PROGRESS REPORT FOR SEPTEMBER 2002 TO JULY 2003

PROJECT NUMBER: AIACC AF_91

PROJECT TITLE: CAPACITY BUILDING TO EVALUATE AND ADAPT TO CLIMATE CHANGE-INDUCED VULNERABILITY TO MALARIA AND CHOLERA IN THE LAKE VICTORIA REGION

PRINCIPAL INVESTIGATOR: SHEM O. WANDIGA

SUPPORTING ORGANIZATIONS: GLOBAL SYSTEM FOR ANALYSIS, RESEARCH AND TRAINING (START), THIRD WORLD ACADEMY SCIENCES (TWAS), UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)

A. SUMMARY:

A science planning and coordination two day Workshop launched this project’s activities. The workshop reviewed the theoretical and practical aspects of the project, agreed on administrative and future activities. The project has successfully recruited the full complement of postgraduate students and research assistants. It has trained them together with field assistants in questionnaire design, data collection and field testing. We have successfully undertaken two primary data collections using the questionnaire in all the three countries. Data entry and analysis using the GIS format (digitization and data automation; spatial database cleaning and attribute data capture) has been completed for Kenya and is undergoing for Uganda and Tanzania. Secondary data collection has been undertaken for Kenya, Uganda and Tanzania. The Kenyan data has been analysed together with primary data sets and weighted in some cases with national census data for the research sites. Climate and hydrological data have been gathered and their analysis is ongoing. Global climate models (GCM) scenarios for the Lake Victoria region diagnostic analysis were done by Dr. Xianfu Lu for our team and are currently being downscaled by us for best fit. National stakeholders’ workshops have been held in Kenya, Uganda and Tanzania. Project methodologies have been elaborated on and have been approved by AIACC. Lastly, contacts have been made with national government officials as well as the UNFCC communication contact persons in each country.

B. TASKS PERFORMED AND OUTPUTS:
1. Meetings

1.1 Science Planning and Coordination Workshop (See Output 1 for details)
A Science and Planning Project Coordination meeting for all fourteen (14) project participants initiating project activities and research agenda was held on 2nd to 3rd September 2002 at Sunset Hotel, Kisumu City in Kenya. The outputs of the workshop were:

- Responded to the queries in the proposal that had been raised by the technical committee members regarding the use of the MARA and GCM models and the relationships between climate variability and incidences malaria and cholera
- Revision of Workplan with additional explanatory notes on specific activities
- Set parameters for site selection and sampling procedure in the three countries
- Acquisition of climate and hydrological data to be handled centrally by the Kenyan team from the Drought Monitoring Centre - Nairobi.
- Agreed on techniques for primary and secondary data
- Established guidelines for the questionnaire
- Set administrative procedures

1.2 Kenyan National Planning and Coordination Meeting (See Output 2 for details)
A National and Planning Coordination Meeting was held on 23rd to 24th January 2003 at Utalii Hotel, Nairobi City to bring together the Kenyan research team and representatives from the Kenya government including the UNFCC communication contact person. The outputs of the meeting were:

- Presentation of progress reports on data collection and preliminary analyses on climate, hydrology, health and socio-economic aspects by the principal researchers and postgraduate students
- Discussion and agreement on data analysis tools for climate and its relation to health parameters
- Identification of indicators for vulnerability and adaptation measures for creating scenarios
- Critique of the collected data and identification of the gaps
- Date of second phase of fieldwork set
- Allocation of task for research analysis

1.3 Uganda National Planning and Coordination Meeting
A national and planning coordination meeting with stakeholders was held on 21 to 22 July in Kampala Uganda. Details of the meeting will be included in next report.

1.4 Tanzania Stakeholders workshop
A national stakeholder’s workshop for Tanzania was held at Muleba town, Kagera on 15 to 16 July, 2003. Details of the meeting will be included in next report.

II Training
A Training Workshop was held for post-graduate students and research assistants from all the three countries at the Kenya Medical Research Institute in Kisumu City from the 14th -20th October, 2002. This was conducted by Dr. Andrew Githeko. The training sought to
equip them with data collection techniques, sampling procedures, use of GPS and data analysis programmes as well as practical field experience.

III Data Collection
1.1 Secondary Data Collection (See Output 3 and 7 for details)
Rainfall data (daily) and temperature data (daily T_{max}, daily T_{min}), and daily records for hydrological data have been collected for Kenya. Similar data for Uganda and Tanzania is being collected. Socio-economic and health data for Kenya has been collected covering the following parameters for 1995-2000:

- Distribution of population by age, sex, households & district
- Percentage distribution of household head by sex and district
- Distribution of population by marital status and district
- Distribution of total population and density by districts and census years
- Number of households by district
- Mean monthly household non-agricultural income by district
- Mean monthly household income from sale of crops by district
- Mean monthly household income from sale of livestock, assets, land and rent by district
- Summary of mean monthly household income from different sources by district
- Mean monthly household food expenditure (inclusive of own consumption) by broad expenditure categories by district
- Percentage share of mean monthly household expenditure by broad expenditure categories by district
- Annual per capital incomes and expenditure by district
- Distribution of expenditure patterns on food and non-food by district
- Distribution of mean expenditures on health by district
- Mean monthly expenditure on cooking and lighting fuel
- Distribution of type of toilets used by households
- Percentage distribution of households by access to sanitation, type of toilet by district
- Distribution of households’ main source of drinking water during dry season in %
- Distribution of households main source of drinking water during wet season in %
- Distribution of time (minutes) taken to reach the nearest health facility in % by region
- Distribution of time (minutes) taken to reach nearest qualified doctor’s office in %
- Population distribution and number of Hospital beds per 1000 population by district
- Number of health facilities (Hospitals Health centres Dispensaries Maternity and nursing homes/clinics by district

So far secondary data collection in Uganda has been done from the following institutions:
Mulago hospital - national referal hospital
Mengo hospital - Protestant founded hospital
Nsambya hospital - Catholic founded hospital
Old Kampala hospital - Islamic founded hospital
Ministry of Health
Institute of Public Health
Centre for Disease Control
National Health Research Council
Government Chemist
National Drug Authority
Makerere University
National Environment Management Authority
UNICEF
WHO
Commercial Market Strategies (for bed nets)
Quality Chemicals (for bed nets)

1.3 Primary Data Collection
Fieldwork has been carried out in all the three countries using standardised questionnaires (Output 4), Table 1 gives a summary of the activities.
Table 1: Primary Data Collection Summary

<table>
<thead>
<tr>
<th>Fieldwork Phase</th>
<th>Kenya</th>
<th>Uganda</th>
<th>Tanzania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites of Data collection</td>
<td>Kisumu (cholera) and Kericho (malaria)</td>
<td>Kabale (malaria) and Gaba (Cholera)</td>
<td>Bugarama (malaria) and Chato (cholera)</td>
</tr>
<tr>
<td>Sample size</td>
<td>301 households</td>
<td>290 households</td>
<td>300 households</td>
</tr>
<tr>
<td>Data entry</td>
<td>Completed in SPSS and Epi-Info</td>
<td>Completed in SPSS and Epi-Info</td>
<td>Completed in SPSS and Epi-Info</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>Preliminary frequencies for socio-economic and health data (See Output 5 for preliminary analysis) done. Second field work data collection ongoing as well as focus group discussion</td>
<td>Preliminary frequencies for socio-economic and health data done, secondary data collection ongoing, focus group discussion and indepth interviews done. Second field work data analysis started</td>
<td>Preliminary frequencies for socio-economic and health data done, secondary data collection ongoing, focus group discussion and indepth interviews done. Second field work data analysis started</td>
</tr>
<tr>
<td>GIS Data Analysis</td>
<td>Digitization and data automation; spatial database cleaning and attribute data capture completed for phase one (see Output 6)</td>
<td>Analysis started</td>
<td>Analysis started</td>
</tr>
<tr>
<td>Climate and hydrological data analysis</td>
<td>Data gathering near completion (see Output 7)</td>
<td>Ongoing data gathering</td>
<td>Ongoing data gathering</td>
</tr>
<tr>
<td>GCM analysis</td>
<td>Diagnostic Lake Victoria region analysis done, downscaling ongoing</td>
<td>Diagnostic Lake Victoria region analysis done, downscaling ongoing</td>
<td>Diagnostic Lake Victoria region analysis done, downscaling ongoing</td>
</tr>
</tbody>
</table>

1.3.1 Description of tasks performed and outputs produced of project activities for the past six months (March-July 2003)

Project activities undertaken in the past six months for Kenya include the following:

- Data entry and preliminary socio-economic/health analysis for the three countries in SPSS and Epi-Info completed (See Output 5);
- Second field work data collection and focus group discussion ongoing;
- Digitization and data automation; spatial database cleaning and attribute data capture completed for phase one (see Output 6);
- Climate and hydrological data analysis near completion (see Output 7);
- Global climate models scenarios for the Lake Victoria region diagnostic analysis was carried out for the project by Dr. Xianfu Lu. The project team is currently downscaling the data and matching the scenarios to establish which model has the closest fit to the region’s climate.
Project activities undertaken in the past six months for Uganda are detailed in Output 8.

Project activities undertaken in the past six months for Tanzania (Output 9) include the following:

- Data entry and preliminary analysis for first fieldwork as reported in the first half-yearly progress report. Dataset was generated and submitted to the Principal Investigator.
- Co-ordinates for the Climatic Stations situated within the vicinity of the study areas in Kagera Region were collected and the dataset was submitted to the Principal Investigator in Nairobi for compilation and retrieval of the climatic data from various sources.
- Participated in the Regional Workshop held in South Africa where a progress report was presented.
- Thesis work by the postgraduate student ongoing - first draft of MA thesis submitted.
- The second fieldwork was used to collect additional information, and to fill-in gaps in the dataset collected during the first fieldwork, this involved:
  - Questionnaire survey revisited for the same households interviewed during the first fieldwork to collect information on income levels.
  - GPS location of each of the households
  - Determination of village boundaries either through GPS readings or retrieval of village maps that have co-ordinates. In Chato village the boundary was determined by traversing through the peripheries of the village and taking coordinates of key features along the boundary using GPS. This was undertaken with the help of village leaders. For the other village, Bugarama, a village map was obtained at the Lands Department in Muleba.
- The Stakeholders Workshop was conducted in Muleba Town between 15th and 16th July. Preliminary research findings of the project were presented. Workshop participants were given the opportunity to comment on the findings. Furthermore, participants identified additional information to be collected. During the workshop, the participants made an attempt to develop interventional measures for malaria and cholera, at both districts level. Workshop proceedings to be submitted.

IV Administrative Outputs

Project funds were received on 24th September 2002 and 15th May, 2003 respectively, following which the following administrative activities have been undertaken:

(i) Disbursement of funds to Tanzanian and Ugandan Principal Researchers
(ii) Recruitment of research assistants and postgraduate students
(iii) Procurement of computers and cameras
(iv) Organisation of workshops and meetings
(v) Data collection, entry and analysis
(vi) Training of postgraduate students, research assistants and field assistants
(vii) GIS data analysis
(viii) Climate data analysis
C. DIFFICULTIES ENCOUNTERED
Time constraints vis-à-vis the work plan because AF 91 started in September 2002 and the reporting period for the AIACC is July and January, this means that our report does not cover the planned bi-annual and annual activities as it should.

The team has appreciated the need for multi-disciplinary and multi-country research coordination. This makes the pace of work sometimes slow and difficult to synchronise the research project. For instance, the Ugandan team had a late start with the data entry because the SPSS entry screen that was provided from Nairobi used a different numbering system of the variables from the Ugandan team and it took sometime before this was clarified.

One of the issues raised by the technical committee was on modelling, in order to solve this we incorporated Prof. Francis Mutua who is a modeller and has given useful inputs towards this end.

We have difficulty in factoring micro scale socio-economic data into health and climate models. Efforts are being made to analyse these data using the SWAT and ACRU models. We are also looking for a group with experience in this area so that we can work with them.

The secondary data collection revealed that there are gaps in the Uganda climate data, particularly from 1972 to 1978 because of the civil strife experienced then. There are data problems in Kericho data, particularly for 1948 and in the 1980s, due to human error at the data entry level. The population census data will need to be digitalised because the available data from Central Bureau of Statistics (Kenya) is not in digitalized form, however there are problems because this data was not geo-referenced. Further, there is need to geo-reference all GPS readings, thus slowing down the data analysis process.

Resources allocated for Tanzanian fieldwork have been inadequate. This is partly because the study area is very far from the workstation. As a result, the funds available could not enable the team to hire transport for fieldwork. Instead, they used the institute’s car where the allocated funds were used for fuel and some basic maintenance costs.

D. CONTACT WITH UNFCCC PERSONS
The project has a significant relevance to the preparation of national communications as it gives a clear understanding on the influence of climate change on health, particularly malaria and cholera. Findings from this study will provide an understanding on the vulnerability, magnitude of impacts, locally derived adaptation strategies, and identify areas for external intervention measures. Findings of the study will therefore provide an input for planning adaptation mechanisms. We have contacted the UNFCCC contact persons as well as Ministry of Health personnel and have established a working rapport.

E. TASKS TO BE PERFORMED IN THE NEXT EIGHT MONTHS
The following tasks will be undertaken in the next eight months:
1. Data Collection and Analysis:
   - Continue climate and socio-economic secondary data collection from meteorological stations and study sites in the Lake Victoria basin and analysis of the same.
   - Statistical downscaling of climate models.
   - A statistical analysis will be run for the time series data in order to estimate the probability distribution functions for temperatures and precipitation for each decade (baseline variability for 1960-70, 1970-80, 1980-90, 1990-2000). Descriptive statistics will be determined (mean, mode, median, standard deviation). Baseline is the state before any climate change variability is imposed.
   - Downscale the outputs of the climate models and scenarios of changes in extreme events (the El-Nino years and La Nina years) and to assign probabilities to these.
   - Use results of the IPCC ensemble runs of GCM projections with a set of scenarios. The ensemble models that have been recently used in the regional studies include the Canadian CCM, UKMO, GFDL Ver 2 and 3; and Japanese climate model.
   - Use some regional climate models that are available (e.g Ssemazi, et.al.).
   - Selected climate change models will be used to estimate possible changes to baseline conditions i.e. perturbations to temperature and precipitation.
   - Use a range of increasing and decreasing synthesis of extreme seasonal rainfall and temperature scenarios, and some of the observed extremes and trends.
   - Assemble all critical indicators (data) available to help identify vulnerability and adaptation measures for creating scenarios
   - Construct socio-economic scenarios using the SWAT or ACRU model, whichever can better handle the socio-economic data alongside other components such as health data, climate data, land-use and hydrology.
   - Validation and sensitivity testing of the climate and health data.
   - Estimate changes in risk magnitude using statistical models of P, T, vs. M,C.
   - Estimate changes in risk distribution from habitat changes.
   - Uncertainty analysis of estimated risk scenarios.
   - Retrieval and analysis of secondary information from published and grey materials.
   - Qualitative analysis of focus group discussions.
   - Preparation of progress report.
   - Follow up to some of the issues raised during the stakeholder workshop.

2. GIS Analysis
   - Continue with GIS digitization of Uganda and Tanzania data.
   - Training research team members in GIS applications to be undertaken.
   - Integrate baseline data into GIS format and produce GIS layers.

3. Meetings
   - Participatory meetings with local communities.
   - Regional Research Group Meetings to review and assess project activities.
   - Preparation of paper for publication.
- Workshop with key policy makers.

**F. EXPECTED DIFFICULTIES**

We do not anticipate difficulties in implementing the above tasks, however, the regional coordination difficulties still remain as mentioned earlier. The inadequate funds for Tanzania may again render the undertaking of the various activities difficult.

**G. LESSONS LEARNED**

Regional and National Workshops have proved useful in understanding the project and facilitating the implementation of research activities. Involvement of stakeholders has enabled the rapid identification of information sources and facilitated the release of otherwise unobtainable data.

We have appreciated the enrichment of the research outputs through the multi-disciplinary and multi-sectoral approaches.

**H. PUBLICATIONS**

No publications so far.
OUTPUT 1: SCIENCE PLANNING AND COORDINATION WORKSHOP
MINUTES
REPORT OF THE AF 91 AIACC PROJECT WORKSHOP HELD AT SUNSET
HOTEL, KISUMU, 2ND –3RD SEPTEMBER 2002.
Persons whose names appear in the Participants List, Appendix 1, attended the meeting. Prof. Shem Wandiga, the Principal Investigator of the project, opened it. His statement is attached as Appendix 2. The Workshop approved the Agenda in Appendix 3.

Presentations by Drs. Dan Olago and Alfred Opere reviewed the General Circulation Models (GCM), Regional Circulation Models (RCM), SRES Scenarios (A1, B2, A1 F1, A2) and other regional model scenarios.

The revised detailed workplan was discussed and amended accordingly (see Appendix 4)

DISCUSSIONS
Response to AIACC Queries:
Section 4.2.1 since the primary objective of the study is mitigation, all the basic parameters will be included in the questionnaire.

On the issue of whether the MARA model will be used – Dr. Andrew Githeko to draft a response to this.

Response
The MARA model was designed to detect suitability of transmission using mean temperature, minimum temperatures and monthly cumulative precipitation. Our study areas have the right conditions for transmission and the current question is what drives hyper-transmission. From our previous work we know that hyper-transmission which precipitates epidemics is driven by co-occurrence of cumulative monthly rainfall thresholds and anomalies in the mean maximum temperature. At lower spatial scales transmission is affected by topography, hydrology and land use change. The MARA model is not suitable for the current work because it is designed for much larger spatial scales. It is also notable that the MARA model was based on the biology and ecology of An. arabiensis, which is the main vector in Southern Africa, and not An. gambiae, which transmits malaria in the East African Highlands. Furthermore transmission in Southern Africa is restricted by minimum temperature unlike at the equatorial region where it is driven by the mean maximum temperatures.

Historical analysis of data from local meteorological stations suggests that the mean maximum temperature is increasing at a rate of 0.5°C per decade. By the end of 2100 this would result in an increase of 5°C that is consistent with most global climate model projections. Using this data we can estimate the rates of elevational spatial change in transmission in the East African highlands. We expect that in this time scale unstable malaria will become stable and the likelihood of epidemics will drop. The MARA model may be useful here.

The most important models at the moment the moment are those that predict epidemics in areas of unstable transmission.
Section 4.7 on SAPs – additional funds to be sought and also a clarification to be made that the term SAPs are not similar to those of GEF and WB which take 15+ years to evaluate. Instead the project seeks to evaluate the impact on the ground.

The mechanisms that drive cholera in the Lake are temperature whereas for malaria its rainfall, and temperature with the later having an exponential effect on the transmission of malaria. Therefore, the selected parameters should explain this mechanism. Humidity is a function of temperature and rainfall.

**Cholera:**
Phytoplankton biology is linked to sea surface temperatures. Higher temperatures help to increase their productivity, thus the zooplankton (cholera vectors) also increase in relation to their food source (phytoplankton). A temperature anomaly of 4°C is required to turn on a cholera outbreak.

**Malaria:**
Minimum rainfall of 150mm per month for 1 to 2 months is required to precipitate a malaria outbreak. Temperature has an exponential effect, increasing the dynamics of malaria e.g. by shortening the time of larvae and parasite development. A temperature anomaly of 3°C is required to turn on a malaria outbreak. The issue of macro- versus microclimate (e.g. in swamps) is also important. For example, papyrus swamps maintain an average temperature of about 18°C, but when cleared the average day temperature can be as high as 30°C.

**Ocean dipole effect:**
We should explore the dipole reversal effect, in addition to El Nino episodes, in relation to the climate of the Lake Victoria basin.

**Critical Climate Parameters:**
Humidity, temperature, rainfall, lake surface temperature,

**GCM Models:**
We shall use outputs from SRES scenarios (A1, B1, A1FI, A2), Bruce Hewitsons data outputs, as well as statistical methods for climate modeling. Appropriate downscaling tools are available at DMCN and can be used as appropriate. For GCM outputs, monthly means will be the primary data used for the identified climate parameters, but daily data could be used in situations where this kind of resolution may appear to be critical.

**Statistical Analyses:**
Various types of multivariate analyses will be employed to analyse the climate data, e.g. monte carlo method, regression method, etc.

**Site Selection:**
Sites should be selected on the basis of the availability of meteorological records and proximity to a meteorological station, and hospitals with good and long-term medical records for malaria and cholera. For malaria, sites should be between 1500 and 2000m
a.s.l., for cholera, sites should be along the lake shore (the closer to the Lake the better), however secondary data will be used to determine this. At the same time exposure rate of the target populations will also be considered in determining the site selection.

GIS Maps/Data:
It was noted that in Tanzania, obtaining GIS maps for the Lake Victoria watershed is not a problem. These could also be available in Kenya and Uganda, but needs to be further explored. Possible sources include LVEMP, Africover, ICRAF, Ministries of Water, and Lake Victoria Development Authority (LVDA). It was agreed that we can use existing GIS templates if they are set up in a manner that would fit our intended use, instead of tying down human resources and time by trying to digitise our own maps from scratch.

Climate Data Collection:
DMCN should be our principal source of data or link to data as they handle or mirror all the meteorological data that comes from the three east African countries, and others.

Health Data:
Ethical aspects should be considered when collecting the data e.g. data confidentiality. Hospital/health data can be obtained from mission hospitals or other e.g. private ones that have good data, as well as from WHO, Provincial Annual Reports, Health Centres, NGOs, etc.

Socio-Economic/ Health Questionnaire:
The socio-economic and health questionnaire will be developed using the following guidelines.

- Demographics of respondent
- Household income(s)
- Household expenditure patterns
- Household food security
- Access and availability of water
- Access and availability of health facilities
- Access and availability of sanitation facilities
- Time activity patterns

Secondary Data:
Secondary data to be collected for the whole catchments area

Sampling Procedure:
Stratified random sampling by:
- Ecosystem – hilltops, swamps and hillside
- Gender
- Age
- Socio-economic status

Research clearance:
Research clearance permits will be required for the investigators and the students, and all three participating countries are required to check on this matter.

**Research Students (RAs):**
The primary allegiance of the students is to the project, and secondarily to their thesis. The students are required to develop their proposals with the principal objectives of our project in mind. The recruitment of RAs and postgraduates to be completed by end of September 2002.

**Training of Research Assistants and Postgraduate Students:**
This will be done in Kenya Medical Research Institute – Kisian by Dr. Andrew Githeko from the 14th –20th October 2002. The topics to be covered in the training will include:
- Sampling procedures
- Data gathering techniques
- Focus Group Discussion
- Field Testing
- MS Access Statistical Package

**Data Storage:**
It was agreed that data be stored in MS Access database format. The structure of the database, its design and management centre are yet to be agreed.

**Sub-contracts:**
These were reviewed and agreed. Honoraria will be paid on delivery of the identified Verifiable Deliverables that have been outlined in the proposal workplan. Student and Investigator contracts should be issued for Uganda and Kenya scientists. In Tanzania, the agreement has been signed by the Institution, which the scientists directly work for, so no further cover is required.

**Insurance Cover:**
Each person will be responsible for obtaining an insurance cover for the time during which they are doing fieldwork as it was not catered for in the proposal.

**Accounting System:**
The project will adopt the KNAS accounting system. The KNAS Office is charged with ensuring that these guidelines are circulated to the project members.

