Stimating social carrying capacity in Mediterranean mountains protected areas. Methodological orientation[i]

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Abstract

The concept of social carrying capacity, though opens to debate and critique, is a valuable tool that enhances the management of recreational use in protected natural areas. In this study, conducted in Sierra de las Nieves natural park (Spain), we first categorised the hikers making use of the park and then, from the profiles obtained, analysed their perception of crowding on the trails. This assessment was subsequently used to assess levels of user satisfaction and thus to determine the psychosocial carrying capacity of the park. The results obtained can be extrapolated to most of the Spanish natural parks in Mediterranean mountain areas, due to their comparable levels of visitor numbers and to the prevalence of recreational hiking use. The results suggest that management efforts should be directed toward relocating trails outside the core areas, such that user preferences may be satisfied while less impact is made on the areas of highest environmental value.

Key words: Hiking; visitors classification; natural areas planning and management; social carrying capacity.

1.Introducción

Natural parks (a status created by Act No. 4/1989 and equivalent to the IUCN Protected Area Category V - Landscapes/Seascapes (Dudley, 2008)) are widespread in Iberian Mediterranean Mountains as a consequence of its better Biodiversity conservation compared to another agrarian environments. Accordingly, recreational practices in natural spaces are still at an embryonic stage of development, although visitor numbers are growing. This changing pattern reflects a situation similar to that already experienced in the sociological context of Anglo-Saxon countries, where the

protection of natural spaces and the practice of recreational activities in such spaces date back to the 1950s and 60s. Accordingly, literature review reveal that empiric information about number and motivation of users is uneven and scarce opposite to the deepers and more assorted studies in Anglo-Saxon area.

Working on this assumption, the aims of this study are:

-Know users motivation

-Apply motivation to the analysis of the crowding perceived by users as a basis for determining social charge

-Generate an instrument for park planning and management, verifying the degree of consistence between management goals for the natural park and visitor's motivations.

The natural park of Sierra de las Nieves (Andalusia, Spain, see Fig. 1) has been chosen as a significant study site. Applied methods have been:

-Territorial analisys of park planning and public outodoor recreation services.

-Planning and carrying out a survey focused on the users of included in public trail net, the only outdoor activity included in natural park planning.

-Analyse survey results according to literature review about motivation, crowding and social carrying capacity

Ought to the space limitation, methods and results have been merged.

2. Methods and results

2.1. Motivation and crowding as components of social carrying capacity

To achieve these goals, literature review work revealed the relationship of three concepts: motivation, crowding and social carrying capacity. Early studies focused on estimating the social carrying capacity of recreational and protected natural areas (Wagar, 1964). Subsequently, differences in users'motivation were introduced as a factor underlying their perceptions of crowding (Driver, Brown and Perry, 1978; McCool and Petersen, 1982).

Knowledge of users' motivations is fundamental to our study goals, as this factor is the basis for understanding the demand for recreational facilities and, at the same time, a valuable tool for developing effective management measures (Arnegger, Woltering & Job, 2010; Saepórsdóttir, 2010; Farias, 2011) and for estimating social carrying capacity from perceptions of crowding. In this way, crowding perceptions, being subjective judgments by individuals, depend on widely varying social and/or

psychological factors, including the type of user, the activity performed and the environment in which it takes place (Graefe & Vaske, 1987). Literature review also show that survey is usually the way to fit both motivation and crowding perception.

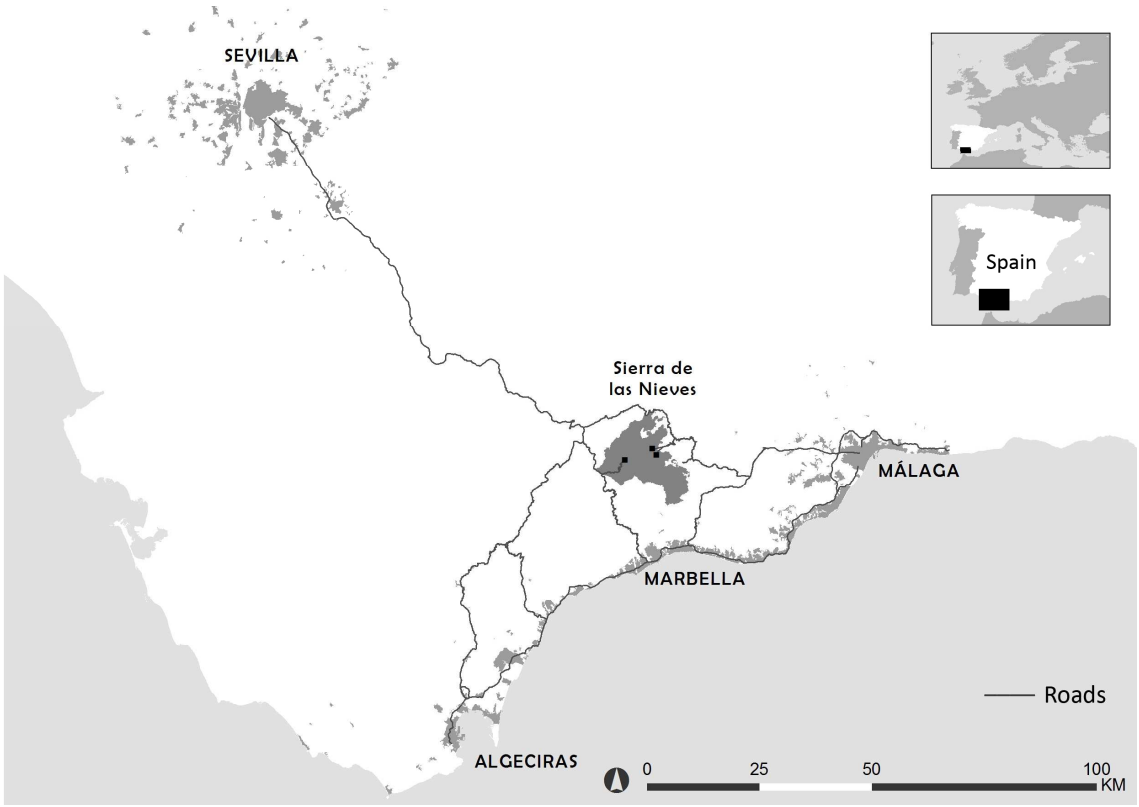
For developing these ideas, we start with territorial analisys (1st) as a determining factor of survey planning (2nd) and finish with survey results analysis (3rd).

