THE TOURISTIC POTENTIAL OF WATER RESOURCES IN SUCEAVA DISTRICT

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Abstract
It was realised a map of the touristic potential of the water resources in Suceava District and various aspects of this potential are discussed. Rivers, lakes, swamps, springs and other forms of water which represents a touristic resource are detailed by functional domains; from these, the mineral springs and the presence of the snow are the most important elements of touristic potential that can generate touristic flows. The evolution, in the county, of the water resources-related tourism is assumed to be similar to that observed for other countries in Central-Eastern Europe.

Key words: *Touristic potential map, Involuntary improvement, Extreme sports, Climate change.*

JEL classification: *Q25, Q26, Q54, Y91*

1. INTRODUCTION

This paper presents the water resources of Suceava District, a district with high touristic potential. These resources are estimated mainly qualitatively (types and their characteristics) and secondary quantitatively (their number and the facilities that can ensure the use of this potential). For the synthetic presentation of the exposed aspects, two maps of the study area are created and, in turn, the particular elements of attractiveness of the rivers, wetlands, springs and snow and ice are analyzed. In the category of wetlands (dedicated name at international level) there are lakes (classified by major genetic types and functionality), eutrophic swamps and peat bogs. Snow and ice, often treated by meteorological or geomorphological-centered studies, are treated as water resources, so in a hydrological manner, as currently practiced in the international literature.

The touristic potential of inland water resources is a topic of current interest, both in Romania (Berlescu, 1998) and internationally (Szromek and Kapczynski, 2008), where the correlation of the fluctuations of the profile tourist market with the climate change is of major importance (Scott, Jones et al, 2007).

The main types of activities that can generate tourist flows directly related to water resources in the studied area are: balneotherapy, swimming, snorkeling, sailing (with rafting, canyoning, paddling - including kayaking and canoeing), fishing, skiing, skating, snowboarding, snowmobiling and recreation. Well valorified, at present, are only the mineral springs, the areas with snow, the lakes and the wetlands. The touristic potential of other types of water resources will be better utilized as living standards increase.

2. METHODOLOGY

The collecting of the data which were the basis for the two maps and for the observations in this article was made through field studies and using various bibliographic sources. The background for the two made maps (Fig. 1, 2) is represented by a NMT (Numerical Model of the Terrain) generated based on 1:25,000 topographic maps. For the first map (Fig. 1), over the NMT was added a raster with the land shadowing having a 60% transparency, and the main water-related points and areas of interest were represented by category. The second map (Fig. 2) is a division of the county according to the duration of the snow cover – the newly created areas have different potential for the development of the snow and ice-related tourism; snow cover duration was extracted from climate maps and the areas with different durations were defined as follows: below 500 m = 60-80 days, 500-1000 m = 80-120 days, 1000-1700 m = 120-160 days, over 1700 m = 160 days.

The separation of the areas and points with high touristic potential (represented on the map in Figure 1) from those with low touristic potential (only mentioned in the paper) is made based on the intrinsic potential of a tourist attraction. For example, the number of mineral springs is much higher than those represented on the map or known to the scientific community and, therefore, the identification of the "main" mineral springs is made starting from the existence of their touristic valorification; on the contrary, the use of rivers for rafting in certain sectors takes into account the qualitative criteria, of the greater potential of the areas with keys and gorges comparing to other sectors of the river, and is not based on the criterion of the using of the area by tourists.

The distinction between lakes and ponds and between mineral and nonmineral springs is also a source of variable conventional boundaries.

