Sustainable Agriculture and Natural Resource Management
Collaborative Research Support Program

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Trip Report: Bolivia and Ecuador

June 15-28, 2007; Oct 8-13, 2007; Nov 12-20, 2007; Jan 9-25, 2008

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Purpose of Trip: Collaborate with LTRA project partners to define objectives and begin implementation of the Watershed Modeling and Assessment cross-cutting research, with a primary focus of establishing a basic hydrologic monitoring program for each watershed.

Sites Visited: Bolivia: Ancoraimes watershed (LTRA-4); Toralapa watershed (LTRA-3)
Ecuador: Illangama (Guaranda) and Del Alumbre (Chillanes) watersheds (LTRA-3)

Description of Activities/Observations:
The initial visits to the watersheds (June 2007 visits to Toralapa, Guaranda, Chillanes) provided a basic understanding of the topography, landscape features, land use, and stream characteristics. Based on insights from these field visits along with subsequent analysis of maps and imagery with field GPS data, preliminary locations for stream gauging stations and rainfall/weather monitoring points were identified. Initial visits were also very important in identifying project partners and providing preliminary training on monitoring goals, methods, and equipment.

Field visits Oct/Nov 2007 and Jan 2008 focused on finalizing site locations in consultation with field/watershed coordinators, preparing and installing field equipment, training partners in flow monitoring, and collecting field data for land use classification. For stream flow monitoring we are using natural stream channels, selecting a specific monitoring location that has a stable cross-section. At each location a data-logging pressure sensor records pressure every 10 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 in each watershed to record barometric pressure which is then used to 'correct' the stream pressure data to give water depth. Sensor sensitivity is better than 1cm. A staff gauge installed at each site is used by a field observer to record water depth on a daily basis as a reference and validation for the sensor data. The stage-discharge relationship at each monitoring station is needed to convert depth (stage) to

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flow rate, and requires measurement of flow rate for a range of low to high flow conditions. Basic equipment for flow measurement was provided for each watershed team including a flow meter, electrical conductivity testers, balance, and stopwatch. An important focus of the time in the field was to practice the flow monitoring tech niques using the flow meter and using the salt dilution (tracer) method.

In each watershed, weather stations, recording raingages, and manual raingages have been located to give good spatial coverage of the area. One complete weather station (rainfall, temperature, relative humidity, solar radiation, wind speed and direction, and barometric pressure) is located in each watershed, with 2-4 additional recording raingages throughout the watershed. Additionally, we have the cooperation of local observers to take daily records of rainfall using a "manual" gauge, and some of these observers also take daily readings of stream stage. The connections of the partners in the watershed are very important and the interest and commitment of local observers appears to be very strong. This collaboration with local observers is very important for the completeness and quality of the overall data collection effort in the watersheds.

The salinity dilution (salt tracer) method for estimating flow rate in the streams is very important in the project watersheds because it is a flow measurement technique that is suitable for use in turbulent mountain streams. Training on flow monitoring using the salinity tracer method and flow meter was an important component of site visits, both to collect background data, but also to provide hands-on training to clarify methods and ensure quality control.

Training was a key element of all activities during these trips: reviewing basic concepts of watershed hydrology and fundamentals of monitoring for water balance assessment, and providing specific instruction related to the installation, operation, and maintenance of different types of instrumentation. This has accomplished primarily through on-the-job training and 'hands-on' experience in the field.

Time during field trips was never sufficient to complete the installations and accomplish all objectives, and a list of tasks was always left to be completed. The strong support of the project directors (Victor Barrera, Ruben Botello, Jorge Cusicanqui) and the working collaboration with the lead watershed partners (Carlos Montufar, Ana Karina Saavedra, Mirco Peñaranda) has been excellent and greatly appreciated.

Summary of accomplishments across the 4 project watersheds:

- 17 stream gauging stations (pressure sensors and staff gauge) installed
- 4 weather stations installed and operating
- 13 recording raingages (tipping bucket) installed
- initial data on flow rates at each station
- training on flow monitoring using the salinity tracer method and flow meter for project teams at each location

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

1. Flow measurements to establish a stage-discharge curve for each stream monitoring site is a critical element of this watershed assessment program. The particular importance of obtaining flow estimates at high flow conditions has been stressed with each of the on-site cooperators. The salinity method and/or the flow meter may be used as appropriate, or in extreme conditions, a simple timed float to estimate velocity is valuable. Methods for the salinity tracer method continue to be refined, with documents also translated to Spanish.

2. For all sites, establishing a more complete raingage network is desirable to better account for the spatial variability in precipitation. The goal of using more community observers will be pursued as this engages the community and is much cheaper. Assessing the quality of data is then necessary.

List of Contacts Made:

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