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THE IMPACT OF INFRASTRUCTURE PLANNING IN SPATIAL PLANS ON CARRYING CAPACITY ASSESSMENT IN MOUNTAIN TOURIST AREAS

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This paper analyses the impact of infrastructure planning on carrying capacity assessment in mountain tourist areas, aiming to define the procedure, as well as to present an algorithm that could enable the application of carrying capacity methods in the process of developing planning documents. This would, in addition to the common practice of the hitherto used research methods, pay appropriate attention to the impact of infrastructure systems. In this regard, the paper first presents the basic theoretical and methodological problems of carrying capacity assessment, and then it considers the basic characteristics of evaluating carrying capacity in mountain tourist areas. Following this is a review of the basic principles of infrastructure planning, which gives practical recommendations for the infrastructure planning process in mountain tourist areas, with a particular emphasis on the impact of infrastructure on carrying capacity assessment. The example of Tara National Park, a mountainous area in Serbia which served as a place for verification of this procedure, shows the need to review the current planning solutions defined for this protected area.

Key words: **carrying capacity, spatial plans, infrastructure planning, mountain tourist areas.**

INTRODUCTION

In spatial and urban practice, infrastructure has not always been treated in accordance with its position and role in organized and settled space, and it has often been considered to be a set of technical systems with an underlined functional dimension, often without integral links with other activities on some territories.

The assessment of carrying capacity is extremely important to tourism and other kinds of development of diverse natural areas, including mountain areas, which are particularly fragile and abundant in natural heritage. This is particularly true if the area is protected or planned for protection.

This paper aims to study the impact of infrastructure planning (except transport infrastructure) in spatial plans on the assessment of carrying capacity in mountain tourist areas, namely, it aims to enhance the spatial planning process, and emphasize the role and impact of infrastructure systems on the overall development of mountain areas and the activities taking place in them, taking into account foreign and local good practice.

CARRYING CAPACITY OF SPACE: THEORETICAL AND METHODOLOGICAL ASPECTS

There have been a number of attempts to give a precise definition of the carrying capacity of space. Several definitions will be presented here, which are similar in many aspects, but also different.

Mathieson and Wall (2006) define carrying capacity as the maximum number of people that can be present in a specific location without inducing an irreversible change or degrading the physical environment and without significantly endangering the quality of recreational experience. Similarly, according to Lješević (2002), carrying capacity involves the number of users that a specific area can accommodate in a specific time period without irreversible physical or environmental degradation, or degradation that could lead to a reduction in tourism in a given area or location. The Federation of Nature and Natural

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Parks of Europe – EUROPARC interprets carrying capacity as the ability of an ecosystem to self-maintain and to support the unlimited development of human activities, with no negative feedback effects (Jovičić, 2011). Coppock and Duffield (1975) proposed a general qualitative definition, which implies that carrying capacity involves the level of use that an area can sustain for the purposes of tourism without an unacceptable degree of change to the characteristics and quality of the resources, or the recreational experience itself. Such a definition allows different aspects of reflection on carrying capacity (physical, ecological, economic, anthropogenic and psychological), where each aspect causes a different measure of capacity, mainly incomparable to the measure of another aspect or the measure of the same aspect in a different domain (Dabić and Milijić, 1997).

Maksin-Mićić (2007) defines carrying capacity as an integrated view of the environmental capacity, the natural and manmade resources in an area, the different spatial needs for developing specific activities, and the functions and development of local communities. Accordingly, its basic components are: environmental capacity, psychological tourism capacity (the maximum degree of tourism that does not bring about a decrease in the quality of the tourism experience) and the socio-cultural capacity of the local population (the maximum degree of tourism development which does not disturb the way of life, culture or customs of the local population).

According to Castellani and Sala (2012), the assessment of carrying capacity of an area cannot be unique for each tourist destination, but several factors should be considered. Therefore, apart from the availability and limitations of the natural and physical resources, it is necessary to take into account the characteristics of the management system, the prevailing types of tourism in a studied area, the local stakeholders' perceptions of specific issues (e.g. their concept of crowding), as well as other local conditions and features. For the above-mentioned reasons, certain authors (Lindberg *et al*., 1997, McCool and Lime, 2001) suggest that the question "How many is too many?" should be replaced by "How much change from the natural conditions is acceptable given the goals and objectives of a specific area?"

