

THE NATURAL CONDITIONS OF SOIL FORMATION IN CRIȘURILOR PLAIN

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Abstract. The paper aims to research interdisciplinary approach in a detailed analysis of issues related to the natural conditions of soil formation in Plain Crișurilor: geology, hydrogeology, topography and morphometric characters, climate, vegetation, surface water, groundwater and stagnant waters, so the results can allow the resolution of practical problems related to the use and exploitation of land resources. The research was conducted during 2011-2016. For the study of climatic elements were taken and processed data for a period of 45 years (1970-2015). Meteorological data was provided by NMA Bucharest, recorded at weather stations located in the area Crișurilor Plain - Oradea, Chișineu Cris, Holod, Săcuieni). The plant species were identified using plant Identification Manual.

Keywords: geological structure, hydrogeology, morphometric characters, climate, vegetation

INTRODUCTION

Crișurilor Plain is located in the middle of the Banato-Crișene Plain between Barcău and the northern edge of the alluvial cone of Mures. The surface is about 3.600Km² with altitudes range between 90-180m. The western boundary is the western border of the country and the eastern limit Crișene Hills. The north continues with Barcăului Plain and Mureș Plain in the south, having continuity in Hungary. It comprises two subunits (Fig. 2): High Plain of Crișurilor (subdivisions - Biharia Plain, Miersig Plain, Veljurilor Plain, Cermeiului Plain, Craivei Plain), located at altitudes between 100 and 185m and the Low plain of Crișurilor (subdivisions - Parhidei Plain, Borșului Plain, Salonta Plain, White Crișului Plain, Black Crișului Plain, Chisineu - Cris Plain and Ineu Plain), located at elevations below 100 m (Măhăra, 1977).

MATERIAL AND METHODS

For the study of climatic elements were taken and processed data for a period of 45 years (1970-2015). Meteorological data was provided by NMA Bucharest, recorded at weather stations located in the area Crișurilor Plain - Oradea, Chișineu Cris, Holod, Săcuieni). The plant species were identified using plant Identification Manual.

RESULTS AND DISCUSSION

The geological structure and hydrogeology Crișurilor Plain. Territory Crișurilor Plain is covered by Quaternary deposits: fluvial-lacustrine deposits, gravels, sands, clays,

reddish clay, loess, sand wind, warehouses swamp, peat (Fig. 1). In some areas of the plain, at depths of 2-6 m, occur deposits with high content of sulphate and chloride salts.

Relief and morphometric characters Crișurilor Plain. The altitude (Fig. 2) varies from 80 to 120m in the east presents an altitude of 180m. Landforms have longitudinal arrangement in steps from east to west. Share lowest elevation is 88 m in the eastern plain near the Romanian-Hungarian border. Maximum altitude is approximately 200-230 m (southern Barcău Basin and Cigher Basin). Oradea city in the east presents an altitude of 140m. The average altitude is 110-120 m.

Climate Crișurilor Plain. Research climatic elements was conducted over a period of 45 years (1970-2015) using meteorological data provided by NMA Bucharest (data recorded by weather stations located within the Crișurilor Plain - Oradea, Chișineu Criș, Holod, Săcuieni). Climate elements of the study area are presented in tabular form (Table 1 – 8).

Table 1.

The average monthly air temperature (°C) (NMA data from Bucharest)

Station	MONTH											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Oradea	0,9	0,6	5,4	11	16,3	19,2	21	20,5	15,8	10,7	4,8	0,5
Chișineu Criș	-1,1	0,7	5,3	10,5	16,1	19,0	21	20,3	15,6	10,3	4,6	0,6
Holod	0,7	1	5,5	10,5	16	19,0	20,7	20,2	15,7	10,7	5,1	0,8
Săcuieni	-1	0,8	5,6	11	16,6	19,5	21,1	20,5	15,9	10,7	4,8	0,4

Table 2.

Seasonal average temperatures and half (°C) (NMA data from Bucharest)

Station	SEASONS				SEMESTERS	
	WINTER	SPRING	SUMMER	THE AUTUMN	COLD	HEAT
Oradea	1.46	10.8	20.2	10.4	3.5	17.2
Chișineu Criș	0.00	10.6	20.0	10.1	3.4	17.0
Holod	0.3	10.6	19.9	10.4	3.7	16.9
Săcuieni	0.00	11.0	20.3	10.4	3.5	17.4

The average annual temperature is between 9.6 and 12 °C, the absolute minimum air temperature was -30 °C in 2003 to Chisineu Cris, and the absolute maximum of 40.4 °C, was recorded at the weather station Oradea in 2007. Average the annual maximum is between 18.7 °C and 13.6 °C, the maximum was recorded at the station Oradea in 2000, while the minimum was recorded at Săcuieni (1980). Average annual minimum temperatures present maximum of 7.4 °C for 2007 to Săcuieni, and minimum of 3.2°C to Chișineu Criș in 1983. The average annual temperature at the soil surface is between 9.5 and 15.5 °C.

