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SKI ACTIVITY IN WESTERN PART OF SOUTHERN CARPATHIANS. CASE STUDY: STRAJA SKI AREA

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Abstract: The present paper is dedicated to the presentation of the ski potential of one of the most famous ski domain in the Southern Carpathians - the Straja ski area. It is located in the southeastern part of the Retezat - Godeanu range, on the northern slope of the Vâlcan Mountains. Straja ski area is endowed with a relentless tourist flow drawn by the scenic beauty of the winter landscape, by its specific amenities and facilities and by the considerable low prices of cable transportation and accommodation. The present analysis starts with a quantitative evaluation of the terrain factors by creating the hypsometric, slope and aspect models but also of the climatic variables. It is followed by an account of its cable transportation facilities, Straja having 7 cable transportation lines, serving 6 ski trails, each different in size, vertical drop, surface, degree of difficulty, carrying capacity and some other services they offer such as night skiing. Furthermore we have also presented the cable transportation functioning periods, which are well correlated with the presence and persistence of the snow layer, this being an important indicator of the management of the ski activities.

Key words: ski activities, Straja ski area, Southern Carpathians, Vâlcan Mountains

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INTRODUCTION

Skiing activities represent very important attributes of winter tourism, being at the same sport activities, generating an entire industry within mountain areas (Agrawala, 2007; Hudson, 2002, 2004), which is one of the most spectacular forms of tourism (Booth and Cullen, 2001; Heberlein et al., 2002; Jeanneret, 2001; Godde et al., 2000; Yang et al., 2009).

In the Romanian Carpathians and especially in the Southern Carpathians, skiing activities are in full spatial expansion and development of the its specific infrastructure (MPTVP, 2009;

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MPDTN, 2010). The Straja ski area started developing as a ski destination after 1990, reaching today the status of one of the most attractive ski area in the Southern Carpathians, where alpine skiing and backcountry skiing can be practiced (SDML, 2008).

From the point of view of tourist taxonomy, Straja was considered initially a genuine tourist nucleus (Țigu, 2001). Today, Straja is a very important resort of local interest, according to H.G. 1122/2002 (PATZVJ, 2003) and reached regional importance. Moreover, Straja is also considered in the National Mountain Tourism Development Plan - Superski în Carpați, second edition (Lege nr. 418/2006 din 16/11/2006; SDDMVJ, 2008).

The purpose of this paper is to present the natural potential of the Straja ski area, its present infrastructure and its development perspectives.

STUDY AREA

Straja ski area is located in the Southern Carpathians, in the southeastern part of the Retezat - Godeanu range, on the northern slope of the Vâlcan Mountains (figure 1). They are oriented in a WSW - ENE direction and are located between the upper Motrului Valley and the Jiului Gorges, with a length close to 50 km and a width of 18 - 20 km (Muică, 1995). The geographic borders of these mountains are well expressed by the relief through strong level oscillations at the limit between the steep slopes of the Vâlcan Mountains and the smooth interfluves towards the subcarpathians part of Oltenia region in the south and the Petroşani Depression in the north, but also through transversal deep valley which separates them from the western and the eastern mountain masses (Geografia României, III, Carpații Românești şi Depresiunea Transilvaniei, 1987; Velcea and Savu, 1983; Muică, 1995).

Straja is the generic name of the area situated on the northern slope of the Vâlcan Mountains, above the small town of Lupeni, under the peak bearing the same name at the moth-eastern boarder of these Mountains, with a declared tourist and sportive activity.

The ski area is bordered in the north by the Petroşani Depression, i.e. by the town of Lupeni, in the east by the line connecting the Sohodol and Baleia rivers, on the southern side by a fraction of main the ridge, where the Straja Peak - 1868 m (figure 1), the Mutu Peak - 1737 m, the Verde Peak - 1627 m, the Gura Plaiului Peak - 1579 m and the Vârful lui Frate Peak - 1524 m are lined up and in the west by the interfluve separating the Braia and Tunsului rivers.