The purpose of the assessment of carrying capacity (Bilen and Bučar, 2004) is finding optimal measures and actions that can permanently protect the natural heritage and ecological characteristics of an environment, as well as the existing balance, structure, ethno-social and other characteristics of the local population, and the dominant system of cultural values. Accordingly, it is especially important to restrict the development of tourism to the carrying capacity level which protects its natural heritage, protects the population and their basic cultural and other structural characteristics, and protects the economic value of an area. The degradation and saturation of natural and anthropogenic resources are thereby prevented and furthermore, the attractiveness of those resources is preserved, as well as the intensity of their activity, which enables sustainable development, namely, development that will ensure permanent use of a specific area without disturbing the basic natural heritage and living conditions of the local population.

The World Tourism Organisation (UNWTO) has defined three dimensions to the evaluation of carrying capacity (Jovičić, 2010):

- Ecological capacity entails the maximum degree of tourism carrying capacity without ecological degradation and it includes a complex consideration of factors;
- Psychological capacity involves the maximum degree of carrying capacity from the viewpoint of the number of tourists, their activities and built facilities, without a decrease in the quality of tourists' experience. It cannot be easily determined because the perceptions and attitudes of visitors on the mentioned factors differ;
- Socio-cultural capacity means the maximum development of tourism which does not impair the way of life, culture or tradition of the local population. The problem comes from the fact that the local population often wants to change their way of life by way of developing tourism.

Apart from these levels of assessment, some authors have also distinguished the tourism/recreational or the functional evaluation of carrying capacity, which is based on the interaction between the parameters of the resources and their levels of use, their type, the space and time variations in the tourism activities, the behaviour of the users, perception of the quality of resources etc. Hence, the functional assessment of carrying capacity partly integrates the above-mentioned levels of physical, economic and psychological capacity, and implicitly, the key factors of ecological capacity, with mostly quantitative expression of the physical and economic aspects, and with the use of certain standards of capacity. Moreover, there are difficulties in introducing quantitative capacity standards for tourist areas for different types of tourist activities, which are increasingly under the influence of various unquantifiable factors (circumstances, mood, education, fashion, individual opinions etc.), and which increase as the environmental care of (even intact) natural areas increases (Bovy and Lawson, 1977).

The carrying capacity should therefore combine the different dimensions of capacity, which the experts in this area have mostly agreed on, although they disagree on the methods for its assessment. Hence, there are different mathematical formulae for the capacity of tourist resorts (Jovičić, 2011).

It must be noted that some authors oppose the term 'calculation' of the capacity, pointing out that the capacity can only be assessed or predicted according to predetermined conditions or factors, which additionally result in changes in the environmental conditions and thereby in environmental systems (Jovičić, 2010).

Carring capacity evaluation in spatial plans for mountain areas

The carrying capacity in mountain tourist areas is evaluated according to the basic principles of carrying capacity assessment, depending on the special orographic characteristics of the mountain's natural conditions and resources, i.e. depending on the special activities for tourists that are possible only at these destinations. According

to Dabić (2011), due to the more modest scientific acknowledgements on the nature of mountains (high ones in particular), in relation to the more accessible natural areas, biologists and ecologists are usually reluctant to define even the basic quantitative criteria and indicators of the capacity of nature compared to the activities that take place there. Hence the conditions and parameters for determining the carrying capacity of mountain areas are often descriptive and/or general environmental requirements, or they are subjective qualitative evaluations of the current capacity, unable to solve the real issues of carrying capacity.

Since mountain (especially high mountain) tourist resorts have been primarily promoted as the development cores of winter tourism, the determination of their capacity and the overall planning of their development are mainly based on the criteria and indicators of winter sports and recreation in winter conditions (Dabić, 2011). At the peak of mountain tourism in the middle of the 20th century, mountain resorts were promoted as such, but the importance of this diminished when the focus turned towards more moderate and rational concepts, which entailed the all year-round use of mountain tourist destinations, thus reinstating the importance of summer mountain tourism, which had been unjustifiably neglected.

