CARRYING CAPACITY AND IMPLEMENTATION CHALLENGES IN VINTGAR GORGE, A HIGHLY VISITED AREA

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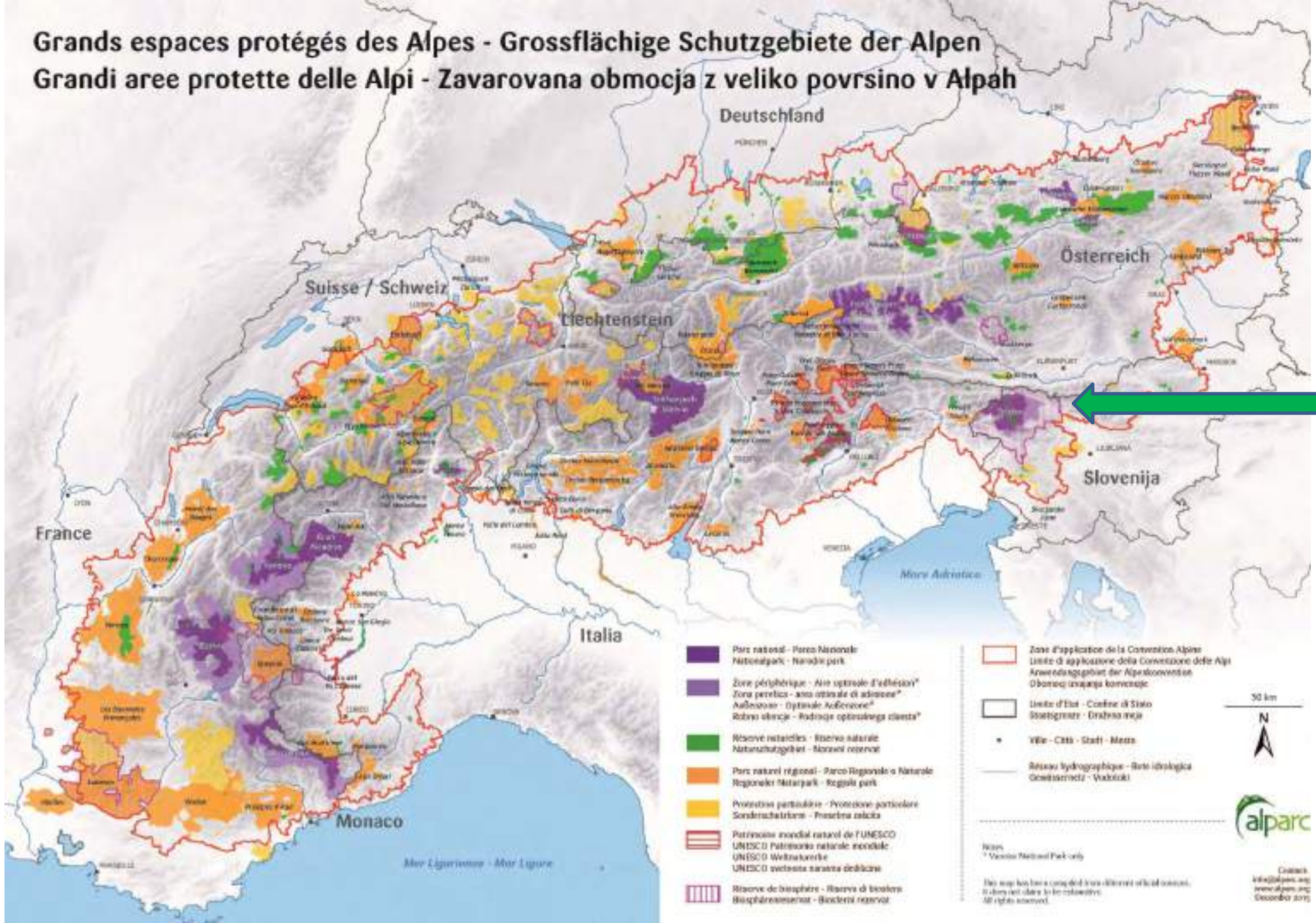
Proposed methodology for estimating the **carrying capacity** for visitation of natural assets on the case of the Vintgar gorge