2.2. Territorial analisys of user-outdoor recreation environment

Study Area and Sampling

The natural park of Sierra de las Nieves (Andalusia, Spain, see Fig. 1) was selected as the study site for various reasons. First, it is a significant example of the function of Mediterranean mountain areas in the context of the European Union, as many natural parks are located in such areas; second, it reflects, in terms of visitor numbers and the hiking-oriented focus of the park's infrastructure and regulations, the user conditions prevailing in Spanish natural parks; third, its planning is based in the existence of *Abies pinsapo bois*, a high value tree from the biodiversity viewpoint.

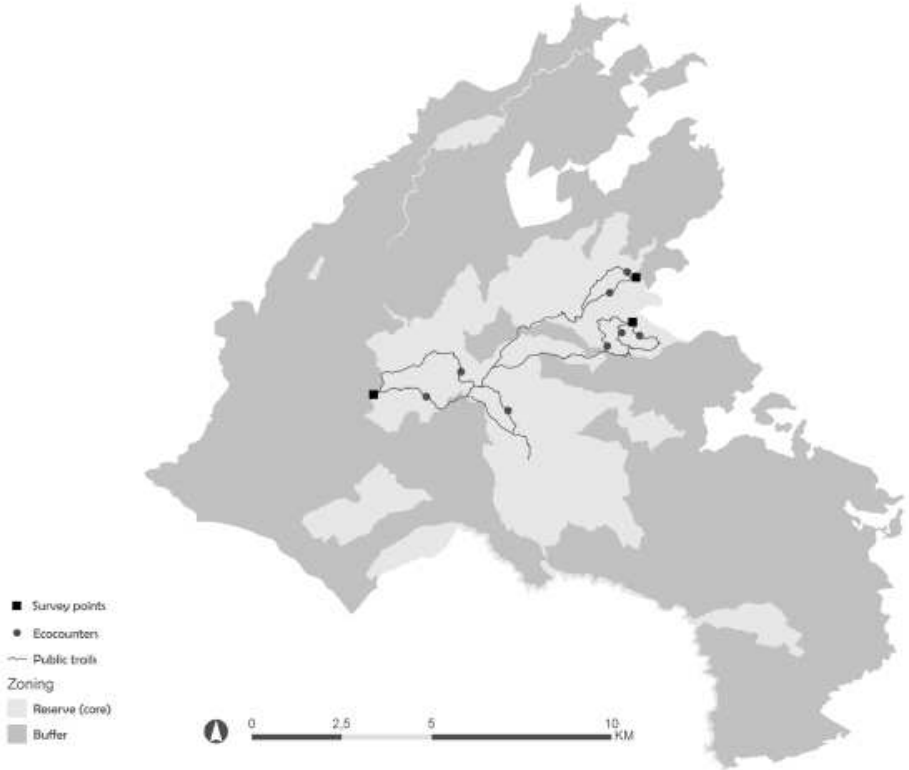
Figure 1. Study area: Natural Park Sierra de las Nieves



Regarding to the number of users of park trails, 23.000 per year, we know it throughout the dataloggers (automatic data recorders) installed (see figure 2). In contextualizing this number, we can find significant information about the representativeness of the

study área. This type of natural space, with relatively low visitor numbers, is the most common and accounts for the largest total surface area, both in Spain as a whole and in the region of Andalusia in particular, in the category of natural park Cabalar, 2013; Muñoz, 2008). In this respect, Spain's parks are well behind those in the USA and other European countries (Fernández & Santos, 2010) and the scarce and not much reliable sources show a low number of visits. (EUROPARC, 2013 2012). Thus, 92% of these parks receive fewer than 50,000 visitors a year, and 64% receive 10,000-50,000 visitors (Sierra de las Nieves is in this visitor range). On this point, and nevertheless it's a secondary factor in this study, it must be outlined the lack of automatic data recorder. Often, the information belong only to visitors centres, without knowing if their activity affect more vulnerable natural elements and avoiding the measurement of carrying capacity.