The carrying capacity for winter sports as the key aspect of the capacity of a high-mountain tourist resort is determined by evaluating its natural potential for alpine skiing, since it is the most popular and economically the most important contemporary activity related to winter sports and mountain recreation (Maksin *et al*., 2011). The potential of alpine skiing is conditioned by the availability, size and quality of alpine ski resorts where a commercially significant number of high-quality ski slopes can be placed, with rational construction costs of a ski transport system, measured in terms of the number of simultaneous skiers. In the planning process, the capacity of an alpine ski resort is determined first globally, and then at regional, sub-regional, and local levels.

The criteria for determining the carrying capacity of an alpine ski resort are determined by the following parameters: skiers' requirements; the physical and technical conditions of alpine ski slopes; the technical and economic conditions of the ski transport system; and the increasingly strict demands regarding environmental protection. The capacity of a mountain area for the supply of other winter tourism activities (tour skiing, Nordic skiing, ice skating etc.), given that they are generally of a smaller scope and importance, is usually not determined by calculation, but mainly normatively, in relation to the established capacity of the alpine ski resort (usually through the percentage in relation to the number of alpine skiers, i.e. they enter the quota of other users, which is 40-50% of the total users of the winter tourism centre).

The capacity of the summer tourism supply in mountain areas is higher in physical terms than the capacity of the winter supply, in view of the considerably higher accessibility of the area in summer conditions when there is no snow, and there are no low temperatures, strong winds etc. However, due to biological occurrences and processes in the vegetation period, when flora and fauna are fully active, the ecological capacity, especially in high-mountain areas, is objectively lower than in the winter period, namely its natural elements are more vulnerable. At the same time, a rich summer supply is the key factor for a relatively balanced year-round use of mountain areas, so its capacity is an important criterion for the contemporary economic justification and feasibility of high-mountain and middle-mountain tourist resorts. The capacity is checked by the evaluation of programming and planning alternatives for mountaineering, mounting biking, horse-riding, sport fishing, mountain waters recreation, grass and artificial surface skiing, paragliding and similar activities, hunting, rural tourism supply etc. The capacity of the above-listed individual activities is evaluated mostly subjectively, namely, empirically on the basis of previous experience (Dabić, 2011). Unlike high-mountain and higher middle-mountain areas, lower middle-mountain areas and low mountains can, depending on the climate and other natural characteristics, have a higher demand during the summer season, so the evaluation of the capacity of these areas has to be more complex in relation to the existing and potential activities and amenities related to tourism.

A study of the capacity of the suitable alternative locations for a tourism accommodation centre completes the physical capacity of the mountain tourist area in terms of the number of users. The purpose of the carrying capacity of a mountain area for an accommodation centre is mainly in the availability of natural locations favourable for transport accessibility, tourist accommodation, public amenities and sports and recreation (by area, latitude, slope, sunshine duration, protection against the wind, torrential floods, floods and avalanches, attractiveness and preservation of landscape etc.) As the key criteria for determining the carrying capacity of the accommodation for overnight users, the following are usually considered (Maksin *et al*., 2011): the availability of new and old locations in and outside the settlements and the centre that are convenient for the accommodation and recreation of tourists; the suitability of the visual and physical contact with the tourism supply in the area; transport accessibility; the strengths and weaknesses of the infrastructure in the area; and the existing or planned capacity of the infrastructure.

When the development of a tourism centre, subregion or region exceeds the carrying capacity according to the established criteria (either because it had not been carefully planned or evaluated or because the plan was not followed), measures for keeping or reducing that level of pressure by users should be implemented. These measures may include: restricting arrivals, especially of day-trippers (car park limitations, a ban on certain vehicles, high or differentiated prices, introduction of tickets etc.); limiting further construction; introducing a planned timetable of tourist and recreation activities; improving management standards; and the supervision, protection, and development of new, alternative destinations (Dabić, 2011). When planning documents developed for mountain tourist areas reveal that the carrying capacity has been exceeded, it is necessary to incorporate some of the measures mentioned in them and to insist on their priority in relation to other plans and measures.

THE MAIN PRINCIPLES OF INFRASTRUCTURE PLANNING AS A BASIS FOR SPATIAL PLANNING

The infrastructure is indispensable for performing activities in a regulated area, i.e. it is the basis for the existence and development of a specific regulated area. It is a largely spatial category, strongly connected with geospace and conditioned by it, and it has to be observed as a unique sum of the other systems forming "the system of systems".