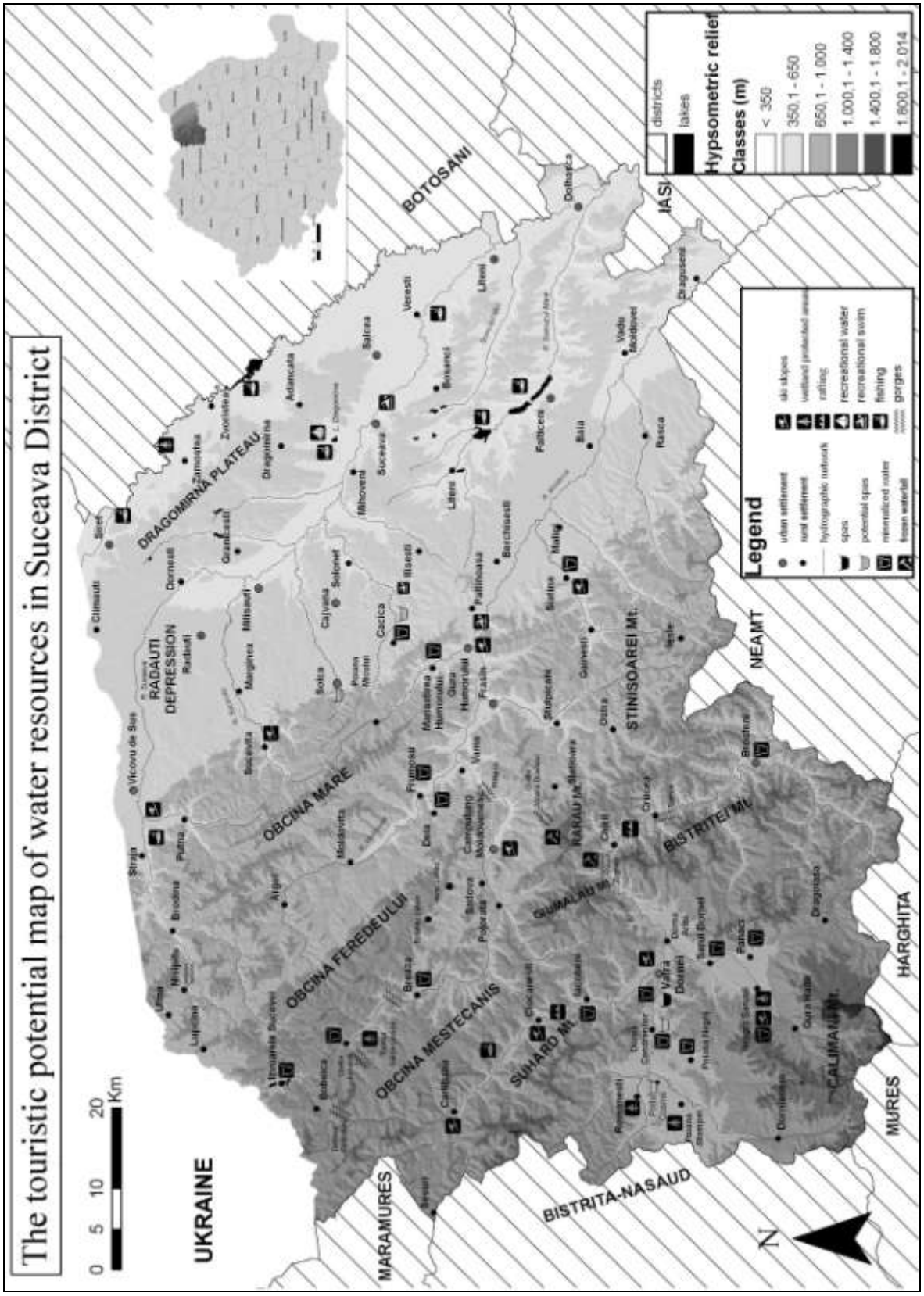

Figure 1 – Map of water resources with the highest touristic potential in Suceava District

