GEOGRAFICKÝ ČASOPIS

48 1996 2

*Mihaela Alexandrescu**

FAVOURABLE CLIMATE CONDITIONS OF THE SUBCARPATHIAN AREA IN ROMANIA. CHARACTERISTIC FEATURES

Mihaela Alexandrescu: Favourable climate conditions of the Subcarpathian area in Romania. characteristic features. Geogr. čas., *48*, 1996, 2, 6 figs., 7 refs.

The Subcarpathians lie at the contact area between the mesophile vegetation of the Central Europe and the sylvosteppe and steppe xerophile vegetation peculiar to the southern and central parts of Eastern Europe. The area, rich in a great variety of natural resources, has been populated from very old times and, in consequence it has been suffering deepgoing changes and many imbalances. Another reason for people seeking to settle there is its mild climate.The paper presents some suggestive variables in support of this reality, in a representative area between Dâmbovița and the Prahova valleys, motivating the therapeutical availabilities of this environment which ought to be made better use of than they are at present. Here they are: insolation during the vegetation period, average, maximum and minimum annual temperatures, days with specific thermal features of air temperature, mean and absolute thermal amplitude of air temperature, multiannual precipitation means, maximum and minimum rainy days/year, 24-hour maxima, number of days with precipitation falls, persistance and depth of the snow layer, and finally the weather classes. The fact that the climate is moderate, relatively mild in winter and without heat excess in summer represents a healthy background for any activity and moreover helps improving one's health condition if put to therapeutical uses.

Key - words: Subcarpathians, climate conditions, anthropic activity

The Subcarpathians are situated at the eastern and southern foot of the Carpathian range in Romania. They constitute a transitional area to the lowlands, more precisely to the Moldavian Plateau, the Romanian Plain and the Getic Piedmont. Their outer flank lies at the contact between the mesophile vegetation characteristic of Central

* Institute of Geography of the Romanian Academy, D. Racoviță 12, 70307 București, Romania

Europe and the sylvosteppe and steppe xerophile vegetation specific to the southern and central parts of Eastern Europe.

An active surface, dominated by slopes, altitudes of 400 - 900 m, friables rocks (marls, clays, sands), a complex geological structure and active tectonics are the major elements which account for a highly varied landscape. The favourable climate and the wealth of natural resources have early attracted a numerous population, hence a great impact on the environment in keeping with the technological progress of each epoch. Landscape dynamics being thus exacerbated, imbalances, as a rule, set in. It has been admitted now that human intervention in the Subcarpathian area ought to be held under control. Therefore, highlighting those climate feature which have a positive influence on human activity could indicate some types of work which do not imbalance the environment and possibly have a greater efficiency even.