Figure 2. Dataloggers and survey points situation in public trail network. Natural park Sierra de las Nieves



Focusing on hiking, it is significant that the only park activities assigned a specific location are those of leisure (recreation areas) and hiking (see Fig. 2). Hiking is the most popular recreational activity, both in protected natural areas and among all outdoor recreational activities in Spain; according to a report published by the Spanish

Centre for Sociological Research (CIS, 2010), 8.6% of people aged over 14 years practise mountaineering, hiking and/or backpacking. Likewise, several studies (Cabalar, 2013; Farias, 2011; Muñoz, 2008) show that virtually all Spanish protected areas have public trails with or without signposting.

The definition and management of this natural park (with a total surface area of 20,163 ha) is the responsibility of the Andalusian Regional Government, in application of Act No. 4/1989 of 27 March on the Conservation of Natural Areas and Wildlife (Junta de Andalucía, 1989). This status is equivalent to the IUCN Protected Area Category V - Landscapes/Seascapes (Dudley, 2008). The fundamental justification for establishing this natural park is the delicate situation of two species, the Spanish fir (*Abies pinsapo bois*) and, to a lesser extent, the gall oak (*Quercus faginea ssp. Faginea*). The Spanish fir dates from the Tertiary period and is only found in a few areas of the Serranía de Ronda and in the Yebala range in northern Morocco. Thus, in terms of biodiversity, this area is of great importance. Nevertheless, processes of deforestation, incessant since the fifteenth century, had led to a clear risk of this species' extinction, a risk known to the National Forestry Department for several decades. In 1995, the area (extended) was declared a Biosphere Reserve, but in Spain there are no specific management and zoning regulations for this territorial category, and so it is subject to the regulations applicable to natural parks. Among other objectives, the park managers seek to consolidate and amalgamate the currently discontinuous presence of Spanish firs, previously found only in shaded valleys where the altitude and orientation provided the humidity and cool temperatures needed for their survival. Applying protectionist zoning criteria, these formations comprise the central area afforded the very highest levels of protection (see Figure 2), as stipulated in the Natural Resources Management Plan (Junta de Andalucía, 2003), although the same degree of protection was also granted to other isolated areas. In addition, a peripheral area of protection was established around the Spanish fir woods. In this way, we understand that the trail network is localiced in the areas with most biodiversity values ought to planning linking with the earlier UICN proposals (environmental education).

However, the area presents other physical factors that are of greater significance for the nearby population, in the provinces of Málaga, Cádiz and Sevilla, namely its altitude and the presence of snow. Torrecilla mountain, at 1,919 m above sea level, is the

highest peak in the province of Málaga. Snow is a rare sight in coastal Western Andalusia and so its presence on the slopes of Sierra de las Nieves ("*Snowy Mountains*") makes it a prime destination for winter recreation, despite the absence of any kind of infrastructure for snow sports, which would be unviable due to its short duration. The connection between the park and its snow cover arises from its location, concerning both the atmospheric conditions that produce snowfalls and its altitude, determined by the geology of the mountains. The third physical factor is a further identifier of the park in terms of recreational activities, but for a much more restricted population – speleologists. The limestone formations contain a series of chasms of international importance, especially the GESM sinkhole, which at 1,100 m, is the deepest in Andalusia and one of the deepest in Europe. Of these four factors – the Spanish fir, Torrecilla mountain, access to snow and speleology – the first three constitute the main attractions for visitors, and as a result of their dependence on altitude, they share the same space, namely the area afforded the highest levels of protection.

2.3. The survey: its planning and primary results

As it has been enounced, we followed the proposals of Graefe y Vaske (1987) for survey planning and we started from a set of premises stemmed from the territorial analysis of the study area and from the visitors affluence chronology provided by dataloggers.

