Mediterranean Forests in Transition (MEDIT): Deliverable No6

Title: Database of plant functional traits and environmental conditions for the study sites

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Summary

This report summarises the structure and functionality of the MEDIT database. This database has been developed in the Microsoft Access 2007 software and provides users with a functional tool to link all the measurements made and data gathered during the MEDIT project. It will eventually be released for open access or incorporated into the TRY dataset, once the key publication arising from the project have been published.

Introduction

The measurements included in the MEDIT dataset can be hierarchically categorized to three level:

- Data refereeing to the organ level. Here all leaf level measurements including leaf structure, i.e leaf area (L_A), leaf thickness (L_T), leaf dry and wet mass (L_M), leaf dry mass per area (M_A) and leaf dry matter content (LDMC) can be found. Leaf chemistry data are also included at this level, i.e. leaf concentration of elements such as C, N, S, P, Mg, Ca and K. Leaf biochemical fluxes data are also incorporated, including, leaf saturated photosynthesis (A_{sat}) and dark respiration (R_d), as well as a number of parameters used to infer these rates in empirical models of photosynthesis, such as carboxylation efficiency (V_{max}), electron transport rate (J_{max}) and stomatal conductance (g). Wood density is also included here as a proxy of "fast to slow" strategy (Reich 2014). Indices of leaf flammability are also grouped at this level. All these functional characters are used to infer the way plants are building their photosynthetic tissue and use available resources to optimise carbon acquisition under given environmental conditions. They thus can be used to explain short term plant growth.
- Data refereeing to the whole plant (individual) level. These data include biometric characteristics of the plants such as diameter at breast height (D) and height (H). Wood density and flammability could also be included here to infer the integrated plant strategy in terms of distributing the resources and dealing with disturbances. Finally tree ring measurements such as ring width per

year (RW) and standardised ring width index (RWI) are categorised at this level. Estimates of optimum growth curve used both in model and statistical analysis have been include. These data can be used to infer the long-term growth patterns of the tree species of interest.

- Data refereeing to the community (stand) level. These data characterise the abiotic and biotic conditions of the MEDIT plots. They include classic topographic parameters such as altitude slope and orientation of the study plots, edaphic parameters such as soil type, depth, sand/clay/silt fractions as well as water holding capacity (WHC). Climatic parameters extracted from the very high resolution WORLDCLIM dataset as also linked here, expressing the long term prevailing climate. Measurements of leaf area index made both at the whole stand level as well as in 5 subplots are used to infer both the standing biomass of the plots and the light conditions at the forest floor. An important element at this level is the complete stand description, of tree by tree measurements established in the study plots. Diameter has been measured at each mature (D>1cm) tree in the plot and in around 60% of the trees we have also measured tree height. Species richness within the study plot and regeneration measurements are also linked here. These data are used to fully describe the stand structure.

Table 1: Summary of the MEDIT dataset with variables measured categorised at discrete hierarchical level of ecosystem organisation.

Measurement	Traits/ Variables	No Samples
Organ Level		
Leaf structure	L_A, L_T, M_A, LDMC	643
Leaf chemistry	C, N, S, P, Ca, Mg, K	643
Leaf Fluxes	Asat, Vmax, Jmax, Rdark, gs	389
Wood	WD	643
Leaf Flammability	Smoke, Pyrolysis and Flame Time and Temp	125
Individual Level		
Diameter	D	8982
Height	H	5846
Tree Cores	Annual Growth (RW,RWI)	282
	Long-term estimates (Gm, Do, Db)	
Community Level / MEDIT sites		
Topography	Altitude, Slope, Orientation	70
Soil Mechanical Properties	Soil Type, Depth, WHC, Sand/Clay/Silt	61
Chemical Properties	pH, ECEC, SOM, C, N, P, Ca, Mg, K	61
Climate	19 bioclimatic variables from WORLDCLIM	70
Total Leaf Area Index	LAI	40
Richness	At 1, 6.25, 25, 100 and 900 m^2	40
Stand structure	Tree by Tree	40
Regeneration	5 subplots (1x1m^2) within the 900m^2	40

Material and Methods

The raw data obtained from field and/or laboratory measurments were initially recorded in spreadsheets. Data quality control was then applied to identify outliers and potential errors. In cases outliers were found they were either removed ot marked as strange values not to be used in the statistical analyses. All these spreadsheets were then incorporated in the MEDIT dataset. A set a clssic queries for example a link with site specific conditions and mean community level traits, or mean regeneration density were developed. The user is able to define any query that he/she requires. The following image presents the structure and functionality of the dataset.