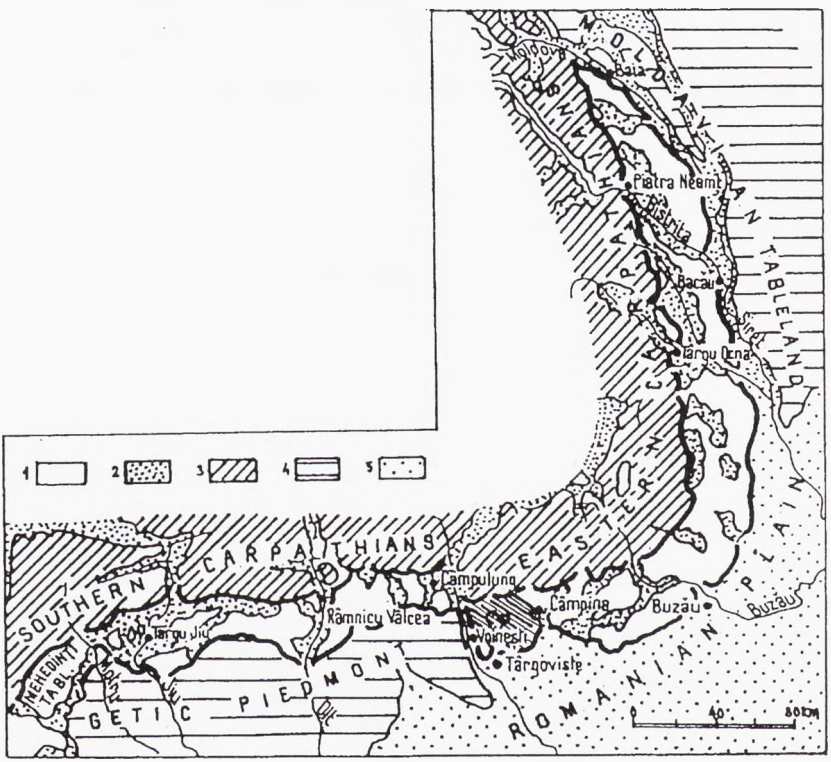

Fig.1. The Subcarpathians and their neighbouring geographical units (you find it only on the paper attached).

CLIMATE CONDITIONS

The wide range of problems posed by the Subcarpathian zone surpass the economy of this paper, therefore we shall discuss only a limited but representative area situated at the contact between the Curvature and the Getic Subcarpathians, that is, between the Dâmbovița and the Prahova rivers (Fig.1).

General atmospheric circulation. Sheltered by the Carpathian Mountains, the

Prahova Subcarpathians are spared the excessive cold air advections from the east of the Continent which usually affect (especially in the cold seson) the eastern and southern parts of Romania. On the other hand a western zonal circulation develops foehn effects and northern air masses penetrate along the Carpathian valleys, which cross the Subcarpathians.

Solar radiation. The geographical position of the area, and more especially its general southward exposition, offer much sunshine, about 2 100 - 2 200 hours/year, mostly in the warm season (ca 1 500 hrs), mean annual global solar radiation amounts reaching 120 kcal/sqcm (Atlas. Republica Socialistă România, 1972 - 1979).

The landscape is dominated by the sunny slopes, or slopes with very much sunshine, and receive 70 -100% of the solar energy that reaches the soil surface during the vegetation period. Today, they are covered by orchards (plum-and apple-trees, moreover), villages and towns, grazes, hay-fields and forest land. As some of the slopes are undergoing modelling processes, they cannot be put to account as efficiently as their caloric potential would allow it.

Air temperature. The Subcarpathian hills register average annual values of 10° C as against the lowlands and 6° C as against the mountain. In July, which is the warmest month of the year, averages do not go up over 21°C in the south either, reaching 17°C in the north. In winter the cold air layer (thermal inversion) centered in the Romanian Plain is felt up to 500 m , where it records -2°C. Above that altitude, up to the contact with the mountain, the temperature falls only to -3°C. In harsh winter weather, when arctic or polar continental masses of air would hang for a long time over Romania, values keep decreasing in the Subcarpathian zone, too (the incidence of such cases during the last 50 years is of 35%). When winters are milder, temperatures do not fall below 0°C (in 20% of the cases).

The optimum living environment offered by the Prahova Subcarpathian climate conditions is illustrated also by other thermal variables, e.g. ***days with certain predominant features***, significant from a bioclimatic standpoint.

Frosty nights are those when minimum temperatures register -10°C or less. The number of such nights in the studied area ranges between 13 (at the contact with the plain) and 15 - 16 (northward).

Winter days are those in which maximum temperatures do not exceed 0°C. An average of 16 such days, occurs in the south, 21 in the hills and 27 in the contact area with the mountain.

Frost days record minimum temperatures of 0°C or less. There has been an average of some 100 such days in the southern extremity and 130 in the northern one over the last 50 years (Fig. 2).

As a rule, frost may set in from the first decade of October, upward to the mountains and in depressions, one week later in most of the hills, and after another two weeks in the south, in the contact area with the plain (25th October). For comparison's sake, let us recall that frost occurs on the 1st of September in the mountain area and on the 1st of November in the plains.

In the particularly cold autumns the frost may come about one month earlier than averagely normal (in the first decade of September in the north and in the last decade of that month in the south).