**Reporting Schedules:**
Narrative reports of the work done so far after each activity is completed and a financial running expense account should be sent to Prof. Wandiga on a continuous basis and not at the end.

**Computer and Accessories:**
These will be purchased centrally and in one procurement in order to ensure that we all get good quality computers.

**Consultants/Experts:**
For consultants or experts that can act as internal reviewers of the process, the following names were suggested: Basalirwa and Otiti (both Uganda), Dr. A.Z. Owino (Potsdam, climate modelling). Other names will be forwarded by project members later.

**Data Assessment:**
Pls should continuously carry out data assessment. Secondary data analysis can be internally reviewed by consulting the above experts, or principal researchers.

**Reporting Mode:**
Prof. Wandiga is to liaise with Neil Leary in order to get the preferred format for the bi-annual project reports.

**AIACC Funds for Workshops:**
AIACC can give up to $10,000 for workshops. Proposals will however have to be written.

**Extra Research Funding:**
Students may apply to other funding agencies e.g. IFS for money to supplement their research as that provided for in the proposal may not be adequate. Other avenues should be explored by contacting e.g. Dr. Nyenze in WMO/CLIPS(Health and Climate), Dr. Owino in Max Planck (capacity building and training in running models), NOAA programmes, WHO "Roll Back Malaria" programme, START Fellowships, USAID, UNICEF, IFS SIDA-SAREC, Pharmaceutical Companies.

**APENDIX 1: PARTICIPANTS OF AIACC KISUMU MEETING ON 2-3RD SEPT. 2002.**

<table>
<thead>
<tr>
<th>Name</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Alfred Opere</td>
<td>Tel: 254-2-449004 Ex.2203</td>
</tr>
<tr>
<td>P.O.Box 30197 Nairobi</td>
<td>Mobile: 0722-858660</td>
</tr>
<tr>
<td>Tel: 254-2-449004 Ex.2203</td>
<td>Email: <a href="mailto:aopere@uonbi.ac.ke">aopere@uonbi.ac.ke</a></td>
</tr>
<tr>
<td>P.O.Box 30197 Nairobi</td>
<td></td>
</tr>
<tr>
<td>Tel: 254-2-449004 Ex.2203</td>
<td></td>
</tr>
<tr>
<td>Prof. Paul Edward Mugambi</td>
<td>Tel: 256-041-540692</td>
</tr>
<tr>
<td>Makerere University</td>
<td>Mobile: 077 454541</td>
</tr>
<tr>
<td>P.O. Box 7062, Kampala</td>
<td>Fax:256-041-3440190 256-041-541280</td>
</tr>
<tr>
<td>Dr. Andrew Karanja Githeko</td>
<td>Email: <a href="mailto:ppmugambi@yahoo.co.uk">ppmugambi@yahoo.co.uk</a></td>
</tr>
<tr>
<td>Kenya Medical Research Institute</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 54540 Kisumu, Kenya</td>
<td>Tel: 035 22923</td>
</tr>
<tr>
<td>Dr. Pius Sylvester Achola</td>
<td>Mobile: 0722 890856/073803782</td>
</tr>
<tr>
<td>Kenya Medical Research Institute</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 54540 Kisumu, Kenya</td>
<td>Tel: 035 22923</td>
</tr>
<tr>
<td>Dr. Pius Yanda</td>
<td>Mobile: 0722 890856/073803782</td>
</tr>
<tr>
<td>University of Nairobi,</td>
<td>Email: <a href="mailto:dachola@yahoo.com">dachola@yahoo.com</a></td>
</tr>
<tr>
<td>Pan African Start Secretariat</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 301970 Nairobi, Kenya</td>
<td>Tel: 4447740</td>
</tr>
<tr>
<td>Dr. Daniel Olago</td>
<td>Mobile: 0722 768536</td>
</tr>
<tr>
<td>University of Nairobi,</td>
<td>Fax: 254-2-4449539</td>
</tr>
<tr>
<td>Pan African Start Secretariat</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 301970 Nairobi, Kenya</td>
<td>Email: <a href="mailto:dolago@uonbi.ac.ke">dolago@uonbi.ac.ke</a></td>
</tr>
<tr>
<td>Dr. Eric Odada</td>
<td></td>
</tr>
<tr>
<td>Prof. Rehema Jacton Sigalla</td>
<td></td>
</tr>
<tr>
<td>University of Dar-es-salaam</td>
<td></td>
</tr>
<tr>
<td>Pan African Start Secretariat</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 301970 Nairobi, Kenya</td>
<td>Tel: 4447740</td>
</tr>
<tr>
<td>Dr. Eric Odada</td>
<td>Mobile: 0744 265580</td>
</tr>
<tr>
<td>University of Dar-es-salaam</td>
<td>Fax: 22-2410393</td>
</tr>
<tr>
<td>Pan African Start Secretariat</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 301970 Nairobi, Kenya</td>
<td>Email: <a href="mailto:vanda@ira.uds.ac.tz">vanda@ira.uds.ac.tz</a></td>
</tr>
<tr>
<td>Prof. Eric Odada</td>
<td></td>
</tr>
<tr>
<td>Pan African Start Secretariat</td>
<td></td>
</tr>
<tr>
<td>P. O. Box 301970 Nairobi, Kenya</td>
<td>Tel: 4447740</td>
</tr>
<tr>
<td>Dr. Eric Odada</td>
<td>Mobile: 0744 307831</td>
</tr>
<tr>
<td>University of Dar-es-salaam</td>
<td></td>
</tr>
<tr>
<td>Pan African Start Secretariat</td>
<td></td>
</tr>
</tbody>
</table>

Dear Colleagues, Ladies and Gentlemen.
I warmly welcome you to this workshop that will map out our study and activities for the project “Capacity building to evaluate and adapt to climate change induced vulnerability to malaria and cholera in the Lake Victoria Region.” Our project aims at increasing the understanding of the relationship between climate change parameters and the incidences of malaria and cholera in the Lake Victoria region. Malaria, for a long time before the endemic spreads of HIV/AIDS, was the leading killer of people in this region. It remains a major cause of death in the region. Episodes of cholera are also frequent in the region. The frequency and intensity of the two diseases outbreak maybe associated with climate.

The purpose of this meeting is:
   a) To understand and establish the theoretical and practical basis of the project by every researcher.
   b) To agree on the activities that each one of us will undertake in the project during the first year.
   c) To agree on the role of each group of teams of researchers in the project.
   d) To agree on the project management and the necessary role each administrative institution is to provide.
   e) To prepare research questionnaires and agree on each.
   f) To consider and answer research questions raised by the AIACC Science Director.
   g) To consider any other relevant issue.

Ladies and Gentlemen, these are important challenges that we must accomplish in two days. I call on each one of us to give the best in enabling this workshop achieve its objectives.

I wish to register my sincere appreciation to each one of you who has assisted in one way or the other in the development of the project to this stage. We have just made but one step in our journey. For the three years, we will intimately interact with one another. We will certainly have our times of joy and times of disappointment. Whatever, the occasion, I wish we shall develop the true academic spirit of solving challenges. Above all, this project calls for hard work. I am sure that you have accepted to work hard, otherwise you would not attend this meeting.

Lastly, let me give a very hearty thank you to our sponsors, AIACC Science team, START Head Office Staff and TWAS Staff. The comments of the technical committee and their criticism of the project have been our strength.

Ladies and Gentlemen, welcome to Kisumu City, welcome to AIACC project on East Africa and welcome to hard work.

Thank you.
# APPENDIX 3: DETAILED WORKPLAN

<table>
<thead>
<tr>
<th>No.</th>
<th>Mo.</th>
<th>Activity</th>
<th>Method</th>
<th>Verifiable Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1: Planning and Analysis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>First coordination meeting</td>
<td>Workshop</td>
<td>Minutes of workshop</td>
</tr>
<tr>
<td>2</td>
<td>1-2</td>
<td>Procurement of equipment</td>
<td>Administration</td>
<td>Invoices/receipts</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Recruitment of research assistants (postgraduate RAs)</td>
<td>Administration</td>
<td>Supply of C.V.s.</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>Training of RAs and Field Testing of Questionnaire</td>
<td>Training Workshops</td>
<td>Training workshop report</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Develop socio-economic questionnaire</td>
<td>Formulation of quantitative and qualitative questions</td>
<td>Approved Questionnaire</td>
</tr>
<tr>
<td>6</td>
<td>2-3</td>
<td>Develop health questionnaire</td>
<td>Formulation of quantitative and qualitative questions</td>
<td>Approved questionnaire</td>
</tr>
<tr>
<td>7</td>
<td>2-3</td>
<td>Field test questionnaires</td>
<td>Pilot surveys</td>
<td>Revised Questionnaire</td>
</tr>
<tr>
<td>8</td>
<td>1-6</td>
<td>Climate data gathering (2nd data) – precipitation (P) and temperature (T)</td>
<td>Secondary data collection from meteorological stations</td>
<td>Climate Database</td>
</tr>
<tr>
<td>9</td>
<td>1-6</td>
<td>Malaria (M) and cholera (C) data gathering (2nd)</td>
<td>Secondary data collection from health institutions</td>
<td>Health database</td>
</tr>
<tr>
<td>10</td>
<td>1-6</td>
<td>Habitat, risk agent numbers and distribution data gathering (2nd)</td>
<td>Secondary data collection from research institutions</td>
<td>Risk agent database</td>
</tr>
<tr>
<td>11</td>
<td>1-6</td>
<td>Socio-economic data gathering (2nd)</td>
<td>Secondary data collection from national statistical bureaus and social and economic ministries</td>
<td>Socio-economic database</td>
</tr>
<tr>
<td>12</td>
<td>3-4</td>
<td>Identification of candidate pilot sites</td>
<td>GIS layers and data from socio-economic surveys</td>
<td>GIS maps</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>Visit candidates sites and select final pilot sites</td>
<td>Fieldwork</td>
<td>Reports on pilot sites</td>
</tr>
<tr>
<td>14</td>
<td>11-12</td>
<td>Year 1 report writing</td>
<td>Summary of results from project activities by PIs</td>
<td>Half-year reports</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Present project objectives and sensitize pilot communities.</td>
<td>Participatory methodologies</td>
<td>Workshop reports</td>
</tr>
<tr>
<td>16</td>
<td>2</td>
<td>Field test questionnaires</td>
<td>Pilot fieldwork</td>
<td>Amended questionnaire</td>
</tr>
<tr>
<td>17</td>
<td>1-6</td>
<td>Climate data gathering (1st data)</td>
<td>Time series and statistical analysis, Descriptive statistics &amp; Model testing</td>
<td>Time series data statistical analysis report, descriptive statistics report, model report</td>
</tr>
<tr>
<td>18</td>
<td>3-4</td>
<td>Malaria (M) and cholera (C) data gathering (1st)</td>
<td>Time series and statistical analysis Descriptive statistics Model testing</td>
<td>Health database for 1st data</td>
</tr>
<tr>
<td>19</td>
<td>3-4</td>
<td>Socio-economic data gathering (1st)</td>
<td>Participatory methodologies, socio-economic surveys, focused group discussions, household interviews, field surveys and key informant interviews</td>
<td>Socio-economic 1st database Field report</td>
</tr>
<tr>
<td>20</td>
<td>6-8</td>
<td>Statistical analysis of climate data (P, T) and health data (M, C), socio-economic data</td>
<td>GIS and regression analysis</td>
<td>GIS maps/reports Analysis reports.</td>
</tr>
<tr>
<td>21</td>
<td>7-9</td>
<td>Time series analysis, climate-disease correlations and parametric modeling</td>
<td>Time series and correlation analysis, and parametric modeling</td>
<td>Models</td>
</tr>
<tr>
<td>22</td>
<td>10</td>
<td>Validation and sensitivity testing</td>
<td>Correlation and parametric modeling</td>
<td>Models</td>
</tr>
<tr>
<td>23</td>
<td>10-11</td>
<td>Interpretation of results</td>
<td>Evaluation</td>
<td>Evaluation report</td>
</tr>
<tr>
<td>24</td>
<td>11-12</td>
<td>Integrate baseline data in GIS format</td>
<td>GIS</td>
<td>GIS maps</td>
</tr>
<tr>
<td>25</td>
<td>12</td>
<td>Research group meeting to discuss results and flag data gaps</td>
<td>Workshop</td>
<td>Workshop report</td>
</tr>
<tr>
<td><strong>Year 2: Analysis and Planning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>13-15</td>
<td>Apply existing climate change models to estimate T and P scenarios</td>
<td>Model testing</td>
<td>Scenario Development</td>
</tr>
<tr>
<td>27</td>
<td>14-16</td>
<td>Estimate changes in risk magnitude using statistical model of P, T, vs. M, C (activity 18)</td>
<td>Risk analysis</td>
<td>Scenario Development</td>
</tr>
<tr>
<td>28</td>
<td>15-18</td>
<td>Estimate changes in risk distribution from habitat changes (activity 10)</td>
<td>Model testing</td>
<td>Scenario Development</td>
</tr>
<tr>
<td>29</td>
<td>18</td>
<td>Uncertainty analysis of estimated risk scenarios</td>
<td>Model testing and correlation analysis</td>
<td>Scenario Development</td>
</tr>
<tr>
<td>30</td>
<td>15-20</td>
<td>Draft manuscript 1 for journal article 1</td>
<td>Result compilation</td>
<td>Manuscript</td>
</tr>
<tr>
<td>Week</td>
<td>Activity Description</td>
<td>Method/Document</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Workshop with key policy makers and international agencies (e.g. UNEP, WHO)</td>
<td>Workshop</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Meeting with pilot communities to present results and initiate strategic planning</td>
<td>Participatory stakeholders</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>meeting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Focus Group Discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Report and Minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Formation of local working groups</td>
<td>Participatory stakeholders</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>meeting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Focus Group Discussion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Report and Minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Identification of all possible community-based M, C risk adaptation/mitigation strategies</td>
<td>Evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local Adaptation Strategies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Feasibility assessment to identify viable short list of strategies</td>
<td>Pre-“practice and attitude”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>survey of target risk groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>List of Viable Strategies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Multi-criteria evaluation of viable strategies to identify preferred adaptation options (PAOs)</td>
<td>Participatory workshop using</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>multi-criteria decision making</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>List of Preferred Adaptation Options</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Produce strategic action plans (SAPs) for pilot community adaptation</td>
<td>Design SAPs with the</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>representatives of target risk groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAPs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Draft manuscript 2 for journal article 2</td>
<td>Result compilation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manuscript</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Follow-up meeting with key policy makers to mobilize resources</td>
<td>Workshop</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Year 2 report writing</td>
<td>Summary of results from project</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>activities by PIs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Implementation of priority adaptation/mitigation actions from SAPs</td>
<td>Implementation using</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>participatory approaches</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Report of Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Monitoring and evaluation</td>
<td>Post-“practice and attitude”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Results of Post- “practice and attitude” survey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Modification of actions as required</td>
<td>Adaptive feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Report of Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Field manual: “Integrated capacity building for community-based adaptation to climate-induced malaria and cholera health risks”</td>
<td>Publication</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Field Manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Draft manuscript 3 for journal article 3</td>
<td>Result compilation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manuscript</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Dissemination workshop</td>
<td>Workshop</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Final report writing</td>
<td>Summary of results from project</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>activities by all team members</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Final Report</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OUTPUT 2: NATIONAL PLANNING AND COORDINATION MEETINGS

a) Kenya

MINUTES OF THE AF91- KENYA GROUP MEETING HELD AT UTALII HOTEL, JANUARY 2003

DATA GATHERING

1. CLIMATE
Four stations have been selected for further analysis at each of the study sites i.e. Kisumu and Kericho. Rainfall data (daily) and temperature data (daily $T_{\text{max}}$, daily $T_{\text{min}}$). Daily records are also required for hydrological data. Daily mean values (e.g. $T_{\text{average}}$) and mean monthly values are to be avoided as the data smoothing may obscure critical information on variability that may be primary drivers of the climate-health link.

Uganda and Tanzania are to provide the names of meteorological stations within and around their study sites.

It should be noted that up to 1962, Imperial Units were used when recording the meteorological data. There are, therefore, translation errors in some cases when the data was converted to S.I. units. Quality assurance and quality control (QA/QC) checks on the data are, therefore, essential. It may be necessary to obtain hard copies of the data to check whether that that is provided in electronic or other format, is correct (Action: Opere/Githui).

There are gaps in the Uganda data, particularly from 1972 to 1978. There are data problems in Kericho data, particularly for 1948 and in the 1980s.

Temperature data can also be obtained from satellite observations for the period 1984 to present. Some of the data may be obtained free of charge from the Malindi Research Station – further details will be obtained from Mr. Mwangudza and Professor Malo (the station coordinator, to see how far back we can go with this data (Action: Olago). The satellite imagery will give coverage of the area. It can be specific e.g. we may select a certain hour of the day and night for $T_{\text{max}}$ and $T_{\text{min}}$ data, respectively. This will ensure that both the costs of data acquisition, and data storage capacity requirements, are kept at a minimum. Such data would be useful for verification of meteorological station data, and a series of one year would be sufficient for this. Digital data (not maps), geometrically corrected, will be used.

Humidity data could be critical, and for scenario generation, it might be useful. Sensitivity tests could be run to verify this. As far as possible, the data and sites should all be co-located.

Cost of meteorological data is high, and modalities of cost reduction will be looked into (Action: Prof. Laban Ogallo).
2. SOCIO-ECONOMICS
The population census data for Kenya (1999) is not yet available in Kenya, but parts of it can be downloaded from the internet.
- Secondary data can be obtained at the District Level.
- World Bank also has relevant secondary data
- CBS can generate a tailored folder (data) if given specific requests as to the data that are required.

The secondary data are contained in publications of 1994, 1997 at district level, and the data include:
- Household incomes (mean monthly)
- Household expenditures (mean monthly)
- Household welfare indicators
- Healthcare delivery systems
- Disease incidence

Analysis:
- Primary data can be obtained from 1998 to present.
- Data, entered in SPSS, can easily be imported into Epi-Info.
- The following are needed for the socio-economic component:
  - Standards for household size classes (to check with HABITAT or CBS)
  - Age structure

3. HEALTH
We need data on the frequency of infections at household level.

What is the correlation between impact and vulnerability? We may need to generate a composite index of vulnerability.

From the colonial years up to the early 1980s, there are Health Bulletins which may contain useful information. Health Bulletins could be available at:
- CBS
- Welcome Trust (behind Kenyatta Hospital)
- Ministry of Health Library, Division of Vector Borne Diseases (Public Health)
- Dr. Onsongo (Director of Disease Outbreaks)

The Kericho Tea Estate Hospital should have relevant, long-term health data. Due to the issue of co-located data, we would need to identify hospitals within a maximum radius of 40km in our study sites. The Kericho Tea Estate Hospital and other mission hospital data can then be used as controls, using a technique of weighted regression analysis.

Kericho has three clinics and three district hospitals, but the data is only from 1998 to present. Some of the data is not reliable, for example at Kaitui. There is a missionary hospital (Tanwek Hospital) in the vicinity of Kabianga area.

The data in the hospitals that have traditionally been used include:
• Total hospital admission
• Total inpatient/outpatient malaria cases (HIV affects the mathematics)
It was felt that reported cases would be more representative of the general area.

Cholera:
• Dr. Waiyaki (KEMRI – bacteriologist) should be contacted for cholera data (Action: Kathuri)
• There were cholera outbreaks in 1982, 1992 and 1998 connected with El Nino. It is critical to get all data for these periods to sort out the thresholds for cholera outbreaks.
• Medical data to be obtained from Ministry of health and/or World Health Organisation – this data to include intervening peak seasons (Action: Olaka)

Analysis:
• MATLAB is a spatial statistical analysis programme for malaria.

4. HYDROLOGY/LAND USE
Daily data (not monthly) are required for the hydrology of the basin. The data should be co-located with the sites and other data being gathered.

Sources of hydrological data:
• LVEMP – good database with daily data (available from Professor Mutua)
• LANDSAT/SPOT satellite data
• River Nyando – a student of Geography Department has digitised the whole river basin (Mr. Ouna at ILRI)
• Ministry of Water

It would be useful for us to look at the following w.r.t. hydrology:
• Extent of flooding areas
• Changes in extent of flooded areas over time
• Snapshots of the dynamics of open water surface area (from satellite images)
The above can be accomplished by obtaining data from the following sources:
• Ordnance surveys (1952, 1956, 1962, 1973) – data available from the Geography Department, UoN. The maps will be digitised using GIS.
• Ordnance surveys are also available for Uganda and Tanzania.
• Ahero gauge has good data
• Hydromet Project Database in the Ministry of Water. There is also one at the Africana Section, University of Nairobi, and also at the CBS.

For the database on land use, we can explore the following:
• FAO digitised format data
• Ministry of Water (available for research) who also have available a DTM
• Central Bureau of Statistics (CBS)
Analysis:
• The maps need to be digitised at a scale of 1:10,000 in order to be able to capture the data at household level
• HYDATA – hydrological model
• IDRISI – has in-built hydrological models.
• The hydrology components of the SWAT and ACRU models are to be critically examined to see which of the two models is likely to better handle our hydrological data.

5. FIELDWORK
• The same group will be revisited, and GPS locations of those households whose locations were not taken will be ascertained.
• GPS readings should be taken in UTM system

The sample sites geographical locations (UTM coordinates) are as follows:
• Kisumu West: 9976N - 9994N; 667E to 688E
• Kericho: 9949 - 9970N; 735E – 743 E

6. SCENARIOS
Further discussions on generating detailed, specific scenarios will be initiated at a later date. The following issues below should, however, be considered urgently:

• What is the common field to relate all the various data? (action: Nyandega, Olago, Olaka)
• Are all critical indicators (data) available to help us identify vulnerability and adaptation measures? (Action: Githeko, Opondo)
• It is noted that the primary data is a sample for a specific time period. For scenarios, we would need to also have secondary data that will have a time series.
• Correlation indices are required to link our GIS layers to the global scale. (Action: Nyandega, Olago, Olaka)
• How can purchasing power be measured at the local scale (as opposed to global scale indicators such as GDP which are too generalised to reflect the local conditions)? Indices can be described. (Action: Opondo, Kathuri)
• The socio-economic components of the SWAT and ACRU models are to be critically examined to see which of the two models is likely to better handle our socio-economic data. (Action: Opere, Githui)
• Different scenarios will be explored mainly by sensitivity analysis. (action: all)
• Scenarios as inputs are a bit problematic because one has to input scenarios that make sense.
• Some models are hardwired - all you need is to define your location and it gives you the output.
• But some are not and one has to play around with them but caution is necessary.
• Prof. Mutua recommends that regional GCM because the global ones do not take in topography.
• We do not need to run GCM models because Prof. Mutua already has the results/figures so that we can justify the figures that we select for creating scenarios. And in any case IPCC has already run the models.
• Mr. Nyandega feels that trend and synthetic models are more appropriate for the project.
• We can run the GCM models and layer them on GIS and so we can generate more information. But we have to be sure that the merging does not result in opaque layers. So circumvent this we could use for example:
  ➢ Canadian results = Layer 1
  ➢ UK results = Layer 2 etc
• Then we could pass light through the layers and see whether they agree and if they do then there must be something of interest from these layers.
• The essence of modelling is to give us a body of data which can enable us to predict the likelihood of an event.
• The cumulative curve is useful in giving us the threshold, of interest is to why the threshold is changing.
• Data on vector densities for malaria so that we can extrapolate.
• Min. of Health has a dept. which collects data on vector borne diseases and this data can be extracted.
• For cholera = Div. of Communicable Diseases so they could be having data on cholera.
• Clear research questions to be defined and addressed.
• Basic understanding of the biology of the system that we are dealing with.

