EXTERNAL EVALUATION PANEL REPORT 2006

Sustainable Management of Rural Watersheds (SUMAWA) Project:
Biophysical, Livestock and Human Interactions in the Njoro River Watershed

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PROJECT DESCRIPTION AND OVERVIEW

The Sustainable Management of Watersheds Project (SUMAWA) is a multi-disciplinary research effort focusing on the River Njoro watershed in Kenya, involving collaboration between scientists based in two Kenyan universities (Egerton and Moi), three US universities (University of Wyoming, University of California--Davis, and Utah State), and two Kenyan government institutions (Department of Fisheries and Kenya Wildlife Service). SUMAWA aims to improve understanding of the biophysical and human factors governing watershed health in the River Njoro catchment area and, through a range of outreach and stakeholder engagement activities based on applying research insights in practice, to improve watershed health and contribute to livelihood security and sustainability for those living in the watershed. Lessons from the project are of wider potential relevance for watershed management elsewhere in Kenya and the east Africa region.

The River Njoro is approximately 50 km in length and its watershed covers around 270 sq. km, with a total human population of about 350,000. Rising from the eastern Mau Escarpment in Kenya's Rift Valley at an altitude of over 3,000 m above sea level, the river flows through forests then mixed agricultural and grazing lands before serving the towns of Njoro and Nakuru (Kenya's fourth most populous urban settlement) and associated industries. It eventually empties into Lake Nakuru National Park, an inland soda lake and Ramsar site of global significance for its large resident population of flamingos, and Kenya's most visited national park.

The project comprises four main, interlinked components: hydrology, ecology, stakeholder engagement, and socio-economics. Each of these components intends to contribute to a deeper understanding of the explanatory variables and causal mechanisms in watershed degradation. The research is stakeholder-driven in the sense that a starting point for hypothesis development and data collection in the hydrology and ecology components are the problems identified and prioritized by communities living in the watershed. These components also identify and calibrate key indicators of watershed health or degradation for use in monitoring and watershed planning. The socio-economic component provides baseline data against which the impact of proposed interventions on people's livelihoods can be evaluated, and includes comparative economic analysis and household modeling to understand the factors that explain whether or not households are likely to adopt and sustain those interventions that apply at household level. The research approach is iterative, drawing on an initial characterization of watershed status and processes to build decision-support tools to assist in the development of alternative "what if..?" scenarios of watershed futures, understanding the inherent trade-offs in water resource- and land-use decisions, and using the results of their application to revisit and refine the problem model.

The long-term goal of SUMAWA is to build an overall conceptual model of watershed processes and response, synthesizing outputs from each of the four components to assist in local and regional watershed management decision-making. Key component outputs contributing to this goal include the Watershed Evaluation and Planning (WEAP) tool from the hydrology and stakeholder components; the Biological Monitoring and Assessment Tool (BIOMAT) from the ecology component; and comparative economic analysis, household models, and trade-off analysis from the socio-economics component. An output of the stakeholder component is also a methodological toolkit in participatory rural appraisal

(PRA), for use in continuing engagement with local communities and water resource user groups. This watershed model and associated expertise is intended to be institutionalized within a center of excellence in watershed management to be established by the end of the project in Egerton University, which is located within the Njoro watershed, and through its adoption and practical application in full or in part by key stakeholders including the Rift Valley Water Resources Management Authority, Water Resources User Associations, public health authorities, Department of Fisheries, and Kenya Wildlife Service.

ROLE OF EXTERNAL EVALUATION PANEL (EEP)

To achieve a dynamic, effective, and responsive program, the Global Livestock CRSP (GL-CRSP) incorporates a results-driven framework, the keystone of which is a continuous cycle of evaluation. Project progress is monitored on an ongoing basis, and budget allocation decisions are based on performance. While the nature of the evaluation process varies from project to project, the performance of each GL-CRSP project is assessed as part of routine management; continuation of the project is contingent on each research team's ability to deliver results. Projects are reviewed in the second or third year of activity.

External evaluations carried out by independent reviewers offer a critical and impartial view about the quality and progress of the research programs. They provide evidence for objective decision-making about program components and can help to address difficult institutional issues or biases. To carry out these evaluations, an External Evaluation Panel (EEP) is convened.

Members of the evaluation teams are senior scientists recognized by their peers and selected for their in-depth knowledge of a research discipline relevant to the CRSP and experience in research and/or research administration. At the Global Livestock CRSP, expertise is drawn from the External Program Administrative Council (EPAC) and the Pool for External Evaluation of Research, a pool of accomplished research scientists and faculty members with expertise in disciplines complimentary to the EPAC. Candidates for the EEP are nominated by the Management Entity (ME), in consultation with the EPAC and are subject to approval by USAID.

According to a Scope of Work (SOW) developed by the ME in consultation with the EPAC and USAID, each external evaluation will, as needed:

- Assess whether the research project is well-balanced, whether the different activities are progressing adequately, and whether they are relevant and helping to achieve the larger program goals;
- Identify inadequate performances;
- Gauge effective balance between research and training for development of institutional research capability;
- Assess the balance of domestic versus overseas research in terms of effectiveness of solving constraints in developing countries;
- Evaluate the performance and the productivity of each institution on each project;
- Assess the appropriateness of projected resource allocations; and,

- Evaluate the dissemination of research results, and the effectiveness of utilization (a measure of the appropriateness of the research).

Review Schedule. The ME – in consultation with its own advisory groups and collaborating institutions, as well as USAID and the evaluation team – developed an appropriate work schedule for the external review of the SUMAWA project. The review includes site visits and meetings with project participants and collaborators. The SUMAWA review did not include visits to the US collaborators, although the Lead US Principal Investigator did participate in the review in Kenya. It is however a limitation of the review that the team was not able to speak directly with some of the US investigators.

Review Team. The External Evaluation Panel review team for the SUMAWA project included two members of the EPAC, one regional representative, and an external scientist with expertise in hydrology. The members of the panel were: Dr. Robin Mearns, Senior Natural Resource Management Specialist, World Bank and member of the GL-CRSP External Program Administrative Council; Dr. Deborah Rubin, Director, Cultural Practice LLC and member of the GL-CRSP External Program Administrative Council; Dr. Kyung Yoo, Professor, Department of Biosystems Engineering, Auburn University; and Ole Kamuaro Ololtisatti, Coordinator, Policy Impact Project, International Livestock Research Institute. Dr. Mearns served as the team leader for the review.

Outcome of the Review. The EEP recommendations will serve as the basis for bringing about changes in the specific activities of the project. If the CRSP governing bodies or its ME disagrees with a recommendation, the ME will submit the rationale and justification for such disagreement to USAID. Copies of these documents (both the review and the response) will be made available to BIFAD and its relevant committees, the Administrative Management Review Team, and USAID in their roles in reviewing the CRSP.

SUMMARY OF KEY FINDINGS

Key findings (not in order of priority) at the project level

- Communication among and between project components and staff has improved dramatically with the reorganization of the project and the hiring of additional staff and redistribution of responsibilities.

- Financial management has improved greatly. Over the past year, clear guidelines have been created about financial procedures for all levels of research and management. New procedures are setting the foundation for transparent, efficient, and timely management and reporting of the financial systems.

- Interlinkage among components is present, but could be strengthened and focused. In particular, analysis from the socio-economic component will be very important for ensuring impact of the other components. The socio-economic component is currently understaffed and under-budgeted and would benefit from additional support.

- The project is doing an excellent job of linking to key stakeholder groups in the watershed, from the community level to the national government institutions. It is considered a major and influential actor by the Rift Valley Water Resources Management Authority.

- The project work to develop inventories of biodiversity in the watershed is leading to important understandings about changes in ecosystem health.

- The more narrowly focused livestock activities of the project are two: research on the impact of livestock production on the watershed and an economic study of the trade offs of livestock production and other livelihood options. Problems have stalled these two activities, but their importance to the overall project requires renewed attention to ensure their completion.

- The project needs a comprehensive research and dissemination framework that will link each research activity to its appropriate deliverables, with clear monitoring of progress from research to publication, outreach, and/or policy impact.

- Student research has greatly contributed to the research outputs of the SUMAWA project. Additional financial support to assist high performing students is warranted.

THE PROBLEM MODEL AND QUALITY OF SCIENTIFIC RESEARCH

SUMAWA's problem model begins from the premise that the Njoro watershed has come under increasing pressure through human population increase and resulting land-use change, leading to a severe decline in water quantity and quality in both the River Njoro and local aquifers. Indicators of ecosystem stress are found in degraded habitats and loss of biodiversity (e.g. birdlife, macro-invertebrates, and lake phytoplankton), disruption of hydrological processes (water infiltration and percolation, surface runoff and ground water), water pollution (high fecal coliform counts and sediments), increased incidence of water-borne disease in the human population, and adverse changes in both the level and ecology of Lake Nakuru. Through stakeholder engagement to jointly identify, pilot-test, and demonstrate promising measures to address these sources of ecosystem stress (e.g., on-farm soil and water conservation, fish-pond aquaculture, public health education, and simple household water treatment methods), and the development of multi-criteria decision-support tools for use in watershed planning, SUMAWA aims to contribute to improving the long-term health of the Njoro watershed.

Stakeholders Component

The goals of the Stakeholder Component (SC) parallel those of the larger problem model and project objectives to both understand watershed health as well as apply good science to the improvement of watershed health. For the SC, these twin goals of understanding and application are expressed using a bottom-up approach to engage local riparian communities in a participatory problem analysis and solution opportunity appraisal process"[1] and then using the problem analysis to generate topics for the other research components, acting as the driver for the scientific investigations.

Such a model is valuable when the stakeholder work (in conjunction with the socio-economic survey) establishes the baseline understanding of the characteristics and needs of the communities in the watershed that are then used to shape the scientific research agenda. This has occurred to some extent. The initial set of community consultations and Participatory Rural Appraisal (PRA) developed a list of researchable topics, such as concerns about water quality, economic opportunities, declining crop productivity, and other issues which were taken up by the hydrology and ecology components.

The SC group is commended for their increasing attention to gender issues as central to their investigations (see section on gender below). They acted to modify their work when the first effort to attract stakeholders did not attract an adequate representation of women. The SC team responded by holding a second workshop specifically to address women.[2] In the future, it is important to draw out the lessons from this experience to ensure adequate representation

[1] Francis K. Lelo, Wanjiku Chiuri, and Marion W. Jenkins, "Managing the River Njoro Watershed, Kenya: Conflicting laws, policies, and community priorities." Paper presented at the International workshop on 'African Water Laws: Plural Legislative Frameworks for Rural Water Management in Africa', 26-28 January 2005, Johannesburg, South Africa.

[2] Francis K. Lelo 2004 "Report on the Watershed Women Leaders Seminar." Meeting held at Egerton University, Njoro, May 21, 2004. Unpublished project document. Egerton: SUMAWA/GL CRSP.

of both men and women and treatment of both men's and women's issues in the tiered workshops for 2006.

There are two areas where the work of the SC could be enhanced. First, the results of the stakeholder work could and should contribute not only to the topics being studied by the other components, but also the way in which their research efforts are designed and implemented. This would make the participatory process less extractive and more genuinely participatory and ensure that the evidence-based recommendations (e.g., on fish pond construction and operation or conservation farming) will be adopted by the communities. When stakeholder input is limited to topic identification, there remains a risk that scientific testing and results will not address the constraints or mobilize the opportunities of the stakeholder environment. Closer collaboration between the stakeholder work and the scientific work throughout is needed.

The second area concerns the conceptual formulation of the participatory rural appraisal and its relationship to existing social research on community and ethnic identity. This direction is touched upon in an unpublished paper[3] citing work suggesting identifying factors in successful participation efforts, such as mutual trust and mutual agreement upon outcomes. PRA practitioners are successful when they are able to find ways to bring diverse community groups together to find common ground and develop consensus for action.

The SC of SUMAWA works in a complex social environment where the diverse stakeholders often have conflicting rather than mutual practical and strategic interests and where historical ethnic or cultural characterizations are changing rapidly in order to take advantage of emerging economic or political change. In such situations, it is critical for the researchers to avoid simplistic descriptions of cultural groups within the watershed that assume, rather than investigate, linkages between culture and behavior.[4] The SC component would benefit from incorporating research findings from social research on ethnic identity and on collective action that provides more nuanced understandings of the complexity of links between gender, culture, and collective action, and individual behavior.[5] It would also add to the utility and sophistication of the PRA tool that has been developed. Additional historical and qualitative research on socio-cultural dynamics can supplement the information provided in the brief community meetings and the survey data and permit closer and more nuanced

[3] M. W. Jenkins, F. K. Lelo, L.W. Chiuri, W. A. Shivoga, and S. N. Miller, "Community Perceptions and Priorities for Managing Water and Environmental Resources in the River Njoro Watershed in Kenya" (unpublished, n.d.).