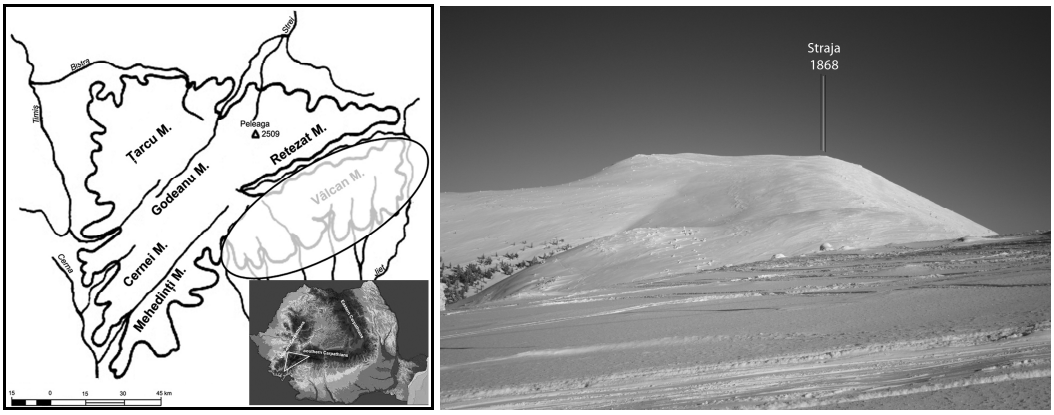

Figure 1. Location of Vâlcan Mountains and Straja Peak
(Source: photo by Voiculescu, 2009)

Straja is located in the Hunedoara county (being administrated by the municipality of Lupeni), but also within the Vâlcan Mountains, due to the fact that Straja is also an entrance point to theses mountains; the ski trails number 3.11 and 12 (Popescu, 1979) go towards the main ridge, making the connection towards east and west with other trails.

MATERIALS AND METHODS

The main features of mountain resorts to be analyzed and compared are the natural factors, especially the ones related to terrain and the climatic factors, having the major concern directed towards snow - duration of the snow layer, depth and the economic conditions related to infrastructure and capitalization of wither-sport produce.

Therefore we have used a 30 m resolution Aster DEM to depict the thematic maps concerning the terrain analysis important for ski resorts: altitude, slope and aspect (Török-Oance, 2001 - 2002). As for the analysis of the climatic factors we have used the data provided by the Parâng weather station.

RESULTS

Terrain features

The terrain factor is an essential element serving the principle of providing high quality natural background for the winter - sport tourism (Jamieson and Johnson, 1998; McClung and Schweizer, 1999; Schweizer and Jamieson, 2001; Țigu, 2001).

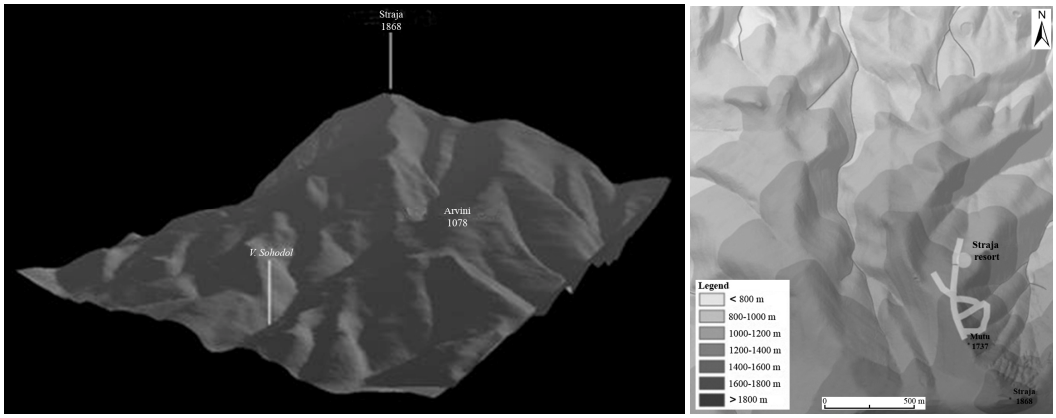

Figure 2. DEM (on the left side) and hypsometric map (on the right side)