The first of these was the seasonality of park use. This question was addressed in order to clarify the relationship between visitor numbers, natural cycles and the work year; for this purpose, the survey period was divided according to these criteria over a full year. The availability of dataloggers facilitated the counting of the annual distribution of visits; the fact that one year's accumulated data had previously been obtained was used as a criterion for the timing of the survey. The following selection criteria were applied with regard to natural cycles: high summer temperatures, seasonal changes in vegetation in accordance with the annual hydrological cycle, the existence of sunny days with mild temperatures during the winter months, and the presence of snow. According to the Natural Resources Management Plan (Junta de Andalucía, 2003), the latter factor is associated with episodes of overcrowding. Data collection was interrupted during the hottest months (June to September), as the dataloggers reflect a

sharp fall in the numbers of trail users in these months. As regards the advisability of conducting visitor surveys on days of rain or mist, we decided to determine visitor numbers during these periods, before excluding them from the study period. In practice, these weather conditions were found to be dissuasive, and so when the forecasts supplied by the National Meteorological Agency suggested the likelihood of unfavourable weather, surveys were not conducted. On the contrary, the days when the presence of snow coincided with good weather conditions were specifically included in the survey programme (28% of the surveys). These weather conditions were identified directly by the interviewer as one of the items checked on the questionnaire. Regarding the working day/holiday status of the date, the survey days were classed as weekends (7 days, 58.6% of the surveys), long weekends (7 days, 17.4% of the surveys), Christmas period (10% of the surveys) and working days (2 days, 1.2% of the surveys). The Easter holidays were excluded due to the abnormally rainy weather experienced in the year in question.

The second issue considered was to include in the survey only those persons identified as users of public trails. To ensure this outcome, the survey was planned such that the survey sites were exclusively those where there was access by motor vehicle to the start point of a trail (see Fig. 1). Of these sites, we then selected the three which preliminary field work had shown to be most frequented by vehicles (see Fig. 2). The criteria for selecting respondents was that they should be aged over 16 years and have hiked the trail in question, in full or in part. The visitors who agreed to participate in the study were given a brief description of the study goals. Data were collected from midday until sunset (the exact time depending on the month), and so the answers provided referred to activities that had already been carried out. The questionnaires were completed by the interviewers. A total of 345 valid questionnaires were obtained.

The questionnaire contained three sections relating to the following study goals (Ocaña et al., 2013): visitor characteristics (origin, age, sex, profession), motivation and perception of crowding (this latter aspect was fundamental to estimating the social carrying capacity) and satisfaction with the trail experience, as described in the literature review. The characteristics of the respondents were similar to those reported by Wöran & Arnberger (2012) in a study carried out in the Austrian Alps. The age range was 16-75 years, with an average of 37.7 years (vs. 41.4 years in the above-cited

study), with a relatively low participation by women (28% vs. 47%). 50% of the visitors were university educated and 81% were in employment (vs. 74.2%), but the numbers of pensioners (2.3% vs. 11.9%) and students (2.6% vs. 10.0%) were very low. These differences reflect the social environment of the recreational activities in Mediterranean societies, and the fact that such active, outdoor activities have only recently been widely adopted, hence the scant presence of retired persons. On the other hand, the low number of women doesn't match with the Spanish eco tourist profile (Muñoz, 2008: 294).

As regards the visitors' origins, the data obtained for users' profiles in Sierra de las Nieves corresponds to the prevailing pattern in natural parks in Andalusia (Hidalgo, 2009), with most visitors arriving from nearby urban areas. Figure 1 shows the location of this natural park with respect to the potential demand for its recreational activities. The metropolitan areas of Sevilla, Algeciras and Málaga-Costa del Sol, all at a distance of about two hours by car, depending on the access point (see Fig. 1) provide a potential user population of around one million in the first and third cases, and of 300,000 in the second. Analysis of the survey results shows that the relationship between road access, the respondents' place of origin and their distribution among the three selected survey points corresponds to a proximity model. These three areas account for 94% of the respondents, with a clear predominance of those from Málaga (75%). This population, therefore, is mainly a nearby one, which is in accordance with the characteristics observed in other protected natural areas, both in Spain as a whole (Ruiz & Galdós, 2007) and in Andalusia (Hidalgo, 2009). This finding is also in line with Wöran & Arnberger (2012) regarding the prevalence of users from the same country, although the latter study did not report the proximity of visitors' area of origin or the duration of their visit. In both studies, visitors predominantly arrived in their own vehicles (98.5% vs. 97%), which suggests proximity. Results for the duration of the visit, however, were unequal; in our study, 90% of the respondents were on a day trip (vs. 46.1% for Wöran & Arnberger). Our assessment of these data is that, in contrast to the universal nature of its biodiversity values, the spatial context of this natural park as a tourist destination is very limited.

As regards the visitors' origins, figure 1 shows that metropolitan áreas of Sevilla, Gibraltar-Algeciras and Málaga-Costa del Sol, all at a distance of about two hours by car, provide a potential user population of around one million in the first case and third

cases, and of 300,00 in the second. These three areas account for 94% of the respondents, with a clear predominance of those from Málaga (75%). This population, therefore, is mainly a nearby one, that chose protected areas more as outdoor recreation areas that by their biodiversity values. This profiles matches with the studies of Ruiz y Galdós, 2007 in Basque Country and Hidalgo (2009) in Andalusia, but not with Cabalar findings in some natural parks in Galicia (Cabalar 2013).

