Water-Quality Procedures for the Agua Salud Project

Water chemistry is used to describe the hydrologic and biogeochemical processes that provide water and nutrients to plants and break down bedrock to form soil. Three broad types of water samples are collected: grab samples (stream water, throughfall, overland flow, groundwater), stream-water event samples, and wet-dry collector rainwater samples. Grab samples are collected for low-flow (base-flow) conditions in streams on a regular basis and for other types of samples when conditions permit. Events are sampled automatically using an ISCO sampler that is triggered by rising stage and proceeds through a program that samples at frequent intervals early in the event and more slowly as the event recedes. The wet-dry collector has two sides, one collects dry fallout when the weather is dry and the other collects rain. The lid moves from on collector to the other when rain starts and returns when the rain ends.

We analyze many dissolved and solid phases including bioactive, major, and trace constiuents. Analyses are divided between those that are done in the field, because the measurement is easy or because the property being measured is not stable during storage, and those done in the lab. In the field, pH, conductivity, temperature, and dissolved oxygen are measured. Samples are brought back to the lab in coolers and are processed to preserve them for a suite of chemical analyses. Processing includes filtration through 0.22 μm hydrophilic polyethersulfone filters for trace-metal, major-constituent analyses, nutrient, and dissolved organic constituents. Samples are filtered through 0.22 μm polycarbonate filters for suspended solids. Cold is used to stabilize nutrients, organic phases, and major constituents, and ultra-pure acids are used to preserve trace metals. The hydrology lab analyzes the major constituents (Na^+, K^+, Mg^{2+}, Ca^{2+}, $Si(OH)_4$, Cl^-, SO_4^{2-}, alkalinity [with $pH=H^+$, OH^-, $H_2CO_3^*$, $HCO3^-$, CO_3^{2-}]), nutrient ions (NO_2^-, NO_3^-, NH_4^+, PO_4^{3-}), dissolved organic carbon (DOC), dissolved organic nitrogen (DON), , dissolved organic phosphorus (DOP), and several trace constituents (Sr^{2+}, Al^{3+}, Mn^{2+}, Fe^{2+}, Fe^{3+}, $B(OH)_3$, F^-) where detectable. Hydrogen and oxygen isotopes in water are analyzed using a Picarro L1102-i isotopic liquid water and water vapor analyzer. Of particular interest are results from similar tropical sites showing that the concentrations of bioactive constituents often increase with increasing discharge indicating that a significant portion of the fluvial flux of these bioactive constituents is lost under high-flow conditions - a "leak" that is often not sampled.

For the solid phases, total concentration, loss on ignition, and particulate organic carbon (POC) is measured in the laboratory. Eventually, samples on filters collected from each stream will be batched by stream discharge interval and analyzed for solid-phase chemistry (Na, K, Ca, Mg, Si, Al, Sr, Mn, Fe, Ti, Zr) and X-ray diffraction mineralogy. Overbank samples will be collected after major storms and analyzed for a suite of constituents.

The water-quality sampling program involves two technicians in the field and one laboratory chemist. One of the field technicians is responsible for chemical analyses done in the field, and the other for assisting in the collection of the samples and maintenance of equipment.