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The impact of land use changes on water pathways, soil formation and soil functioning

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The major role played by the hydrology in controlling biogeochemical fluxes at various scales has been highlighted in several studies (e.g. Van Gaelen et al., 2014; Jiang et al., 2010). Numerous studies have highlighted different factors controlling water fluxes at the hillslope or catchment scale, such as physico-chemical soil characteristics and structure (Uhlenbrook et al., 2008) and soil thickness (Buttle et al., 2004).

Given the potential important impact of land use changes on water fluxes (Özturk et al., 2013), it is surprising that relatively few studies investigated the impacts of those changes. This does not only imply that the consequences of land use change on hydrological and biogeochemical pathways and fluxes are still difficult to predict but also that we lack critical information on how such changes may feed back to soil processes. Therefore, it remains impossible to assess to what extent land use conversions may affect biogeochemical processes in soils and/or soil production through weathering.

The overall objective of this research project is therefore to investigate how land use change affects water and biogeochemical fluxes and how these changes may, on their turn, affect soil and landscape development on the long term. In order to achieve this objective it is necessary to not only assess the effect of land use on fluxes leaving the catchment, but also on how land use change affects water pathways and water chemistry within the catchment. This requires the combined use of a wide range of classical and novel techniques.

Two catchments with contrasting land use (agriculture vs. natural forest) were selected in a subtropical region in the south of Brazil. Soil sampling, stream discharge monitoring and sampling, pore water sampling, groundwater monitoring and sampling, and geophysical techniques (Time Domain Reflectometry and Electro Magnetic Induction) are combined to yield information on water and solute movement at the plot, slope and catchment scale. The combined interpretation of these information sources will improve our understanding of the interactions between the water fluxes and the soil system under different land use systems. Combining these data with detailed studies of clay mineralogy and weathering will allow to gain first insights on how land use changes may affect biogeochemical processes and soil weathering at the landscape scale.