Interreg CENTRAL EUROPE

Co-funded by the European Union

HUMANITA

Local Action Plan to monitor and resolve human-nature conflicts in pilot sites

D.3.4.1.

Version 1

11 2025

Partner:

EGTC Geopark Karawankne-Karavanke

Author: Urosh Grabner

Table of contents

Introduction

Within the framework of the **Interreg CE Humanita project,** natural parks and protected areas involved are required to develop, for each pilot site, a Local Action Plan (D.3.4.1) to monitor and resolve human-nature conflicts at the respective sites.

An action plan is the operational plan for the park/protected area's strategy for managing tourism impacts. The Action plan document showcases the actions needed to achieve sustainable management of tourism according to the defined objectives of optimising human activities with biodiversity and nature protection.

It provides practical guidance on the implementation and monitoring of actions that the organisation is committed to achieving upon approval.

The document begins by outlining the context of the park/protected area and displaying the main issues and criticalities that currently threaten the biodiversity and health of the area's habitats. It describes the current impacts of mitigation measures in place, featuring the main gaps and weaknesses that still exist.

It highlights challenges and potential room for strengthening the strategies in force by combining integrative measures and tools resulting from the monitoring activities performed and the knowledge exchange that occurred along the project's progress. It illustrates how the action plan will be included in a wider framework of strategies, in effect, within which administrative and legislative structures at local, regional and national levels will be part, and how it will reinforce them as well.

The action plan includes a Zone plan to designate areas of the parks/protected areas for different recreational uses other than their current use.

The document also includes actions specifically aimed at developing new narratives of the park/protected area to foster human responsibility and awareness about environmental values.

An action plan contributes to concrete actions for achieving policy changes and real-world impacts.

1. Introduction to the Protected Area

The Karawanken-Karavanke UNESCO Global Geopark is a cross-border region of natural and cultural experiences with an outstanding geological heritage. Five Slovene and nine Austrian municipalities are bound together in an area of 1,067 km². It is a unique area characterised by a wide variety of habitats due to its distinct geological features. The region includes rock walls, screes, mountain meadows, marshes, fens, and forests, all of which support numerous rare and protected plant and animal species. It is estimated that **more than 1,500 plant species,** around **7,500 animal species,** and **30,000 insect species** can be found in the Karawanken-Karavanke Geopark.

Some notable **endemic species** found here are **Zois' bellflower** *(Campanula zoysii)*, **Wulfen's primrose** *(Primula wulfeniana)*, **Karawanken gentian** *(Gentiana froelichii)*, and **Peca meadow oat-grass** *(Helictotrichon petzense)*. The family of wild orchids in the wider Geopark Karavanke area is estimated to include approximately 40 species. Among these are the **Kamnik orchid** *(Nigritella lithopolitanica)*, the **Black Vanilla orchid** *(Nigritella nigra)*, the **Lady's slipper orchid** *(Cypripedium calceolus)*, the rare **Greater butterfly-orchid** *(Platanthera chlorantha)*, the **Dark-red helleborine** *(Epipactis atrorubens)*, etc.

The area is an important ornithological region that serves as a mating and nesting ground for various owl species, woodpeckers, and birds of prey, including the rare **Golden Eagle** *(Aquila chrysaetos)* and the **Peregrine Falcon** *(Falco peregrinus)*. It is also home to critically endangered grouse species such as the **Rock Ptarmigan** *(Lagopus muta)*, **Black Grouse** *(Lyrurus tetrix)*, **Western Capercaillie** *(Tetrao urogallus)*, and **Hazel Grouse** *(Tetrastes bonasia)*.

In addition to these birds, the region is home to many vulnerable and protected species, including the **Stone Crayfish** *(Austropotamobius torrentium)*, rare dragonflies, butterflies, and moths. It also hosts amphibians and reptiles such as the **Alpine Salamander** *(Salamandra atra)*, the **Yellow-bellied Toad** *(Bombina variegata)*, the **Alpine Newt** (Ichthyosaura alpestris), the **Nose-horned Viper** *(Vipera ammodytes)* and many others.

The area is home to several protected species of butterflies and insects, including the endangered **Black Apollo** *(Parnassius mnemosyne)*, the **Alpine Longhorn Beetle** *(Rosalia alpina)*, and **Lorkovic's Brassy Ringlet** *(Erebia calcaria)*. Additionally, large predators such as **Brown bears** *(Ursus arctos)*, **Wolves** *(Canis lupus)*, **Golden jackals** *(Canis aureus)*, and **Lynxes** *(Lynx lynx)* have been recorded in the region.

The Karawanken-Karavanke UNESCO Global Geopark is notable for its significant conservation efforts, with approximately 13% of its area designated as Natura 2000 sites. In total, the Geopark includes **18 Natura 2000 sites,** with seven located in Austria and 11 in Slovenia. Austria also has three nature-protected areas, two of which are recognised as Natura 2000 sites. Additionally, there are four landscape-protected areas and 14 natural monuments, according to regional authorities. On the Slovenian side, there is one landscape-protected area and two natural monuments classified as national conservation areas. More than 75% of these protected areas are in Slovenia, where nearly 29.6% of the total surface area is under protection. In contrast, Austria has about 5.5% of its area, which equates to 38.1 km², protected under various levels of legislation.