European Charter for Sustainable Tourism

12th Network Meeting

Aleš Zdešar
Triglav National Park Expert Service
Bled, Slovenia, 16.05.2023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Grandi aree protette delle Alpi - Zavarovana obmocja z veliko povrsino v Alpah
Deutschland
Österreich
Suisse / Schweiz
Liechtenstein
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Mar Ligurienne - Mar Ligure
Parc national - Parco Nazionale
Nationalpark - Narodni park
Zone périphérique - Aire optimale d'adhésion*
Zona periferica - area ottimale di adesione*
Außenzone - Optimale Außenzone*
Robno območje - Rodnejše optimalnega območja*
Réserve naturelles - Riserva naturale
Naturschutzgebiet - Naravni rezervat
Parc naturel régional - Parco Regionale o Naturale
Regionaler Naturpark - Regijski park
Protection particulière - Protezione particolare
Sonderschutzzone - Posebno zaščito
Patrimoine mondial naturel de l'UNESCO
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UNESCO Weltnaturerbe
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Réserve de biosphère - Riserva di biosfera
Biosphärenreservat - Biosferni rezervat
Zone d'application de la Convention Alpine
Limite di applicazione della Convenzione delle Alpi
Anwendungsgebiet der Alpenkonvention
Območje izvajanja konvencije
Limite d'Etat - Confine di Stato
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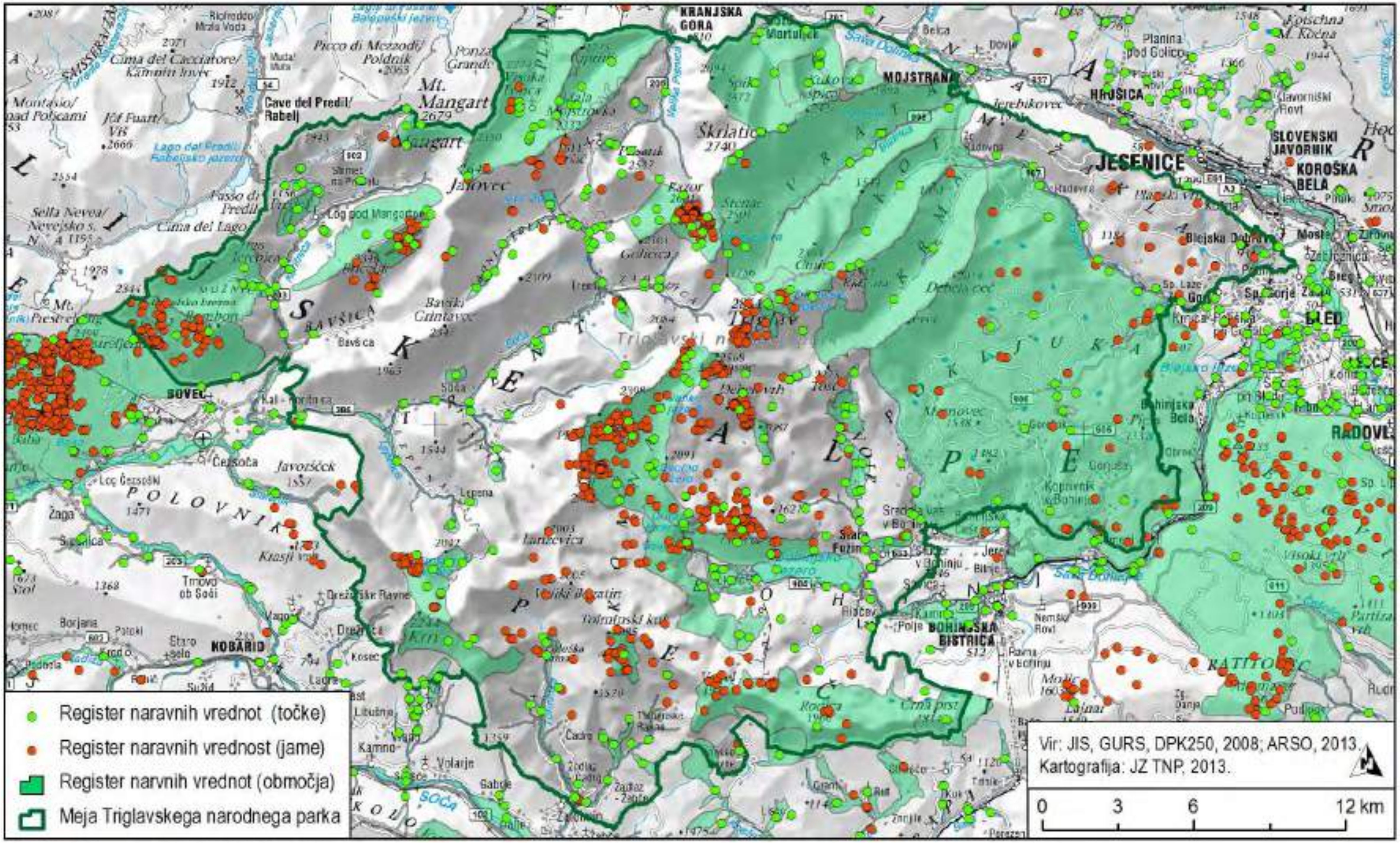
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Meja Triglavskega narodnega parka
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KRANJSKA GORA
MOJSTRANA
JESENICE
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Visit - impacts on nature

Impact on aquatic ecosystems - rivers, lakes, drinking water, springs, etc.

- deterioration of lakes stocked with fish and located near mountain huts
- presence of bacteria in many of the springs sampled
- significantly increased consumption of drinking water (in the high mountains and valleys)
- major problems in waste water treatment (mountain huts, dispersed settlements, campsites along the Soča river, overloading of existing central waste water treatment plants, etc.)
- degradation of water ecosystems due to recreational activities - canyoning, boating, viewing of natural values - erosion, potholes, etc.)