[4] For example, the EEP learned from conversations with Ogiek women that they were given title to land in their own names by the government with their husbands' full support when the forest land was degazetted although historically neither Ogiek men nor women held title to land and women in particular did not usually own other assets. Clearly, even "traditional, gendered" cultural patterns are accommodating to change in some circumstances and with appropriate incentives.

[5] See, e.g., policy briefs on collective action edited by Ruth Meinzen Dick and Monica di Gregorio, 2020 Focus no. 11, 2004 (http://www.ifpri.org/2020/focus/focus11.asp); studies such as that by Corrine A. Kratz on ethnic identity, "Are the Ogiek really Masaai? or Kipsigis? or Kikuyu?" *Cahiers d'Etudes africaines,* no. 79 (20:3), 1981; and recent critiques of participation, such as the collection by Bill Cooke and Uma Kothari (eds.) Participation: The New Tyranny?, (London, UK: Zed Books, 2001).

analysis of existing avenues for community cooperation beyond the expressed (but often superficial) statements of community members themselves. It would also position the SC team to write up their results in a more analytical manner and to contribute directly to current social science theory on the cultural aspects of natural resource management. Currently, the SC team has not submitted papers to peer-reviewed journals. The conference papers are a good start but need to move beyond description to the type of theoretical sophisticated analysis suggested above.

Recommendations

- Pursue additional secondary research on ethnic identity, collective action, and gender to provide an analytical context to and enhance the analysis of the PRA material.
- Clarify the feedback processes for providing and testing technical recommendations with the community members.
- Liaise with other components to ensure that community members are involved in the testing and evaluation of proposed technologies and/or income generating schemes and that the results are included in the community action plans.
- Develop a checklist for interactions with the communities to ensure wide stakeholder involvement at meetings (e.g., Have women and men been notified of the meeting time and place? Is the meeting location convenient to all community members? Is the meeting time acceptable to both men and women?).
- Develop a plan for additional gender analysis of the PRA and socio-economic baseline data.
- Clarify the research results expected from the tiered workshop process.
- Develop a schedule for writing and submitting research results to peer review journals.

Hydrology Component

Hydrologic conditions are one of two elements commonly used to address the health of a watershed and its water system, the second being ecological conditions (see following section). The Problem Model (PM) has clearly emphasized the importance of the hydrology research components for the long-term sustainability of the Njoro River watershed. The PM scientifically illustrated how the hydrology research component will be used to develop database and information which are critical to assess the degradation of the river system and to develop methodologies for rehabilitation of the impaired water quality and decreased and often depleted water quantity. Achieving the objectives related to these components will require long-term monitoring of the hydrologic conditions and more reliable field monitoring of the hydrological field data using better instrumentation. The hydrologic research component also needs to study an instrumented paired watershed to evaluate the

effects of various land uses on soil erosion and sedimentation and the aquatic and terrestrial ecosystems. Laying out the sustainable results of the above studies will require long-term study to compensate any missing or poor database due to erratic climatic conditions and other un-controllable interferences.

The proposed objectives and activities of these research components address the PM through development of a watershed model and other water resource related models. However, considering the degradation of the Lake Nakuru water system, the point source (PS) pollutants from wastewater treatment plants (municipal, industrial and institutional) in the watershed as well as the non-point source (NPS) pollutants from the upper watershed should be considered in the project. The final destination of the Njoro River is the Nakuru National Park and the discharge of the PS and NPS pollutants will highly affect the water quality in the park. Several occasions of accidental discharge of untreated or inadequately treated wastes took place during the project period. These pollution sources should be included in the PM to achieve one of the ultimate goals of the project, maintaining a healthy and ecologically sustainable lake.

With the fast growth of population in the watershed, the water quality of the river and Lake Nakuru will continue to deteriorate if these sources are not identified and alleviated. The relationship of water quantity and quality and human health issues, especially their impact on women and children is an important activity in the project. The degraded water quality and decreased or depleted water quantity of the Njoro River creates an additional burden to women who are the primary collectors of household water and causes serious water-borne diseases to children. The water and human health activity in the hydrology component links the concerns about the health problem identified in the PRA to the identification of the specific waterborne diseases affecting community health through the tracking of diarrheal diseases at local clinics. The project has also helped to train local clinicians in improved data management, mapping, and other techniques.

Agricultural cultivation in the watershed is one of the major causes of sedimentation in the river system and in Lake Nakuru and analysis of its impact on the watershed should be added together with the impact of livestock to the biophysical and human models that SUMAWA is pursuing to develop.

Specific efforts are being made by the project to deepen the understanding of the contributions of livestock in overall watershed processes. This takes several forms, including the contributions of both resident and the migrant (non-permanent) livestock populations to water quantity and quality in the River Njoro and, in turn, the impact of water quality on animal and human health. Progress in this activity area has been slow, in part owing to difficulties in mobilizing appropriate staff and student inputs. The PIs should ensure that the research on the impact of livestock on the watershed is a high priority for the project in the coming months.

The research components are logically connected to the PM to help develop policies and implementation plans to rehabilitate the seriously deteriorated Njoro River system. The PIs and students of the research components are working closely to develop solutions. The WEAP21 model, BioMat and other models and methodologies to rehabilitate the river system and alleviate future damages to the watershed can be applied to the watersheds under similar conditions. This will, of course need site-specific assessments of the watersheds by

applying the proposed watershed hydrology model (SWAT). Such site-specific assessments will provide required field data and parameter values for necessary validation of the model for different watersheds.

This project uses GIS/RS (Geographic Information System/Remote Sensing) to develop maps for land uses, soils, and other surface conditions in the watershed. The information is used to develop the relationship between these parameters and watershed degradation. This technology will help determine the condition of other watersheds without or with less field monitoring.

Field monitoring data are important and critical input for the success of the project as any significant deviation of field data can negatively affect the decisions made through the WEAP computer model that will be one of the important final products of the project. The research will need to maintain acceptable Quality Assurance (Q/A) and Quality Control (Q/C) of the field data. Considering the complex activities required for these research components the projects have been maintaining adequate quality. But potential problems were observed which need attention of the PIs and Co-PIs to improve or correct. One of the problems is the river flow measurement. Currently, the project has installed two automatic stream stage gauges and two automatic rain gauges at strategic locations, but accurate measurements cannot be easily accomplished without electronic sensors and data loggers to supplement the presently used manual gauges. Accurate river flow data will provide important input to the project but a measuring station at the upper watershed showed serious interruption by the flow conditions. The culverts, which are used to determine flow rates by measuring the flow depth through the pipes, were severely blocked by trash carried in the stream. In the upper watershed, it was observed that the culverts were partially blocked by bamboo sticks and other trash materials carried in the river. Occasional cleaning of the area is necessary when the river is flowing. The gauge readers should be adequately trained in cleaning activities along with the flow depth acquisition. Additional training of students as the field observers and operators of such devices is important for maintaining a high level of data quality. It is an evaluator's concern that the current project time and budget will only allow the project to achieve relatively short term monitoring of the watershed and the river system's hydrology and ecology.

The groundwater in the region plays an extremely important role in water supply to the water systems. It seems that the region's groundwater system is complex and highly interrelated. The hydrology of the river system is closely related to the groundwater system as the groundwater flows in and out of the river along the entire stretch of the river. Therefore, the water quality of the river directly affects that of the ground water.

With the exception of a groundwater expert (see recommendations), the Hydrology research component has adequate personnel support. The PIs and co-PIs are well educated with the expertise (hydrology, ecology, and soil science) needed to conduct these research components. Along with the findings of the project, several government agencies provide financial and in-kind support. The provincial office of the Rift Valley Water Resources Management Authority and Egerton University have recently exchanged a Memorandum of Understanding (MOU) for research cooperation. The objectives of the annual work plans (2004 and 2005) changed but the principal components stay the same: water quality and quantity monitoring, hydrologic and ecologic data acquisition, calibration and test of a watershed model, GIS/RS application and data modification, development of WEAP21

model. The hydrology component plans to develop an instrumented experiment watershed to test a soil erosion computer model (RUSLE) and to demonstrate effects of land uses on the water quality of the Njoro river system. As mentioned before a paired watershed will provide more reliable and resilient information to monitor the effects of different land uses on the water quality and quantity.

Recommendations

- Recruit staff member and student(s) to lead the livestock activity and its impact on water quality, aquatic and terrestrial ecosystems, and river morphology of the Njoro river system, and incorporate into an existing RAP or prepare a stand-alone RAP with adequate budget.

- Develop a research activity that will identify a pair of medium-size watersheds on or near the campus to study effects of agricultural land uses on water quantity and quality. A suggested site is the hill-slope near the new fish pond site. The hill-slope can be slightly modified to build two identical watersheds as the hill slope has relatively uniform slope and soil types covered with a perennial grass. The paired watersheds can be used to obtain data as well as to demonstrate to the farmers the effects of conventional and conservation cultivation methods on the environment of the Njoro River watershed. Along with the proposed RUSLE (Revised Universal Soil Loss Equation) to simulate field soil erosion the WEPP (Water Erosion Prediction Project) model is also suggested for the same objective. RUSLE is primarily applicable to small-scale plots. However, the WEPP model was developed to compensate this limitation of RUSLE. It is applicable to relatively large-scale watersheds with multiple slopes, land uses, and irregular shapes. For overall simulation of water quality/water quantity of the entire Njoro River watershed AGNPS (Agricultural Nonpoint Source) model along with the SWAT (Soil and Water Assessment Tool) is suggested. Once a solid database is established, the models can provide information for effects of various hypothetical land use changes on water quality and quantity. The database requires reliable field monitoring of hydrology, climatology, and land uses. The latter three models will require rather comprehensive data and were developed to use GIS/RS to help generate input data easier.

- All water quality data reported for the project should include information on quantity as well as quality. Also included in the report should be sediment data in quality and quantity. Sediments are the most important non-point source pollutant in water systems which carries other chemicals and destroys aqua-ecosystems when deposited on the bottom of streams. Sediments also cause loss of flow capacity of streams and storage capacity of embankment dams along the waterway. The loss of water holding capacity of Lake Nakuru would be one of the negative impacts of sediments from the Njoro River and other inflows. Major sources of the sediments in the watershed include intensive field cultivation, livestock operation, bank erosion of the river due to mudslides and direct access into the river to use the water. The cultivated fields along the waterway especially contribute unscreened sediments and other pollutants to the river.

- Give greater emphasis on water quantity issues in the research.

- Ensure that the gauge readers and students are trained and instructed to clean all water measurement sites if feasible during the river flow seasons and/or to record the condition of the measuring sites as a reference for data analysis.

- To better understand the regional groundwater system an expert in geo-hydrology should be involved in the project to study and assess the geo-hydrologic conditions in the region.

Topics for Additional Research with Leveraged Funds for the Hydrology Component

- The critical areas along the riverside including the riparian areas should be protected by limiting or restricting the inflow of pollutants. As a BMP (Best Management Practice) ecologically sensitive streams in forest areas are often protected by SMZ (stream management zone) in the U.S. SMZ is a designated width of a buffer strip with native/introduced plants which is restricted from any access by human or animals. Similarly a combination of aquatic buffer and grass strip along both sides of the Njoro River would drastically reduce the pollutants moving into the river. This system will play an important role of limiting pollutant inflow from the cultivated areas which are close to the river system. Research is needed to determine the optimum width of the grass strip and aquatic buffer to minimize loss of the individual farmlands. Also an important activity to be studied is the fencing at the current water collection sites to restrict direct access by community people and animals. An alternative water collection system for human uses and animal consumption at each water collection site may be installed with water supplied by gravity pipes or hand pumps from the river. This can immediately impact the river water quality, conditions of the riverbanks, and the quality of water the community uses. The households who use the water from the river for domestic uses should be provided with a basic filtering device. A consideration should be also given to development of a simple inexpensive filtering device to clean the water before human consumption.

- Another activity which can immediately impact the community is the RCR (roof catchment of rainwater) system. The houses in the region are well equipped to implement this system as two of three required components are already available at most households; impervious and relatively clean roof, and space for storage tank. The third component to provide the clean rainwater during critical dry seasons of the year is a storage tank. The tank may be built with homemade concrete bricks which are less expensive than commercial plastic tanks. The size of tank for each individual house is determined based on the size of the roof, number of family members, seasonal rainfall amount and distribution, and location of the house. Based on personal observation each household can store up to 10 – 30 cubic meters of clean rainwater during the normal rainy season. This is a sufficient amount of water to use throughout the critical dry season for a family. Protecting the forest is critical to rehabilitate the Njoro River watershed and it can be done better by providing the community with cleaner water sources which do not require boiling. Boiling of water before consumption is an important practice however, since woods and charcoals are the major sources of fuel in the region this practice will help provide clean water but also cause a serious long-term problem of deforestation. An alternative source of fuel to boil the water such as solar energy collecting ovens may be introduced to the community.