Table 3.

Average monthly temperatures recorded on the ground surface (°C) (data from ANM)

Station	MONTH											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Oradea	-1.1	0.4	5.5	11.9	19.2	23.0	24.6	23.5	17.2	10.8	4.4	0.3
Chișineu Criș	-1.1	0.6	6.4	13.0	20.8	24.5	26.7	25.1	18.4	11.5	4.8	0.5
Holod	-1.3	0.7	5.5	11.3	17.5	21.7	23.7	22.8	16.4	11.0	5.0	0.4
Săcuieni	-1.6	0.2	5.7	12.5	20.3	23.9	25.8	24.4	17.7	11.0	4.4	0.4

Table 4.

Average monthly maximum temperatures recorded on the ground surface (°C) (data from ANM)

Station	MONTH											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Oradea	9,5	13,8	27,4	38,2	46,8	51,4	53	51,2	41,8	32,5	18,2	12,3
Chișineu Criș	9,8	14,7	28,5	37,8	45,6	49,3	51	48,9	41,1	31,9	19,0	11,4
Holod	12,2	16,5	27,1	36,7	45,6	51	53	51,3	42,8	34,1	21,7	13,3
Săcuieni	10,25	15,3	29,4	41,4	50,6	54,2	54	52,8	45,3	34,2	20,1	11,31

Table 5.

Average monthly minimum temperatures recorded at the soil surface (°C) (data from ANM)

Station	MONTH											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Oradea	-13,9	-11,4	-6,9	-1,2	3,9	8,2	11	9,6	4,7	-2,2	-5,5	-11,9
Chișineu Criș	-15,5	-12,6	-7,1	-1,0	4,1	8,7	11	9,7	4,4	-2,7	-5,5	-11,8
Holod	-14,7	-12,0	-7,1	-2,1	2,2	6,7	8,9	7,8	3,2	-2,9	-6,5	-12,0
Săcuieni	-15,8	-13,8	-7,5	-1,4	3,7	8,5	11	9,3	4,0	-3,1	-7,3	-13

Table 6.

Increased average temperatures on the ground surface for the spring period February-May (°C)
(Data provided by NMA and processed)

Station	SPRING (February- May)		
	February- March	March - April	April - May
Oradea	2,9	8,7	15,5
Chișineu Criș	3,5	9,7	16,9
Holod	3,1	8,4	14,4
Săcuieni	2,9	9,1	16,4

Table 7.

The decrease in average temperatures on the ground surface for the autumn-winter months from September to December (°C) (Data provided by NMA and processed)

Station	Autumn-winter (September - December)		
	September - October	October - November	November - December
Oradea	14,0	7,6	2,3
Chișineu Criș	14,9	8,1	2,6
Holod	13,7	8,0	2,7
Săcuieni	14,3	7,7	2,4

The average annual precipitation values between 720 mm (Chișineu Cris) and 587 mm (Săcuieni)

Table 8.

Average monthly amounts of precipitation (mm) (data provided by NMA and processed)

Station	MONTH											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Oradea	34,5	30,5	35,2	49,1	60	85,3	75,6	60,1	52,3	43,2	45,0	48,1
Chișineu Criș	37,4	29,5	37,5	54,3	60,3	82,2	71,6	57,9	52,5	43,3	46,7	49,2
Holod	43,0	39,2	43,8	59,6	67,6	90,9	76,6	69,0	79,5	48,8	47,5	55,4
Săcuieni	31,9	28,1	31,3	45,5	60,5	83,8	67,3	59,1	50,9	44,6	42,7	42,2

Table 9.

Frequency average cardinal directions (m / s) (data provided by NMA and processed)

Station	Cardinal points. Wind direction								
	N	NE	E	SE	S	SW	W	NW	
Oradea	9,0	4,8	6,7	10,9	18,3	15,4	7,0	5,4	
Chișineu Criș	12,9	4,5	5,2	6,6	12,2	9,0	6,4	4,1	
Holod	13,3	12,6	12,4	2,2	5,0	12,5	8,9	3,9	
Săcuieni	6,6	10	5,2	5,2	1,1	12,6	2,2	1,7	

Table 10.