In general, the last frost occurs in the final decade of April (21st) at the northern periphery and in the higher hills and in the second decade (11th) in the southern extremity, at the contact with the plain. There are extreme cases when, in the area

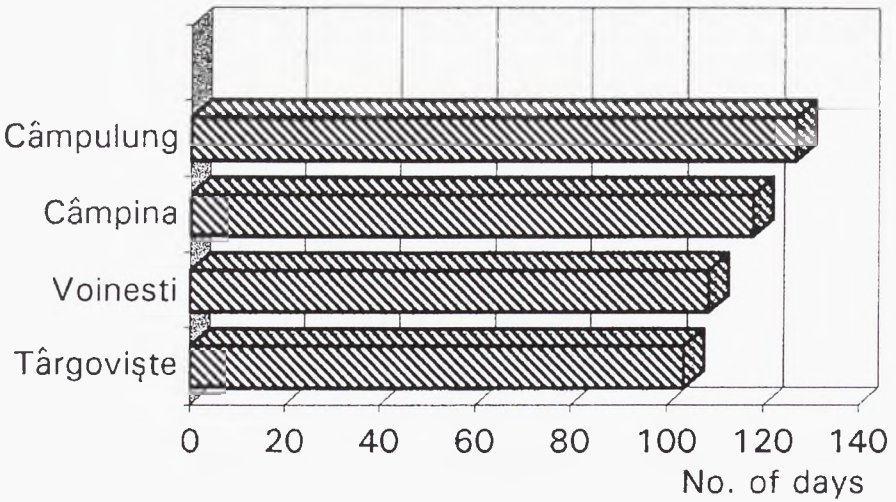

Fig. 2. Number of frost days.

edging the mountain, frost is recorded at the beginning of June (31st May); toward the lowlands such situations may happen in the first decade of May (9th).

This puts the average interval of frostless days at 150 in the north, 175 in the hills proper and at about 200 on the southern hilly summits which, in the cold season, are not reached by the thermal inversion layer from the Romanian Plain in the cold season.

All these characteristic nights and days have been massively recorded in January, the coldest month of the year.

Summer days, with maximum temperatures up to or above 25°C, increase numerically from the north (ca 30) to the south (ca 80) (Fig.3). Their possible occurrence incidence from April through to October is an indication that the Subcarpathian zone is a favourable environment for aero - and heliotherapy far beyound the summer season proper.

Tropical days record up to 30°C or more. Under the influence of tropical and continental air advections, they may occur in the Subcarpathians, too. They have the highest incidence in August and July. In the contact area between hills and mountain, 9% of the summer days are tropical, percentages rising to 13% southward, at 400 - 500 m alt. and to 24% (1951 - 1990) at the hillfoot, close to the plain, which means that heat - induced discomfort periods are short.

Mean annual amplitude of air temperature. The difference between the mean temperature of the coldest month and of the hottest month is ca 21°C toward the mountain zone and 22 - 23°C in the other areas, similar to the Black Sea coast . Yet causes are different: while the sea basin has a thermal - inducing effect, such an effect in the Subcarpathians is due to their position above the "cold pool " forming in the Romanian Plain in winter, a position that shelters them also from canicular summer heat. Thermal amplitude in the Carpathians and in the southern plain of Romania is 17°C and 25 - 26°C, respectively.