Ecology Component

Ecological conditions are the second element commonly used to address the health of a watershed and its water system. The Problem Model (PM) has clearly emphasized the importance of the ecology research component for the long-term sustainability of the Njoro River watershed. The ecology component also looks at the quantity and quality of water in the watershed with particular interest in the seasonal and spatial distribution of the resources.

The ecology component of the SUMAWA project is developing inventories of biodiversity through field monitoring of the aquatic and terrestrial ecosystems which will benefit the watershed by helping understand changes (either improving or degrading) of the health of the watershed ecosystem. One of the research products from this component is BioMat, computer software that is used to simulate ecological conditions of aquatic systems. Since field monitoring of ecosystems is time consuming and costly, this model will help inexpensively simulate the ecosystem of the Njoro River and the technology can be transferred to other watersheds that are under the similar degraded ecological pressure.

Another activity of the ecology component involves monitoring of fecal coliform in the river. This activity has recently identified that the levels are high enough not only to harm human health, but also to possibly harm livestock health as well, a significant finding with possible policy implications for use of the river resources.

The construction and operation of aquaculture demonstration ponds is another key activity for the ecology component. Initially, this activity was to be jointly supported with the Pond Dynamics CRSP, but they were unable to continue with their commitment and the GL CRSP took over their support. The activity continues to draw on staff at Moi University as well as Egerton University.

One demonstration pond has been completed and stocked with fish and an additional three ponds are nearing completion. This activity helps link the stakeholder PRA findings on the need for additional income generation to the scientific research on aquaculture. Improving aquaculture is also an important element of the new Kenyan fisheries policy both as a response to the decline of water quality in the river and its effect on capture fisheries. It is expected that the use of fishponds will provide income without causing overuse of the environment. Research has been conducted on harvesting water for the fish ponds, construction of inexpensive automatic fish feeders, intensive feeding in cages, and improvement in fish feed quality using slaughterhouse refuse and livestock manure. Community members have been trained in the construction and management of fish ponds. Education on fish preparation and cooking is also being carried out, as fish has not been a preferred food of people in Kenya's central provinces.

The Ecology Component currently has an interim-component leader while the previous component leader is on a sabbatical leave. In addition, the Kenyan Government Department of Fisheries and Kenya Wildlife Services provide personnel support by financing an official for an M.Sc. degree and a release time for another official.

Recommendations

- Clarify and refine the plans for institutionalization of the BIOMat model for its use by stakeholders, including attention to training community members in collecting indigenous knowledge on the environment and differences in that knowledge by gender.

- Work with the Socio-economic component to develop a value chain analysis of fish production and marketing, including the economics of fish feed production, marketing of fingerlings, and costs of water.

Topics for Additional Research with Leveraged Funds for the Ecology Component

- An adequate water supply should be identified before any pond aquaculture is introduced and developed for communities and individual families. Pond aquaculture requires a large volume of water. Low-head embankment water supply systems can be installed without an engineering design at low cost in small valleys with or without a perennial stream. The water stored in the embankment during the rainy seasons would be also available for other uses by the community.

Socio-Economics Component

The conception of the socio-economics component is broadly appropriate within the overall context of the project. Currently the component aims primarily to characterize the socio-economic factors that contribute to watershed degradation, and provide baseline data for evaluation of the impact of water resource- and land-use decisions within the Njoro watershed. It is also intended to undertake comparative economic analysis of productive activities within the watershed (e.g., crop production, aquaculture, and livestock), and to model trade-offs in water use among alternative economic activities. It is understood that some household modeling may also be envisaged, in order to understand the factors that explain whether or not household are likely to adopt and sustain certain technologies being proposed under the project.

The baseline survey is based on a stratified random sample of 364 households drawn from five zones or administrative locations with a total population of around 50,000 (comprising around 14% of the total watershed population). Data are disaggregated by main economic activity, household wealth status, gender, and to a lesser extent age and ethnicity. Data were also gathered on land tenure; water use, sources and perceived quality; sanitation; access to credit and product markets; types of housing; farm forestry; and perceptions and awareness of soil and water conservation methods, improved agricultural and agro forestry practices. The issues covered in the baseline survey were identified by researchers in other components. Certain difficulties were encountered in administering the survey (e.g., omission of geo-referenced locational data) which called for remedial efforts to clean data, thereby delaying its completion.

The survey is judged to be adequate for the purpose of monitoring and evaluating the impacts of proposed interventions and decisions (e.g., on water allocation and use among alternative uses and users). To date, however, only a descriptive summary report on the main findings of the baseline survey has been completed. The analysis first needs to be extended to

deepen understanding of the causal mechanisms operating between the socio-economic drivers and biophysical responses within the Njoro watershed. This should result in at least one high-quality, stand-alone publication, preferably in a peer-reviewed, social-science journal.

Secondly, the EEP is concerned that insufficient attention has been paid to linking the comparative economic and trade-off analysis with the proposed interventions being promoted under the project. Given the relatively short time remaining in the current phase of the project with GL-CRSP support, SUMAWA needs to demonstrate impact within the next two years. Priority should be placed on closely coupling activities under different components with one another to ensure maximum impact and synergy within this tight timeframe. In the view of the EEP, the socio-economics component should therefore focus attention on household modeling and comparative economic analysis of those key interventions being proposed under other components of the project. These include: on-farm soil and water conservation through *Leucaena* hedgerows intercropped with maize; fish ponds to raise tilapia and catfish for household consumption and possible sale; a dairy goat-fish farming integration model, with stall feeding of goats within enclosures; and simple household water treatment techniques including water boiling with charcoal, chlorination, and use of ceramic sand filters.

Recommendations

- As an immediate priority, recruit faculty members and students in sufficient number and with the appropriate skills to conduct economic analysis and household modeling within the next two years, with priority given to economic analysis of interventions proposed under other project components. Staff/ students could be identified on Kenyan and/or US sides, but should contribute jointly to the same Research Activity Plans (RAPs).

- Prepare detailed RAPs and budgets for economic analysis and household modeling activities, and submit as an addendum to the overall 2005-06 annual workplan and budget.

- Identify main research outputs or targets, and prepare a dissemination plan specific to the socio-economic component

- US researchers (and, where relevant, students) should visit Kenya more frequently and for longer periods, in order to increase the level of engagement and collaboration between US and Kenyan researchers

PROGRESS

Stakeholder Component

The two major activities of the Stakeholder Component (SC) that have been completed are 1) an inventory of community institutions in the watershed (including both government and non-governmental organization) and 2) PRAs in each of the locations of the watershed to identify stakeholder perceptions, knowledge, and involvement with the watershed. The latter activity contributed to the list of topics to be researched by SUMAWA scientists and it also formed the basis for the development of community action plans (CAPs) to improve watershed livelihoods and watershed health. As part of the second activity, a toolkit for PRAs had been prepared.

In 2005-06, four activities are planned. An additional set of tiered community workshops, culminating in a joint community/scientist workshop, is planned to better connect stakeholders within the watershed with each other, and to bring regional and/or national policy makers together with community leaders and research scientists. In addition a "sharing workshop" was held in late 2005 to communicate the results of the stakeholders work to other components and identify new ways to incorporate their findings in the scientific activities and to plan outreach programs for returning the scientific results to the communities. Finally, an effort to measure perceptions of community members about the interaction of groups within the watershed, supplemented by visits by groups to different parts of the watershed is planned. This activity is expected to help residents understand how their individual behaviors impact on other parts of the watershed system.

In assessing the progress of the stakeholder component, it is important to acknowledge a number of management issues that affect its implementation. Participatory research can often be slow and unpredictable. Communication with and visits to communities is time-consuming and often difficult. The recent promotion of one team member to a Co-PI position will certainly help to backstop the program and maintain a good pace of activity.

Overall, the minimal goals established in the workplan have been met. The component needs to be strongly encouraged, however, to define additional analytical tasks that could enhance the value of its work, particularly in identifying new and creative ways to build into and on the work of other components, to feed community input into the work of other institutions in the watershed, and to truly mobilize the communities themselves for change. What guidelines can the SC offer to ensure that future PRA efforts do not encounter the same problems that they did, e.g., in involving women or in excluding one group by meeting in a territory they would not visit? There is the sense among the EEP team that the SC has amassed, through its PRA work as well as its other community activities, a wealth of knowledge about local practices and beliefs that affect watershed health that has not been fully documented by the other components of the project or by other stakeholder groups. A formal assessment process to clarify gaps in understanding and/or documentation might help the SC in capitalizing on its knowledge base both for the benefit of the project as well as for its contribution to broader issues in facilitating multi-disciplinary work.

Hydrology and Ecology Components

The project is on track to achieve the principal objectives of hydrologic and ecologic components with the following accomplishments. There were four river flow-monitoring sites of which two sites were instrumented with automatic gauge stations. Automatic rainfall gauges were also installed at strategic locations to collect more detailed rainfall information. The historical and current river flow and rainfall data have been analyzed to understand the hydrologic status of the watershed.

The Ecology Component has started to develop an aquatic ecosystem assessment tool, BioMat, and field data were collected and associated into that development. To help understand the changes of the ecosystem health and quality inventories of biodiversity of the watershed was initiated under the leadership of this research component. This research component also has completed one demonstration fish pond and three ponds are ready to be stocked with fish. Near the demonstration pond site small plots were prepared for studying effectiveness of hedgerow cultivation to reduce NPS pollutants into the river system. The watershed hydrology model and WEAP21 model are calibrated and tested with field data. This portion of the research will require a long-term database to develop the required parameter values for future expansion to other watersheds in the region. All collected and analyzed field data are compiled to the SUMAWA computers where the data are accessible to other research components. The above accomplishments are more than adequate in the given time frame and the funds for the project.

There were a total of eleven objectives listed in work plans of 2004 and 2005. All listed research objectives have not been fully achieved by the project. This is mainly due to the ambitious goals of the PIs and co-PIs under the limited time and funds. However, these objectives will need to be continued to completion. The field data acquisition will need to be continued to develop the complete data base for the planned watershed models (SWAT and RUSLE and other suggested models, WEPP and AGNPS), water supply decision making model (WEAP21), and aquatic ecosystem assess model (BioMat).

As mentioned before long-term field data are absolutely necessary to develop parameter values and calibrate the models for application and expansion to other watersheds in the region. The field data are critical inputs to meet the primary objective of the project and long term monitoring is also necessary to compensate the erratic climatic conditions and other interruptions. Hydrologic and ecologic conditions generally require a long-term study to determine the trend affected by the conditions of a river system and its watershed health is defined by short-term as well as long-term hydrologic and ecological sustainability. The recommended paired watershed study will require comprehensive instrumentation to monitor the effect of land uses on NPS movements. The establishment and stabilization of such experimental watershed may need additional time and funds.

The findings of these research components confirmed the level of the Njoro River watershed impairment. The Njoro River system has been mapped with GIS/RS. The map shows land use changes from 1986 to 1993 which showed a dramatic loss of forest and grass land to agriculture and urban uses. The ecology component also confirmed that the river system has been seriously impaired as shown by the macro-invertebrate taxa characteristics. High concentrations of *fecal coliform* were also found in the water that the community uses for household needs and animal watering.

Development efforts of the computer models, WEAP21, BioMat, and the planned watershed models will benefit the scientists in the U.S. The US Environmental Protection Agency requires developing TMDL (Total Maximum Daily Load) for all impaired water systems in the U.S. to maintain required water quality standards of the water and recommends using watershed models to define TMDL and their effects on rehabilitation of the impaired water systems. The outcome of this study will help the U.S. scientists for their model development, validation with understanding of the methodologies and parameter values under the different land uses. The U.S. PIs and co-PIs have shown that their knowledge and technology in this project are applicable to the conditions in the U.S. through publications and project involvements.

The PIs and co-PIs are planning to disseminate the findings through national, regional, and international journals. Also they publish their results using internal publication mechanisms, newsletters, information sheets, and seminars. Findings of these research components were presented at several national and international meetings and conferences. No solid plans to disseminate the research results were found during this visit. However, the PIs and co-PIs of hydrology and ecology components as well as those of other components are aware of the importance of dissemination for the success of the project. Also it was known by the PIs and co-PIs that publications, especially refereed journal publications, are used in faculty promotion evaluation. The Deputy Vice Chancellor of Extension and Research showed strong interest in supporting SUMAWA in publishing their findings and SUMAWA also mentioned that any page charges which may incur for publications in refereed journals will be covered by the project. These circumstances will help and encourage the PIs and co-PIs to pursue publications in refereed journals as well as presentations to regional, national, and international audiences.