2.4. Results: motivation and crowding perception

In relation to questionnaire content, literature review showed that most of surveys employ Likert scales and then analyzed the results obtained using cluster or factorial methods that combine motivation items with sociological ones. Besides that, Spanish research has accepted some of these results and researchers have adapted them in a wide range of profiles (Muñoz, 2008). Nevertheless, given the lack of basic information about study area visitors, we decided to start from the definition of motivation proposed by Manfredo, Driver & Tarrant (1996), as "the individual's intrinsic or extrinsic incentive to engage with an activity", and to including in the questionnaire the Recreation Experience Preference (REP) items (Driver, 1977 *apud* Gallowey, 2012). Regarding to activity selected (Graefe y Vaske, 1987), the survey focused on the public trail users, as public trail network is the only outdoor recreation equipment offered.

In this way, first at all we need to know what weight hiking had as motivation among public trail users. Specifically, Item 3 of the survey "When you go out into the country, is hiking your main reason for doing so?" with a closed yes/no line of response, provided a first line of segmentation. The answer divided the study group into *hikers* (those who answered *yes, 87,8%*) and *visitors* (those who answered *no, 12,25*) (table 4).

After that we applied Recreation Experience Preference (REP) items (Driver, 1977 *apud* Gallowey, 2012), having into account the goals study (to get basic information) and the embryonic stage of development of hiking in Spain. But, in order to avoid that if the questionnaire design were based solely on the principles applied in previous studies biased results might be obtained, we decided to combine closed and open answers (question 2 and counter question 36, see table 1). The closed ones referred to the REP items listed in Table 1, selected from the REP items, such as "*to enjoy nature", "for physical fitness", "to learn"* and "*to be in company*" (in the latter

case, meaning the respondent is motivated to share the experience with friends and family).

The open-ended responses allowed us to relate the users' motivations with different management approaches, identifying the elements of the natural area, whether or not included in the management approach, that are most attractive to the respondents. These responses were then assigned either to the items with which they were related (whether alone or in combination with others) or to the motivations listed in Table 1 as "*related to park management objectives*". The questionnaire responses "*to learn*" and "*related to park management objectives*" raised a conceptual discussion, as their open nature meant they could be included both in the concept of "*to learn*" in general, and specifically, as a particular element of the natural park. We decided to discriminate these responses according to how the attitude in question is addressed in the management objectives, and according to their possible relationship with larger numbers of users and thus the possibility of crowding. In consequence, the following motivation responses were singled out:

- "*To pick mushrooms*".
- "*To see the snow*" because the presence of snow is recognised in the management objectives as one of the causes of crowding;
- "*To see Torrecilla mountain*" because this mountain is famous in the province and attracts many sightseers;
- "*To see the Spanish firs*" However, this motivation was eliminated because only one response to this effect was made, and the latter was included in the item "*To learn*" in response to question 36.

Table 1.- Relation between the motivation dimensions listed in the Recreation Experience Preference scales, the questionnaire items and the open ended responses given by respondents

	Motivation dimensions taken from the Recreation Experience Preference items				Motivations related to park management objectives
Questionnaire questions	To enjoy nature	To learn	For physical fitness	To be in company	
Question 2: Today, in particular, what is your reason for visiting the park?	To spend a day in the open air To see the	To see a specific aspect of the park To walk the *Cañada de las encinas* trail To visit a part of the park not previously visited	For open-air sport Walking Training To explore new trails		To see Torrecilla mountain To see the Spanish firs To see the snow

	sunrise	To see the *Caridad* woods To show the park to a friend To see the landscape To see the birds			To pick mushrooms
Question 36: What motivation would best define the reason for your visit?	To get close to nature	To enjoy the countryside To get to know the natural park To appreciate its natural values To appreciate its cultural values I already knew the park, and I like it	For physical exercise	To be with my friends	

- Source: Survey proyectos SEJ-2007-67690 & P07_HUM_03049
- Items proposed; open ended responses

The third way of identifying motivation searched to know if users had single or multiple motivation/s. The applied procedure was a contingency table (see table 2). When the user did not chose the same closed ítem to 2 and 36 questions or/and when the user gave open answers with different meanings, it was considered as a multiple motivation user.

Table 2.-Contingency table to define motivations, combining question 2 and question 36

Motivation	Question 2				
Question 36	To enjoy nature	To learn	For physical fitness	To be in company	Motivations related to park management objectives
To enjoy nature	To enjoy nature				
To learn	To enjoy nature and to learn	To learn	To enjoy nature and for physical fitness		
For physical fitness		For physical fitness and to learn	For physical fitness		
To be in company				To be in company	
Motivations related to park management objectives					Motivations related to park management objectives

More than two motivations

A motivation code was assigned to each survey respondent according to the profile resulting from this combinatorial process (table 3) and including the earlier segmentation between *hikers* and *visitors*. At last, table 4 shows the frequency distribution of the users motivations issued from these operations.