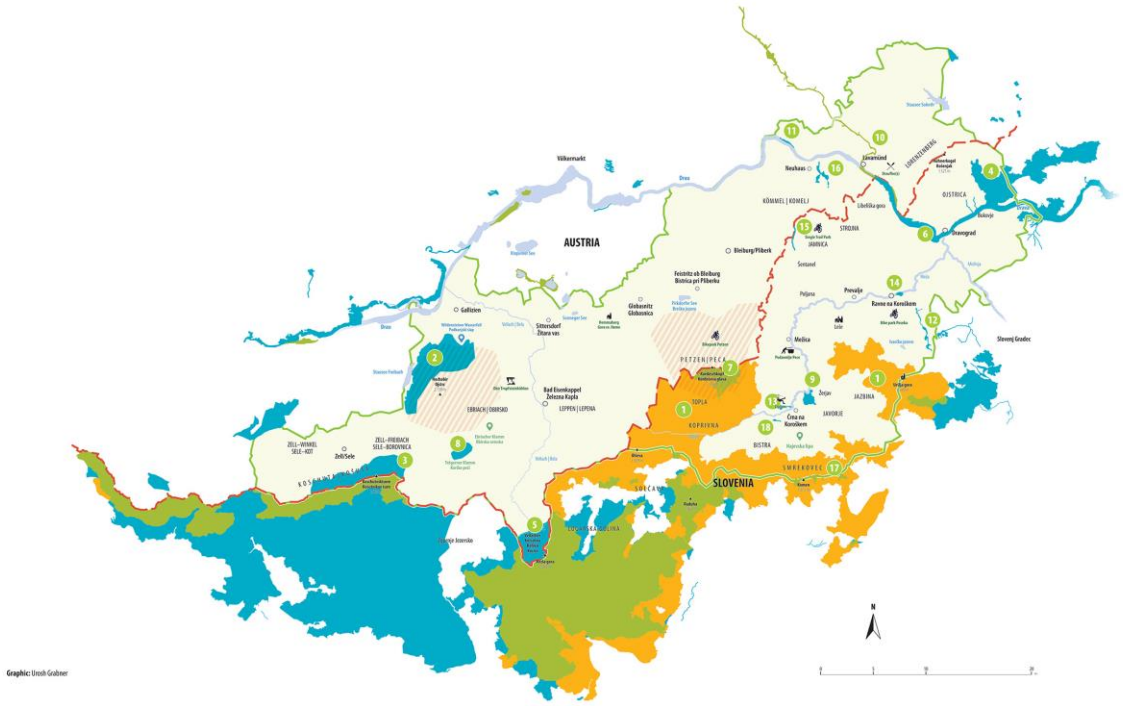

Fig. 1: Karawanken-Karavanke UNESCO Global Geopark with Natura 2000 areas

2. Current state-of-the-art of tourism impacts

The Karawanken–Karavanke UNESCO Global Geopark is a popular tourist destination that offers a wide range of outdoor activities during both the summer and winter seasons. Tourism significantly contributes to the local economy for nine Austrian and five Slovenian municipalities encompassed by the Geopark. However, this influx of visitors poses challenges to sustainable management, necessitating the preservation of the area's unique natural and geological assets.

The increasing number of tourists has led to several environmental concerns. The Geopark is not immune to the **spreading of invasive alien species,** which are also spread and transmitted in a model way through the activities of visitors in nature and occur along transport routes, hiking, and biking trails.

Hikers and bikers can explore the geopark's rich natural and cultural heritage at various sites, some of which are home to protected species and unique habitats. In winter, activities such as ski touring and snowshoeing are prevalent, allowing for flexibility in location. However, these activities can **conflict with areas inhabited by critically endangered grouse species and have an impact on the wildlife itself.**

Despite the requirement for hikers and bikers to use only designated and officially marked trails, there is a noticeable percentage of **illegal activities in nature.** This includes mountain biking to mountain peaks, which poses dangers not only to visitors but also to the environment. Such activities can have a significant impact, particularly in areas with vulnerable and protected species, and can disturb local ecosystems.

Additionally, **erosion** is a problem that occurs in areas of high visitor traffic, affecting both official and unofficial trails, and has an impact on the flora and fauna as well in areas with high erosion problems.

Habitat degradation caused by **trampling** remains a significant concern, and the presence of tourists during both summer and winter often disrupts local wildlife. The popularity of winter outdoor activities, which expanded significantly during the pandemic and continues to attract many visitors, has made the area a sought-after destination for ski touring. Although there are officially no restrictions for ski touring in nature,

there are rules and guidelines that, unfortunately, are not always followed. With this high level of popularity comes risks for the visitors themselves. In recent years, there has been an increase in **mountain accidents,** primarily due to inadequate equipment, poor preparation, inexperienced skiers, or engaging in activities during bad weather. Rescue operations, involving a rescue helicopter and, in most cases, a large number of rescuers on the ground, not only pose an additional burden on the environment and disturbance to wildlife, but also pose a danger to participants in rescue operations, which is often carried out even in very difficult weather conditions.

