ASSISTING DECISION ON THE LAND SUITABILITY FOR GREENHOUSE PROJECTS

ASISTAREA DECIZIEI ASUPRA PRETABILITAȚII TERENULUI PENTRU ÎNFIINȚAREA DE SERE

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Abstract. *Making a decision in starting a greenhouse project implies assessing different factors. The land suitability is one of the most important of them. The land suitability is finally decided as a result of field work and laboratory physical and chemical analysis. The overall decision is made from partial ones regarding the soil properties (such as soil texture, edaphical volume, salinization, and alkalization), the land unit characteristics, the ground water level, and others. To assess the different soil properties, the field data and the laboratory results must be framed in the land suitability classes settled for greenhouses. Official tables and recommendations are available for this purpose, but an automation of this process would bring obvious advantages. The paper proposes a series of procedures to automate search and to make decisions. These procedures are part of a more complex software application in process of development within an academic Grid computing project initiated by four universities and a research institute from Iasi, Romania.*

Rezumat. *Luarea unei decizii referitoare la înființarea unei sere implică evaluarea unei serii de factori. Pretabilitatea solului pentru sere şi solarii are o importanță deosebită. Ea se stabileşte în urma prelucrării datelor obținute în etapa de teren şi a celor rezultate din analize de laborator. Pentru a evalua diferite proprietăți ale solului, datele obținute în teren şi rezultatele de laborator trebuie încadrate în intervalele de valori corespunzătoare unor clase de pretabilitate. Astfel de recomandări se găsesc în metodologia oficială de efectuare a studiilor pedologice, dar o automatizare a acestui proces aduce beneficii evidente. Lucrarea propune o serie de proceduri de automatizare a procesului de cautare in normele metodologice existente şi de emitere a recomandarilor de utilizare şi ameliorare a unităților de teren studiate.*

Locating a greenhouse is often dictated by a series of preconditions like water resources, market requirements and other factors. Moreover, a greenhouse is a protected space that requires long term monitoring of soil features, especially those ones that are easily modifiable. This is why a pedological study is necessary in order to decide if the respective land unit is suitable for starting such a project.

In complex decision situations a large amount of data are involved and the decision maker needs support from a computer system. A software used for those purposes is called Decision Support System (DSS). It is expected to aid the decident to make the best decision. The type of support can be very different [2], from filtering useful information from large masses of data to evaluating alternatives or comparing plans with achievements. Such a software tool could bring benefits within a pedological study for a greenhouse project.

MATERIAL AND METHODS

A pedological study regarding a greenhouse location comprises a terrain phase, a laboratory phase and a data processing phase. In the terrain phase, specific observations are made on the geology, lithology, hydrography, morphology and other soil features. Climate observations are also made. In the laboratory phase physical and chemical analyses are preformed on soil samples. The results are then compared with the observations made in the terrain phase. The resulted data must be processed in order to make a decision.

Official classifications of soil types divide greenhouse soils in classes, subclasses, groups and subgroups [3]. Classes represent the highest grouping level. Situating a soil in a certain class is determined by different restricting factors, the most intense of them being considered as determinant. The following classes are defined for soils that are to be used for building greenhouses:

Class I – soils with no restrains or degradation risks;
Class II - soils with low restrains or degradation risks;
Class III - soils with moderate restrains or degradation risks;
Class IV - soils with severe restrains or degradation risks;
Class V - soils with extremely severe restrains or degradation risks.

The general approach is to study several soil profiles from the respective land unit and to draw a global conclusion from the partial ones. There are several horizons in each soil profile, that is relatively homogenous soil layers that must be identified and measured. A standard depth of about 50 – 100 cm is also designated.

STRUCTURE OF THE DECISION SUPPORT SYSTEM

To assess the different soil properties, the field data and the laboratory results must be framed in land suitability classes for greenhouses. Official tables, recommendations and other reference materials are available for this purpose, but because of the great amount of data, an automation of this process would bring obvious advantages. This is where the Decision Support System intervenes.

The DSS will receive as input the terrain and laboratory data. As output, it will produce a report which during the data processing was step by step enriched with partial conclusions regarding the land suitability from different points of view like soil texture, edaphic volume, salinization, alkalization, terrain slope, Calcium Carbonate contents, nonuniformity degree, humidity excess, lateral drainage. An overall conclusion is suggested in the end of the report.

The system uses a database that stores in tables the existing official recommendations and classifications. These documents were processed to extract and systematize the useful information. Normalizations were made where necessary to bring the tables to an acceptable relational form. The system is designed to accept future adding of new tables when appropriate.

The objective for the Decision Support System is to help making decisions on the soil suitability for greenhouse projects. The general system has three categories of components: experimental input data, standard indicators and soil properties, and a set of algorithms that process the input data on the basis of existing standards and draw the conclusions regarding the land suitability for building a greenhouse.

The architecture of the Web DSSm is presented in the figure 1:

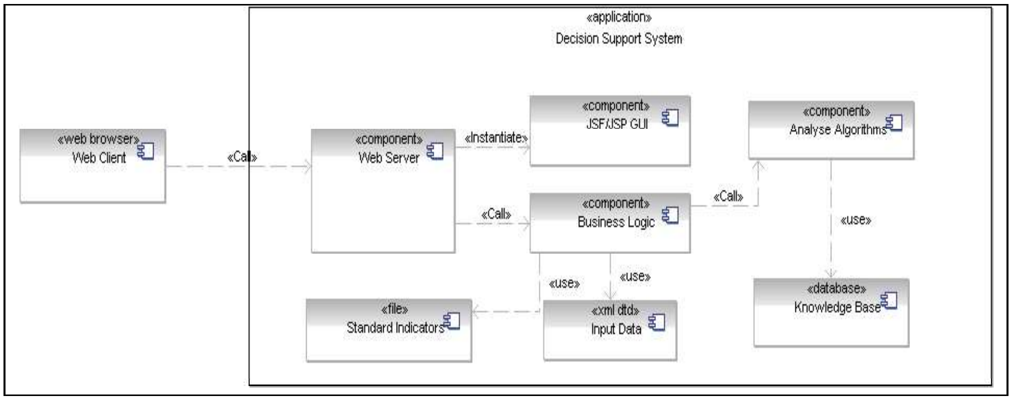
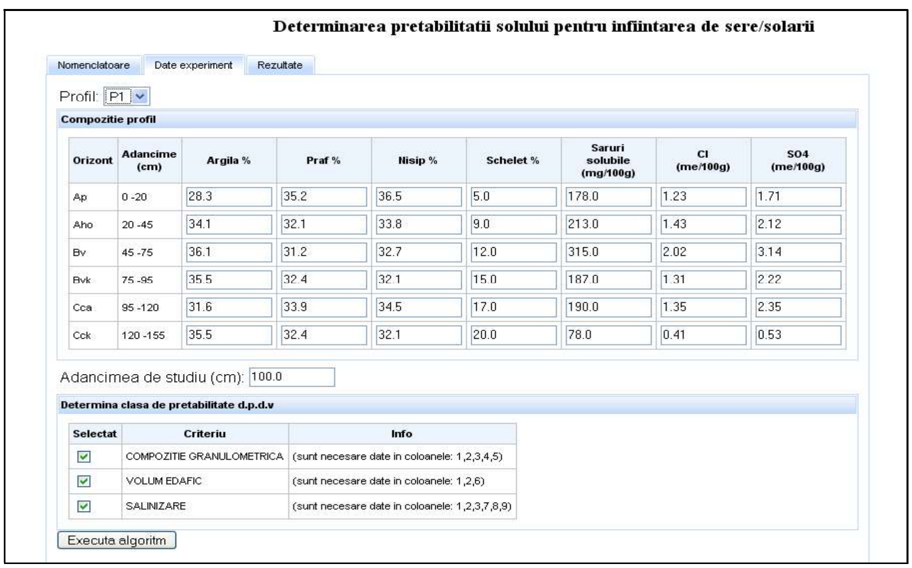


Fig.1 - The architecture of the Web Decision Support System for Greenhouse

The user interface page has three tabs: Nomenclatoare (i.e. Nomenclature), Date experiment (i.e. Experimental Data) and Rezultate (i.e. Results).



Orizont	Adancime (cm)	Argila %	Praf %	Nisip %	Schelet %	Saruri solubile (mg/100g)	Cl (me/100g)	SO4 (me/100g)
Ap	0 -20	28.3	35.2	36.5	5.0	178.0	1.23	1.71
Aho	20 -45	34.1	32.1	33.8	9.0	213.0	1.43	2.12
Bv	45 -75	36.1	31.2	32.7	12.0	315.0	2.02	3.14
Bvk	75 -95	35.5	32.4	32.1	15.0	187.0	1.31	2.22
Cca	95 -120	31.6	33.9	34.5	17.0	190.0	1.35	2.35
Cck	120 -155	35.5	32.4	32.1	20.0	78.0	0.41	0.53

Selectat	Criteriu	Info
☑	COMPOZITIE GRANULOMETRICA	(sunt necesare date in coloanele: 1,2,3,4,5)
☑	VOLUM EDAFIC	(sunt necesare date in coloanele: 1,2,6)
☑	SALINIZARE	(sunt necesare date in coloanele: 1,2,3,7,8,9)

Fig. 2 – The input data page

The Date experiment section is shown in figure 2 as an example. One can see two sections in this page: one for data input and another for selecting, through checkboxes, the desired analysis criteria.

The results (Rezultate) tab displays the resulted reports pursuant to applying the analysis algorithms. In figure 3 is shown as example the report regarding the suitability from the edaphic volume point of view.

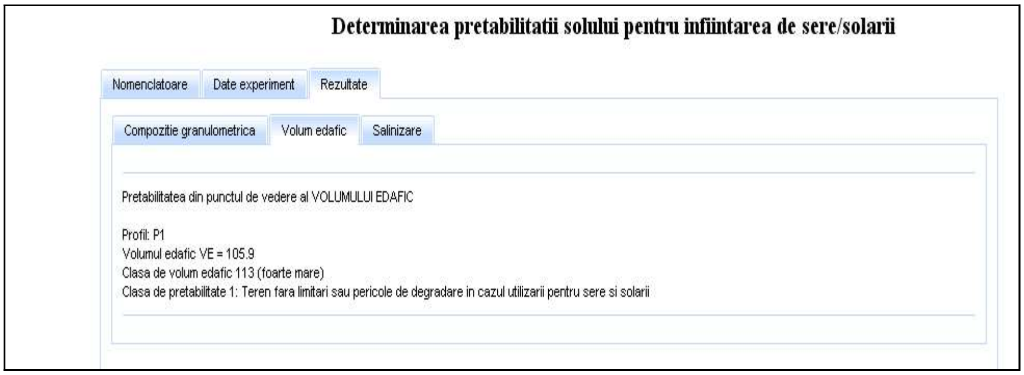


Fig. 3 – The reports page: edaphic volume tab

The DSS is developed as a service within an academic Grid Computing structure called GRAI. The term Grid Computing denominates [1] an infrastructure for parallel/distributed computing that implies using organized software components that run on a large number of computers.

CONCLUSIONS

A Web Decision Support System in soil suitability for greenhouse projects is under development as a service on a Grid Computing infrastructure.

Future work is focused on a deeper evaluation and optimization of the implemented algorithms and on extending the Grid services and Web DSS.

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