Table 3-.Identification codes for questionnaire respondents, according to their motivations

		Hikers	**Visitors**
Motivation		**Code**	**Code**
To enjoy nature		1	2
To learn		3	4
For physical fitness		5	6
To be in company		7	8
Motivations related to park management objectives	To see the snow	9	
	To see Torrecilla mountain	10	
	To pick mushrooms	11	
More than one motivation	To enjoy nature and to learn	12	13
	To enjoy nature and for physical fitness	14	15
	For physical fitness and to learn	16	
	More than two motivations	17	

Source: Survey proyectos SEJ-2007-67690 & P07_HUM_03049

The analisys of these results referred to users motivation begins with the difference between *visitor* and *hikers*. Though quantitatively hikers are highly greater than *visitors*, we must to deep from a qualitative point of view, because the report by the LEADER European Observatory (2001) concluded that for most people, hiking is a recreational activity, not a sport, and is undertaken for many reasons, including an interest in the natural world.

Table 4.-Classification of users of public trails according to their motivation and their self-identification as hikers or as visitors

Motivation		**Hikers**		**Visitors**		**Total motivations**	
		n	%	n	%	n	%
To enjoy nature		98	32.34	18	42.86	116	33.62
To learn		7	2.31	6	14.29	13	3.77
For physical fitness		36	11.88	4	9.52	40	11.59
To be in company		10	3.30	6	14.29	16	4.64
Motivations related to park	To see the snow	13	4.29			13	3.77
	To see Torrecilla mountain	10	3.30			10	2.90

management objectives	To pick mushrooms	4	1.32			4	1.16
More than one motivation	To enjoy nature and to learn	35	11.55	5	11.90	40	11.59
	To enjoy nature and for physical fitness	68	22.44	3	7.14	71	20.58
	For physical fitness and to learn	17	5.61			17	4.93
	More than two motivations	5	1.65			5	1.45
		303	100	42	100	345	100
% of total respondents		87.83		12.17			

Source: Survey proyectos SEJ-2007-67690 & P07_HUM_03049

This statement raises various considerations: if hiking is not in itself a motivation but an activity that can be performed for diverse reasons, do hikers have different motivations from those of other visitors? To what extent do those who identify themselves as hikers agree that sporting activity is the motivation for their visit? Table 4 shows that motivations are different. Thus, in general, visitors describe their motivations as mainly *to be in company* and *to learn*, while 100% of the motivations related to park management objectives correspond to hikers, and it is especially significant that about half of the hikers present several motivations at the same time. But in this way, it must be outlined that only 12% of *hikers* identify their motivation with *physical fitness*, an amount similar to visitors' one. Nevertheless, if we watch multiple motivation, *physical fitness* joined with *to learn* and with *To enjoy nature* is chosen by 28% of *hikers* but only by 7% of *visitors*.

So, if we combine this dilution of fitness motivation with the supremacy of the motivation *enjoy nature* both among *hikers* and *visitors*, the result is the predominance of *enjoy nature* among the users. However, what is *nature* for users*?* We suggest to link *nature*, with the biodiversity values that guide natural park. In doing so, we follow to another study goal verifying the degree of consistence between management goals for the natural park and visitor's motivations. We consider that the main function of protected areas is preserve spaces with high biodiversity values. These values can attract visitors as learning subject and so becoming part of environmental education goals of planning. Nevertheless, the concept enjoy *nature* does not mind only biodiversity values. It can be linked to another experiences and subjects (landscape, peace, water) that do not depend on biodiversity values and that can be provided by spaces that aren't protected areas.

Table 4 results reveal: first, the low number of respondents that chose *learn* as single motivation (3, 77%). Second, the differences between *visitors* and *hikers*, because visitors prefer *learn* much more that hikers (14% against 2%). If we go in depth in these answers, we can deduce that the natural o cultural elements that natural park planning considers more outstanding are not attractive for users. Only one person stated that the Spanish fir, the prime focus of the environmental education aspect of the park, was the reason for their visit, while none of the respondents chose the closed response *cultural values*. However, if we analyse the multiple motivations, the presence of *learn* among them increases, but less than the combination with *physical fitness*. So, though the difference between *hikers* (increase from 2% to 19%) and *visitors* (increase from 14% to 26%) remain, if we gathered all the users, through multiple motivations *learn* expanded from 3,7% al 21,2%. If we have into account, that among these multiple motivations the higher is the combination with *enjoy nature*, we can deduce that *learn* as motivation is not linked to biodiversity park values and that is the motivation more discriminant between *visitors* and *hikers*. Finally, we link multiple motivations to users that have more accurate visit aims.

To determine perceptions of crowding, our literature review led us to apply a procedure based on the use of surveys and on assessing the "*Number of encounters among users*", i.e., the "Encounter rules" method, whereby user experience is expressed in terms of the number, type and location of encounters with other people on the trail and on how these events affect the users' perceptions of quality in the trail activity (Patterson & Hammitt, 1990; Shelby & Heberlein, 1986; Tarrant, Cordell & Kibler, 1997).