3. Current mitigation measures

The Geopark does not have legal authority to implement certain mitigation measures, such as closing areas or restricting movement during specific timeframes, as National Parks do. However, we are actively seeking solutions in collaboration with competent services, organisations, local and state government, and partners who have the legal basis to implement these measures or can simply make changes in their methods of management. Our goal is to ensure the long-term protection of vulnerable areas, finding an effective long-term way of coexistence. After all, nature is also our tourist product. It ensures our survival, not just economic, but also in general.

Nevertheless, certain **self-imposed mitigation measures** also have a beneficial effect on vulnerable areas. For instance, during the transition from winter to summer seasons and vice versa in the tourist area of the Petzen/Pece Mountain in Austria, the cable car is closed to visitors during the mid-season preparation period. During this time, from mid-March to mid-May and from November to the second week of December, the area is primarily occupied by a smaller number of employees conducting maintenance work, with occasional visits from plot owners. This period coincides with the mating season of the vulnerable **Grouse family** *(Tetraonidae),* and all visits are strictly limited to individuals on foot. Reaching the summit on foot takes at least five hours, compared to just 15 minutes with the cable car and a 1.5-hour walk. The shorter daylight hours at that time of the year also limit such long-hour activities.

A similar situation occurs in the Hochobir/Ojstrc area, where the road to the first mountain hut is closed to visitors during winter. There are several other locations within the Geopark where road maintenance is halted in winter, making these areas inaccessible by car (visitors can't get closer by car to the starting points). Mountain huts are often closed during the winter season or are only open on weekends in favourable weather conditions, which further contributes to reduced visitation in vulnerable areas during the rest and mating period.

In the Geopark, we have established strong partnerships with local mountaineering organisations, a collaboration that grows each year as we work together to address environmental impacts. Additionally, the Geopark is currently involved in several projects focused on promoting sustainable tourism, improving infrastructure, and raising awareness and educating both local and international tourists.

In the past, we have experimented with using **warning signs** to alert winter visitors that they are entering a protected area or that access is prohibited, in coordination with plot owners. The primary reason for this is that during winter, trails are not clearly visible as they are covered by snow. When promoting hiking and other outdoor activities, we strictly **advertise only legal trails.** All hiking promotional materials are also linked to awareness-raising, **emphasising etiquette in nature,** highlighting key elements of appropriate behaviour in the natural environment. We ensure that visual material depicts hikers on designated trails and bikers on bike paths, rather than on grass or off the path.

3.1 Key findings and management priorities

The HUMANITA monitoring phase has produced a rich, multidisciplinary database that provides a solid foundation for evidence-based management of the Geopark in this field of work.

Key issues requiring attention:

- Habitat degradation due to trampling, erosion, and unregulated or poor maintenance.
- Local extinction of species.
- Unauthorised trails and illegal outdoor activities.
- Data storage and processing, coordination of various sources, and mutual synchronisation—creating a platform that unifies databases from different sources in one place with varying levels of control and data protection.
- Long-term sustainability of monitoring and observation activities should be ensured through staff training and community involvement.
- Greater impact on the level of visitor awareness and the etiquette of behaviour in nature.
- Advocating the importance of protecting wildlife and vulnerable plant species.

Addressing such tasks can strengthen the Geopark's capacity for sustainable tourism management, its impact, and ensure both visitor satisfaction and the conservation of valuable habitats and species within the protected area. Nature is a product that can be marketed in the way of being treasured.

4. Monitoring activities' results

We primarily focus on monitoring activities to understand the spatial and temporal behaviours of hikers and bikers in two selected pilot sites, as well as in the general area of the Geopark.

Visitor monitoring plays a crucial role in evaluating the number of hikers and bikers on both official and unofficial trails. This process provides insights into the frequency of use on promoted trails, as well as those not formally designated (digital monitoring). By understanding the patterns of high visitation, we can identify specific areas that may experience greater negative environmental impacts on natural resources.

Our monitoring efforts concentrated on several key areas, including the observation of visitors at prominent locations, the assessment of e-DNA transfer through activities involving bikes and footwear, and the evaluation of how heightened tourist activity and the presence of tourism-related infrastructure impact wildlife and contribute to erosion. All monitoring activities conducted at the pilot sites were designed to complement each other and will be part of an ongoing evaluation process.

For comprehensive explanations and findings, refer to **Report D2.2.1.**

Link: Report on testing and data collection in PAs

4.1 Visitor monitoring

To enhance the visitor experience, we have established **a network of three types of "visitor counters" in key locations** (simple visitor counter – only counting hikers or only counting bikers), visitor counters A-B (counting hikers with establishing direction of approach), and complex triple visitor counters (counting and

distinguishing between vehicles, bikers and hikers with establishing direction of approach where needed). This initiative involves eleven devices from the Humanita Project, strategically placed to collect data on open routes accessible to visitors, hikers, and bikers on bike trails, as well as the locations where visitors travel between points.

The choice of locations for these counters depends on several factors, such as the presence of sensitive or protected areas, high tourism activity, and easily accessible starting points or connections between the locations.

In the initial phase in the year 2023/2024, we collectively tested various technologies from different providers (TrafX and eco counters) for counting visitor flow (both hikers and bikers). Our focus was on devices that utilise infrared triggers and counters equipped with magnetometers. In the same period, we started testing **RadioBeam technology** from Chambers Electronics to determine the best structural solution for our needs, monitoring positions and accuracy of data collections at the point of interest.