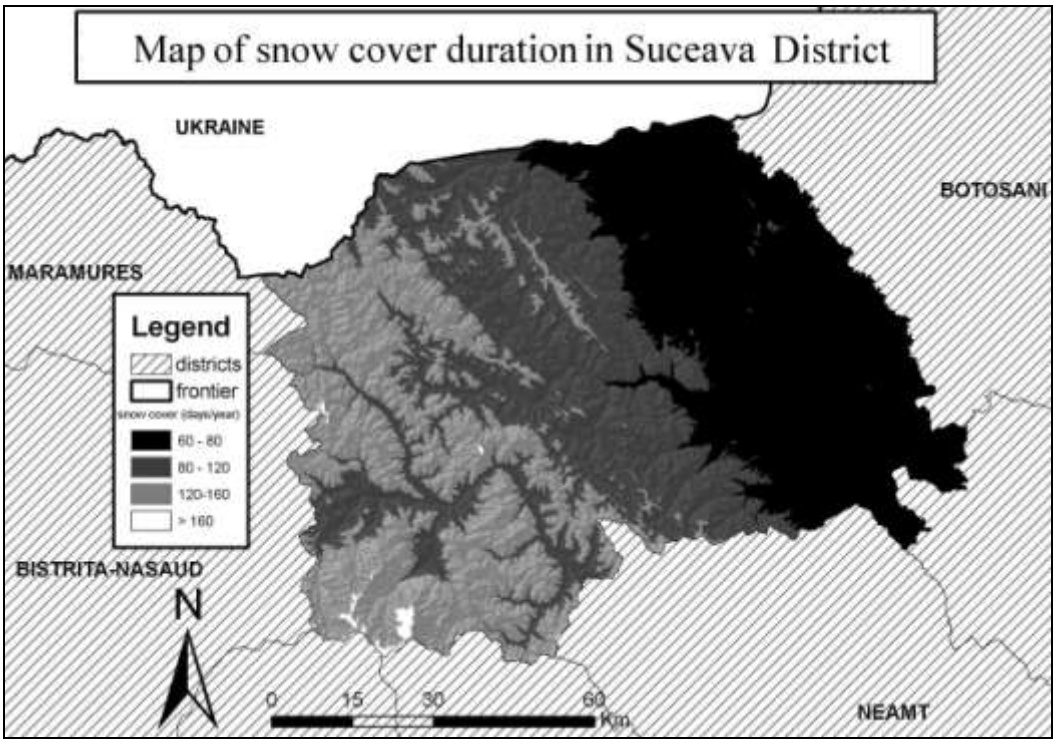

Figure 2 – Map of the potential for winter sports depending on the snow cover duration

According to the majority of modern classifications of standing water bodies (to which we subscribe), there are no lakes (bodies of standing water that have not vegetation at the bottom of the cuvette) in Suceava District, even though there are various water surfaces with the lake name. The springs are classified as mineral if they have an amount of dissolved salts higher than a certain number of grams per liter. In the paper, we adopt, depending on the type of mineral water and on international practice, variable limit concentrations of 0.5 g/l (default, if not mentioned), 1g/l and 1mg/l.

3. RESULTS AND DISCUTIONS

3.1. Rivers

The rivers are a basic touristic potential through the landscape that the large rivers can provide (Suceava, Moldova, Bistrița, Siret) or through the rapids of the bed (most common situation for small rivers, where waterfalls occur - small falls of water, 2-4 m high, occurring in some sectors of the upper mountain rivers, especially in the karstic areas of Rarău Mountains) which can froze in winter, as is the case at Zugreni, on Bistrița Valley and in Rarău Mountains (in limestone quarry area).

The tourism for sportive fishing can be practiced in the most large and medium-sized mountain rivers, so having a magnitude order greater than 3 according to Horton-Strahler hierarchy of rivers system. In the plateau area, only the major rivers (Suceava, Moldova, Șomuz, Siret) have high touristic potential for fishing. Besides the well-known fish that can be fished in the district, one can mention the trout (which can occur, also, in well-oxygenated waters of the plateau) and the huck on Bistrița.