The standard process of infrastructure systems planning entails several interconnected steps (Grigg, 1988):

- Identifying the problem is the first step, which refers to finding the causes of existing difficulties;
- Setting goals is the next step, which is crucial in planning, and particularly complex because different participants in the infrastructure system management have different systems of values;
- Forming alternative solutions is the next, creative step, which cannot be completely left to computer technology and modelling systems, given that creativity exceeds the limits of the obvious alternatives. This step refers to technical, financial, organizational and management options;
- The evaluation of alternatives is a scientific process that involves system-analysis, economics, impact analysis and political judgement. This is a process for which it is necessary to use computer technology and modelling systems for a cost-benefit analysis, for finding the impact of the alternatives, the characteristics of charging etc. The selection of alternatives is definitely a dynamic process which involves the decision maker's flexibility and acceptance of other options if the circumstances require such;
- The selection of a preferred alternative refers to the development of ways to prioritise and present the decision maker's alternative. The next step is not a step in the planning process as it is a discretionary step reserved for the decision maker.

The infrastructure planning process starts with a comprehensive review of the existing and projected infrastructure requirements (Žegarac and Arsić, 1999). The assessment of requirements is an evaluation of the total current needs for the construction and maintenance of separate infrastructure systems, and it is a part of the planning-programming-financial process leading to a usable definition of the requirements. This differs from simply wishes or demands expressed for infrastructure services.

The approach to the analysis of infrastructure requirements and the method used for the construction, renewal and/or replacement of infrastructure in existing practice is mainly general and should be replaced by a more positive approach based on the importance of infrastructure for the total productivity, and the possible influence that infrastructure has on the economic and other development processes in the area (Đorđević and Lukić, 2004). The construction, expansion and/or upgrading of infrastructure should not be carried out in an abstract and non-selective simple way, but in particularly specified areas in order to help specific users.

In a similar way, Lukić and Đorđević (2007) indicate that "planned and programmed infrastructure development" in more developed countries is networked with the planned and programmed development of all other spatial structures. It is very important to note that the development of spatial plans is preceded by the development of infrastructure sector strategies, programs and projects, which are a requirement for the solutions defined in spatial plans. The methodology in the process of infrastructure system planning has a set chronological order: Defining problems – Generating alternatives – Evaluating the alternatives – Selecting the best alternative – Solution requirements.

INFRASTRUCTURE PLANNING IN SPATIAL PLANS FOR MOUNTAIN TOURIST AREAS

Taking into account the above-mentioned and with respect to the general principles of planning sustainable tourism in mountain areas, some practical guidelines for infrastructure planning in spatial plans of mountain tourist areas are given below as recommendations for direct application in planning practice.

First of all, it should be noted that the infrastructure planning process can vary depending on whether the area in question is a mountain area where tourism development is yet to be planned so there is no infrastructure, or there is minimally built or inadequate infra- and superstructure, or it is an area where tourism development has been initiated and there is a built or partly built infra- and superstructure in use for the purposes of tourism.

In each situation, the basic and most important input for further infrastructure planning is a planned evaluation of carrying capacity, regardless of whether or not the mountain area is protected or planned for protection. Mountain areas are very susceptible to the influence of anthropogenic activities ensuing from tourist activities in the area.

Now, as an integral part of the planned carrying capacity evaluation, it is necessary to conduct detailed and precise field research, which will indicate the possibility of using the existing and/or potential (mostly local) sources for different types of infrastructure systems. In the mountain areas where tourism is already working, it is necessary to collect detailed data and requirements from the authorities, organizations and companies managing some types of existing infrastructure systems in the planned areas, and in their immediate or more distant surroundings because of the necessity/possibility of connecting to the existing or planned regional or main systems. In the mountain areas where the tourism process has not yet been initiated, and there are no built facilities of infra or superstructure, great importance is given to the data and conditions from the relevant institutions that refer to the existing and planned regional and major (magistral) infrastructure systems in the immediate or more distant surroundings of the mountain area, in addition to the data obtained by field research, as they are the basis for the infrastructure of the mountain area. If the infrastructure systems in the immediate or distant surroundings are not at a suitable level, we need to initiate their development through the planning documents for larger spatial units (regional spatial plans, municipal

spatial plans, sectoral studies, infrastructural programmes, concepts and strategies etc.).