**Integrated Model – Prof. Mutua**

```
R/F
T°C
Landuse
Hydrology
Socio-economic

\[ R^i \rightarrow \text{Malaria} \]
```

7. OTHER ISSUES

• The SPSS template has been sent to Uganda and Tanzania
• An ID no. is required for the datasets to enable linking of all GIS layers
• The maps need to be digitised at a scale of 1:10,000 in order to be able to capture the data at household level
• The next field trip is scheduled for June-July 2003 to capture possible malaria epidemic following the long rains
• It is recommended that Tanzania and Uganda hold National Committee meetings (such as the one we have just held) in the near future to assess and coordinate the project activities across all regions. Dan Olago is to attend both meetings to brief the NCs on the discussions and outcome of the Kenya Group meeting.
• The South Africa meeting in March will be attended by: Wandiga, Mutua, Githeko and Yanda
• Each group is to write a brief on data analysis: data gathering, tools, scenarios.

b) Uganda
REPORT OF THE AIACC AF-91 UGANDA NATIONAL STAKEHOLDERS MEETING HELD AT MAKERERE UNIVERSITY FACULTY OF FORESTRY 22-7-2003
To note: The list of participants is attached at the end of this report
Presentations by members will be annexed in subsequent communications

The meeting started at 9.15 am and proceeded as follows:

1 Introductions

The chairman Professor E. Mugambi opened the meeting by welcoming members and asking them to introduce themselves.

2. Background to the project

Prof. Mugambi made a presentation of the background to the project in which he outlined the objectives, the key participating countries and institutions, and the source of funding of the project.

3. Progress Report

Dr Edward Kirumira made a presentation on the progress of the project in which he highlighted the activities that have been accomplished, and the challenges that have been experienced over the period.

Involvement of other actors

It was agreed that the involvement of the various institutions in a project of this kind was an opportunity for them to collaborate and form networks on important issues. The presenter pointed out that the involvement of the Uganda National Academy of Sciences, to which all academics are potentially members, is an opportunity that must be seized and utilized for the dissemination of the findings of the study.

The people of Kabale and Gaba where the study was conducted were especially acknowledged for all the assistance that they extended to the project. The individuals and institutions that have in various ways contributed to the study were also thanked, and it was hoped that stronger linkages with various stakeholders could be made so as to make the research more action oriented.

The presenter said that to a given extent, the research is action oriented because of the exchange that is generated among the participants and with the community, but there is
need to do a lot more in this respect. On the involvement of other actors, he said the initial step was to identify focal persons in the various agencies where secondary data could be collected. He also added that the invitation of the various stakeholders to this meeting was a manifestation of the commitment of the project to involve other people and institutions.

Dr Olago informed participants that the project would aim to produce policy briefs that are regional as well as those that are country-specific. This will contribute to the formation of an integrated regional policy and interaction process.

**Challenges of data collection**

One participant advised that in light of the difficulties faced in secondary data collection, the project could make use of the weekly disease summaries that are published in the newspapers as one source.

It was also agreed that since the various institutions must be generating their own data, they should be approached to assist so that the project does not have to generate data that has already been compiled. The focal persons that have been identified in these institutions could be made part of the process in order to help with both data collection and interpretation.

**Dissemination**

It was observed that while many researchers go to a lot of effort to collect data, the problem is that people do not get to know about the data collected; especially the people at the grass roots. This is why some districts like Kampala do not act on the findings of research. An example was given of KCC which had almost abandoned the Vector Control Department, but which could use the information generated by this research to reinvigorate that department.

It was observed that projects are faced with the challenge of making research findings more friendly and understandable to the end users. There is also need to devise measures to see how recommendations can be translated into action.

It was therefore agreed that the need to include some focal persons in the study be further addressed, and that the project would endeavor to devise more user friendly methods of data dissemination.

**Capacity building**

It was agreed that this was a very important aspect of the project, and that it should be emphasized. It was also reported that one of the Research Assistants was due to travel to Nairobi in August for training in GIS.

It was also reported that preparations were underway to have one member of the team to undergo socio-economic scenario training.
4. Cholera situation in Uganda

Dr. Godfrey Bwire made a presentation on the cholera situation in Uganda.

Reactions to the presentation:

Conditions for cholera
It was observed that to concentrate on El Nino as the main factor in cholera is to oversimplify the issue, and that there is need to concentrate on how cholera is caused. Is it climatic conditions? Many people are at risk because of relying on ground water that is contaminated by run-off, and also contaminated by feaces because many people have no latrines. Many people also cannot afford to get clean and safe water. So there is need to broaden the scope because many people live in conditions that put them at risk of exposure to cholera.

The presenter informed members that there are places like Sese Island that seem to have the right conditions for cholera, where the water table is very close and people do not have latrines, but do not actually have the disease. This is because cholera outbreak is dependent on a high dose of the bacteria. Instead, Sese has a very high prevalence of dysentery.

Preparedness for Cholera
Participants were informed that preparedness by the Ministry of Health enabled it to keep the cases low after year 2000. This preparation involved reactivating the cholera task force, sensitization of the people about the disease, and awareness creation so that people could use safe water and also avoid buying food and drinks sold in the open.

It was observed that cholera preparedness needs to be dealt with as a national issue instead of leaving it to local governments. These local governments do not have enough money. This preparedness should include activities like upgrading some of the slum areas and ensuring water quality surveillance. Government should stop dealing with cholera in crisis situations.

Water quality
It was reported by a participant from the department of hydrology that rural safe water coverage had improved from 29% 10 years ago to 55%, and urban coverage had improved to 68%. However, in the urban area, the responsibility of government is to make water pipes available in a location, but not to connect it to people’s homes.

Ms Thereza Twesigomwe from Kabale made a presentation on the malaria situation in Kabale.

Reactions:

Data destroyed by fire
On the report that health data was destroyed by fire in the office of the District Director of Health Services, participants wondered whether it was possible to reconstruct this data from other sources such as the health units or other places where this data had been submitted.

The presenter reported that attempts are being made to do so but it was a lengthy and tiring process.

**Drug abuse**
Participants wanted to know what measures are in place to control the use of drugs like fansidar.

The presenter informed participants that this was a really big problem because people engage in self-prescription and medication. Some people demand certain drugs from the health units. So control is a bit difficult and this is compromising the efficacy of the drugs.

**Bed nets**
It was observed that the use of treated bed nets is a subject of controversy for commercial and political interests.

It was therefore agreed that there is need for better channels of communication to inform the people about the efficacy of using bed nets as a fight against malaria. It was reported that a WHO study revealed that reducing the man-to-mosquito contact was more cost effective than the treatment of malaria. A participant from the National Drug Authority also reported that the treated bed nets were tested and found usable in Uganda.

It was agreed that the numerous FM radio stations in the country would be a good channel for information dissemination, as well as the schools.

**Climate change in Kabale**
Some participants wondered if the claim of climate change in Kabale is real or the changes observed are to due to the changing land use. One wondered if the start and increase of malaria cases in Kabale may also be due to the changing land use patterns whereby new breeding sites and habitats for mosquitoes have been established.

**6. Water and Climate Change**

Mr. Michael Kizza made a presentation on water and climate change.

**Reactions to the presentation:**

**Rainwater harvesting**
It was suggested that the cost notwithstanding, rainwater harvesting should be used more in people’s homes because this would improve sanitation and therefore mean less
vulnerability. Rainwater is already clean. However, there is also need to look at how water is disposed of after it is used, because this is usually a cause of danger to health.

7. Climate aspects of the project

Dr. Dan Olago made a presentation on the climate aspects of the project.

Reactions to the presentation:

It was observed that LVEMP and FAO have done a lot of work in the area of climate since 1997. Ways should be found of convincing these agencies to share some of this information. It may be necessary to form partnerships with them as a way of showing them that the project does not simply seek to grab their data for private use.

There is also need to find ways in which locally available competencies can be used to contribute to the capacity of the project. For instance NEMA and the Water department have a lot of experience in GIS.

Way forward

1. We should take account of the fact that data can no longer be obtained free of charge since it costs money to collect
2. Collaboration between stakeholders is an important issue. We need to attract the sympathy of influential actors by relating research to action. This will also give more credibility to our research.
3. We should plan on having more such meetings
4. Dissemination of findings is recommended as important, coupled with some sensitization
5. Additional funding could be sourced from SIDA because they have a component on water.

List of participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>e-mail/ telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nanyunja K. Robinah</td>
<td>Research Scientist, MUIENR, Box 7298 Kampala</td>
<td><a href="mailto:rhobink@yahoo.com">rhobink@yahoo.com</a></td>
</tr>
<tr>
<td>Theresa Twesigomwe</td>
<td>Health trainer/supervisor, Kabale</td>
<td>Tel 077437729</td>
</tr>
<tr>
<td>Kizza Michael</td>
<td>Asst Lecturer, Dept of Civil Engineering, MUK</td>
<td><a href="mailto:mkizza@tech.mak.ac.ug">mkizza@tech.mak.ac.ug</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tel 077614580</td>
</tr>
<tr>
<td>Daniel Olago</td>
<td>Senior Lecturer, Dept of Geology, University of Nbi, Box 30197 Nairobi</td>
<td><a href="mailto:DOLAGO@UONBI.AC.KF">DOLAGO@UONBI.AC.KF</a></td>
</tr>
<tr>
<td>Kabumbuli Robert</td>
<td>Department of Sociology, MUK, Box 7062 Kampala</td>
<td><a href="mailto:socdev@infocom.co.ug">socdev@infocom.co.ug</a></td>
</tr>
<tr>
<td>P.E. Mugambi</td>
<td>PR AIACC</td>
<td><a href="mailto:pmugambi@math.mak.ac.ug">pmugambi@math.mak.ac.ug</a></td>
</tr>
</tbody>
</table>
OUTPUT 3
SOCIO-ECONOMIC SECONDARY DATA COLLECTION FOR KENYA

1. DEMOGRAPHICS
The demographics of the districts under study i.e Kisii, Kisumu, Homabay and Kericho do not show a regular trend in the 1990s due to subdivisions. In spite of subdivisions, the names of most of them were maintained while for one district i.e Kisii district, the name ceased to exist. Thus, Kisii district was subdivided into Gucha, Nyamira and Kisii Central. Kisumu district was subdivided into Kisumu and Nyando districts. Rachuonyo district was curved from Homabay district while Bomet and Buret districts were curved from Kericho district. It is therefore important that the demographic data reflects all these districts. The following tables show the demographics of these districts.

Table 1: Distribution of population by sex & district by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>50.6</td>
<td>49.4</td>
<td>995456</td>
<td>174084</td>
</tr>
<tr>
<td>Kisumu</td>
<td>48.2</td>
<td>51.8</td>
<td>832845</td>
<td>169458</td>
</tr>
<tr>
<td>Homabay</td>
<td>48.2</td>
<td>51.8</td>
<td>776466</td>
<td>174802</td>
</tr>
</tbody>
</table>

(Tanzania) (Details to be submitted later)
Table 2: Percentage distribution of household head by sex and district by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Population (N)</th>
<th>Sex of household head</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male (%)</td>
<td>Female (%)</td>
</tr>
<tr>
<td>Kisii</td>
<td>174084</td>
<td>73.6</td>
</tr>
<tr>
<td>Kisumu</td>
<td>169458</td>
<td>64.2</td>
</tr>
<tr>
<td>Homabay</td>
<td>174802</td>
<td>61.0</td>
</tr>
<tr>
<td>Kericho</td>
<td>121789</td>
<td>74.9</td>
</tr>
</tbody>
</table>

Source: CBS, 1996

NB: Household Headship: The household head is defined as the senior most member who makes key decisions in the household and whose authority is acknowledged by other members. The high population of female headed households e.g. in Kisumu and Homabay is attributed to the high turn over of labour out – migrants to other areas especially Nairobi, Rift valley and Coast provinces.

Table 3: Distribution of population by marital status and district by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>N</th>
<th>Child under 15 yrs (%)</th>
<th>Single (%)</th>
<th>Married Monogamous (%)</th>
<th>Married Polygamous (%)</th>
<th>Divorced Separated (%)</th>
<th>Widowed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>995456</td>
<td>49.6</td>
<td>18.2</td>
<td>24.2</td>
<td>3.9</td>
<td>1.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Kisumu</td>
<td>832845</td>
<td>47.2</td>
<td>18.1</td>
<td>25.2</td>
<td>5.0</td>
<td>0.7</td>
<td>3.8</td>
</tr>
<tr>
<td>Homabay</td>
<td>776466</td>
<td>47.7</td>
<td>13.7</td>
<td>21.7</td>
<td>10.8</td>
<td>0.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Kericho</td>
<td>678009</td>
<td>50.7</td>
<td>18.6</td>
<td>25.2</td>
<td>1.3</td>
<td>0.7</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Source: CBS, 1996

Table 4: Distribution of household headship by gender and region in % by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>Male head (%)</th>
<th>Female Head (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>67.7</td>
<td>32.3</td>
</tr>
<tr>
<td>Kisumu</td>
<td>57.8</td>
<td>42.2</td>
</tr>
<tr>
<td>Homabay</td>
<td>56.8</td>
<td>43.2</td>
</tr>
<tr>
<td>Kericho</td>
<td>80.2</td>
<td>19.8</td>
</tr>
</tbody>
</table>

Source: R.O.K, 2000
Table 5: Distribution of population by regions and years

<table>
<thead>
<tr>
<th>Region</th>
<th>Population Numbers</th>
<th>Population density per sq.km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisi *</td>
<td>675014</td>
<td>869512</td>
</tr>
<tr>
<td>Gucha **</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kisi Central **</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nyamira **</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kisumu</td>
<td>400643</td>
<td>482327</td>
</tr>
<tr>
<td>Nyando **</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Homabay **</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Rachuonyo **</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kericho</td>
<td>479135</td>
<td>633348</td>
</tr>
<tr>
<td>Bomet **</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Buret **</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Population censuses (various issues)
Key
    * This was sub-divided and the name ceased to exist. It now comprises of Kisii Central, Gucha (Kisii South) and Nyamira (Kisii North).
    ** Districts which were not in existence by 1989.

Table 6a: Distribution of population by age and sex in Gucha district

<table>
<thead>
<tr>
<th>Gucha</th>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 - 4</td>
<td>36593</td>
<td>51</td>
<td>35570</td>
<td>49</td>
<td>72163</td>
</tr>
<tr>
<td></td>
<td>5 - 9</td>
<td>33154</td>
<td>50</td>
<td>32988</td>
<td>50</td>
<td>66142</td>
</tr>
<tr>
<td></td>
<td>10 - 14</td>
<td>39297</td>
<td>51</td>
<td>38135</td>
<td>49</td>
<td>77432</td>
</tr>
<tr>
<td></td>
<td>15 - 19</td>
<td>39297</td>
<td>51</td>
<td>38135</td>
<td>49</td>
<td>77432</td>
</tr>
<tr>
<td></td>
<td>20 - 24</td>
<td>19452</td>
<td>45</td>
<td>25700</td>
<td>57</td>
<td>45152</td>
</tr>
<tr>
<td></td>
<td>25 - 29</td>
<td>13604</td>
<td>43</td>
<td>18037</td>
<td>57</td>
<td>31641</td>
</tr>
<tr>
<td></td>
<td>30 - 34</td>
<td>10273</td>
<td>45</td>
<td>12391</td>
<td>55</td>
<td>22664</td>
</tr>
<tr>
<td></td>
<td>35 - 39</td>
<td>10037</td>
<td>45</td>
<td>12233</td>
<td>55</td>
<td>22270</td>
</tr>
<tr>
<td></td>
<td>40 - 44</td>
<td>7176</td>
<td>47</td>
<td>8177</td>
<td>53</td>
<td>15353</td>
</tr>
<tr>
<td></td>
<td>45 - 49</td>
<td>5485</td>
<td>47</td>
<td>6168</td>
<td>53</td>
<td>11653</td>
</tr>
<tr>
<td></td>
<td>50 - 54</td>
<td>4145</td>
<td>49</td>
<td>4328</td>
<td>51</td>
<td>8473</td>
</tr>
<tr>
<td></td>
<td>55 - 59</td>
<td>2807</td>
<td>47</td>
<td>3194</td>
<td>53</td>
<td>6001</td>
</tr>
<tr>
<td></td>
<td>60 - 64</td>
<td>2411</td>
<td>43</td>
<td>3199</td>
<td>57</td>
<td>5610</td>
</tr>
<tr>
<td></td>
<td>65 - 69</td>
<td>2131</td>
<td>46</td>
<td>2502</td>
<td>54</td>
<td>4633</td>
</tr>
<tr>
<td></td>
<td>70 - 74</td>
<td>1532</td>
<td>45</td>
<td>1896</td>
<td>55</td>
<td>3428</td>
</tr>
<tr>
<td></td>
<td>75 - 79</td>
<td>1017</td>
<td>48</td>
<td>1118</td>
<td>52</td>
<td>2135</td>
</tr>
<tr>
<td></td>
<td>80+</td>
<td>1121</td>
<td>41</td>
<td>1608</td>
<td>59</td>
<td>2729</td>
</tr>
</tbody>
</table>

Table 6b: Distribution of population by age and sex in Nyamira district

<table>
<thead>
<tr>
<th>Nyamira</th>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 - 4</td>
<td>37482</td>
<td>51</td>
<td>36679</td>
<td>49</td>
<td>74161</td>
</tr>
<tr>
<td></td>
<td>5 - 9</td>
<td>35484</td>
<td>50</td>
<td>35149</td>
<td>50</td>
<td>70633</td>
</tr>
<tr>
<td></td>
<td>10 - 14</td>
<td>42364</td>
<td>50</td>
<td>42300</td>
<td>50</td>
<td>84664</td>
</tr>
<tr>
<td></td>
<td>15 - 19</td>
<td>32848</td>
<td>49</td>
<td>33837</td>
<td>51</td>
<td>66705</td>
</tr>
</tbody>
</table>
Table 6c: Distribution of population by age and sex in Kisii Central district

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4</td>
<td>37954</td>
<td>50</td>
<td>37779</td>
<td>50</td>
<td>75733</td>
</tr>
<tr>
<td>5 – 9</td>
<td>35556</td>
<td>50</td>
<td>34992</td>
<td>50</td>
<td>70548</td>
</tr>
<tr>
<td>10 – 14</td>
<td>39289</td>
<td>50</td>
<td>39512</td>
<td>50</td>
<td>78801</td>
</tr>
<tr>
<td>15 – 19</td>
<td>31458</td>
<td>49</td>
<td>33295</td>
<td>51</td>
<td>64753</td>
</tr>
<tr>
<td>20 – 24</td>
<td>19741</td>
<td>42</td>
<td>26897</td>
<td>58</td>
<td>46638</td>
</tr>
<tr>
<td>25 – 29</td>
<td>14531</td>
<td>42</td>
<td>20279</td>
<td>58</td>
<td>34810</td>
</tr>
<tr>
<td>30 – 34</td>
<td>11409</td>
<td>45</td>
<td>13691</td>
<td>55</td>
<td>25100</td>
</tr>
<tr>
<td>35 – 39</td>
<td>11382</td>
<td>45</td>
<td>13875</td>
<td>55</td>
<td>25257</td>
</tr>
<tr>
<td>40 – 44</td>
<td>8234</td>
<td>48</td>
<td>8776</td>
<td>52</td>
<td>17010</td>
</tr>
<tr>
<td>45 – 49</td>
<td>6680</td>
<td>49</td>
<td>6982</td>
<td>51</td>
<td>13662</td>
</tr>
<tr>
<td>50 – 54</td>
<td>4914</td>
<td>49</td>
<td>5033</td>
<td>51</td>
<td>9947</td>
</tr>
<tr>
<td>55 – 59</td>
<td>3211</td>
<td>48</td>
<td>3486</td>
<td>52</td>
<td>6697</td>
</tr>
<tr>
<td>60 – 64</td>
<td>2915</td>
<td>45</td>
<td>3497</td>
<td>55</td>
<td>6412</td>
</tr>
<tr>
<td>65 – 69</td>
<td>2247</td>
<td>44</td>
<td>2893</td>
<td>56</td>
<td>5140</td>
</tr>
<tr>
<td>70 – 74</td>
<td>1580</td>
<td>43</td>
<td>2057</td>
<td>57</td>
<td>3637</td>
</tr>
<tr>
<td>75 – 79</td>
<td>1072</td>
<td>44</td>
<td>1362</td>
<td>56</td>
<td>2434</td>
</tr>
<tr>
<td>80+</td>
<td>1179</td>
<td>38</td>
<td>1893</td>
<td>62</td>
<td>3072</td>
</tr>
</tbody>
</table>

Table 6d: Distribution of population by age and sex in Kisumu district

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4</td>
<td>38916</td>
<td>50</td>
<td>39181</td>
<td>50</td>
<td>78097</td>
</tr>
<tr>
<td>5 – 9</td>
<td>32802</td>
<td>50</td>
<td>32621</td>
<td>50</td>
<td>65423</td>
</tr>
<tr>
<td>10 – 14</td>
<td>34807</td>
<td>49</td>
<td>35519</td>
<td>51</td>
<td>70326</td>
</tr>
<tr>
<td>15 – 19</td>
<td>30676</td>
<td>48</td>
<td>33019</td>
<td>52</td>
<td>63695</td>
</tr>
<tr>
<td>20 – 24</td>
<td>25594</td>
<td>48</td>
<td>28223</td>
<td>52</td>
<td>53817</td>
</tr>
<tr>
<td>25 – 29</td>
<td>19325</td>
<td>50</td>
<td>19523</td>
<td>50</td>
<td>38848</td>
</tr>
</tbody>
</table>
Table 6d: Distribution of population by age and sex in Nyando district