Figure 1. A snapshot of the MEDIT dataset with an example query linking environmental conditions to recruitment rates.
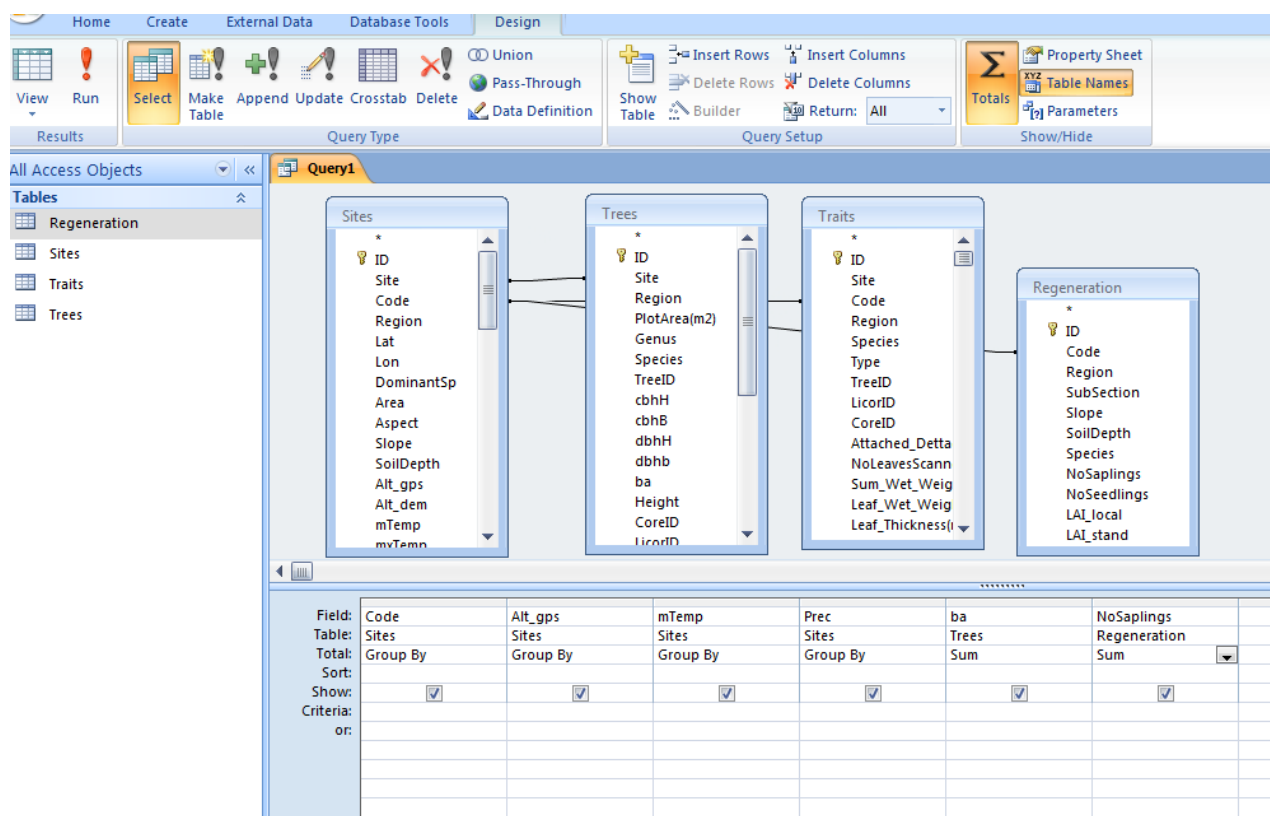
The MEDIT dataset is delivered as a Microsoft Office 2007 file (MEDIT_database.accdb).

Concusions

All measurments made during the MEDIT project have been organised in a functional database that provides a hierarchical structure and links between different levels of the forest areas that were studied. This database has been used to combine the measurments made and organise the file for analysis presented in deliveables D5.1 and D5.2.