ANALYSIS OF NATURAL ENVIRONMENT AND THE POTENTIAL OF FERTILITY OF SOILS FROM INTERFLUVE TIMIS-BEGA (DOWNSTREAM TIMISOARA)

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Abstract. *The analysis the the natural environment (terrain, paleogeographical evolution, geology, climate, hydrography, hydrogeology, soil) and soil fertility potential, ie how to use these soils in the low plain, which is part of the Banat plain requires separate treatment of each component, identifying relationships, influence or conditioning that occurs between these components. In this paper are analyzed the natural characteristics of the interfluve Timis-Bega. The analysis of the natural environment was based on works of scientific documents on the region studied, as well as observations from the site. Interfluve Timis-Bega, downstream of Timisoara, fully overlaps a region of low plains, which is part of the Banat plain. The genesis relief of this unit is closely linked to the dynamics of the foundation plates and microplates of Pannonian Basin, especially those that led to the formation of mountain relief, to the faults and local diving foundation plains. The entire area of the Banat plain and implicitly interfluve Timis-Bega, ranges from average annual isotherms of 10 ° C and 11 ° C and average yearly rainfall is around 600 mm / year. The main rivers courses are Timis and Bega, which is the surface perimeter of limit analyzed. Timis and Bega rivers, over time floods have caused several catastrophic effects of the natural environment and human settlements nearby. It may be mentioned in this regard the flooding caused in 1859, followed by another 30 such events, with very serious consequences. A number of environmental factors and "abandonment of" hydrotechnical works, wich led to a catastrophic hydric event in the spring of 2005. Groundwater level is low in the plain at a depth that influence pedogenetic processes. Until recently, much of the low plain is under increased groundwater influence. Groundwater mineralization determined at different stages of soil salinization. Groundwater bodies related study area are: ROBA03-Timisoara (body of groundwater) and ROBA18 (deep groundwater body). Interfluve Timis-Bega overlap of low plains, with favorable climate conditions and relief, which prints a high fertility soils in this area. The soils from area of analysis have a high degree of fertility. Largest surfaces of total arable land are included in Classes II and III of quality.*

Key words: *fertility, natural environment, soil*

INTRODUCTION

Groundwater level is in the lower plain is at a depth that influence pedogenetic processes. Until recently, much of the low plain is under increased groundwater influence. The groundwater mineralization determined at different stages of soil salinization. Groundwater bodies related study area are: ROBA03-Timisoara (body of groundwater) and ROBA18 (deep groundwater body). Interfluve Timis-Bega overlap of low plains, terrain with conditions and favorable climate, which prints a high fertility soils in this area. The soils from area of analysis have a high degree of fertility. The largest surfaces of total arable land are included in Classes II and III of quality.

The analysis the the natural environment (terrain, paleogeographical evolution, geology, climate, hydrography, hydrogeology, soil) and soil fertility potential, ie how to use these soils in the low plain, which is part of the Banat plain requires separate treatment of each component, identifying relationships, influence or conditioning that occurs between these

components. In this paper are analyzed the natural characteristics of the interfluve Timis-Bega. The analysis of landscape, climate, hydrography and hydrogeology of the lower plain of the Timis-Bega interfluve is particularly important, in several respects: its characteristics influence the process of of soil formation and evolution, distribution, type of use and fertility potential of them.

Because the studied area is part of the lower plain, the rivers Timis and Bega, over time has caused more floods with catastrophic effect on the natural environment and human settlements nearby.

MATERIAL AND METHODS

In this paper are analyzed the natural characteristics of the Timis-Bega interfluve. The analysis of the natural environment was based on the the works of scientific literature of the region studied in, as well as comments to the site. With the help of software specific of geographical information systems was made a map of the territorial administrative units included analyzed area. Characterization of climatic zone was based on data from the meteorological station of Timisoara (annual average temperature, average annual precipitation). Framing soil fertility classes (for arable land) and land situation within the village were obtained from OSPA Timisoara, these data are represented and analyzed in accordance with site specific conditions studied.

RESULTS AND DICUSSIONS

Relief. Interfluve Timis-Bega, downstream of Timisoara, fully overlaps a region of low plains, which is part of the Banat plain.