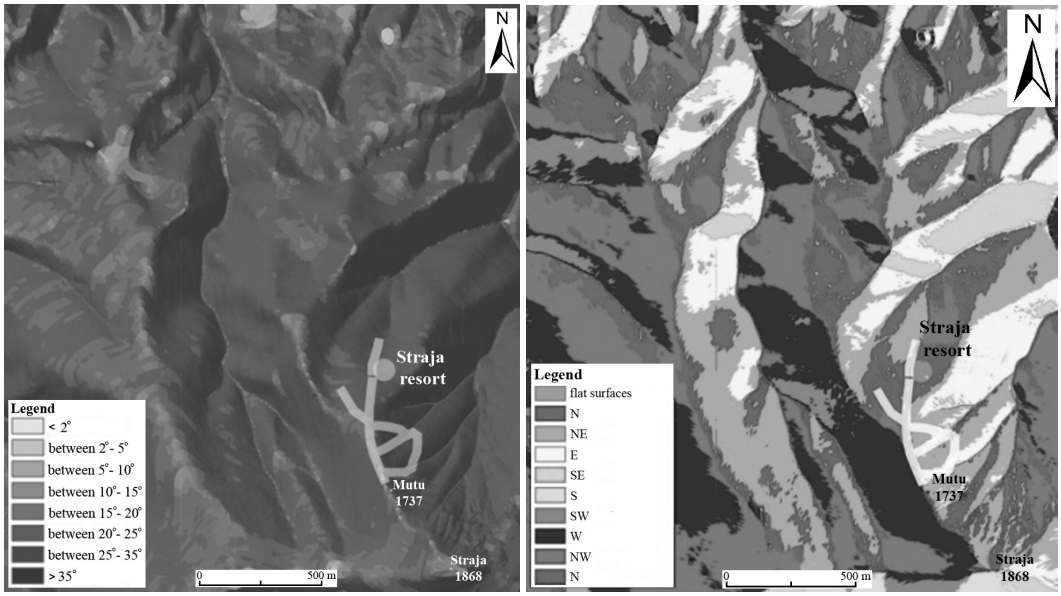

Figure 3. Declivity map (on the left side) and aspect map (on the right side)

The most important factors that need to be studied within the terrain analysis are: altitude, slope, and aspect, to which we can add plane and profile curvature as well. For terrain analysis we had first generate the digital elevation model (DEM), from which we have derived the hypsometric, slope and aspect models (figure 2 and figure 3), using ArcGIS Software.

Altitude bares two connotations: absolute altitude (of the ski area) and vertical drop. High altitude ski area are not characteristic for the Romanian ski area landscape, excepting Sinaia ski area (from Bucegi Mountains) and Bâlea ski area (from Făgăraş massif) both located at over 2000 m altitude. In terms of vertical drop, to be able to consider a ski area for a future or existing resort the vertical drop has to integrate within these values: 400 - 1600 m (Peterson, 2005). Directing our attention towards our areas of interest we can realize that form the altitudes' point of view, the Straja ski area is located within the range of 1800 m and 800 m, measuring a vertical drop higher than 1000 m, being very well integrated into Petterson's principle (2005). This prerequisite condition is fulfilled if we consider the possibility of going downslope until Lupeni, where the bottom station of the chairlift is located.

Slope is a defining parameter for ski area for it separates the type of ski trails for different category skiers. Penniman (1999, pp. 36) separates the skiers into two large categories: skiers who are users of skies or snowboards or other gravity propelled recreational devices whose design and function allow users a significant degree of control over speed and direction on snow and beginners, whom he categorizes as: those individuals whom use one or another of these devices for the first time or who possess marginal abilities to turn or stop on slopes with an incline greater than 20%. It is fair to say that these are quite different one from the other and also use different reporting units (% and °), therefore, today, there are accepted different classifications. There are numerous classifications of ski trails and of skiers alike. Therefore, some researchers (Borgersen, 1977, quoted by Penniman, 1999; Gaylor and Rombold, 1964; Tremper, 2001) separated the skiers into 3 large categories, and allocated very tight classes of declivity for them: beginners or novice, intermediates, advanced or expert (table 1) or according to Blanchère scale (Tremper, 2001), moderate skiers, good skier and very good skier (table 2).

Table 1. Slope gradient criteria

Erickson, 1992 (quoted by Penniman, 1999)			Borgersen, 1977 (quoted by Penniman, 1999)			Gaylor and Rombold, 1964		
Trail code	Skier ability	Grade max	Trail code	Skier ability	Grade max	Trail code	Skier ability	Grade max
easier	basic beginner	15% 8.5°	(no code)	beginner	20% 11.5°	(no code)	novice	20% 11.5°
more difficult	basic intermediate	24% 13.5°	(no code)	intermediate	35% 19°	(no code)	intermediate	34% 18°
most difficult	no description	50% 26.5°	(no code)	advanced	55% 29°	(no code)	expert	35% (.5°
extreme	no description	(no value)	(no code)	expert	80% 39°			>35% >19°

Table 2. Blanchère scale
(Data source: Tremper, 2001)

Skier ability	Caracateristics
moderate skier	a skier of moderate ability capable of secure stem turns, off-piste, in all condition, on slope of 25°-30°
good skier	able to make controlled turns of snow on slopes of 30°-35°. able to descend short steeper pitches and handle difficult snow
very good skier	able to ascend and descend on skis sustained and exposed slopes that most people can only climb up with axe and crampons. these are slopes in excess of 45o requiring a high level of skill and experience, to say nothing of courage.

