperson: Mr Alfred Lang'at* *Rapporteur: Mr J. M. Mwitari*
10:30 - 10:45	Introductions and Workshop perspectives – *Prof. Ogallo, DMCN*
10:45 - 11:15	World Meteorological Organization (WMO) Programmes on Climate and Health – *Mr Paul Llansó, WMO*
11:15 - 11:45	Global Climate Change and ENSO; Implications on Africa – *Dr Mike Hulme, Tyndall Centre for Climate Change Research*
11:45 - 12:30	Linking climate and human health – *Dr Jonathan Cox, London School of Hygiene & Tropical Medicine*
12:30 - 13:00	Discussion
13:00 - 14:00	*Lunch*
14:00 - 15:30	Country presentations on national climate/ENSO impacts on health sector and the role of climate information in addressing health challenges. *Each national health focal point will be requested to come with this presentation and some data on health.*
15:30 - 16:00	Discussion
16:00 - 16:30	*Coffee Break*

Kenya Country Studies Part I:

16:30 – 17:00	Predicting malaria upsurge using GIS in different ecological zones: *Highlands – Dr A. K. Githeko (KEMRI) and Dr Sam Ochola* *Lowlands – Dr Simon Hay Wellcome*
17:00 - 17:30	Discussion
17:30	*Adjourn*

Tuesday, February 12, 2002

08:30 - 09:00	Vector ecology and climate in Kenya – *Dr David Sang (MoH), Dr Eric Muchiri (MoH) and Dr A. M. Ngindu*
09:00 - 09:30	Impacts of extreme climate anomalies on human nutrition – *Mrs Shako, UNICEF, and Mrs Pamela Malebe, MoH*
09:30 - 10:00	Discussion

SESSION II: TECHNICAL SESSION ON ENSO IMPACTS

Chairperson: Mr Paul Llansó
Rapporteur: Dr Bob M. Dawson

10:00 - 10:30 Remote sensing in epidemiology – *Dr Jonathan Cox, London School of Hygiene & Tropical Medicine*

10:30 - 11:00 Coffee Break

11:00 - 11:30 Potential use of GIS techniques in the health sector – *Dr Wilbur Ottichilo, Regional Centre for Mapping of Resources for Development (RCMRD)*
11:30 - 12:00 Discussion
12:00 - 12:30 Impacts of various ENSO phases in the Greater Horn of Africa sub-region – *Prof. L. A. Ogallo and Mr. Joseph Mutemi*
12:30 - 13:00 Discussion

13:00 - 14:00 Lunch

Kenya Country Studies Part II:

14:00 - 14:30 Kenya Country Case Study ("Once Burned, Twice Shy?" Lessons Learned from the 1997-1998 El Niño); *Overview of the Study – Dr F. K. Karanja, UoN*
14:30 - 15:00 Kenya Country Case Study Continued
Impacts on Water Resources – Prof. F. Mutua, UoN
15:00 - 15:30 Kenya Country Case Study Continued
Impacts on Agriculture and Livestock – Messrs A.S. Musili and B. A. Lijoh – MoA

15:30 - 16:00 Coffee Break

16:00 - 16:30 Kenya Country Case Study Continued
Impacts on Health – Dr Seth Kisia, UoN
16:30 - 17:00 Kenya Country Case Study Continued
Impacts on Transport and Communication – Dr Chris Oludhe, UoN
17:00 - 17:30 Discussion

17:30 Adjourn

Wednesday: February 13, 2002

SESSION III: APPLYING CLIMATE FORECASTS IN THE HEALTH SECTOR

Chairperson: Mr Glen Araka
Rapporteur: Mr A. S. Musili

08:30 - 09:00 Impacts of climate on acute respiratory infections – *Dr Wamae, MoH, Mr Mohamed Karama, KEMRI, and Dr M. Hassan*
09:00 - 09:30 Epidemics and climate change – *Dr Joyce Onsongo and Mr A. K. Langat, MoH*
09:30 - 10:00 Environmental Health Management options during extreme climatic events – *Mr Rukunga, African Medical Research Foundation (AMREF), Mrs Tumbo, MoH, and Eng. W. Ndegwa, WHO*