Low plains of Banat are arranged in altimetric rate below 100 m subsidence of the south-western Banat strongly influencing the evolution of the plain, giving it the appearance of a large gathering of water markets (IANOŞ, 2008).

Banat Plain paleogeographical evolution and geology. The genesis of terrain of this unit is closely related to the dynamics of the foundation plates and microplates the Pannonian Basin, especially those that led to the formation of mountain relief, and the faults and the foundations of local dive plain areas (PUŞCĂ, 2002). It is developed on a foundation unit Carpathian crystalline sunk in Miocene to different depths and a highly fragmented system of faults in grid, oriented in two directions: east-west and north-south (Romania Geography, Vol IV). Foundation configuration is directly reflected in the areas of subsidence, which correspond to grabens separated by horsts.

The crystalline fundament is covered by Pliocene-Quaternary sediments, composed of fluvial-lacustrine Pliocene deposits (clay, sand, gravel), above which were made-proluvial Pleistocene alluvial materials (Fig. 1), and the upper loess deposits , loess and sand (Romania Geography, Vol IV).

Based on a variety of order criteria geologic, geomorphologic, hydrological, soil, etc., low plains of the area analyzed was divided into several sections, which will be analyzed separately in the following.

1. Low plains with proluvial-alluvial deposits. Are formed by the union of numerous cones spread of the rivers Mures, Bega, Timis and Bârzava in the old perimeter of Quaternary continental deltas. It features a great unevenness of microrelief and deposits. In general, the beam shapes were later repaired lately by wind, gross fluvial deposits identified and on the finest materials depression or clays (IANOŞ, 2008). The morphology observed numerous digression plains, meanders or swampy areas surrounded by ridges or higher plateaus, traces of ancient high terraces remains (PUŞCĂ, 2002).

In the area studied, with low plain with proluvial-alluvial deposits is represented by:

a. Low plains with proluvial - alluvial deposits of the Timis-Bega - Bârzava. Are relatively recent, drained by several rivers with a permanent basis (Bega, Timis, Pogăniş, Bârzava Moravia). Represents a Holocene divagation region. Loess deposits and alluvial are coated with old alluvial-proluvial most recent. From this group, in the area analyzed is present Moşniţa plain, which borders the western plains of Timis and Bega and common meadows extends west of Recas - West Izvin - Ghiroda south - south Delhi - West Sag - South Padureni - North Liebling - Sacos over Stamora Romanian and Sacoşul Turcesc, which ends in the high Niţchidorf plain (PUŞCĂ, 2002). Between the alluvial deposits fall within, isolated, loess materials and accumulation of salts. Thus, the plain becomes more uneven in morphology the appearance of cenotes alternating with that of the fluviatile banks (IANOŞ, 2008).

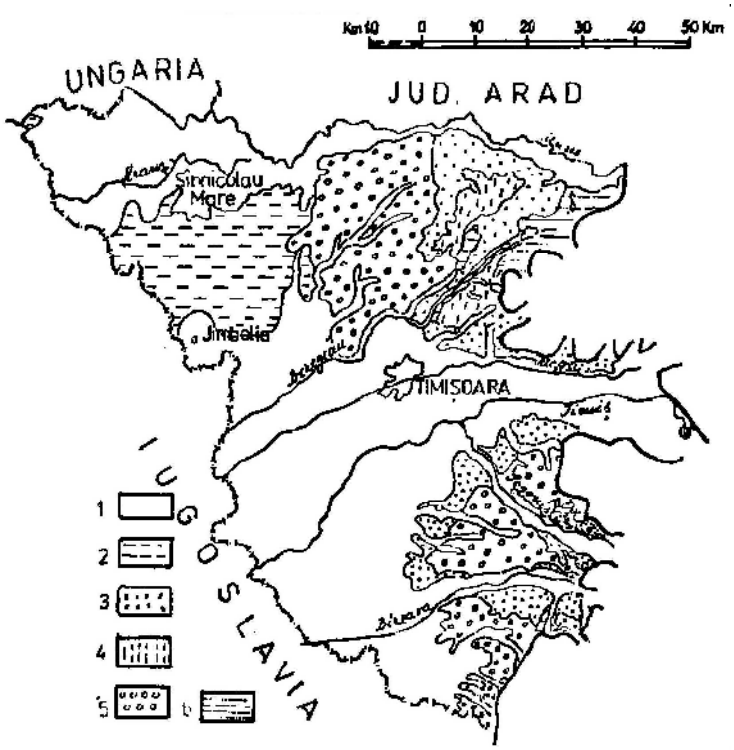

Figure 1 Banat plain - Geological Map
(after Romanian Atlas - 1978, quoted by Puşcă, 2002)