At the highest altitudes, the slopes surpass 30° - 35°, in the middle of the ski area slopes have values of 25° - 30°, but also there are areas with slopes between 15° - 20° (figure 3). To emphasize the role of the slope when classifying skiers we have drawn two profile line along side two ski trails (figure 4 and figure 5). It is easily noticed that 1st profile is consistent with a trail addressing skiers with abilities of descending trails with high speeds, while the 2nd profile is consistent with a trail which can be undertaken by both advanced and medium skiers.

Figure 4. Location of two profile line along side two ski trails

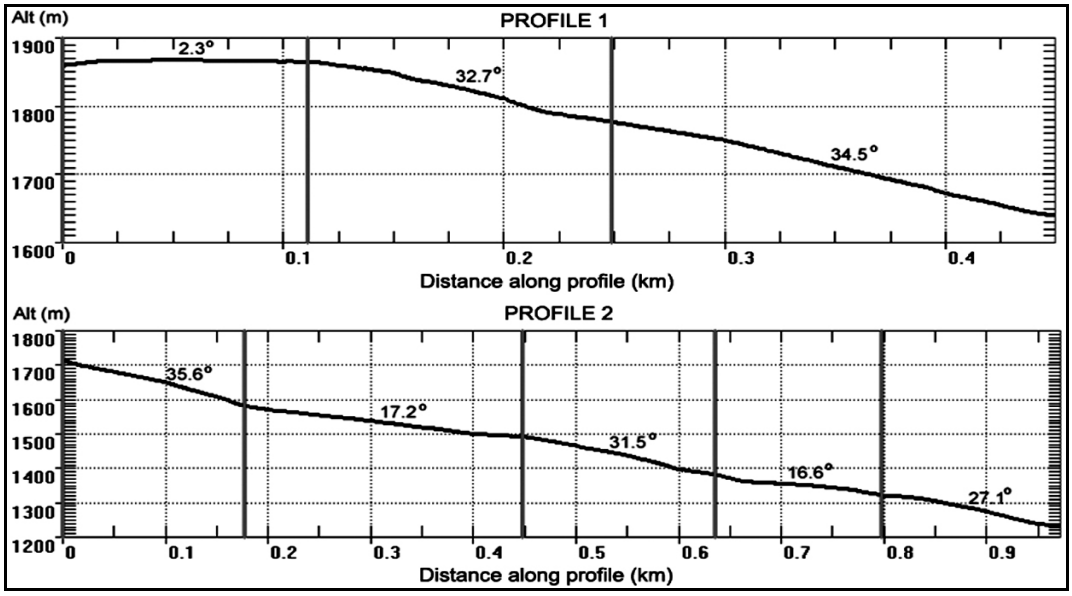

Figure 5. Longitudinal profiles of two ski trails

In terms of aspect, most slopes are oriented towards north, north-west and west (figure 3), which are highly favorable for skiing activities. The radiation of the sun controls snow surface temperature more than air temperature (Tremper, 2001) and plays a very important role affecting snow instability and degree of humidity (McClung and Schaerer, 1993).

CLIMATIC ANALYSIS

The other fundamental natural factors are the climatic ones with a major focus on snow (Jamieson and Johnson, 1998; McClung and Schweizer, 1999; Schweizer and Jamieson, 2001; Țigu, 2001), where literature states that in order to have an economic efficient resort, it is necessary to have 120 days of snow - covered ski area (Țigu, 2001), or other researchers have the opinion that if in seven out of ten winters there is snow covering of at least 30 cm on at least 100 days between 1 December and 15 April (Becken and Hay, 2007, pp. 38; Besancenot, 1990; Freitas, 2005; Hall and Higham, 2005) it is the place of a safe investment. For the synthetic climatic analysis of the Straja ski area we have used the data registered by the close-by Parâng meteorological station, in the interval of 1961 - 2007.

Temperature plays an essential role because it denotes the type of precipitations (figure 6). The mean multiannual average is of 3.4oC. As of the month of December, the mean temperature becomes negative and remains this way until March. Thermal regime influences the type of precipitations, liquid or solid, number of days with snowfall (figure 6) and implicitly the depth and duration of the snow cover (figure 6).

