FOREST SOILS FROM CARAŞ-SEVERIN COUNTY

SOLURILE FORESTIERE DIN JUDEȚUL CARAŞ-SEVERIN

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Abstract: *Forest soil is a general term used in several soil classifications, especially in European literature, for specific soil taxa formed in temperate climates under forest vegetation, native or introduced. Soils under forests are quite varied, but in Caraş-Severin county, dominated Eutric and Dystric Cambisols (71,21%) with Haplic and Albic Luvisols (20,60%). Other types of soils are Leptosols and Rendzic Leptosols, Entic and Haplic Podzols. A very small areas are covered with Stagnic Cambisols or Luvisols. Litter organic matter, interacting with mineral soil particles, contributes to building and maintenance of soil structure and accompanying porosity, and water- and nutrient- holding capacity. There are three broad categories of littler layers or humus forms in the forests soils: mull, moder and mor. Mulls contain what are designated as Ol (SRTS) or L, F, Oi, Oe, horizons. Mor humus types, often forming in coniferous forests is slow to decompose and be incorporated with mineral soil materials in a very thin or absent Of (SRTS) or L, F and H layers.*
Human activities influence in forest soils from Caraş-Severin properties and processes. Effects of acid rain and related pollutants including in some cases heavy metals have been studied.

Rezumat: *Noțiunea de "sol forestier" este o denumire cu character general, folosită în unele clasificări de sol, în special în literatura europeană, pentru o categorie specifică de sol, formată în climatul temperat, sub vegetație forestieră, naturală sau plantată. Solurile sub vegetație forestieră sunt foarte diverse, dar în Jud. Caraş-Severin dominante sunt Cambisolurile (71.21%) - Eutricambiosolul şi Districambiosolul, cu Luvisolurile (20.60%)- Luvosol tipic şi Luvosol albic. Alte tipuri de soluri forestiere sunt Litosolurile, Rendzinele, Prepodsolul şi Podsolul. Suprafețe foarte mici sunt acoperite de Stagnosol. Materia organică a litierei interacționează cu particulele minerale de sol şi contribuie la construirea şi menținerea unei structuri de sol şi implicit a unei porozități ce măresc capacitatea de reținere a apei şi a nutrienților. Există trei categorii mari de straturi de litieră şi humus formate în solurile forestiere: mul, moder şi mor. Mulul forestier este conținut în orizonturile Ol (SRTS) sau L, F, Oi, Oe. Tipurile de humus mor, frecvent formate în pădurile de conifere, sunt greu de descompus şi se încorporează în materialul mineral de sol într-un strat foarte subțire (sau absent) Of (SRTS) sau L, F şi H. Activitatea umană afectează proprietățile şi procesele solurilor forestiere din Jud. Caraş-Severin. Au fost studiate şi efectele ploilor acide şi a poluanților, incluzând şi metalele grele asupra pădurilor şi solurilor forestiere.*

Key words**:** *forest, soil, litter, mull, moder, mor*
Cuvinte cheie**:** *forestier, sol, litieră, mul, moder, mor*

INTRODUCTION

Forest soil is a general term used in several soil classifications, especially in European literature, for specific soil taxa formed in temperate climates under forest vegetation, which consisting of one several species of trees, usually accompanied by shrubs, grasses, etc. Closed forests, woodland, broad-leaf, needle-leaf, deciduous, succulent, evergreen and extremely evergreen forests, scrubs, and dwarf scrubs fall within this kind of vegetation. Soils under forests are quite varied from Luvisols in temperate climates to Ferralsols (2) in tropical ones. All dead vegetation and partly decomposed organic matter, including litter and

nonincorporated humus, being on the soil surface under forest vegetation and not yet integrated in the topsoil horizon.

The surface layer of the forest floor consisting of different fresh, non-decomposed or very slightly decomposed material. The dead plant material consists of lignocelluloses with an average composition of 15-16% cellulose, 10-30% hemicelluloses, 5-30% lignin, and 2-15% protein. Minor components are phenols, sugars, amino acids, and peptides, as well as numerous secondary metabolites. Most of the compounds are used as nutrient and energy sources for microbial growth.

Soils main contain several tons of organic matter per hectare. Plant debris, may become resistant to microbial degradation by interaction with minerals, whereas its completely humified products are produced by random condensation of refractory plant and microbial products. Their diversity and lack of regular polymeric structures do not favor efficient enzymatic degradation and energy production.