Socio-Economics Component

The socio-economics component had a late start, and progress has been further hampered by turnover of the responsible co-PIs. It is reported that there has been less interaction among the US and Kenyan researchers under this component than in other components of the project, with analytical activities in some cases running along parallel lines rather than as part of a joint and coordinated research plan.

To date, only the baseline survey of smallholder households within the watershed has been completed under this component. It is planned in the coming year to undertake additional surveys of large farms and other institutions, and of livestock enterprises, in order to complete the overall baseline. The remaining priority areas described above (comparative economic analysis, household and trade-off modeling) have yet to be carried out, and are currently in the proposal development stage. The EEP understands that activity plans have not been adequately funded for 2005-06 in these areas, and that collaborating staff and students in Egerton University are still being identified. These are critical concerns, and need urgently to be addressed, if the potential of the socio-economic component to contribute to the overall goals of the SUMAWA project is fully to be realized.

TRAINING

Training is one of the integral objectives of the SUMAWA project. It was reported in the annual report that a total of nineteen students are receiving degree training through the project. Of this number, eleven are host country nationals, one is from India and seven are from the United States. There are four PhD students, three from the US and one Kenyan. In addition, nine students are employed as research assistants; four Kenyan and five US students.[6]

In addition to degree training, participants in the project (students and administrative staff) have received training on such topics as the use of GIS in characterizing the watershed, systems analysis, database development and management, and general principles in office and project management. Assistance in writing research proposals would be a useful additional training topic.

There have been other forms of stakeholder and community trainings as well. Local community health workers have received training on data management, mapping, and data analysis. Primary school students have received training in the use of rain gauges. Other short trainings on implementation issues have included demonstrations and practical training such as the construction of fish ponds with communities. These efforts have done a good job of including women. Other instruction, however, such as the rain gauge monitoring activity at the Siagon Primary School (and perhaps others) should more consciously include both women teachers and girl students. Farmers' training through tiered workshops and exchange visits is scheduled for 2006 across the four administrative locations of the watershed.

Among the collaborating institutions, Kenya Wildlife Service (KWS) has benefited from an MSc in Natural Resource Management opportunity for one of their research officers through the project. The Department of Fisheries also has an MSc student training with the project.

Acquisition of new skills, equipment, and access to new software and communication technology has greatly enhanced the capacity of both faculty and staff in the project. Nine new laptop computers with GPRS enabled communication, data loggers at strategic river course points, and automated rain gauges have enhanced the capabilities of project personnel and operations. Visits by the US PI, co-PI, and students have ensured a transfer of skills and sharing of knowledge across and within components. However, in the opinion of the EEP, there is need for the US team to spend longer periods in Kenya to deepen the imparting of relevant and sustainable skills. The US and Kenyan lead PIs need to share more time together in order to exchange and develop their complimentary skills in different aspects of the project.

Kenyan students have learned and benefited a great deal in the technology and knowledge transfers. While on the whole the students appear to be well trained in conducting their research assignments, they would benefit from additional instruction on field procedures. Trip reports should be submitted on a regular basis.

The PIs also need to meet the students regularly to monitor their progress and research related activities. Students have had a hard time arranging meetings with their supervising

[6] Slide presented at SUMAWA overview meeting, Feb 2006.

PIs or appointments to meet PIs are not kept without advanced notice. The current method of communication is not adequate to effectively and reliably conduct research by the students. To improve the communication problem SUMAWA installed and maintained SUMAWA intranet. The system was made available to PIs and students for helping better internet search of scientific information, but they are limited by hours of access.

One limiting and perhaps inhibiting factor for the students is the lack of support for their tuition and their low stipend fees. The project should consider paying tuition fees and an reviewing stipend levels to help students meet their basic and tuition needs.

Training efforts to better understand the implications of unequal gender relations and their impact on the project have been both relatively varied and numerous in comparison to most CRSPs. In June 2005, a four-hour workshop on basic gender concepts and approaches to gender analysis was offered to the PIs and other researchers and students attending the GL CRSP conference in Dublin, Ireland. SUMAWA component teams have changed their recruiting process to advertise more broadly to ensure that women as well as men were identified and considered in filling student research positions. Several well-qualified and dynamic female students have joined the project as a result.

The impact of the training on the quality of the component teams' intellectual work is less clear (see section on gender). Workshop materials have not been made available to the students and they did not seem to be aware that gender training had been offered to the PIs.

Students also benefit from other experiences outside of the classroom. They have attended workshops and conferences are part of the short term training activities in the project.

As far as trainee recruitment is concerned, the EEP heard that the Research Action Plans (RAP) determine the advertisement and selection process. It is satisfying to note that the process is open and competitive, giving those who qualify opportunities to meet expectations on them.

The project team explained that some of the students who seem not have a direct role in the project activities were retained because they are yet to graduate with their M. Sc. On the other hand, some have had financial constraints that prolong their completion of thesis work. Whereas they may not be directly with the project the retention encourages them to finish what is outstanding with the project and university while appreciating their contribution to the process.

Recommendations

- The EEP recommends that student support be equal to the life of the project (i.e., two years) in order to leverage adequately on their skills, time and training opportunity at the various stages of their MSc degrees.

- It is also the observation of the EEP that a training plan that addresses the research agenda be developed to assist in the research implementation and future interventions.

- Though not mentioned anywhere in the meetings or documentation, it is the considered view of the EEP that farmers/livestock representatives attend future project meetings as part of the broader project team.

- To make materials (such as the resource CD) from the gender workshop available to students

- To organize a gender training workshop for SUMAWA students

- To ensure that both boys and girls are included in monitoring activities at local primary schools and that both men and women teachers are exposed to and encouraged to apply the project's activities in classroom instruction.

- To ensure that both men and women are offered training opportunities, especially in topics in which each is relatively underrepresented.

PROJECT MANAGEMENT

From the outset, SUMAWA was a Kenya-conceived and -led project. This feature makes it quite unique among current GL-CRSP projects, and should be seen as an important strength. However, owing to problems in communication, and resulting misunderstandings and differences in overall 'vision' between the Kenyan and US lead PIs, the early years of the project were fraught with difficulties at the level of project management. Research was initiated in the hydrology and ecology components, and to a lesser extent activities under the stakeholder component, without a clear or shared sense of direction. This contributed to mistrust among team members and had wider implications, for example in financial management. This initial phase of the project has been characterized as 'too much too soon'.

The project was virtually suspended for a year in 2004 to allow for project management to be re-engineered, for team-building activities, and for a common sense of purpose to emerge with ownership from both Kenyan and US sides of the team. This was done with the active participation of the GL-CRSP's Management Entity (ME) from UC-Davis. While this hiatus delayed research progress, it has undoubtedly been beneficial in establishing priorities and setting a course for the remainder of the project.

One important innovation introduced during this reorganization of the project was the preparation of Research Activity Plans (RAPs) for each major activity under the project, of which there are several per component. These RAPs describe discrete research tasks, and assign staff and students as appropriate to contribute to realizing the goals of each activity. Budgets are assigned accordingly, along with planned outputs or research milestones. The introduction of RAPs has been extremely helpful in clarifying roles and responsibilities within the team as a whole, understanding how each activity or building block contributes to the wider research effort, providing a framework for monitoring of research progress, and clear lines of responsibility for addressing any problems that may emerge. Progress in each RAP is now reviewed during monthly PI meetings, and at a substantive level, during the quarterly 'sharing' workshops that have recently been introduced, involving all team

members including students, to allow for open and free exchange of information and ideas. The meetings produce minutes which are distributed to the team.

A difficult problem for the project has been the relatively high turnover of research staff (co-PIs) or their inability to commit time to the project because of promotions (in some cases) or other administrative or research commitments. It is critically important that the main PI for each component be available for research and work with students. The lead US PI and the host country PI should work with the university administration to obtain release time from teaching or administration responsibilities. If this is not possible, then the component leader should step down and take up a position as researcher in favor of another faculty member with more time to lead the component. Since the SUMAWA project is supplementing the pay of the component leaders, it is necessary for them to be fully committed to the work of leading the component.

As part of the reorganization of project management, a Project Coordinator was hired and began work in mid-2005. Reports from virtually all team members, and from stakeholders including the Vice Chancellor of Egerton University, confirm that the arrival of the Project Coordinator has led to a marked improvement in the way team members interact, to an improved flow of communication within the team, and to consolidation of the shared sense of purpose that has now emerged in SUMAWA. As a result of these changes, the project is now well equipped in its management structure of realizing its overall goals within the coming two-year period.

Communications have improved considerably among team members in general, and between the US and Kenyan sides of the team in particular. Electronic communications have improved with the acquisition of GPRS-based internet-access capability for several laptop computers, although more still needs to be done to fully operationalize the planned two Safaricom email accounts intended for student use. Over the last three months the lead PIs on the US and Kenyan sides have established regular (weekly) contact through an internet-based 'chat room', which has contributed significantly to the smooth flow of communication. This innovation now needs to be extended 'downwards' to other team members, allowing the co-PIs and students in each component to communicate regularly with each other across the Kenya-US divide.

Comments from Kenyan research team members, which are supported by the perceptions of EEP members, suggest that progress towards meeting the project's goals would be accelerated considerably if the US team members could spend more time in Kenya, through a combination of more frequent and longer-duration visits.

As a result of recent program management changes, and the specific efforts of the Project Coordinator, students have recently become better integrated into the structure and functioning of the project. There is further to go in this respect, however. Although students' theses form critical building blocks of the RAPs under each component, students currently feel that their ability to focus attention on the project is hampered by the need to engage in supplemental employment to meet their financial, family and other obligations. Each student currently receives a monthly stipend of KSh. 8,000 (approximately US$ 120 equivalent) from the project, but is otherwise self-supporting. Students are usually recruited after they have finished their coursework. Tuition fees for MSc students amount to a total of around US$ 3,000 per student (for two years).

Recommendations

- In the view of the EEP, the project should cover the cost of tuition fees for all participating students, at least at MSc level and Ph.D. levels during the candidate's degree program. This would be a relatively modest sum in the context of the overall project budget, but would have a disproportionately positive impact on recruitment of quality students and students' motivation and ability to contribute in a timely manner to realizing the overall goals of the project.

- Component leaders must be capable of providing adequate time and intellectual commitment to the project. If administrative duties are too burdensome and cannot be reduced in negotiation with the university, then the component leader should be asked to step down into a researcher position and another component leader should be named. A policy statement to this effect should be added to the project policy manual.

- Create a master calendar for the office that is shared monthly with all project members of all field visits, travel, and other key project activities to help with the coordination of vehicles, personal schedules, and to enhance project communications.

- Suggest that key communications (schedules, trip reports, papers) be copied to the project coordinator.

- Students should be recruited in the first year of their studies. This will enable the project to better prepare the students through coursework selection, training, and mentoring. First year students can contribute to the project by assisting 2nd year students, faculty, or in the office.

FINANCIAL MANAGEMENT OF RESEARCH AND PROJECT OPERATIONS

Establishing and maintaining an efficient and accurate financial management system has been a real challenge for the SUMAWA project. The project is very complex and its scale is unusually large for Egerton. There have been some difficulties that at times had a direct and negative impact on the ability of the team to complete its research activities on time. The team is making real progress as a result of the larger project reorganization effort over the past year and of targeted assistance on financial systems and office management systems training.[7] The GL CRSP ME is helping to develop transparent and efficient financial systems of SUMAWA, and to build the capacity of the project staff and Egerton faculty in preparing and maintaining accurate budgets and accounts for their research and operations. In the view

[7] In February 2005, Susan Johnson of the GL CRSP ME visited Egerton for several weeks to develop guidelines and processes for managing many office and financial activities. In the fall of 2005, a project administrator was hired at the University of Wyoming to assist the US PI with account management (among other responsibilities), visiting Egerton in November 2005 to further the earlier efforts to improve financial monitoring.

of the EEP, the project has passed through a difficult period is now well positioned for increasing the accuracy and sophistication of its financial management over the next few years in ways that will benefit not only the project but also the host institution.

Flow of funding

The resources of the project are not managed directly by Egerton University, but are channeled to the project staff through an administrative office of the GL CRSP based in Nairobi. Project funds are sent from USAID to UC Davis to U Wyoming and then transferred to a project bank account in Nairobi. When needed, these funds are transferred to a second project account in Nakuru, although some project expenses are directly debited from the Nairobi account. A portion of project funds are given to Egerton University in payment for overhead and to rent the project office. The university pays the salaries of faculty involved in the project and provides the use of equipment and facilities, such as the chemical lab for soil testing, and although these resources are significant, it is not possible without further investigation to accurately quantify the value of this support. The host university has an external audit process that looks at the entire financial system of the university and its departments, but this review does not drill down to the project level. Kenyan scientists receive additional salary support and stipends from the project.

