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COMMUNITY RESOURCE MAPPING IN SUSTAINABLE NATURAL RESOURCE MANAGEMENT: A CASE STUDY OF SW UGANDA

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ABSTRACT

Southwestern Uganda represents a fragile ecosystem of complex and interrelated ecology with extreme socio-cultural and biophysical diversity. The area has productive soils and receives bimodal rainfall promoting varied agricultural systems and land use practices. With population growth of 2.2% per annum, this ecosystem is exposed to environmental and socio-economic problems like land degradation, soil erosion, low-income, poor nutrition, fragmented farms and low agricultural output. To mitigate these environmental and socio-economic uncertainties, and continue exploiting these rich natural resources areas, ICRAF and FORRI developed intervention strategies ranging from integrated watershed management to tree germplasm production and distribution. These intervention strategies were supported by community resource mapping for integrating predefined-research areas into community knowledge of their own resources. Acquired geospatial data were analyzed to support community resource mapping and scientific analysis was used for assessment of impacts of land management practices, conservation and conflict resolution. Community–based resource managers and local policy makers were trained in geospatial tools and applications. A GIS node was established in Kabale district to support future spatial analysis and information management. This paper reviews how integrated natural resource intervention strategies and community resource mapping were complemented to realize sustainable development action planning in SW Uganda. It also reviews the benefits of community resource mapping in property rights and geospatial technology transfer. IN this paper, technical backstopping of community effort and capacity building are recommended for sustainable community resource mapping activities.

INTRODUCTION

Southwestern Uganda represents a fragile ecosystem of complex and interrelated ecology with extreme socio-cultural and biophysical diversity. The area has productive soils and receives bimodal rainfall promoting varied agricultural systems and land use practices. With population growth of 2.2% per annum (NARO, 2001), this ecosystem is exposed to environmental and socio-economic problems like land degradation, soil erosion, low-income, poor nutrition, fragmented farms and low agricultural output (GMP 2002). To mitigate these environmental and socio-economic uncertainties, and continue exploiting these rich natural resources areas, the World Agroforestry Centre (ICRAF) and the Forestry Resource Research Institute (FORRI), through Geographical Information for Sustainable Development (GISD) funding developed intervention strategies ranging from integrated watershed management to tree germplasm production and distribution (Raussen et al 2002). These intervention strategies were complimented by community resource mapping, a participatory activity, which according to Raina (2003), not only raises the level of education, awareness and livelihoods, but with concomitant legislation, the right to information.

Participatory resource mapping makes access to information and transparency in local governance a reality. The resource maps graphically represent the communities' perception of

how they view and use their environment. The process of making the map, the questions raised, and features chosen to be included on the map provide information on community use, ownership and access to the resources (Verooy, R. et al 2000). The maps provide a wealth of information on the environment and social setting for resource use. Through participatory mapping, spatial inventories of natural resources, property status, land use rights and perceived problems can be created for more equitable and sustainable resource management but need to foster transfer of decision making power and financial responsibility to local level government (Deichmann & Wood, 2001).

Introduced in SW Uganda under ICRAF-FORRI 2002 intervention strategies, community resource mapping, which involved community groups training and participation in NRM plans development, targeted the following objectives:-

- Map and analyze the status of the community natural resource base, in a participatory manner, in order to identify critical areas of environmental and natural resource degradation as well as socio-economic uncertainties.
- Seek solutions, develop and implement collective intervention strategies
- Monitor changes in the natural resource base over time and the impact of the interventions for better management of the resources and informed decision-making.

To realize full benefits of the ICRAF-FORRI 2002 intervention strategies and community resource mapping in natural resource management in SW Uganda, a series of GIS and remote sensing data layers were acquired and processed to the scientific and users specifications. These layers formed the basis for natural resource management plans and community resource mapping training materials and input.