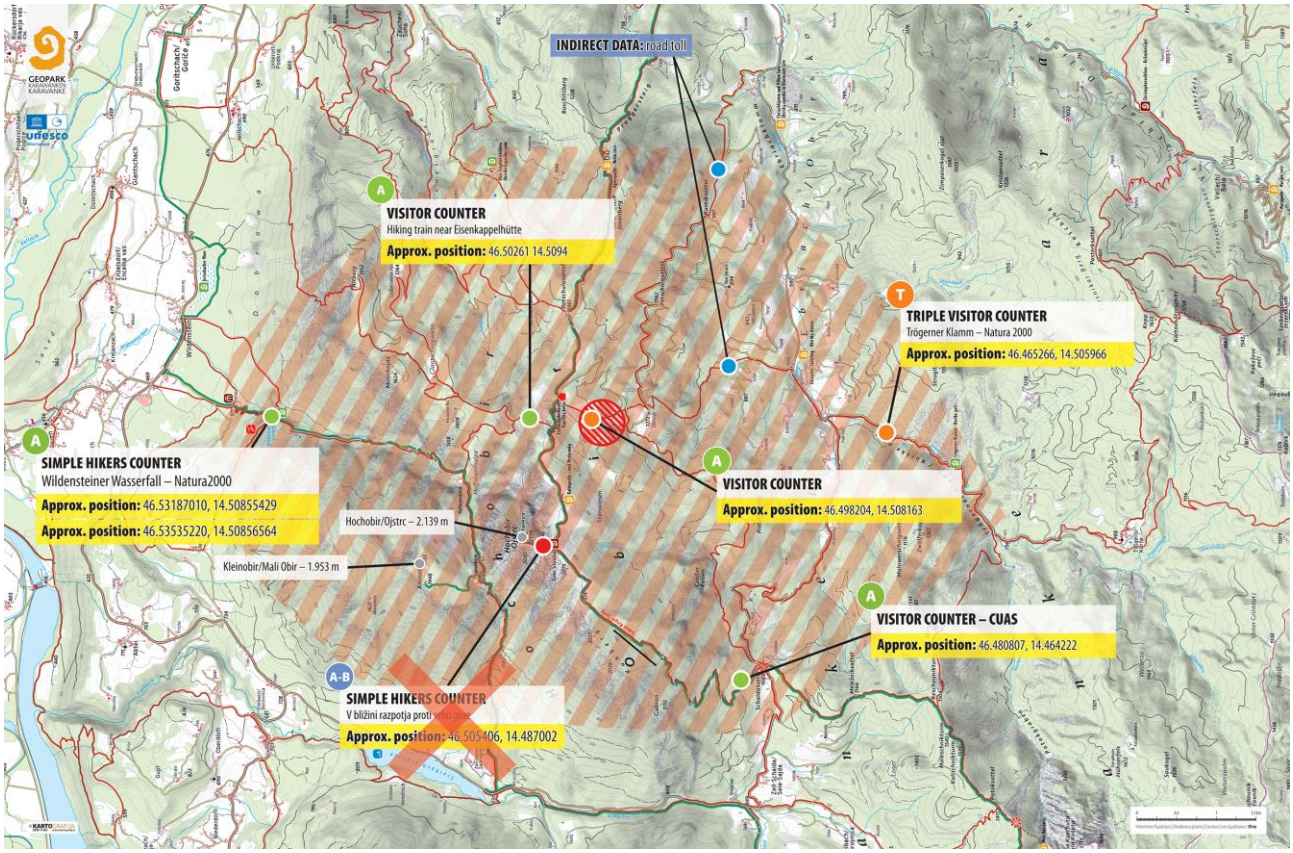

Fig. 2: Pilot site Hochobir/Ojstrc

During our study visits with various partners (outside of the project) who are already conducting visitor monitoring, we carried out numerous interviews, field trips, and research. These focused on the implementation of monitoring systems, comparisons of different monitoring environments, the techniques used, potential problems, gaps, and weaknesses. We also explored solutions, support structures, and established a long-term implementation baseline that ensures acceptable and affordable financial stability over time.

After several testing phases, including comparisons, networking, and identifying points of interest, we assessed the financial structure needed to ensure the long-term stability of our implementation.