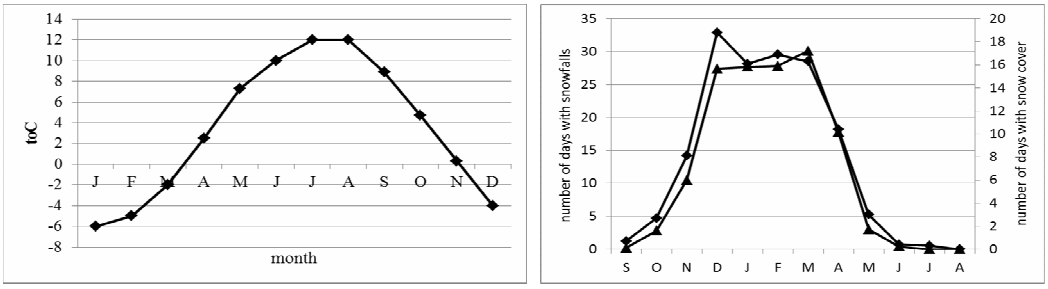

Figure 6. Variation of temperature (on the left side), a number of days with snowfalls and number of days with snow cover (on the right side), at Parâng weather station between 1961 - 2007, average multiannual values

As soon as October, the first days with snowfall are registered, so that in November the fist snow layer takes shape. Snow falls until the month of May, but the snow cover, being conditioned by temperature, only lasts up to April and rarely up to May. In this context, we need to mention that he earliest fist day with snowfall was registered to be the 03.08 and the latest fist day with snow fall was 12.11. Continuing the same idea we need to mention that the earliest last day with snowfall was registered to be 16.04 and the latest last day with snowfall 19.07. Therefore the longest period of the snowfall interval was of 312 days and the smallest of 255 days (Bogdan, 2008). Furthermore we need to mention that the average duration of the snowfall interval is of 93.7 days and the average duration of the snow cover is of 131.1 days (Bogdan, 2008).

SKI INFRASTRUCTURE

At the beginning of the years 2000, at Straja there were one chairlift and two ski lifts (Țigu, 2001). Today there are 7 homologated ski trails (tabelul 3, figure 7 and figure 8) with a total length of 9074.5 m which cover a surface of de 143,750 sqm. The ski trails are homologated (as stated in the Strategia de dezvoltare durabilă a Microregiunii Valea Jiului, 2008). Even though all the ski trails are located on the northern side of the Vâlcan Mountains, they are differentiated according to the local topography. Therefore they differ in size and covered surface (figure 8). As for the degree of difficulty, 50% of the ski trails are easy, 16.6% medium and 33.3% difficult. Only one ski trail, Telescaun which insures the connection of the highest parts of the ski area and the town of Lupeni, has a shared degree of difficulty between medium (80%) and difficult (20%), therefore being dedicated to skier with high technical abilities. We need to mention that 3 of the ski trails have night lighting that insures their lengthy operation hours which can be noticed in the schedule of the cable transportation facilities.

Table 3. Caracteristics of the ski trails
(Data source: Strategia de dezvoltare durabilă a Microregiunii Valea Jiului, 2008)

Nr. crt.	Name of the homologated ski trails	Trail lenght (m)	Degree of difficulty	Vertical drop (m)	Surface (m²)	Night skiing
1.	1,2 Constantinescu	1741.5	easy	364	45000	yes
2.	1,2 Lupului	519	difficult	163	32500	no
3.	1,2 Mutu	1269	medium	320	10000	yes
4.	1,2 Sfântu Gheorghe	700	easy	144.5	26000	no
5.	1 Platoul Soarelui	405	easy	51	27000	yes
6.	1 Canal	1400	difficult	180	3250	no
7.	1 Telescaun	3200	medium (80%), difficult (20%)	593	-	no

1 - ski trails homologated (Strategia de dezvoltare durabilă a Microregiunii Valea Jiului, 2008)
2 - ski trails homologated according to Ministerul Turismului din România