Average wind speed on cardinal directions (m / s) (data provided by NMA and processed)

Station	Cardinal points. wind direction								
	N	NE	E	SE	S	SW	W	NW	
Oradea	4	3,8	2,8	2,5	4,1	4	3,3	3,2	
Chișineu Criș	3,7	2,7	2,5	2,9	3,9	4	3,5	3,2	
Holod	3,5	2,3	2,3	2,5	3,5	3,8	3,3	3	

Cris Plain hydrographic network is part of the Crișuri Basin.

Table 11.

Crișurilor plain hydrographic network
(Source: Water Basin Administration Crișuri)

Nr. crt.	River	Hydrometric station	River length (Km)	Surface (Km ²)	Annual average flow (m ³ /s)
1	<i>Crișul Alb</i>	Ineu	178	4240	19,8
		Chișinău Criș	211		23,50
2	<i>Cigher</i>	Cigher	36	465	1,66
3	<i>Crișul Negru</i>	Tinca	110	4237	24,90
		Talpoș	126,5		25,60
4	<i>Holod</i>	Holod	48	499	3,70
5	<i>Teuz</i>	Cermei	42,4	237	1,68
6	<i>Crișul Repede</i>	Oradea	143	2986	25,40

Aquifer has an average depth of between 1-5m in Salonta Plain, Plain White Cris, Chișineu Criș Plain. High Plain is between 5-10m, the average amplitude variation is between 1 and 3m. Meadow areas have an average depth of the aquifer between 1 and 2m. Stagnation of water formed over time large areas of swamps, about 1200ha. Currently have been converted and furnished as ponds: lake complex at Cefa (670H), Lake Inand (200ha), Madaras (30ha), Homorog (105ha), Tămașda (206 ha), lakes Cris White (Bocsig, Ineu , Seleuș) Cermei Lake basin Teuzului lake on Cigher Taut, lake Socodor (155ha), Lake Pilu (260 ha).

Vegetation. Primary steppe plant associations were replaced by crops or secondary herbaceous vegetation, often degraded or ruderalised. The crops appear associations: *Artemisia austriaca*, *Cynodon dactylon*, *Poa bulbosa*, *Bromus squarrosus*, *Agropyron sp.*, etc, and the remains of steppe meadows primary associations *Carex praecox*, *Poa pratensis* cu *Festuca vallesiaca* și *Festuca pseudovina* cu *Stipa pennata*, *Poa bulbosa*, *Koeleria gracilis*, *Koeleria javorkae*, și *Botriochloa ischaemum*. In grasslands dried appears *Adonis vernalis*, *Chrysopogon gryllus*, *Cirsium furiens*, *Echium italicum*, *Nepta nuda*, *Orobanche elatior*, *Orobanche reticulata*, *Ranunculus ilyricus*, *Stipa capilatta*, *Vicia narbonensis*, *Vicia serratifolia* *Artemisia sp.*, *Lathyrus silvestris*, *Peucedanum alsaticum*, *Senecio doria*, *Seseli varium*, *Trinia ramosissima*.

In areas with good water supply and drought during the summer are species: *Alopecurus pratensis*, *Becmannia eruciformis*, *Roripa kernerii*. *Specifice arealului sunt și speciile de plante: Plantago schwartyenbergiana*, *Plantago tenuiflora*, *Pholiusus pannonicus*, *Limonium gmelini*, *Peucedanum officinale*, *Aster sedifolius*, *Filipendula vulgaris*, *Agropyron pectiforme*., Forest vegetation is composed of *Robinia pseudocacia*, *Quercus pedunculiflora*, in association with *Quercus pubescens*, *Quercus frainetto*, *Quercus cerris*. Herbaceous vegetation consists of forests: *Dornicum hungaricum*, *Gladiolus imbricatus*, *Iris graminea*, *Oenanthe fistulosa*, *Corydalis solida*. Wet meadows are made up of natural vegetation *Dechampsia caespitosa*, *Agrostis canina*, *Agrostis stolonifera*, *Agrostis alba*, *Tripholium hibridum*, *Festuca pratensis*, *Euphorbia palustris*, *Cirsium brachicephalum*, *Stipa pennata*, *Echium maculatum*, *Dictamnus albus*, *Phragmites communis*, *Typha latifolia*, *Carex riparia*, *Carex hordeistichos*, *Carex apporopinquata*, *Carex elata*, *Carex paniculata*, *Hottonia palustris*, *Aldroxanda vesiculosa*, *Stratiotes aloides*, *Hypericum tetrapterum* *Menyanthes trifoliata*, *Ranunculus ligua*, *Geranium pratense*, *Berula erecta*, *Aster linosiris*, *Iris spuria* și *Juncus sp.*, *Menianthes trifoliata*, *Cicuta virosa*, *Salix aurita*, *Urtica kioviensis*. Water surface of lakes, can meet species:

Nymphaea alba, *Nuphar lutea*, *Trapa natans*, *Sagittaria sagittifolia*, *Caltha palustris*, *Berula erecta*. Grasslands on salty soils have in composition *Statice gmelini*, *Bassia hirsuta*, *Puccinellia distans*, *Agropyron elongatum*, *Crypsis aculeata*, *Spergularia marginata*, *Petrosimonia triandra*, *Aster tripolium*, *Atriplex sp.*, *Camphorosma annua*, *Camphorosma monspeliaca*, *Lepidium crassifolium*, *Plantago maritima*, *Artemisia santonicum*, *Hordeum hirtum*, *Trifolium fragiferum*, *Aster tripolium*, *Aster sedifolius*, *Peucedanum latifolium*, *Scorzonera parviflora*, *Scorzonera laciniata*, *Mentha pulegium*, *Spergularia media*, *Sueda maritima*, *Artemisia maritima ssp. Monogyna*, *Festuca pseudovina*, *Gypsophila muralis*, *Bacterium nuissimum*, *Achillea setacea*, *Achillea collina*, *Scorzonera canum*, *Juncus gerarde*, *Sueda pannonica*, *Crypsis aculeata*. The composition of woody vegetation prevail: *Quercus pedunculiflora* și *Quercus pubescens*, together with *Quercus cerris*, *Quercus frainetto*, *Quercus robur*, *Tilia tomentosa*, *Acer campestre*, *Fraxinus excelsior*. Forests are a mixture of species: *Tilia tomentosa*, *Carpinus betulus*, *Ulmus foliacea*, *Fraxinus excelsior*, *Quercus robur*, *Corylus avellana*, *Quercus petraea*. Has limited distribution: *Quercus frainetto*, *Acer campestre*, *Ulmus foliacea* și *Carpenus betulus*. In the undergrowth dominate: *Ligustrum vulgare*, *Crataegus monogyna*, *Rosa canina*, *Cornus mas*, *Cornus sanguinea*, etc.



Fig. 1. Deposits rock. The hydrographic network (Source: Geographic Atlas of Romania from 1972 to 1978)