Accordingly, questions about both number of encounters and presence of snow. So, question 12 asked how many other people the users had passed on the trail, with one set of replies limited to closed intervals (1-5, 6-10 and more than 10) and another, open response specifying the number of such encounters. Question 13 asked how people viewed this number, among the closed options of "*very few*", "*reasonable*", "*excessive*" and "*unaffected*". These items may be interpreted related to weather conditions on the day (item 77).

The results shown in table 5 are consistent with another finding from the literature review, namely the influence of total visitor numbers on users' perceptions of crowding

(Gallowey, 2012): users don't notice crowding as a factor that lessen outdoor experience quality when the total number of users is low. So only 20,8% of respondents assessed as "*excesive*" the number of encounters.

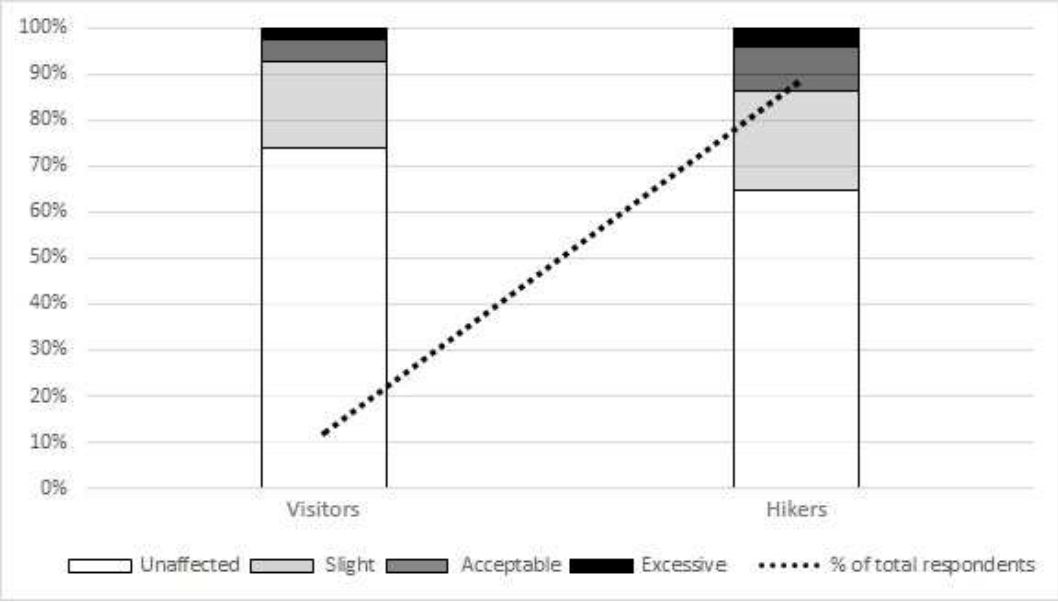
Table 5.-Respondents' assessments of the number of trail encounters

	Assessment of the number of trail encounters						
Number of people encountered	Unaffected	Slight	Acceptable	Excessive	No opinion	Total	%
0		3	3	1		7	2.31
1 to 5	1	16	21	1		39	11.3
6 to 10	2	6	41	1	2	52	15
More than 10	10	8	159	69	1	247	71.4
Total	13	33	224	72	3	345	100
%	4.05	9.54	64.74	20.81	0.87	100	

Fte.: Encuesta proyectos SEJ-2007-67690 & P07_HUM_03049

Though these results let us get ahead that motivation has no o few influence in crowding perception, the estimation of social carrying capacity need the linking of both concepts. This linking was possible throughout the code showed in table 3 and graphics 1 and 2 present it evidence. Since *visitors* and *hikers* have very similar valuations (graphic 1), we have joined both in ranks defined by motivation and we have gathered the three motivations referred to "Motivations related to park management objectives" for make easier graphic representation. In effect, we can verify that the differences among respondents classified according their motivation are very short.

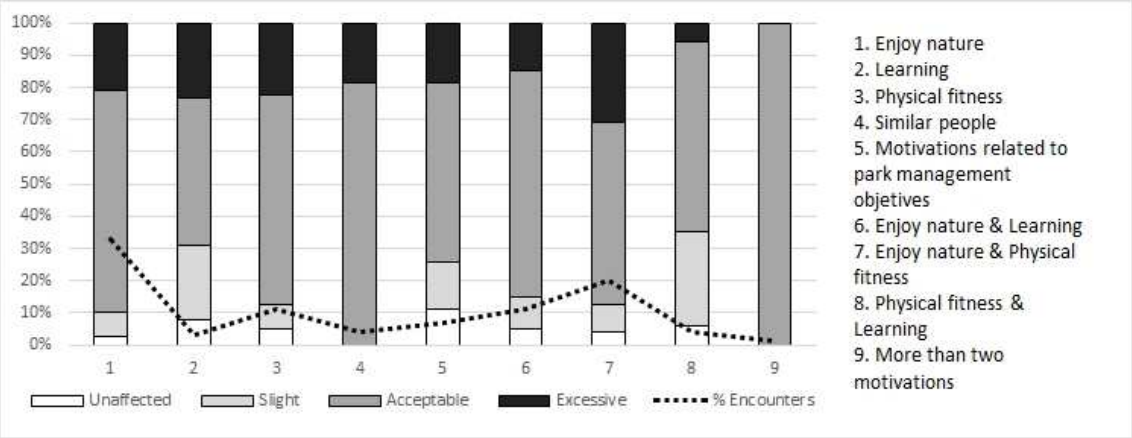
Gráphic 1. Relationship between *visitors* and *hiker* segmentation and crowding perception



