



MSc Theses Opportunities

We offer several MSc thesis opportunities in two research projects that are currently conducted by the Geo04 group (Geografia Fisica e Geomorfologia). The first project is dealing with land use changes in southern Ticino Switzerland. The second project is addressing Calanchi forms and process dynamics in the Oltrepo area, Southern Lombardy.

Land use changes in the Onsernone valley (Ticino, Switzerland)

Agriculture constitutes the ecologically most intense and, in terms of surface area affected, largest anthropogenic impact into natural soil landscapes. Within a third-party funded project (ATB, Potsdam Germany and DFG), sensor-based soil characteristics will be collected in the field that are able to detect and quantify land use-induced soil changes. Furthermore, the land use history of the study area will be spatially determined by means of remote sensing and GIS. The combination of the soil and remote sensing data will finally lead to a model of the land use-induced anthropogenic influence on natural soil landscapes.

1. SWAT hydrologic model of the upper Onsernone Valley

Watershed models are valuable tools used in the study of impacts of land use/cover (LULC) changes on hydrology. The Soil & Water Assessment Tool is a model used to simulate surface and ground water and predict the environmental impact of land use, land management practices, and climate change. SWAT is a distributed, process-based watershed model, but with significant number of empirical relationships. Major hydrologic processes that can be simulated include surface runoff, infiltration, shallow aquifer and deep aquifer flow, and channel routing.

2. Soil Erosion Modeling of slope systems in the Southern Ticino Switzerland

Soil erosion models, such as WEPP EROSION 2D/3D or USPED, will be tested on small watersheds within the Onsernone Valley, using observed rainfall and related surface runoff and sediment yield. Three watersheds will be selected with varying land use types. The erosion models will be applied for the specific return period of rainfall events.

3. Investigation of Soil and Lithological Distribution by Geophysical Investigations

The Profiler EMP-400 is a frequency domain, electromagnetic profiling system that is widely used to better understand the spatial variability of soils and soil properties. They measure changes in the apparent electrical conductivity (EC_a) of the subsurface without direct contact with the sampled volume. The thesis objective is to compare the south-facing slopes and the north-facing slopes to detect hydrologically active areas, higher clay contents and soil water conditions. The measurements will be calibrated and validated with 2D electric resistivity tomography transects and soil moisture probes.

4. Soil Characteristics via Multispectral Analysis

Recent advances in measuring radiance from the earth's surface using multiple-wavelength scanning spectrometers and, in the application of computer-implemented pattern recognition techniques have resulted in detecting various earth surface features with extreme rapidity and varying degrees of accuracy. The thesis is aimed to measure spectral information and to compare this information with spectral libraries in order to determine the mineral composition of specific soils in the study area.

5. Geomorphological Mapping

Geomorphological maps can be considered graphical inventories of a landscape depicting landforms and surface as well as subsurface materials. Geomorphological mapping is a preliminary tool for land management and geomorphological risk management, also providing data for other sectors of environmental research such as landscape ecology, forestry or soil science. The student will work with existing references and field work on delineating a map.

Qualitative and quantitative assessment of soil erosion dynamics in calanchi areas: The Oltrepo Pavese case study.

The thesis is aiming at a qualitative and quantitative assessment of soil erosion processes related to the Calanchi areas of the Oltrepo Pavese. Therefore, innovative techniques will be applied such as a rainfall simulator and automatic suspended sediment sampling and analyzing methods. The field work information will be later used for the application of GIS-based simulation models for a small test area close to Varzi.



For further questions please contact:

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