

## **CEAȚA – FENOMEN DE RISC CLIMATIC ÎN MASIVUL RARĂU**

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**ABSTRACT. - Fog – climatic risk phenomenon in Rarău Massif.** This study tries to make a short presentation of fog as a risk phenomenon in Rarău Massif its impact over the life of human society in this massif. It begins with a short description of the natural environment in which is situated the Rarău Massif, pointing out the climatic component from this massif. The second part presents the terminology about risk phenomenon and other terms involved in the relation between risk and society. After that follows a short presentation of risk phenomenon and, between these, with a concentration over fog, with its characteristics and its relations with other climatic phenomenon. After that follows a presentation of the way how fog as a phenomenon evolved in Rarău Massif between 1989 and 2004. Next it is made a description of how this phenomenon influences the human life and, particularly, over tourism, studying the fog in Rarău Massif and in the region around it, insisting over its unfavourable effects. In conclusion it is trying to be made a synthesis of the study, showing the relation between the climatic risk phenomenon – fog, and the human society, why is it so important for tourism and how does act in the presence or absences of this climatic risk phenomenon.

**Key words :** fog, depression, phenomenon, impact, climatic, Rarău.

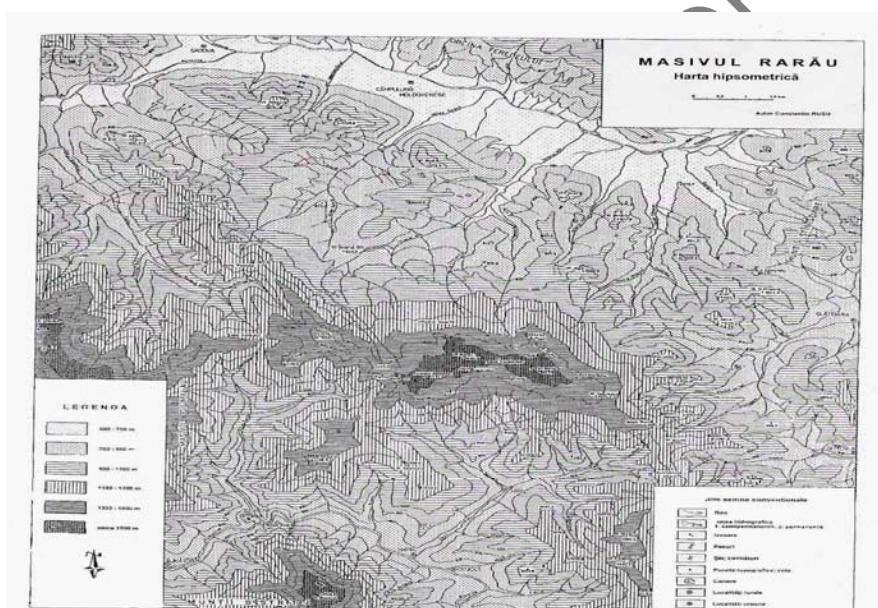
### **1. Region's description**

The Rarău Massif belongs to the Rarău – Giupalău Mountains, which are situated into the Bistrița Mountains. They are part of the Moldo - Transylvan Carpathians (central group), from the Roumanian Carpathians („Geografia României”, 1987). The massif is situated between 47°23'47'' (the aber of Chiril and Bistrița rivers) - 47°32'32''°N (Moldova River at Câmpulung Moldovenesc), and between 25°28'06'' (the aber of Izvorul Giupalăului and Moldova rivers at Pojorâta) - 25°43'30''°E (Slătioara). The bounds of this massif are given by the Câmpulung Moldovenesc, Obcina Mestecănișului and Obcina Feredeului through the valley of Moldova River in north. At east, the limits are Obcina Voronețului through two valleys: the creeks Șandru and Slătioara (the Slătioara - Rădeasa tectonic and erosion corridor). Towards south-east we find the Stânișoara Mountains through Valea Chiril – Curmătura Prislopului aliniagment (between