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>23417</td>
<td>50</td>
<td>23284</td>
<td>50</td>
<td>46701</td>
</tr>
<tr>
<td>5 - 9</td>
<td>20903</td>
<td>51</td>
<td>20458</td>
<td>49</td>
<td>41361</td>
</tr>
<tr>
<td>10 - 14</td>
<td>23133</td>
<td>52</td>
<td>21720</td>
<td>48</td>
<td>44853</td>
</tr>
<tr>
<td>15 - 19</td>
<td>19156</td>
<td>51</td>
<td>18507</td>
<td>49</td>
<td>37663</td>
</tr>
<tr>
<td>20 - 24</td>
<td>21175</td>
<td>83</td>
<td>13407</td>
<td>52</td>
<td>25582</td>
</tr>
<tr>
<td>25 - 29</td>
<td>8647</td>
<td>47</td>
<td>9714</td>
<td>53</td>
<td>18361</td>
</tr>
<tr>
<td>30 - 34</td>
<td>6722</td>
<td>45</td>
<td>8152</td>
<td>55</td>
<td>14874</td>
</tr>
<tr>
<td>35 - 39</td>
<td>6161</td>
<td>45</td>
<td>7628</td>
<td>55</td>
<td>13789</td>
</tr>
<tr>
<td>40 - 44</td>
<td>5373</td>
<td>47</td>
<td>6177</td>
<td>53</td>
<td>11550</td>
</tr>
<tr>
<td>45 - 49</td>
<td>4642</td>
<td>48</td>
<td>5068</td>
<td>52</td>
<td>9710</td>
</tr>
<tr>
<td>50 - 54</td>
<td>3958</td>
<td>49</td>
<td>4050</td>
<td>51</td>
<td>8008</td>
</tr>
<tr>
<td>55 - 59</td>
<td>2627</td>
<td>47</td>
<td>2982</td>
<td>53</td>
<td>5609</td>
</tr>
<tr>
<td>60 - 64</td>
<td>2366</td>
<td>45</td>
<td>2950</td>
<td>55</td>
<td>5316</td>
</tr>
<tr>
<td>65 - 69</td>
<td>1904</td>
<td>43</td>
<td>2503</td>
<td>57</td>
<td>4407</td>
</tr>
<tr>
<td>70 - 74</td>
<td>1430</td>
<td>44</td>
<td>1827</td>
<td>56</td>
<td>3257</td>
</tr>
<tr>
<td>75 - 79</td>
<td>922</td>
<td>47</td>
<td>1033</td>
<td>53</td>
<td>1955</td>
</tr>
<tr>
<td>80+</td>
<td>1037</td>
<td>50</td>
<td>1039</td>
<td>50</td>
<td>2076</td>
</tr>
</tbody>
</table>

Table 6e: Distribution of population by age and sex in Homabay district

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 4</td>
<td>24826</td>
<td>50</td>
<td>24414</td>
<td>50</td>
<td>49240</td>
</tr>
<tr>
<td>5 – 9</td>
<td>20615</td>
<td>50</td>
<td>20326</td>
<td>50</td>
<td>40941</td>
</tr>
<tr>
<td>10 – 14</td>
<td>22198</td>
<td>51</td>
<td>21486</td>
<td>49</td>
<td>43684</td>
</tr>
<tr>
<td>15 – 19</td>
<td>17754</td>
<td>49</td>
<td>18331</td>
<td>51</td>
<td>36085</td>
</tr>
<tr>
<td>20 – 24</td>
<td>10377</td>
<td>42</td>
<td>14402</td>
<td>58</td>
<td>24779</td>
</tr>
<tr>
<td>25 – 29</td>
<td>7468</td>
<td>42</td>
<td>10169</td>
<td>58</td>
<td>17637</td>
</tr>
<tr>
<td>30 – 34</td>
<td>6140</td>
<td>41</td>
<td>8734</td>
<td>59</td>
<td>14874</td>
</tr>
</tbody>
</table>
Table 6f: Distribution of population by age and sex in Rachuonyo district

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>25113</td>
<td>50</td>
<td>25049</td>
<td>50</td>
<td>50162</td>
</tr>
<tr>
<td>5 - 9</td>
<td>22558</td>
<td>51</td>
<td>22005</td>
<td>49</td>
<td>44563</td>
</tr>
<tr>
<td>10 -14</td>
<td>25386</td>
<td>51</td>
<td>214491</td>
<td>49</td>
<td>49877</td>
</tr>
<tr>
<td>15 -19</td>
<td>19616</td>
<td>51</td>
<td>18661</td>
<td>49</td>
<td>38277</td>
</tr>
<tr>
<td>20 - 24</td>
<td>10409</td>
<td>42</td>
<td>14296</td>
<td>58</td>
<td>24705</td>
</tr>
<tr>
<td>25 - 29</td>
<td>6964</td>
<td>40</td>
<td>10303</td>
<td>60</td>
<td>17267</td>
</tr>
<tr>
<td>30 - 34</td>
<td>6056</td>
<td>41</td>
<td>8765</td>
<td>59</td>
<td>14821</td>
</tr>
<tr>
<td>35 - 39</td>
<td>5478</td>
<td>41</td>
<td>7917</td>
<td>59</td>
<td>13395</td>
</tr>
<tr>
<td>40 - 44</td>
<td>4812</td>
<td>43</td>
<td>6391</td>
<td>57</td>
<td>11203</td>
</tr>
<tr>
<td>45 - 49</td>
<td>4076</td>
<td>43</td>
<td>5396</td>
<td>57</td>
<td>9472</td>
</tr>
<tr>
<td>50 - 54</td>
<td>3717</td>
<td>46</td>
<td>4362</td>
<td>54</td>
<td>8079</td>
</tr>
<tr>
<td>55 - 59</td>
<td>2538</td>
<td>44</td>
<td>3194</td>
<td>56</td>
<td>5732</td>
</tr>
<tr>
<td>60 - 64</td>
<td>2462</td>
<td>43</td>
<td>3239</td>
<td>57</td>
<td>5701</td>
</tr>
<tr>
<td>65 - 69</td>
<td>2147</td>
<td>43</td>
<td>2818</td>
<td>57</td>
<td>4965</td>
</tr>
<tr>
<td>70 - 74</td>
<td>1594</td>
<td>48</td>
<td>1760</td>
<td>52</td>
<td>3354</td>
</tr>
<tr>
<td>75 - 79</td>
<td>1020</td>
<td>47</td>
<td>1132</td>
<td>53</td>
<td>2152</td>
</tr>
<tr>
<td>80+</td>
<td>1193</td>
<td>55</td>
<td>966</td>
<td>45</td>
<td>2159</td>
</tr>
</tbody>
</table>
Table 6g: Distribution of population by age and sex in Kericho district

<table>
<thead>
<tr>
<th>Kericho</th>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>39338</td>
<td>51</td>
<td>37781</td>
<td>49</td>
<td>77119</td>
<td></td>
</tr>
<tr>
<td>5 - 9</td>
<td>33572</td>
<td>50</td>
<td>33339</td>
<td>50</td>
<td>66911</td>
<td></td>
</tr>
<tr>
<td>10 -14</td>
<td>33806</td>
<td>50</td>
<td>34337</td>
<td>50</td>
<td>68143</td>
<td></td>
</tr>
<tr>
<td>15 -19</td>
<td>28532</td>
<td>50</td>
<td>28416</td>
<td>50</td>
<td>56948</td>
<td></td>
</tr>
<tr>
<td>20 - 24</td>
<td>23762</td>
<td>49</td>
<td>24723</td>
<td>51</td>
<td>48485</td>
<td></td>
</tr>
<tr>
<td>25 - 29</td>
<td>18905</td>
<td>52</td>
<td>17482</td>
<td>48</td>
<td>36387</td>
<td></td>
</tr>
<tr>
<td>30 - 34</td>
<td>13599</td>
<td>53</td>
<td>12183</td>
<td>47</td>
<td>25782</td>
<td></td>
</tr>
<tr>
<td>35 - 39</td>
<td>12109</td>
<td>51</td>
<td>11711</td>
<td>49</td>
<td>23820</td>
<td></td>
</tr>
<tr>
<td>40 - 44</td>
<td>8910</td>
<td>53</td>
<td>7817</td>
<td>47</td>
<td>16727</td>
<td></td>
</tr>
<tr>
<td>45 - 49</td>
<td>7544</td>
<td>56</td>
<td>5969</td>
<td>44</td>
<td>13513</td>
<td></td>
</tr>
<tr>
<td>50 - 54</td>
<td>5757</td>
<td>58</td>
<td>4220</td>
<td>42</td>
<td>9977</td>
<td></td>
</tr>
<tr>
<td>55 - 59</td>
<td>3158</td>
<td>52</td>
<td>2959</td>
<td>48</td>
<td>6117</td>
<td></td>
</tr>
<tr>
<td>60 - 64</td>
<td>2415</td>
<td>46</td>
<td>2788</td>
<td>54</td>
<td>5203</td>
<td></td>
</tr>
<tr>
<td>65 - 69</td>
<td>1876</td>
<td>49</td>
<td>1954</td>
<td>51</td>
<td>3830</td>
<td></td>
</tr>
<tr>
<td>70 - 74</td>
<td>1435</td>
<td>47</td>
<td>1606</td>
<td>53</td>
<td>3041</td>
<td></td>
</tr>
<tr>
<td>75 - 79</td>
<td>1233</td>
<td>52</td>
<td>1118</td>
<td>48</td>
<td>2351</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td>1301</td>
<td>43</td>
<td>1746</td>
<td>57</td>
<td>3047</td>
<td></td>
</tr>
</tbody>
</table>

Table 6h: Distribution of population by age and sex in Bomet district

<table>
<thead>
<tr>
<th>Bomet</th>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>36283</td>
<td>51</td>
<td>34437</td>
<td>49</td>
<td>70720</td>
<td></td>
</tr>
<tr>
<td>5 - 9</td>
<td>31406</td>
<td>51</td>
<td>30763</td>
<td>49</td>
<td>62169</td>
<td></td>
</tr>
<tr>
<td>10 -14</td>
<td>30109</td>
<td>50</td>
<td>30200</td>
<td>50</td>
<td>60309</td>
<td></td>
</tr>
<tr>
<td>15 -19</td>
<td>22910</td>
<td>49</td>
<td>23658</td>
<td>51</td>
<td>46568</td>
<td></td>
</tr>
<tr>
<td>20 - 24</td>
<td>15330</td>
<td>45</td>
<td>19076</td>
<td>55</td>
<td>34406</td>
<td></td>
</tr>
<tr>
<td>25 - 29</td>
<td>11577</td>
<td>47</td>
<td>13217</td>
<td>53</td>
<td>24794</td>
<td></td>
</tr>
<tr>
<td>30 - 34</td>
<td>7946</td>
<td>47</td>
<td>8783</td>
<td>53</td>
<td>16729</td>
<td></td>
</tr>
<tr>
<td>35 - 39</td>
<td>7014</td>
<td>44</td>
<td>8843</td>
<td>56</td>
<td>15857</td>
<td></td>
</tr>
<tr>
<td>40 - 44</td>
<td>5056</td>
<td>45</td>
<td>6068</td>
<td>55</td>
<td>11124</td>
<td></td>
</tr>
<tr>
<td>45 - 49</td>
<td>4198</td>
<td>46</td>
<td>4945</td>
<td>54</td>
<td>9143</td>
<td></td>
</tr>
<tr>
<td>50 - 54</td>
<td>3488</td>
<td>47</td>
<td>3890</td>
<td>53</td>
<td>7378</td>
<td></td>
</tr>
<tr>
<td>55 - 59</td>
<td>2338</td>
<td>46</td>
<td>2728</td>
<td>54</td>
<td>5066</td>
<td></td>
</tr>
<tr>
<td>60 - 64</td>
<td>1997</td>
<td>44</td>
<td>2547</td>
<td>56</td>
<td>4544</td>
<td></td>
</tr>
<tr>
<td>65 - 69</td>
<td>1592</td>
<td>45</td>
<td>1919</td>
<td>55</td>
<td>3511</td>
<td></td>
</tr>
<tr>
<td>70 - 74</td>
<td>1367</td>
<td>44</td>
<td>1717</td>
<td>56</td>
<td>3084</td>
<td></td>
</tr>
<tr>
<td>75 - 79</td>
<td>1166</td>
<td>49</td>
<td>1221</td>
<td>51</td>
<td>2387</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td>1246</td>
<td>42</td>
<td>1688</td>
<td>58</td>
<td>2934</td>
<td></td>
</tr>
</tbody>
</table>
Table 6i: Distribution of population by age and sex in Buret district

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Male</th>
<th>%</th>
<th>Female</th>
<th>%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4</td>
<td>26913</td>
<td>51</td>
<td>26248</td>
<td>49</td>
<td>53161</td>
</tr>
<tr>
<td>5 - 9</td>
<td>23942</td>
<td>51</td>
<td>23352</td>
<td>49</td>
<td>47294</td>
</tr>
<tr>
<td>10 -14</td>
<td>22801</td>
<td>49</td>
<td>23327</td>
<td>51</td>
<td>46128</td>
</tr>
<tr>
<td>15 -19</td>
<td>18782</td>
<td>50</td>
<td>18987</td>
<td>50</td>
<td>37769</td>
</tr>
<tr>
<td>20 - 24</td>
<td>16042</td>
<td>50</td>
<td>16145</td>
<td>50</td>
<td>32187</td>
</tr>
<tr>
<td>25 - 29</td>
<td>13343</td>
<td>53</td>
<td>11989</td>
<td>47</td>
<td>25332</td>
</tr>
<tr>
<td>30 - 34</td>
<td>9283</td>
<td>55</td>
<td>7685</td>
<td>45</td>
<td>16968</td>
</tr>
<tr>
<td>35 - 39</td>
<td>8509</td>
<td>54</td>
<td>7304</td>
<td>46</td>
<td>15813</td>
</tr>
<tr>
<td>40 - 44</td>
<td>6386</td>
<td>57</td>
<td>4752</td>
<td>43</td>
<td>11138</td>
</tr>
<tr>
<td>45 - 49</td>
<td>5263</td>
<td>59</td>
<td>3674</td>
<td>41</td>
<td>8937</td>
</tr>
<tr>
<td>50 - 54</td>
<td>3872</td>
<td>60</td>
<td>2606</td>
<td>40</td>
<td>6478</td>
</tr>
<tr>
<td>55 - 59</td>
<td>1975</td>
<td>54</td>
<td>1701</td>
<td>46</td>
<td>3676</td>
</tr>
<tr>
<td>60 - 64</td>
<td>1402</td>
<td>46</td>
<td>1636</td>
<td>54</td>
<td>3038</td>
</tr>
<tr>
<td>65 - 69</td>
<td>1085</td>
<td>45</td>
<td>1336</td>
<td>55</td>
<td>2421</td>
</tr>
<tr>
<td>70 - 74</td>
<td>876</td>
<td>45</td>
<td>1068</td>
<td>55</td>
<td>1944</td>
</tr>
<tr>
<td>75 - 79</td>
<td>732</td>
<td>50</td>
<td>725</td>
<td>50</td>
<td>1457</td>
</tr>
<tr>
<td>80+</td>
<td>837</td>
<td>44</td>
<td>1082</td>
<td>56</td>
<td>1919</td>
</tr>
</tbody>
</table>

Source for 6a to 6i: R.o.K, 2001

Table 7: Number of households in the area under study and population by 1999.

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gucha</td>
<td>89776</td>
</tr>
<tr>
<td>Kisii Central</td>
<td>100315</td>
</tr>
<tr>
<td>Nyamira</td>
<td>99701</td>
</tr>
<tr>
<td>Kisumu</td>
<td>123341</td>
</tr>
<tr>
<td>Nyando</td>
<td>68371</td>
</tr>
<tr>
<td>Homabay</td>
<td>67040</td>
</tr>
<tr>
<td>Rachuonyo</td>
<td>68152</td>
</tr>
<tr>
<td>Kericho</td>
<td>98867</td>
</tr>
<tr>
<td>Bomet</td>
<td>70769</td>
</tr>
<tr>
<td>Buret</td>
<td>647376</td>
</tr>
</tbody>
</table>

2. Household Welfare Indicators
   a) Household Incomes

Table 8: Mean monthly household non-agricultural income by district (Ksh.) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Wages Salaries Profits</th>
<th>Other wages Salaries Profits</th>
<th>Non-agric income from business</th>
<th>Income from non-agric assets</th>
<th>Income from pensions</th>
<th>Transfer in kind</th>
<th>Transfers in cash</th>
<th>Value of sale of assets</th>
<th>Value of loans received</th>
<th>Other miscellaneous incomes</th>
<th>Total non-agric income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>3684.5</td>
<td>186.1</td>
<td>1167.3</td>
<td>21.2</td>
<td>2.0</td>
<td>147.4</td>
<td>418.3</td>
<td>0.9</td>
<td>79.7</td>
<td>20.8</td>
<td>564.6</td>
</tr>
<tr>
<td>Kisumu</td>
<td>4392.0</td>
<td>235.3</td>
<td>1378.4</td>
<td>69.2</td>
<td>39.1</td>
<td>83.7</td>
<td>370.4</td>
<td>1.1</td>
<td>111.8</td>
<td>28.7</td>
<td>6597.8</td>
</tr>
<tr>
<td>Homabay</td>
<td>1972.8</td>
<td>216.7</td>
<td>325.4</td>
<td>9.3</td>
<td>64.2</td>
<td>170.0</td>
<td>386.6</td>
<td>3.0</td>
<td>58.9</td>
<td>6.3</td>
<td>3154.4</td>
</tr>
<tr>
<td>Kericho</td>
<td>161.20</td>
<td>899.3</td>
<td>562.4</td>
<td>1.2</td>
<td>16.6</td>
<td>52.3</td>
<td>80.8</td>
<td>0.0</td>
<td>55.1</td>
<td>169.2</td>
<td>3393.9</td>
</tr>
</tbody>
</table>

Source: CBS, 1996

Table 9: Mean monthly household income from sale of crops by district (Ksh.) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Maize sales sales</th>
<th>Cash crop sales</th>
<th>Wheat sales</th>
<th>Cereal sales</th>
<th>Vegetable sales</th>
<th>Beans sales</th>
<th>Root sales</th>
<th>Sugarcane sales</th>
<th>Fruit sales</th>
<th>Other crop sales</th>
<th>Total crop income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>538.5</td>
<td>216.3</td>
<td>0.0</td>
<td>19.7</td>
<td>12.1</td>
<td>181.2</td>
<td>15.9</td>
<td>586.6</td>
<td>65.1</td>
<td>22.5</td>
<td>1658.1</td>
</tr>
<tr>
<td>Kisumu</td>
<td>62.9</td>
<td>11.7</td>
<td>0.0</td>
<td>57.4</td>
<td>5.7</td>
<td>25.3</td>
<td>11.0</td>
<td>49.5</td>
<td>2.3</td>
<td>3.1</td>
<td>228.8</td>
</tr>
<tr>
<td>Homabay</td>
<td>56.0</td>
<td>63.3</td>
<td>0.0</td>
<td>.49.9</td>
<td>0.2</td>
<td>12.2</td>
<td>43.9</td>
<td>0.0</td>
<td>6.6</td>
<td>16.3</td>
<td>248.4</td>
</tr>
<tr>
<td>Kericho</td>
<td>1810.0</td>
<td>67.8</td>
<td>0.0</td>
<td>0.0</td>
<td>1.2</td>
<td>75.4</td>
<td>1.2</td>
<td>73.1</td>
<td>0.1</td>
<td>0.0</td>
<td>2028.7</td>
</tr>
</tbody>
</table>

Source: CBS, 1996
Table 10: Mean monthly household income from sale of livestock, assets, land and rent by district (Ksh.) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Livestock sales</th>
<th>Livestock consumed</th>
<th>Livestock products sold</th>
<th>Livestock products consumed</th>
<th>Income from land sales</th>
<th>Income from interest</th>
<th>Total crop income (sale)</th>
<th>Our own crop consumption</th>
<th>Total agricultural income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>816.7</td>
<td>14.1</td>
<td>59.1</td>
<td>67.4</td>
<td>2.0</td>
<td>16.8</td>
<td>1658.1</td>
<td>1791.4</td>
<td>4425.6</td>
</tr>
<tr>
<td>Kisumu</td>
<td>396.0</td>
<td>36.0</td>
<td>62.4</td>
<td>41.8</td>
<td>10.1</td>
<td>8.9</td>
<td>228.8</td>
<td>245.4</td>
<td>1029.3</td>
</tr>
<tr>
<td>Homabay</td>
<td>308.9</td>
<td>42.2</td>
<td>24.1</td>
<td>48.7</td>
<td>9.4</td>
<td>9.5</td>
<td>536.2</td>
<td>672.0</td>
<td>1960.1</td>
</tr>
<tr>
<td>Kericho</td>
<td>672.9</td>
<td>35.5</td>
<td>238.4</td>
<td>442.4</td>
<td>58.5</td>
<td>28.8</td>
<td>2028.7</td>
<td>3469.5</td>
<td>6974.7</td>
</tr>
</tbody>
</table>

Source: CBS, 1996

Table 11: Summary of mean monthly household income from different sources by district (Ksh) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Total non-agricultural income</th>
<th>Total agricultural income</th>
<th>Total household income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wages/ salaries/ profits</td>
<td>Other non-agricultural income</td>
<td>Agricultural income</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>--------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Kisii</td>
<td>3870.7</td>
<td>1778.0</td>
<td>2767.6</td>
</tr>
<tr>
<td>Kisumu</td>
<td>4627.3</td>
<td>1970.5</td>
<td>800.5</td>
</tr>
<tr>
<td>Homabay</td>
<td>2189.5</td>
<td>964.9</td>
<td>1079.3</td>
</tr>
<tr>
<td>Kericho</td>
<td>2511.4</td>
<td>882.5</td>
<td>4945.9</td>
</tr>
</tbody>
</table>

Source: CBS, 1996

b) Household Expenditure
Table 12: Mean monthly household food expenditure (inclusive of own consumption) by broad expenditure categories by district (Ksh.) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Cereal &amp; cereal products</th>
<th>Meats &amp; meat product</th>
<th>Oils</th>
<th>Vegetables / fruits</th>
<th>Roots</th>
<th>Sugar</th>
<th>Tea</th>
<th>Other food products</th>
<th>Purchased food expenses</th>
<th>Total food expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>3395.2</td>
<td>950.6</td>
<td>394.2</td>
<td>464.4</td>
<td>99.4</td>
<td>461.3</td>
<td>110.8</td>
<td>31.0</td>
<td>4033.8</td>
<td>5906.8</td>
</tr>
<tr>
<td>Kisumu</td>
<td>1711.8</td>
<td>1022.6</td>
<td>219.2</td>
<td>461.5</td>
<td>85.4</td>
<td>386.9</td>
<td>95.7</td>
<td>53.7</td>
<td>3713.7</td>
<td>4036.9</td>
</tr>
<tr>
<td>Homabay</td>
<td>2038.7</td>
<td>717.1</td>
<td>176.9</td>
<td>260.5</td>
<td>148.5</td>
<td>301.0</td>
<td>56.6</td>
<td>32.5</td>
<td>2995.4</td>
<td>3731.9</td>
</tr>
<tr>
<td>Kericho</td>
<td>4423.5</td>
<td>952.4</td>
<td>112.5</td>
<td>241.0</td>
<td>61.2</td>
<td>309.9</td>
<td>67.1</td>
<td>7.0</td>
<td>2227.1</td>
<td>6174.6</td>
</tr>
</tbody>
</table>

