(1) Introduction and research question:

Brazil’s natural ecosystems of the state Mato Grosso included Cerrado, Pantanal and rainforest. Between 1992 and 2005 extensive forest clearance rates of 5000 to 11,000 km² and 2000 to 4500 km² per year from 2006 has been ascended for mechanised agriculture in Mato Grosso. The toy production has increased in the same period from 3 to nearly 20 Million tons per year (see Figure 4) and further expand can be easily implemented in the Cerrado and forest transition region (Jasinski et al. 2005). This development is enhanced by the paving of highways (Cuaba-Santarém) as export corridor for cash crops using the Amazon River then (Fearnside 2007).

The Tenente Amaral catchment is situated in the Northeast of the Pantanal Basin with an extension of nearly 865 km² and comprises nearly 20000 ha of the Pantanal area, which is a major feeder of the Pantanal floodplain. Erosion is figured out to be a major threat in this catchment which comes along with continuously increasing sediment discharges in the São Lourenço River in the last decades, too (Horwitz and Walling 2005). Wantzen et al. (2006) showed in an impact assessment approach that 90% of the catchment is moderately or strongly impaired. It is believed that the combined effects of land-use change lead to high concentrations of sediment-attached nutrients and has strong impact on water quality and pollution through sedimentation in the Pantanal. These negative effects can be strengthened if the predicted double cropping practice for soybean will take place in the Cerrado ecosystem (Wantzen et al. 2006).

To produce this high biomass yields it is required to apply large amounts of fertilizer and lime because the dominating dystrophic soil type Oxisol shows an acidic reaction which reduces the P availability (Wildic & Liiteren 2005). The interactions between current land-use such as continuous crop production under intensive management and the biogeochemical and hydrological cycling have to this end not received much attention. We want to use a meso-scale ecohydrological modelling tool (SWAT) to simulate current and future feedback mechanisms. To enable modelling, we plan an extensive field campaign that focuses on the two key interacting compartments to further understanding vegetation-soil-water interactions.

(2) Study Area

The Tenente Amaral catchment is situated in the Northeast of the Pantanal Basin with an extension of nearly 865 km² and elevators ranging between 400 and 800 m a.s.l. The climate is Aw (humid tropical savanna climate) according to the Köppen classification with a distinctive dry season between May and September. The mean average temperature is about 25 °C with an annual average rainfall of 1400 mm. The Rio Tenente Amaral is a tributary of the São Lourenço River which is a major feeder of the Pantanal floodplain. Erosion is figured out to be a major threat in this catchment which comes along with continuously increasing sediment discharges in the São Lourenço River in the last decades, too (Horwitz and Walling 2005). Wantzen et al. (2006) showed in an impact assessment approach that 90% of the catchment is moderately or strongly impaired. It is believed that the combined effects of land-use change lead to high concentrations of sediment-attached nutrients and has strong impact on water quality and pollution through sedimentation in the Pantanal. These negative effects can be strengthened if the predicted double cropping practice for soybean will take place in the Cerrado ecosystem (Wantzen et al. 2006).

The Soil Water Assessment Tool (SWAT) (Arnold et al. 1998) is a river basin scale and process oriented ecohydrological model under public domain. It is applied widely for meso-scale ecohydrological modelling on all continents and in different ecosystems (Gassman et al. 2007). The major goal of the development of SWAT was to quantify management practices and scenario analysis in complex watersheds. It is a continuous time routing model which operates with a daily time step for 1-100 years. The model is coded in ArcGIS, ArcView-GIS and MapWindow-GIS environment, too.

(4) Modelling:

The Soil Water Assessment Tool (SWAT) (Arnold et al. 1998) is a river basin scale and process oriented ecohydrological model under public domain. It is applied widely for meso-scale ecohydrological modelling on all continents and in different ecosystems (Gassman et al. 2007). The major goal of the development of SWAT was to quantify management practices and scenario analysis in complex watersheds. It is a continuous time routing model which operates with a daily time step for 1-100 years. The model is coded in ArcGIS, ArcView-GIS and MapWindow-GIS environment, too.

SWAT contains process descriptions for:

Hydrology (based on water balance equation): Precipitation (spatial and temporal), runoff generation, evapotranspiration, interception, infiltration and percolation, soil water balance, groundwater recharge.

Nutrients and chemicals: Estimation of nitrogen, phosphorus, potassium, calcium, magnesium, bicarbonate, sulfate, nitrate, phosphate, nitrate, nitrite, ammonium, chloride, sodium, and potassium.

Erosion (based on MUSLE) and sediment transport: Sediment detachment, sediment transport and routing, sediment deposition.

Channel processes: Channel routing, sediment routing, chemical routing.

Plant growth and agriculture: Growth cycle, biomass production and management practices (crop rotations, tillage, biomass harvesting).

Model application and scenario development concerning land use change, climate change and agricultural production of different crops and management practices to assess:

a.) interactions of availability of water and nutrient resources, erosion and their cycling with intensive biomass production;

b.) impacts of sustainable management options such as crop and plant rotation schemes on water, sediment and nutrient cycling;

c.) biomass production as a function of different crops and agricultural practices considering different schemes to minimise soil erosion and nutrient depletion.