Visit - impacts on nature

Impact on species, habitats, natural values

- Increased stress on wildlife due to high, dispersed and temporally unfavourable visitor pressure on the park area (e.g. chamois - declining numbers in the whole Alpine arc, Capercaillie, etc.)
- Reduction of the integrity of the most favourable (and important) habitats due to visitor pressure
- Potential risk of introductions of non-native species (activities on watercourses, etc.)
- Increasing pressure on quiet areas due to adverse weather/climatic conditions (raised bogs)
- Increasing pressure on quiet areas due to development of certain activities (e.g. touring skiing)
- Significant increase in panoramic motorised overflights in the park (noise, impact on wildlife)
- Significant increase in noise, degradation of space due to traffic
- Spatial degradation (erosion) of the most visited natural values and parts of the park




Visit - impact on experience

Transport

- hot spots in the park where the congestion of individual motor traffic exceeds the volume and capacity of the existing (and planned) infrastructure (Vršič, Vrata, Krma, Radovna, Pokljuka, Uskovnica, Trenta, Lepena, ...)
- dissatisfaction of visitors, dissatisfaction of citizens, property owners, dissatisfaction of park rangers, wardens, police; congestion, illigal parking in the natural environment, unregulated infrastructure, fines, ...
- unregulated individual traffic causes problems for public transport – visitor/resident dissatisfaction, delays, inadequate information, etc.
- lack of efficient regional public transport with links to the national level

Visit - impact on experience

Overloading parts of nature with visitation / overcrowding

- excessive pressure on the most tourist-interesting natural values, unregulated management system, degradation through excessive infrastructure development for safety, walking in columns, litter, erosion, ...
- overcrowding of parts of the high mountains
- overloading of water ecosystems with activities (canyoning, water sports, etc.)
- overloading of airspace - impact on the peaceful experience of the park
- pressure from day visitors and tourists without reservations (illegal camping, illegal parking - dissatisfaction of visitors, dissatisfaction of citizens, property owners, dissatisfaction of wardens, wardens, policemen)










When there are enough visitors?

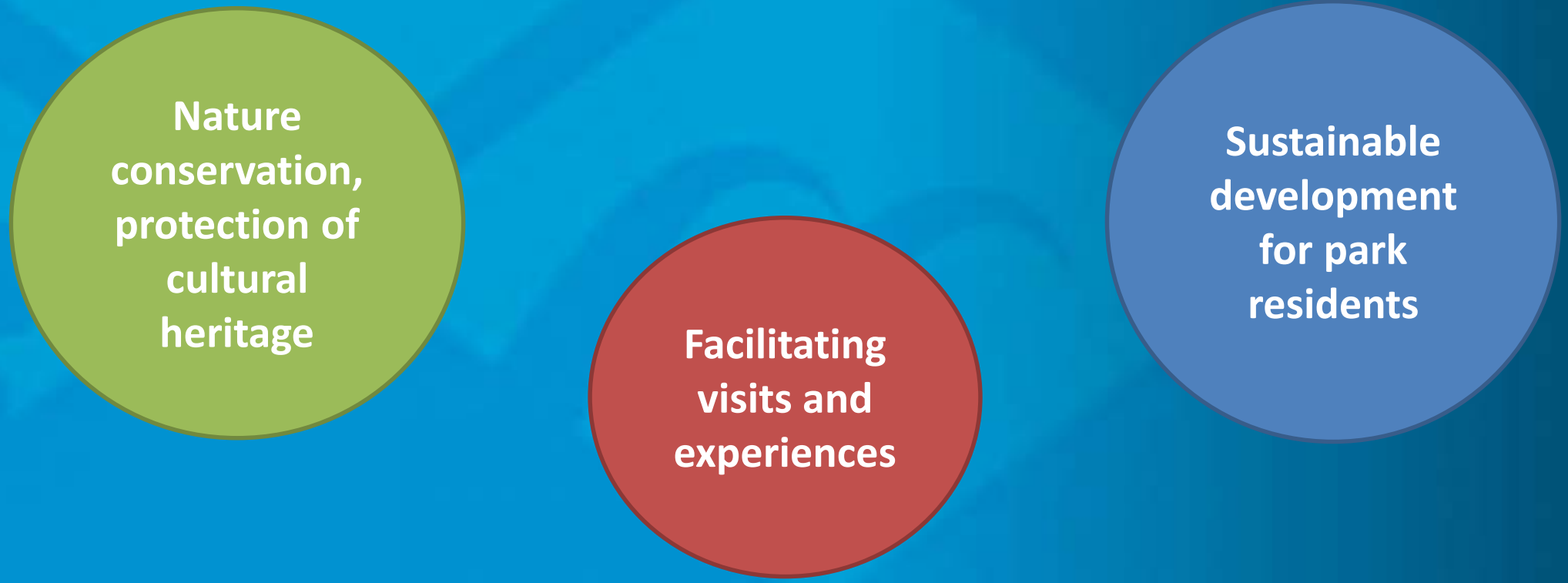
Is there enough already?