This paper reviews how integrated natural resource intervention strategies and community resource mapping were complemented to realize sustainable development action planning in SW Uganda. It focuses on the Kyantobi watershed management intervention site, where community resource mapping impacted on community livelihoods. The paper also reviews the benefits of community resource mapping in property rights and geospatial technology transfer. Technical backstopping the community effort and capacity building are recommended for sustainable community resource mapping activities.

MATERIALS AND METHODS

Study Area

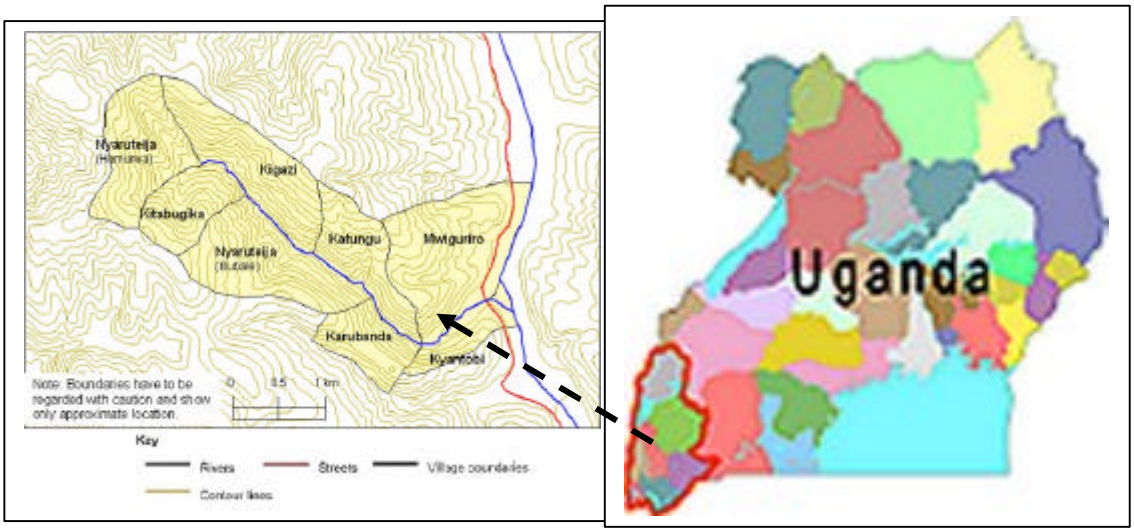

Figure 1: Map of Uganda showing regions and case study sites

Kyantobi watershed is located in Bubaare sub-county, Kabale district (Figure 1). The site inherits the general characteristics of southwestern Uganda, which has a fragile ecosystem of complex and interrelated ecology with extreme socio-cultural and biophysical diversity. The Kyantobi watershed site has productive soils and bimodal rainfall promoting varied agricultural systems and land use practices.

Materials

Kyantobi watershed was delineated using digital data and 1;50,000 topographic map sheets obtained from the National Biomass Study (NBS) of the Forest Department (Uganda Ministry of Water, Lands and Environment) and the Survey and Mapping Department (Uganda Ministry of Water, Lands and Environment) respectively. The digital data layers, which include population data, contours, vegetation cover, water bodies, land use systems, land cover, infrastructure, gazetted areas and administrative boundaries were compiled from SPOT 1995 images and topographic maps and subsequently assembled in a database by ICRAF under the GISD project (GIS for Sustainable Development) funded by the US State Department. Landsat TM 1990 images and geo-referenced aerial photographs were also acquired to aide in information update for various intervention strategies.

Under ICRAF-FORRI intervention strategies, a GIS node was established at ICRAF Kabale to support various spatial analyses including biophysical, socio-economic and cultural evaluation of production systems, and also to provide information flow for decision-making at organizational, district as well as watershed levels. Key examples of such information include characterization of land use/cover, and identification and delineation of both current and potential NRM problem domains. A Series of socio-economic data were also sourced from district departments and local organizations to enhance the local GIS database. These data include agriculture statistics, local institutions, local infrastructure, operating NGOs and CBOs, water sources and market centers.