In the mountain and plateau region of Suceava District it can be practiced paddling on Suceava, Bistrița, Moldova and Siret Rivers (which fulfill the conditions of water depths for this sport) and rafting on the mountain areas of the mentioned rivers and on some of their tributaries. The rafting is an activity that takes place on rivers with rough or white water and, therefore, require the existence of a specific morphology of the land and / or the existence of high waters (in the hydrological sense of exceeding waters at the hydrological stations). The terrain morphology specific for rafting is that of canyons and gorges; these are on Moldova River at Breaza and Pojorâta, on Bistrița (eg. Zugreni Gorge, 4km long, 150-200 m wide, with rapids, whirlpools, areas of 12-15m deep), on Devil's Mill (Devil's Mill Gorge on a tributary of the Valea Caselor river which flows out in Moldova at the exit of Campulung Moldovenesc Depression, 90m long, 4-5m wide), on Lucava (Lucava Keys, on a tributary on the right of upper Moldova, on the territory of Moldova-Suliţa county) and on Cârlibaba (Cârlibaba Gorge, in the upper sector of the eponymous river). The other condition for rafting practice consist in the creation of a temporary possibility that this extreme sport can be practiced also in other areas of the big rivers or on the small rivers: the rainy periods create high waters, floods and high speeds of water and are the most favorable for this sport. In the romanian hydrological literature there are identified the following periods of the annual regime

of the rivers in Suceava District: winter low water levels period, spring high water levels period (frequent spring floods), spring low water levels period (in the second half of the spring and more and more smaller by increasing altitude), early summer high water levels and floods, summer-autumn low water levels and autumn high water levels (Ujvari, 1972).

Each of these periods has its own characteristics. Winter low water period is unfavourable to the practice of rafting on all rivers in the district due both to the low level of rivers and to the ice bridge that can occur. The ice bridge frequency is variable, both spatially and temporally. Spatially, during winter months, some rivers can have ice bridge and others do not; this difference appears depending on the river water temperature, its speed and flow, the water depth, the altitude of the stream – thus, in an apparently paradoxal manner, some mountain areas will be ice bridge free while the lower plateau areas show it: this occurs because in the plateau areas of the district the cold air masses of thr Siberian anticyclone are installed, which result in a warmer climate in the higher areas (a phenomenon known as thermal inversion), and because the water flow rate is lower in the plateau. As an example of temporal variation in the plateau region, Moldova, Bistrița, Suceava and Siret had ice bridge from December to March in the winter 1946-1947 and in the winter 1951-1952 these rivers had only frost at banks (Ujvari, 1972). The beginning of frost phenomena is in November in the plateau and in December in the mountains; their end takes place in March.

Spring high waters have a frequency of 20% (occurring in 20 years of 100) for the rivers that flow from the plateau and are regularly formed only in the Carpathian Mountains, mostly in April; the summer high waters have a frequency of 20 % in the plateau and of 25-35% in the mountains; fall higher waters period has a frequency of 30% and now take place 10% of the floods that occur in one year (Ujvari, 1972). The frequency of drought years is only 10-20% (lower at the mountain and higher at the plateau), which ensures good flow to the rivers identified as having high potential for water sports.

On the narrow sectors of the mountain rivers, the canyoning can become a popular sport once with the increase of the revenue of the Romanians, of the level of training and because their demographic structure has a relatively large sample of people aged 30 +/- 5 years, all these being characteristics of those who practice canyoning (Hardiman and Burgin, 2011).

The construction of dams and the regularisation of the river courses have a generally negative impact on the potential of the rivers for various water sports (Hynes, Hanley et al, 2009, Hynes and Hanley, 2006). By building dams, it is shortened or interrupted the useful river length for rafting or paddling. River impoundment generate water speed increase, but this does not also increase the potential for the two mentioned sports, in most periods of the year, because the higher speed of the river is associated with lower levels of it - the catchment is discharged more quickly. The only periods when the levees are contributing to the amplification of the referred potential are those mentioned as having high water levels, when the levees rise the higher waters upper than if there were no levee (this is an involuntary arrangement for extreme sports); during low waters, they have an inverse effect.