Legend: 1. current sediment and subactuale, **2.** loess and loess deposits, **3.** fluvial deposits (Pleistocene) **4.** fluvial deposits (Pleistocene environment) **5.** Quaternary undivided **6.** Pontian-sarmathian

b. Alluvial-proluvial plain of the lower Timis. From this unit, in the Timis-Bega interfluve is found Sânmihai - Diniaş plain. Is composed of fluvial material covered by deposits of wind, river, lake or materials other types of most recent deposits, arranged unevenly. The altitude of this plain is reduced from east to west, from 95 m to 80 m west, the limit is achieved with a field of loess of fluvial-lacustrine of the Torontal plain and Checea-

Ionel, follows a tortuous course in the localities: East Becicherecu Mic - Beregsău Mare east - west Sânmihaiu Roman - Sânmihaiu German east - south Iohanesfeld - west Foieni - east Graniceri - east Giera - west Livezile. To the south, with Ciacova plain limits is the lower river north Timisu Mort from Cebza climbs and follows the north up to the contact with Timis River with Timisoara plain, which is separated from a limit west of Parta - West Sag - Utvin west - west Dudestii Noi - east Becicherecu Mic (PUŞCĂ, 2002).

2. Low plains with fluvio- lacustrian deposits. Represents the area with the lowest elevation. Are relatively recent, drained by several rivers with permanent regime. Very low slope and local or general subsidence determined alluvial deposits and loess deposits covering older alluvial deposits recent or very fine textured lacustrine origin (IANOŞ, 2008). This category includes several subdivisions, including the interfluve Timis-Bega Plain is distinguished Cenei-Ionel-Livezile. It is located on the periphery of the cone of the three rivers: Bega, Timis and Bârzava (PUSCA, 2002). Very small slope caused sharp divagation of rivers, and their loosen marshland of entire areas. The plain has elevations between 78 and 85m and plan aspect bordered by a web of loops, dead branches or large depression areas (IANOŞ, 2008).

3. Meadows are the latest forms of the land relief (Holocene), covered, in general, by gross material, rarely smooth, by thickness more and more higher from west. Their appearance varies by the area that crosses the river, so in the middle and lower rivers Timis and Bega have created a common meadow ridges and valleys with numerous relicts, with front and side deposits usually smoother (IANOŞ , 2008).

Climate. To characterize the climate of Timis-Bega interfluve were used weather station data from Timisoara, as well as work papers. In this paper we describe the study area only in terms of air temperature and rainfall.

Air temperature. The whole area of the Banat plain and interfluve implicitly Timis-Bega, ranges from average annual isotherms of 10 ° C and 11 ° C (IANOŞ, 2008). In the area examined average annual temperature varies very small, slightly increasing from east to west (from 10.8 ° C in Timisoara westward increase to 10.9 ° C at Banloc and Diniaş).

Tabel 1

Temperature (° C) and precipitation (mm) multiannual average measured at the weather station Timisoara

Station	**Perioad**	**Months**												**Annual**
Timişoara	1961 - 2005	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**	
Temperature (°C)		-1.2	1.1	5.8	11.3	16.6	19.7	21.5	20.5	16.5	11.1	5.6	1.1	10.8
Precipitation (mm)		37.7	33.2	33.4	51.4	60.1	77.6	62.5	53.1	47.5	42.2	48.2	50.8	597.7

Atmospheric precipitations. Amount of precipitation decreases slightly from east to west, while reducing the altitude. The lowest values of precipitation recorded in western Banat Plain (550-600 mm), represented by Table 1 and the highest (600-650 mm) in the east towards the hillside. The amount of water (rain or snow) is losing winter of 200-250 mm, and values over 300 mm of rainfall leading to surface water wetlands. Winter precipitation amount varies from 150 mm drier springs for an excess over 300 mm of precipitation. In summer is recorded small amounts of precipitation, about 200-300 mm, and in autumn relatively small amounts (70-90 mm).

