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The Bioclimatic Dimension of the Transylvanian Plain

Nicolae BACIU
Faculty of Geography
Babeş-Bolyai University, Cluj

Carmen STĂNESCU
Iuliu Haţieganu Elementary School, Cluj

Eduard SCHUSTER
Faculty of Geography
Babeş-Bolyai University, Cluj

Octavian LIVIU-MUNTEAN
Faculty of Environmental Science
Babeş-Bolyai University, Cluj

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Abstract

The Transylvanian Plain occupies the central part of the Transylvanian Depression with its territory of over 3900 km^2, its geographical and economic components being placed radial-concentrically: the river systems, biotic and climatic elements, and the energy material flux are centrifugal. Consequently, the Transylvanian Plain is characterized by an evident *central isolation*, which corresponds to the tendencies of national categorization – an area of maximal poverty or an underprivileged area. We add specific biotic and climatic elements to suggest this current scientific idea.

E-mail: nicubaciu2@yahoo.com, nbaciu@geografie.ubbcluj.ro

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1. Introduction

The Transylvanian Plain occupies over 3900 km^2 (23°52'– 24°37' E, 46°35'– 47°12' N) and it is situated in the centre of the Transylvanian depressional basin being characterized as a region of low hills,[1] bordered by the two Someş Rivers, Valea Florilor, the Mureş Corridor, the valley of Lunca (and Luţ) and Dipşa with the lower Şieu (Fig. 1 and 2). Obviously, the opinions regarding the boundaries of the Transylvanian Plain differ. We are referring to the longitudinal limits,

[1] Tiberiu Morariu, "Raionarea fizico-geografică a Câmpiei Transilvaniei", *Studia Universitatis Babeş-Bolyai, Geologia – Geographia* T.I II, no. 5, S. II (1958), 1.

since the latitudinal boundaries are, for the time being, unanimously accepted. Thus, T. Morariu, G. Posea and I. Mac[1] fixed the east–west limits on the Valea Florilor and Dipşa Valley.

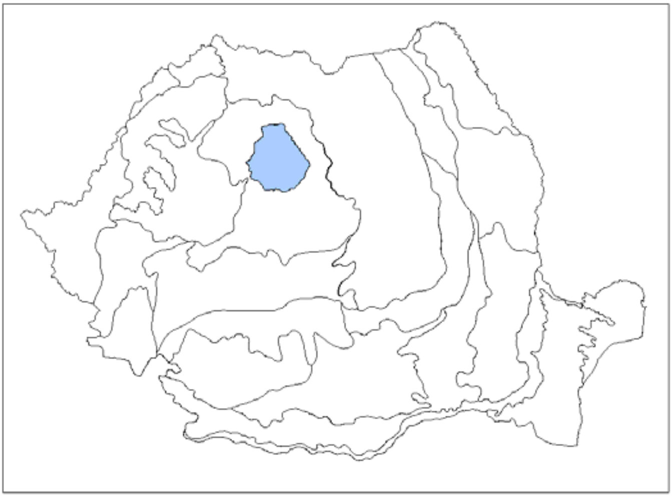

Fig. 1. The geographical location of the Transylvanian Plain within Romania

The boundaries of the Transylvanian Plain were the starting point for the elaboration of some entire theories in the world of both geographers and biologists. In 1980 Al. Savu included the entire area situated between the Corridor of the Someş Rivers and the valley of Niraj in the Transylvanian Plain, his main aim being to divide the Transylvanian Depression into relatively homogenous units with respect to their surface.[2] In *Geografia României* (The Geography of Romania), vol. III, the limits of the Transylvanian Plain are: "the Someş Rivers, the Mureş (between the mouth of the Arieş and of the brook Luț), the Șieu–

[1] Tiberiu Morariu, Grigore Posea, Ion Mac, "Regionarea Depresiunii Transilvaniei" (The Regions of the Transylvanian Depression), *St. şi Cercet. GGG, Geografie*, XXVII (1980), 2.

[2] Alexandru Savu, "Depresiunea Transilvaniei (Regionarea fizico-geografică) Puncte de vedere" (The Transylvanian Depression (Physical-Geographical Regions) Points of View), *Studia Universitatis Babeş-Bolyai*, *Geologia – Geographia*, XXV (1980), 2.

Dipşa Corridor, and the brook Lunca in the east, and the line formed by the localities Turda – Ceanu Mic – Boju – Dezmir in the west."[1]

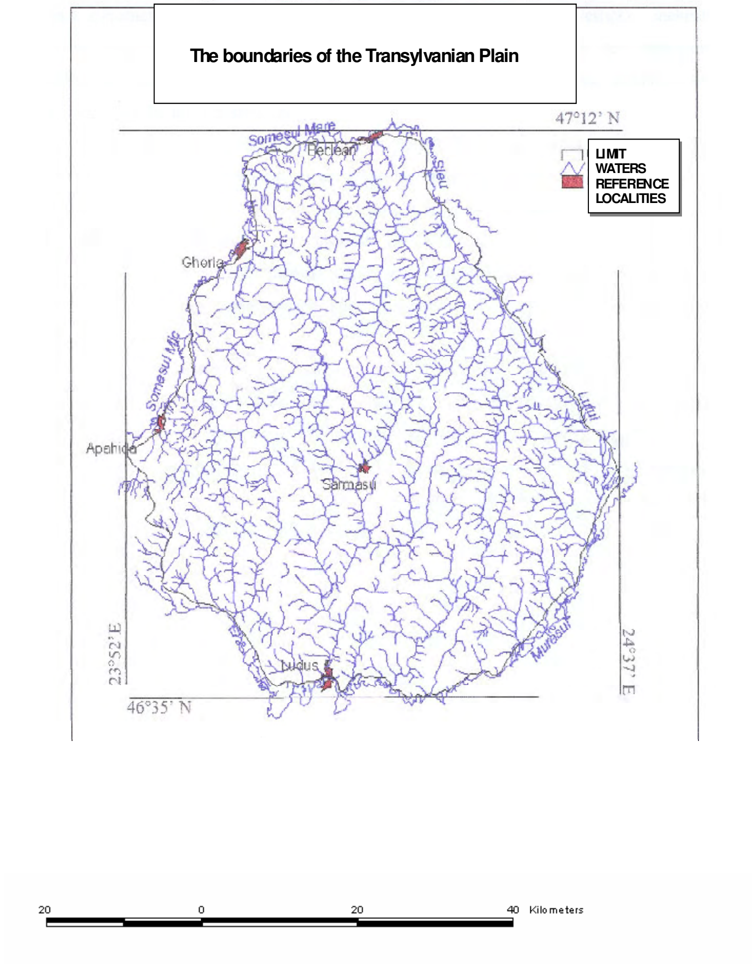

Fig. 2. The boundaries of the Transylvanian Plain

[1] *** *Geografia României. Partea a treia* (The Geography of Romania. Third Part) (Bucureşti: Editura Academiei, 1983).

One of the best arguments regarding these limits was elaborated by Grigor P. Pop:[1] if the clearest and unanimously accepted boundary is the southern one (on the Mureş up to the confluence with the Arieş), westwards "the Transylvanian Plain is closed (…) at the Corridor of the Lower Arieş and then Valea Racilor to Tureni, afterwards following the eastern foot of Feleac Mountain (Ceanu Mic and Aiton) and Zăpodie Valley (…)", since "the relief and the characteristics of the plain are continued west of the Valea Florilor – Valea Murătorii line (our note: a line considered by geographers for a long time the western limit)… inclusively in what regards the glimee-type landslides…"; similarly, the matured valley character is preserved, which, besides the fish lakes in Valea Caldă, represent defining elements of the physiognomy of the Transylvanian Plain.