What types of visit are acceptable?

…

The National Park is dedicated to (among other things):

To facilitate visitation for recreational, tourist and spiritual purposes to the extent and in a manner that is least disruptive to nature and compatible with the objectives of the National Park



Everyone is allowed to visit the National Park under the same conditions and it is free of charge, except in the case of a concession (contract) for the use of part of the National Park.

The Minister may restrict access to natural values or specific parts of the National Park on the basis of an expert assessment of the threat. Threats shall be deemed to have been demonstrated if the expert threat assessment demonstrates that it is likely that viewing or visiting a part of the national park could result in a threat to the conservation of natural values, plant or animal species and their habitats, habitat types and cultural heritage.

In the National Park, several natural values or parts of the National Park are already equipped and open for viewing and visiting, as follows:

- **Savica Waterfall, Mostnica Gorge, Vintgar Gorge, Tolminka and Zadlaščice Gorge**

- Trail around Lake Bohinj, **Pokljuška Trail**, **Pokljuka Gorge**, **Goreljek peatbog Nature Trail**, **Peričnik Waterfall**, **Triglavska Bistrica Trail**, Path to Martuljek waterfalls, **Soča Trail**, Source of the Soča River, **Mlinarica Gorge**, Šunikov gaj (Lepena), Path of Peace, Zadlaška Cave, Iron Trail, Via Alpina, Juliana, **Mangrt Trail**, …

- 830km of mountain paths

Many and different operators – TNP, Local municipalities, Local Touristic organisations (public organization), Loacal Touristic board/association, Private companies, Mountain assosiation of Slovenia, …

Peričnik waterfall – TNP

Savica waterfall – Bohinj tourist association

CARRYING CAPACITY METODOLOGY – Vintgar gorge

Vintgar gorge – Gorje tourist association

CARRYING CAPACITY METODOLOGY – Vintgar gorge

Reasons for the decision to work on carrying capacity metodology and to limit the number of visitors in the gorge

In recent years the tourism boom in Slovenia (especially in mountain areas) has led to a rapid and dramatic rise in visitor numbers. In 2011, the Vintgar Gorge received approximately **77,000 visitors**, in 2016 the figures rose to 220,000 and in 2019 they totaled over **400,000 visitors**.

The management of the gorge is not solved!

Reasons for the decision to work on carrying capacity metodology and to limit the number of visitors in the gorge

Environmental issues

- High traffic overloading of entrance points, prohibited parking on grasslands, overloaded local roads, traffic jams, etc.
- Toilet facilities insufficient for the number of visitors, inappropriate waste water treatment

Reasons for the decision to work on carrying capacity metodology and to limit the number of visitors in the gorge

Nature conservation issues

- Pressure on wildlife.
- Unrestricted access to the water.
- Degradation of the gorge due to the construction of safety nets with the aim of ensuring complete safety.

Reasons for the decision to work on carrying capacity metodology and to limit the number of visitors in the gorge

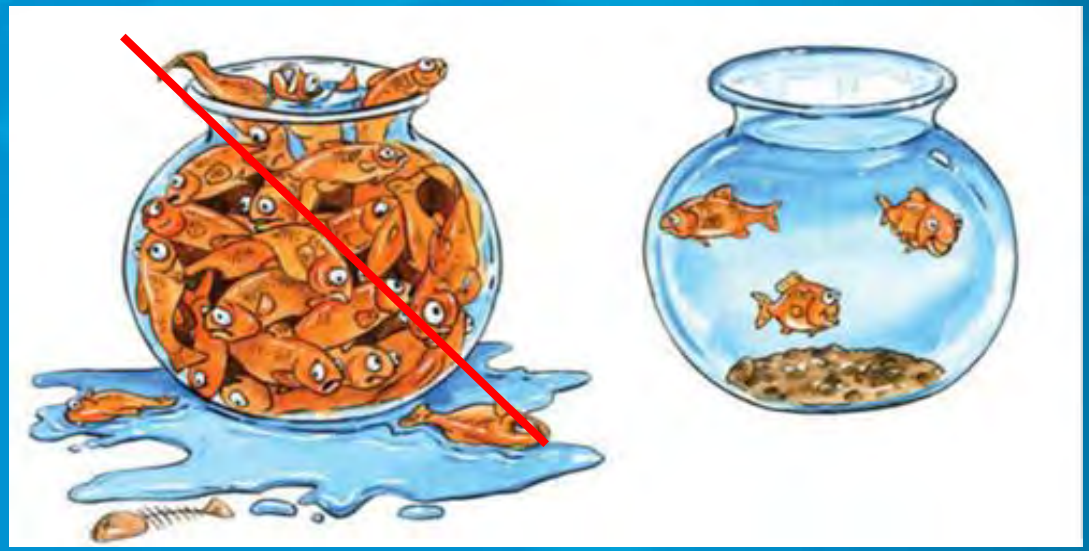
Sociological issues

- Gorge visitation affects the quality of life of the residents of the nerby villages.
- The visitors' experience of the gorge is limited as a result of overcrowding.