An important issue should be pointed out here, which is the possibility of inadequate cooperation (not always and not for all of the systems) between a planning document developer and the relevant authorities, organizations and companies that provide the requirements and data in the infrastructure domain. This may often lead to wrong conclusions and the inappropriate planning of some infrastructure systems within a spatial planning document. It is therefore necessary to define clearly and precisely the jurisdiction (who should provide data and requirements), procedures (deadlines, finances etc.), and obligations (what to prepare and how) in this domain through regulations both from planning field and from the legislation that regulates the functioning and development of the relevant infrastructure systems. Furthermore, as an example of good practice, individuals and/or teams from relevant institutions in charge of preparing data and requirements should engage in part of the planning process or in the planning team, in order to comprehend the actual problems in the tasks.

The application of the data and conditions from the domain of infrastructure systems, using a suitable procedure for evaluating the carrying capacity (coordination with ecological, socio-cultural and other conditions and requirements, existing/planned facilities of the superstructure etc.) can only lead to a preliminary carrying capacity. To be exact, the defined normatives for the infrastructure of a mountain tourist area[2] should be applied to the so-called preliminary carrying capacity, in order to get the necessary infrastructure capacity for individual systems and appropriate spatial entities within the total planned area.

The necessary capacities should be compared with the conditions and real possibilities for ensuring the infrastructure capacity, which should be considered both spatially (by relevant spatial entities) and temporally (infrastructure provided in stages). In this way, we can calculate the total potential capacity of infrastructure and capacity for individual infrastructure systems. It should be noted that besides the necessary favourable characteristics of traffic accessibility, the possibility of a suitable water supply system, i.e. of providing both drinking and technical water is vital for the carrying capacity. The other infrastructure systems of technical character have some but significantly less influence, because with sufficient financial resources, they can be provided easily, adequately and reasonably fast.

If the potential infrastructure capacity is smaller than the required capacity, the preliminary carrying capacity should be corrected (reduced): the potential infrastructure capacity determined in the previously described way (considered spatially and temporally. i.e. through considering the possibility of developing different phases) should be in a ratio with previously defined and accepted normatives for the infrastructure of a mountain tourist area, and the preliminary carrying capacity is corrected through the reduction of the planned capacity so the final capacity of the planned area is reached. It is then considered in accordance with the possibilities for infrastructure and superstructure both spatially (by individual spatial entities) and temporally (by different construction stages of infrastructure and superstructure).

If, during the spatial planning process, new data or facts occur which require a correction of the preliminary carrying capacity, it is necessary to reconsider the set strategic decisions and defined basic and individual development goals for the planned area, and if necessary, harmonise them, which can sometimes lead to the repetition of the whole spatial planning process.

If the possible infrastructure capacity is in accord with the required capacity, the preliminary capacity is also its final carrying capacity.

After the previous steps, practical "physical" solutions and structures are defined with the potential consideration of alternative and/or variable solutions.

It should be noted here how important it is that the planning process should, in addition to spatial and urban planners, experts in charge of individual infrastructure systems, relevant experts (the representatives of infrastructure systems management and other members of the planning team, representatives of the local authorities etc.), also include the local inhabitants, general public, economic and other entities, and potential investors etc. Thus, any substantial changes to the defined planning solutions can be avoided during the next step of making and adopting the planning documents when the participation of the public is defined by law and regulations. Otherwise, the whole planning process might be repeated.

In accordance with the infrastructure planning in spatial plans for mountain tourist areas, the authors of this paper have defined a corresponding algorithm (Figure 1) for practical use in spatial planning for mountain areas, noting that this procedure can be applied in the planning process of other (protected or planned for protection) areas that require a carrying capacity assessment.

An analysis of several spatial plans for special purpose areas was carried out for protected mountain areas in Serbia. It established that an estimation of the space carrying capacity is an exception rather than a rule, depending on the attitude of the plan's developer, as the current regulations in this domain do not specify it as an explicit obligation. Regarding the connection of the border carrying capacity and the planned/potential infrastructure capacity in the plans analysed, practical estimations were only done for individual infrastructure systems in the areas of Kopaonik and Stara planina[3]. Nevertheless, almost all of the plans contain at least a declarative commitment to respecting the border carrying capacity, although it has not been defined.

[2] Defining normatives for the infrastructure of a mountain tourist area is of vital importance for infrastructure planning, but they will not be elaborated on here due to the complexity of this field that requires special and detailed integrated and sectoral expert research.