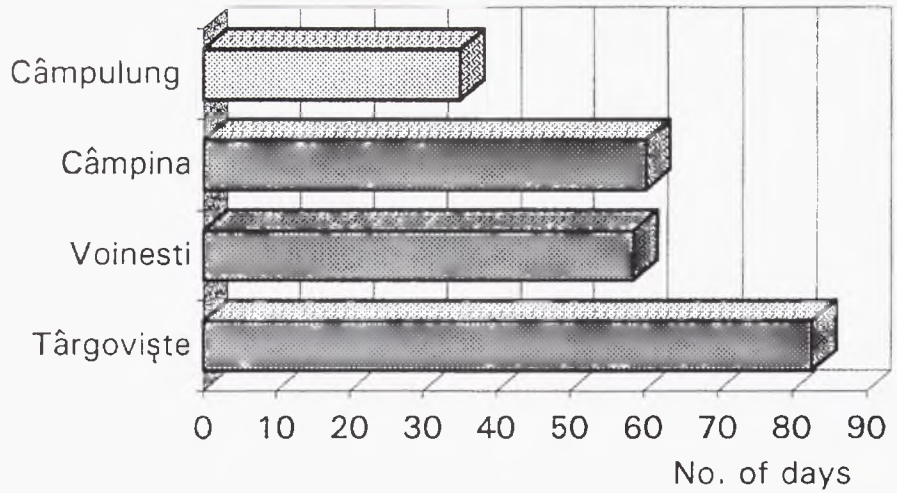

Fig. 3. Number of summer days.

The absolute amplitude exceeds 60°C, comming close to 70°C in the depressions and valleys. This parameter, suggestively illustrating the non-periodical character of air temperature oscillations, gives an idea of the maximum strain human, animal and vegetal organisms can put up with.

Precipitation is the basic element which, by the energy released, has in time fragmented the relief. In the specific conditions of the Subcarpathians (underlain by permeable and impermeable, consolidated and unconsolidated rocks), it has created a huge diversity of landscapes.

The distribution of mean annual amount of precipitation (1950 - 1990) in the western extremity of the Curvature Subcarpathians suggests a dominantly western circulation, with values slightly decreasing from ca 850 mm in the west to ca 750 mm in the east. On the other hand, going from the south to the north, up to the central - north sector (relatively richly - afforested, with additions of condensation nuclei produced by the cement factory at Fieni) there is an obvious increase (from ca 700 to 800 - 900 mm). Upwards, toward the contact with the mountain, values remain approximately constant. This fact could be the result of some foehn effects and adiabatic processes due to the air descending on the south slopes, stronger in both the eastern and northern Subcarpathian zone and in the mountain area of the Ialomita Valley.

Rainfall is more abundant at the end of spring and the beginning of summer, owing to an enhanced cyclonic activity developed along a polar front, and to the thermal convection of the air masses behind the cyclones (Fig.4).

The rainiest month is July (ca 100 mm, that 15% of the annual quantity). A second pluviometric maximum, with lower values this time (50 - 60 mm in the Prahova Subcarpathians), is produced by enhanced cyclonic activity centered in the Mediterranean Sea and which reaches the south-western and southern territory of Romania. Quite exceptionally, values can be exceedingly high - over 300 mm - as recorded in June 1975 and July 1979.

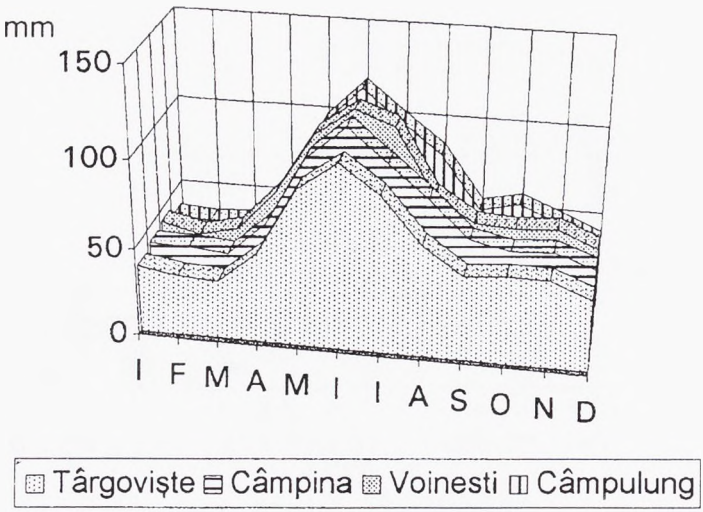

Fig. 4. Mean annual amount of precipitation.