According to the Triglav National Park Act, the Triglav National Park Public Institute (TNP), which manages the national park and its territory and is also responsible for the Vintgar Gorge, has **the right and the obligation to restrict access** to natural assets/value or individual parts of the national park when further visitation or viewing of that particular part of the national park could pose a threat to the preservation of natural assets.

For the purpose of preparing the risk evaluation analysis and propose a visitation limit for the Vintgar Gorge, the TNP has prepared an evaluation of the carrying capacity of the Vintgar Gorge.

Carrying capacity *is the maximum number of people that may visit a tourist destination at the same time, without causing a negative impact on the natural and social environment and an unacceptable decrease in the quality of visitors' satisfaction* (Mangion 2001).



Why choose carrying capacity metodology as a visitor management tool?

- An effective instrument for visitor management.
- Essential support in decision-making processes.
- Expert basis for coordination needs with stakeholders.
- Important nature conservation measure.

The specific figures (numbers) derived from the carrying capacity are a clear message to the society (tourism sector) that it‘s enough.

The calculation and implementation of the visitor carrying capacity of a natural asset may help reduce the negative impact of visitation and contribute to greater visitor satisfaction.

The discussed methodology for defining carrying capacity is suitable for the natural assets where visitors move along walking trails (or where scattered visitation over a wider area is not possible) and where entrance and exit points are regulated, well-known, few in number and enable visitation control. Such destinations include gorges, waterfalls, small-sized nature reserves, etc.

CARRYING CAPACITY METODOLOGY – Vintgar gorge

Mombacho Volcano Nature Reserve of Nicaragua

Estimation of the tourist carrying capacity of the Natural Reserve Mombacho Volcano, Granada, and the Natural Reserve Datanli-El Diablo, Jinotega, Nicaragua

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Abstract

The study was undertaken in the Natural Reserve Mombacho Volcano (NRMV), Granada and the Natural Reserve Cerro Datanli-El Diablo (NRDE), Jinotega. The main objectives of this research were to analyze the current tourism management in the sites, to determine the visitor carrying capacity for the walking trails and give recommendations for managing visitors in the sites.

The visitor carrying capacity (VCC) works as a potential strategy to reduce recreational impacts in Natural Protected Areas [5]. Visitor carrying capacity is considered at three consecutive levels: physical carrying capacity (PCC), real carrying capacity (RCC) and effective carrying capacity (ECC) [3]. The PCC was estimated based on the dimension of each trail, the space needed for each visitor and the time required to walk it. The RCC involves correction factors such as distance between groups, soil erodability, difficulty to walk, and others. The ECC includes the Management Capacity (MC), which is given by the existence of appropriate personnel, equipment and facilities in the protected area [3]. The MC of the NRMV estimated was 74.24%. If the MC increases to 80% because of improvement in any of its components; the ECC would increase in the same proportion. According to Fundación Cocibolca, the organizations managing the NRVM, scholar visitors show a different behaviour than economics visitors. This rationale was considered in the calculation of the correction factors. This gave a much lower ECC for students. Therefore the maximum number of visits registered exceed the ECC calculated for students but not for economists. If the trend of visits continues to increase in the following years, it will be necessary to restrict the number of visits during the top periods.

On the other site, the peak El Gobiado, North sector of the NRDE has 3 defined walking trails: El Congo, El Leon and Campanero. The MC was 62.34% of the optimum. The scenario of MC at 80% would increase the ECC even more than in the NRMV case. It is suggested that this research could be used by the Ecotourism Project, funded by PNUD and further developed by PAGIENO applying the recommendations for visitor management on the walking trails, fauna species indicators for impact monitoring in the site, and training local tourist guides for visitor management.

Keywords: protected areas, evaluation, visitor carrying capacity, physical carrying capacity, management capacity, real carrying capacity, effective carrying capacity, MARENA, SINAP, Fundación Cocibolca and PAGIENO.

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CARRYING CAPACITY METODOLOGY – Vintgar gorge

Fandoqloo Forest, Iran

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ORIGINAL ARTICLE

Estimation of Tourism Carrying Capacity of Fandoqloo Forest in Ardebil Province, Iran

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ABSTRACT

Technique of tourism tolerance capacity or tourism carrying capacity is an applied and administrative technique in sustainable tourism. Carrying capacity estimates physical, actual and effective capacities in a tourist spot and manages them based on sustainability and management indexes and acceptable limits of changes in the indexes. In this paper, tourism carrying capacity of Fandoqloo Forest of Ardebil Province(Iran), located in the northwestern of Iran was determined through quantitative estimation of land carrying capacity by a systematic assessment. Results of the study showed that each tourist spot has its specific potential and carrying capacity of each region differs according to the environmental conditions. Hence, it needs sustainable programming and management adapted with tourism carrying standards and endurance ability.