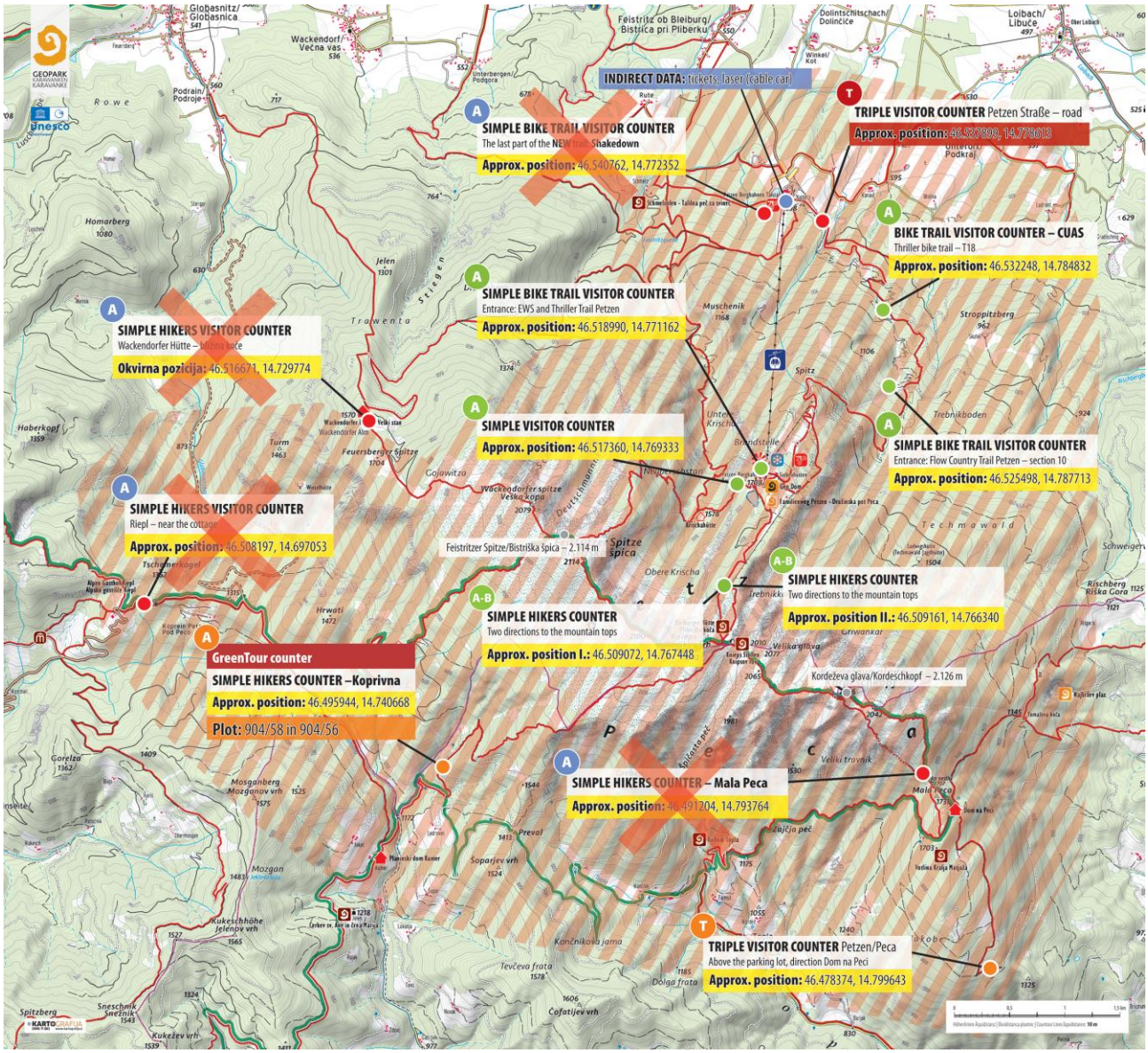

Fig. 3: Pilot site Petzen/Peca

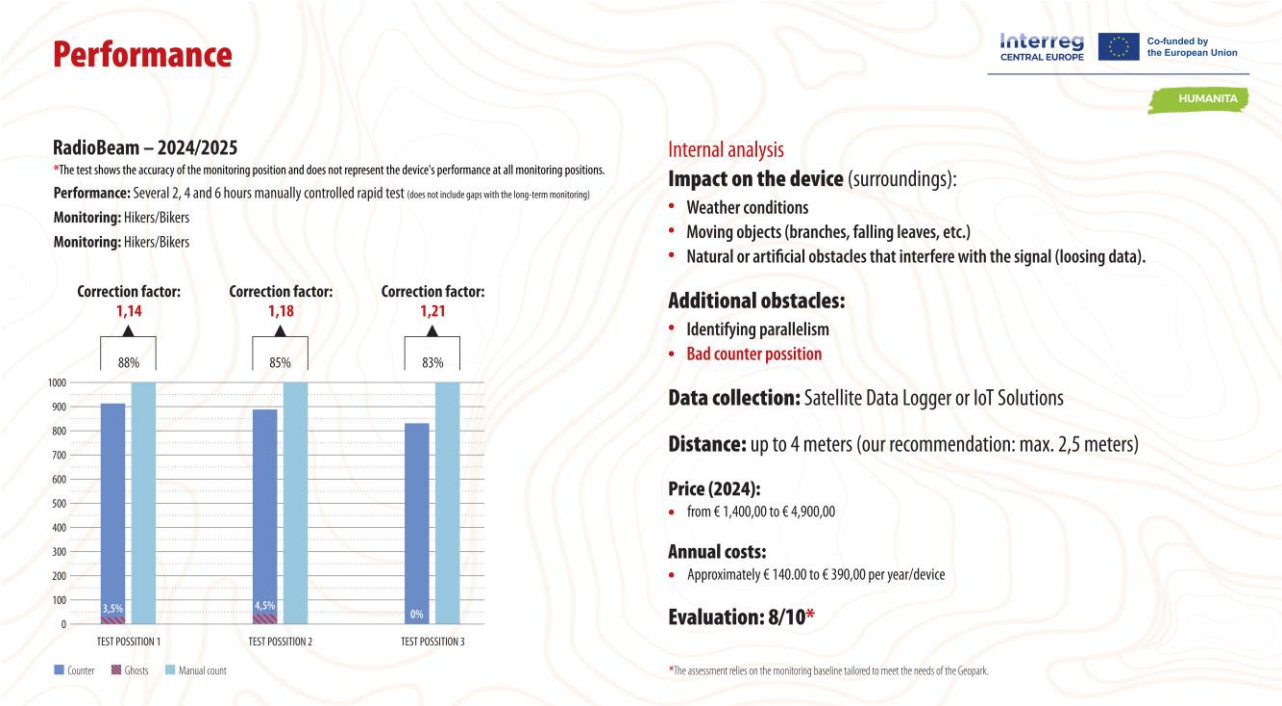

Fig. 4: Test performance example

During the same period, we tested visitor counting using wildlife cameras. Starting in July 2023, CUAS implemented an algorithm (Microsoft MegaDetector) for automatically counting hikers, bikers, animals, and vehicles using wildlife camera recordings (video), and it continues to be tested with new data from FH Kärnten. Similarly, we conducted testing of AI using YOLO algorithm versions (www.v7labs.com), focusing on training our own YOLO object detection models and evaluating the effectiveness of tracking various objects. Nevertheless, although the tests were highly promising, we excluded this method of visitor counting due to the controversial nature of 'video surveillance' and concerns about 'personal data' intrusion (filming in public places must be conducted under specific legal conditions – GDPR).

Additionally, we have established a system for gathering information based on indirect data from various hotspot locations. We collected GNSS data from outdoor and fitness Apps such as **Strava Metro,** Outdooractive, and Komoot. This data provides insights into popular activity highlighted areas and identifies illegal activities occurring in the natural areas of the whole Geopark. We also analysed indirect data from ticket sales over the past five years for tourist areas like Petzen/Peca, toll (ramp) data for the approach to Hochobir/Ojstc and other highlight spots. This information has given us valuable insights into tourist and local activities at key starting points.

Useful information can be compared with indirect data from overnight stays in the Geopark areas; however, this doesn't include one-day activities without accommodations, as it does not encompass local activities in nature.

4.2 Vegetation

Vegetation is divided into groups of: Native plants, Non-native plant species and Invasive alien species.

One of the significant groups of flora in the Geopark includes not only native **protected** and **vulnerable species,** but also a specific group of **endemic species.** In this regard, extensive monitoring will be necessary to identify key areas where interference with the natural environment is excessive or unacceptable.

Most, if not all, **endemic plant species and protected vulnerable species habitats are in the highest areas,** which are also the most attractive to visitors during summer and winter seasons. These areas present an extra challenge because their appeal draws a growing number of visitors engaging in a wider variety of outdoor activities, which can lead to greater negative impacts on vulnerable and protected environments.