From among the relationship types between the Transylvanian Plain and the neighbouring regions, we mention the *unconditioned relations* with the eBistriţa Hills and the eastern end of the Feleacu Hill, and the *intermediated relations* northwards, westwards and southwards to the narrowing of the wide Someşul Mare and Someşul Mic and Mureş valleys.

Climatic conditions: created by the rain shadow of the Trascău Mountains affecting the vegetation development, the pedogenesis and the way in which the soil is used in the south-western part of the Plain.

Hydrographical conditions: the Transylvanian Plain is a water source for its border rivers, the Mureş and the two Someş Rivers. On the other hand, the valleys of these rivers have become geomorphologic and phytogeographic (in the past even demographical) barriers.

Demographic conditions: besides hydrography, the demographic component completes the image of a territory with multiple centrifugal fluxes and which make this area an isolated region in the centre of the Transylvanian territory.

2. The climate and its role in defining the ecologic potential

The climate of the Transylvanian Plain is characterized by the quasi uniform manifestations of its components, though at the topoclimatic level there are some differences. Thus, the most accentuated differences are between the nemoral north and the forest-steppe south, and between the well-known rain shadow in the SW area caused by the

[1] Grigor P. Pop, *Depresiunea Transilvaniei* (The Transylvanian Depression) (Cluj-Napoca: Presa Universitară Clujeană, 2001), 172.

nearby Apuseni Mountains and the eastern area, where the masses of oceanic air are reformed. The NW part also suffers foehn influences imposed by the Meseş Mountains, even if the distance from them seems considerable. These influences affect the phyto-landscape: termophile oak species (*Quercus pubescens*) appear on the sunlit slopes (*thermo-nemoral phyto-landscape*). The opinion of the researchers who assert that the Meseş Mountains are a far too distant reference point is supported by the presence of numerous mesophile herbaceous species (*Festuca rubra*) and of mesophile woody species (*Fagus sylvatica*). The actual relationship between climatic elements and the development of the vegetation must be perceived as a result of the dynamics in time, and it can be extended to complex analyses in which other components – the edaphic basis or the anthropic activity [a climatic retrospect at the level of the phases of the Holocene resolves problems related to these correlations, be they pedo-climatic, hydro-climatic (the appearance and evolution of lakes), phyto-climatic correlations (the extension of forests), etc.] – are included as well.

Air temperature as a climatic component important from an ecological point of view shows slight differences especially between the northern (7.5–8°C, and even 7°C on the highest peaks, at approx. 600 m) and SW part (8.5–9°C) under the influence of foehn processes in the shadow of the Trascău, as well as between the western and eastern parts of the region: from an average of 8°C temperature falls slightly towards 7°C in the opposite area. In the NW part the presence of lakes and higher relief forms leads to temperature differences of 1, or even 1.5°C between valleys and peaks under the complementary influence of summer mists.[1] Monthly mean temperatures exceed 5°C from April to the end of October, determining the date of sowing and in a lesser degree the choice of culture types, which, unfortunately, depends on the inertion in exploitation.

There are more than 75 summer days from April to October in the central, eastern and (partially the) southern part, and 65–70 days in the other portions of the territory; frosty days are frequent in March (5–6 days) and October (4–5 days), rare in April (3–4 days), possible in May (1 day) and September (1 day). The last frost is on 24 April and the first on 8 October (there being a number of 167 frostless days). Between 1st

[1] Wilfried Schreiber et al., *Analiza peisajelor geografice din partea de vest a Câmpiei Transilvaniei* (The Analysis of Geographical Landscapes in the Western Part of the Transylvanian Plain)(Cluj-Napoca: Presa Universitară Clujeană, 2003), 17.

March and 1st October, the thermal constant of the interval with daily means over 5°C is over 3000°C and of the interval with over 10°C, 2500–2700°C. These values are close to those characteristic in the Hills and the northern part of the Western Plain, and they have important phenological influence.

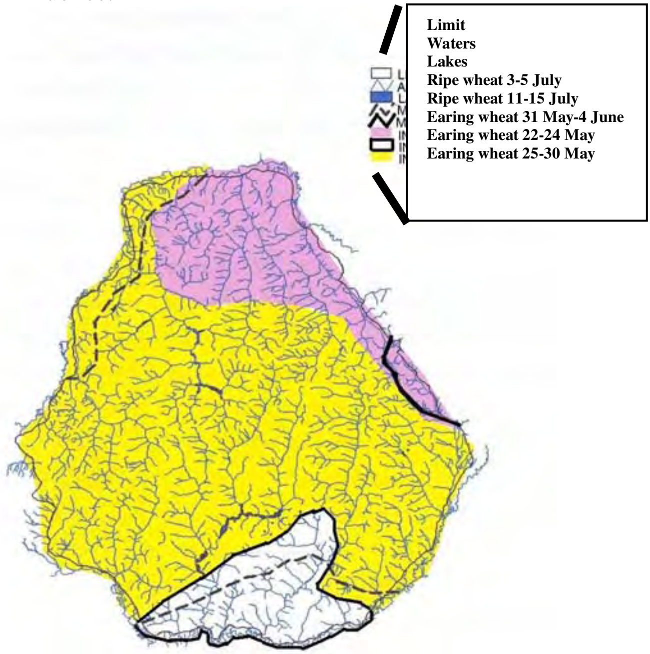

Fig. 3. Phenological differences at the level of the Transylvanian Plain

The mean temperatures of the extreme months also show slight differences. The mean of January is -3–-4°C in the entire region, the north–south differences being less than 1 degree. On the other hand, in July 16–17°C are recorded in the centre and the east of the Plain, 17–18°C in west and south-west, and even somewhat higher values in the south-western end. The tendency of continentalization in the south-western part is, therefore, the consequence of rainfalls and not of the temperature. Associated with the higher temperatures in the SW, the real evapotranspiration in the frostless months, April–October, is of 550–600 mm, creating a yearly deficit of 50–100 mm with direct negative consequences in plant cultures.

The difference between the Mureş Plain and Someş Plain becomes evident if we analyze *the first frosty day*. In the southern half of the region the first frosty day is recorded during the first ten days of October, while in the northern and north-western area this is due in the last ten days of September. In the southern and south-western part the first frosty day is towards the second ten days of October. 6 October as the first frosty day delimitates the two areas of the Transylvanian Plain.[1] The opposite phenomenon, the *last frosty day*, is recorded during the last ten days of April (24 April in the centre and in the south), in the higher hills in the north of the Plain being signalled at the beginning of May.

These phenomena must be correlated with other, ecological phenomena related to the vegetation period of plants, such as phenological data. The two phenological phases in the map we have drawn (Fig. 3) – the earing and ripening of winter wheat – are based on the sum of temperatures between the mean date when spring comes and the mean date of earing (760°C), and between the date when spring comes and the date when the plant matures (1490°C).[2]

The introduction of phenological data in geo-ecological studies was considered important by former papers as well: E. Haeckel, relying on some anatomical and morphological studies, claimed that the plants' "bonding" to their habitat is often in conformity with the form of growth, the capacity to develop, phenological events and the organ structure; although ecologists in particular could not quantify the environmental interactions of every community member.[3]

Similar differences regarding phenological data can be observed also in the flowering of sunflowers or apple trees, an asymmetry being distinguishable, according to our map, on the SW–NE axis. It must be mentioned that the phenological data afferent to the SW area are similar to those which characterize some extended areas in the Western Plain.