Keywords: *Tourism development, Carrying capacity, Sustainable management, Ardebil Province, Iran*

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INTRODUCTION

In the process of land programming and management, understanding of land consistency and ability for different applications, and using quantitative methods for estimating the amounts of use of available resources in certain carryings of the land in temporal units of programming have key roles in the land planning and management. Thinking of civil system which has been created in the concept of sustainable development especially in metropolitan field, role and operation of resorts and especially natural resources within urban and extra-urban and their environmental operations have made the environment of human society significant [1].

It is obvious that, recreational resources are founded often based on natural features and capabilities in such areas so at least is considered as a major factor to determine a place as recreational. Obviously, in such circumstances, maintaining the dynamism and the quantity and quality of this category of natural resources is necessary to utilize them consistently and providing acceptable level of a recreational experience for visitors [2]. Since resources are often limited in nature and needs of human civilization to the use of resources resulted from some factors such as economic and industrial development and population growth is steadily increasing, therefore, every day there is more pressure on natural resources to meet these needs . Thus, optimal balance between the creational capability of a resource as one of the important functions of environmental resources and the amount of using them by the visitors is a much important task and forms the basis of systematic programming of urban resorts to prevent creation of ecological disturbance in these areas as well as making it possible to have steady and optimal utilizing of them [3].

Effective adjustment and completing the actual strategy in assisting the pressure of tourism on the environment are often done based on carrying capacity. Use of carrying capacity index in programming of recreational regions began in the second half of 1960s. This term means the number of using periods of a recreational area without permanent decline in physical and biological capacity to support recreation, area and obvious damage to the recreational quality[4]. Global Tourism Organization defines the carrying capacity as following a certain level of touchy visitors in an area who can accumulate in a certain time and place [7].

El Caminito del Rey

22 MAY 2016

El Caminito del Rey Path achieves the maximum number of visitors, by receiving 1,100 people at the reopening

20,700 entrance tickets for all days until 30th June have sold out online to members of public

caminito del rey · entradas · aforo · ardales

The reopening of the path caused great excitement this morning. The proof are 1,100 people, the maximum possible number of visitors, who were received. There are hardly any tickets left for the following days

The carrying capacity of a natural asset considers three levels:

- the **physical carrying capacity** (PCC),
- the **real carrying capacity** (RCC), and
- the **effective carrying capacity** (ECC).

The relationship between them can be represented as follows:

PCC > RCC >= ECC

Assumptions

- **Length of trail:** the total length of the walking trail and visitor flows
- **Time of walking:** the average time needed to walk the trail
- **Opening hours:** the average duration of time when the site is open to visitors, per day and per year (e.g. 10 hours/day and 7 months/year)

Additional information:

Parking areas, Toilet areas, Condition of the route (e.g. erosion, shortcuts, dangerous sections, etc.), trail width.

The starting point for defining the PCC is that in order to walk unobstructed a person needs at least 1 metre of space ahead and behind

Calculating the PCC

The PCC considers the following components: length of trail (l), distance between visitors (sp) and the time needed (t):

PCC = l/sp*no

l = length of trail = 1600m

sp = space needed for walking = 1m2

no = Number of possible visits per day

no = h/t

h = open hours (on average 10 hours)

t = time needed to walk the trail (40 minutes or 0.66 hours)

no = 10/0.66 = 15,15

PCC = l/sp*no = 1600/1*15,15 = 24240 visits/day

Calculating the RCC

The RCC is calculated using the following equation:

RCC = PCC – cf1 – cf2 – cf3 - … = (PCC*cf1*cf2*cf3 …)

cf = correction factor (limiting factor)

The correction factors are different for every site. In the case of Vintgar Gorge, the following correction factors carry the highest weight:

- Weather
- Security (falling rocks, slippage, time needed for the rescue team to arrive in case of an accident)
- Nature protection (early and late hours – high impact on birds and the riparian habitat)
- Social factor (experience, relationship between visitors, and the relationship between visitors and local people)

Weather (cf1)

Historical precipitation data for the area of the Bled Meteorological Station for the last four years (https://meteo.arso.gov.si) showed in the period between 1 May and 30 November during these years there were about 4 day with precipitation exceeding 20mm per day. The assumption is that gorge visitation is impossible under such weather conditions.

S1 = 4days*10hours (average number of open hours per day) = 40hours

Sc = 2100hours (total number of open hours per year)

cf1 = S1/Sc*100 = 40/2100*100 = 1.9

cf1 = 1 – S1/Sc = 1 - 40/2100 = 0,98

CARRYING CAPACITY METODOLOGY – Vintgar gorge

Nature protection (cf2, cf3)

cf2 = impact on wildlife

S2 = 3 hours in a day are more critical in terms of nature protection than the other 7 hours, i.e. 2 hours in the morning and 1 in the evening.