In early spring, when the continental masses of air are still dominant, there is a fall in the quantities of precipitation (ca 40 mm), a second annual pluviometric minimum (40 - 50 mm) occuring in autumn (October).

Heavy rainfall is usually recorded in the warm period of the year (actually the rainiest), when quantities can be larger or equal to the monthly values. In the studied Subcarpathian zone there were exceptional situations, with over 100 mm rain water gathering within 24 hrs. Some of the factors responsible for it are: the Mediterranean cyclones, the vicinity of the mountain liable to bringing about orographic rains, and the presence of open depressions allowing convection to develop in the wake of summer heat. This type of precipitation is one of the major causes of the reactivation of imbalances in the Subcarpathian landscape, especially in areas with deforested slopes, put now to various uses (grazing, crops). The friable rock structure is a key reason for having the Subcarpathians framed into the "critical environment".

There are about 100 days, on the average, with precipitation falls, most of them at the end of spring and the beginning of summer and in late autumn.

The snow layer is a major winter phenomenon with impact on agriculture, transport, tourism and climatotherapy. It usually settles two weeks after the first snow falls, persisting from October to April. There is an average of 60 days in which there is a snow layer in the Subcarpathian depressions that edge the mountains, 50 days in the hilly zone and 40 days in the south, toward the plain area. In October, the layer is very thin (1-2cm) and has a low density, becoming no more than 10 cm - thick in January (maximum value) (Fig.5).

Weather classes offer a general view on the complexity of the climate and its effects upon organisms. This bioclimatic indicator is a favourite of East European researchers. Weather classes are established according to mean, maximum and minimum air temperature values, winds, relative humidity, cloudiness and diurnal precipitation. There are three basic groups (Fedorov 1925, completed by Chubukov 1949):

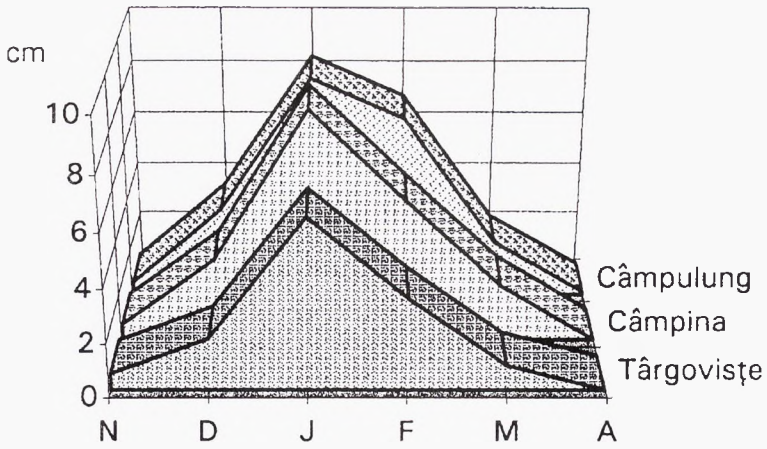

Fig. 5. Snow layer thickness.

Frostless weather

I - Sunshine, very warm and very dry (average daily temperature >22°C , relative humidity < 40%)
II - Sunshine, warm and dry
III - Sunshine, moderately warm and dry
IV - Overcast in the daytime and less cloudy at night
V - Sunshine, moderately warm and humid, overcast at night
VI - Dull, without precipitation falls
VII - Rainy, dull
XVI - Very hot and very humid (average daily temperature >22°C, daily relative humidity >80%)

Weather with temperatures oscillating around 0°C

VIII - Overcast in the daytime
IX - Sunshine

Frosty weather

X - Mild frost (average daily temperature < 0°C...-2°C)
XI - Moderate frost (-2.4°C...-12.5°C)
XII - Frost (-12.5°C...-22.4°C)
XIII - Very frosty (-22.4°C...-32.4°C)
XIV - Excessive frost (-32.5°C...-42.4°C)
XV - Biting frost (-42.5°C)