A preliminary analysis indicates that the Geopark is home to **more than 1,500 plant species.** Notably, nearly **2% of these species are endemic** to the region. Additionally, around **20% of the plant species are protected** under the Regulation on Protected Wild Plant Species in Slovenia and Austria. Furthermore, **5% of the plant diversity consists of non-native and invasive alien species. An unknown percentage represents species that have become locally extinct in the region.**

And when we are addressing the protection of vulnerable species, it is also necessary to highlight the impact of **the local extinction** of individual species. Many vulnerable species living in the wider area beyond the Geopark's boundaries are already rare in our region or have completely vanished. **Among the most endangered plant species on the verge of local extinction** in our Geopark are the **Alpine Edelweiss** *(Leontopodium nivale ssp. alpinum),* various **Wild orchids** *(Orchidaceae)* such as the **Lady's Slipper** *(Cypripedium calceolus),* the endemic **Kamnik Orchid** *(Gymnadenia lithopolitanica),* the **Red Vanilla Orchid** *(Gymnadenia miniata)* and the **Dark Vanilla Orchid** *(Gymnadenia rhellicani).* All types of **Pasqueflowers** *(Pulsatilla),* the **Winter Aconite** *(Eranthis hyemalis),* the **Dog's-Tooth Violet** *(Erythronium dens-canis),* the **Wulfen's Primrose** *(Primula wulfeniana),* and many others.

In the HUMANITA project, the Geopark primarily focused on **identifying non-native and invasive alien species** in the whole Geopark area, their locations, threats, impact on habitats and appropriate measures to address them in the future.

Invasive alien species and **non-native species,** alongside climate change, urbanisation and pollution, pose the greatest threat to biodiversity, and the Geopark region is not immune to this effect.

The innovative concept for Citizen Scientist – direct approach, was thoughtfully developed by our Geopark colleague, Project Manager and photographer Urosh Grabner. This initiative demonstrates a commitment to environmental stewardship and seeks to engage the public in meaningful discussions about sustainability practices. Urosh's unique combination of project management expertise and artistic vision has resulted in an approach that not only gives results but also educates and inspires attendees to collaborate with appreciation and protection of our natural ecosystems.

To reach this goal, we've launched a one-of-a-kind Citizen Scientist – direct approach initiative (Invasive Alien Plant Species and Non-native plant species). This initiative aims to create a comprehensive database or map of all non-native plant species found in the Geopark Karawanken-Karavanke area. It is an ongoing process achieved with the assistance of the local community, collaborating with various interest groups, including nature enthusiasts, wildlife photographers, and mountain guides, to gather information based on clues about the locations of all known non-native and invasive alien plant species within the Geopark nature area.