Source: CBS, 1996

Table 13: Mean monthly household non-food expenditure by broad expenditure categories by district (Ksh.) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Fuel/ House</th>
<th>Domestic</th>
<th>Transport &amp; communication</th>
<th>Clothing</th>
<th>Foot</th>
<th>Personal care</th>
<th>Recreation</th>
<th>Transfers</th>
<th>Rent</th>
<th>Other</th>
<th>Insurance</th>
<th>Household</th>
<th>Seeds</th>
<th>Farm</th>
<th>Others</th>
<th>Enterprise</th>
<th>Durable</th>
<th>Other</th>
<th>Education</th>
<th>Medical</th>
<th>Total non-food</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lighting</td>
<td>wash</td>
<td>service</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>costs</td>
<td>costs</td>
<td></td>
<td>costs</td>
<td>costs</td>
<td>costs</td>
<td>costs</td>
<td>costs</td>
<td>costs</td>
<td>costs</td>
<td></td>
</tr>
<tr>
<td>Kisii</td>
<td>395.2</td>
<td>86.3</td>
<td>41.4</td>
<td>91.1</td>
<td>142.8</td>
<td>56.6</td>
<td>48.3</td>
<td>0.8</td>
<td>85.3</td>
<td>13.6</td>
<td>5.6</td>
<td>12</td>
<td>13.0</td>
<td>45.8</td>
<td>33.6</td>
<td>8.1</td>
<td>304.1</td>
<td>553.6</td>
<td>1888.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kisumu</td>
<td>164.7</td>
<td>115.0</td>
<td>36.2</td>
<td>221.0</td>
<td>288.8</td>
<td>55.7</td>
<td>101.3</td>
<td>15.9</td>
<td>118.7</td>
<td>144.8</td>
<td>29.4</td>
<td>10.0</td>
<td>31.6</td>
<td>7.8</td>
<td>23.4</td>
<td>16.1</td>
<td>8.8</td>
<td>278.0</td>
<td>353.7</td>
<td>2020.2</td>
<td></td>
</tr>
<tr>
<td>Homabay</td>
<td>286.0</td>
<td>63.2</td>
<td>8.1</td>
<td>84.4</td>
<td>131.5</td>
<td>67.4</td>
<td>27.1</td>
<td>1.1</td>
<td>966</td>
<td>45.4</td>
<td>9.6</td>
<td>1.9</td>
<td>23.6</td>
<td>9.9</td>
<td>21.2</td>
<td>16.7</td>
<td>4.4</td>
<td>49.7</td>
<td>229.9</td>
<td>1132.7</td>
<td></td>
</tr>
<tr>
<td>Kericho</td>
<td>183.8</td>
<td>96.3</td>
<td>66.8</td>
<td>75.4</td>
<td>187.6</td>
<td>50.5</td>
<td>61.3</td>
<td>416.5</td>
<td>75.6</td>
<td>68.8</td>
<td>3.6</td>
<td>3.9</td>
<td>1.6</td>
<td>639</td>
<td>154.2</td>
<td>19.2</td>
<td>18.0</td>
<td>201.7</td>
<td>231.7</td>
<td>1750.8</td>
<td></td>
</tr>
</tbody>
</table>

Source: CBS, 1996
Table 14: Summary of mean monthly household expenditures by broad categories by district (Ksh.) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Education expenses</th>
<th>Medical expenses</th>
<th>Food expenses</th>
<th>Own crop consumption</th>
<th>Other non-food expenses</th>
<th>Durable expenses</th>
<th>Total household expenditure</th>
<th>Total household income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>304.1</td>
<td>553.6</td>
<td>4115.4</td>
<td>1791.4</td>
<td>1001.7</td>
<td>22.2</td>
<td>7788.4</td>
<td>10074.3</td>
</tr>
<tr>
<td>Kisumu</td>
<td>278.0</td>
<td>353.7</td>
<td>3791.5</td>
<td>245.4</td>
<td>1338.2</td>
<td>50.4</td>
<td>6057.1</td>
<td>7625.1</td>
</tr>
<tr>
<td>Homabay</td>
<td>49.7</td>
<td>229.9</td>
<td>3089.1</td>
<td>642.8</td>
<td>823.2</td>
<td>29.9</td>
<td>4864.6</td>
<td>4482.1</td>
</tr>
<tr>
<td>Kericho</td>
<td>201.7</td>
<td>231.7</td>
<td>2705.1</td>
<td>3469.5</td>
<td>1293.8</td>
<td>23.6</td>
<td>7925.3</td>
<td>10368.6</td>
</tr>
</tbody>
</table>

Source: CBS, 1996

Table 15: Percentage share of mean monthly household expenditure by broad expenditure categories by district (Ksh.) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Education share</th>
<th>Medical share</th>
<th>Other non-food share</th>
<th>Durable share</th>
<th>Purchase food share</th>
<th>Livestock / products</th>
<th>Own crop share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>4.0</td>
<td>7.8</td>
<td>15.2</td>
<td>0.2</td>
<td>49.3</td>
<td>1.3</td>
<td>22.1</td>
</tr>
<tr>
<td>Kisumu</td>
<td>4.2</td>
<td>5.9</td>
<td>15.5</td>
<td>0.7</td>
<td>64.0</td>
<td>2.5</td>
<td>7.2</td>
</tr>
<tr>
<td>Homabay</td>
<td>0.9</td>
<td>3.9</td>
<td>19.6</td>
<td>0.5</td>
<td>56.7</td>
<td>2.2</td>
<td>16.2</td>
</tr>
<tr>
<td>Kericho</td>
<td>3.4</td>
<td>3.1</td>
<td>16.6</td>
<td>0.3</td>
<td>43.8</td>
<td>8.5</td>
<td>24.2</td>
</tr>
</tbody>
</table>

Source: CBS, 1996

Table 16: Annual per capital incomes and expenditure by district (Ksh) by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Per capita expenditure</th>
<th>Per capita income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>19273.9</td>
<td>23733.7</td>
</tr>
<tr>
<td>Kisumu</td>
<td>16136.0</td>
<td>20774.8</td>
</tr>
<tr>
<td>Homabay</td>
<td>18376.5</td>
<td>16548.2</td>
</tr>
<tr>
<td>Kericho</td>
<td>22983.7</td>
<td>29415.4</td>
</tr>
</tbody>
</table>

Source: CBS, 1996
Table 17: Distribution of expenditure patterns on food and non-food by region in % by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>Food expenditure</th>
<th>Non-food expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>83.4</td>
<td>16.6</td>
</tr>
<tr>
<td>Kisumu</td>
<td>79.3</td>
<td>20.7</td>
</tr>
<tr>
<td>Homabay</td>
<td>77.5</td>
<td>22.5</td>
</tr>
<tr>
<td>Kericho</td>
<td>79.7</td>
<td>20.3</td>
</tr>
</tbody>
</table>

Source: Compiled from R.O.K, 2000

Table 18: Distribution of mean expenditures on health (Ksh) by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>Doctors</th>
<th>Medicine</th>
<th>Hospital</th>
<th>Other medical</th>
<th>Medical insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>1.4</td>
<td>18.2</td>
<td>2.6</td>
<td>0.4</td>
<td>0.05</td>
</tr>
<tr>
<td>Kisumu</td>
<td>8.8</td>
<td>15.6</td>
<td>10.6</td>
<td>2.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Homabay</td>
<td>0.0</td>
<td>12</td>
<td>37.2</td>
<td>0.5</td>
<td>1.7</td>
</tr>
<tr>
<td>Kericho</td>
<td>1.2</td>
<td>49.9</td>
<td>5.1</td>
<td>0.0</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Source: Compiled from R.o.K 2000

Table 19: Mean monthly expenditure on cooking and lighting fuel (Ksh.) by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>Electric</th>
<th>Gas</th>
<th>Firewood</th>
<th>Paraffin</th>
<th>Charcoal</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>0.0</td>
<td>0.6</td>
<td>16</td>
<td>71.8</td>
<td>8.9</td>
<td>0.4</td>
</tr>
<tr>
<td>Kisumu</td>
<td>2.3</td>
<td>0.0</td>
<td>20.1</td>
<td>82.8</td>
<td>28.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Homabay</td>
<td>0.0</td>
<td>0.0</td>
<td>3.1</td>
<td>55.6</td>
<td>6.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Kericho</td>
<td>0.0</td>
<td>0.0</td>
<td>1.9</td>
<td>85.9</td>
<td>8.0</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Source: Compiled from R.o.K 2000

c) Other Household Welfare Indicators

Table 20: Distribution of type of toilets used by households in % by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>None</th>
<th>Flush sewer</th>
<th>Flush to septic tank</th>
<th>Pan / bucket</th>
<th>Covered pit latrines</th>
<th>Uncovered pit /latrines</th>
<th>VIP latrine</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>1.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>57.4</td>
<td>40.0</td>
<td>0.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Kisumu</td>
<td>19.9</td>
<td>0.4</td>
<td>0.4</td>
<td>0.0</td>
<td>52.7</td>
<td>21.1</td>
<td>4.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Homabay</td>
<td>50.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>29.9</td>
<td>15.1</td>
<td>2.0</td>
<td>3</td>
</tr>
<tr>
<td>Kericho</td>
<td>35.1</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
<td>47.3</td>
<td>14.1</td>
<td>0.0</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Source: Compiled from R.o.K 2000
Table 21: Percentage distribution of households by access to sanitation, type of toilet by district by 1994

<table>
<thead>
<tr>
<th>District</th>
<th>Access to sanitation</th>
<th>Type of main toilet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pit</td>
<td>V.I.P</td>
</tr>
<tr>
<td>Kisii</td>
<td>99.0</td>
<td>96.8</td>
</tr>
<tr>
<td>Kisumu</td>
<td>78.6</td>
<td>67.4</td>
</tr>
<tr>
<td>Homabay</td>
<td>50.4</td>
<td>40.6</td>
</tr>
<tr>
<td>Kericho</td>
<td>73.5</td>
<td>72.1</td>
</tr>
</tbody>
</table>

NB: Access to sanitation is defined as the population with reasonable access to sanitary means of excreta and waste disposal, including outdoor latrines.

Source: CBS, 1996

Table 22: Distribution of households with access to safe sanitation and those without toilets in % by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>Safe Sanitation (%)</th>
<th>Unsafe Sanitation (%)</th>
<th>Toilet (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>58</td>
<td>42</td>
<td>1.6</td>
</tr>
<tr>
<td>Kisumu</td>
<td>57.7</td>
<td>42.3</td>
<td>19.8</td>
</tr>
<tr>
<td>Homabay</td>
<td>30.0</td>
<td>69.1</td>
<td>50</td>
</tr>
<tr>
<td>Kericho</td>
<td>47.5</td>
<td>52.5</td>
<td>35</td>
</tr>
</tbody>
</table>

Source: Compiled from R.o.K, 2000

Table 23: Distribution of households’ main source of drinking water during dry season in % by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>Piped water in compound</th>
<th>Public outdoor tap/ borehole</th>
<th>Protected water</th>
<th>Unprotected well / rain water</th>
<th>River / lake/ pond</th>
<th>Vendor / Thick</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>9.8</td>
<td>0.7</td>
<td>43.3</td>
<td>28</td>
<td>18.1</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Kisumu</td>
<td>5</td>
<td>25</td>
<td>18.6</td>
<td>5.6</td>
<td>42.1</td>
<td>3.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Homabay</td>
<td>0.9</td>
<td>4.2</td>
<td>8.4</td>
<td>9.7</td>
<td>76.8</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Kericho</td>
<td>2.1</td>
<td>10.2</td>
<td>16.2</td>
<td>2.9</td>
<td>68.7</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Source: Compiled from R.o.K 2000
Table 24: Distribution of households main source of drinking water during wet season in % by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>Piped water in compound</th>
<th>Public outdoor tap/borehole</th>
<th>Protected water</th>
<th>Unprotected well/rain water</th>
<th>River/lake/pond</th>
<th>Vendor/Thick</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>9.8</td>
<td>0.7</td>
<td>42.7</td>
<td>29.1</td>
<td>17.1</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Kisumu</td>
<td>5.5</td>
<td>17.2</td>
<td>36.7</td>
<td>23.9</td>
<td>37.7</td>
<td>1.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Homabay</td>
<td>1.0</td>
<td>0.9</td>
<td>10.8</td>
<td>21.9</td>
<td>42.8</td>
<td>0.9</td>
<td>21.7</td>
</tr>
<tr>
<td>Kericho</td>
<td>2.7</td>
<td>16.7</td>
<td>14.9</td>
<td>13.4</td>
<td>52.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Source: R.o.k, 2000


<table>
<thead>
<tr>
<th>District</th>
<th>% Stunted children</th>
<th>% Wasted children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>50.8</td>
<td>44.4</td>
</tr>
<tr>
<td>Kisumu</td>
<td>30.8</td>
<td>38.2</td>
</tr>
<tr>
<td>Homabay</td>
<td>37.6</td>
<td>44.8</td>
</tr>
<tr>
<td>Kericho</td>
<td>32.0</td>
<td>45.8</td>
</tr>
</tbody>
</table>


Table 26: Distribution of time taken to reach the nearest dispensary and/or nearest hospital in %

<table>
<thead>
<tr>
<th>Region</th>
<th>To nearest dispensary</th>
<th>To nearest hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 10 minutes</td>
<td>10 -30 min</td>
</tr>
<tr>
<td>Kisii</td>
<td>2.0</td>
<td>47.9</td>
</tr>
<tr>
<td>Kisumu</td>
<td>1.6</td>
<td>46.4</td>
</tr>
<tr>
<td>Homabay</td>
<td>0.0</td>
<td>31.7</td>
</tr>
<tr>
<td>Kericho</td>
<td>0.5</td>
<td>43.1</td>
</tr>
</tbody>
</table>

Source: Compiled from R.O.K 2000

Table 27: Distribution of time taken to reach nearest qualified doctor’s office in % by 1997

<table>
<thead>
<tr>
<th>Region</th>
<th>&lt; 10 minutes</th>
<th>10 -30 min</th>
<th>30 -60 min</th>
<th>60 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>0.0</td>
<td>4.6</td>
<td>22.6</td>
<td>72.7</td>
</tr>
<tr>
<td>Kisumu</td>
<td>0.25</td>
<td>21.2</td>
<td>12.8</td>
<td>65.3</td>
</tr>
<tr>
<td>Homabay</td>
<td>0.0</td>
<td>6.2</td>
<td>14.7</td>
<td>78.5</td>
</tr>
<tr>
<td>Kericho</td>
<td>0.0</td>
<td>15.0</td>
<td>39.9</td>
<td>45.1</td>
</tr>
</tbody>
</table>

Source: Compiled from R.o.K, 2000

3. Health care delivery systems and disease incidence
According to R.o.K (1984), Kisii, Kisumu and Kericho districts had health facilities as distributed among the population as shown in the table below.
Table 28: Population distribution as per health facilities

<table>
<thead>
<tr>
<th>Region</th>
<th>Population per rural health facilities</th>
<th>Hospital beds per 1000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kisii</td>
<td>18644</td>
<td>0.75</td>
</tr>
<tr>
<td>Kisumu</td>
<td>10645</td>
<td>1.91</td>
</tr>
<tr>
<td>Homabay</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Kericho</td>
<td>7244</td>
<td>1.50</td>
</tr>
</tbody>
</table>


The following table shows the number of health care facilities in the four districts by 1997.

Table 29: Health facilities in the regions

<table>
<thead>
<tr>
<th>Regions</th>
<th>Number of health facilities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospitals</td>
<td>Health centres</td>
</tr>
<tr>
<td>Kisii</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Kisumu</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Homabay</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Kericho</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Compiled from the respective district development plans of 1997 and 2002

In Kisumu district, most of the health facilities are run and maintained by the Ministry of Health (MOH). However, most of them lack adequate equipment and drugs and are also understaffed. In the divisions with very poor roads, like Muhoroni, Nyando and Kadibo, accessibility to the health facilities during rainy seasons by any motorized means is impossible (R.o.K 1997).

According to R.o.K (2002), Kisumu district has a doctors / patient ratio of 1:5379. The average distance to the health centres is 5-8 Km. It also notes that 80% of the households in Kisumu district have access to health centres.

R.o.K (1997) indicates that Kisii district has five operational hospitals. However, only one of them is government maintained and the rest are privately owned. Kisii district hospital serves as a referral hospital to Nyamira, Homabay, Migori, Kuria, Suba, Rachuonyo and Trans Mara districts. The district hospital and most government health centres are heavily congested by both out and in-patients. Most of the health centres are over-utilized due to the high population of the areas they serve and lack of expansion of existing facilities. Provision of equipment in all the governmental maintained health facilities is inadequate to make them effectively operational. Indeed, growth of health facilities in Kisii district between 1991 and 1995 has been insignificant as shown in the table.

44
Table 30: Health facilities in Kisii district between 1991 and 1995.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Health Centres</td>
<td>12</td>
<td>12</td>
<td>11</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Dispensaries</td>
<td>28</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Private clinics</td>
<td>12</td>
<td>13</td>
<td>15</td>
<td>17</td>
<td>22</td>
</tr>
</tbody>
</table>


R.o.K (1997) indicates that there are 19 doctors working in Kisii district and this works out to one doctor for every 48700 patients. Most of these doctors (over 75%) are based in Kisii town and hence are not easily accessible to rural population.

The introduction of user changes in government health facilities has caused some people not to seek treatment from the facilities.

According to R.o.K (2002) Kisii district was recently subdivided into Gucha, Nyamira and Kisii Central districts. Gucha district has one government hospital and one private hospital. It has three gov’t health centres and 2 private ones. Government dispensaries are 11 while private ones are two. There are about 12 private clinics and 74 health posts. The doctor – patient ratio is 1:250606. The average distance to the nearest health facility is 7Km. 60% of the households have access to health facilities.

Nyamira district has a doctor-patient ratio of 1:65000. It has 2 hospitals and 21 health centres while dispensaries are not indicated. About 78% of the households in Nyamira district have access to health centres. The average distance to the nearest health centre is 7Km (R.o.K, 2002).

Current data for Kisii Central is not available.

In Homabay district out of 24 health facilities by 1997, 17 of them are established and run by the government, four by the missionaries and three privately. By 1997, there were 10 doctors in the district and this implies 1 doctor for every 21931 people as per the 1989 census (R.o.K, 1997). According to R.o.K (2002), Homabay district has a doctor / patient ratio of 1:38707. The district has one hospital, 20 health centres and 15 dispensaries. It has a total of 660 ward beds. The average distance to the nearest health facility is 10Km.

Rachuonyo district which was curved from Homabay district and declared a full-fledged district on 1st July 1996 has four hospitals and 36 health centres. The average distance to the nearest health centre is 5Km. About 60% of the population in the district has access to health facilities. The doctor/patient ratio in the district is 1:52434 (R.o.K, 2002).

Out of the 59 health facilities in Kericho district by 1997, 37 out of them are government owned. Although the private facilities are better equipped and supplied with drugs, preference is still given to government facilities because they are cheaper. In spite of cost-sharing system, there is still an influx of patients to the government facilities due to lower charges (R.o.K, 1997).
The current data for Kericho district is not available. However, data from the two districts recently curved from it i.e. Bomet and Buret is in this case also necessary. Buret district has four hospitals, five health centres and 23, dispensaries and 11 clinics. The doctor / patient ratio is 1:150,000. About 60% of the district’s population has access to health facilities. The average distance to the nearest health facility is 5Km (R.o.K, 2002).

Bomet district has two hospitals, seven health centres and 39 dispensaries. The doctor/patient ratio is 1:102048. About 80% of the population has access to health facilities. The average distance to the nearest health facility is 6Km (R.o.K, 2002).

In terms of disease incidence R.o.K (1997) indicates that in Kisumu, malaria was the leading cause of morbidity despite a steady decrease since 1993. In 1993, about 190906 outpatients were treated of malaria and this declined to 178574 and 147, 467 in 1994 and 1995 respectively. R.o.K (2002) also indicates that malaria is among the three most prevalent diseases in Kisumu district. The other two diseases are anaemia and HIV/AIDS. Kisumu also experiences epidemics which are caused by poor water sanitation that result into cholera outbreaks, typhoid and other contagious diseases which claims many lives. Floods tend to interfere with sanitation facilities thereby causing water contamination and large masses of stagnant water. This also leads to outbreak of malaria among other waterborne diseases. Interventions for epidemics include proper excreta disposal (ventilated improved pit latrines), clean water supply, vector control and promotion of hygiene.

In Kisii district, the high and well-distributed rainfall creates the presence of mosquitoes which has caused malaria to be a major killer diseases. There were 345 deaths in 1991, 260 in 1992, 197 in 1993, 430 in 1994 and 458 in 1995 due to malaria in the district (R.o.K, 1997). In Gucha and Nyamira districts which were formally, part of Kisii district, malaria is still the common disease (R.o.K 2002).

In Homabay district, malaria is the most common disease whose incidence level in 1991& 1992 was 34% and 33% in 1993. Malaria district is still the most prevalent disease in the district followed by diarrhoea diseases, skin diseases and eye infections (R.o.K, 1997 and R.o.K 2000).

Malaria is also a top disease in Kericho district. There were 33232 malaria cases in 1992, 40792 in 1993, 124497 and 114408 in 1994 and 1995 respectively. In 1994 and 1995, malaria and diarrhoea were the first top two diseases in Kericho district. In Buret district, malaria is the leading disease accounting for 35% of the diseases. Other prevalent diseases in Buret district include respiratory tract diseases and skin diseases. These diseases are also the most prevalent ones in Bomet district (R.o.K 1997 and R.o.K, 2002).

It is important to examine malaria cases in Kericho district in greater detail based on some information gathered from key informants in December 2002.

DATA GATHERED FROM KEY INFORMANTS IN KERICHO DISTRICT

A) Data was collected from Kericho District Hospital and the District public health officers. These provided malaria cases in Kericho district from 1998 up to October 2002 as shown in table 31. It was not possible to get data for as far back as possible due to poor recording system.
Table 31: Malaria cases in Kericho district since 1998

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>1950</td>
<td>3954</td>
<td>2587</td>
<td>6318</td>
<td>5493</td>
<td>5000</td>
<td>4155</td>
<td>1753</td>
<td>3071</td>
<td>4057</td>
<td>2314</td>
<td>4126</td>
</tr>
<tr>
<td>1999</td>
<td>4005</td>
<td>2766</td>
<td>3683</td>
<td>3147</td>
<td>5537</td>
<td>6489</td>
<td>8591</td>
<td>4738</td>
<td>2236</td>
<td>2766</td>
<td>2663</td>
<td>1870</td>
</tr>
<tr>
<td>2000</td>
<td>2765</td>
<td>3318</td>
<td>4112</td>
<td>4168</td>
<td>7283</td>
<td>6290</td>
<td>3354</td>
<td>4296</td>
<td>3916</td>
<td>3461</td>
<td>2899</td>
<td>2874</td>
</tr>
<tr>
<td>2001</td>
<td>4834</td>
<td>4801</td>
<td>7547</td>
<td>2975</td>
<td>3337</td>
<td>4464</td>
<td>4634</td>
<td>3579</td>
<td>4254</td>
<td>4457</td>
<td>3486</td>
<td>3046</td>
</tr>
<tr>
<td>2002</td>
<td>4262</td>
<td>4507</td>
<td>3202</td>
<td>3932</td>
<td>5425</td>
<td>15817</td>
<td>23616</td>
<td>11454</td>
<td>4996</td>
<td>4321</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Data, 2002

From the same sources, Kericho district has the following number of doctors, clinical officers and nurses (Table 32).

Table 32: Health Personnel in Kericho district by 2002

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors</td>
<td>6</td>
</tr>
<tr>
<td>Clinical officers</td>
<td>40</td>
</tr>
<tr>
<td>Nursing officers</td>
<td>252</td>
</tr>
<tr>
<td>Total</td>
<td>298</td>
</tr>
</tbody>
</table>

Source: Fieldwork data, 2002

According to the officers interviewed, most of these health officers provide their services in Kericho district hospital while the rural areas are understaffed. Out of the six doctors, four are based in Kericho district, two of whom are consultants while the other two are medical officers. The other two doctors serve the rural part. One of them is the district medical officer of health while the other one is based at Londian hospital. Kericho district hospital has 28 clinical officers and 121 nurses while the rural part of the district has 12 clinical officers and 131 nurses.