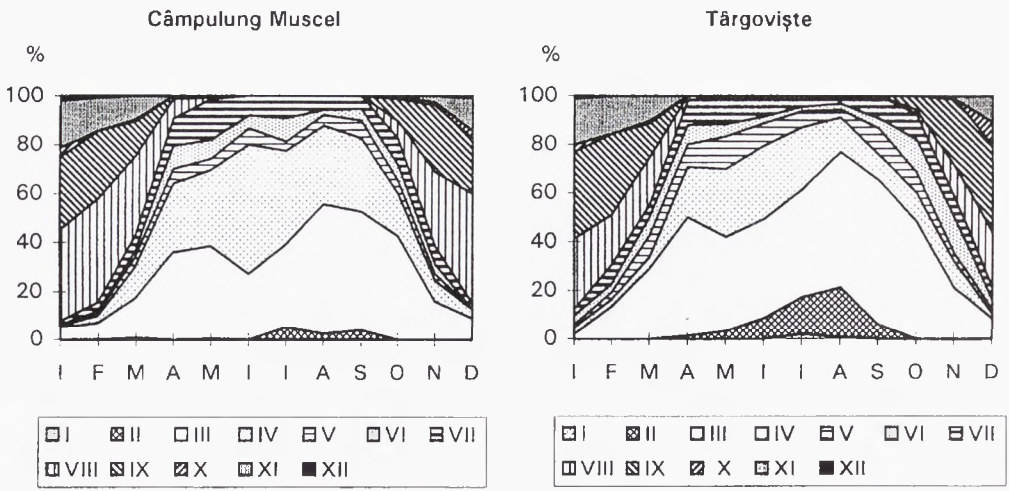

Fig. 6. Weather classes.

The results obtained indicate new possibilities of using the natural Subcarpathian potential, more precisely its climate factors, for spa cures.The existing spa - cure facilities (offering treatments based on sulphur, sulphate and chlorine - rich waters) struggling with financial difficulties, cannot be operated at full capacity.

Weather classes were followed up over a five - year period (1986 - 1990) in two stations: one in the contact area with the mountains (Câmpulung Muscel), the other in the southern extremity (Târgoviște) (Fig.6).

Classes III (sunshine, moderately humid and warm) and IV (warm, overcast in the daytime and slightly clouded at night) were found to have the highest incidence.

Dominant *in summer* is again class III, which together with classes II (sunshine, warm and dry), IV and V (sunshine, moderately warm and humid, overcast at night) represent 80 % of weather types in the area. Classes II, III and V have a positive psychotherapeuthical action, all forms of climatotherapy being indicated (walking, boating, bathing in lakes, swimming - pools, etc.). Classes III and V are the best, with moderate temperatures and humidity levels and relatively much sunshine. Class IV, without atmospheric precipitation or only with afternoon falls, is recorded at the passage of atmospheric fronts in the daytime, or in the intervals of air warming. This type of weather, with intermittent insolation, fortifies the organism through heliotherapy and aerotherapy, the only possible rowback being the wind.

Wintertime is dominated by the classes with temperatures oscillating around 0^{o}C, as well by frosty weather classes: IX (with sunshine) prevails in the south of the Subcarpathians (30%), VIII (overcast in the daytime) in the north (ca 40%), XI (moderate and frosty) and X (slightly frosty). These four types of weather are recorded during much of the winter (ca 70% in the south and over 80% in the north). Class VIII, often windy and with precipitation, characterizes the passage of atmospheric fronts, and can produce meteorotropic reactions. Class IX, with sunshine, features by high atmospheric pressure and is recommendable for aerotherapy, heliotherapy and

winter sports. Classes X and XI are marked by overcast days with snowfalls and occasionall winds during the passage of atmospheric fronts. Negative meteorotropic reactions may set in.