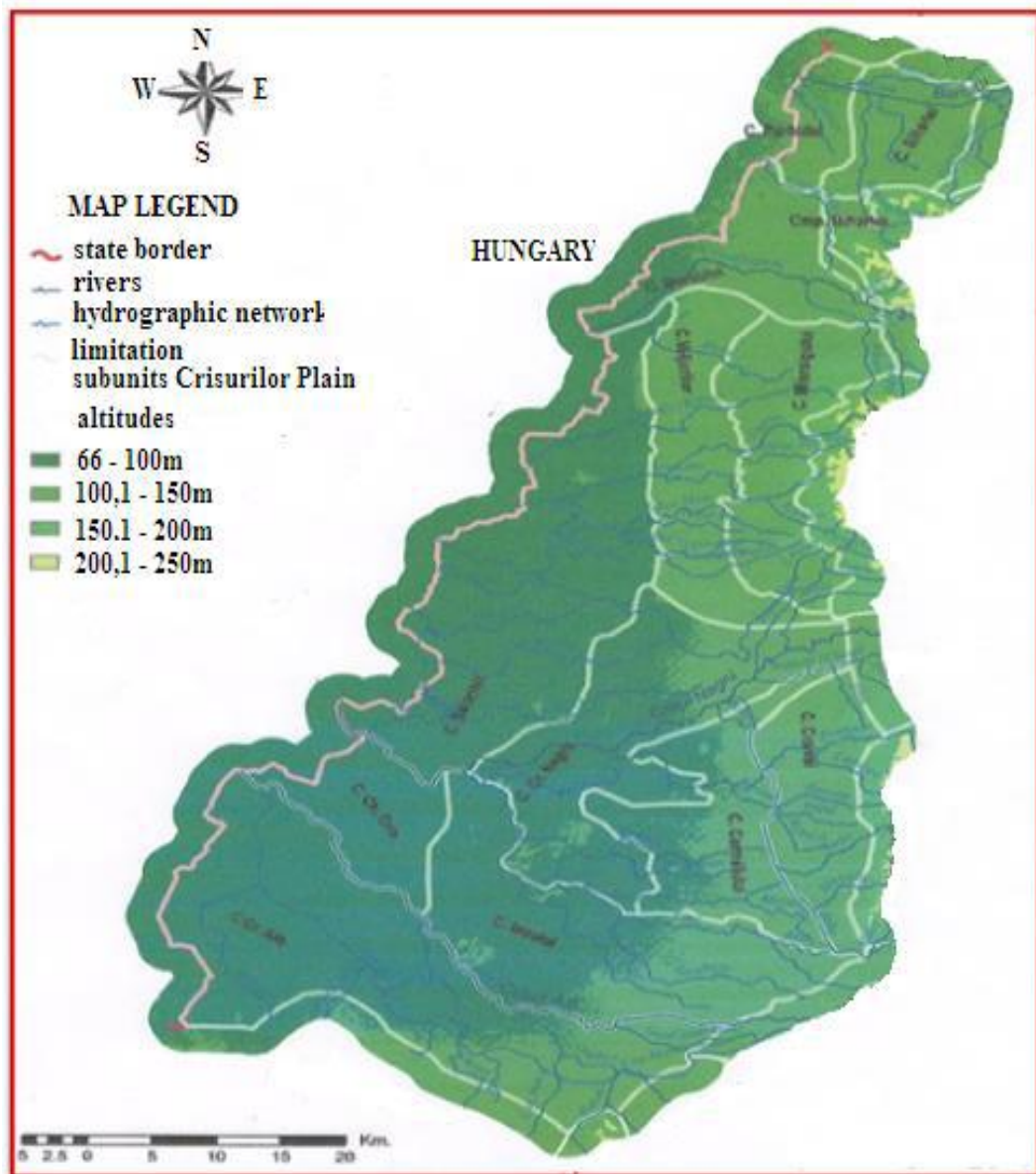


Fig. 2. Altitude relief. The hydrographic network. Crișurilor Plain subunits (Source: Processing by G. Posea)

The structure of herbaceous vegetation in forests is *Brachypodium silvaticum*, *Hypericum hirsutum*, *Geum urbanum*, *Carex sp.*, *Juncus sp.*, *Convallaria majalis*, *Fragaria vesca*, *Festuca gigantea*, *Hieracium racemosum*, *Hieracium murorum*, etc.

On soils with ground water located at depths greater than 2 meters, the plant associations occur: *Festuca sulcata* *Festuca pseudovina*, *Poa bulbosa*, *Alopecurus pratensis*, *Koeleria gracilis*, *Lolium perene*, *Euphorbia cyparissias*, *Antoxantum odoratum*, *Lolium perene*, *Plantago lanceolata*, *Taraxacum officinale*. Herbaceous vegetation on soils with excess moisture is composed of hydrophilic species: *Dechampsia caespitosa*, *Agrostis*

cannina, Trifolium hybridum, Festuca pratensis, Phragmites communis, Typha latifolia, Carex sp., Juncus effusus, Juncus inflexus., Scirpus palustris, Schoenoplectus palustris.

CONCLUSION

Soils of Crișurilor Plain is formed on Deposits: fluvial-lacustrine deposits, gravels, sands, clays, reddish clay, loess, sand wind, warehouses swamp, peat.

Crișurilor Plain has two major levels of relief. The first level corresponds to the high plains with altitudes between 100-180m, the second level low plains, located at low altitude under 100m. In High Plain are vertical erosion processes and in Low Plain , processes of accumulation and marsh. In Low Plain , groundwater depth is 0.5-2 m, causes a supraumezire soil, intense manifestations of gleyzation process in the soil profile, ponding and swamp, resulting in the formation of gleisols and subtypes of other land gleyic . The association groundwater depth at critical with a high content of soluble salts (mineral water) leads to the formation of soils affected by salinity or alkalizing. Stagnation of water from precipitation recorded on depression relief units and promotes the formation of pseudo stagnosols or subtypes stagnic other soil types. The climate is an important factor in the formation and distribution of soils from the early stages of pedogenetical and evolutionary processes, also the vegetation structure. Climatic elements varies reduced.

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