Crushing of macro aggregates provides plant-derived material from roots or leaves colonized by microorganisms, which decompose them and form humified material, microaggregates and sand grains. Mostly large, undecomposed root and plant fragments exist in the 500-2000 μm aggregate fractions; whereas, in the 10-100 μm aggregate fractions mare decomposed materials have been observed. The plant sources, amounts, and compositions of litter fall change during ecosystem succession as forests develop during their regrowth after disturbance of a previous forest or after planting. Because of this repeated and continual litter recycling, whether from complex plant communities or from forests trees in monoculture stands, some forest ecosystems can be self-maintaining for nutrients and soil organic matter for the many years that trees grow and , perhaps, indefinitely. Due to the variety in and composition of litter, in any single forest ecosystem decomposition processes are very complex, involve differing groups of organisms. Early stages of decomposition for much litter include camminution- chopping and shredding- of individual plant materials. These processes may be carried out by centipedes, beetles springtails, warms, slugs, and any of a vast variety of soil fauna. Of course fungi and bacteria are ultimate decomposers. In some forest litter layers, nets and mats of fungal hyphae bind together litter components to create carpet-like forest floors.

Forest soil scientists recognize three broad categories of litter layers or humus forms: mull, madder and mor (11). Within each of these broad categories of humus forms are numerous variations, depending on the characteristics of the forest ecosystem. The soil cover in the forest ecosystem consist usually of Cambisols, Luvisols, Albeluvisols, Leptosols and Podzols (1,4,12).

Cambisols are soils that is only moderately developed on account of limited age or rejuvenation of the soil material. A Cambisol is a young soil. Pedogenic process are evident from colour development and for structure formation below the surface horizon. Cover 12% Europe.

Leptosols are shallow over hard rock and comprise of very gravelly or highly calcareous material. They are found mainly in mountainous regions and in areas where the soil has been eroded to the extent that hard rock comes near to the surface. Leptosols on limestone are called Rendzina while those on acid rocks, such as granite, are called Rankers (WRB). Cover 9% of Europe.

Luvisols show marked textural differences within the profile. The surface horizon is depleted in clay while the subsurface “organic” horizon has accumulated clay.

Albeluvisols have an accumulation of clay in the subsoil with an irregular or broken upper boundary and deep penetrations or “tonguing” of bleached soil material into the illuviation horizon. The typical “albeluvic tongues” are generally the result of freeze- thaw

processes in periglacial conditions and often show a polygonal network in horizontal cuts. Cover 15% of Europe, the most common soil in forest.

Podzols. Under acidic conditions aluminum, iron and organic compounds migrate from the surface soil down to the B-horizon with percolating rainwater. The humus (mor) complexes deposit in a spodic horizon while the overlying soil is left behind as a strongly bleached albic horizon. Cover 14% of Europe, the dominant soil of the northern latitudes or in the mountain, higher than 1000-1200 m altitude.

MATERIAL AND METHODS

The study was initiated in 1975 and will be continued until present as part of pedological research effectuated in Caraş-Severin County at 1:50000 or 1:10000 scales. The physical and chemical properties were analyzed in accordance with the methods recommended of I.C.P.A. This research was located at Caraş-Severin county in Southwest Romania, the total area of the county is 851.976 hectare, from which 386.096 ha (45.32% are forest land).

RESULTS AND DISCUSSIONS

Text The purpose of a soil survey is to define soil types and soil profile description. It includes mapping of soils and observation of relationships between soils and land use. Soil types are classified according to characteristic physical and chemical properties. The main soil types in Caraş-Severin in the forestland are presented in table 1 (WRB).

Table 1

Forest soils in Caraş-Severin county

Soil class	Area; hectare	%	Soil type	Area: hectare	%
Cambisols	266.621,8	71,21	Eutric Cambisols Dystric Cambisols Rhodi-eutricCambisols	168.695,9 97.840,1 95,8	45,05 26,12 00,2
Luvisols	77.139	20,60	Haplic Luvisols Albic Luvisols Haplic Luvisols-Luvic Phaeozems Chromic Luvisols	71.328,6 2145,3 3665,9	19,05 0,57 0,97
Podzols	2585,8	0,69	Entic Podzols Podzols	1754,8 831,0	0,45 0,22
Stagnosols	54,8	0,01	Stagnosols	54,8	0,01
Anthrosols	343,5	0,09	Cambisols, Luvisols, Podzols, Regosols- eroded phase	343,5	0,09
-	6061,0	1,62	Leptosols Fluvisols Regosols	5844,5 211,1 5,4	1,56 0,06 -
-	21.627,9	5,78	Rendzic Leptosols	21.627,9	5,78
TOTAL	374.444,6	100		374.444,6	100

It is evidently that the dominant type of soil is Dystric Cambisols for coniferous forest and Eutric Cambisols for deciduous forest. Other types of soils with a large area are Luvisols with 20.60% from total. For highland the dominant type soil are Podzols.