Start-up funds were sent to the project account and to the University at the beginning of the project. In principle, additional funds are transferred from Wyoming to the Nairobi project account upon receipt of project invoices from the SUMAWA office. There have been delays both in the preparation of the invoices from the Kenya SUMAWA office as well as in the processing and transfer of funds from Wyoming. Even after funds are wired, it can take two weeks or more to arrive in Nairobi, so it is imperative for the efficient functioning of the project that invoicing for reimbursement is completed sufficiently in advance of the need for operating funds. The additional administrative assistance to both Kenyan and US offices in the past year is helping to clarify the procedures for making sure this process of invoicing and reimbursement is now followed. Quarterly compilations of expenses and invoicing will be replaced by monthly compilation and invoices to improve the flow of the funds, and no funds will be transferred to Kenya without adequate invoicing.

In the first year, SUMAWA received $300,000 as its initial award, a higher figure than the average $250,000 award for other GL CRSP program components. Over the course of the first year, because of the slow rate of disbursement to the project combined with a shortfall in funds by the GL CRSP overall, some funds were returned to the GL CRSP ME. A higher allocation of funds in the second year of the project compensated for the earlier return, but the process created the perception on the part of some project participants that the project funding had suffered an overall loss.

Management of funds

Administrative costs for the project have increased over the past year, with the addition of a project coordinator in country and a project administrator in the US. There is universal agreement by the project participants, however, from faculty, students, and staff, that the addition of the project coordinator has enormously improved project operations generally. The transfer of some of the operational responsibilities to the project coordinator position

will also allow the financial staff the opportunity to increase the sophistication of their financial monitoring.

Until now, the project expenses have not been tracked according to the specific research activity or component to which they related although the detail for doing so is available. The EEP team recommends that separate budgeting be developed for each RAP to enable more accurate linking of research activity costs with work plan development. With the breakout of funds by RAP budgets, each PI would be able to have more accurate information as to his or her available allocation and balance.

Some difficulties have emerged over the request to allocate funds for unanticipated expenses. A comprehensive set of financial guidelines and policies, which includes among many other topics, detailed guidance on allowable per diem rates and costs and clear procedures for expenditure reports and accounting was established with considerable assistance from the GL CRSP ME. The project management should periodically review these policies and procedures with project participants to avoid misunderstandings over reimbursements.

The EEP was not charged with carrying out a financial audit of project funds and did not review detailed reports on project expenditures. It is possible to gain some insights from review of the budgeted (not expended) amounts. Generally, CRSPs are encouraged to balance their spending so that tenured or tenure-track faculty in the US receive only small amounts of salary support (usually summer stipends for nine-month faculty), with the bulk of funding being reserved for student support and the financing of research activities. In the case of Egerton University, in the 2005-6 workplan, the costs budgeted for student training (14%) is a relatively small percentage of the project personnel budget while the faculty researcher support figures are significantly higher (approximately 50%), with the remainder of personnel costs divided between administration (27%) and consultants (9%). The EEP feels that student support should be increased and faculty/researcher stipends should be limited to those individuals who are actively committed to and engaged in current research activities.

Adminstrative costs for the project have been supplemented by support from the Management Entity. Given the complexity of the project and the importance of facilitating this interdisciplinary applied research effort, these costs are not unreasonable and the support appears to be paying off nicely in terms of improved management.

Leveraging of funds

In addition to the support of the host university, the project has leveraged both financial and other resources that have not been fully captured in the project reporting, particularly from the partners and stakeholders. For example, the Provincial Fisheries Office now provides 80% of the salary of the fisheries employee who is completing a master's degree under the program and also supports one-third of the time of the Assistant Director of the Rift Valley Fisheries office to work on project-related topics such as advocacy on aquaculture in the national fisheries policy. Similarly the Rift Valley Water Resources Management Authority is collaborating closely with the stakeholder component of the project on the formation of the Water Resources User Associations, providing the time of the staff member for social mobilization as well as some transport and funds for snacks at the workshops.

The project is encouraged to pursue possible sources of funding from USAID/Kenya as well as the REDSO office as part of their natural resources management efforts. For example, a USAID/Kenya team working on a new activity on the Mau forest recently toured the SUMAWA project area and met with the team and future linkages might develop.

Recommendations

- Establish line item budgets for each research activity in both US and host country institutions.
- Provide training for PIs and/or appropriate administrative staff in the maintenance of RAP "shadow budgets."
- Continue the refinement of the monthly expense sheets to include columns to track to which RAP and/or component of the larger project the expense refers.
- Encourage regular and direct communication between the Wyoming and Egerton project administrators to ensure that needed information is included with the invoicing and that the expense statements and invoices are sent in a timely manner.
- Regularly summarize the RAP budgets into component level budgets.
- Provide monthly statements with expenses and available balances to PIs and co-PIs.
- Regularly review with project participants the rules for reimbursement of allowable expenses, the list of unallowed expenses, and the procedures for filing expenditure reports. This could be accomplished by a periodic email notice from the lead PIs on the need to follow the guidance supplemented by more detailed review as needed at meetings.
- Pursue other external support for outreach and stakeholder involvement from Kenyan and international organizations.
- Pursue, to the extent possible given time available, alternative funding support for student research and training from such programs as the newly instituted Borlaug LEAP fellowship and CGIAR program for women masters' students.

INTEGRATING GENDER INTO SUMAWA RESEARCH AND PROJECT OPERATIONS

The SUMAWA project has made a determined effort to improve understanding of the relevance of gender issues to its research agenda as well as the management of its research activities. In this, it has done more than other projects both within the GL CRSP and more generally across the CRSP portfolio. Overall attention to gender in the SUMAWA project has been slowly increasing in scope and improving in quality. In 2003, a gender assessment of the project proposal found that except for a very vague comment that "gender issues will

be incorporated in the project design" of the various activities, there was no clear approach or plan for addressing gender issues in the project.[8]

Today, there is a higher level of understanding that attention to gender involves identifying areas of gender inequality – where either women or men experience unequal access, knowledge, or power – that affect the ability of people to act as fully productive members of society regardless of their socially defined gender roles. The project includes a "gender policy" in its project operations and policy manual which provides guidance on affirmative action in staffing and selection of students for training as well as asserting the need to fairly depict women in project activities and publications and to include women as representatives in al stakeholder activities.[9] The social scientist with the strongest background in gender mainstreaming has been promoted into the position of co-PI on the Stakeholder Component, increasing her familiarity with the work of the other PIs and allowing her to provide additional support in gender analysis to other components. Most importantly, scientists across the different components of the project acknowledged the need for addressing gender issues in their research efforts and in project management.

While it is important to stress that the integration of gender issues into research and extension does not necessarily depend on the number of women involved, reviewing the number of women relative to men who are involved in and leaders of the research program can help to highlight areas of under-representation or management inequities. Each component has expanded its recruitment of women for student research positions, especially in fields in which women are generally underrepresented and several have been successful at finding qualified applicants. Since the start of the research effort in 2002, the number of women (including both US and Kenyan) on the SUMAWA core research team has increased from 12.5 % (2 out of 16) to 35% (6 out of 17); among the M.Sc. and Ph.D. students (both US and Kenyan), the annual proportion has shifted from 11% women (1 out of 9) during 2002-3 to 50% (4 out of 8) during 2005-6 according to data presented to the EEP. The proportion of total students completing degrees, however, favors men overwhelmingly, 13 to 4, with women comprising 23.5% (4 out of 17) degree seekers.[10] Given the relatively short time of the project it is not possible to say if this reflects any particular gender-based constraint or is simply a function of the relatively later entry of more women into the program. Currently, the Stakeholder and Socio-economic Components both have women as Co-PIs and one woman student each, while the Socio-economic has another woman researcher. The Ecology Component includes one woman student. Finally, the Hydrology Component includes a woman as Co-PI and one woman PhD candidate. The respective proportion of women on each research team is: Stakeholder (33%), Socio-Economic (28.5%), Ecology (14.2%), and Hydrology (21.4%).

The PIs attended a half-day gender training workshop in June 2005 in conjunction with the GL CRSP research conference in Dublin, Ireland. Several scientists reported that this training has helped in their understanding of and recognition of the importance of investigating women's issues and gender inequalities more broadly and their impact on the watershed environment. The training also helped to highlight issues that had not emerged in

[8] Deborah Rubin, "Gender Assessment of the Global Livestock Collaborative Research Support Program (GL CRSP)" Report prepared for the GL CRSP, University of California, Davis. Contract Number: K-841458. (April 28, 2003).
[9] SUMAWA Policy and Procedures Manual, Section 17: "Gender Issues Policy," page 11.
[10] Slide presentation by Prof. William Shivago, "SUMAWA Overview," page 5 (February 7, 2006).

more general reporting and had helped to identify similar threads among women's and gender issues across the different components. The gender analysis of patterns of water collection brought to light the finding that men, rather than women, extract the larger volume of water from the river and take it for resale rather than for domestic use.

What continues to be a struggle for the project is how to mainstream attention to gender throughout the research project cycle and how to improve the quality of gender analysis of the research results. The project is limited in its ability to carry out additional gender analysis where the sex-disaggregated data was not collected in the initial stages of the research. However, there is a considerable amount of published research on gender relations among the ethnic communities in the Njoro River watershed and in Kenya more widely that has been produced by US, Kenyan, and other researchers over the past forty years. This literature is a valuable supplement to the primary data collection efforts of the SUMAWA team, but little of this background literature is referenced in existing project documents. Additional support and attention to these aspects of gender integration into the project is warranted.

Gender issues are increasingly addressed but have not always been taken into account during project design and development. In some activities, researchers have worked to improve gender integration during the implementation phase. In the Stakeholder Component, a watershed women leaders' seminar was organized in May 2004 to compensate for the lack of women in attendance at earlier stakeholder meetings. In the Socio-economic component, some but not all of the baseline data was collected in a sex-disaggregated manner and some additional sex-disaggregated data collection and analysis is being considered. If the baseline survey or supplementary survey data is adequately designed, the data collected will be able to answer the questions asked by the USAID gender guidance, "how will the proposed intervention either help or hinder efforts to promote gender equality?", and it will provide enormously useful information about the utility of specific recommendations. With the relevant sex-disaggregated data collection, it will be possible to analyze, in the future, the gendered impact of the project, but it is not fully possible to do that at the present time. In the Hydrology and Ecology components, lack of attention to gender differences during design of some research activities, such as in labor availability or crop preference may affect the adoption of even technically sound recommendations, e.g., in the conservation of steep slopes and/or fish pond development. In all of the components, repeated and regular review of research activities to consider whether gender inequalities are relevant to the substance or the application of the research results would help to compensate for aspects overlooked in project design.

For the future, it would be helpful for those with more gender mainstreaming knowledge and experience to either develop a brief checklist of gender issues to consider in project design during the preparation of the RAP and/or to provide consultation on gender integration so that the appropriate elements can be included in the research. A separate budget line for this support may be needed. It is also critical that researchers make sure that their representation of gender relations is based on the results of sound social scientific research and does not reinforce existing stereotypes.

Both the Stakeholder and Socio-economic components have identified ways to include attention to gender in their workplans. The Stakeholder Component will improve its handling of the recruitment of participants for its series of tiered workshop to ensure that an adequate number of and appropriate type of women's representatives attend and have an

opportunity to contribute to the proceedings. The Socio-economic component hopes to continue with further gender analysis of the baseline survey. There are good opportunities for more explicit attention to gender in the activity now starting up in the Hydrology Component on the impact of livestock on the watershed by considering the different patterns of livestock ownership and use by men and by women and carrying out a gender analysis on key impact indicators. Finally, the Ecology Component has been working to increase its involvement of women in its pond construction program and should be encouraged to be more attentive to gender-based constraints in its planning of feeding regimes and marketing and processing options. In the future, it would be very helpful to do a gender analysis of the value chain for fish farming and marketing.

Because of the sensitivity surrounding the study of ethnicity in Kenya, there has as yet been little research linking ethnicity and gender issues. Gender, is, however, a fundamentally cultural issue, and gender research will have to address cultural differences across the watershed. It is important for the SUMAWA project to address this point and to clarify how ethnicity and gender intersect, while also identifying creative ways to encourage women to move beyond their own cultural stereotypes and to collaborate in finding ways to improve the health of the watershed.