The climatic differences between the N–NW and S–SW part are the clearest in the *precipitation* quantity: 650 mm, and less than 550 mm/year (Viişoara–Câmpia Turzii area). For the two areas the geo-ecological consequences are evident, both in what regards natural vegetation and the way in which the land is used. The consequences on

[1] *Atlas. Republica Socialistă România* (Atlas. The Romanian Socialist Republic) (Bucharest: Editura Academiei RSR, 1974), IV – 3.

[2] Ibid.

[3] Roman Lenz et al., *A Historical Perspective on the Development of Ecosystem and Landscape Research in Germany* (Berlin, Heidelberg, New York: Springer Verlag, 2001), 17–35.

the physiognomy of the hydrographical network are in direct relation with the altimetry and fragmentation of the relief: the greater frequency of semi permanent networks in SW and the high river discharge in NW. The raingauge data collected at Turda station in the interval 1949–1997 reveals an average of 495.9 mm, which is outstanding for the 200 mm level of the Plain, and which is impressive taking into consideration its surface and its relative altimetric uniformity. The most significant precipitations, recorded before 1985, a year considered the beginning of an arid stage in the history of the Plain – though the phenomenon has been represented by a descending line long for a long time (fig. 4) –, fell in the northern area, east of the Fizeş–Meleş interfluve, higher than 700 mm. It is, however, hard to believe that these values will be attained ever again.

With reference to the regime of precipitations one can perceive the uniformity of the data recorded at the meteorological stations (Fig. 5). The monthly progress of precipitations can be compared, the yearly and monthly total quantity showing significant differences. There are also differences between the months of the cold season and those of the warm season. For example, without exception, more than half of the precipitation quantity falls in the May–July interval,[1] June being the wettest month of the year. From an ecological point of view this pluvial surplus does not compensate evapotranspiration, the deficit reaching 100 mm/year, identical with the shortage calculated in the north of the Plain of Central Muntenia or in the north of the Western Plain.

Sometimes precipitations fall in a short interval of time (41.4 mm/30'), they are torrential and favour the triggering or reactivation of slope processes (the recorded maximum precipitations were of 65 mm in 24 hours at Sărmaşu station). Together with the physiognomy of the rivers' drainage basin, the riverbeds' incapacity to carry off greater quantities of water and the gentle slopes, the torrential rains of June–July represent a real danger of inundation.

The water deficit in the soil and the atmosphere is recorded in the spring in March and in the August–September period, the De Martonne aridity index (wetness coefficient) presenting values of 25–35 (higher in January, lower in September and March).

[1] Titus Man and Radu Pop, *The Analyses of Hydrological Drought in Transylvanian Plain during 1980–1997* (Cluj-Napoca: Studia Universtatis UBB, 2001).

Table 1. Precipitations in June – absolute and relative values

Station/year/ month/%	Turda	Budeşti	Chiochiş	Cojocna	Cozma	Luduş	Săbed	Sărmaş
Anual (mm)	495.9	500.08	562.8	562.1	625.6	546.9	598.04	539.1
Month VI (mm)	84.7	75.1	72.9	84.4	93.9	86.3	87.3	82.4
Percentage %	17.08	15.01	12.9	15.01	15	15.7	14.6	15.3

Table 1 clearly shows the relationship between the position of the station within the Plain and the local climatic expressions. The rain shadow behind the Trascău creates the conditions for the convective torrential rains, a fact stated by the data of the Turda station. In the northern (Chiochiş) or eastern (Săbed) area downpours are more rare.

A survey of the mean monthly (the rainiest month is June) and multiannual precipitation values leads to the possibility of calculating the climatic erosivity index.[1] In correlation with the rate of the wooded area, this index illustrates the intensity of the erosion on the slopes, and, implicitly, the erosion rate of soils, as it is shown by Table 2. We took into consideration the wooded areas within the administrative territory of the villages to which the stations belong, these being regions where the analyzed index manifested itself to a maximum degree. A retrospective survey shows a similar situation, for example in the year 1897 when wooded areas or associated wooded areas were, surprisingly, more reduced (e.g. Sărmaşu, 2.09%, Cojocna, 2.24%, Budeşti, 0.79%) or similar in extent to the present day situation (Cozma, 4.7%, Chiochiş, 12.4%).

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[1] Maria Pătroescu, *Subcarpaţii dintre Râmnicu Sărat şi Buzău. Potenţial ecologic şi exploatare biologică* (The Sub-Carpathians between Râmnicu Sărat and Buzău. Ecological Potential and Biological Exploitation) (Bucureşti: Ed. Carro, 1996), 75.

Table 2. Climatic erosivity (CE) indices and wooded areas in villages near the meteorological stations in the Transylvanian Plain

Station/CE	Budeşti	Chiochiş	Cojocna	Cozma	Luduş	Sărmaş
CE	11.27	9.44	12.67	14.09	13.61	12.59
Rate of wooded areas (2003)	4.2	12.8	4.2	4.8	2.6	5.6

CE = climatic erosivity index (calculated by means of the relationship between the square of the precipitations in the rainiest month and the multiannual mean precipitations values).

The *multiannual precipitation* system is characterized by considerable fluctuations, on average significant negative exceptions, superior to positive ones, being recorded once in seven years. Thus, the alimentation regime of rivers and the agrarian production is directly affected. Since 1985 (at some stations since 1983) pluvial discrepancies in the precipitation quantity for consecutive years, and also constant divergences from the yearly and multiannual means have been recorded (Table 3). In the latter case, significant negative divergences were recorded in 1986 and 1990, undifferentiated according to the stations in the Plain: 182.5 mm, and 152 mm in Sărmaşu, 179.09 mm and 210.4 mm in Cojocna, 155.27 mm and 167.67 mm in Săbed. Correlated with the value of drainage on the slope and the evaporation, the quantity of precipitation in 1986 and 1990 (repeated at a lower degree in 1994 – negative divergence of 127.9 mm in Sărmaşu) reveals serious problems of agricultural management and supports the hypothesis of *incidental agrarian production*, this time based on climatic parameters.

Table 3. Pluviometric fluctuations at Sărmaşu station in the 1985–1997 interval (95.1 = the rainiest month corresponds to the multiannual mean 1968–1997; 129.9 = the divergence of the rainiest month from the mean)

YEAR	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Sum
1985	23.3	29.4	9	72.8	59.4	95.1	34.3	76.6	23.7	5.7	49.3	36.9	515.5
1986	32.6	26.2	17.2	58.7	12.1	57.8	71.7	19.4	4.7	24.8	7.7	23.8	356.7
1987	34.7	17.4	15.6	43.1	97.4	37.1	12.4	58.8	9.1	22.7	51.7	45.3	445.3
1988	49.4	23.2	70.7	57.6	32.7	68.3	46.7	34.5	27.5	11	9.9	36.1	467.6
1989	6.9	17	13.6	79.5	73.5	98.6	32.3	70.9	31.8	13.1	23.4	7.3	467.9
1990	19.4	17.1	9.8	32.6	31	46.8	74.4	25	39.9	23.2	28.8	39.2	387.2
1991	11.4	13.9	3.4	25.7	86.8	83.2	129.9	80.2	47.4	69.9	30.5	19.7	602
1992	19	12.3	8.7	32.4	31.7	134.3	48.2	6.2	50.9	56.5	40.1	17.9	458.2