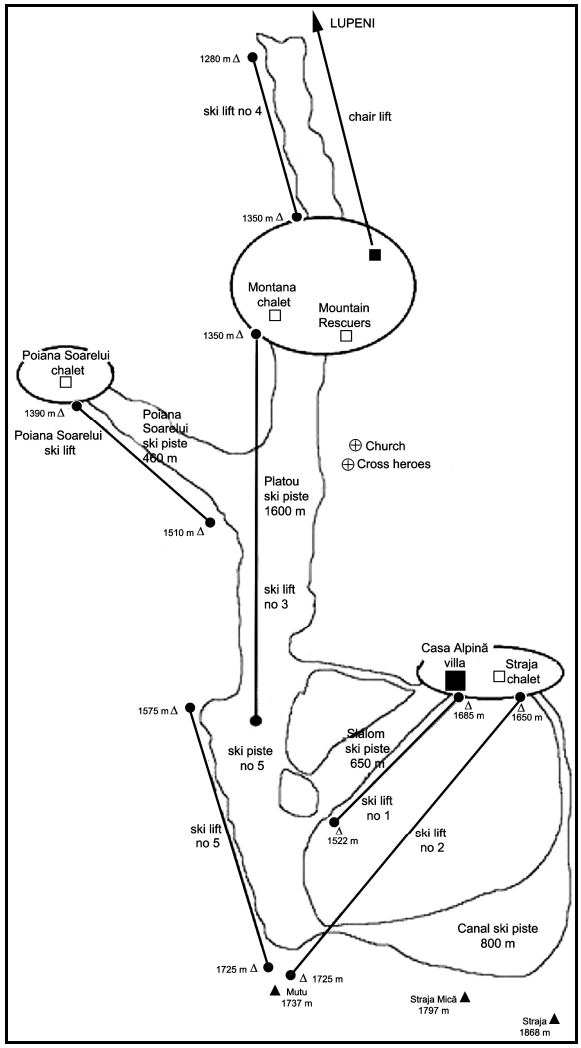

Figure 7. Ski trails of the Straja ski area
(Source: Strategia de dezvoltare durabilă a Microregiunii Valea Jiului, 2008)

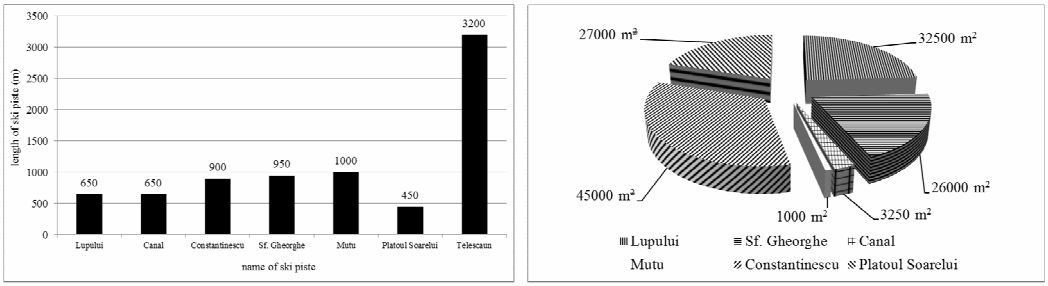

Figure 8. Length of ski trails (on the left side) and surface covered by the trails (on the right side)

The highest density of users is noticed on the Constantinescu and Mutu ski trails (figure 9) due to their considerable length and their medium degree of difficulty. Another ski trail very much used is the Platoul Soarelui (figure 10) due to its easy degree of difficulty, where tourists come to learn to ski. The Lupului and Canal ski trails (figure 10) are used only by skiers with high technical abilities.

Figure 9. Constantinescu ski piste (on the left side) and Mutu ski piste (on the right side)
(Source: photos by Voiculescu, 2009)

Figure 10. Platoul Soarelui ski piste (on the left side) and Canal ski piste (on the right side)
(Source: photos by Voiculescu, 2009)

Cable transportation has developed over time and space as a response to gradually rising tourist demands. If until 2001 there was only one means of cable transportation which served various trails and had a length of 1.45 km, with a capacity of 650 pers / hour (Ţigu, 2001), thereafter the situation improved considerably. Presently, there are 6 ski lifts, with a total length of 4671 m and which now serve all the ski trails of the Straja ski area. Transport time is reduced and the operation hours are differentiated in accordance the facilities of each ski trail, especially with the night skiing facilities (table 4).

Table 4. Caracteristics of ski lifts
(Data source: Strategia de dezvoltare durabilă a Microregiunii Valea Jiului, 2008)

Name of lift	Ski trail served	Length (m)	Vertical drop (m)	Transport duration (min.)	Capacity persons/hour	Schedule
Ski lift 1	Lupului, Mutu Constantinescu Platoul Soarelui	519	163	4	675	09.00-02.00
Ski lift 2	Mutu, Lupului, Canal Platoul Soarelui Constantinescu	905	260	5	780	09.00-17.00
Ski lift 3	Constantinescu Sfântu Gheorghe Platoul Soarelui	952	180	5	840	09.00-24.00
Ski lift 4	Sfântu Ghorghe	650	145	5	424	09.00-17.00
Ski lift 5	Constantinescu Platoul Soarelui Mutu	1260	198.6	4	600	09.00-24.00
Ski lift 6	Constantinescu Platoul Soarelui	385	102	4	520	09.00-24.00

The transport capacity rose in the last few years, having values between 424 pers / hour and 840 pers / hour, the highest values being reached by the Constantinescu, Sfântu Gheorghe ski trails which are the lengthiest and the most used by tourists. The smallest values are registered by the Lupului ski trail which is relatively short, but at the same time the most difficult and by the Platoul Soarelui which is again a short ski trail, but this time the easiest as well (table 3).