Participatory Community Resource Mapping in Kyantobi Watershed

Participatory resource mapping work commenced in the office at the Geographic Information Systems (GIS) node established at ICRAF in Kabale beforehand to support such and related spatial analysis and information management. Using the ArcView 3 GIS package, the watershed boundaries were delineated from a template of geo-referenced satellite images, aerial photograph and topographic map sheets (figure 2). Additional secondary data and information were included taking into account geographical, ecological and socio economic aspects of the watershed. These were reviewed from literature and from key informants in the community. Among secondary data was population for the watershed since demographic characteristics affect management of natural resources. High population densities often increase pressure on the land and water resource, which if not properly managed, can result in serious degradation problems.

Office work was later followed by fieldwork involving community resource mapping exercises during which the community inhabitants and farmers provided local knowledge. GPS (global positioning systems), topographic maps of the area, [1]Landsat-TM sheets, map showing the delineated watershed, and data layers from NBS were also used. The methodology used in the fieldwork combined different participatory techniques/tools, thus; 1). participatory mapping of the community resources. 2). Transect surveys/walks with communities; 3). analysis of key elements of the natural resource base through observations and focused group discussions. These techniques helped to identify key characteristics of the landscape and analysis of state of natural resources.

[1] Landsat Thematic Mapper

Developing the Natural Resource Maps

In Kyantobi watershed, farmers were mobilized to come together and were sensitized on community resource mapping and its usefulness. They then drew sketches of their village landscape on large flip charts using ink markers, and indicating information on the occurrence, distribution, access and use of important resources within their community. On these maps the farmers indicated the location of various features within their village boundaries including roads and paths, soil types (in local language), slopes, soil erosion and water run-off areas, settlements, farm boundaries, crops, trees, hedgerows, bare hills, etc. Topographic map sheets were used to identify height, degree of slopes, land use/cover and changes that have occurred over time. The sketch maps were later transposed onto the topographic maps to generate scaled outputs (Figure 2). After mapping, discussions were opened up on land use practices and their consequences, problem areas identified and solutions/interventions outlined.