Climographs (Walter-Lieth type) were first used in 1969 by its authors. The method is based on the ratio between the average monthly temperature and precipitation, expressed graphically through these climograph. Dry periods resulting from the interference curve of

temperature with precipitation scale 1/2, and the dryness are found at the intersection of two curves at scale 1/3, highlighting the poor rainfall periods.

As shown in the climograph (Fig. 2), between drought periods is within the range July to September, when the drought is followed certain conditions and dryness.

During high rainfall is recorded during May-June with a peak in June.

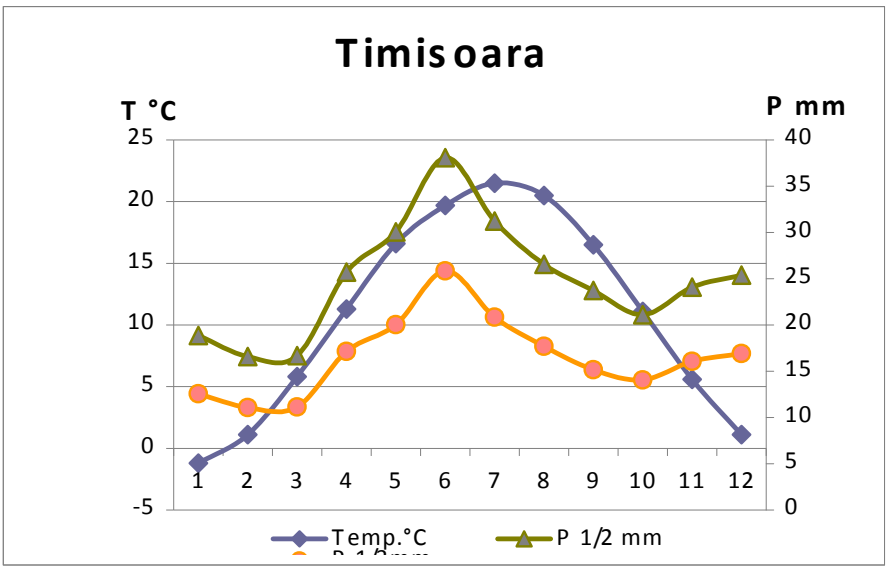

Figure 2 Climograph of the Station Timisoara average values values between 1961-2005

Hydrography and hydrogeology. The most important rivers courses area are Timis and Bega, that is the limited analyzed perimeter.

Timis River has its source on the eastern slopes of the mountains Semenic below the Piatra Gozna, at an altitude of 1135 m (UJVARI, 1972). River is formed at the confluence of three branches: Semenic Gradiste and Brebu. Because of neotectonics, the middle and lower curved Timis has attracted southwest area of subsidence Alibunar. As a result, the river has a very low slope (0.4 to 1.0 m / km) and drains a land with high groundwater level (PUSCA, 2002).

Bega River is the last affluent of the left Tisza, making the confluence with the territory of Yugoslavia, near the village Titel (UJVARI I, 1972). Its length is about 170 km (its159 km through the territory of Timis county) and drains an area of 2241 sqare km basin (2211 sqare km is located in Timis county). In the plain, Bega has a very low leakage slope (0.4 to 1.0 m / km) and a tendency to divagation clearly present. To prevent frequent flooding caused by high waters of the river, in 1728 and began digging the navigable channel connecting channels Timis-Bega, Bega-Timis at the Costei and at Topolovat.