1993	14.8	14.7	50.1	54.7	16.7	83	89.6	29.5	78.7	16.3	38.2	46.7	533
1994	12.4	6.2	25.7	56	69.2	20.1	25.1	46.2	34.6	72.6	27.9	15.3	411.3
1995	26.3	28.7	6.9	19.4	76.8	64.7	23.5	89.5	61.6	0.9	46.8	53.2	498.3
1996	28.4	20.1	24	26.1	61.3	76.6	62	28	94.2	42.8	12.2	36.8	512.5
1997	10.1	23.2	14.6	74.8	55.1	77.5	102.4	69	70.8	35.6	29.4	36.8	599.3
Mean value 1968-1997	25.31	21.79	22.18	48.69	68.35	**82.48**	72.07	56.81	44.09	34.26	31.91	31.23	539.16

We chose Sărmaşu station to study *meteorological risk phenomena* as well. For example, the number of stormy days was 32–46 in a year in the interval 1980–2002, with a slight tendency to cover the months of the cold season as well (this phenomenon was signalled each month in 2002 with the exception of January, February, March and November). Fog is a phenomenon which underwent radical changes in 1996. If before this year the number of foggy days had been constant for more than 40 years, beginning with this limit year the values have been descending to 27 (1996) or 30 (2002), as a consequence of the aridization tendency and the increasing autumnal temperatures. Another phenomenon with interesting changes in the last 20 years is the mean number of heavily windy days: in the interval 1980–1990 2.6 such days were recorded per year, while since 1991 this value has been decreasing considerably, to 0.83 days per year, with three consecutive years without this phenomenon.

Comparing these values with those of other similar geomorphologic regions, we observe that these phenomena are not constant and usually present in the Transylvanian Plain. Other climatic indicators, such as the number of days with hail (Fig. 4) indicate values favourable to human activities.

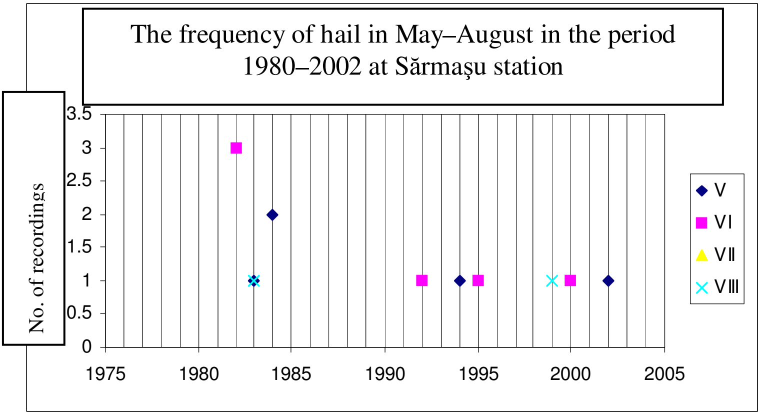
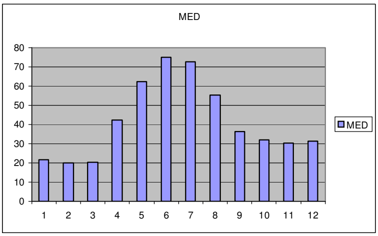
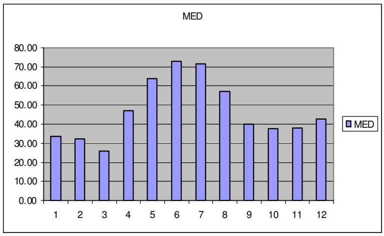


Fig. 4. The frequency of hail in the interval 1980–2002

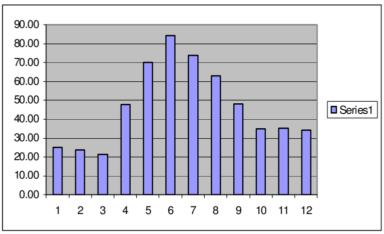
Budeşti (500.08 mm)



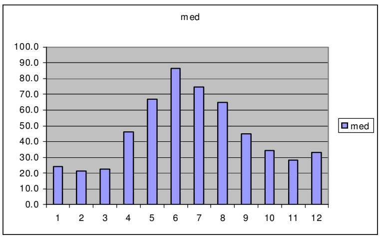
Chiochiş (562.83 mm)



Cojocna (562.1 mm)



Cozma (625.63 mm)



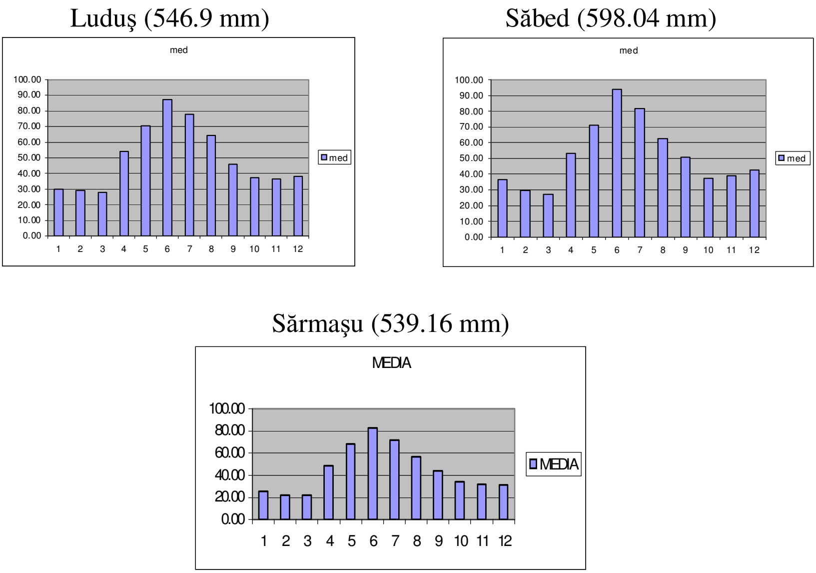


Fig. 5. Multiannual mean precipitation values (1968–1997)

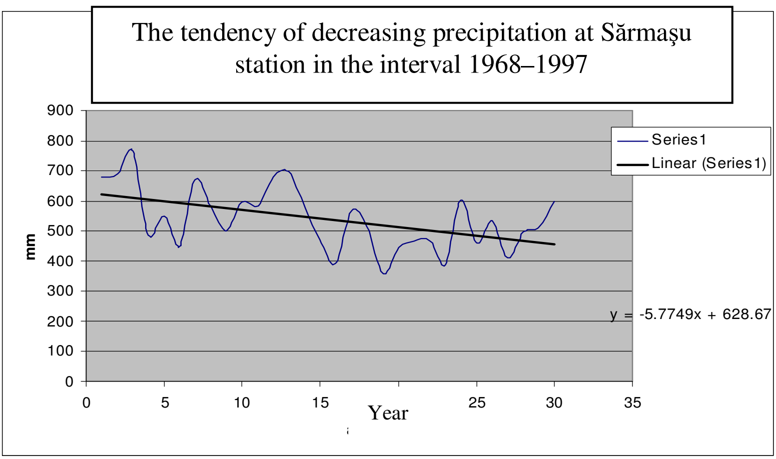


Fig. 6. The decrease in the precipitation level at Sărmaşu station

3. Vegetation and fauna

3.1. Vegetation

The territory of the Transylvanian Plain shows an apparent and treacherous impression of uniformity and monotony regarding vegetation. Having analyzed the forms of the relief, the inclination of slopes, the dynamics of agricultural exploitation, and the anthropized ecosystems, this view is definitively changed.[1] The typology of vegetation and the spatial extension are the expressions of the climatic characteristics, therefore the correlation with the climate (and microclimate) is obligatory. Besides the soils, the topoclimate is a determinative factor in the existence and spread of phytocenoses. More than elsewhere, in the Transylvanian Plain the major differences in the structure of vegetation are due to the monoclinal relief besides other variables. The SW slopes have the benefit of a greater insolation, and they are also greatly inclined. This results in additional warmth and in less humidity, the xerophile character of plants being accentuated as well. A specific microclimate independent of the natural area is created, which leads to the individualization of some distinct phytocenoses. On the other hand, the dip slope of cuestas and the interfluves remain mostly true to the character of the natural vegetal area.