The district has a number of health facilities (Table 33).
Table 33: Distribution of health facilities in Kericho District by 2002

<table>
<thead>
<tr>
<th>Type of health facility</th>
<th>Sponsor</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals</td>
<td>Government</td>
<td>2</td>
</tr>
<tr>
<td>Hospitals</td>
<td>Private</td>
<td>2</td>
</tr>
<tr>
<td>Hospitals</td>
<td>Company</td>
<td>2</td>
</tr>
<tr>
<td>Hospitals</td>
<td>Mission</td>
<td>2</td>
</tr>
<tr>
<td>Nursing homes</td>
<td>Private</td>
<td>2</td>
</tr>
<tr>
<td>Health centres</td>
<td>Government</td>
<td>7</td>
</tr>
<tr>
<td>Health centres</td>
<td>Mission</td>
<td>1</td>
</tr>
<tr>
<td>Dispensary</td>
<td>Company</td>
<td>15</td>
</tr>
<tr>
<td>Dispensary</td>
<td>Private</td>
<td>2</td>
</tr>
<tr>
<td>Dispensary</td>
<td>Mission</td>
<td>3</td>
</tr>
<tr>
<td>Dispensary</td>
<td>College</td>
<td>2</td>
</tr>
<tr>
<td>Dispensary</td>
<td>Government</td>
<td>39</td>
</tr>
<tr>
<td>Clinics</td>
<td>NGO</td>
<td>1</td>
</tr>
<tr>
<td>Clinics</td>
<td>Private</td>
<td>1</td>
</tr>
<tr>
<td>Mobile</td>
<td>Church</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>82</strong></td>
</tr>
</tbody>
</table>

Source: Fieldwork data, 2002

According to the officers interviewed, Kericho district experiences malaria epidemic every year mainly in June and July. The worst epidemic was in 1998 due to ElNino rains i.e December 1997 and January / February 1998. The Public health officer said that the epidemics impacts on people’s economic activities negatively because of the large numbers who get sick in every family. The epidemic also usually result in deaths.

Malaria epidemics in the region has tended to increase people’s health seeking behaviour. Thus, due to large number of people who catch malaria, the health facilities in the district especially Kericho district hospital gets overstretched. For example in 1998, the nurses and clinical officers who work in the department of public health had to be seconded in Kericho district hospital to save the bad situation.

The district public health office handles malaria epidemics by:

- Intensifying health education in the district
- In door residual spraying
- Fogging, though the machine used is out of order and
- In schools, they give out anti malarials (Sp drugs) and also spray mosquito breeding zones.

The officer noted that each of the eight divisions in the district has a spray pump and chemicals. They spray one month before the epidemic and since chemicals are not enough, they mainly spray in houses that are 1 Kilometre away from the breeding zones. The district public health office organizes meetings of in-charges from all the divisions to distribute chemicals before the epidemic.

The officers said that interventions by non-governmental organizations in the district are limited. Red cross provided some mosquito nets and 10 pumps in July 2002. AMREF has been assisting over the years by donating Ksh. 54,200/= for community mobilization to create awareness of malaria outbreak. It also started giving some mosquito nets to women groups as an income generating activity i.e. rural women were supposed to sell nets and then give back the cash to the
public health office so that AMREF could provide more nets. However this project failed at Kapsit et because most of the women sold nets but didn’t give back the money.

The department of public health at Moi University has also helped to train 40 local people at Kaitui in year 2001 as a way of creating community awareness and preparedness of malaria epidemics.

Safe use project, an agricultural NGO has also intervened in the district by providing mosquito nets, pumps, chemicals and some money for servicing motorcycles for health officers when doing screening of houses. Safe use project also seconded an officer to work in the district’s department of health between 1998 and 2002.

B) Data collected from Kabianga dispensary which was one of the sites where field work was done.

The nurse in charge said that malaria epidemic in the area is in June/July every year which is a wet season. She said that 1998 was the worst epidemic. Malaria epidemics impact on the dispensary facilities which are limited because they have no admission facilities. They also experience shortage of drugs and when they refer patients, many of them complain of transport problem especially at night.

They handle epidemics by providing health education. The public health technicians also organize the community to drain stagnant water, spray in schools and clear bushes. The dispensary committee also purchases drugs when those provided by the government are not enough or are delayed. She said that 60% of the drugs are provided by the dispensary committee while the government provides 40%. She said that there has not been any NGO intervention.

The main drugs provided are chloroquine, chomaquine tabs / fansider, quinine injection/tabs. She lamented that most drugs from the government are brought even after the epidemic. She said that they normally attend a seminar on malaria epidemic preparedness before the epidemic at the district public health office. They are also told to collect the drugs for their health clinic but the drugs are very few.

The following table (table 34) shows cases of malaria at Kabianga since year 2000.
### Table 34: Distribution of cases of malaria at Kabianga since 2000

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>176</td>
<td>162</td>
<td>62</td>
</tr>
<tr>
<td>Feb</td>
<td>148</td>
<td>255</td>
<td>101</td>
</tr>
<tr>
<td>Mar</td>
<td>146</td>
<td>285</td>
<td>225</td>
</tr>
<tr>
<td>April</td>
<td>103</td>
<td>120</td>
<td>404</td>
</tr>
<tr>
<td>May</td>
<td>276</td>
<td>180</td>
<td>116</td>
</tr>
<tr>
<td>June</td>
<td>331</td>
<td>110</td>
<td>243</td>
</tr>
<tr>
<td>July</td>
<td>262</td>
<td>465</td>
<td>363</td>
</tr>
<tr>
<td>Aug</td>
<td>154</td>
<td>244</td>
<td>248</td>
</tr>
<tr>
<td>Sep</td>
<td>115</td>
<td>77</td>
<td>214</td>
</tr>
<tr>
<td>Oct</td>
<td>96</td>
<td>67</td>
<td>106</td>
</tr>
<tr>
<td>Nov</td>
<td>146</td>
<td>88</td>
<td>-</td>
</tr>
<tr>
<td>Dec</td>
<td>130</td>
<td>64</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Field Data, 2002

In terms of health personnel, Kabianga dispensary has one nurse, one clinical officer and one public health technician. These are not able to handle malaria epidemics.

C) Data collection from Sosiot health centre which is also one of the sites where fieldwork was done.

Malaria epidemic is usually in June / July every year and the 1998 one was the worst. In the 1998 malaria epidemic, some clinical offices were brought in the health centre to help. It was also in the same period that a proposal to expand the health centre was proposed and immediately initiated by JICA to handle other epidemics. The new health centre with capacity of 38 beds is to be opened in January 2003.

During epidemics, anti-malaria drugs are also given to schools by the public health officers. In year 2002, the ministry of health also gave 100 free nets, 50 of them were for the staff while the other 50 were to be given to the local people. Spraying is done by the public health through local chiefs. It is also done in schools. Stagnant waters are also put west oil to prevent breeding of mosquitoes. Spraying is usually done at the onset of rains usually from April to early June.

In June 2002, there were many cases of malaria and they gave free malaria treatment.

The health centre has 1 clinical officer and six nurses and these are not enough to handle bad epidemics like that of 1998. The main drugs used are fansider, amodiaquine and quinine. During malaria epidemics, no NGO has intervened. The table below shows cases of malaria in the area since 1998.
Table 35: Distribution of malaria cases at Sosiot area.

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>976</td>
<td></td>
<td>208</td>
<td>135</td>
<td>167</td>
</tr>
<tr>
<td>February</td>
<td>1238</td>
<td>142</td>
<td>87</td>
<td>109</td>
<td>179</td>
</tr>
<tr>
<td>March</td>
<td>383</td>
<td>107</td>
<td>135</td>
<td>130</td>
<td>172</td>
</tr>
<tr>
<td>April</td>
<td>195</td>
<td>130</td>
<td>173</td>
<td>109</td>
<td>180</td>
</tr>
<tr>
<td>May</td>
<td>176</td>
<td>103</td>
<td>178</td>
<td>92</td>
<td>397</td>
</tr>
<tr>
<td>June</td>
<td>147</td>
<td>578</td>
<td>167</td>
<td>101</td>
<td>839</td>
</tr>
<tr>
<td>July</td>
<td>167</td>
<td>495</td>
<td>293</td>
<td>128</td>
<td>1176</td>
</tr>
<tr>
<td>August</td>
<td>141</td>
<td>196</td>
<td>128</td>
<td>106</td>
<td>346</td>
</tr>
<tr>
<td>September</td>
<td>135</td>
<td>261</td>
<td>153</td>
<td>101</td>
<td>246</td>
</tr>
<tr>
<td>October</td>
<td>146</td>
<td>182</td>
<td>165</td>
<td>131</td>
<td>194</td>
</tr>
<tr>
<td>November</td>
<td>156</td>
<td>249</td>
<td>105</td>
<td>243</td>
<td>206</td>
</tr>
<tr>
<td>December</td>
<td>130</td>
<td>148</td>
<td>148</td>
<td>159</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Fieldwork data, 2002

REFERENCES
2. Population Censuses (various issues).
OUTPUT 4
QUESTIONNAIRE

HOUSEHOLD SURVEY

This survey is part of a study being carried out in Kenya, Tanzania and Uganda on the impact of climate change-induced vulnerability to malaria and cholera in the Lake Victoria region. The study seeks to improve the understanding of the relationship between climate change parameters and the incidences of malaria and cholera in the Lake Victoria region. It aims at identifying priority risk groups and working with pilot populations (representative of priority risk groups) to distinguish risk management strategies and select preferred options to inform policy.

The information acquired in this survey will be treated as strictly confidential and will be for academic purposes only.

Your cooperation is very much appreciated.

Questionnaire Number ________    Date ______
Interviewer __________    Country ________
Interviewee____________    Country __________
Province _________________   District____________
Location_______________

1. Location of household:  1) Valley bottom
                            2) Hill side
                            3) Hill top

2. Distance from the lake_______    3.Elevation (in meters) ___
4. Longitude ________________    5. Latitude ______________

6. Presence of stagnant water?
1) Yes
2) No

DEMOGRAPHICS OF RESPONDENT

7. Gender:   1) Male
              2) Female

8. Age in years ____

9. Level of education
   1) None
AF91

2) Primary Education
3) Tertiary Education
4) Secondary Education
5) Other

10. Marital Status:
   1) Single
   2) Married
   3) Divorced / Separated
   4) Widowed

11. Number of people living in the household ____

**HOUSEHOLD INCOMES AND EXPENDITURE PATTERNS**

12. What are the sources of income for this household?
   1) Formal employment
   2) Self employment
   3) Farming
   4) Fishing
   5) Other

13. What is the total income for this household per month ($)?
   1) 0-180
   2) 181-360
   3) 361-540
   4) >540

14. Which of the following staple foods are consumed in the house?
   Maize ________ Wheat ________
   Bananas ________ Beans ________
   Cassava ________ Potatoes ________
   Sorghum ________ Millet ________ Others ________

15. Do you normally have the following meals in your house?
    Breakfast ________ Lunch ________ Dinner ________

16. Do you eat any of the following items at least once a week in your house?
    Meat ________ Fish ________ Eggs ________
    Chicken ________ Vegetables ________

17. Are there days when you do not have enough food?
   1) Yes
   2) No

18. Do you have access to agricultural land?
   1) Yes
   2) No
19. Please indicate which crops you grow on your land:
- Grow maize _____
- Grow beans _____
- Grow bananas _____
- Grow potatoes _____
- Grow sorghum _____
- Grow coffee _____
- Grow millet _____
- Grow tea _____
- Grow wheat _____
- Grow sugar cane _____
- Grow pyrethrum _____
- Grow fruits _______

20. What do you do with the food that you grow?
- Sell all _____
- Eat all _____
- Sell some _____

21. Do you buy foods from the market?
   1) Yes
   2) No

22. Do you keep livestock?
   1) Yes
   2) No

23. Which types of animals do you keep?
- Cows_______
- Goats and Sheep_______
- Chicken _______
- Keep others _______

**INDICATORS OF WEALTH**

24. Do you own land?
   1) Yes
   2) No

25. What is the size of the land? ________

26. House type:
   - Grass roof/Mud wall ____
   - Iron roof/Mud wall ______
   - Permanent _______

27. Do you own a radio?
   1) Yes
   2) No

28. Do you own a bicycle?
   1) Yes
   2) No

29. Do you have access to newspapers?
   1) Yes
   2) No

**ACCESS AND AVAILABILITY TO WATER**

30. Where do you get your water from in the dry season?
- Tap _____
- Borehole _____
- Roof water_____  
- Lake water _____
- Protected well _____
- River/Stream _____
Unprotected well_______   Pond___________   Other______

31. Do you buy water?
   1) Always
   2) Sometimes
   3) Never

32. How do you store your water?
   1) Jerry can
   2) Drum
   3) Large tank
   4) Pot

33. What are the major water problems in your house?
   1) Accessibility
   2) Availability
   3) Quality
   4) Quantity

ACCESSIBILITY AND AFFORDABILITY OF HEALTH FACILITIES

34. Where do members of your family **NORMALLY** receive treatment?
   Provincial hospital _____   District hospital ____   Health Centre ______
   Local dispensary _______   Mobile health post/service ______  Herbalist ______
   Private hospital _______   Private clinic______   None of the above ______

35. Who owns the health facility where you go for treatment?
   Government _______   Religious organisation ____   Private _____
   Other organizations ____

36. How far is the health facility from your home (km)? ______

37. Can you walk from your home to the health facility?
   1) Yes
   2) No

38. How else can you get to the health facility?
   1) Motor Vehicle
   2) Bicycle
   3) Boat

39. In the last three months, how many members of your family have visited the hospital? ___

40. Do you **always** get the medical services you need from the hospital?
   1) Yes
   2) No

41. Do members of your family **always** get well after treatment?
   1) Yes
   2) No
42. Do you have to pay for the treatment of malaria?
   1) Yes
   2) No

43. How much did you pay for the last treatment? $ ______

44. Was the patient admitted?
   1) Yes
   2) No

45. How do you consider these costs to be?
   1) Low
   2) Fair
   3) High

46. How do you cope with increased malaria in your house?
   Sell some animals ____  Sell some food ____  Other ways _____

47. From your experience, is the health of your family members associated with weather?
   1) Yes
   2) No

**KNOWLEDGE ABOUT MALARIA**

48. How do you know when a person has malaria?
   1) Fever
   2) Headache
   3) Stomach-ache
   4) Joint aches
   5) Vomiting
   6) Lack of appetite
   7) Convulsions

49. How is malaria treated?
   1) Modern Medicine
   2) Tepid Sponging
   3) Herbal Medicine
   4) Prayer

50. How is malaria prevented?
   1) Draining stagnant water
   2) Clearing bushes
   3) Use of mosquito coils
   4) Use of mosquito nets

51. What causes malaria?
   1) Mosquitoes
   2) Others
52. What age group is most affected by malaria?
   1) Babies / Infants
   2) Children
   3) Adolescents
   4) Adults

53. In which part of the year is malaria most common?
   1) Dry season
   2) Wet season
   3) Both
   4) Do not know

ATTITUDE TOWARDS MALARIA

54. Do you consider malaria to be a severe disease?
   1) Yes
   2) No

55. Who should pay for the treatment of malaria?
   1) Government
   2) Family
   3) Both

56. Who should pay for the prevention of malaria?
   1) Government
   2) Family
   3) Both

57. If you or a member of your family has malaria, do you need to go to a health facility for treatment?
   1) Yes
   2) No

58. Can the local herbalist cure malaria?
   1) Yes
   2) No

59. Should members of your household sleep under bed nets?
   1) Yes
   2) No

PRACTICE – MALARIA

60. What do you do when you have malaria?
   1) Do nothing
   2) Treat at home
   3) Go to health facility
   4) Visit a herbalist
   5) Other
61. What do you do when your child has malaria?
   1) Do nothing
   2) Treat at home
   3) Go to health facility
   4) Visit a herbalist
   5) Other

62. Which medicine do you use for treating malaria in your home? _________________

63. How many people sleep in your household? _________________ (Number of persons)

64. How many bed nets do you have? _________________________ (Number of bed nets)

65. How many people sleep under bed nets? _________________

66. How often are the bed nets treated with an insecticide?
   1) Twice a year
   2) Once a year
   3) Never

67. How else do you control mosquitoes in your house?
   1) Spray with insecticide
   2) Use mosquito coils
   3) Bush clearing
   4) Drain stagnant waters
   5) House screening

IMPACT – MALARIA

68. Was anybody in your household hospitalized last year because of malaria?
   1) Yes
   2) No

69. Have you lost a member of your household to malaria in the last five years?
   1) Yes
   2) No

70. Was it a child or an adult?
   1) Yes
   2) No
   3) Both

CHOLERA

ACCESS AND AVAILABILITY OF SANITATION FACILITIES

71. What type of toilet do you use?
   1) Flush
   2) Pit latrine
   3) Bush
72. Do you have access to a sewage system?
   1) Yes
   2) No

73. Are there institutions dealing with sanitation issues?
   1) Yes
   2) No

74. How do you treat your drinking water?
   1) Boiling
   2) Filtering
   3) Chemicals
   4) Other
   5) No treatment

75. Why don’t you treat your drinking water?

76. Do you know the consequences of drinking untreated water?
   1) Yes
   2) No

77. What are the consequences drinking untreated water?
   1) Disease
   2) None
   3) Don’t know

78. How did you learn about the consequences?
   1) Media
   2) Health Service Providers
   3) Community Awareness Programs
   4) Formal Sources (teachers, etc)
   5) Informal networks

79. Do you wash your hands before eating a meal?
   1) Yes
   2) No

80. Has anybody in your household above 5 years old had diarrhoea in the last three months?
   1) Yes
   2) No

81. If yes, please describe the nature of the disease
   1) Frequent visits to the toilet
   2) Uncontrollable
   3) Watery
   4) Smell
   5) Fever
   6) Dehydration
82. How did the person get diarrhea?
   1) After drinking water from the lake
   2) After drinking piped water
   3) After drinking pond water
   4) After drinking water from the stream
   5) After drinking roof water
   6) After bathing in the lake
   7) After eating food
   8) After attending a funeral
   9) Other

83. Was the disease life threatening?
   1) Yes
   2) No

KNOWLEDGE

84. Do you know of a disease called cholera?
   1) Yes
   2) No

85. How does one get the disease?
   1) Drinking untreated water
   2) Eating contaminated food
   3) Other
   4) Do not know

86. What should one do when one gets the disease?
   1) Take to the health facility
   2) Treat at home

87. If treatment is done at home, how should it be done?
   1) Oral Rehydration Salts
   2) Fluids (porridge)
   3) Others
   4) Do not know

88. Under what weather conditions is cholera likely to occur?
   1) Dry season
   2) Wet season
   3) Do not know

89. How can one prevent the disease?
   1) Drinking treated/boiled water
   2) Washing hands before eating and after visiting the toilet
   3) Covering food

ATTITUDE TOWARDS CHOLERA

90. If one has cholera, what should be done?
AF91

1) Treat at home
2) Treat in a health facility
3) Do nothing
4) Other

IMPACT OF CHOLERA

91. How many people had cholera in your home during the last outbreak (97/98)? ______
(Number of persons)

92. Did any one in your household go to a health facility for treatment of cholera?
   1) Yes
   2) No

93. Was anybody in your household hospitalized because of cholera?
   1) Yes
   2) No

94. How much money did your household spend to treat cholera then? $___________

95. Did your household lose anybody to cholera?
   1) Yes
   2) No

96. Was it a child or an adult?
   1) A child
   2) An adult
   3) Both

ACTIVITY PATTERNS FOR MALARIA AND CHOLERA

97. Please indicate in the table the normal daily schedule for different members of the household
from the time they wake to the time they go to sleep.

<table>
<thead>
<tr>
<th>Time</th>
<th>Female Adult</th>
<th>Male Adult</th>
<th>Female Child</th>
<th>Male Child</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e.g. 6–7 am)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The first analysis done on the socio-economic data was simply frequencies to get a feel of the data and construct profiles based on these characteristics.

**A. LOCATIONAL CHARACTERISTICS OF HOUSEHOLDS**

<table>
<thead>
<tr>
<th>Location of Household</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valley bottom</td>
<td>160</td>
</tr>
<tr>
<td>Hill side</td>
<td>140</td>
</tr>
<tr>
<td>Hill top</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Location of household
B. DEMOGRAPHIC CHARACTERISTICS

**Gender**
- Female: 56.0%
- Male: 44.0%

**Level of education**
- Primary education: 56.0%
- Secondary education: 15.4%
- Tertiary education: 4.0%
- None: 24.5%

**Marital status**
- Married: 76.1%
- Single: 3.7%
- Widowed: 16.5%
- Divorced/separated: 3.3%

**Age in years**
- Percentages for different age groups are provided, with the highest concentration in the 40-45 age range.
SOURCES OF HOUSEHOLD INCOMES

Is formal employment a source of income?

Yes 15.6%
No 84.4%

Is self employment source of income?

Yes 31.7%
No 68.3%

Is Farming source of income?

No 74.3%
Yes 25.7%

Is Fishing a source of income?

No 88.7%
Yes 11.3%
C. Regularity of Meals and Dietary Intake

Do you normally have breakfast in your house?  
- Yes
- No

Do you normally have lunch in your house?  
- Yes
- No

Do you normally have dinner in your house?  
- Yes
- No

Meat eaten at least once a week  
- Yes
- No

Fish eaten at least once a week  
- Yes
- No

Eggs eaten at least once a week  
- Yes
- No

Chicken eaten at least once a week  
- Yes
- No

Vegetables eaten at least once a week  
- Yes
- No

Are there days when you do not have enough food?  
- Yes
- No
D. Household Food Consumption

Maize Consumption
Wheat Consumption
Banana Consumption
Bean Consumption
Cassava Consumption
Potatoes Consumption
Sorghum Consumption
Millet Consumption
E. Crop Cultivation I

- **Access to agricultural land**
  - Yes: 95.0%
  - No: 5.0%

- **Maize Cultivation**
  - Yes: 98.6%
  - No: 1.4%

- **Cultivation of Beans**
  - Yes: 90.4%
  - No: 9.6%

- **Cultivation of Bananas**
  - Yes: 45.1%
  - No: 54.9%

- **Cultivation of Potatoes**
  - Yes: 69.9%
  - No: 30.1%

- **Cultivation of Sorghum**
  - Yes: 55.5%
  - No: 44.5%

- **Cultivation of Coffee**
  - Yes: 7.6%
  - No: 92.4%

- **Cultivation of Millet**
  - Yes: 70.0%
  - No: 30.0%
E. Crop Cultivation II

Cultivation of Wheat
- Yes: 1.7%
- No: 98.3%

Cultivation of Tea
- Yes: 27.7%
- No: 72.3%

Cultivation of Pyrethrum
- Yes: 2%
- No: 99.7%

What do you do with the food that you grow?
- Sell all: 30%
- Eat all: 40%
- Sell some: 50%

Do you buy foods from the market?
- No
- Yes
F. Livestock Keeping

Livestock Keeping

Do you keep livestock?