*Riscuri și catastrofe**Victor Sorocovschi*

Todirescu and Văcăria Peaks) and Hogeia Creek (tributary of the Gemenea Creek). In south, the limit with Bistrița Mountains (Pietrosu Massif) it is made by the Bistrița River. In south – west, the limit is represented by the Bistrița Gorges from Zugreni. In west, the limit with Giumalău Massif is through Izvorul Giumalăului Valley – the Fundul Colbului Saddle (1295 m) – Valea Colbu. In north-west, the limit with Obcina Mestecănișului it is made by the Putna Valley and Mestecăniș Pass (1096m). (Rusu, 2000)

The key element of the relief is inversion, which correspondes with marginal syncline, which narrow part is underlined by a ruiniform relief, with heights benith 1500 m, with a serie of peaks : Puciosu Bârsanului, Bâtca Oblâna, Tarnița, Clifele etc. The relief first characteristics are the shapes created in mezozoic sediments, the most important beeing limestone and dolomite. So, the abrupts, the structural plateaus, the ruiniform relief, the narrow valseys and the detritus trails are the elements the give personality to this massif.



**Fig. 1.** Rarău Massif – hypsometric map (after Rusu, 2000)

The massif's hydrography it is based over two main collectors, which have smaller tributaries, a part to north in Moldova and a part to south in Bistrița. These two flow to the Siret river. The rivers from this massif have zones with gorges and gulleys, as are over Bistrița at Zugreni, over Moldova at Piatra Străjii and Strâmtura Roșie, over Izvorul Alb at Piatra Buhii etc. The underground waters

*Fenomene și procese climatice de risc*

emerge as freatique waters, with a very low mineralisation. There are still karstic and intermitent karstic springs, centred at Izvorul Alb spring and over the south flank.

The vegetation, fauna and soils are characteristic to the subalpin layer and the coniferous forest and mixture forest, protected vegetation; as well there is the fauna for coniferous forests, protected fauna from the restricted areas in this region. The soils are characterised by the diversity of types, from cambisoils to rendzinic, alluvial, unevolved soils etc.. This thing it is caused by the great variety of geological rocks, as are the cristalin, limestone and alluvial rocks etc..

The Rarău Mountains region is characterised by a continental climat with excessive nuances. The average temperatures range between 2°C at Rarău Climatic Station and 6,8°C Câmpulung Moldovenesc Climatic Station, having one of the most lowered temperature in Moldova and in the country. The coldest mounth is January, with a average temeprature of 7,7°C Rarau and 3,5°C at Câmpulung Moldovenesc, and the wormest in July, with a average temperature of 16,4°C at Câmpulung Moldovenesc, and in August, of 11,8°C at Rarau. The frequency of winter days vary between 120 and 150 and even 180 days on the highest peaks. The winter are long and biting in Rarău and more moderated in the surrounding depressions. The firts day with frost appears before the 1<sup>th</sup> of October, and the last after the 1<sup>th</sup> of May.

The annual average precipitations values varies between 686 mm at Câmpulung Moldovenesc and 926 mm at Rarău. The highest procent of precipitations faul in summer. Thus, at Rarău, between June and September, falls over 51% off the annual quantity, the rainiest month being June, with 161,89 mm. The month with the fewest precipitations is January, with 30,98 mm. The annual average cloudiness is of 6,5-7,0 tenths of the canopy at over 1200 m and a bit lower in Moldova Valley, with 5,5-6,0 tenths. The annual average number with clear sky is beneath 40, and of those with clouded sky over 140.

The highest frequency is that of west and nord-west winds, followed by east; the annual average windspeed is of 8-10 m/s. The frequency of calm can be as high as 40%, especially in depressions, because of the shelter phenomenon. Through the valleys, especially Bistrița and Moldova valleys are felted mountain and valley, as felted in Câmpulung Moldovenesc, more because of the fresh and clear air from here.

