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Effects of slash & burn vs. slash & mulch on water, solute, and sediment dynamics at the watershed level

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The research objective of this sub-project (part of ENV25/3) is to establish which changes occur in the water and nutrient dynamics at watershed and sub-watershed level when farmers move from slash-and-burn to slash-and-mulch fallow clearing techniques in Eastern Amazonia. Over a period of two sequential years water-, nutrient-, and sediment fluxes will be monitored at different spatial scales in a nested series of catchments near the town Igarapé Açu.

Mulching will in general decrease nutrient losses to the atmosphere but this may be partially offset by increased leaching and irretrievable loss of nutrients from the region through groundwater and surface water movement. Also, the mulch may affect overland surface run-off and thereby reduce sediment transport and associated nutrient losses. Monitoring of groundwater movement and stream flow composition will determine whether any significant changes occur in the water-, nutrient, and sediment fluxes.

This research builds on the experience from phases I and II (project ENV25/1 and /2), in which at point level, little nutrient leaching was found to occur over the year. There are two reasons to extend mass balance measurements to the watershed level. The first reason is that in the field studies, downward water movement was indirectly calculated as the difference between precipitation and actual evapotranspiration. The only way to prevent that all measurement errors accumulate in the downward movement part of the water balance, is to measure this component independently as groundwater recharge and watershed discharge. The second reason is that nutrients often move along preferential pathways during peak flow which can not reliably be sampled at point level. By measuring at the watershed level, one integrates over larger areas and time spans, thereby catching peaks and preferential flow paths. It is very well possible that the preferential nutrient movement is not very important in the homogenous sandy soils of the project area, but direct measurement of nutrient outflow is important to establish the conditions under which the developed techniques can reliably be used.

Determination of the extrapolation domain of the technologies developed in the second phase is an important goal of the third phase. By analyzing the processes governing water and nutrient movement at the landscape and watershed level, reliable predictions can be made about the physical suitability of fallow management practices outside the direct project area.

In order to meet the overall aim, the following specific research objectives will have to be met:

- Obtain a closed water balance for a set of experimental watersheds with different fallow clearing techniques by measuring rainfall, actual evapotranspiration, and stream flow
- Measure total nutrient and sediment outflow
- Measure and model the main water and nutrient flowpaths in order to reliably establish the extrapolation domain of the obtained results
- Compare Phase II point measurements with Phase III watershed measurements.