Timis and Bega rivers, over time floods have caused several natural catastrophic consequences on the environment and human settlements nearby. It may be mentioned in this regard the flooding caused in 1859, followed by another 30 such events, with very serious consequences. To avoid occurrence of such events have been taken several measures such as the setting of: locks, polders, reservoirs permanent and impermanent, hydraulic components, hydrometric stations, etc.. This work provides a degree of safety, but requires further

undertaking maintenance measures (resize, enhance, restore, etc.). A number of environmental factors, and "the abandon" of these technical works, have generated a catastrophic event fluid in the spring of 2005, an event that has remained well printed in the memory of the population due to flows recorded the flood wave amplitude, and material damages caused by water overflowing from rivers or accidents due to some of the existing hydraulic structures (Ianoş, 2008). Among the factors that led to the flooding include: large quantities of rainfall in the region / basin, air temperature remained positive up to high altitudes which prompted so the melting of snow and rivers supply large quantities of water. Under pressure from the huge volume of water yielded some hydraulic structures, following several villages were flooded (Crai Nou, Otelec, Foieni, etc.), an event with serious implications on the environment and population.

Groundwater level is low in the plain at a depth that influence pedogenetic processes. Until recently, much of the low plain is under increased groundwater influence. The sewerage and drain excess groundwater, groundwater levels dropped, but traces in the soil could not be further removed. Gleyzation, sometimes very intense, persists.

In micro depressions groundwater is between 0.5 to 1.5 m we find flat areas between 1.5 to 3 m and the ridges between 3 to 5 m.

Ground waters from here have some contents of harmful salts. Groundwater mineralization determined at different stages of soil salinization.

In the plains of Banat is located nine groundwater bodies (ROBA01, ROBA02, ROBA03, ROBA04, ROBA05, ROBA12, ROBA18, ROBA19 and ROBA20) in alluvial deposits (sands, gravels, silturi, subordinate intercalations of marl and clay) of quaternary age.

Groundwater bodies ROBA01, ROBA03, ROBA05, ROBA012 and ROBA18 have **cross-border** nature, that is developing in the border region and continue to the territory of some neighboring countries.

Groundwater bodies associated study area are: **ROBA03-Timisoara** (body of groundwater) and **ROBA18** (deep groundwater body).

Water body ROBA03-Timisoara is continuing cross-border nature into Serbia. In Romania has an area of 2577 sqare km and extends from geomorphologic terms, the western and south-western section of the Plain Timis including low flood plains formed by rivers Bega Veche, Bega, Timis, Bârzava and Moravita.

The main source of water body are rainfall, and to which are added the water on the areas of floodplain rivers in times of flood and storm. At low levels, natural rivers drain into the phreatic horizon.

The first aquifer just below the stratum of soil is often covered with layers there is no other role, protecting, developing up to approx. 35.5 m (Jimbolia). The thickness varies greatly from 2.4 to 27.0 m (Otelec-Pustiniş).

Water body ROBA18 - Banat has cross-border nature, in Romania covers an area of 11,408 sqare km River Basin Area comprising the entire Banat from at Mures Valley Vicinic (Plain Caras) and Timis River corridor (including) the western border, continuing on the territory of Serbia, which also deals with an area of 8556 sqare km.

In general, deep aquifer layers captured by mining wells and hydrogeologic of research are grouped in complex aquifer horizons developed in deposits of Pannonian age. The number and their thickness increases from east and north-east to south-west, from contact with the highland and regions of Carpathian mountainous to the central area of Pannonian Basin.

Soils. Timis-Bega interfluve overlaps of low plains, with the favorable climate conditions and land relief, which imprints a high fertility of the soils in this region.

The analyzed area is located 6 communes (Fig. 2), downstream from Timisoara to the border state.

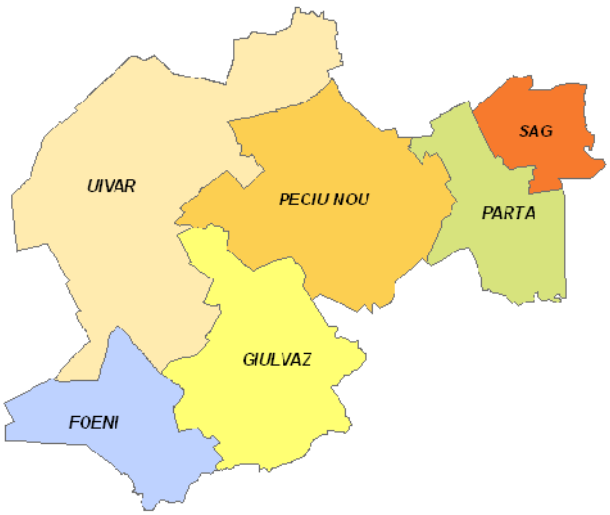

Figure 3 Communal territorial structure of the Timis-Bega interfluve

Pedological studies conducted by OSPA Timisoara allow an overall assessment of the land in the communal territories, based on this information can be obtained at the global picture of the entire area analyzed. Therefore, the largest share of total area of the communes in the territory considered is agricultural land (Table 2).