This made István Csürös and his colleagues[2] elaborate a model of the vegetation spread according to the determinant action of insolation (Fig. 7.).

The exposition of slopes determines the vegetation typology of the Transylvanian Plain, thus the correlation of the two variables led to the establishment of some association types. István Csürös and his colleagues[3] outlined the presence of herbaceous and woody vegetation differentiated according to slope types, but they also established, *in extenso*, major differences in the vegetation of the slopes with different erosion degrees.

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[1] Nicolae Baciu, *Câmpia Transilvaniei. Studiu geoecologic* (The Transylvanian Plain. A Geological Study) (Cluj-Napoca: Presa Universitară Clujeană, 2006).

[2] István Csürös et al., *Vegetația, ecologia şi potențialul productiv pe versanții din Podişul Transilvaniei* (Vegetation, Ecology and Productive Potential on the Slopes of the Transylvanian Plateau) (Bucharest: Ed. Academiei, 1968), 40.

[3] Ibid.

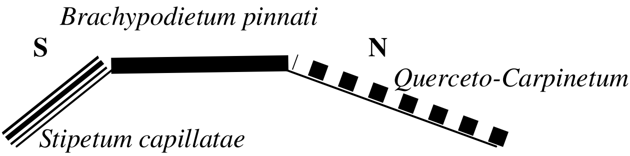

Fig. 7. Slope inclinations and insolation determining the presence of associations[1]

3.1.1. The vegetation of escarpments in the Mureş Plain: S-SW (sunny) and W (partially sunny) slopes:

They correspond to the escarpments of the Mureş Plain, thus the vegetal associations will have a double connotation: the typical associations of such slopes; *specific or adapted* associations of eroded slopes. Due to the geomorphologic, climatic and vegetal differences between the Mureş Plain and the Someş Plain, these two subunits will be discussed separately in this chapter (see the map of vegetal associations at the end of the chapter).

Herbaceous vegetation

a. The *Xerophytes* which predominate in the natural landscape of these slopes ("insular steppic vegetation"[2]), catalogued progressively as of the Boreal age, postglacial warm and arid period, found on the S-SW slopes conditions which made possible vegetal continuity.

Feather grass associations (*Stipetum lessingianae* and *Stipetum pulcherrimae*) predominate in the upper third of sunny slopes[3] and they are the most representative xerophile associations. The species present in the association are *Stipa lessingiana* and *Stipa pulcherrima*, the latter being more widespread, *Linum hirsutum*, *Astragalus asper*, *Salvia nutans* and *Salvia nemorosa*, *Galium verum*, *Artemisia campestris* and *Dictamnus albus*. Due to the fact that they are sensitive to grazing, they are the *indicators of anthropization*.

The presence or absence of the species constituting these associations reveals the degree of human intervention, at least by means of grazing activity. Moreover, the fact must be mentioned that the forage

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[1] According to István Csürös and his colleagues. Ibid.

[2] Nicolae Doniță et al. (1960), *Harta geobotanică a R.P.R.*, Editura Academiei R.P.R., Bucuresti.

[3] Csürös et al., *Vegetația, ecologia…*, 50.

value of these pastures is reduced, plant density is also reduced, in time becoming necessary to exchange the grazing of cattle (more valuable) for the grazing of sheep. The consequence was the destruction of these associations and the excessive reduction of the area, even the disappearance of some Xerophile species: *Crambe tataria*, *Centaurea trinervia*, *Nepeta ucranica*, this latter found in isolated islands only in the north of Şăulia.

East of the line of the Plain Brook we find strong Xerophile elements, such as *Agropyron pectiniforme, Rosa micrantha, Marrubium peregrinum*, which appear only insularly in the western part, this denoting an arider microclimate than in the western part.[1]

Phytocenoses predominated by *Stipa capillata* consist of approximately the same species as the above discussed associations.

Fescue and dwarf sedge association (*Festuca sulcata – Carex humilis*). This is a relict Boreal association, which succeeded in maintaining a considerable spreading due to its resistance to grazing and due to its spreading to eroded soils or soils beginning to erode. These characteristics led researchers to the conclusion that the members of the Stipeae tribe withdrew before the grazing, giving the resistant species the possibility to develop.[2] Gradually, the Stipae were transformed into ***Festuca sulcata – Carex humilis*** meadows. They occupy the middle part of the slopes (of the escarpments) and the upper third, representing a transitional association towards degraded meadows.

In the initial degradation phase of the sunny slope vegetation (S–SW) an **anthropogenic vegetation** (meadows predominated by beard grass) appears, Graminacaee being substituted mainly by leguminous plants: ***Dorycnium herbaceum***, yellow lucerne (*Medicago falcata*) and Dicotyledons. Due to their resistance to grazing, leguminous plants have become associated with the breeding of sheep. Thus the fact that the vegetation cover is reduced to less than 50% on the strongly inclined slopes can be explained with the appearance of a *degradation indicator*: *Artemisia campestris* together with Graminaee –*Agropyrum intermedum* and *Calamagrostis epigeios*.

The *Thymus sp. – Salvia sp.* association appears on the excessively eroded slopes, this association containing Dicotyledons to a

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[1] Alexandru S. Bădărău et al., *Analiza de inspiraţie naturalistă şi aplicarea acesteia asupra peisajelor Câmpiei Transilvaniei* (Naturalist Analysis and Its Application to the Landscapes of the Transylvanian Plain), vol. VII (Deva: Geis, 2000), 65.

[2] István Csürös et al., *Vegetaţia, ecologia...*, 72.

significant proportion: *Adonis vernalis*, *Potentilla arenaria*, *Thymus glabrescens* and *Salvia nutans*. The specific vegetation of *Thymus* and *Salvia* is considered a result of the degradation in the course of time of the feather grass associations. Moreover, it competes efficiently also with Graminaee associations.

b. *Xero-mesophytes.* They prefer regions with insequent landslides (of escarpments), for example Urmeniş, Suat, Dâmbul de Lut, etc., the proximity of regions with landslide depressions, and *terraced areas* as well – agricultural terraces, partly abandoned (Frata) or situated in slopes affected by *overgrazing* – animal tracks. *Festuca sulcata–F. vallesiaca*, as well as *Brachypodium pinnatum* and *Dorycnium herbaceum* associations are to be found here.

c. *Mesophytes*. They are characteristic to microlows made by slides, areas with low caloric contribution and sheltered from the insolation typical to S–SW slopes. The most representative species of mesophile vegetation are *Poa pratensis*, *Festuca pratensis*, *Agropyrum repens*, together with *Achillea millefolium* and *Rumex acetosa* – from among Dicotyledons.[1]

Plantations

a. Protective forest plantations

They had become a necessity because of the excessive erosion of the soil on slopes, and in order to protect the new arable lands in the river meadows of the Plain in the 1960s. The plantations thus created generally look like an amphitheatre, they are situated at the source of secondary rivers. They also take the form of *slope plantations*. The species preferred in the 1960s were *Pinus silvestris*, *Pinus nigra*, *Robinia pseudacacia*. Previously, in the pre-war period existed *private plantations* – for example those in Frata, which have been destroyed – with economically more valuable species: *Quercus petraea* and *Quercus robur*. The importance of plantation and the gravity of soil erosion in the Transylvanian Plain led to the founding of a pomological research station in Săbed (having a perimeter of 46 ha, scientific research activity began on it in 1892). Its objective was to study and verify the adaptability of different tree and bush species to different soils and slope inclinations and to exploit the obtained results in the Transylvanian Plain and other regions.