Starting in November 2024, we conducted several interviews with dedicated members of the local community (who are already active in nature) to gain clues and information on the location of all found non-native plant species in the Geopark.

The strategy focuses on connecting with individuals from specific interest groups related to outdoor activities such as hiking, photography, or simply being nature enthusiasts. The main approach is direct,

personal interaction customised to each person's specific interests, creating meaningful connections with those already engaged in the topic.

Additionally, raising awareness and involving selected volunteers has also sparked interest among secondary participants. These participants, through the main information channel, offer clues about the locations and confirmations of non-native species in the environment, sharing valuable insights through active volunteers or direct contacts.

The process consists of three main phases:

- gathering data and clues from individuals through brief, productive interviews,
- identifying non-native plant species and confirming locations (field work or digital proof),
- and entering the collected data into a database (Geopark Karawanken-Karavanke).

Result

To date, more than **30,000 confirmed locations** of non-native plant species have been recorded in the database for the Geopark Karawanken-Karavanke. The majority consists of Invasive Alien Species. Altogether, **over 80 non-native plant species** have been identified, and there are still more than 15,000 clues pending verification. Each month, we receive several new tips that require confirmation and regularly fill gaps in the database and co-create the final image of the digital map of the Geopark with confirmed locations.

Based on the data we have collected so far, we estimate that there are **between 50,000 and 100.000 locations with non-native plant species within the Geopark area.** This estimate considers gaps in data from less accessible regions, as well as unsurveyed locations that may not have been included and unconfirmed data that still need to be inspected.

No physical "samples" were collected throughout the process, except for individual photo materials used to identify species. Once the species and location were confirmed, the photos were not archived due to the large amount of data. In this context, "samples" refer to digital databases used for further analysis and creating the digital map of all collected data in the future.

Through the concept of a set of confirmed locations, we have also identified a set of the most common alien species that dominate the Geopark area. These are **Annual Fleabane** *(Erigeron annuus)* with currently over 6,400 confirmed locations, **Black Locust** *(Robinia pseudoacacia)* with over 1,800 confirmed locations, **Canada Goldenrod** *(Solidago canadensis)* and **Giant Goldenrod** *(Solidago gigantea)* combined form over 4,400 known locations, **Himalayan Balsam** *(Impatiens glandulifera)* with over 2,800 known locations, **Horseweed** *(Erigeron canadensis)*, over 800 known locations, **Japanese Knotweed** *(Reynoutria japonica)*, which together with **Giant Knotweed** *(Reynoutria sachalinensis)* and **Bohemian Knotweed** *(Reynoutria × bohemica)* forms over 2,400 known locations, **Large-leaved Lupine** *(Lupinus polyphyllus)* with almost 300 known locations, **Small Balsam** *(Impatiens parviflora)* with over 600 confirmed locations, **Staghorn Sumac** *(Rhus typhina)* and **Tree-of-Heaven** *(Ailanthus altissima)* together form over 500 known locations, and **Yellow Oxeye** *(Telekia speciosa)* with over 350 confirmed locations.

Fig. 5: Sample of Invasive Alien plant species

It is also worth mentioning the presence of critical species such as: **American Pokeweed** *(Phytolacca americana),* **Bamboos** – *Genus Bambusa,* **Common Evening-Primrose** *(Oenothera biennisneeds),* **Common Ragweed** *(Ambrosia artemisiifolia),* **Cutleaf coneflower** *(Rudbeckia laciniata) – Goldquelle,* **Jerusalem Artichoke** *(Helianthus tuberosus),* **Orange Day-Lily** *(Hemerocallis fulva),* and **Shaggy Soldier** *(Galinsoga quadriradiata).*

The extensive floods of 2023 contributed to the presence and spread of certain non-native species in the area surrounding the Geopark. These floods literally washed some species from gardens and parks into natural habitats. It is important to note that, in addition to these non-native species—primarily garden and park plants—that have remained unusually prevalent in nature after two years, we have also confirmed the presence of two highly toxic species. These are **Jimsonweed** *(Datura stramonium),* which has been found in over 20 locations, and **Snow-on-the-mountain** *(Euphorbia marginata),* which has been identified in over 50 locations.