Profile description

1. Dystric Cambisols- Valea Miniş
Slope, 35-50%, altitude 550m, metamorphic rock
Forest: *Fagus silvatica* with grass consisting of *Vaccinium myrtillus*, *Luzula, Deschampria, Poa*, etc.
0-6 cm, leaf litter, Ol
6-0 cm, Oh, 10YR 4/2. A madder with an L/Oh/Af horizon sequence transitional to mull, characteristic for a very thin film-like H layer, produced by advanced but incomplete humification processes. The organic matter is incompletely incorporated within mineral soil materials Biochemical transformation of the vegetal residues is very intense and is due mainly to arthropods with fungi.
8-18 cm Ao, 10YR 6/8, loamy, crumb structure, skeleton grains
18-36 cm AB, 10YR 6/6, loamy, sub angular blocky structure, skeleton grains
36-85 cm BV, 10YR 6/8, sandy-loamy, many skeleton grains, sub angular blocky structure, roots
>85 cm R+B, 10YR 6/8, pebbles and stones with sandy-loamy material Analytical data

Table 2

Analytical data

Depth, cm	8-18	18-36	36-50	>85
pH	4,50	4,55	4,70	5,10
Clay,%	21,5	20,7	19,9	14,0
Silt,%	22,2	22,4	21,4	13,6
Humus,%	0,80	0,49	0,30	
CEC s.	0,01	8,54	7,90	6,54
BSP,%	22,6	24,5	25,4	32,7

2. *Entic Podzols*- Mountains Ţarcu; 975-1000 m altitude crystalline metamorphic rock. Forest: Picea excelsa, with Phegopteris, Sphagmum, oxalis. Slope: 10-15%
0-3 cm, Ol- litter
3-10 cm Oh on aeromorphic humus- mor (raw humus). Decomposition of organic residues, done especially by fungi, is slow and incomplete. As soil fauna is absent, there is practically no mixing of surface organic matter with the mineral soil beneath.
10-23 cm, Ao, 10YR 4/4, sandy, skeleton grains, angular blocky structure
23-85 cm, Bs, 7,5YR 5/4, sandy, skeleton grains, pellets.

Table 3

Analystical data

Depth, cm	10-23	30-85
pH	4,89	4,93
Clay, %	7,4	4,4
Silt, %	18,2	14,4
Humus, %	2,53	1,80
CEC s, me	9,63	6,04
BSP, %	17,03	12,08

CONCLUSIONS

Text Deep root systems provide stability for tree and access to nutrients and water source. From deep roots proliferate fine roots and mycorrhizae of soil materials in fissures, transport to surface, uptake in plant tissue, and later deposition as litter, and litter decomposition contributes to cycling of nutrients.

Effects of acid rain and related pollutants, including in some cases heavy metals, were recorded in Caraş-Severin forest and these change soil acidity interactions with aluminum chemistry, influence an root growth and effects on soil and aquatic biota.

Perennial presence of forest vegetation and recycling of organic matter via litter fall and litter decomposition are essential components for productive, sustainable forest ecosystems.

BIBLIOGRAFY

1. BRIDGES E. M., BATJES N. H., NACHTERGAELE F.O., 1998 - World Reference Base for Soil Resources- Atlas", ISRIC- FAO-ACCO-ISSS
2. CANARACHE A., VINTILĂ I., MUNTEANU I., 2006 - Elsevier's Dictionary of Soil Science
3. CONEA ANA, VINTILĂ IRINA, CANARACHE A., 1977 - Dicționar de știința solului", Ed. Ştiințifică şi enciclopedică, Bucureşti
4. DECKERS J.A., NACHTERGAELE F.O., SPAARGAREN O.C., 1998 - World Reference Base for Soil Resources- Introduction ISSS, ISRIC, FAO, Acco
5. DONIȚĂ N., POPESCU A., PAUCA M., BIRIȘ I., 2005 - Habitatele din România, Ed. Tehn. Silvică, Bucureşti
6. GIURGIU V., 2004 - Gestionarea durabilă a pădurilor României, Silvologie, Ed. Academiei Române, Bucureşti
7. IANOȘ GH., ROGOBETE GH., 1989 - Eroziunea solurilor în județul Caraş-Severin şi măsurile de ameliorare", Public SNRSS nr. 26, ASAS, Bucureşti, p. 77-89
8. PATROESCU M., CHINCEA I., 2007 - Pădurile cu pin negru de Banat, Ed. Brumar, Timişoara
9. PĂUNESCU C., 1975 - Soluri forestiere, Ed. Academiei, Bucureşti
10. ROGOBETE GH., ȚĂRĂU D., 1997 - Solurile şi ameliorarea lor. Harta solurilor Banatului, Ed. Marmiasa, Timişoara
11. SCHNITZER M., 2005 - Organic matter, Enciclop. Of Soil, vol. 3, Elsevier Ltd.
12. TÂRZIU D., 1997 - Pedologie şi staţiuni forestiere, Ed. Cereş, Bucureşti
13. TRACI C., 1990 - Reconstrucția ecosistemelor forestiere de pe terenurile degradate, Vol. "Fundamente ecologice pentru silvicultură", Bucureşti, ASAS.