Sc = 10 hours/day (average number of open hours per day)

cf2 = S2/Sc*100 = 3/10*100 = 30

cf2 = 1 – S2/Sc = 0,7

Cf3 = impact on riparian habitats

S3 = water access is possible at a trail section about 400m **(150m)** in length

Sc = 1500m (total length of the trail)

cf3 = S3/Sc*100 = 400/1600*100 = 25 → cf3 = 150/1600*100 = 9,4

cf3 = 1- S3/Sc = 1- 400/1600 = 0,75 → cf3 = 1- S3/Sc = 1- 150/1600 = 0,0625

Security (cf4)

S5 = in the trail section about 200 metres in length the risk of rockfall is higher (the narrowest section of the gorge with no protection nets)

Sc = 1600m (total length of the trail)

cf4 = S4/Sc*100 = 200/1600*100 = 12,5

cf4 = 1 - S4/Sc = 1 - 200/1600 = 0,875

Security (cf4)

S5 = in the trail section about 200 metres in length the risk of rockfall is higher (the narrowest section of the gorge with no protection nets)

Sc = 1600m (total length of the trail)

cf4 = S4/Sc*100 = 200/1600*100 = 12,5

cf4 = 1 - S4/Sc = 1 - 200/1600 = 0,875

Social factor (cf5)

Considering the exceeded social capacity, dissatisfaction of visitors and local people and the fact that the Vintgar Gorge is located inside the national park, which makes nature experience one of its priority objectives, this study assumes a standpoint that the social factor shall be defined by considering **the distance between visitors in the gorge to be at least 10 metres.** Such a distance will allow visitors to move freely and unobstructed, without having to move out of the way to let other visitors pass, allows for short stops to enjoy the gorge, take photographs and experience nature without causing excess disturbance to other visitors.

Social factor (cf5)

Cf5 (social factor) = S5/Sc*100 = 8 (gap between optimal and real values: 10m-2m) the calculation is based on the assumption that the distance between two visitors is 10 metres, and that each visitor has 1 metre of personal space; therefore, the real distance between two visitors should therefore be 8m/10m*100 = 80

Cf5 = 1 – S5/Sc = 1 – 8/10 = 0,2

Social factor (cf5)

Calculating the social factor using a survey

- Conduct of the survey in summer 2021 (cooperation with Local Tourist Association and external contractor)
- The social factor is a key component in determining carrying capacity (not always, depending on the genre and sensitivity of the NV)
- By carrying out the survey, TNP wished to confirm or refute the value of the social factor, which has been advocated and used by the TNP in carrying capacity calculations

Cf5 = 0,16 (survay) **Cf5 = 0,2** (TNP assumption)

The final definition of the RCC considering all correction factors is as follows:

RCC = PCC – cf1 – cf2 – cf3 - … = (PCC*cf1*cf2*cf3 …)

RCC = PCC*(100-cf1/100)*(100-cf2/100)*(100-cf3/100)*(100-cf4/100)*(100-cf5/100)

RCC = 24240*(100-1,9/100)*(100-30/100)*(100-9,4/100)* (100-12,5/100) *(100-84,7/100) = 24240*0,98*0,7*0,9*0,9*0,153 = 2182/day

The RCC (real carrying capacity) of the Vintgar Gorge is approximately **2290** visitors/day

Calculating the ECC

The ECC is the maximum number of visitors that the site manager can manage sustainably in compliance with the RCC and the existing management capacity (e.g. number of staff, infrastructure, parking, toilets). The management capacity can change rather quickly (e.g. by hiring additional staff, putting up an extra chemical toilet), but this is not always an option. The main issue in this regard is the provision of sufficient number of parking places (if needed) or provision of public transport.

ECC = RCC * Mc

ECC = RCC * (100 – Mc/100)

Mc = management capacity, which consists of the number of staff, number and capacity of toilets, number of parking places, …

Mc = n1 (staff) + n2 (parking) + n3 (toilets) + … / n *100

Mc = 1- n1+n2+n3/n

Calculating the maximum current number of visitors

The daily quota, which is calculated on a 10-hour average daily opening of the gorge, is converted to a single average visit of 40 minutes, which amounts to a maximum of **145 visitors** in the gorge at any one time.

For the busiest hours (e.g. between 10.00 and 17.00), the length of the path (1600m) and the 10m visitor spacing (realistically 8m) are used to determine a maximum of 200 visitors at a time in the gorge. If a 20% margin is also taken into account to allow for the management of the busiest days (individual weekends, August), then the TNP proposes that the maximum current number of visitors in the gorge is **245** (the number was confirmed also with a survay)

Implementation of the calculated carrying capacity:

- Coordination with the current manager (Local Tourist Association) of the gorge.
- Coordination with the Ministry of Natural Resources and Spatial Planning.
- Preparation of governement act to limit number of visitors per day according to calculated carrying capacity.
- Coordination with Tourist sector on regional and national level with the aim to moderate the growth of tourism.

