Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program

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Trip Report: Zambia
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Purpose:
The overall goal was to assemble background information necessary to support the watershed assessment component of the SANREM CRSP Long-Term Research activity, "Developing a Participatory Socio-Economic Model for Food Security, Improved Rural Livelihoods, Watershed Management, and Biodiversity Conservation in Southern Africa". This was accomplished through the following specific objectives:

- Identify important factors in the hydrology of the Luangwa River watershed
- Collect ground truth points to classify satellite imagery for land cover mapping
- Develop a preliminary modeling framework for assessing impacts of land use practices on the Luangwa River
- Identify available sources of data and data needs, and identify opportunities for monitoring to provide essential data needed to support watershed assessment efforts.

Sites visited:

WCS/COMACO Lusaka office (brief visits on arriving and leaving the country)
Luangwa River valley (drive from Mfuwe through Chitungulu to Lundazi)
Lundazi region (8 days)

Description of activities:
The eight days on location in the Luangwa valley were based in Lundazi, working out of the Wildlife Conservation Society/Community Markets for Conservation (WCS/COMACO) office. The focus was on two activities: 1) field visits to understand the landscape systems, land use practices, agricultural production methods, hydrologic characteristics of the region, and 2) computer analysis using satellite imagery, elevation data, and geographic information system (GIS) analysis. Malambo Moonga, GIS/data analyst from the Lusaka WCS/COMACO office worked with me the entire time in Lundazi. On field visits we were accompanied by COMACO extension staff, and Nemiah Tembo was of particular assistance in understanding the characteristics of the region. In addition to observations of soil, cropping systems, landscape forms, and land cover, the field visits were also used as an opportunity to explore possible locations for monitoring runoff and sediment at different watershed scales. Different land cover classes and locations were recorded by global positioning system (GPS) and photographs for comparison with satellite imagery. Discussion with Lydiah Gatere at Lundazi provided an

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opportunity to learn about her planned soils research and to explore the possibility of adding a runoff/infiltration component to her plot research.

Data analysis and modeling work involved: assembling and sharing data sets; compiling weather data from the Lundazi Meteorological Office; developing data sets to map river networks of the valley using elevation data (SRTM – Shuttle Radar Topography Mission); and developing a modeling framework for runoff prediction modeling using available land cover and topographic data. The GIS analysis and hydrologic modeling was used as a training opportunity in teaching Malambo concepts and applications focusing on GIS raster analysis.

Findings and Recommendations:

The three primary landscape regions in the Luangwa watershed – valley floor, hills/escarpment zone, and the plateau – have very different functions and impacts in the watershed. The plateau areas have low runoff potential due to the low slopes and permeable soils. The traditional practice of making ridges for planting is also effective in retaining potential surface runoff. The ridges did not appear to be specifically oriented with respect to slope, and by orienting across the slope, maximum water retention and minimum runoff would be achieved. The most significant source of runoff and erosion in the plateau area appeared to be from roads, pathways, and compacted areas around settlements. In the hill region, runoff and erosion potential is much higher because of the steeper slopes. While much of this region in the Eastern side of the valley is in National Forest, the encroachment and clearing of land is potentially of greater concern because of the likelihood of increased runoff and erosion. The possibility of identifying a small paired watershed study to compare a 'farmed' versus 'native forest' land use in this area would provide valuable information on infiltration, storm runoff, erosion and sediment delivery, groundwater recharge, and base flow. Some anecdotal evidence suggested that an extended base flow period does occur when the native forest vegetation is present. There was little time spent in the valley floor, so assessment was limited. The general characterization of the valley floor is that soils are heavy clay and are not tillable except in the alluvial areas of the tributaries to the Luangwa. The clay soils (characteristic of the Mopane forests) would have high runoff potential even though slopes are generally low.

The lack of specific information or data on rainfall/runoff processes in this region is a significant limitation in the analysis of land use impacts on the watershed ecosystem. The value of hydrologic monitoring at several scales (plot, small watershed, tributary watershed) is important to be able to provide an assessment of land use impacts on water management, groundwater levels, flooding, sediment delivery, etc. While it is too late to implement a monitoring program for this rainy season, the possibility of implementing trial/demonstration monitoring would be valuable for the preliminary data collected and would allow the development and evaluation of monitoring approaches before a full implementation next year. Six plastic raingages were taken and left with the Lundazi office with the goal of collecting rainfall data at sites throughout the valley to supplement the data collected at the official Lundazi station.

A specific plan for assessment of watershed impacts should be developed immediately with the goal of preliminary test implementation yet this rainy season. Such a plan will position the project for meaningful data collection and analysis in the following two years of the project.

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