Table 5. Ski lift demands
(Data source: Documentație Primăria Lupeni, 2005)

Number ski lift	Demand (%)
1	2
2	22
3	30
4	5
5	18
6	23

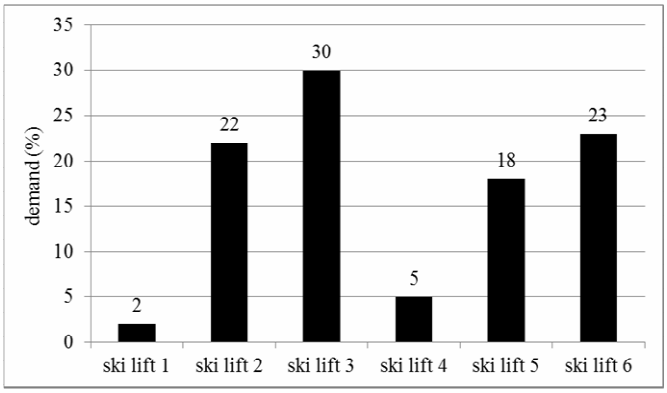

Figure 11. Demand dynamics for the ski-lifts
(Source: Documentație Primăria Lupeni, 2005)

Ski lift demands according to Documentație Primăria Lupeni (2005) differ in accordance with their degree of usage (table 5, figure 11). The highest demand (30%) is without out a doubt for the ski lift no 3, placed at the eastern end of the ski area, holding the advantage of transporting tourists towards the highest areas of the domain.

Table 6. Ski activities record
(Data source:according to Documentație Primăria Lupeni, 2005)

Winter season	Month	Ski lift
1999 - 2000	November	did not work
	December	1,2
	January	1,2
	February	1,2,3
	March	1,2,3
	April	did not work
2000 - 2001	November	did not work
	December	1,2
	January	1,2
	February	1,2,3
	March	1,2,3
	April	did not work
2001 - 2002	November	did not work
	December	1,2
	January	1,2
	February	1,2,3
	March	1,2,3
	April	did not work
2002 - 2003	November	did not work
	December	1
	January	1,3
	February	1,2,3
	March	1,2
	April	did not work
2003 - 2004	November	did not work
	December	1,2,3,4,6
	January	1,2,3,4,6
	February	1,2,3,4,6
	March	1,2,6
	April	did not work
2004 - 2005	November	did not work
	December	1,2,3,4,5,6
	January	1,2,3,4,5,6
	February	1,2,3,4,5,6
	March	1,2,3,6
	April	1,2,3,6

High demands (23%, respectively 22%) are directed to the ski lift no 6, respectively no 2, accessible at the entrance in the ski domain. Small demand is directed towards the ski lift no 1 (2%), due to the fact that it serves the Lupului ski trail, which is the most difficult, destined for advanced skiers only and respectively towards ski-lift no 4 (5%), due to its lowest location and lack of snow at the beginning and at the end of the season. Even though the winter season is considered to be entailed in the November-April interval, skiing activities take place in the December-April interval, when the snow has the required characteristics for the skiing activities. Their intensity is determined by snowfall and implicitly by the existence and the depth of the snow

layer. The municipality of Lupeni, which is responsible for the administration of the Straja ski area, has created an interesting record of the ski activities in the interval 1999 - 2005 (Documentație Primăria Lupeni, 2005) (table 6).

After analyzing this record we have determined some interesting aspects with regard to the usage dynamics of the ski-lifts in the November-April interval:

- the months of November and April coincide with the beginning, and the end of the season respectively, therefore are not suited for skiing activities, except for the year 2005 when 4 ski lifts were still in usage in the April;

- the months of February and March are characterized by a high frequency of winter sport activities, when the snow layer has a considerable depth and when at least 2 - 3 ski lifts operational;

- in the same idea we need to mention that in the winter of 2003 - 2004 in February and March, 5 lifts were functioning, while in the winter of 2004 - 2005 all ski lifts were operational in the same monthly interval, which is a clear indicator of the large quantities of snow and of the favorable depth of the snow layer for skiing;

- in the winters of 2003 - 2004 and 2004 - 2005 a high usage of the ski lifts was recorded: 5 of them in the December - February interval, respectively 6 for the same interval in the winter of 2004 - 2005 and 4 ski - lifts for both winters in the March-April interval.

