



## Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program

SANREM CRSP  
Office of International Research, Education and Development  
Virginia Polytechnic Institute and State University (0378)  
526 Price's Fork Road, Room 211  
Blacksburg, Virginia 24061

Phone: (540) 231-1230  
Fax: (540) 231-1402  
sanrem@vt.edu  
[www.oired.vt.edu/sanremcrsp](http://www.oired.vt.edu/sanremcrsp)

### Trip Report: Zambia

10-20 December 2007 and 18-28 February 2008

Conrad Heatwole

Biological Systems Engineering, Virginia Tech

**Purpose of Trip:** Install equipment for watershed monitoring including stream gauging stations, weather stations, and rain gauges for the four Emusa watersheds identified in March 2007. Follow up on installation of the stations and download data in February 2008.

**Sites Visited:** WCS head office (Lusaka), Lundazi and field sites in Emusa

#### **Description of Activities/Observations:**

Primary focus was on establishing a hydrologic and meteorologic monitoring network for the paired hill watersheds and dambo watersheds described in the Mar 2007 trip report. The December visit was a good time to install equipment as flow was intermittent in the streams which made it easier to install the towers that hold the staff gauge and pressure sensor. In February, we were able to observe conditions with stream flow. Staff from the WCS Lundazi office were very supportive and Peter Banda and White Lunga in particular were key partners in the field work.

*Stream flow monitoring.* We are using natural stream channels, selecting monitoring locations with stable cross-sections. At each location a data-logging pressure sensor records pressure every 15 minutes. A non-vented pressure sensor is being used because of flexibility in installation options and simplicity of maintenance. A reference pressure sensor is located at Emusa (with the station manager)



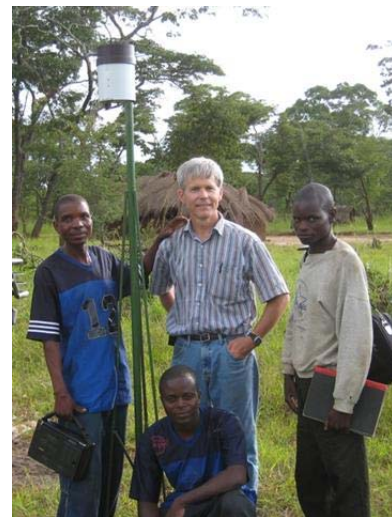
Mphiri Dambo: a) Dec. 2007



b) Feb. 2008

which is used to ‘correct’ the stream pressure data to give water depth. Sensor sensitivity is better than 1cm. A staff gauge at each site is used by a field observer to record water depth on a daily basis for reference and as a validation of the sensor data. The stage-discharge relationship at each monitoring station is needed to convert depth (stage) to flow rate, and requires measurement of flow rate for a range of low to high flow conditions. A flow meter and stopwatch were left with White Lunga, the Emusa station manager who has responsibility for overseeing the flow monitoring. Alfred, an assistant at the center is providing the primary field observations for the 2007-2008 rainy season. An important focus of the time in the field was to practice the flow monitoring techniques using the flow meter. The salt dilution technique is not being used in these streams because the streams are generally not very turbulent. For high flow conditions when the flow meter cannot be used, a float timed over a set distance will be used to estimate flow velocity. The observation of stage will be used with the surveyed channel cross-section to estimate flow rate for peak flow events. Field observers have been recruited at each location and data from the Dec to Feb period was good.

*Weather measurements.* A weather station (rainfall, temperature, relative humidity, solar radiation, wind speed/direction, barometer) was installed at Emusa, and a smaller station at the ZAWA camp on the Chifunda road (first 4 parameters). A recording rain gauge installed at the Chazovu school in December was replaced in February with a Davis Vantage Pro2 Plus (7 parameters). The headmaster and teachers were very enthusiastic about having the weather station. The Davis provides a real-time readout in addition to storing the data for later download by computer thus is more supportive of the school program than the Hobo instruments which provide no real-time view of the data. The Chazovu school is the central/head school for the district, so the rain gauge placed there in Dec. generated interest among all the schools of the district. Recording rain gauges (Hobo) were installed at the Munyukwa, Kamatete and Mphiri schools, again with great interest and support from the teachers. In total, 3 weather stations and 3 recording rain gauges have been deployed. In addition, there are several farmers keeping records on manual gauges throughout the general Emusa area of the watersheds.



Kamatete school and rain gauge.  
(Teachers on left and right)

*Valley rivers.* While a goal each visit was to visit the Manga area and follow up on options for monitoring the major tributaries, there was not sufficient time to make that trip. It will be a challenge to have quality measurements in that area because of the size of the rivers, and at this point, the resources are not in place to extend the monitoring to this level. It was also a goal to visit Chama and better understand a broader landscape and land use issues in the Luangwa valley, but again, there was not time.

*Observations.* The assumptions about characteristics of the basic hydrology of the plateau and hill region were reinforced in observations during storm events in February. A heavy storm generated runoff in the plateau region that flooded the Chama Road just south of Emusa and subsequently flowed across the bridge on the Emusa to Chifunda road. Even with the very high

flows, the water was clear. In contrast, runoff from both of the hill watersheds (Luelo, Kamwamphula) had heavy sediment loads. There is a challenge to adequately communicate this message to those responsible for land use and land management in the region, from the politicians to the farmers.

**Suggestions, Recommendations, and/or Follow-up Items:**

Measurement of sediment load in the streams will be the next measure to incorporate into the monitoring program for next year. Having a committed partner in the field will be a key to facilitating the collection of good data.

It would be an interesting opportunity to bring in an environmental education component into the school program that could link in to natural resource management themes. A manual rain gauge, a min/max thermometer and record book will be taken for each school on my return in the fall.

**List of Contacts Made:**

Name	Title/Organization	Contact Info (address, phone, email)
Davies Banda	Headmaster Chazovu MB School	P.O. Box 530033, Lundazi +260.979.383.689
Andrew Ngwira	Teacher In Charge Kamatete School, Chazovu Zone	c/o Munyukwa Basic School Box 530137, Lundazi