[3] This methodology was developed and applied in the Institute of Architecture and Urban&Spatial Planning of Serbia (the Institute has produced spatial plans for those mountains). Besides that, they are working on integral and problem research/study for the mountain areas of Serbia.

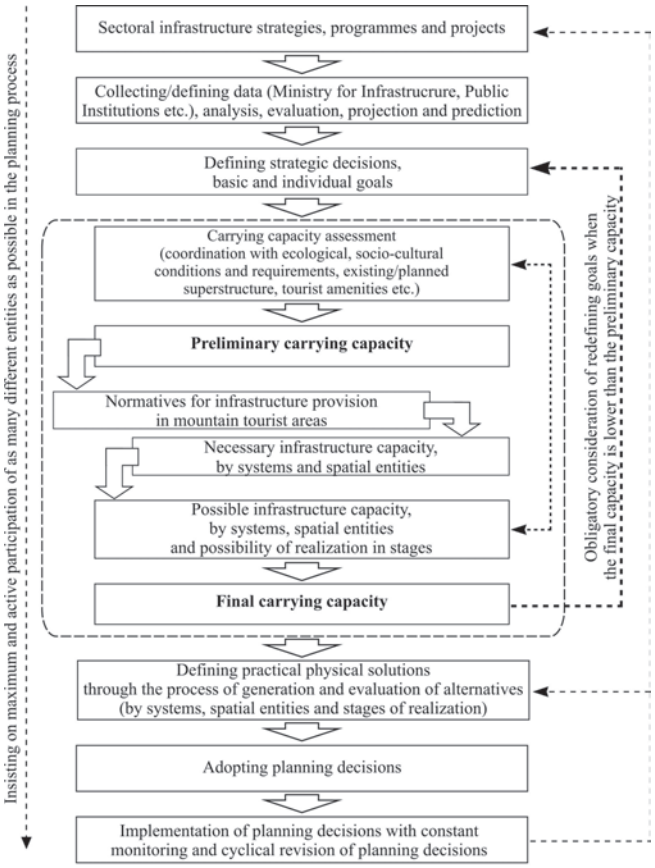

Figure 1. Infrastructure planning process in spatial plans in mountain tourist areas with a special emphasis on the carrying capacity evaluation

In accordance with the previously proposed algorithm, here is a simplified example of a carrying capacity evaluation for the area of Tara National Park regarding the possibility of a water supply, and taking into account the planning solutions in the Spatial Plan of Special Purpose for Tara National Park (2010), and in the Master Plan of Tourism Development with the Business Plan for Tara Mountain and Its Surroundings (Horwath and Horwath Consulting, 2007), with a note that these documents do not include a carrying capacity assessment.

Tara National Park is in the westernmost point of the Republic of Serbia, and it covers the area bordered by the flow of the River Drina, between Višegrad and Bajina Bašta, consisting of the Zvezda, Crni vrh and Ravna Tara mountain ranges. In the east, the area is separated by the River Solotuška and the Ponikve highlands, and in the south by Kremanska and Mokrogorska valley. The area of Tara National Park is regulated by the Law on National Parks (2015), and it covers 24,991.82 ha, with 3,323.92 ha in the first degree of protection, 8,514.39 ha in the second degree of protection and 13,153.51 ha in the third degree of protection (Figure 2).

The border capacity of the area of Tara National Park in this example is carried out for the whole year, without a separate consideration of the winter and summer periods, and bearing in mind a relatively small potential for the construction of larger ski resorts. To define the border capacity, the following normatives were adopted: 0.25 users per hectare in the zone of first degree protection; 0.5 users per hectare in the zone of second degree protection; and 2 users per hectare in the zone of third degree protection. These normatives are lower than those typically used for protected mountain areas[4], since accessibility is a significantly limited characteristic of the landscape in the area of Tara National Park, especially in the first zone of protection. This is also due to the dispersive distribution, large distances and the existing and planned tourism zones being limited in size by protected areas.

The application of previously defined normatives to the areas of suitable protection regimes defined by law, results in the preliminary carrying capacity of the area of the National Park Tara being 31,400 users. The application of empirical

[4] In the Spatial Plan of Special Purpose for Kopaonik NP (2009) the following normatives were used for the summer period: 1 user/ha for the first degree of protection, 1.5 users/ha in the second degree of protection and 2 users/ha in the third degree of protection, and the Amendments to the Spatial Plan of Special Purpose for NP Kopaonik - the Draft plan (Institute of Architecture and Urban & Spatial Planning of Serbia, 2016), also for the summer period: 0.5 users/ha for the first degree of protection, 1 user/ha in the second degree of protection and 4.1 users/ha in the third degree of protection.