DISCUSSION

If in the beginning of the years 2000, the Straja ski area had great potential to achieve the required numbers for the specific indicators (Qt / Qp, where Qt - pers/hour, Qp - capacity of cable transportation; Lt / Nl, where Lt - total length of the transportation lines, Nl - no of accommodation beds; Qt / Nl și Lp / Nl, where Lp - ski trail length) for the tourist nucleus status, presently most of these have been achieved (table 7):

Table 7. Characteristic of the ski trails including the optimum carrying capacity (Qt)

Nr. crt.	Name of the homologated ski trails	Trail lenght (m)	Width (m)	Vertical drop (m)	Degree of difficulty	Qt (persons)
1.	Constantinescu	1741.5	50	364	easy	435
2.	Lupului	519	40	163	difficult	120
3.	Mutu	1269	50	320	medium	345
4.	Sfântu Gheorghe	700	30	145	easy	105
5.	Platoul Soarelui	405	60	102	easy	150
6.	Canal	1400	8	260	difficult	40
	Total	4239.5				1195

The carrying capacity is calculated having in view the vertical drop, the width of the ski trail and especially important is the difficulty category of the ski trails. It defines how many persons can be at the same time on that particular trail without inconveniencing each other. Without considering the trail under the chairlift where the carrying capacity is rather impossible to calculate due to the fact that it belongs to two category types, there can be 1195 skiers on the ski trails of Straja. Here there can be added the persons riding the ski lift at the same time.

Without counting the benefits of the chairlift there are over 4.2 km of ski trails over the altitude of 1200 m, which is highly important considering the fact that there are the one mostly used (table 5) and the fact that most of the season they are the beneficiaries of natural snow, and also if we compare them to the 2001 retaliation (Țigu), when there were 1.95 km of ski trail, we realize the improvement.

Furthermore if we take into consideration the evaluation criteria of the attractiveness of this ski area, according to Țigu (2001), we can conclude the following:

- the degree of accessibly to the ski area has improved due to the fact that in addition to the chairlift the road which connects the town of Lupeni with the resort of Straja was asphalted on a length of 9.3 km;

- the natural tourist potential is outstanding serving as guarantee for the tourist market;

- the ski area is endowed with features which enables tourists to practice alpine skiing, snowboarding and backcountry skiing;

- the accommodation capacity has improved as well, through the emergence of new locations as a result of private local investors, but also through the improvement of the degree of comfort - some of the existing chalets being classified;

- if 10 - 15 years ago, the length of the trails was a weak point, today it became a point of attractiveness, due to its present size;

- the existence of 7 cable transportation lines insure an efficient access to all trails;

- the length of the trails are better correlated with the accommodation capacity, still in weekends and in peak season on some of the trails there are uncomfortable agglomerations of skiers;

- in the same peak-season the hourly flow of the cable transportation capacity is overrun.

Even though this is beyond our purpose, we could mention that during the summer season there are different activities that can be practiced in the Straja area: rest, walks, berry picking. The tourist demand of the Straja ski area is characterized by an effective and sustained national demand according to Țigu (2001). Unfortunately the international demand is still very low. Considering the potential demand, it follows the pattern of the effective one.

CONCLUSIONS

It is without a doubt that Straja represents one of the most dynamic and most important ski area of the Southern Carpathians, being integrated from a taxonomical point of view as a tourist resort. It has a tremendous natural potential, having sheltered and relatively long slopes, and of 4 - 5 months of snow each year. Due to its location in the western part of Southern Carpathians, Straja ski area is attractive to tourists from the din Banat and Transylvanian Regions, as much as to the ones coming from the southern and eastern part of Romania, a reality which we have observed on location.

Complementing the alpine skiing activities, the Straja ski area is the perfect place for tourist that want to learn how to ski and also the perfect place to enjoy the snow and other winter activities such as snowboarding, ski touring, snow-mobiles rides which are specific to mountain areas characterized by skiing activities, according to Hudson (2002). It is remarkable the fact that in the last few years, the degree of attractiveness has improved due to the emergence of new ski lifts but also due to the improvements of the skiing conditions (more facilities, better grooming).

Having in view that Straja ski area is integrated in the larger Parâng - Retezat region, declared by the Romanian Ministry of Tourism and Regional Development as a national tourism interest area (PIDULJH, 2008), we can therefore underline the attention that is directed towards this particular area, especially that according to PIDULJH (2008), the region that Straja is integrated in is annually visited by 500,000 tourists.

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