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[1] Ibid.

b. erosion-preventive hedge rows – they are planted in meadows and pastures in order to prevent erosion, both in terraced areas and mainly in regions where there are no terraces and where there is a real danger of slope processes being started. The shrub species used are mainly: *Corylus avellana*, *Ligustrum vulgare*, *Cornus sanguinea*, and *Prunus chamaecerasus*. These hedges are important not only as an anti-erosion measure, they also have an economic value: the vegetal production of the meadows in these perimeters is clearly superior to those where there are no such plantations. The water balance on the slopes is ameliorated as well.

3.1.2. Dip slope vegetation in the Mureş Plain: N–NE (shaded) and E (partially shaded) slopes:

a. Herbaceous vegetation

Xero-mesophytes. They predominate in shaded slopes and compensate for the reduction of wooded areas. The **fescue and tufted vetch association** (*Festuca sulcata – Vicia cracca*) is wide-spread and it consists of xerophiles: fescue – *Festuca sulcata*, *Thymus glabrescens*, *Carex humilis,* as well as Gramineae and mesophile leguminous plants - *Festuca pratensis*, *Agrostis tenuis*, *Poa pratensis*, *Vicia cracca*, *Trifolium pratense*.

The **fescue and pseudovina association** (*Festuca sulcata – F. pseudovina*) is a transitional phase towards pastures degraded because of grazing. Its xerophile character is due to the presence of *Andropogon ischaemum*, *Potentilla arenaria*, *Medicago falcata*, *Fragaria viridis*; its mesophile character is due to the appearance of the species: *Festuca pratensis*, *Agrostis tenuis*, *Trifolium pratense*, *T. repens*, *Achillea millefolium.*

b. Arboreal vegetation. The "historical" region of *oak groves* in the southern part of the Transylvanian Plain can be reconstructed by following the forest islands on hillcrests or on some shaded slopes beginning from Ceanu Mare and Frata to Papiu Ilarian, Grebenişu de Câmpie, Şincai and Band. The islands of arboreal vegetation makes possible for us, however, to determine the dominant species of old and those which are the most frequent nowadays. The arboreal species of the shaded slopes in the Mureş Plain basically are not different from the region of the Someş Plain. It was, however, influenced by past destructions, mainly regarding the microclimatic changes that took place and the phenomenon of aridation at local level. Mesophile oaks *Quercus robur*, *Q. pedunculatus*, *Q. petraea* are widely spread, in addition to other mesophile species: *Acer campestre*, *Carpinus betulus, Q. petraea,* in the *Aceri tatarico – Quercetum petreae roboris* association; meso-hygrophiles – *Fraxinus excelsior*.

Towards interfluves and at the foot of slopes these associations are replaced by xero-mesophile species, such as *Quercus cerris* or some xerophytes – *Q. pubescens*, *Tillia cordata.*

c. The shrub strata. It appears at forest boundaries or at the foot of slopes and it is represented by the common hazel (*Corylus avellana*), *Crataegus monogyna*, *Prunus spinosa*, *Ligustrum vulgare*, *Cornus sanguinea*, *Cornus mas*, *Rosa canina* and *Sambucus nigra*.

3.1.3. The vegetation of interfluves (hillcrests) in the Mureş Plain:

It is the transitional region from the point of view of landscape and vegetation between the two genetically different slope types of the Transylvanian Plain. The spreading of associations (areal from the point of view of adaptation to xerothermic/humid conditions too) is influenced by the form of the interfluves. The plain or slightly convex ones have xero-mesophytes characteristic to degraded meadows (the facility of grazing being evident), the interfluves without transitional regions (in angle) have no distinct associations, while strongly convex ones are represented by mixed xerophile and mesophile vegetal formations.

a. Herbaceous vegetation

Xero-mesophites. They – mainly – grow in the area formerly occupied by oak groves, this conferring therefore a xero-mesophile character to them as well. The **feather grass and Danthonia association** (*Stipa stenophylla–Danthonia calycina*) is well represented. *Stipa stenophylla* is a xero-mesophile compared to other feather grass species, much more sensitive to the strongly xerophilous character of sunny slopes; therefore we can define it as typical to the vegetation of hillcrests. The association contains xerophytes: *Festuca sulcata*, *F. vallesiaca*, *Carex humilis*, *Serratula radiate* and xero-mesophytes: *Galium verum*, *Salvia nutans*, etc.

The *Stipa joannis – Thymus glabrescens – Potentilla arenaria* association. It consists approximately of the same species as the first interfluve association.

The *Brachypodietum pinnati – Dorycnietum herbaceum* association.

b. Arboreal vegetation.

The mesophile species – *Quercus robur*, *Q. pedunculatus*, *Q. petraea, Carpinus betulus* of the *Melampyro bihariense–Carpinetum* association besides those of the *Aceri tatarico–Quercetum petreae roboris* association*: Acer campestre*, *Q. petraea* are replaced towards the interfluves by xero-mesophile species such as *Quercus cerris* or some xerophytes – *Q. pubescens*, *Tillia cordata.*

3.2.1. The vegetation of escarpments in the Someş Plain:
S–SW (sunny) and W (partially sunny) slopes:

In contrast with the Mureş Plain, in the Someş Plain there is a major ecological change, namely, the plants belonging to the *Stipeae* category are replaced by *Festuceae*, a fact that can also clarify the boundary between the two subunits (also) from the point of view of natural vegetation.

a. Xero-mesophytes in partially abandoned *terraced areas* – agricultural terraces (Lechința, Viile Tecii, Căianu – Vamă, Ghirişu Român).

b. Mesophytes, which follow one another in the same associations as those discussed afore.

c. Arboreal vegetation. In "compensation" for steppic vegetation on the sunny slopes of the Someş Plain there are forests predominated by xerophilous woody species, an unparalleled situation at the level of the Plain. *Quercus pubescens* in the *Corno–Quercetum pubescentis* association and *Quercus cerris* in the *Quercetum cerris–petreae* associations are the species to be found on escarpments in the north-western and north-eastern areas, especially on the slopes which dominate secondary valleys.