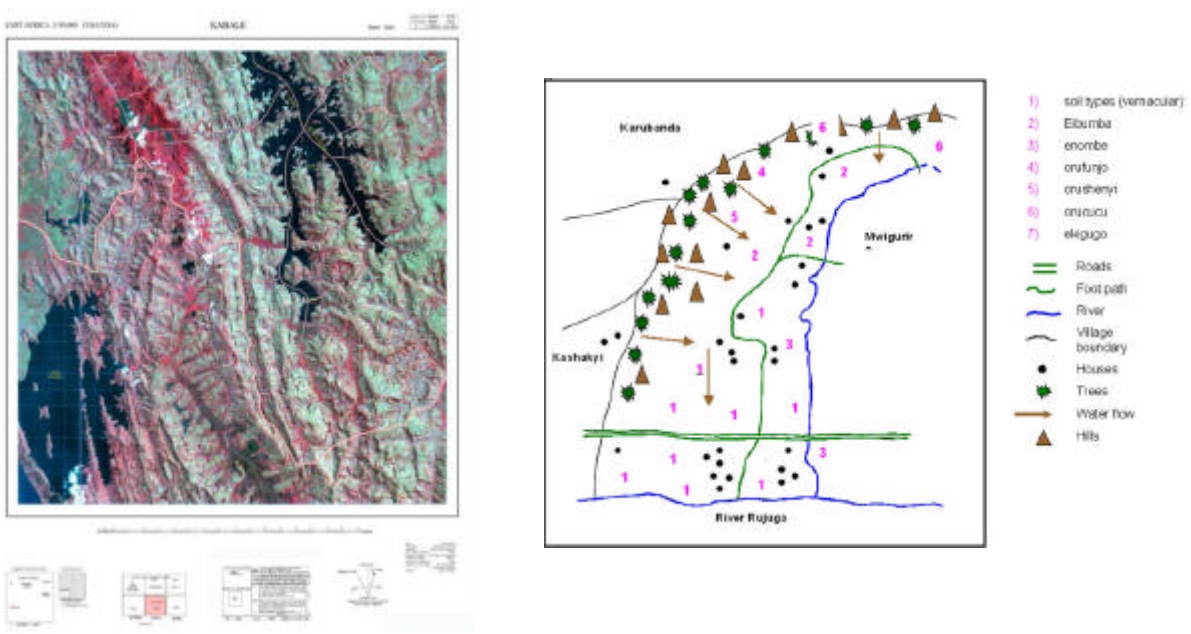

Figure 2: Geo-reference satellite image and Kyantobi Village watershed map

Transects

The community resource mapping team walked along the established transects to assess and analyze the status of the natural resources and noting down key issues for further discussion. The composition of the community mapping team included several farmers with good knowledge of the environment. This facilitated direct on-site appraisal about the status of the natural resources. The team mobilized by local council leaders (LCls) comprising of men, women, young children and the elderly assured an inclusive appraisal process. Under Uganda's decentralized government structure, the local councils have the authority to take decisions that affect the environment and natural resource issues in their areas of jurisdiction. And since the council leaders are democratically elected and serve as community agents, their involvement added value and confidence to the exercises.

Analysis of the Status of the Natural Resource Base

The analysis of the status of the natural resource base involved identifying the problems and solutions as faced and perceived by the local people. Problem areas were identified based on information provided and the knowledge obtained during the walks. While taking notes, an analyses and or diagnosis was made of the key elements related to the use of natural

resources; including farming patterns in the area, major economic activities, natural resource management opportunities and challenges and level of involvement of other development partners. Direct observations were made for example of trees, soils and soil erosion potential, crops, pastures, animals, crop yields, conflicts of use of natural resources, land use/cover, water quality; socio-economic situations like infrastructure, institutions, etc. This facilitated qualitative knowledge of the natural resource base and located sites of problems. It also allowed in-situ visits to critical areas with problems of degradation, soil erosion, bare hills, low productivity, etc, and later-on for monitoring of high risk issues, setting community recommendations and priorities. Inclusion of local knowledge helped in the identification of topics related to access to and distribution of resources and the changes that have occurred over time. An inventory of the prevailing biophysical and socio-economic parameters of the watershed was developed which can also serve as baseline data upon which future evaluation of impact of interventions can de based.

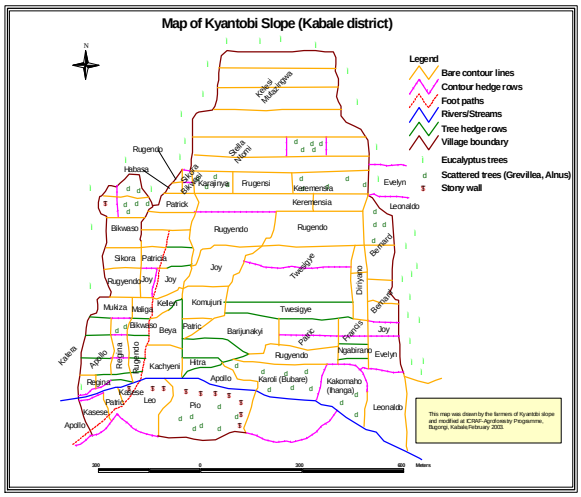

Figure 3: Resource map of Kyantobi village

Replication to Other Sites

After showing signs of success in Kyantobi watershed, the community resource mapping and spatial analysis methodology were replicated to other sites in SW Uganda in order to spread out both the practice and potential outcomes (figure 4). In order to achieve this, a participatory approach involving sensitization and training on the relevancy and usefulness of the methodology in NRM was done for local stakeholders. Local stakeholders were trained and therefore equipped with skills to collect data and use GIS-based spatial tools to perform various spatial analyses e.g. in identification of potential areas for soil and water conservation technologies, or other interventions to address specific NRM problems at landscape and watershed scales. These activities, it was envisaged would provide a spatial dimension that was lacking in other scenarios, thus improving overall decision-making. Participants included community-based natural resource managers who are actively involved in NRM e.g. environmental, agriculture, and forestry officers from local government departments, NGOs, CBOs and local leaders in SW Uganda.