Because of human intervention over the streams, the touristic potential of the rivers in the district has changed its characteristics continuously during the communist period, reaching some stability in present when there are no major works on them.

Thus, in the Siret catchment (including Siret, Suceava and Moldova rivers) there were built 540km of levees, 120 adjustments totaling 380km and 540 bank protections for 180km of water courses (Hociung and Băișanu, 2009), which has led, together with the building of numerous lakes, to large changes in river flow regime: high waters or useful floods (with predictable river level, water speed and frequency in order to be used) for extreme sports can only appear on Bistrița, Moldova, Suceava and their mountain tributaries having the Horton-Strahler order greater than 3, while Siret river becomes usable downstream Suceava river flows out in it. Among the negative effects of anthropogenic river improvements one can remember the amplification of the ice jam phenomenon on Bistrița River by the regularisation of this river (Rădoane, Ciaglic et al, 2009). Ice jams also appear on Suceava and Moldova and on the mountain tributaries of them and of Bistrița and these temporary pause any river-related tourism activities.

Both fishing and, especially, swimming are dependent on the temperature of the rivers: annual average temperature in the mountains is 2-6°C and of 6-9°C in the plateau. Even if mountain waters are much colder than the plateau ones, they are preferred for swimming because they have a lower turbidity.

"Dead" rivers-related activities, which resulted in a material basis are to be mentioned – this basis is now landmark: plutăritul (old economical like-rafting sailing), which was performed on the Bistrița, Cârlibaba and other tributaries of Bistrița has created "haituri" (plutărit stations) and on some rivers in the district it lasts water mills.

3.2. Wetlands

Standing water bodies in the district are in the category of ponds and marshes. The ponds with touristic interest, presented below keeping the popular name of lake or pond, are of natural or, more often, anthropic genesis. They have touristic potential by allowing fishing, swimming, entertainment, snorkeling and sailing with boats of various sizes, as is possible in some places (such as Lake Dragomirna / Lipoveni). Lakes with the largest area (and therefore most likely to attract tourists) are anthropogenic and

located within the plateau, being constructed for other economical purposes (the regulation of the rivers regime, irrigation, water supply and electricity generation): Bucecea and Rogojeşti on Siret, Dragomirna on Dragomirna, Şomuz I, Şomuz II, Pocoleni, Fălticeni I and II on Şomuzu Mare. From the small lakes, high touristic potential (by temperature and transparency) have the natural, landslide dammed lakes Iezer and Bolătău, located in the mountain area of medium altitude, the oldest lakes of this kind in Romania (Mîndrescu, Iosep et al, 2010).

The temperature of the lakes is that which determines the preferences for swimming and fishing. Maximum daytime temperature is 28-35°C for the lakes in the plateau and 14 to 25°C for those in the mountains and their average July temperature is 18-22°C in the plateau and 8-20°C in the mountains (Ujvari, 1972). The tourists who choose mountain lakes have this option for their temperature, fishing and water transparency. The first two reasons are endangered by the current climate changes which lead to increased water temperatures in lakes and to lake wildlife changes (Scott, Jones et al, 2007). In winter, on all the lakes appears the ice bridge, and it does not affect fishing and recreation, but also offers the skating practice possibility.

The marshes of the district are mostly eutrophic and mesotrophic, most of them being located along the major rivers. In the mountain region there are areas with oligotrophic swamps, few in number, known as peat bogs. Among the eutrophic marshes, of touristic interest is the forest reservation Zamostea-Lunca (107.6ha), located on the right bank of the Siret River in the village Zvorişteа. Peatlands are generally associated with botanical reservations. In Dorna Basin there are 23 peat bogs between 800 and 950 meters altitude in spruce forests. Peat bogs with high touristic potential are Poiana Stampei (with the potential given by its very large area for a peat bog, of 681.89ha - being the largest peat bog reserve in Romania – and by the possibility of visiting it on a wooden bridge of 900m length), Găina – Lucina (having as advantage its location at an altitude of 1200m and less its surface, of only 1ha). Other important peat bogs are Tinovul Şaru Dornei (36ha, in Neagra Şarului), Grădiniţa (in the west of Dorna Depression, 226ha) and the peat bog from Româneşti (Dorna Depression).