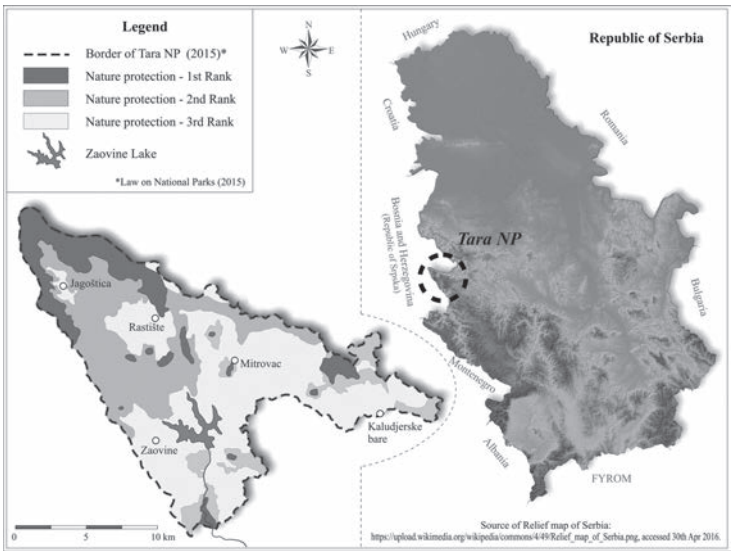

Figure 2. Tara NP, Nature protection rank and the position in the Republic of Serbia (Source: processed by the authors)

norms for the share of overnight tourists in relation to day-trippers and employees, and the consideration of the specific characteristics of the observed area, as well as the defined planning solutions, can result in an estimation of the number of users by certain categories: 12,500 overnight tourists, 13,900 day-trippers from the areas outside the NP, 2,000 employees (15% of beds and employees outside tourist accommodation), 3,000 other permanent inhabitants in settlements within the area of the NP.

If we apply the adopted normatives for water consumption to the estimated number of users in different categories of users (determined in an analysis of a larger number of planned documents developed for similar areas): 400 l/u/d (liters per user per day) for the accommodation capacity, 10 l/u/d for day-trippers, 150 l/u/d for employees, 250 l/u/d for inhabitants, 100 l/u/d for tourist spots and 75 l a day for a head of cattle, we get the total need for water for the area of Tara NP, which is at its maximum about 83 l/s. The Spatial Plan of Special Purpose of Tara National Park (2010) envisages for this national park (except for smaller isolated zones), the water supply from the system "Tarski vodovod" with its spring in the Kruščica accumulation, with a total projected capacity of 80 l/s (Figure 3). At first sight, the planned/potential capacity of the water supply system approximately satisfies the previously determined carrying capacity of the area in question.

However, the Tarski vodovod water supply system is, according to the spatial plan, also the basis of water supply for other areas around Tara NP, such as the settlements of Kremna and Mokra Gora, and parts of the settlements Kaluđerska bara, Solotuša and Zaovine, with their own accommodation capacity, other tourist amenities, population etc. Furthermore, the normatives applied for determination of the preliminary carrying capacity are far stricter than those usually used for such areas. For that reason, we can conclude that it is necessary: (1) to correct the preliminary carrying capacity of the area of the Tara NP in accordance with the possinbility of a water supply or (2) do suitable research in the direction of the possibility of enlarging the capacity of the Tarski vodovod water supply system and using the water from the Zaovine accumulation for these needs. According to the results, it is necessary to make corrections and amend the existing planning solutions.

CONCLUSION

Within the stages of the elaboration process of planning solutions, the planned carrying capacity evaluation is of special and often vital importance for adequate spatial planning in mountain tourist areas. It is a part of the planning process, which is, besides defining the normatives and standards for infrastructure provision of the tourist area, vital for infrastructure planning in spatial plans. It is therefore essential to formulate extensive methods and research procedures which will estimate and then monitor the carrying capacity in mountain tourist areas, taking into consideration as many relevant and primarily measurable indicators, so as to enable a timely reaction in case of unfavourable and/or undesired changes.