## **2. Climatic risk phenomenon in Rarău Massif**

Considering the natural phenomenon of meteorologic and climatic origine, a key part has the meterologic and climatic risque phenomenon. These are phenomenon with values that reach and even get over some quatitative thresholds, that are a risq for the human activity. They apear when is exceeded the normal

wind speed, the normal fallen precipitations quantities, the air temperature, at the recede of horizontal visibility etc.. Also, they represent some phenomenon that are a risk for the human life through their way of acting : thunderstorms, hail, high speed winds, snow transportation, blizzards, fog, deposits of ice on soil or other objects – hoarfrost, glazed frost, frozen snow or sleet.

A big part of this phenomenon appear in the massif in the cold season, having „the biggest number of meteorologic phenomenon, including the number of days and the period of life. These are because of the complex meteorologic phenomenon, that appear from the action of low temperatures over the water vapors from the atmosphere.” (Rusu, 2000)

### 3. The fog and it's evolution in the Rarău Massif

From all the other phenomenon, a very important place in tourism and into the normal development of human activities is made by **fog**. It is the result of the condensation of water vapors into the lower layers of the atmosphere as water drops and ice microcrystals, which determine the drop of visibility beneath 1 km. All these form in the conditions low temperatures and high relative humidity.

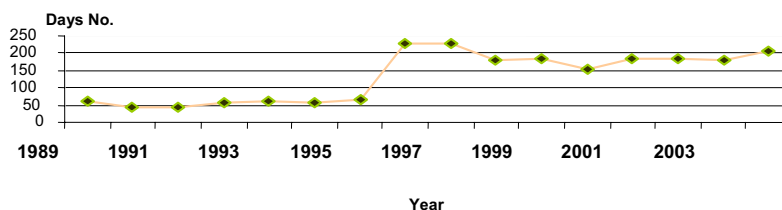
In Rarău Massif, the fog is an all year phenomenon, with a maximum intensity in winter and autumn, especially in December with 16 days in average over the month. The minimum appears in May with a average of 7.93 days. We have an annual average of 14.33 days with fog.

The most powerfull fog it is felt between October and March, because of the frequent invasions of warmer air from west, which meets here a very cold air from the East-European Anticlon and the polar masses from the Scandinavian Peninsula. The drop of the number of fog days in summer time appears because of the weackning of atmospheric influences, with a high predominance from the western ones, not so good for fog development.

**Table 1.** Monthly and annual average number of days with fog – Rarău Climatic Station (1989-2004)

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Average	12.7	12.2	12.7	10.4	7.9	8.7	9.9	9.8	13.6	14.1	13	16	141.3

Over the years there is a very contradictory evolution of the days with fog, with a jump in the year 1996, because of the different sources of data – much lower data in the Daily Meteorological Bulletins, which have a high effect over the annual average values. Even so, the values are still uniform, varying around 50 days between 1989 – 1995, and 200 days between 1996 – 2004. The maximum has been reached in 1996, with 230 days.

*Fenomene și procese climatice de risc*

**Fig. 3.** Multiannual going of the days with fog number at Rarău Climatic Station (1989-2004)

#### **4. The influence of fog over society in Rarău Massif**

The fog is a very well known phenomenon in high altitude zones, influencing in a bad way the tourism, as well in summer and more in winter. The thicker, the strongest the effect of fog over tourists. Sometimes it can be replaced by foggy air, not as dangerous as the fog.

It produces the reduction of visibility beneath 1 km, which makes the minor and even major relief, if it is very thick, hide from the sight of tourists and can confuse them. Following this, it may be possible to loose the track, a catastrophic thing in foggy times, with no special orientation. Also, it can make you loose time, which can determinate the lengthening of the track; if the length is very big, you can risk an opened air camping (not very good on a ground you cannot see very well). In extreme cases, it can determinate the accidentation or even death of tourists, through the leaving of the track and the fall into abyss, or meeting wild animals that hide in the fog.

