ENVITAM

GEPROC
Ecole doctorale en GEnie des PROCédés

Joint PhD-Student day, 8 february 2012

Title : Relevance of pedotopographical indicators in the assessment of spatial distribution of soil water resources under forest stands. General Methodology.

Authors : F. Ridremont[1] & H. Claessens[1]

Authors affiliation :
Univ. Liège, Gembloux Agro Bio-Tech, FNP, Forest and Nature Management

Corresponding email address: francois.ridremont@ulg.ac.be

Abstract :

Water resources constitute one of the most decisive factors of the adaptation of forest ecosystems facing climate changes. The assessment of soil water resources should lead a better understanding of forest sites vulnerability to water stress and provide appropriate management recommendations for the choice of trees species and sylvicutlural techniques.

This study aims to confront mapping pedotopographical indicators related to the water resource richness of forest sites to the soil moisture regime. The effect of soil moisture on the forest ecosystem productivity and the bioindicator expression of flora will be study too.

The study area is located in shale - slate stones pedological context of the Belgian Ardenne ecoregion (Vencimont-Gedinne). Forests occupy 90% of the watershed and the forest composition is dominated equally between broadleaved species (*Quercus* sp. and *Fagus sylvatica* L.) and coniferous species (*Picea abies* (L.) Karst. and *Pseudotsuga menziesii* (Mirb.) Franco).

The general methodology will be based on the following steps:

1. Terrain investigations to localize potential study sites which must cover topographic heterogeneity of the watershed.
2. Selection and characterization of the 25-30 sites :
   - Terrain analysis to derive topographic indicators from Digital Elevation Model using mapping software. Terrain attributes selection and classification will be processed to identify major landforms of the study area that have an influence on the dynamics of soil water. Different levels of map resolution will be test using classical topographic data and Lidar dataset.
   - The physical and chemical properties of soil having a relation with soil moisture (texture, organic matter content….) will be measured through laboratory analysis and the Automatic Resistivity Profiling (ARP) or the Ground Penetrating Radar (GPR) technologies will be used to better understand soil organization (depth, stones content…).
   - The evolution of water content in soil profile (70 cm) and the distribution of subsurface soil water (15 cm) will be assessed using Time Domain Reflectometry (TDR) technology. TDR access tube will be installed on the 25-30 selected forest sites and subsurface measures will be based on a systematic sampling.
   - The forest ecosystem productivity will be assessed using a biomass index derived from forest plots devoted to a diameter growth and canopy cover monitoring.
   - The floristic approach using bioindicator plant species is considered like a practical alternative to estimate soil moisture in the common forest management. The humidity indices of Ellenberg (1992) and Noirfalise (1984) will be derived from complete phytosociological relevés.
3. Analysis of data will be based principally on supervised (CART – Neuronal Network)

and unsupervised learning (ACP, k-Means…) to clarify the relationship between soil properties, soil moisture regime and biotic effect on ecosystem biomass and floristic expression.

It is expected that the results help forest managers in the edition of tools efficient to ensure a better match between tree species and forest sites and so to increase the resilience of forest ecosystems to climate changes.