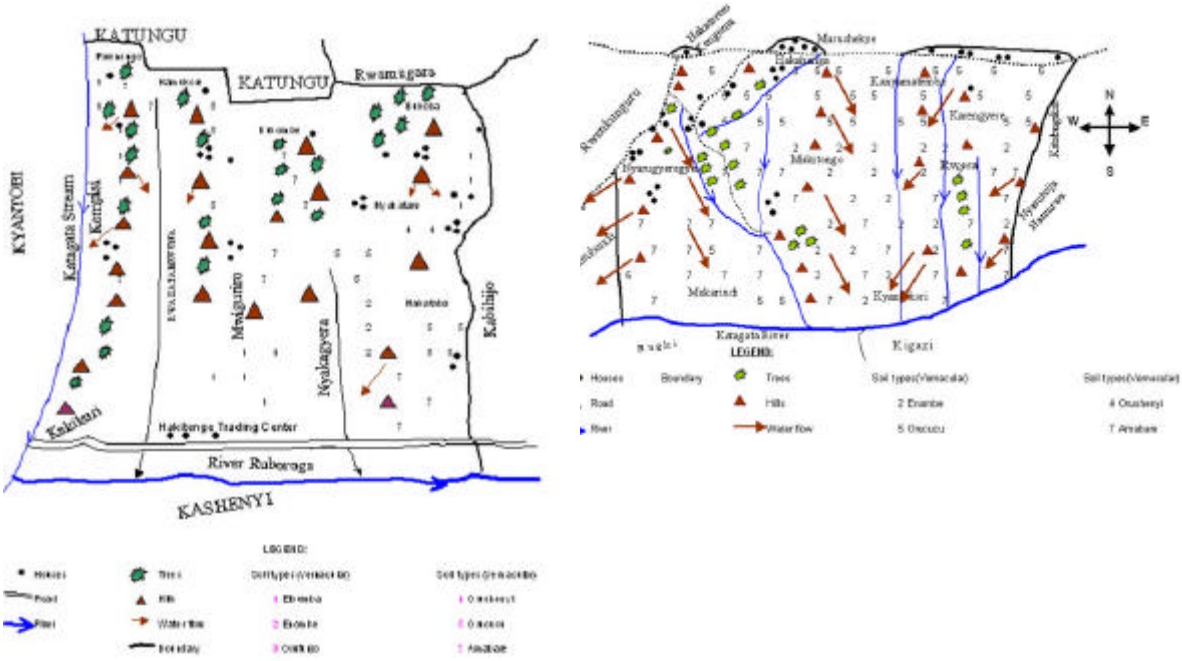

Figure 4: Community resource maps for Mwiguriro and Nyaruteija villages

RESULTS AND DISCUSSIONS

Generally, integration of community resource mapping into agroforestry based intervention strategies has supported and added value to development efforts in environmental protection and natural resource management in southern Uganda. It has facilitated the identification of environmental and socio-economic problems. Those identified during the exercise include intensive arable farming that has depleted soil nutrients and caused severe runoff, low biomass on the landscape, soil erosion and nutrient depletion, few fuel wood sources, floods and landslides.

Originally, few farmers were involved in agroforestry activities promoted under FORRI-ICRAF intervention strategies, but now many have picked-up interest because of the enthusiasm developed during the community resource mapping exercises. From this exercises, the participants have developed their own indicators including signs of soil erosion, yellowing of crops, bare soils, fragmented farms, deforested areas, etc to support them in monitoring the quality of the community natural resource base and for making decisions over time. They also used these indicators to identify appropriate agroforestry technologies and laying down implementation strategies.