10:00 - 10:30	Discussion
10:30 - 11:00	*Coffee break*
11:00 - 11:30	Predictability of the climate of the eastern Africa sub-region – *Mr William Nyakwada, KMD*
11:30 - 12:00	Climates of GHA and health risk mapping with climate indicators – *Dr J. N. Muthama, UoN*
12:00 - 12:30	Predicting Malaria upsurges in the Kenyan highlands – *Dr A. K. Githeko, KEMRI*
12:30 - 13:00	Discussion
13:00 - 14:00	*Lunch*
14:00 - 15:30	Exercises on basic statistical concepts used in climate information and prediction services – *Dr John Owino, UoN, and Mr Z. K. K. Atheru, DMCN*
15:30 - 16:00	***Coffee Break***
16:00 - 17:00	Exercises on basic statistical concepts used in climate information and prediction services *Continued – Dr John Owino, UoN, and Mr Z. K. K. Atheru, DMCN*
17:00 - 17:30	Discussion
17:30	*Adjourn*

Thursday: February 14, 2002

SESSION IV:	**TECHNICAL SESSION ON CLIMATE DIAGNOSIS, PREDICTION AND VERIFICATION** *Mr Simon Gathara, DMCN, and Mr Paul Llansó*
08:30 - 09:00	Tour of DMCN
09:00 - 09:30	Draft of National Climate Outlooks – *Climate Scientists*
09:30 - 10:30	Session I: Introduction to Breakout groups exercise - *Health & Climate groups*
10:30 - 11:00	*Coffee Break*
11:00 - 13:00	Session II: Breakout groups – *Health & Climate groups*
13:00 - 14:00	*Lunch*
14:00 - 15:30	Session III: Report on Breakout groups
15:30 - 16:00	*Coffee break*
16:00 - 17:00	Session IV: Refine Framework, Plans of Action
17:00 - 17:30	Discussion
17:30	*Adjourn*

Friday: February 15, 2002

08:30 - 11:00	Visit to Kenya Medical Research Institute (KEMRI)
11:00 - 11:30	*Coffee*
SESSION V:	**WAY FORWARD (PLENARY)** *Chairperson: Mr E. D. Kadete* *Rapporteur: Dr B. D. Mbulamberi*
11:30 - 12:00	Integration of Climate and Health in Health Training Programmes *– Mr J. M. Mwitari, MoH, Mr Paul Tuukuo, Kenya Medical Training College (KMTC), and Mr Glen Araka, Moi University*
12:00 - 12:30	Ways to implement health planning based on knowledge on climate *– Dr Richard Muga, Director of Medical Services, Mr Muchiri, Deputy Chief Economist MoH, and Dr T. Gakuru*
12:30 - 13:00	Discussion
13:00 - 14:00	*Lunch*
14:00 - 15:00	Problems, gaps and strategies; Capacity building; Future interactions; Workshop evaluation and recommendations
15:00 - 15:30	**CLOSING AND CERTIFICATE AWARDING CEREMONY**

ANNEX II

LIST OF PARTICIPANTS

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ANNEX III

LIST OF ACRONYMS

AMREF	African Medical Research Foundation
ARI	Acute Respiratory Infections
DMCN	Drought Monitoring Centre, Nairobi
EWS	Early Warning System
ENSO	El Niño/Southern Oscillation
GHA	Greater Horn of Africa
GHACOF	Greater Horn of Africa Climate Outlook Forum
GHGs	Green House Gases
GIS	Geographical Information System
GPO	General Post Office
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Inter-Governmental panel for climate Change
KEMRI	Kenya Medical Research Institute
KMD	Kenya Meteorological Department
KMTC	Kenya Medical Training College
MARA	Mapping Malaria Risk in Africa
MoA	Ministry of Agriculture
MoH	Ministry of Health
NASA	National Aeronautics and Space Administration (USA)
NMHSs	National Meteorological and Hydrological Services
NOC	National Operations Centre (Kenya)
PR	Permanent Representative with WMO
RCMRD	Regional Centre for Mapping of Resources for Development
STDs	Sexually Transmitted Diseases
TMA	Tanzania Meteorological Agency
UK	United Kingdom
UNEP	United Nations Environment Programme
UNICEF	United Nations International Children's Emergency Fund
UoN	University of Nairobi
WCAD	World Climate Applications Division
WCP	World Climate Programme
WHO	World Health Organization
WMO	World Meteorological Organization