Taking into account the above-mentioned, through consideration of basic theoretical and methodological principles of the field of carrying capacity assessment, the characteristics of the planned evaluation of carrying capacity in mountain tourist areas, and the presentation of the basic principles of infrastructure planning in spatial plans, practical recommendations have been given, i.e. a suitable algorithm for the application of spatial planning, namely, the

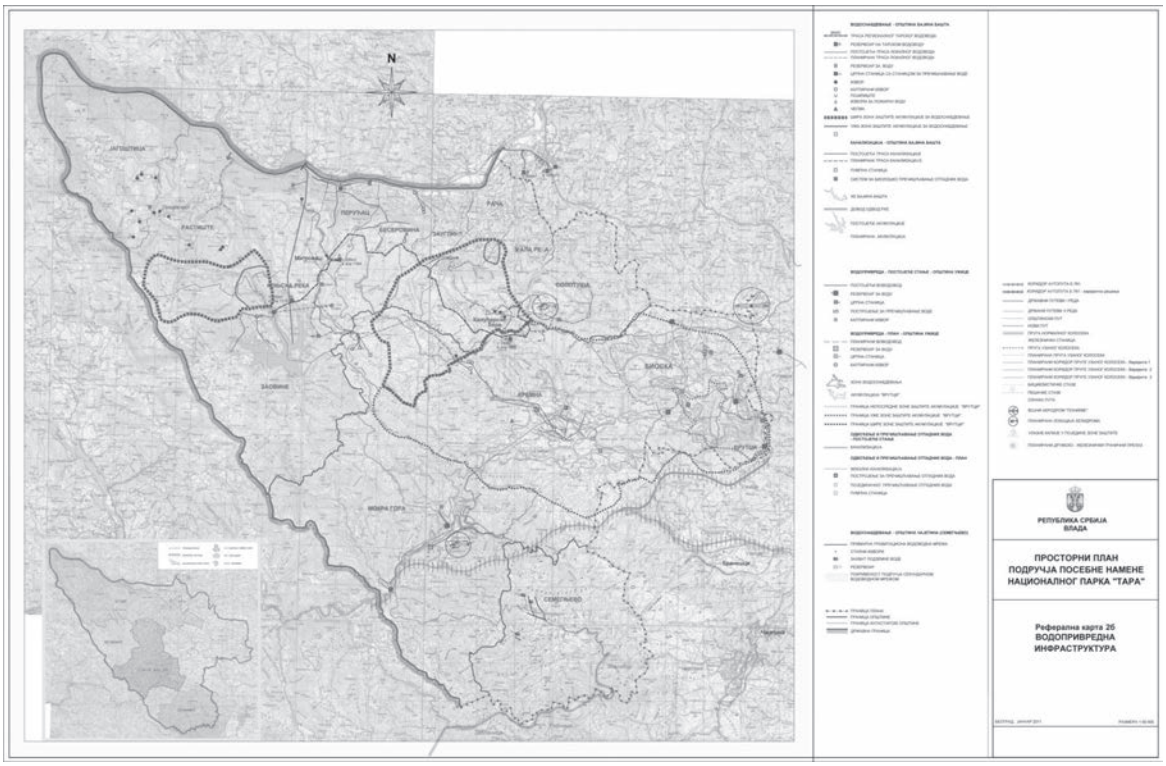

Figure 3. Spatial Plan of Special Purpose for Tara NP, Referral map 2b: Water management infrastructure. (Source: Spatial Plan of Special Purpose for Tara NP (2010))

procedure of infrastructure planning in mountain tourist areas. The novelty in the proposed procedure involves the fact that when the carrying capacity has been assessed and coordinated with ecological, socio-cultural conditions and requirements, the existing/planned superstructure, tourism amenities etc., then the required and also the potential infrastructure capacity are considered (with the use of normatives and standards for infrastructure provision), as well as their influence on the space carrying capacity.

Considering the current practice in this area, the authors have analysed several spatial plans developed for protected mountain areas in Serbia, with a specific display case evaluation of the space capacities in the area of Tara NP, where it was found that a review of the current planning solutions is necessary.

It must be noted that the application of the proposed algorithm is not restricted to mountain tourist areas, but the same procedure may be applied in the planning process for other areas in need of carrying capacity assessment.

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