Implementation of the calculated carrying capacity:

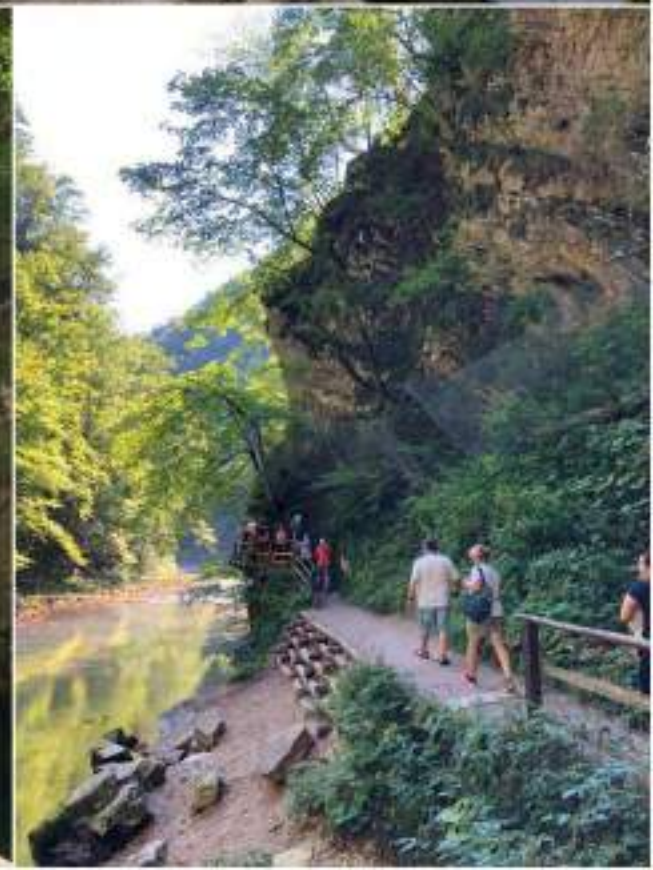
Governement act to limit number of visitors per day according to calculated carrying capacity – **April 2023 (2290/day, 245 maximum)**

Next steps:

- **management arrangements for the natural value (contract,concession, guardianship)**
- **cooperation and trust between TNP and Local tourist association**

Visitor management action by Local Touristic Association

- **introduction of one-way traffic**
- **reservation system and online sales**
- the removal of most stationary traffic from the entry point of the gorge
- the introduction of a main car park on the site of the existing infrastructure and the introduction of public transport to entry point
- reconstruction of galleries, bridges
- **investments in safety systems (rockfall risk assessment, safety nets, …)**







The designation of nature conservation values (such as Vintgar gorge) in Slovenia is based on the strict criteria (preservation, characteristic, typical features, rarity, …).

How many safety nets can be placed in a nature conservation site to have:

- relatively high safety for visitors and
- to ensure that the features that made Vintgar gorge a nature conservation site in the first place are not compromised?

TNP belives that limiting the number of daily visitors can help to reduce the extent of safety nets.

CARRYING CAPACITY METODOLOGY

TNP has prepared carrying capacity calculations also for other natural values inside the park:

- **Vintgar gorge** - **2290 visitors/day** (calculation also confirmed on the basis of a visitor survey carried out in 2021)
- **Tolminka gorge** - **1050 visitors/day** (also confirmed by a survey in 2022 - approx. 1000/day)
- **Savica waterfall** - **1135 visitors/day** or **1700 visitors/day** (July, August)
- **Mostnica gorge** - one-way **880/day**; two-way **440/day**
- **Source of the Soča river** - **500 visitors/day** (in case of the starting point at the Mountain hut at the Source of the Soča River); **1500 visitors/day** (in case of the starting point at the car park on Vršiška cesta)
- **Martuljek gorge and waterfalls** - **1300 visitors/day** (lower waterfall); **1500 visitors/day** (lower and upper waterfalls)
- **Peričnik waterfall** - ?; survey carried out and social factor determined

CARRYING CAPACITY METODOLOGY – canyoning Fratarica

CARRYING CAPACITY METODOLOGY – canyoning Fratarica

Problems

- Too many people in one group
- Too many groups/day
- Overcrowded - up to 130 people/day
- Expirience is downgraded

- Pressure on nature
- Problem with effective instrument (consesus) for managing canyoning

Input data for calculating carrying capacity:

- Group can have 9 people max
- Time for group to come through canyon = 3-4 hours
- The time gap between two groups = 30 minutes
- The canyon is opened 6 hours / day for canyoning

CARRYING CAPACITY METODOLOGY – canyoning Fratarica

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Today

Up to 130 people/day and with no limitations

Tomorrow

Max. 63 people/day or max. 7 groups/day

The process of regulating canyoning:

- Carrying capacity calculation
- In cooperation with Ministry preapering a draft of goverment act to limit number of people/groups doing canyoning per day (ongoing process)
- TNP takes over management – development of reservation system (app), adaptation of the criteria and conditions for the granting of consents, trust agreements with the local community and the Canyoning Association (mantainance, toilets, parking places, security, …)
- Communication plan

Thank you!

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