Tabel 2

The situation of the land (ha) of Timis-Bega interfluve
(under OSPA Timisoara)

No. Item	Location	Total area	Total farmland	Arable land	Pastures	Grassland	Vineyards	Gardens
1.	Foieni	6.406	5.816	4.728	931	151	0	6
2.	Giulvăz	10.296	9.548	7.082	2.143	317	4	2
3.	Parța	6.137	5.580	4.864	672	42	2	0
4.	Peciu Nou	12.974	12.195	9.118	1.960	883	24	210
5.	Şag	3.402	2.946	2.353	458	58	53	24
6.	Uivar	19.532	18.099	15.658	2.213	214	1	13

In terms of use, the largest share of arable land is owned (Table 2), for all communal territory over 90% of soils meet the optimal conditions for agriculture. Grasslands occupy smaller areas as a share of total farm land being located in second place (Table 2). The largest areas of pastures and meadows are found within the communes Uivar and Giulvăz. As an area of low plains, meadows and fruit trees, vineyards plantations, occupy very small areas (Table 2).

The specific environmental conditions analyzed perimeter of the (plains average annual temperature of 10.8 ° C, average annual rainfall of 600 mm) caused the formation of soils with different levels of fertility (chernozem, eutric, preluvisols, etc..). These soils are classified into five quality classes (fertility), presented in Table 3.

Tabel 3

Fertility classes (quality) of soils for the category of use "Arable" (ha)
(source: OSPA Timisoara)

No. Item.	Location	Arable land (ha)	Class I 81-100 pct.	Class II 61-80 pct.	Class III 41-60 pct.	Class IV 21-40 pct.	Class V 0-20 pct.
1.	Foieni	4728	720	1616	1060	1200	132
2.	Giulvăz	7082	168	2092	2375	2043	404
3.	Peciu Nou	9118	3207	2255	958	1210	1488
4.	Şag+Parţa	7217	360	3091	2816	856	94
5.	Uivar	15658	1558	4562	6838	2523	177

The largest areas under first degree of quality are within the village of Peciu Nou and the small village Giulvăz (Table 3). For all classes of communal territories-II and-III of quality sums up the largest areas.

CONCLUSIONS

Interfluve Timis-Bega overlaps a low plain (with deposits alluvial-proluvial and fluvial-lacustrian) component of the Banat plain. In altimetric terms it falls within a low range from 100 to 80 m, interfluve Timis-Bega is between multiannual average isotherms of 10 ° C and 11 ° C. Multiannual average temperature varies extremely limited, slightly increasing from east to west. Rainfall, against thermal values, decreases slightly from east to west, while reducing altitude. The lowest values of precipitation recorded in western Banat Plain (550-600 mm) and highest (600-650 mm) in the east. These climatic features offers the best conditions for agriculture. The main surface courses that drains the perimeter the rivers Bega and Timis are researched. But over time has caused several catastrophic floods on the natural environment and human settlements nearby. To prevent such hydrological events is necessary to adopt additional protective measures, to resize and maintain existing hydrotechnical constructions. Groundwater level is low in the plain at a depth that influence pedogenetic processes. Groundwater bodies related study area are: ROBA03-Timisoara (body of groundwater) and ROBA18 (deep groundwater body). Generally, deep aquifer layers by collected mining drillings and hydrogeological research horizons are grouped in complex aquifer developed in deposits of Pannonian age. The number and their thickness increases from east and north-east to south-west. The analyzed soils of the area have a high degree of fertility, they have the largest share of agricultural land. The largest surfaces of total arable land are included in Classes II and III as therefore the analyzed region can be considered one of the most favorable for agriculture.

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