Plantations

a. Protective forest plantations

Although the problem of erosion on sunny slopes is not as stringent as in the southern region of the Plain, there are examples of erosionally ameliorated cuestas at Bonțida, Țăgşoru, Fizeşu Gherlii, etc., where the destruction of forests was done *historically*. The favourite species was *Robinia pseudacacia*, afterwards *Pinus nigra*, *Pinus silvestris* being introduced, species which met the expectations with regard to the speed of growth and the anti-erosion effect, and also

b. shrub species, which had not been used to this effect that far: common hazel (*Corylus avellana*), *Ligustrum vulgare*, *Cornus sanguinea*, and *Prunus chamaecerasus*. In Țaga area there are sloped areas stabilized with *Hippophaë rhamnoides.*

3.2.2. Dip slope vegetation in Someş Plain:
N–NE (shaded) and E (partially shaded) slopes:

Herbaceous vegetation

a. Xero-mesophytes. They predominate on shaded slopes and compensate for the reduction of wooded areas. The **fescue and tufted vetch association** (*Festuca sulcata – Vicia cracca*) is wide-spread and it consists of xerophiles (*Festuca sulcata*, *Thymus glabrescens*, *Carex humilis*) as well as Graminaee and mesophile leguminous plants: *Festuca pratensis*, *Agrostis tenuis*, *Poa pratensis*, *Vicia cracca*, *Trifolium pratense,* alternating with typical mesophytes – *Achillea millefolium*, *Rumex acetosa*, *Chrysanthemum leucanthemum*.

The ***Festuca sulcata–Danthonia calycina association*** is mainly to be found in the western part of the Someş Plain besides *Bromus erectus* **association**.

b. Mesophytes. Recently destroyed forests are replaced by clearly mesophilous associations consisting of relict forest species: *Mercurialis ovata, Anemone silvestris, Campanula persicifolia*, etc.[1] Such is the case of the *Pedicularis–Carex Montana* association.

The ***Danthonia calycina–Agrostis canina*** **association** can be found in microlows created by landslides and it consists of mesophilous and meso-hygrophilous species. In microlows there are also hygrophytes – rough-stalked meadow-grass (*Poa trivialis*), *Carex distans, C. gracilis*, *Agrostis alba*.

Arboreal vegetation. Only on the shaded slopes of the Someş Plain we can find the woods typical to the vegetation of the region to which the Transylvanian Plain belongs. We are referring to the compact forests of the north-western area (the highest area of this region and therefore slightly atypical to the general character of the "plain" – Bandău Valley, the Lower Fizeş Valley), the predominant associations being *Carpino-Fagetum* – with species of *Quercus robur*, *Q. petraea*, *Q. pedunculatus*, *Carpinus betulus* and common beech (*Fagus sylvatica*), which is no longer so frequent in other areas – and *Lathyro hallersteinii–Carpinetum.* We find the same species – beech is less frequent – in the central-northern and north eastern areas.

At the foot of slopes or near rivers mesophilous or meso-hygrophile species appear: *Acer campestre*, *Populus alba*, *P. tremula*, *P. nigra*, willows (*Salix sp.*).

[1] István Csürös et al., *Vegetația, ecologia...*, 45.

The shrub stratum. It appears, as in the southern area, at the forest borders or at the foot of slopes, and it is represented by *Corylus avellana, Crataegus monogyna, Prunus spinosa, Ligustrum vulgare, Cornus sanguinea*, *Cornus mas*, *Rosa canina*, and *Sambucus nigra*.

3.2.3. The vegetation of interfluves (hillcrests) in the Someş Plain:

a. Herbaceous vegetation

Xero-mesophytes. They are less wide-spread here than in the Mureş Plain, leaving space for arboreal vegetation, which is present on hillcrests substituting rapidly herbaceous vegetation in sunny facies (a more evident process than in the south). In the north-western part the relief is higher and it has considerable relief energy, a fact which strengthens this remark. The situation is somewhat similar in the *border* areas towards the marginal valleys of the northern region of the Transylvanian Plain.

b. Arboreal vegetation

The dense forests of shaded slopes appear in most of the regions of the Someş Plain (especially in N and NW), starting with the intermediate interfluvial areas: the *Carpino–Fagetum* association containing oak species: *Quercus robur*, *Quercus petraea*, *Q. pedunculatus*, and *Carpinus betulus* and even *Fagus sylvatica*. The *Lathyro hallersteinii–Carpinetum* association in the NW part is replaced by *Quercetum cerris–petreae*. The *Carpino–Fagetum* association suffered intense and rapid deforestation in the far northern area, leaving place to orchards (Cireşoaia–Nireş) and in the north-eastern region to fruit-trees and vineyards (Teaca–Lechința), both on hillcrests and on dip slopes.

As a conclusion a relationship can be established between the *vegetal associations* (Fig. 9) of the Transylvanian Plain and the *landscape types* (Fig. 11) which they impose, doubled by anthropic intervention.[1]

[1] Alexandru Sabin Bădărău et al., *Analiza de inspirație naturalistă şi aplicarea acesteia asupra peisajelor Câmpiei Transilvaniei* (A Naturalist Analysis and Its Application to the Landscapes of the Transylvanian Plain) (Deva: Geis vol VII, 2000).

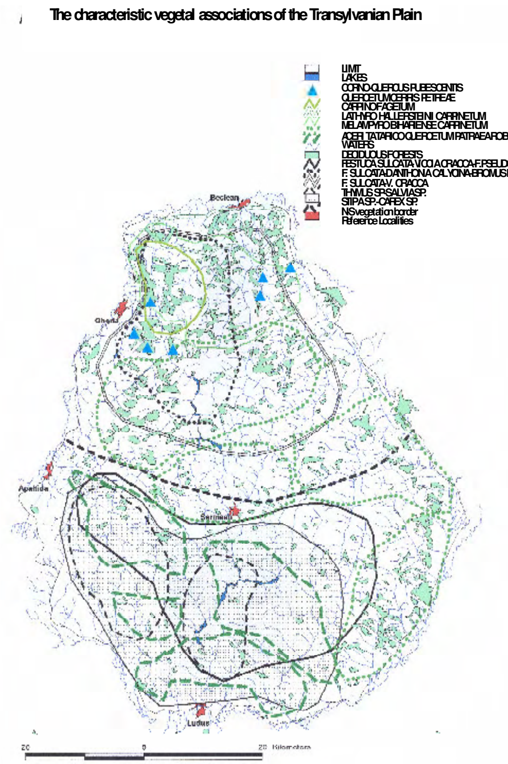

Fig. 9. Vegetal associations

1. Nemoral forest landscape – oak and mixed Central-European forests, with secondary mesophile meadows from the northern part of the unit. A climatic limit of this landscape is the 650 mm mean multiannual isohyet. The secondary meadows created as a consequence of deforestation are predominated by the *Agrostio tenuis–Festucetum rubrae* type, which shows positive net water balance and high mean atmospheric humidity. Natural vegetation is represented by *Querceto petraeae-Carpinetum betuli*. The direct consequence of anthropization was the elimination of forests, especially in watersides and in torrential basins – in order to place and extend rural habitats on the plateaus as well – where the determinant aspect of the landscape is given by orchards (the

Cireşoaia–Nireş area) and areas covered by fruit-trees and vineyards partially degraded in the present (the Teaca–Lechința area). The predominant soil types are Haplic Luvisols (WRB SR) together with Luvisols and Eutric Cambisols, in conformity with the existent vegetation.

2. Transitional landscape between the northern forests and the southern forest-steppe landscapes. In fact, it is a transitional strip between the northern woody and the southern forest-steppe regions, placed on the 600 mm isohyet, being conditioned by an older climate (probably from the Subboreal), and later on by the anthropic intervention in the landscape. The edaphic characteristics are determined by transitional soils between the northern woody area to the forest-steppe one, namely haplic luvisols and mollic luvisols) besides a considerably large area of phaeozems (chernozem soils).

3. The thermonemoral landscape in the north-west of the Transylvanian Plain (the lower basin of Fizeş) is characterized by the appearance of nemoral thermophilous species such as *Quercus cerris* in association with *Quercus petraea* or *Quercus pubescens*. In this north-western area a surplus of humidity can be felt as compared with the south-western region, caused by oceanic influences coming from the other side of the Meseş, woody formations with *Quercus pubescens* appearing only on sunny escarpments.