The role and involvement of the US women researchers in SUMAWA has been generally positive. The professional women from the US provide a positive example to the Kenyan researchers about women's abilities to succeed in scientific fields and to lead and manage scientific research programs. Reports from the researchers and other program staff about several of the women doctoral students who have spent time in Kenya was overwhelmingly positive: that they were capable, hard-working, and willing to get involved in the community. Several interviewees noted a desire for the US team members to spend even more time in Kenya so that there is more time to interact on the broader themes of the research – such as reducing gender inequalities – in addition to achieving the narrower activity objectives.

Recommendations

- Clarify and emphasize the message that attention to gender in fundamentally concerned with reducing gender inequalities and removing gender-based constraints and not simply or only targeting women as stakeholders or participants, although that may be an appropriate outcome in many cases.

- Improve the quality of gender integration into project design and analysis by providing consultations with the gender mainstreaming advisors on the project to research components during the design of new RAPs.

- Provide additional training on gender integration and analysis for students.

- Provide a separate budget line to support specific research that will enhance gender analysis of the overall program.

- Prepare a "state of the art" paper on gender issues in the watershed (i.e., gender issues in agriculture, natural resource management (including tenure security and common property work) and water supply and sanitation) that incorporates an historical

perspective and refers to supplementary ethnographic research as well as the data provided by the stakeholder PRAs and the baseline socio-economic survey.

- Carry out repeated and regular review of research activities to consider whether gender inequalities are relevant to the substance or the application of the research results and refine RAPs accordingly.

- Develop stronger links between the SUMAWA gender advisors and others agencies with gender expertise, such as the gender advisor from the Rift Valley Water Resources Management Authority.

OUTREACH, IMPACTS AND WIDER ENGAGEMENT

The project spreads across four administrative locations of Njoro Division in Nakuru District, Rift Valley Province of Kenya. The locations are Nessuit, in the upper watershed area, Njoro, in the middle catchment zone, Ngata, in the lower section and Kaptembwo (Baruti) area, adjacent to Lake Nakuru and the mouth of the river. Stakeholder outreach is an integral activity in the project design. Whereas outreach has been undertaken in the last two years, there is a clear need to widen the scope of engagement and strengthen the nascent relationship of people within the river Njoro basin. More of the target stakeholder groups need to be reached and mobilized if the project is to register significant support and sustainability. Perhaps a functional desegregation of the stakeholder fraternity in the respective locations into youths, women, and other categories with clear interest in the watershed health could be considered.

The outreach exercise could also be diversified through distribution of the project summary capturing the thrust of the science in lay language, tying it with how research is intended to be a tool beneficial to the majority of the watershed interest groups. The project leadership has built a network of contact persons within the respective political units on the landscape who can act as agents for disseminating quality project information to the local population in their languages.

As far as government agencies are concerned, the project has engaged focal institutions in the provincial, divisional as well as location level. Of particular mention is the Rift Valley Water Resources Management Authority (WRMA), a structure developed through the devolution of the responsibilities of the Ministry Water Resources and Irrigation, as envisaged in the Water Act (2002). The Authority has oversight of all the water towers (watersheds) within the Rift Valley, including river Njoro. The Fisheries Department, under the Ministry of Livestock and Fisheries Development, is a vital partner of the project. The Kenya Wildlife Service (KWS) are another category of stakeholders that have benefited from the extensive characterization of the watershed. The management of Lake Nakuru National Park, their research officers and databases contribute continuously with the project.

At the same time although the team did not visit with representatives from the Municipality of Nakuru, it was told that they are a core collaborating partner. The area of interest for this metropolitan is sewage discharge, water quality and quantity within their jurisdiction. Coincidently, the Nakuru Municipality, through bilateral assistance from the Japanese

International Cooperation Agency (JICA), has constructed a laboratory located within the KWS premises where data analysis is shared by all. The facility is said to provide useful services to the project and the other collaborators. Leveraged resources in-kind have come in handy in this instance.

Opportunities for the project to deepen its outreach do exist given that the establishment phase was effective in mapping out the current watershed stakeholder profile. Community engagement has been a particularly useful outreach activity. The installation, management, and protection of four rain gauges in community areas and facilities such as schools is worth mention here. Data sharing between community members, the Meteorological department in Nairobi, and the project improves any conceptualized interventions.

Although this is a joint US-Kenyan project, the outreach status of activities in the United States has not been captured here. However, it is worth saying that a number of co-PIs and students have had an opportunity to contribute to the project through hands-on research and spending time in the Kenyan site. This is an ongoing activity.

Dissemination of research findings

The research findings have been reported as shown in the table below. There are a total of 14 thesis/dissertations during the past three years. With the level of funding and the time frame this is an excellent outcome of the project. Results of the students' work were presented at various scientific meetings and conferences by the PIs and co-PIs. However, most of the publications are non-refereed conference presentations or abstracts with poster presentations. There were four peer-reviewed publications in conference proceedings and currently one article has been submitted to a refereed journal. Even scientific findings published in refereed journals are highly appreciated. Some of the conference presentations and poster presentations of this project are of high quality and introduce the project and its methodologies and findings to national and international audiences. However, the PIs and co-PIs are encouraged to consider publishing their findings in international as well as regional refereed journals. It is also suggested that all students who contributed to the findings be included in the publication either as authors or co-authors when appropriate, or acknowledged in other ways. This practice is important for the student's training and their future scientific/professional career. Upon availability of funding, the students should also be invited to attend and present papers at international as well as regional conferences to provide them with opportunities to meet and learn from others scientists.

Number of publications, 2003- 2005 from all research components

Type of publication	Total # of publications
Students' thesis/dissertation	14
SUMAWA PAR	5
Abstract/ presentations at scientific meetings/conferences	20
Other publications	10
Peer reviewed publications	4
Refereed Journals	1 (submitted)

Policy Implications

The SUMAWA project goals and objectives have important and strategic policy implications. Land Use and Environmental Protection among all stakeholders are critical components in the context of Njoro Watershed.

Kenya Wildlife Service (KWS) and Lake Nakuru National Park – Lake Nakuru National Park was the leading revenue earner for KWS in 2005. The park brought in US$3.2 million. This figure is set to improve with a proposed park management plan that will benefit from information currently generated through SUMAWA. Policy direction on watershed health has a direct impact on the KWS planning process. Above all, Lake Nakuru is a Ramsar site, recognized internationally for its rare bird life. As part of the project research sites, it has helped the wildlife authorities understand the watershed problem better.

Additionally, KWS has no control over the private lands that the watershed cuts through. With the intervention of this project it is able to reach a larger stakeholder community and educate them on the importance of the Lake to the country and national biodiversity base. It also enhances quality of KWS research on the ground which is very limited at the moment.

They are also able to lobby the tourism sector with quality information, such as the Municipality's discharge of sewage into the lake, the adverse effects of unregulated crop farming within the watershed and its siltation effects on the lake among others.

The Water Resources Management Authority (Rift Valley) – The WRMA has drafted a memorandum of understanding with Egerton University, via SUMAWA project on collaboration. This in itself is a policy initiative that recognizes the role of this project in the policy formulation process and lessons learned within from the Njoro that can be replicated elsewhere in the country. In addition, the EEP was informed that the SUMAWA project is an "agent" of the Authority in research and other information that stakeholders may not access otherwise. At the moment, this is the only watershed benefiting from high-level research in the country. At the grassroots stakeholder level, the Authority has mandated to the project to assist with the identification of watershed communities and their structure for formulation and registration of a Njoro River Water Resources User's Association (WRUA).

Consequently, SUMAWA has been identified as a "main actor" of basin issues, laying a foundation for influencing the policy process from an informed perspective.

The Fisheries department- The Provincial Director of Fisheries contributes up to a third of his time on the project. One other member of staff is pursuing an Msc in Fisheries and is attached to the project on a full-time basis, with a keen interest in aquaculture. A third person has an unspecified amount of time to maintain strategic links with the project at the cost of the government. The EEP were informed that a Fisheries policy is going to be developed for the country and this project will play a major role. Strategically, the government is focusing on a shift of attention in fisheries from *capture* to *culture*. The officers attached to the project collaborate with a faculty member, Dr. Liti, a specialist in aquaculture technology and a co-PI in the ecology component. The input of the project into this process is potentially very high and is already being felt.

The Office of the President – The provincial administration in Kenya plays a key role in linking grassroots activities to government institutions and programs. Chiefs, District Officers, Provincial Officers are part of the contact persons that collaborate with the project. Suffice it to say that this is a particularly important point in Kenya because the consent and cooperation of this hierarchy of officials is crucial to project success. They maintain and report on public domain activities on a monthly basis to their superiors which lends credence to a common interest such as the one led by this project.

Dialogue within and between direct and indirect watershed stakeholders can be enhanced in a supportive policy environment.

Recommendations

- Widen the scope of engagement and strengthen the nascent relationship of people within the river Njoro basin. More of the target stakeholder groups need to be reached and mobilized.

- Project information should be disseminated to local populations in their language.

- The project team should publish findings in international as well as regional refereed journals. It is also suggested that all students who contributed to the findings be included in the publication either as authors or co-authors when appropriate, or acknowledged in other ways.

- Develop a comprehensive outreach and information dissemination plan of action that will strategically target stakeholders and enhance the publication, outreach, and/or policy impact of the project.

SUMMARY OF KEY FINDINGS

Key findings (not in order of priority) at the project level

- Communication among and between project components and staff has improved dramatically with the reorganization of the project and the hiring of additional staff and redistribution of responsibilities.

- Financial management has improved greatly. Over the past year, clear guidelines have been created about financial procedures for all levels of research and management. New procedures are setting the foundation for transparent, efficient, and timely management and reporting of the financial systems.

- Interlinkage among components is present, but could be strengthened and focused. In particular, analysis from the socio-economic component will be very important for ensuring impact of the other components. The socio-economic component is currently understaffed and under-budgeted and would benefit from additional support.

- The project is doing an excellent job of linking to key stakeholder groups in the watershed, from the community level to the national government institutions. It is considered a major and influential actor by the Rift Valley Water Resources Management Authority.

- The project work to develop inventories of biodiversity in the watershed is leading to important understandings about changes in ecosystem health.

- The more narrowly focused livestock activities of the project are two: research on the impact of livestock production on the watershed and an economic study of the trade offs of livestock production and other livelihood options. Problems have stalled these two activities, but their importance to the overall project requires renewed attention to ensure their completion.

- The project needs a comprehensive research and dissemination framework that will link each research activity to its appropriate deliverables, with clear monitoring of progress from research to publication, outreach, and/or policy impact.

- Student research has greatly contributed to the research outputs of the SUMAWA project. Additional financial support to assist high performing students is warranted.

SUMMARY OF RECOMMENDATIONS

Stakeholder Component

- Pursue additional secondary research on ethnic identity, collective action, and gender to provide an analytical context to and enhance the analysis of the PRA material.

- Clarify the feedback processes for providing and testing technical recommendations with the community members.

- Liaise with other components to ensure that community members are involved in the testing and evaluation of proposed technologies and/or income generating schemes and that the results are included in the community action plans.

- Develop a checklist for interactions with the communities to ensure wide stakeholder involvement at meetings (e.g., Have women and men been notified of the meeting time and place? Is the meeting location convenient to all community members? Is the meeting time acceptable to both men and women?).

- Develop a plan for additional gender analysis of the PRA and socio-economic baseline data.

- Clarify the research results expected from the tiered workshop process.

- Develop a schedule for writing and submitting research results to peer review journals.

Hydrology Component

- Recruit staff member and student(s) to lead the livestock activity and its impact on water quality, aquatic and terrestrial ecosystems, and river morphology of the Njoro river system, and incorporate into an existing RAP or prepare a stand-alone RAP with adequate budget

- Develop a research activity that will identify a pair of medium-size watersheds on or near the campus to study effects of agricultural land uses on water quantity and quality. A suggested site is the hill-slope near the new fish pond site. The hill-slope can be slightly modified to build two identical watersheds as the hill slope has relatively uniform slope and soil types covered with a perennial grass. The paired watersheds can be used to obtain data as well as to demonstrate to the farmers the effects of conventional and conservation cultivation methods on the environment of the Njoro River watershed. Along with the proposed RUSLE (Revised Universal Soil Loss Equation) to simulate field soil erosion the WEPP (Water Erosion Prediction Project) model is also suggested for the same objective. RUSLE is primarily applicable to small-scale plots. However, the WEPP model was developed to compensate this limitation of RUSLE. It is applicable to relatively large-scale watersheds with multiple slopes, land uses, and irregular shapes. For overall simulation of water quality/water quantity of the entire Njoro River watershed AGNPS (Agricultural Nonpoint Source) model along with the SWAT (Soil and Water Assessment Tool) is suggested. Once a solid database is established, the models can provide information for effects of various hypothetical land use changes on water quality and quantity. The database requires reliable field monitoring of hydrology, climatology, and land uses. The latter three models will require rather comprehensive data and were developed to use GIS/RS to help generate input data easier.