Also, fog has an indirect effect, reducing the air temperature, and, when with strong winds, it determines a very cold air. It affects the human body with a heavier respiration, a tissue weakening and an intensification of chilblain and hypothermia.

It can be followed by hoarfrost (made by the freezing of water drops over cold objects), which can break down tree branches, telecommunication cables, transportation cables for ski tracks, etc.

Fog can also influence other touristic activities, such as hiking, sports and other activities in opened air, determining the slowing or even the stopping of them, making the tourist to “refuge” in the chalet, that diminishing the income from mountain tourism.

The Rarău Massif has a lot of fog, with a multiannual average of 15.83 days. The dropping from summer, together with low intensity and frequency of the

wind, helps a lot the summer tourism, making it easier to develop. In the winter, the values of fog are at their medium, but I accompanied by a high humidity and strong winds, that make the tourism difficult to develop. Also, the hoarfrost is very thick, determining big damages on communication cables. March and September are the most unfavorable months, having the highest values of fog, wind, humidity and cloudiness. Such weather can determinate accidents through climbing attempts, with serious wounds or even death.

There can be an influence also from society to fog, smoke from big factories, car emissions and from house consume having a strong effect on the atmosphere. This smoke can contain carbon dioxide, nitrogen oxide and other chlorine-fluorine carbides, that in combination with the water vapors can make the air very hard to bread and toxic. Such air has a bad effect over tourism, especially on mountain regions. Rarău Massif is not situated in a very populated region, only two little towns standing in its surroundings, which make little emissions from the few factories presented in these towns (they are more touristic towns); the biggest part comes from car emissions and house consume. So here there is no effect from society over fog, which determines no influence over tourism (the air here is very fresh and pure, that makes even the fog more pure, but still the fog is very thick when it appears).



Fig. 4. Fog in Rarău Massif (Piatra Șoimului – January 2006)

### 5. Future directions

Fog is a risk phenomenon with a big negative impact climatic over tourism in Rarău through the diminishing of the horizontal and vertical, very important for the trips and excursions in the massif. Also, it influences the transport (primary source of income for the Rarău tourism), sometimes the access in the massif being blocked.

*Fenomene și procese climatice de risc*

A very strong effect, especially in the mountains, is the combination between fog and strong winds, which determines a very low effective temperatures, that has a very unpleasant effect over the human body.

It would be better if there could be much better meteorological prediction, especially in winter (December), so that the tourists were able to know what they can expect coming here. So all the events in the massif could be projected based on meteorological predictions, avoiding the periods with bad weather, especially with dense fog. But most of that event occurs around Christmas and New Year's Eve, as is presented in the table below, so it makes no difference what the prediction says, the data stay still; but it can bring information over the way weather will be and some unpleasant facts can be avoided.

The same can happen in summer too, when appears the most important touristic traffic (above 200 tourists per month), because of the good weather, nice view, sportive activities (alpinism and mountaineering a.s.), cultural attractions around the massif (festivals, religious holidays etc.).

**Table .2.** Annual average number of tourists in Rarău Massif  
(from Rarău Chalet Statistics)

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
<b>Roumanian</b>	28	32	12	16	216	300	280	200	275	160	67	299	1885
<b>Foreign</b>	0	4	0	0	0	22	36	89	15	0	8	107	291
<b>Total</b>	28	36	12	16	216	322	316	289	290	160	85	406	2176

The periods with fog and bad weather can be avoided with a good prediction and with a more wider range of other touristic attractions that can keep the tourist in the massif. The most important part of the tourists in Rarău come for week-ends (roumanian tourists) or tours, so they stay for a short period of time. To make them stay for a longer period is a big effort because it includes good accommodation facilities, camping sites, guidance, a clean ground, strong salvamont actions and very good roads. These things are not presented yet in this massif.

A good meteorological prediction can be made in this massif through a good Climatic Station, the one that is now present in the massif having no relevant data for good prediction. A good local prediction can be made only by a good local station, with a small size, only for local information. So meteorology can contribute to the tourism development and to a better life for the local people.

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