Fuente: Encuesta proyectos SEJ-2007-67690 & P07_HUM_03049

Based on these results, we have developed the remaining study goals in the Discussion and Conclusions paragraph.

Graphic 2. Relationship between motivation and crowding perception



5. Discussion and Conclusions

1.-Estimation of social carrying capacity and possibility of extrapolate study results to another natural parks in Spanish mediterranean mountain. Two study areas facts, 1.-focusing methods in hiking and 2.-low total number of users, let extrapolate the results to this rank of Spanish natural park.

1.1. Following an epistemological order, the first result is about users motivation. According to Spanish literature (Hidalgo, 2009; Ruiz and Galdós, 2007) prevail nearby users that identify themselves as *hikers*, they don't overnight in the park and whose motivation combine *enjoy nature* with *physical fitness* and to a lesser extent, *learn* the surroundings. On the opposite, with a much lower number, users that identify themselves as visitors; the only outstanding difference regarding on motivation is that *learn* get more presence among *visitors*. In this way, results verify LEADER European Observatory (2001) approach: trail users don't identify hiking as a sport. About this subject, our proposal is:

a) To consider hiking as a multipurpose outdoor recreation activity and consider that multipurpose motivation doesn't blur users motivation but, on the contrary, it must be understood as an improvement of the outdoor experience. We derive of this the following management proposal: to include both cultural and natural elements in trails route

b) The propriety of keeping the difference *hiker/visitor* in the statement of users profiles, despite the low number of the last ones.

1.2. Regarding to the relationship between motivation and crowding perception in order to estimate social carrying capacity. The results show that users do not sense crowding regardless of their motivation. This is consistent with the low number of people incoming. So, these results can be extrapolated stating that crowding perception don't damage quality outdoor experience in Spanish Mediterranean mountain natural parks. Only the short and mayfly presence of snow is a *crowding-pull factor* and it may be considered the main cause of *fluctuating crowding* (Hadwen *et al*, 2011).

2. To apply social carrying capacity to the improvement of management and planning of Spanish Mediterranean mountain natural parks.

Generate an instrument for park planning and management, .

2.1. In relation to verifying the degree of consistence between management goals for the natural park and users' motivations, these findings highlight the inconsistency between the park management objectives of environmental protection, the location of the recreational facilities and the users' actual preferences; thus, although the trail network is concentrated in areas of greatest environmental value, possibly because of their relation with the goals of environmental education, and also in accordance with the first proposals by the IUCN, these environmental values are of only incidental importance to most users. So we validate the suitability of knowing users motivation as a management tool.

2.2. These results are interpreted as providing a reason for diversifying the location and characterisation of the infrastructure within the natural park, and generating a methodology for relocating trails in accordance with user preferences and environmental constraints, thus alleviating the pressure on areas that are currently over-utilised (http://analisisgeografico.uma.es/sierranieves/).

2.3. However, the appearance of snow as a *crowding-pull factor* only could be resolved by restrictive measures given its uncertain and ephemeral behaviour and its location in high biodiversity values areas.

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Legislación y normativa

Decreto 344/2003, de 9 de diciembre, por el que se aprueba el PORN y PRUG del Parque Natural Sierra de las Nieves http://www.juntadeandalucia.es/medioambiente/portal_web/web/temas_ambientales/espacios_protegidos/planificacion/PORN/PORN_PRUG_Sierra_Nieves/decreto344snieves.pdf Last accessed: November 2012 [consulta octubre 2015]

Ley 4/1989 de 27 de marzo de conservación de los espacios naturales y de la flora y fauna silvestres, aplicada en Andalucía a través de la Ley 2/1989, de 18 de julio, por la que se aprueba el inventario de espacios naturales protegidos de Andalucía, y se establecen medidas adicionales para su protección

Mapas

PN Sierra de Las Nieves. *Junta Rectora Consejería de Medio Ambiente* (s/f). E.1: 80.000. Papel.

[i] Esta comunicación forma parte de los resultados de la suma de dos proyectos: el Proyecto I+D+I, del Ministerio de Ciencia e innovación del Gobierno de España (referencia SEJ-2007-67690), con Carmen Ocaña Ocaña como investigadora responsable, y el Proyecto de Excelencia de la Consejería de Innovación, ciencia y empresa de la Junta de Andalucía (Referencia P07_HUM_03049), con Mª Luisa Gómez Moreno, como investigadora responsable.