- All water quality data reported for the project should include information on quantity as well as quality. Also included in the report should be sediment data in quality and quantity. Sediments are the most important non-point source pollutant

in water systems which carries other chemicals and destroys aqua-ecosystems when deposited on the bottom of streams. Sediments also cause loss of flow capacity of streams and storage capacity of embankment dams along the waterway. The loss of water holding capacity of Lake Nakuru would be one of the negative impacts of sediments from the Njoro River and other inflows. Major sources of the sediments in the watershed include intensive field cultivation, livestock operation, bank erosion of the river due to mud slides and direct access into the river to use the water. The cultivated fields along the waterway especially contribute unscreened sediments and other pollutants to the river.

- Give greater emphasis on water quantity issues in the research.

- Ensure that the gauge readers and students are trained and instructed to clean all water measurement sites if feasible during the river flow seasons and/or to record the condition of the measuring sites as a reference for data analysis.

- To better understand the regional groundwater system an expert in geo-hydrology should be involved in the project to study and assess the geo-hydrologic conditions in the region.

Topics for Additional Research with Leveraged Funds for the Hydrology Component

- The critical areas along the riverside including the riparian areas should be protected by limiting or restricting the inflow of pollutants. As a BMP (Best Management Practice) ecologically sensitive streams in forest areas are often protected by SMZ (stream management zone) in the U.S. SMZ is a designated width of a buffer strip with native/introduced plants which is restricted from any access by human or animals. Similarly a combination of aquatic buffer and grass strip along both sides of the Njoro River would drastically reduce the pollutants moving into the river. This system will play an important role of limiting pollutant inflow from the cultivated areas which are close to the river system. Research is needed to determine the optimum width of the grass strip and aquatic buffer to minimize loss of the individual farmlands. Also an important activity to be studied is the fencing at the current water collection sites to restrict direct access by community people and animals. An alternative water collection system for human uses and animal consumption at each water collection site may be installed with water supplied by gravity pipes or hand pumps from the river. This can immediately impact the river water quality, conditions of the riverbanks, and the quality of water the community uses. The households who use the water from the river for domestic uses should be provided with a basic filtering device. A consideration should be also given to development of a simple inexpensive filtering device to clean the water before human consumption.

- Another activity which can immediately impact the community is the RCR (roof catchment of rainwater) system. The houses in the region are well equipped to implement this system as two of three required components are already available at most households; impervious and relatively clean roof, and space for storage tank. The third component to provide the clean rainwater during critical dry seasons of the year is a storage tank. The tank may be built with homemade concrete bricks which

are less expensive than commercial plastic tanks. The size of tank for each individual house is determined based on the size of the roof, number of family members, seasonal rainfall amount and distribution, and location of the house. Based on personal observation each household can store up to 10 – 30 cubic meters of clean rainwater during the normal rainy season. This is a sufficient amount of water to use throughout the critical dry season for a family. Protecting the forest is critical to rehabilitate the Njoro River watershed and it can be done better by providing the community with cleaner water sources which do not require boiling. Boiling of water before consumption is an important practice however, since woods and charcoals are the major sources of fuel in the region this practice will help provide clean water but also cause a serious long-term problem of deforestation. An alternative source of fuel to boil the water such as solar energy collecting ovens may be introduced to the community.

Ecology Component

- Clarify and refine the plans for institutionalization of the BIOMat model for its use by stakeholders, including attention to training community members in collecting indigenous knowledge on the environment and differences in that knowledge by gender.

- Work with the Socio-economic component to develop a value chain analysis of fish production and marketing, including the economics of fish feed production, marketing of fingerlings, and costs of water.

Topics for Additional Research with Leveraged Funds for the Ecology Component

- An adequate water supply should be identified before any pond aquaculture is introduced and developed for communities and individual families. Pond aquaculture requires a large volume of water. Low-head embankment water supply systems can be installed without an engineering design at low cost in small valleys with or without a perennial stream. The water stored in the embankment during the rainy seasons would be also available for other uses by the community.

Socio-Economic Component

- As an immediate priority, recruit faculty members and students in sufficient number and with the appropriate skills to conduct economic analysis and household modeling within the next two years, with priority given to economic analysis of interventions proposed under other project components. Staff/ students could be identified on Kenyan and/or US sides, but should contribute jointly to the same Research Activity Plans (RAPs).

- Prepare detailed RAPs and budgets for economic analysis and household modeling activities, and submit as an addendum to the overall 2005-06 annual workplan and budget.

- Identify main research outputs or targets, and prepare a dissemination plan specific to the socio-economic component

- US researchers (and, where relevant, students) should visit Kenya more frequently and for longer periods, in order to increase the level of engagement and collaboration between US and Kenyan researchers

Training

- The EEP recommends that student support be equal to the life of the project (i.e., two years) in order to leverage adequately on their skills, time and training opportunity at the various stages of their MSc degrees.

- It is also the observation of the EEP that a training plan that addresses the research agenda be developed to assist in the research implementation and future interventions.
- Though not mentioned anywhere in the meetings or documentation, it is the considered view of the EEP that farmers/livestock representatives attend future project meetings as part of the broader project team.

- To make materials (such as the resource CD) from the gender workshop available to students

- To organize a gender training workshop for SUMAWA students

- To ensure that both boys and girls are included in monitoring activities at local primary schools and that both men and women teachers are exposed to and encouraged to apply the project's activities in classroom instruction.

- To ensure that both men and women are offered training opportunities, especially in topics in which each is relatively underrepresented.

Project Management

- In the view of the EEP, the project should cover the cost of tuition fees for all participating students, at least at MSc level and Ph.D. levels during the candidate's degree program. This would be a relatively modest sum in the context of the overall project budget, but would have a disproportionately positive impact on recruitment of quality students and students' motivation and ability to contribute in a timely manner to realizing the overall goals of the project.

- Component leaders must be capable of providing adequate time and intellectual commitment to the project. If administrative duties are too burdensome and cannot be reduced in negotiation with the university, then the component leader should be asked to step down into a researcher position and another component leader should be named. A policy statement to this effect should be added to the project policy manual.

- Create a master calendar for the office that is shared monthly with all project members of all field visits, travel, and other key project activities to help with the

coordination of vehicles, personal schedules, and to enhance project communications.

- Suggest that key communications (schedules, trip reports, papers) be copied to the project coordinator.

- Students should be recruited in the first year of their studies. This will enable the project to better prepare the students through coursework selection, training, and mentoring. First year students can contribute to the project by assisting 2nd year students, faculty, or in the office.

Financial Management

- Establish line item budgets for each research activity in both US and host country institutions.

- Provide training for PIs and/or appropriate administrative staff in the maintenance of RAP "shadow budgets."

- Continue the refinement of the monthly expense sheets to include columns to track to which RAP and/or component of the larger project the expense refers.

- Encourage regular and direct communication between the Wyoming and Egerton project administrators to ensure that needed information is included with the invoicing and that the expense statements and invoices are sent in a timely manner.

- Regularly summarize the RAP budgets into component level budgets.

- Provide monthly statements with expenses and available balances to PIs and co-PIs.

- Regularly review with project participants the rules for reimbursement of allowable expenses, the list of unallowed expenses, and the procedures for filing expenditure reports. This could be accomplished by a periodic email notice from the lead PIs on the need to follow the guidance supplemented by more detailed review as needed at meetings.

- Pursue other external support for outreach and stakeholder involvement from Kenyan and international organizations.

- Pursue, to the extent possible given time available, alternative funding support for student research and training from such programs as the newly instituted Borlaug LEAP fellowship and CGIAR program for women masters' students.

Gender Integration

- Clarify and emphasize the message that attention to gender in fundamentally concerned with reducing gender inequalities and removing gender-based constraints and not simply or only targeting women as stakeholders or participants, although that may be an appropriate outcome in many cases.

- Improve the quality of gender integration into project design and analysis by providing consultations with the gender mainstreaming advisors on the project to research components during the design of new RAPs.

- Provide additional training on gender integration and analysis for students.

- Provide a separate budget line to support specific research that will enhance gender analysis of the overall program.

- Prepare a "state of the art" paper on gender issues in the watershed (i.e., gender issues in agriculture, natural resource management (including tenure security and common property work) and water supply and sanitation) that incorporates an historical perspective and refers to supplementary ethnographic research as well as the data provided by the stakeholder PRAs and the baseline socio-economic survey.

- Carry out repeated and regular review of research activities to consider whether gender inequalities are relevant to the substance or the application of the research results and refine RAPs accordingly.

- Develop stronger links between the SUMAWA gender advisors and others agencies with gender expertise, such as the gender advisor from the Rift Valley Water Resources Management Authority.

Outreach, Impact and Wider Engagement

- Widen the scope of engagement and strengthen the nascent relationship of people within the river Njoro basin. More of the target stakeholder groups need to be reached and mobilized.

- Project information should be disseminated to local populations in their language.

- The project team should publish findings in international as well as regional refereed journals. It is also suggested that all students who contributed to the findings be included in the publication either as authors or co-authors when appropriate, or acknowledged in other ways.

- Develop a comprehensive outreach and information dissemination plan of action that will strategically target stakeholders and enhance the publication, outreach, and/or policy impact of the project.

APPENDIX

SCOPE OF WORK

External Site Visit Reviews – SUMAWA

I. Adequacy of the Problem Model and the Quality of the Scientific Research

a) How does the Problem Model (PM) address a development issue of importance to the country(s) in which the project functions. Is the PM clear, fully developed, and scientifically sound?
b) Is the scope of the research appropriate given the budget and timeframe? Does the budget accurately reflect the needs of the project?
c) How do the objectives and activities fit the problem model?
d) Are there aspects of the PM that are missing or are inappropriate? What are they?
e) What is the quality of research being conducted? How does the research make a significant contribution to the relevant field(s) of science and how does it advance understanding of appropriate development processes?
f) How does the research support a problem solving objective and does it link logically with the PM? Does it develop a technology that has development/science value? How can that technology be applied?
g) How does the team's expertise match the research agenda? Is the level of contribution appropriate to the area of investigation? How does the team interact?
h) Is the research agenda appropriately matched to the project's resources? Why or why not?
i) How effectively has new knowledge been applied in the modification of the original PM and workplans?
j) Evaluate the quality of publications and papers.

II. Progress

a) Considering the funding history of the project, evaluate the accomplishments of the project and provide rationale for your evaluations.
b) Have goals and objectives, as articulated in the workplans, been met? If not, please provide explanation.
c) Should the project be continued or modified? Provide rationale for your evaluation.
d) In what ways have the impacts and outputs been significant? Evaluate the mechanisms for dissemination of research results.
e) What, if any, are the benefits to the US?
f) Does the project have an effective plan for dissemination of research results? What is it?

III. Policy

a) Do the project goals have policy implications? What are they and how have they impacted national development?
b) Has policy been incorporated in the project design? At what level are appropriate policy makers engaged? (ministries, provincial, regional, local, etc.)

IV. Training

a) Rate the adequacy of the amount and quality of the training. Is there an appropriate

mixture of long- and short-term training? Evaluate the impact of the training on participants.
b) How does the human capacity building provide the basis for long-term capability to institutionalize the goals of the project?
c) Evaluate the role of students on the project. Are students an integral part of the project? How are they selected and mentored?

V. Project Management

a) Has the team developed mechanisms to ensure that local, national and regional needs and priorities will continue to be incorporated into the development of the research agenda? What are these mechanisms?
b) Do regional collaborators and team members have a substantive role throughout the life of the project? What are these roles?
c) Describe the project management structure and function. Is it appropriate for the type of research being conducted?
d) Evaluate the intra-project communication. Describe strengths or weaknesses.
e) Does the project management function effectively? Why or why not?
f) Evaluate the quality of communication with all members including host country collaborators. Is communication adequate and frequent enough, or are there problems?
g) How effective are operational decisions? What mechanisms have been incorporated for evaluation of ongoing work? Are they effective?

VI. Financial Management

a) Have USAID and GL-CRSP financial management guidelines been implemented? What has been the track record of the project in submitting vouchers and using funds in a timely manner each year?
b) Have cost matching requirements been met? What has been the effect of the cost matching requirements?
c) Have funds been provided to the project in a timely manner each year? If not, please provide explanation.
d) What is the level of support that the lead university and host country university provides to the project? Do the universities have any formal reviews, oversight and internal/external evaluations?
e) Is the administrative cost of the project appropriate for the size of the project? Is the present structure cost-effective and efficient? What modifications should be made to improve the administrative performance of the project?

VII. Gender

a) How were gender issues taken into account during project design and implementation?
b) Has a gender component been incorporated into all activities as appropriate? If not, why not?
c) How have US professional women been incorporated into the CRSP program?
d) What are the contributions of each research project in supporting participation by US and host country women at the scientist, training and producer levels?
e) Can project impact be disaggregated by sex?