Farmers and the FORRI-ICRAF team developed an action plan relating to the prevailing problems and resource base conditions. Farmers contributed a lot to the site identification for planting of high value trees (for wood, poles, timber and fodder), soil and water conservation activities (hedgerows, improved fallowing, shrubs that improve soil fertility, etc) as well as indigenous and temperate fruit growing as some of the agroforestry interventions that they needed to focus on. By also using their indigenous knowledge, they provided information on high value indigenous trees (e.g. *Cordia, Albizia, Acassia*) and fallow shrubs. With help of the community resource maps, farmers agreed amongst themselves and encouraged one another to plant *Calliandra calothyrsus and Leucae diversifolia* hedgerows across water run-off areas and *Grevillea robusta* and *Alnus acuminata* trees on bare hills.

In addition to supporting decision making and planning for the Kyantobi community, the community resource mapping methodology contributed to mobilizing funds to implement community action plans. The community resource maps have been used to present requests and source funding for agroforestry work as well as other developmental activities from the Bubaare sub-county development fund and from other development organizations. This is for the reason that the resource maps show locations or sites where action/interventions need to be taken together with the distribution/location of resources and resources patterns in the community.

Africare, an NGO working in SW Uganda, adopted the integrated watershed management approach facilitating community participation in the project "Uganda Food Security Initiative" implemented in Ntungamo, Kabale, Kisoro, Kanungu and Rukungiri districts. Selection of watersheds for this approach was a very important process which required an in depth analysis of demographic, biophysical, socio-economic and policy issues. Delineation of watersheds in selected sub-counties was done using community resource mapping and GIS tools in conjunction with the newly developed GIS database. Delineation was followed by establishing area, population density and biophysical characterization and assessment of NRM problems and possible interventions in each watershed. Following this, potential watersheds were selected e.g. Noozi and Nyakishenyi. This is an example where geo-spatial data and spatial analysis were combined with community resource mapping to contribute towards understanding and decision-making in food security improvement programmes in SW Uganda.

The training in community resource mapping and training in the use of geospatial tools provided to natural resource managers and local leaders had a positive contribution. With the help of the trainees, various communities have adopted the methodology and have been able to identify deforested and degraded areas, areas prone to soil erosion, bush fires, etc, followed by making and implementing collective community action plans. Ten communities in Ihanga watershed (Kabale district) and one community in Nyakishenyi (Rukungiri district) have adopted the methodology.

CONCLUSION

The land management practices and socio-economic factors in SW Uganda are dynamic and their impact on land use/cover changes and subsequent intervention measures like various agro-forestry technologies require integration of tools that can back-up and build capacity for the local communities. Integration of geo-spatial tools together with community resource mapping methodologies can provide the local people, NGOs, CBOs and district departments, with the necessary basic information for research, analysis, planning and better informed policy-making on the resource base as well as giving support to local community development efforts. Integrating farmers' experiences in the resource base analysis, seeking solutions to problems and laying intervention strategies empowers communities to have involvement and ownership of both information and decision-making processes.

Comments from many farmers during discussions before, during and after resource mapping indicated that their immediate desire is to eradicate poverty, a deprivation they have been trapped in for years. The goal of integrating geospatial tools and resource mapping into agroforestry interventions is short term and could not be entirely achieved through the long-term application of this Geographic Information System support. However these farmers do not underestimate the contribution and long-term benefits of these tools to their community and in enhancing sustainable natural resource and environmental management. One of the immediate contributions that farmers reported was that they were able to discuss and agree on boundary issues as they mapped farmers' individual plots and community resources and this

was a step towards resolving boundary conflicts and enhancing property rights. Integrating GIS and participatory learning and development efforts will continue to have big potentials in southern Uganda as has been exhibited by the interest of local farmers who have already used it.

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Abbreviations

CBO	Community Based Organization
GIS	Geographic Information systems
GISD	Geographic Information for Sustainable Development
GPS	Global Positioning System
NGO	Non Governmental Organization
NRM	Natural Resource Management
FORRI	Forestry Resources Research Institute
ICRAF	World Agroforestry Centre (International Centre for Research in Agroforestry)