- Yes: 100%
- No: 0%

Cattle Keeping

- Yes: 80%
- No: 20%

Goat Keeping

- Yes: 50%
- No: 50%

Sheep Keeping

- Yes: 40%
- No: 60%

Chicken Keeping

- Yes: 100%
- No: 0%

Other Animals Kept

- Donkeys: 10%
- Rabbits: 50%
- None: 40%
G. Land Ownership and Indicators of Wealth

- **Do you own land?**
  - Yes: 80%
  - No: 20%

- **Size of land (Acres)**
  - 0: 100%
  - 5: 80%
  - 10: 60%
  - 15: 40%
  - 20: 20%
  - 25: 0%

- **House type**
  - Grass-roof/Mud wall: 60%
  - Iron roof/Mud wall: 50%
  - Grass-roof/Iron roof addition: 40%
  - Permanent/Iron roof: 30%
  - Grass-mud wall/Iron roof: 20%
  - Permanent: 10%
  - No: 0%

- **Do you own a radio?**
  - Yes: 100%
  - No: 80%

- **Do you own a bicycle?**
  - Yes: 70%
  - No: 30%

- **Do you have access to newspapers?**
  - Yes: 60%
  - No: 40%
H. Availability and Accessibility of Water I

Do you get water from tap in the dry season?

Do you get water from borehole in the dry season?

Do you get water from roof in the dry season?

Do you get water from lake in the dry season?

Do you get water from protected well in the dry season?

Do you get water from river/stream in the dry season?

Do you get water from unprotected well in the dry season?
H. Availability and Accessibility of Water II

Frequency of Water Buying

Storage of Water in Jerry Can

Storage of Water in a Drum

Storage of water in a large tank

Storage water in a pot

Is accessibility a major water problem?

Is quantity a major water problem?

Is availability a major water problem?

Is quality a major water problem?
AF91

OUTPUT 6
GIS ANALYSIS

Belgut

Kisumu West

AIAAC, 2003
OUTPUT 7
ACTIVITIES REPORT ON CLIMATE, HYDROLOGICAL AND LAND USE DATA

The Lake Victoria Basin is bounded by the following coordinates: latitude 3°N-4°S and longitudes 30°E to 36°E. As far as possible, efforts have been made to have the data and sites all co-located.

1. Climatological Data

Four stations have been selected for further analysis at each of the study sites in Kenya, Uganda and Tanzania. The stations selected are within a radius of 50 km of the study areas. The data that are being collected and analysed are: rainfall data (daily) and temperature data (daily $T_{\text{max}}$, daily $T_{\text{min}}$). Daily mean values (e.g. $T_{\text{average}}$) and mean monthly values are being avoided in the analysis as the data smoothing may obscure critical information on variability that may be primary drivers of the climate-health link.

Quality assurance and quality control checks are currently being carried out on the data sets. It is noted that up to 1962, Imperial Units were used when recording the meteorological data. There are, therefore, possibilities of translation errors in some cases when the data was converted to S.I. units, for example in Kericho data, particularly for 1948 and in the 1980s. Certain gaps in data recording have been noted. For example, there are gaps in the Uganda data, particularly from 1972 to 1978 due to the war. For the Tanzania data, what is available for free covers the period 1954 to 1974, and any data from 1975 to present has to be purchased from the national meteorological offices. In Kenya long records are available, but are also sold to the user. The cost of meteorological data is quite high, and the team is currently negotiating for a complete or partial waiver of the data costs in the East African countries. DMCN is our principal source of data or link to data as they handle or mirror all the meteorological data that comes from the three east African countries, and others.

Temperature data can also be obtained from satellite observations for the period 1984 to present for the Lake Victoria basin. Due to the prohibitive costs of such satellite data, negotiations are underway with the San Marco Space Research Station in Malindi, Kenya for supply (at nominal cost) of NOAA and Seastar satellite data covering the basin. Such data would be useful for verification of meteorological station data, and a series of one year would be sufficient for this. The meteorological data currently available (at 30km resolution) comprises of: temperature (air and dew point), humidity, pressure, wind speed and direction.

2. Hydrological and Pollution Data

Hydrological data collection is currently being undertaken. These data have been furnished mainly by the Ministries of Water in the three countries i.e. Kenya, Uganda and Tanzania. The discharge records are now available for some of the major rivers at a daily frequency from 1947 to present. The discharge stations are mostly located close to the point where the rivers enter the lake (co-located with cholera study sites), and so contain integrated sub-catchment rainfall-run-off information. The rivers include Sio, Nzoia, Gucha, Nyando, Sondi Miriu and Mara. There are, of course, data gaps ranging from a few days to months, but most of these gaps can be filled in using rating curves or other techniques. The data is currently being checked for quality assurance and quality control. Physicochemical data that have been acquired for some of the rivers mentioned above include the following parameters: temperature, pH, turbidity, conductivity, colour, Ca, Mg, Na, K, alkalinity, nutrient compounds, and heavy metals. River
discharge data from the highland areas within the study areas have not yet been obtained. Negotiations are on-going to acquire these data from the relevant ministries. Such data are crucial for the co-location of hydrological data with the other data types that are being obtained from the highland study areas. Microbiological data (faecal coliform, vibrio cholerae) are not available.

We are currently collecting and collating ordnance survey maps (1952, 1956, 1962, 1973) in order to determine the extent of flooded areas and changes in the extent of the flooded areas over time. The maps will be digitised using GIS. For more recent periods, snapshots of the dynamics of open water surface area will be obtained from satellite images. These satellite images will be sourced from the San Marco Space Research Station, Malindi, Kenya.

The hydrology components of the SWAT and ACRU models are currently being critically examined to see which of the two models is likely to better handle our hydrological data. These two spatial models have been suggested as they also have nested within them climate and land use modules and can be easily linked to GIS environments. They are integrated catchment models that could be very useful to our study and are flexible enough to incorporate climate, hydrological, land use and other environmental variables at local level.

3. Land Use Data

The collection and collation of land use data is still in the early stages. We propose to use existing GIS templates if they are set up in a manner that would fit our intended use, instead of tying down human resources and time by trying to digitise our own maps from scratch. It was noted that in Tanzania, obtaining GIS maps for the Lake Victoria watershed is not a problem. Possible sources of Lake Victoria GIS maps for Kenya and Uganda sites include LVEMP, Africover, ICRAF, Ministries of Water, FAO, the Central Bureau of Statistics, Lake Victoria Development Agency (LVDA) and the Regional Centre for Mapping and Resources Development (RCMRD). The RCMRD has digitised the whole lake basin (Kenya side) covering roads, rivers, urban centres, contours, vegetation types and economic activities at a scale of 1:50,000. This dataset, however, is being sold at a price of about USD$5000.

For the specific study site areas, the ordnance survey and other maps will be digitised at a scale of 1:10,000 in order to be able to capture the data at household level, and to enable comparison of changes in flood extent and land use with socio-economic and health data.

The satellite images (NOAA and Seastar) that are archived at San Marco Space Research Station in Malindi, cover the period April 2001 to present. The resolution of these images is about 1.1km. ENVI software will need to be purchased in order to decipher the images, and CDs would be required to store the data needed for our study sites.

4. Assessment of impacts and adaptation to climate change; Impact of climate change-induced vulnerability to malaria and cholera in the Lake Victoria region

4.1. Selected Sites of Study
In Kenya, the target sites are as follows: Kericho (malaria) and Kisumu (cholera). In Tanzania, they are Bugarama village, Muleba District (malaria) and Chato Village, Biharamulo District (cholera). In Uganda, we have Kasese, southwest Uganda (Malaria) and Gaba, Kampala
(cholera). The sites that were selected for malaria are high altitude sites, where previously there was very little incidence of the disease as compared to today. The sites for cholera are well-known areas that experience cholera outbreaks from time to time.

4.2. Climate data
The meteorological variables selected for analysis in this project are rainfall, temperature, evaporation and humidity. Analysis of the baseline climate for the Kenya sector has already been conducted and the preliminary results are presented below. These are based on daily records. Quality assurance and quality control checks are still being carried out for the Tanzania and Uganda data. The preliminary results will be available by end of August 2003.

4.2.1 Preliminary Results of Climate Data Analysis in the Kenya Sector
The following stations were selected in the region of study, being co-located with the study sites (within a radius of 40km).

Kisumu:
1. Kisumu Meteorological Station,
2. Kisumu New Prison,
3. Kibos Cotton Experimental Station,
4. Kibos Sugar Research Station.

Kericho
1. Kaisugu House
2. Kericho Chagaik Estate
3. Hail Research Station

The analysis of the data has been done using Microsoft Excel Spreadsheet and Arcview GIS Software. Monthly means of rainfall were calculated from daily records for the period 1961-1990. Monthly means of temperature, humidity and evaporation were also calculated from daily records for the period 1989-1994. These may not compare very well with the rainfall data collected for 30 years but it provides an estimation of the average values for the region since temperature, humidity and evaporation do not show much year-to-year variation.

Study Region
The map below shows the location of the meteorological stations from which the data was obtained. The stations’ locations have been laid over the digital elevation model for the region (resolution: 1km), the rivers of Kenya and the Lake Victoria digital maps. The darker the brown shade, the higher the elevation. The map shows Kericho at higher elevations than Kisumu. The elevations for the two main Meteorological stations are 1146m for Kisumu and 2148m for Kericho.
Rainfall
From Figure 2 it can be seen that Kericho receives much higher rainfall than Kisumu. The rainfall seasons are *trimodal*. There are three observed peaks: April, August and November. For Kericho, April is the wettest month and December the driest month. For Kisumu, April is the wettest month while July is the driest month. On average, the study regions in Kisumu and Kericho receive about 1400mm and 1940mm of annual rainfall respectively. In Kericho, there are about 7 months on average, within one year that receive more than 150mm of rainfall as compared to only about 3 months in Kisumu as can be seen from Figure 2. This should be compared to the fact that a minimum rainfall of 150mm per month for 1 to 2 months is required to precipitate a malaria outbreak.
Temperature, Evaporation and Humidity

In Figure 3a below, the mean maximum temperature occurs in March (the warmest month) and the mean minimum temperature occurs in July (the coolest month). The evaporation does not vary much and almost equals the rainfall, except during the rainy seasons where the rainfall is much more than the evaporation.

In Figure 3b below, the mean maximum temperature occurs in February (the warmest month) and the mean minimum temperature occurs in September (the coolest month). Here the rainfall is seen to exceed the evaporation by large amounts even during the non-raining seasons, unlike for Kisumu.

The pattern of humidity in both the study areas (although not shown on the graph) is a mirror image of evaporation. It ranges on average from 54% to 65% in Kisumu and 56% to 76% in Kericho.
Figure 3a: Variability of Temperature and Evaporation for Kisumu.

Figure 3b: Variability of Temperature and Evaporation for Kericho.
AF91

4.2.2. HYDROLOGICAL DATA
There are eleven main rivers draining into Lake Victoria: Nzoia, Yala, Nyando, Sondu-Miriu, Gucha, Mara, Gurumeti, Duma, Simiyu, Magoga, Isonga and Kagera (Figure 4) (Shepherd et al., 2000). Of these, only two are shared by more than one country; the Kagera is shared by Tanzania, Rwanda, Burundi and Uganda, while the Mara is shared by Kenya and Tanzania. The Kericho site (Kenya) for malaria lies in the Sondu-Miriu drainage basin (Figure 4). The Bugarama village, Tanzania (malaria) lies in the Kagera drainage basin (Figure 4), while Kasese (Uganda) is on the slopes of the Rwenzoris. All the cholera sites are in the Lake edge drainage area (Figure 4).

Figure 4. The river drainage basins of Lake Victoria (from Shepherd et al., 2000).

The demographic and biophysical characteristics of the drainage basins of Lake Victoria are indicated in Table 1 below.
Table 1. Demographic and biophysical characterisation of the inlet drainage basins of Lake Victoria (from Shepherd et al., 2000).

<table>
<thead>
<tr>
<th>River basin name</th>
<th>Countries sharing basin</th>
<th>Est. basin size (km²)</th>
<th>Ave. est. 2000 pop. Density (people/km²)</th>
<th>Est. total pop. In 2000</th>
<th>Ave. annual rainfall (mm)</th>
<th>Ave. sediment transport capacity index</th>
<th>Ave. % slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nzoia / Yala</td>
<td>Kenya</td>
<td>15,143</td>
<td>221 (±154)</td>
<td>3,346,000</td>
<td>1,306</td>
<td>0.14</td>
<td>2.3</td>
</tr>
<tr>
<td>Nyando</td>
<td>Kenya</td>
<td>3,517</td>
<td>174 (±127)</td>
<td>611,000</td>
<td>1,360</td>
<td>0.30</td>
<td>5.0</td>
</tr>
<tr>
<td>Sondu Miriu</td>
<td>Kenya</td>
<td>3,583</td>
<td>220 (±148)</td>
<td>788,000</td>
<td>1,415</td>
<td>0.14</td>
<td>2.3</td>
</tr>
<tr>
<td>Gucha</td>
<td>Kenya</td>
<td>6,612</td>
<td>224 (±183)</td>
<td>1,481,000</td>
<td>1,300</td>
<td>0.16</td>
<td>2.0</td>
</tr>
<tr>
<td>Mara</td>
<td>Kenya / Tanzania</td>
<td>13,915</td>
<td>46 (±56)</td>
<td>640,000</td>
<td>1,040</td>
<td>0.15</td>
<td>2.0</td>
</tr>
<tr>
<td>Gurumeti</td>
<td>Tanzania</td>
<td>12,290</td>
<td>21 (±26)</td>
<td>258,000</td>
<td>879</td>
<td>0.12</td>
<td>1.6</td>
</tr>
<tr>
<td>Mbalaget</td>
<td>Tanzania</td>
<td>5,702</td>
<td>37 (±22)</td>
<td>211,000</td>
<td>766</td>
<td>0.05</td>
<td>0.6</td>
</tr>
<tr>
<td>Duma / Simiyu</td>
<td>Tanzania</td>
<td>9,702</td>
<td>50 (±26)</td>
<td>485,000</td>
<td>804</td>
<td>0.06</td>
<td>0.5</td>
</tr>
<tr>
<td>Magoga / Muame</td>
<td>Tanzania</td>
<td>5,104</td>
<td>88 (±47)</td>
<td>449,000</td>
<td>842</td>
<td>0.05</td>
<td>0.4</td>
</tr>
<tr>
<td>Isonga</td>
<td>Tanzania</td>
<td>8,972</td>
<td>48 (±22)</td>
<td>430,000</td>
<td>897</td>
<td>0.04</td>
<td>0.3</td>
</tr>
<tr>
<td>Kagera</td>
<td>Tanzania / Uganda / Rwanda / Burundi</td>
<td>59,158</td>
<td>181 (±196)</td>
<td>10,711,000</td>
<td>1,051</td>
<td>0.24</td>
<td>3.0</td>
</tr>
<tr>
<td>Lake edge</td>
<td>Kenya / Tanzania / Uganda</td>
<td>40,682</td>
<td>133 (±175)</td>
<td>5,411,000</td>
<td>1,077</td>
<td>0.21</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Hydrological data has been obtained for the study sites in Kenya. Efforts are at an advanced stage to obtain co-located hydrological data for the sites in Uganda and Tanzania. These data are expected to be available by mid-August 2003. Meanwhile, maps of the study sites are being digitised and the following characteristics of the sites will be noted with respect to hydrology: the extent of flooding areas (current maps), the changes in extent of flooded areas over time (from ordnance survey maps), the dynamics of open water surface area (from appropriate satellite images of the areas).

Preliminary results for the Kericho area, Kenya, show that highest discharge rates in Sondu Miriu River occur in the six months from April to September. Peak river discharge lags two of the three observed rainfall peaks (April and August) by one month, but is coincident with the rainfall peak in November.

![Figure 5. Mean monthly discharge for Sondu Miriu River, station 1JG01, alt. 1500m a.s.l., 1961-1990.](image-url)
The Uganda project team has continued to execute the project and has undertaken the following activities:

(a) Questionnaire Survey:
This phase of the project started in December 2002 to January 2003. It was preceded by the successful training of the Research Assistants and the PhD student in Kisumu in December 2002 for a week. The Research Assistants involved were Timothy Baguma and Robinah Nanyunja, and the PhD student was Robert Kabumbuli.

The questionnaire survey was conducted in two sites namely; Kabale in south-western Uganda (latitude: 01° 15’S, longitude: 29° 59’E) for malaria and Gaba in Central Uganda (latitude: 00° 16’N, longitude:32° 38’E) for cholera. Gaba is located to the south-east of Kampala on the shores of Lake Victoria's Murchison Bay.

Kabale was selected as a malaria site because it is reported to be experiencing an increasing incidence of malaria due to climate change. Gaba was selected for mainly cholera because it suffered in the cholera epidemic that followed the 1997 el nino rains. The area is densely populated and, together with its other socio-economic characteristics, it is quite vulnerable to cholera. However, it was also decided to administer the malaria questions to the Gaba sample in order to give us a comparison on malaria between the Kabale highlands and the lower lying regions around Kampala.

A total of 290 questionnaires were administered in both Kabale and Gaba: 160 in Kabale and 130 in Gaba.

(b) Data Entry and Analysis:
We had a late start with the data entry because the SPSS entry screen that was provided from Nairobi used a different numbering system of the variables from ours and it took sometime before this was cleared.

(c) Secondary Data:
Secondary data collection is currently going on and is on course, undertaken by the whole team. The places that have been / will be visited include, but not limited to:

1. Mulago hospital - national referral hospital
2. Mengo hospital - Protestant founded hospital
3. Nsambya hospital - Catholic founded hospital
4. Old Kampala hospital - Islamic founded hospital
5. Ministry of Health
6. Institute of Public Health
7. Centre for Disease Control
8. National Health Research Council
9. Government Chemist
10. National Drug Authority
11. Makerere University
12. National Environment Management Authority
13. UNICEF
14. WHO
Report On the Aiacc Project - Uganda June 2003

Context of the Study
There have been reports of an increase in malaria cases in the recent years in Uganda, particularly in the Southwestern districts that include Rakai, Mbarara, Bushenyi, Rukungiri, Ntungamo, Kisoro and Kabale. Some of these reports have made it necessary for teams from the Ministry of Health to be dispatched to these locations to assess the situation and to recommend the most urgent actions (Bakyaita et al 2001).

Any sudden increase in the malaria incidence beyond what is considered normal constitutes an epidemic, especially when it grows beyond a mere seasonal increase in the disease. Malaria epidemics tend to occur when a large number of susceptible persons who are likely to become ill are suddenly exposed to infection (Bakyaita, 2001). Persons are most susceptible when they have not been long exposed to the disease and have therefore not built up an immunity against it. This is precisely the situation that prevails in the South-western Uganda districts.

The districts of South-western Uganda are labelled ‘epidemic prone’ due to high altitude associated with low temperatures that would not ordinarily support malaria transmission. Since 1990, epidemics have occurred every two years in Kabale, Kisoro and Rukungiri districts. In 1997/98, an epidemic associated with El Nino affected the whole South-western region, and another upsurge was reported in Kabale in 2000.

It is for this reason that Kabale district was chosen as the malaria site for the AIACC study in Uganda in December 2002. Kabale is the southernmost district of Uganda. It lies between 29° 45’ and 30° 15’ East longitude and 1° 00’ and 1° 29’ south latitude. It borders with the districts of Kisoro to the west, Rukungiri to the north, Ntungamo to the east and the Republic of Rwanda to the south (Kabale District Council, 2000). It is about 380km from the capital Kampala. At an altitude of 1800m, it is one of the most malaria epidemic-prone districts of Uganda, most especially because recent climate changes have seen the on-set of this previously uncommon disease.

As regards cholera, the disease incidence has been increasing in the country due to the more frequent El Nino-like rainfall patterns. The 1997/98 rains for instance had an accumulated 2,091.2mm in a period of eight months, compared to a normal annual average of 1,615.5mm. The increased rainfall has led to outbreaks of water borne diseases, particularly cholera and malaria.

Although many parts of the country are affected by cholera, Kampala has been the most severely hit by the disease. In the 1998 outbreak, there were a total of 46,236 cases reported, but 5,814 cases were in Kampala alone. Cholera incidence declined steadily in the country from 1998 to 2001, but then shot up again in 2002 (Okware, 2003). In Kampala, two locations of Kawempe and Gaba were most hit.

For the AIACC study therefore, Kampala was chosen to study the vulnerability and adaptation of cholera increase. Gaba parish in Kampala was selected for the household interviews because it suffered in both the 1998 and 2002 outbreaks. Located on the shores of Lake Victoria in Murchison Bay, about 6km from the city centre, Gaba is very prone to cholera. The main
lakeside trading centre is characterised by a very high population density, over crowded housing, and a high transit population. Hygiene in Gaba trading centre is noticeably very poor. The place is visibly dirty. Garbage, waste water and excreta disposal are all very poor. Amidst these poor hygiene conditions, a vibrant fresh and cooked food vending business takes place. It is hard for residents to maintain cleanliness in such circumstances. The rate of contamination of both food and water is therefore quite high, making the area extremely vulnerable to cholera.

**Field-work**
A total of 290 questionnaires were administered to respondents in a household survey in Kabale and Kampala; 160 for the malaria site in Kabale and 130 for the cholera site in Gaba-Kampala. Although the questionnaires were the same for the two sites, it was decided that the questions relating specifically to cholera were not administered at all in Kabale. On the other hand, the malaria questions were administered in the cholera site in Gaba because people there also experience malaria. The advantage of this is that it will give us an opportunity to make a comparative analysis of the malaria variables between Kampala and Kabale. The comparison will be mainly between rural and urban locations, and well as between different altitudes.

Data has been entered into the SPSS programme and has already been cleaned. Analysis of the data will start as soon as the study team is ready to write the report of findings of the study.

**Focus group discussions**
Some focus group discussions have been held by the study team with the communities in Kabale, and they focused mainly on how people cope with the increasing incidence of malaria. More FGDS will be held as soon as the secondary data gathering is completed so as to give the study team an opportunity to verify important issues with the communities.

**Indepth interviews**
The study team has conducted a number of in-depth interviews with a wide range of stakeholders as key informants. The subject covered was mainly the socio-economic dimension of both malaria and cholera. The different stakeholders involved included staff of different hospitals in Kabale and Kampala, staff of local government, staff of academic and research institutions, and government ministries and departments. The data collected was of a primary nature, and the secondary data gathering is now on going.

Secondary data

Gathering secondary data is now going on, and the agencies that are involved are virtually the same as those that were involved in the in-depth interviews. What is emerging out of this exercise is that there is a richness of data in various institutions but it is very poor kept and poorly organised. It takes a very long time to make sense of any data because it is not computerised. Record keeping has also been poor, so the data available is only for the last ten or so years.

**References:**
Bakyaita Nathan, Talisuna Ambrose: Malaria Epidemic in the districts of Southwestern Uganda; IDS Bulletin, Volume 1, March 2001


Okware Sam: Update on Cholera in Uganda; Ministry of Health, January 2003
OUTPUT 9
REPORT OF PROGRESS OF THE AIACC PROJECT-TANZANIA

The Tanzanian team has undertaken two socio-economic field surveys as well as holding a stakeholders meeting. Highlights of their work is given below.

Preliminary Findings on the Assessment of Vulnerability to Malaria and Cholera in Muleba and Biharamulo District, Kagera Region, Tanzania.