CONCLUSIONS

The intense economic, social and political activity experienced by Romania over the past five years has been entailing a lot of change at all levels and in all fields. In this turmoil, the environment and its problems have been the last thing people are concerned with.Were they allowing themselves time to think, they would probably realize that work could be more efficient using the rich natural potential and carefully avoiding to overtax it. Sheltering a numerous population (10%), the Subcarpathians have become one of the most vulnerable zones of Romania. I deemed it necessary to reveal some of the aspects concerning the climate of this area that could suggest activities less damaging for the environment and more stimulating for people's health, such as spa - cure tourism. A moderate climate with mild winters and not excessively hot summers, moderate precipitation, and atmospheric shelter, represents a healthy background for a wide range of activities, promoting sustainable development in the Subcarpathian area.

REFERENCES

ALEXANDRESCU, M. (1993). Deviations of the 1950 - 1989 annual rainfall quantities in the Subcarpathians between the Dambovita and the Prahova valleys. *Revue Roumaine de Geographie*, 37, 103 -111.

BAIBAKOVA, E. M., ILICEVA, E. M., NEVRAEV, G. A., SVAREV, Iu. N. (1964). *Metodika izucenia i shema opisania klimata kurortov*. Moskva (Ministerstvo zdravohranenia SSSR).

BOGDAN, O., MIHAI, E., NEAMU, Gh. (1980). Potentialul climatic al dealurilor dintre Raul Targului si Teleajen. *Studii si Cercetari de geologie, geofizica, geografie, seria Geografie*, 27, 65-82.

STANCIU, N. (1972). *Insolatia si rezerva de apa a solului*. Bucureşti (Ceres).

TEODOREANU, E., DACOS-SWOBODA, M., ARDELEANU, C., ENACHE, L. (1984). *Bioclima statiunilor balneoclimatice din Romania*.. Bucureşti (Sport - Turism).

TEODOREANU, E., (1992). The bioclimate of the Rucar - Bran corridor. *Revue Roumaine de Geographie*, 36, 99 -112.

Atlas. Republica Socialista Romania (1972 - 1979). Bucureşti (Academiei).

Mihaela Alexandrescu

PRIAZNIVÉ KLIMATICKÉ PODMIENKY SUBKARPATSKEJ OBLASTI RUMUNSKA. CHARAKTERISTICKÉ ČRTY

Subkarpaty ležia v kontaktnej zóne mezofilnej vegetácie strednej Európy s lesostepnou a stepnou xerofylnou vegetáciou, charakteristickou pre južnú a strednú časť východnej Európy. Územie, bohaté na rozmanité prírodné zdroje, bolo osídlené od pradávna, následkom čoho bolo postihnuté hlbokými zmenami a narušením rovnováhy. Ďalším dôvodom, prečo tu ľudia hľadali možnosti osídlenia, bola mierna klíma tohto územia.

Príspevok sa za účelom potvrdenia tejto skutočnosti na príklade územia medzi dolinami riek Dimbovita a Prahova, zaoberá analýzou niektorých klimatických parametrov motivujúcich

terapeutické možnosti tohto prostredia, ktoré by mali byť lepšie využité než sú v súčasnosti. Sú to: insolácia počas vegetačného obdobia, priemerné, maximálne a minimálne ročné teploty, dni so špecifickými teplotnými podmienkami, priemerná a absolútna teplotná amplitúda, dlhodobé zrážkové priemery, maximum a minimum daždivých dní v roku, 24-hodinové maximá zrážok, počet dní so zrážkami, stálosť a hrúbka snehovej pokrývky a konečne - typy počasia.

Skutočnosť, že klíma je mierna, t.j. pomerne mierna v zime a bez horúcich extrémov v lete, predstavuje zdravé prostredie pre akúkoľvek činnosť človeka a v prípade liečebného využitia navyše napomáha zlepšiť jeho zdravotný stav.

Obr. 1. Subkarpaty a ich susedné geografické jednotky.

Obr. 2. Počet mrazových dní.

Obr. 3. Počet letných dní.

Obr. 4. Priemerný ročný úhrn zrážok.

Obr. 5. Hrúbka snehovej pokrývky.

Obr. 6. Triedy počasia.

Preklad: M. Stankoviansky