VIII. Miscellaneous

a) Has the project leveraged significant funding from other sources? Why or why not?
b) Is the project regional? Is the rationale for regionalization clear? What are the linkages to regional activities? How appropriate are they? Should changes be made? Why? Are its linkages appropriate to its regional activities?
c) What is the level and quality of inter-project collaboration?
d) Describe any significant linkages to other research/development projects (CRSP or non-CRSP)?
e) Identify unexplored areas of collaboration between projects that are feasible and have potential.

ITINERARY

Agenda for External Review and Site visit of SUMAWA project

Sunday, February 5

Arrive Kenya. No scheduled agenda items.

Monday, February 6

8:00 – 9:30 AM	External Evaluation Panel Breakfast Meeting with Associate Director, Global Livestock CRSP *GLCRSP Nairobi Office* • Review Process, Scope of Work • Team Assignments • Report Schedule • GL-CRSP and SUMAWA project background
10:00 AM	Departure for Njoro
12:00 PM	EEP Meeting with US Principal Investigator *Enroute, Lake Elementaita Lodge*
2:30 PM	Arrival at Njoro, check-in at ARC
3:00 – 5:30 PM	Tour of Egerton University • Aquaculture project – Demonstration Fish Ponds • Campus boreholes and water resource facilities • Steep slopes demonstration • Soil Pit Sampling Meetings with Egerton University Vice Chancellor and Deputy Vice Chancellor for Administration and Finance
7:30 PM	Official Dinner at ARC

Tuesday, February 7

8:30 – 11:30 AM	Presentations by SUMAWA Team Principal Investigators • Stakeholder/Outreach Component • Socio-Economics Component • Ecology Component • Hydrology Component
12:00 – 1:00 PM	Lunch at Egerton University Botanical Gardens

1:00 – 5:30 PM Upper Watershed Visit
- Nessuit Bridge
- Sigaon Primary School
- Ogiek Community Meeting

Wednesday, February 8

8:30 – 9:30 AM Meeting with Students

9:30 – 10:15 AM Gender Strategy Meeting

10:15 – 10:30 AM Break

10:30 – 11:30 AM Stakeholders Component
-- All component members and students

11:30 – 12:30 PM Management Team

12:30 – 1:00 PM Break

1:00 – 2:00 PM Meeting with US PI over lunch

2:00 – 2:45 PM Ecology Component
--All component members and students

2:45 – 3:00 PM Break

3:00 – 4:00 PM Hydrology Component
--All component members and students

4:00 – 4:45 PM Socio-economic Component
--All component members and students

5:00 – 5:30 PM Tour of PARIMA GIS labs

5:30 – 6:00 PM Meeting with Vice Chancellor

Thursday, February 9

8:30 – 10:00 AM Lower watershed visit
- Data Logger – Egerton Bridge
- Njoro Bridge
- Njoro Health Clinic

10:30 – 12:30 PM Meeting with Water Resources Management Authority, Nakuru

1:00 – 3:00 PM	Meeting with Kenya Fisheries, Nakuru Lunch Meeting with SUMAWA Team • Presentation of Preliminary Results
3:00 – 4:00 PM	Meeting with Kenya Wildlife Services and Lake Nakuru National Park
4:00 – 6:00 PM	Visit to mouth of River Njoro Meeting with Host Country PI

Friday, February 10

8:30 AM	Departure for Nairobi
2:00 - 7:00 PM	External Evaluation Panel Report planning meeting and report writing
7:00 PM	Meeting with USAID officials

Saturday, February 11

8:00 – 9:00 AM	EEP Meeting
9:00 - 1:00 PM	Report Writing Meeting with GL-CRSP Kenya Office Administrator
1:00 – 2:00 PM	EEP Meeting
2:00 – 3:00 PM	Report writing
3:00 – 3:30 PM	Meeting with USAID CTO, debriefing
3:30 – 4:00 PM	Meeting with US PI, preliminary results of review Meeting with Host Country PI

MEETING AND INTERVIEW CONTACTS

Monday February 6, 2006

GL-CRSP Office in Nairobi
Susan Johnson, GL CRSP, Assistant Director
Prof. Scott Miller, SUMAWA, Lead PI (US)

Egerton University, SUMAWA management
Prof. Scott Miller, SUMAWA Lead PI (US)
Prof. William Shivoga, SUMAWA Lead PI (Kenya)
Prof. Frances Lelo, Stakeholders Component Leader
Dr. Patterson Semenye, SUMAWA Project Coordinator

Egerton University, Senior Administration
Prof. James K. Tuitoek, Vice Chancellor
Prof. J. M. Mathooko, Deputy Vice Chancellor

Egerton University, Demonstration Fish Ponds
Dr. David Liti, Moi University, Ecology Component Leader
Mr. Simon Macharia, Department of Fisheries, MSc student

Egerton University, Borehole Monitoring
Prof. Gichaba, Hydrology Component Leader
Mr. A. K. Kiptaunui, MSc student
Mr. Ngige Macharia, MSc student

Egerton University, Steep Slopes Demonstration
Mr. Shadrack Inoti, PhD student

Egerton University, Soil Pit Sampling
Mr. Z. Gichuru Mainuri, MSc student

Dinner with Egerton University administration and the SUMAWA team

Tuesday, February 7, 2006

Egerton University
Presentations by SUMAWA researchers:
Overview, Prof. W. Shivoga, SUMAWA Lead PI (Kenya)
Stakeholder/Outreach Component, Prof. Francis Leo, Component Leader
Socio-Economics Component, R. Njeri Muhia, Acting Component Leader
Ecology Component, Dr. David Liti, Component Leader
Hydrology Component, Prof. Maina-Gichaba, Component Leader
Closing Summary, Prof. Scott Miller, SUMAWA Lead PI (US)

Visit to the Upper Watershed
Nessuit Bridge, Siganon Primary School, Ogiek Community Meeting
Mr. Francis Lesingo, Ogiek Community Leader
Members of the community and the school

Wednesday, February 8, 2006

Meeting on Financial Management (Rubin only)
Zakayo Akula, Project Administrator

Meeting with Students
Steve Huckett, PhD student
Sarah Ogalleh, MSc student
A. K. Kiptanui, MSc student
Milcha F. Ngugi, MSc student
Eric Enanga, MSc student
Mr. A. Mureithi, MSc student
Mr. Mainuri, MSc student

Gender Strategy Meeting
Prof. Wanjiku Chiuri, Co-PI, Gender Mainstreaming

Stakeholder/Outreach Component
Prof. Francis Leo, Component Leader
Prof. Wanjiku Chiuri, Co-PI, Gender Mainstreaming
Steve Huckett, PhD student
Sarah Ogalleh, MSc student

Management Team
Zakayo Akula, SUMAWA Financial Officer
Prof. Scott Miller, SUMAWA Lead PI (US)
Prof. William Shivoga, SUMAWA Lead PI (Kenya)
Prof. Frances Lelo, Stakeholders Component Leader
Dr. Patterson Semenye, SUMAWA Project Coordinator
Prof. Wanjiku Chiuri, Co-PI, Gender Mainstreaming
Prof. Maina-Gichaba, Hydrology Component Leader
Mary Ndivo, SUMAWA Project Secretary

Ecology Component
Dr. David Liti, Component Leader
Prof. William Shivoga, SUMAWA Lead PI (Kenya)
Milcha F. Ngugi, MSc student
Eric Enanga, MSc student

Hydrology Component
Prof. Maina-Gichaba, Component Leader
Mr. S. K. Inoti, PhD student

Mr. Mainuri, MSc student
Mr. A. K. Kiptanui, MSc student

Socio-Economics Component
R. Njeri Muhia, Acting Component Leader
Mr. E. Bett, MSc student
Mr. A. Mureithi, MSc student

Egerton University, Senior Administration
Prof. James K. Tuitoek, Vice Chancellor

Thursday, February 9, 2006

Egerton University, Senior Administration
Prof. S. Abdulrazak, Deputy Vice Chancellor for Research and Extension
Ms. Esther Gitunda, Administrative Assistant

River Flow Data Logger
Prof. Maina-Gichaba, Hydrology Component Leader
Mr. Mainuri, MSc student
Mr. A. K. Kiptanui, MSc student

Njoro Health Clinic
Jane Murithi, Public Health Officer
John Soik, Public Health Clinician

Rift Valley Water Resources Management Authority
Engineer W.O. Matagaro, Director
Ms. Jacinta Were, Social Mobilization Officer (also Gender Mainstreaming and HIV/AIDS)

Department of Fisheries
Mr. Godfrey Monor, Provincial Fisheries Officer
Mr. Nicholas Ntheketha, Municipal Fisheries Officer {?}
Mr. Simon Macharia, Department of Fisheries, MSc student

Kenya Wildlife Services
Ms. Lydia Kisaoyan, Deputy Warden, Nyakuru National Park
Mr. Apollo Kariuki, Research Officer,
Mr. Dixon Twoo, Nakuru District Warden

Friday, February 10, 2006

Project Management
Patterson Semenye, Project Coordinator

USAID Mission to Kenya and USAID/Washington
Joyce Turk, EGAT/AG/AM
Jim Yazman, EGAT/AG/AM
Kenya Mission personnel (to be added)

Saturday, February 11, 2006

GL-CRSP Office in Nairobi
P. Barbie Allen, GL-CRSP Office Administrator
Scott Miller, SUMAWA PI
Joyce Turk, USAID Cognizant Technical Officer

BACKGROUND – SUMAWA Project Timeline

2001 June	PARIMA Conference at Egerton • Meeting between Layne Coppock, Aboud (PARIMA project), William Shivoga and Susan Johnson. Small proposal is presented by Prof. Shivoga.
2001 September	GL-CRSP pursues larger watershed project • Approached Pond Dynamic Aquaculture CRSP and SANREM CRSP as partners.
2002 March	Planning Meeting held at Egerton University • Pond Dynamic/Aquaculture CRSP brings Fisheries and Moi as collaborators • Layne Coppock and PARIMA participate (incl. Steve Huckett, student of Coppock)
	Funding provided by ME directly to Egerton Univ. for meeting, proposal preparation and equipment purchase.
2002 May	Proposal submitted by Kenyan PIs
2002 July	U.S. PIs selected following visit to region • Miller identified by Tom Thurow (former EEP) • Jenkins identified by ME • Both met with ME prior to traveling to Kenya
Oct. 2002 – Sep. 2003	One-year planning/training/needs assessment grant approved
2003 February	New 3-year proposal submitted • Covers Oct. 2003 – Sept. 2006 • Reviewed by GL and PD/A CRSPs • Competed with other GL-CRSP projects
2003 October	1st year workplan • Funded solely by GL-CRSP • Project also received J.Ellis award for Tracy Baldyga
2003 August	Meeting with Miller, Jenkins and ME (initiated by Miller) • Requests time to restructure project • Base studies continued
2004 October	No new workplan or new funds
2004 February	Visit by Susan Johnson to Egerton University • Interviewed all participants individually • Made recommendations regarding project management
2004 April	Workplan submitted for Phase I, FY05
2005 July	Workplan submitted for Phase II, FY05

ACRONYMS

AGNPS	Agricultural Nonpoint Source
BIFAD	Board for International Food and Agricultural Development
BIOMAT	Biological Monitoring and Assessment Tool
BMP	Best Management Practice
CAP	Community Action Plan
CGIAR	Consultative Group for International Agricultural Research
CTO	Cognizant Technical Officer
DVC	Deputy Vice Chancellor
EEP	External Evaluation Panel
EPA	Environmental Protection Agency
EPAC	External Program Administrative Council
GIS/RS	Geographic Information System/Remote Sensing
GL-CRSP	Global Livestock Collaborative Research Support Program
KWS	Kenya Wildlife Service
LEAP	Leadership Enhancement for Agriculture Program
ME	Management Entity
MOU	Memorandum of Understanding
NPS	Non-Point Source
PI	Principal Investigator
PM	Problem Model
PRA	Participatory Rural Appraisal
PS	Point Source
Q/A	Quality Assurance
Q/C	Quality Control
RAP	Research Activity Plan
RCR	Roof Catchment of Rainwater
RUSLE	Revised Universal Soil Loss Equation
SC	Stakeholders Component
SMZ	Stream Management Zone
SOW	Scope of Work
SUMAWA	Sustainable Management of Rural Watersheds
SWAT	Soil and Water Assessment Tool
TMDL	Total Maximum Daily Load
USAID	United States Agency for International Development
WEAP	Wathershed Evaluation and Planning tool
WEPP	Water Erosion Prediction Project
WRMA	Water Resources Management Authority, Rift Valley