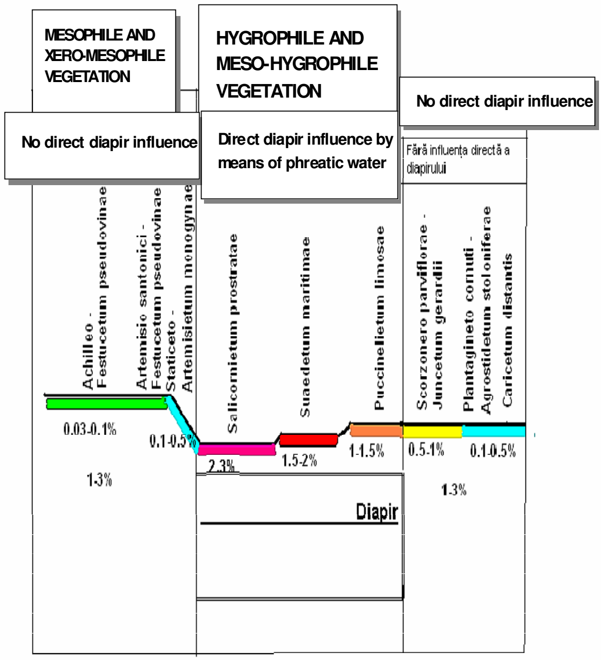

Fig. 10. Halophilous vegetal associations in a diapir area; the percents indicate the degree of NaCl concentration at the surface and at 0.5 m[1]

4. "Relict" forest-steppe landscape in the rain shadow of the Apuseni Mountains is present in the south of the Transylvanian Plain. From a demographic point of view it is an area of maximum anthropization where the initial landscape has almost entirely been transformed. The characteristic soils are Chernozems (Cambic Chernozems) and Phaeozems. On sunny escarpments there are strongly eroded soils and Calcic Chernozems.

5. East of the Mociu–Luduş line as far as the valley of Comlod, the climate is slightly more arid, therefore strongly xerophile elements appear on steep sunny slopes, such as *Agropyron pectiniforme, Rosa*

[1] Cf. Alexandru Sabin Bădărău, *Landscape Transformation in the Transylvanian Plain,* PhD thesis, Babeş-Bolyai University, Cluj-Napoca (2004) – in print.

micrantha, Marrubium peregrinum, which are present only in the western area.

6. The landscape of halophile formations. They are the most significant formations at an azonal level in the landscape of the Transylvanian Plain (*Puccinellio–Salicornietea* class). These halophile elements appear in wide areas since they have very efficient means to spread at distance. The shaping of anticline valleys on the diapir folds in the west, east and north of the Transylvanian Plain, and also in the area of domes, led to the formation of vast salt areas of geological conditioning with different water regimes, especially in diapiric intrafold erosional basins. This is why the halophile formations are placed concentrically in these areas (Fig. 10) according to the degree and type of saltness and also according to soil hydromorphism.

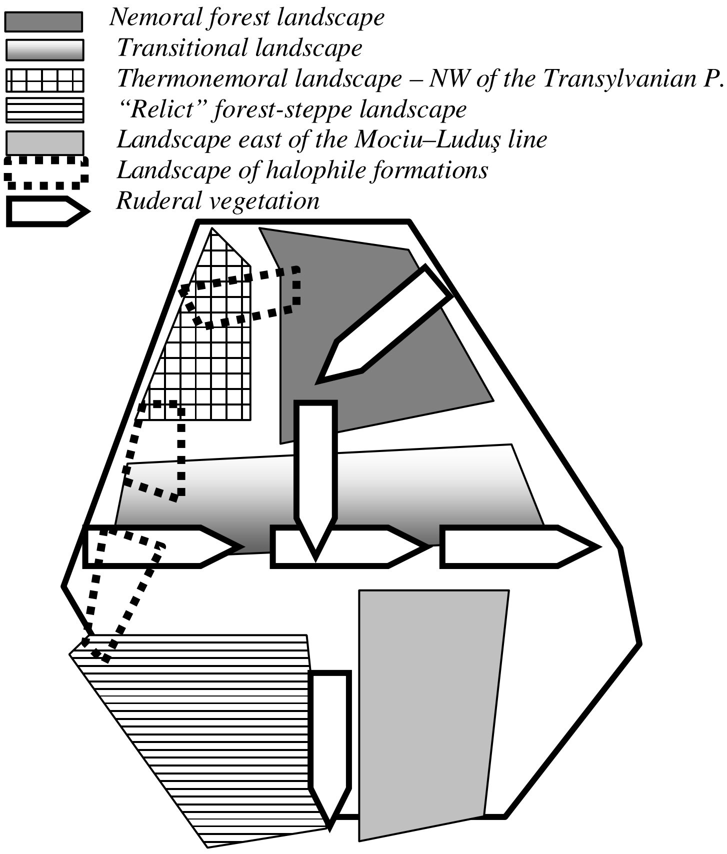

Fig 11. Schematic map of phyto-landscapes in the Transylvanian Plain

7. Ruderal vegetation. It consists of anthrophile formations, connected to the anthropic impact on the environment, which spread along communication axes.

As there are some bioclimatic factors of favourability and risk, in correlation with the anthropic specificity of the Transylvanian Plain, we would like to present the following SWOT analysis:

Strengths	**Weaknesses**	**Opportunities**	**Threats**	Solutions for regional control
Favourable geographic Location within Transylvania	"Central" isolation determined by centrifugal energetic dynamics	Exploiting the existent "crossing" infrastructure at a superior intrazonal level	Decreasing interest in this region at national level	– at a regional level (NW and Central Development Regions); – reconsidering the role of the town Sărmaşu as a polarizing centre
Morphologic and morphomeric characters favourable to a better agricultural exploitation	The incidence of landslides and a rare settlement network	Reintroducing some policies of territorial planning	Unawareness at a local level of the existence of these favourable factors; lack of information	Implementing some model farms such as the ones which existed in the interwar period
Climate adequate to better agricultural productions	Climatic disequilibrium at a local level – related to the recording of annual precipitation quantities; The lack of compensating irrigation systems	Common interests at a regional and national level in the application of a suitable agro-technique, flexible to climatic conditions	Getting used to the psychology of "casual agricultural productions"	Regional and national implication by means of compensatory financing and subventions
Dense hydrographic network and lakes	Poor quality of phreatic waters, insignificant discharge, besides the anastomizing and euthrophization of lakes	Water alimentation projects, regulation of watercourses and efficient maintenance of lakes	Depriving the population of minimal conditions of comfort	– water conduits and the creation of some irrigation systems; – encouraging SME-s to valorise the potential of lakes
The productive potential of hill meadows (and, in a few cases, water meadows)	Major discrepancies between the productions of sunny and shaded slopes; Meadows in the last phase of	Planting hedges on slopes and correlating the pressure of grazing with the production of the	No involvement of the local factor and its "inertia in exploitation"	Establishing specialized farms

	degradation	meadows		
Significant industrial potential based on the exploitation of methane gas	Poor quality infrastructure	Latent (virtual) economic potential with respect to the exploitation of salt resources in the marginal areas	The demographical export marginalizes even more this region	– supporting at a regional level the industrial role of Sărmaşu; – SME-s in the domain of salt exploitation for local interest

Translated by Ágnes Korondi