Rapid Hydrological Analysis of the Los Negros Watershed in support of a Compensation-for-Watershed Services (CWS) Mechanism

Donor: the Center for International Forestry Research (CIFOR)

Project Summary

Working in close coordination with local landowners, Natura is currently undertaking a *Rapid Hydrological Analysis of the Los Negros Watershed.* Not only will this study provide the hydrological data required to evaluate the basis of Natura's incipient Los Negros Valley CWS system, it will also provide guidance to the forestry research community on whether it is possible (and if so, how) to undertake rapid, inexpensive hydrological analyses that can provide a robust scientific basis for CWS systems.

Numerous small streams feed into the Los Negros River. The basis for charging for the "environmental service" provided by the upper watershed (and hence hypothesis this project is testing) is that as the watershed is increasingly deforested, water supplies will gradually reduce. In order to quickly address what is a temporal phenomena, we have reformulated the question as a spatial hypothesis: micro watersheds that are already deforested will produce less water than micro watersheds that still maintain their forest cover. Our interest is assessing differences in dry season water flow, when lack of water becomes the limiting factor for agricultural productivity. By assessing relative wet season/dry season flows within each micro watershed, we will factor out differences in the size of the watersheds. Student Alex Carrasco is currently assessing and measuring dry season stream flow in eight micro watersheds that have approximately the same wet season stream flow. We hypothesize that in the dry season, when rainfall is much lower, the watersheds that still have forest cover will produce significantly more water than those that do not. To measure this effect we will construct weirs and measuring stations in each micro-watershed and collect data on stream flow for one year.

Project Description

Hydrological research is expensive and time consuming. If CWS systems are really to integrate forest conservation and sustainable development in the world's poorest and most biodiverse watersheds, the forestry research community needs to find a quick and easy way of undertaking a sufficient level of hydrological analysis that while providing data of sufficient accuracy to guide the development of CWS systems, can be collected cheaply and rapidly by local institutions.

Though many of the nascent payments for watershed services systems in Latin America have been studied and analyzed by researchers, little attention has been paid to what is perhaps the most important basis of all such systems: the hydrological characteristics of the watersheds that are purportedly providing the "environmental service". In most systems, there is simply an assumption that reducing forest degradation will maintain stream flow. In other words, most existing CWS systems have at their fundamental base an untested assumption of a direct forest/water relationship.

With support from the Center for International Forestry Research, Natura Bolivia is undertaking a *Rapid Hydrological Analysis of the Los Negros Watershed*. Not only will this study provide the hydrological data required to support (or destroy!) Natura's incipient Los Negros Valley CWS system, but it will also provide guidance to the forestry research community, CIFOR, and practitioners on whether it is possible (and if so, how) to undertake rapid, inexpensive hydrological analyses that can provide a robust scientific basis for CWS systems.

In the Rio Los Negros watershed, there is a registered concern over the state of the river, especially the water level. Preliminary results of a survey conducted in the watershed point to an overwhelming consensus that the river is much lower than it was in past decades and that the level continues to diminish, especially in the dry season. According to local residents, the main water problems are erosion, diminished water flow and sedimentation.

Indeed, the dropping water level has been a point of contention among community in the watershed. In the early 1990s, residents of Los Negros blocked the road to Santa Rosa, demanding that no more colonists enter and cut the forest at the headwaters. On a separate occasion, Los Negros sent a commission of government officials to Santa Rosa to arrange a system of 'irrigation turns' which would regulate how much and when irrigators could divert water from the river to their fields. In Los Negros, irrigators have organized themselves to construct and maintain 8 canals, a number of which have been operating since the 1960s. All the canals have rules, regulations and enforcement systems, and each charges a membership fee and dues. There is thus, already a well-regulated, complex system of management—and payments for water services—in the lower part of watershed.

Numerous small streams feed into the Los Negros River. The basis for charging for the "environmental service" provided by the upper watershed (and hence hypothesis we are testing) is that as the watershed is increasingly deforested, water supplies will gradually reduce. To address this hypothesis in an experimental design, we first assessed and mapped land use using satellite images in a number of micro (~ 1-2 km^2) watersheds. Field visits than confirmed

whether micro watersheds were still forested or not, and located potential sites for undertaking field measurements of stream flow.

In order to quickly address what is a temporal phenomena (i.e. over time, with continued deforestation, stream flow will reduce), we reformulated the question as a spatial hypothesis: micro watersheds that are already deforested will produce less dry season water than micro watersheds that still maintain their forest cover. Our interest is differences in water flow in the dry season, when lack of water becomes the limiting factor for agricultural productivity. By assessing relative wet season/dry season flows within each micro watershed, we will factor out differences in the size of the watersheds. The hypothesis we are testing, therefore, is that:

In comparison with wet season stream flow, dry season stream flow in deforested watersheds will be relatively lower than dry season stream flow in watersheds that still retain forest cover.

We will assess and measure dry season stream flow in eight (~ 1 km^2) watersheds that have ~ the same wet season stream flow. We have already selected four watersheds that still maintain significant forest cover, two that are partially degraded and two that have lost much of their forest cover. We hypothesize that in the dry season, when rainfall is much lower, the watersheds that still have forest cover will produce significantly more water than those that do not. To measure this effect we have constructed weirs and measuring stations in each micro-watershed and collect data on stream flow for one year. The relevant comparisons will be *within* watershed (to factor out size differences), so our expected results will be, for example, deforested watersheds produce 20% of their wets season flow in the dry season, while forested watersheds produced 60% of their wet season flow.

We expect that such results, if sufficiently differentiated, will be appropriate for assessing the validity of assuming the forest/water relationship. In addition to stream flow measurements we

ware also measuring precipitation in each of the micro watersheds. This will allow us to assess if differences in rainfall regimes could cause hydrological patterns.