3.3. Springs

The springs present touristic interest when they are mineral. In this case, close to them there are or can appear balnear resorts. In the central-eastern Europe they are poorly known and used (Kosice, Pivac et al, 2011).

The mineral waters are mostly carbonated in the mountain area of crystalline schists, being associated with the postvolcanic events of the halo contact mofette (emissions of CO_2 and, less frequently, H_2S). In the Dorna Depression there are more than 40 such springs, the most notable being at Vatra Dornei, Poiana Negri and Neagra Şarului.

The majority of mineral waters are in the mountain area and includes, especially, carbonated mineral water, bicarbonated, ferruginous and with calcium and sodium. Ferruginous mineral springs are at Vatra Dornei, Poiana Negri, Dorna Candrenilor, Broşteni; radioactive mineral springs are at Vatra Dornei (small concentrations of radioactive salts), carbonated springs at Dornişoara, Broşteni (bicarbonated, which are also rich in calcium and magnesium) and Şaru Dornei (bicarbonated, rich in arsenic, sodium, calcium and magnesium) (Berlescu, 1998).

In the flysch mountain area there are sulfate and sulfide mineral springs - with hydrogen sulfide and other sulfides in a concentration of 1 mg/l sulfur and over (Romanescu, 2003): Moldova-Sulița, Poiana Mărului, Frumosu, Sucevița, Putna, Gura Humorului, Izvoarele Sucevei.

Springs with chlorinated water (especially salty water, with more than 1 g/l NaCl) occur both in the flysch Carpathians and at the contact of the mountains with the Plateau of Moldavia: Straja, Putna, Vatra Moldoviței, Sadova, Breaza, Vicov, Cacica, Solca.

Moldavian Plateau comprises predominantly sulfide and sulfate mineral springs, related to the presence of sulphates from Miocene formations or to the existence of salts from the clays and sandy shales of Sarmatian age (eg. at Strunga).

3.4. Snow and ice

The mountain climate allows the existence of winter resorts in Suceava District. As winter mountain tourism and is also done outside the resort, a map of snow cover duration (Figure 2), good for winter sports and recreation, is suggestive to indicate the higher potential for tourism of the western half of the Carpathians in the district. Calimani Mountains are in the area where the snow appears and disappears earlier than and later than in any area in the Suceava District. A recent study in the Austrian Alps has shown that there is a direct correlation between the snow layer thickness and the number of winter tourists (Falk, 2010). In Suceava District, snow depth is directly proportional to its duration, which affects the spatial distribution of the number of tourists. Current climate changes lead to the gradual decrease of the number of days with snow cover, thus reducing winter tourism potential of the Suceava District.

4. CONCLUSIONS

Using the maps, which are elements of graphic complex statistics, we observe a higher concentration of water-related touristic objectives in the western third of the district, in the mountain-plateau contact area and along the larger rivers. The western area of the district is the most attractive and is on the first place also because of the winter tourism.

The touristic valorification of the water resources is increasing due to the increasing number of hotels, guesthouses and winter and balnear resorts, due to the restoration of the old ones and due to the growing revenue of the Romanians. Thus, although health tourism in the former communist countries declined in the '80s and '90s, it has a revival in the recent years (Kapczynski and Szromek, 2008).

The climate changes lead to the gradual reduction of the touristic potential of water resources, particularly by affecting the snow layer, but also by increasing the water temperature of rivers and mountain lakes or by hardening the forecast of high waters useful for rafting, which will diminish the fidelity of the tourists (Wu and Liang, 2011) for water-related tourism activities in Suceava District.

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