1. Introduction
The first fieldwork for the AIACC project, Tanzania part was carried out between 20th November 2002 and 12 December 2002 and 5th to 15th July, 2003, in Kagera Region. The study was carried out in two villages in the region, one each in Muleba and Biharamulo districts. The fieldwork involved the research team travelling from Dar es Salaam to Muleba and later to Biharamulo district. While in the mentioned districts the team had preliminary separate brief discussions with the district authorities (the District Executive Director, District Commissioner, District Medical Officer, and District Health Officers) to introduce the project and to acquire a general overview of the malaria and cholera situations in respective areas. As well this opportunity was used to earmark potential villages to be selected for this study.

1.1 Selection of study villages
Two villages have been selected for this study, namely BUGARAMA in Muleba District and CHATO in Biharamulo District. The two villages represent case studies for malaria and cholera respectively. Bugarama village is located above 1500m above sea level and meets the requirement for the malaria study of the project, and Chato is located at the lakeshore thus being suitable for the cholera part of the investigation. To start with, and for logistical reason, it the research team decided to have both case study villages in one district – Muleba. Looking at topographical maps several villages could fit into the “lakeshore-highland >1500m” condition for selection. However, discussions with the district authorities revealed that in Muleba district that for malaria, there have been a number of outbreaks, hence the selected highland village of Bugarama in Biirabo ward (Nshamba Division) fitted well into the study. The discussions revealed further there have never been cholera outbreaks in the recent history, except for sporadic cases that were reported to have been “imported cases” from other areas – from islands inside Lake Victoria. And, for that matter, villages along the lakeshore in Muleba district would not be suitable sites for the cholera study. Consultations with the district authorities in Muleba and Biharamulo districts then provided for an alternative place with a history of previous cholera incidences - Chato village, in Chato Division.

2. Participatory discussions in the selected villages
Group discussions were arranged and carried out in the two selected villages on 25th November 2002 and 3rd December 2002 in Bugarama and Chato village respectively. In each village the research team started by introducing the study, followed by self-introduction of all participants, and subsequently the discussions proceeded. The discussions drew representatives from all the sub-villages (vitongoji) that make each village and various groups (e.g. age, wealth, level of education) of local people in the two villages, and aimed at obtaining a general overview of the malaria and cholera situations in each village and the local perspectives on adaptation mechanisms (curative and preventive) to these diseases. The research team facilitated the discussions, but every participant had an equal chance to express ones opinion. Notes were taken
on issues upon consensus among the participants. To generate the information needed the
discussion focused on the following issues:

(a) Introductory analysis
   - Economic activities in the village,
   - Socio-economic groups in the village and criteria used to classify them.
(b) For malaria and cholera
   - Conditions that enable them tell/ predicted that a malaria/cholera outbreak is going to
     happen,
   - Whether the incidences/outbreaks of malaria/cholera have been increasing over years,
   - Time of the year when malaria/cholera is a problem,
   - Identification of symptoms of malaria/cholera,
   - Age groups (e.g. infants, youths, adults, elderly, etc.) affected most by malaria/cholera,
     and possible explanations,
   - How they address the malaria/cholera problem (e.g. availability of health facilities,
     whether people afford to get medical services, etc.),
   - Problems of water availability and how they address them.

2.1. Findings from Participatory Discussions in Bugarama Village
Bugarama village is located in Biirabo ward, in Nshamba Division. The village has four sub-
villages namely Kantare, Bugarama, Omukituntu, and Kyaibumba with 110, 120,130 and 140
households respectively. By May-June 1999 the village had a total of 409 households and a total
population of between 2809 and 2819 people. Most of the inhabitants are the Haya.

2.1.1 Economic activities in the village
In Bugarama village the main economic activity is agriculture, including crop cultivation and
livestock keeping. The agriculture practiced in this village is mainly at subsistence level. The
main food crops grown here include bananas, maize, beans, cassava, groundnuts and beans.
Coffee is grown as the major cash crop. The livestock kept in the village include cattle, both
indigenous breeds and improved dairy cattle – however not all households keep cattle, goats
(local and improved dairy breeds), pigs, rabbits, chicken and ducks. Cattle are raised both for
sale and domestic use. Most of the livestock keepers use animal manure in the banana fields. It
was mentioned that those who keep cattle keep about 3-5 cows mainly for milk production.

2.1.2 Socio-economic/wealth groups in the village and criteria used to classify them
The local people in Bugarama village identified three socio-economic/wealth groups, namely the
(i) Washongole – the rich people, (ii) Watu wa kati (wa kawaida) – the common people in the
middle class, and (iii) Kacheku or Umwolu/Aboru – the poor people. The three groups were
characterised based on wealth that they own, as well other aspects, e.g. ability to pay for the
education of his/her children. Some of the criteria that characterises each of the three socio-
economic categories are highlighted below.

(i) Washongole – the rich people
   - Have lots of resources
   - Are self sufficient in most respects
   - Owns a good house
   - Have many herds of cattle
   - Have big farms
   - Makes and sells local brew (rubisi, etc.)
   - Have plenty of money
(ii) Watu wa kati (wa kawaida) – the middle class or common people
- Owns a good house
- Do not have cattle
- Have small farm plots
- Have a little money
- May not be able to send children to school/hospital

(iii) Kacheku or Umwolu/Abwolu (singl/pl)– the poor people
- Owns a house that is not very good, or may not have one at all,
- Do not have sufficient food for the household. In many cases depends on “kuhemea” (getting food stuffs from other households),
- Most of the time is spent on casual labour,
- Gets one meal a day,
- May have a small farm plot that is not well attended, and do not produce good crops,
- Have big families (with many children).

Of the three socio-economic groups, the “Watu wa Kati” category has the largest number of people, followed by the “Aboru”. The “Washongole” are very few in Bugarama, and are considered to be mainly the businessmen (though not very well educated), and are mainly men. It was pointed out during the discussion that, traditionally, women did not get a share of wealth/inheritance from their parents, and as such there were no female-Mshongole. Women could only be found in the other two socio-economic groups, with most women in the third category. Today, however, there are a few females (married or unmarried) who own a lot of wealth (e.g. a big shamba, a good house, money, etc.) and may be called Washongole. A local terminology “kiumbi keire” is used to describe this group of female washongole, regardless of how one got this wealth.

2.1.3 Bugarama experiences with malaria
(i) Conditions locally used to predict that a malaria outbreak is going to happen:
Local experiences in Bugarama indicate that years with food shortages, caused by drought are often followed by severe incidences of malaria. The relationship between drought and malaria is in this area also reflected in the local name for malaria, “mushana”, local term that at the same time means periods of drought (or extended dry seasons). Participants in the group discussion in Bugarama village mention also that in such dry years when the level of nutrition is not very good the body becomes weak and easily succumb to malaria. During such years with food shortage young children were reported to also suffer from anaemia. It should be noted here that when people in this village, and elsewhere in Muleba district, talk of food shortage, they actually refer to poor harvests of their staple food crop – banana.

(ii) Whether the incidences/outbreaks of malaria/cholera have been increasing over years:
It was rather difficult to go far back in history concerning outbreaks of malaria. However, local memories were able to reflect on particular climatic conditions that were associated with incidences of malaria. Participants reported, for example, that:

- In 1970 there was a severe famine, attributed to drought, and that was followed by a malaria epidemic.
- In 1974 the area experienced drought, there was food shortage and people received relief food (the yellow corn, locally known as yanga). According to local knowledge this season also had many incidences of malaria, though only a few people died.
- Before the El Nino rains of 1997/98 there was also drought.
- The El Nino season (1997/98) experienced severe food shortage/famine in the area, and malaria was rampant.

(iii) Time of the year when malaria/cholera is a problem:
The period between September and April is when there are more severe incidences/outbreaks of malaria in this village. Local people associate these outbreaks to the season when beans are growing in the field, under the bananas. They point out that during this season mosquitoes find suitable breeding ground in the beans fields where the microclimate is dump and humid. Also during the rainy season there are several places where stagnant water can be found, e.g. in portholes (madimbwi) and cut banana stems. According to the people the mosquitoes breed on bean-leaves.

(iv) Identification of symptoms of malaria:
Participants to the group discussion narrated the various symptoms that they use to characterise someone with malaria. They include:
- High fever (sometimes coming periodically),
- Vomiting (vomited material with yellowish colouration),
- Headache
- Degedege (convulsions – epilepsy?) in small children
- Loss of appetite
- Dizziness
- Loss of sight (macho kuwa mengine!)

(v) Age groups affected most by malaria, and possible explanations:
Concerning the different groups affected most by malaria; participants identified three key groups – the infants, women – especially pregnant, and the elderly.
- Infants: Children at the age of 0-5 years of age were reported to be most seriously affected by malaria. This was attributed to several reasons, including: (1) poor nutrition for this age group, particularly between September and November, when even the breast fed infants do not get enough milk from their mothers, (2) because they are not able look for food for themselves, unlike the grown ups. (3) In several incidences if children are fed with potatoes they suffer from diarrhoea, hence they become very weak and easily attacked by malaria, (4) many women from poor households spend most of their time doing casual labour elsewhere (kuhemea), and there is little time to attend these young children.

- Women: It was reported during the discussion that women, especially pregnant, are the second most group affected by malaria. The main reason for the pregnant women was reported to be due to poor nutrition. This makes them weak and more susceptible to malaria. Other non-pregnant women were also reported to be more affected than men. This was attributed to that they (women) work so much in the farms than men, which makes them weaker and more susceptible than men. Also there was an assertion that adult men are nutritionally better of compared to women as they spend long times in pombe shops and eat good food in kiosks (local restaurants) before going home to join the household for another meal. This allegation posed by women was not refuted by participant males, perhaps reflecting that it was somewhat a true observation.
Another explanation to why women suffer more from malaria than men is that during the growing season women are more involved in weeding in beans field. It was argued that the women together with their children become exposed to frequent mosquito bites, and hence more prone to contract malaria. It was noted that traditionally Haya men do not take part in weeding beans, because they cannot manage, hence they less exposed to mosquito bites.

It was argued further that even at home women are more exposed to mosquito bites in the evenings compared to men because most evenings the men are out in the bar enjoying local brew and, perhaps, not as much bitten by mosquitoes.

- The Elderly: the elderly people were reported to also be affected by malaria, though to a lesser extent compared to the other two groups.

(vi) How they address the malaria problem (e.g. availability of health facilities, whether people afford to get medical services, etc.):

Several viewpoints were raised concerning ways in which malaria incidences are controlled through either treated or prevented. The following are among those local viewpoints and/or undertakings.

- The use of bednets, and of recent the use of the tables Ngao to impregnate the bednets against mosquitoes. However, there was a concern that not many people can afford buying bednets for the entire household. This will clearly be shown later during analysis of household questionnaires.

- Other people mentioned that malaria cannot be prevented, it is only when one contracts malaria that one goes for medication.

- Many people use traditional curative measures (local herbs) to malaria than going to hospitals. Participants estimated that of two-third of the malaria patients get cured after using these traditional medicines. Several plants were mentioned to cure malaria, although to different levels of success. They include (using their Haya names): Mbilizi, Kajule, Nkaka, Ikintuntumwa, Mwarobaini,…, and …?

Several explanations were given to the use of the local herbs for treating malaria, that: (1) they are quite common, well known and familiar to most people, (2) easily available, and less expensive, and effective as first aid before taking the patient to hospital/health centre, (3) Pregnant women using these herbs against malaria do not encounter any problems during delivery.

- The use of health facilities: Participants pointed out that every village had got its own “First Aid Kit”. Every household in the village contributes shillings 1,500/= annually to the “Village Health Facility”, after which one gets free services. A Village Health Attendant is available in Bugarama village and provides first-aid services to all villagers. It was noted however that the household that have not contributed the shillings 1,500/= to the village health facility has to look for other means of treatment when a household member falls sick. However, under “emergency” situations even one who has not paid his dues receives the medication on condition that he pays his/her contribution upon recovery. Those considered as being extremely poor people in receives treatment free of charge, without a need to contribute. It was pointed out that a receipt of one having paid the contributions to the village health facility may be used a security/guarantee when one goes to (government) hospitals, such as Rubya. The facility attends not only malaria but
other illnesses as well. A health centre is also located in the neighbouring village (centre known as Biirabo).

(vii) Problems of water availability and how they address them:
According to participants in this study, there are three main sources of water for village community. Firstly, in the past they used to depend mainly on springs and the two rivers that traverse the north and southern part of the village. Secondly, and more recently, the village community has access to piped water. The village has deep wells and pumps installed by Hesawa. The third source is rainwater harvesting from the roofs of the houses. It was noted, however, that for the first two sources one has to travel for about two or so kilometres to get to the water point.

NOTE: Informal interview with two elderly men in their late 70s in Kantare subvillage, indicated that also there has never been any cholera outbreak in the village and elsewhere in Muleba district in the recent past, there was once a cholera incidence before the second world war (in 1936). This was the era of Chief Mugunda. Then a patient could have severe diarrhoea for only two days and died. They indicated further that areas that were infected with the disease were put under quarantine, and fenced using ropes so that other people could not get into the area. The disease (cholera) is known as ensheshe in Haya. Many of the young generation have never heard of such incidence.

2.1.4 List of participants in the group discussion in Bugarama village
1. Joswam R. Babu - Primary School Teacher - Bugarama
2. Salvatory Rugenzi
3. Rucia Saidi
4. Brukelia S. Kagimbo
5. Gipson Rwanyumbe - Councillor
6. Nicholas Rushaga - Village Attendant
7. Zefrin Kagimbo
8. Sylvester Lwabumbile - Village Chairman
9. Hulbano Nyegeza
10. Fortunatus Rwamugudu
11. Godfrey Frederick
12. Hakimu Kayanda - Biirabo Ward Secretary
13. Diockisi Anthony
14. Juliano Brandesi - Village Health Attendant
15. Ferdinand Ngazi
16. Theofro Lwakatare
17. Eugen Chiliberti
18. Kelezensia Ferdinand
19. Serafina Sebastian
20. Hilda Theofro
21. Imelda Simon
22. Idaya Somaida
23. Nulati Somaida
24. Prudence Thomas
25. Leokadia Elias
27. Prof. Pius Yanda - Researcher
28. Dr. Richard Kangalawe - Researcher
2.2. Findings from Participatory Discussions in Chato Village
Chato village is located in Chato ward, in Chato Division. The village has five sub-villages namely Elimu, Chato Kati, Kalema, Beach, and Vijana, with 81, 115, 87, 60 and 69 households respectively (total 412). By 2001 the total population was 4109, including 2403 females and 1706 males. The dominant inhabitants in this village are the Sukuma, Wajita, Wasubi (native group), Wanyiramba. The history of the area indicates that apart from the native Wasubi, people of other ethnic groups moved into the area in search of agricultural land.

2.2.1 Economic activities in Chato village
In Chato village there are three main economic activities.
(i) Agriculture (including crop cultivation and livestock keeping). The main food crops grown here include maize, bulrush millet, sorghum, beans, cassava and sweet potatoes. Cotton and tobacco are grown as the major cash crops. Both smallholder and commercial farms are found in this village for most crops. Livestock keeping in the village involves cattle, goats, sheep, chicken and guinea fowls (kanga). Cattle are raised both for sale of live animals and milk, and domestic use.

(ii) Fishing is another important economic activity in Chato village. This is due to its location at the lakeshore. The fishing activity was reported to be undertaken by private individuals and by cooperative groups and large companies. Majority of the people in the village have fish as an important ingredient in most of the meals. In addition, cold chain trucks carry fish and export them outside the village to fish markets in other regions, e.g. processing factories in Mwanza.

(iii) Small businesses. Several people in the village were reported to be involved in small businesses. The businesses include shops and kiosks, restaurants, and selling of various goods during the market day (gulio) that is open in the village every Saturday. During the market days the goods usually sold are foodstuffs and various other items usually found in ordinary shops (e.g. clothes, etc).

2.2.2 Socio-economic/wealth groups in Chato village and criteria used to classify them
Participants in the group discussion in Chato village identified three socio-economic/wealth groups, namely the (i) Wasaabi/Wagaga (in Sukuma/Kijita respectively) – the rich people, (ii) Wanivii (in Kijita) – watu wa kati or the common people (the middle class), and (iii) Wahabi/Wahavigeto in Sukuma or Mtaka in Kijita – Watu wa Hali ya Chini (i.e. the poor people). The three groups were characterised mainly based on wealth that they own, particularly the number of cattle and money they have. The criteria characterising these socio-economic categories are highlighted below.

(i) Wasaabi/Wagaga – the rich people
   - Have 300+ herds of cattle
   - Have plenty of money

(ii) Wanivii (watu wa kati) – the middle class or common people
   - Have ≥50 herds of cattle

(iii) Wahabi/Wahavigeto or Wataka (Watu wa Hali ya Chini) – the poor people
- Have 10 herds of cattle or less.

In this village the Wahabi/Wahavigeto or Wataka socio-economic/wealth category were reported to be the largest group, followed by the Wanivii (watu wa kati). The Wasaabi/Wagaga category has very few peoples. It was pointed out that the Wasaabi/Wagaga could be men or women provided that they have the needed wealth for that category. It was noted that although many people have large pieces of land, land is not used as a criterion in categorising people in the various socio-economic groups. The reason to this is that no cultivates all the land he/she owns at all times, hence not a suitable criterion, regardless of how the plots are actually cultivated.

2.2.3 Chato’s experiences with cholera
(i) Conditions locally used to predict that a cholera outbreak is going to happen:
Local experiences in Chato indicate that they do anticipate cholera outbreaks mostly during rainy seasons, and during the mango-season. Participants in the study associated the outbreaks to two situations, firstly that of not using toilets and that during the season mangoes wastes are spread all over, attracting the bacteria for cholera.

(ii) Whether the incidences/outbreaks of cholera have been increasing over years:
It was rather difficult to go far back in history concerning outbreaks of cholera. However, the local remembered two incidences. The first is that of 1983 when a cholera patient was brought from a neighbouring village of Bukamila. His arrival in the village sparked the outbreak, as many people contracted cholera thereafter. Narrative concerning this outbreak indicated that the equipment that was used to carry that cholera patient was through into the lake, and incidentally it was close to where people used to collect water for domestic use. It appears that that equipment provided the inoculum with the cholera pathogen that later infected many people causing the outbreak. The other outbreak in fresh memory was that of 1997/98, during the El Nino rains. Participants in this study pointed out that during this season 19 people died of cholera. Analysis of secondary data from the health facilities is going on and will be used to substantiate this local information, as well as establishing other periods with cholera epidemics that could not be immediately remembered by the local people.

(iii) Time of the year when cholera is a problem:
The rainy season (between -------- and -------) is particularly when there are outbreaks of cholera in this village. Participants in the study pointed out that during this season there may be many incidences of cholera being attributed to the fact that many people in the village do not use toilets. As such most of the faecal material may find its way into water bodies that are as well sources of water for domestic use.

(iv) How the local people identify cholera (symptoms of):
Participants to the group discussion narrated the various symptoms that they use to characterise a cholera situation. They include:
- Frequent diarrhoea, which is watery with whitish colour.
- Vomiting (vomited material with bluish-green colouration),
- General body weakness
- Loss of water from the body
- Loss of appetite

(v) Age groups affected most by, and possible explanations:
- Participants claimed that with cholera all people are equally susceptible.
How they address the problem (e.g. availability of health facilities, whether people afford to
get medical services, etc.):
The following are among those local viewpoints and/or undertakings concerning ways in which
cholera incidences are treated or prevented.
- General cleanliness
- Washing hands with soap
- Boiling drinking water.
- The use of health facilities when one falls sick. The village is fortunate in that the Chato
Health Centre, which caters for the Chato Division (and other neighbouring divisions), is
located in Chato village.
- It was noted that currently there are no traditional medicine/cure for cholera in the
village. The disease is considered new to the area, and as such, traditional herbalists have
not yet been able to invent any curative or preventive medicines for cholera.

2.2.4 Chato’s experiences with malaria

(i) Conditions locally used to predict that a malaria outbreak is going to happen:
Being at the lakeshore, malaria is a common and persistent problem in the village, because
mosquitoes find breeding grounds all year round. However, during the dry season there are few
breeding grounds, which makes the population of mosquitoes is somewhat lower. Yet it was
noted that the number of malaria patients has been increasing everyday.

(ii) Identification of symptoms of malaria:
Participants to the group discussion narrated the various symptoms that they use to characterise
someone with malaria. They include:
- High fever,
- Shivering,
- Vomiting,
- Headache
- General body weakness and feeling tired,
- Loss of appetite.

(iii) Age groups affected most by malaria, and possible explanations:
Concerning the different groups affected most by malaria; participants identified two groups –
the infants (0-5 years), and children above 5 year of age.
- Infants: Children at the age of 0-5 years of age were reported to be most seriously
affected by malaria. In these very young kids malaria tends to be a serious problem
especially when the first teeth are coming out. It was described by participants in this
study that the fever associated with the emergence of the teeth is quite similar to one of
the malaria symptoms. This quite often confuses the parents to the extent that they send
the children to health centres for treatment when it is already too late.
- In the other age group the malaria cases are also many, but less serious compared to the
young children.

(iv) How they address the malaria problem:
- As a first step Malaria is treated using Muarobaini (neem tree – Azadiracta indica).
- It was reported that there area many other traditional curative medicines (local herbs) that
people use treat malaria. However, participants in the group discussion in this village
declined mentioning those herbs with the fear that if they mention them in front of other
participants all people in the community will those herbs and the herbalists would lose
their business.
The use of health facilities: As mentioned earlier, Chato village is fortunate in that there is a public Health Centre located within the village. Many people obtain medical treatments for various ailments from this centre, services that are available for free. However, it was pointed out that the services provided are at present not adequate as the area of influence of this centre has so many people, and that the medical kit sent to the centre is too small compared to the number of people who depend on it. The centre provides health services to people in Chato and Nyamirembe Division, both in Biharamulo district, and people from the western part of Geita District in Mwanza region. It was mentioned that despite the fact they usually get treatment for free, the health centre together with the local people have introduced a 100/= shillings contribution for anyone attending the centre. The collected money is used as an emergency fund to be used in a situation where a patient from the health centre has to be referred to the district hospital and the patient cannot afford by oneself. At the village there is also a privately owned dispensary and three medical stores.

(v) Problems of water availability and how they address them:
In Chato village there is no problem of water availability given that the village borders the lake. The question is how safe this water is. At the village there are also shallow wells with pumps. However according to participants these wells are too few and have limited capacity compared to the number of people using them.

2.2.5 List of participants in the group discussion in Chato village
1. Dr. Richard Kangalawe - Researcher
2. Ms. Rehema Sigalla - Graduate student
3. Mr. Dosteus Lopa - Research Assistant
4. Mr. Bruno Mwano - Research Assistant
5. Joram Sangija - Field Assistant (Nurse, Chato HC)
6. C. Essemi - Field Assistant (Nurse, Chato HC)
7. Ernest Mahwahwa - Village Chairman
8. Julius Mazige
9. Clement Malongo
10. Mwajuma Bakari
11. Salome Marko
12. Leticia Dashinia
13. Edward Otto
14. Deonatus Biseko Fangali
15. Jonathan Mahimbu
16. William Bandiku
17. Elias Kasiaina
18. Busamingo G. Joselyo
19. Joyce Madundo
20. Sikudhani Majaliwa
21. Deus Matogo
22. M. Daudi (F)