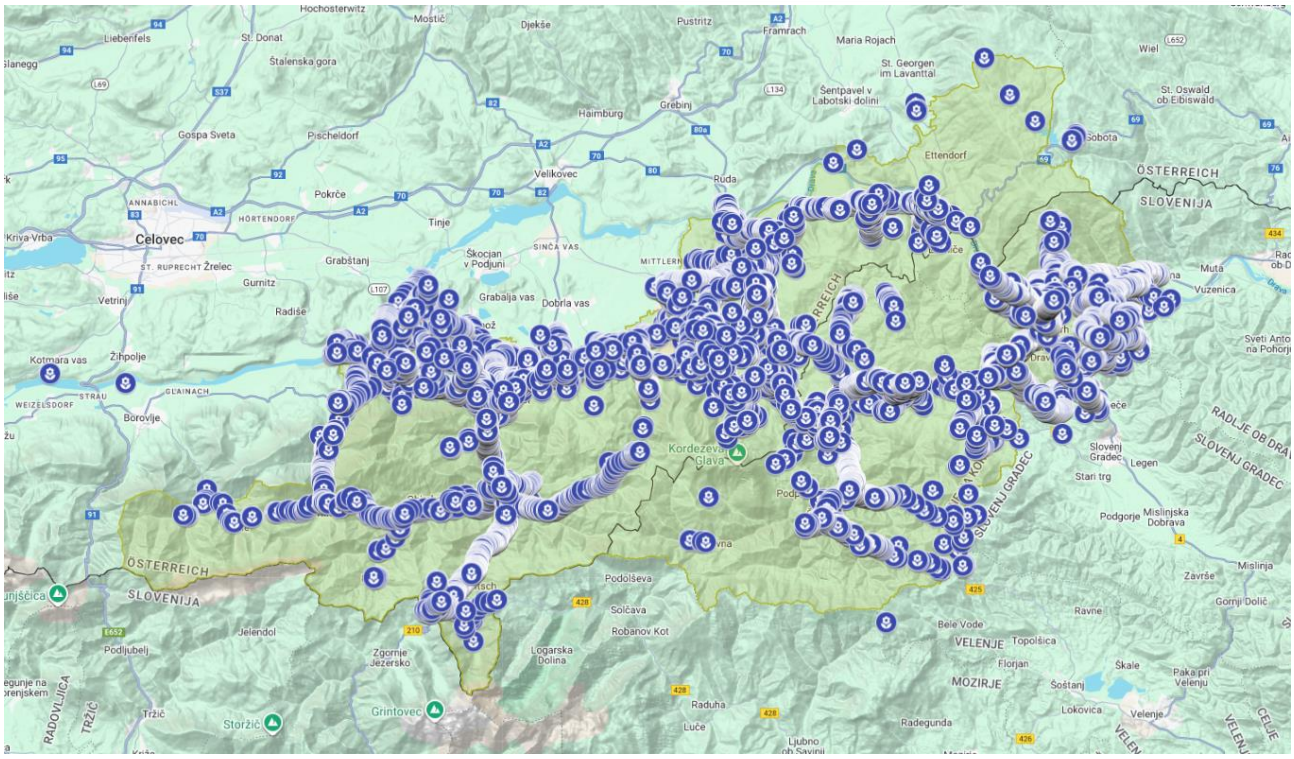

Fig. 6: Map of confirmed locations of Non-native and Invasive Alien plant species in the Geopark Karawanken-Karavanke.

The locations of confirmed observations also show the pattern of observer/human movement (paths, road connections, trails, etc.). The next step is to pinpoint and address gaps in remote, hard-to-reach areas to verify or dismiss the presence of non-native species, along with planning actions for containment, removal, and ongoing monitoring of non-native species. Some of those locations were already inspected and have confirmed minor presence of individual non-native and Invasive alien plant species; however, this is a continuous process, as the transfer of biological material can occur at any time.

The methodology used can also be applied to identify and catalogue different plant and animal species within the Geopark. Additionally, this approach can be adapted by any other organisation or individual looking to gather a large amount of useful data in a clear and transparent format adjusted to their needs. This technique streamlines the process of digitising the entire area, creating a comprehensive repository of valuable information. By systematically identifying these species, we can enhance our understanding of the region's biodiversity and ecological interactions. This initiative not only enriches the data available for researchers and conservationists but also facilitates informed management practices that promote the preservation of the unique ecosystems found within the Geopark.

4.3 Wildlife

For wildlife observations in areas adjacent to high-traffic visitor locations, we are utilising **20 wildlife cameras.** To confirm the behavioural patterns and presence of animals (various forms of wildlife with a concentration of vulnerable and endangered species), the observations were focused on 20 carefully selected sites within the Petzen/Peca pilot area (for which we have obtained the appropriate permits from the plot owners).

All cameras were set up to capture both video and photo data, increasing the chances of documenting animals in extreme situations, such as nighttime, rapid movements, and adverse weather conditions. This approach not only confirms known behavioural patterns in their habitats but also provides valuable data for

analysis. In addition to photographic evidence of animal presence, the collected data has also yielded educational materials.

The collected information is crucial for conservation efforts, identifying areas of various biodiversity, and assessing the impacts of human activity on wildlife.

We configure our wildlife cameras to capture a combination of photos and videos to increase the chances of monitoring animals in the area. The basic settings we use for photos are high-resolution 30MP photos, 9 photos in sequence. For video: 4K video at 30 fps for 60 seconds (the camera also records low-resolution backup videos at 720p), and the PIR sensitivity is best set to medium. A 256 GB memory card provides plenty of space to store all data for at least six months. The camera also supports remote data transfer via the cloud, helping to minimise physical interference in the observation area. Lithium batteries have proven to be an effective energy choice and have failed only once in 20 cases (in the testing period).

Fig. 7: Example of observations and the presence of wild animals on the Wildlife cameras.

Result

The initial analysis of the collected observations confirms the presence of various species exhibiting known behavioural patterns, emphasising the significant impact of human activity on their behaviour. The animals primarily inhabit their environments at night, with occasional sightings occurring early in the morning, typically until around 8 a.m., before the first hikers/visitors begin to arrive at approximately 9 a.m. Typically, the animals return late in the evening (but not always), about an hour before sunset. The human activity in the observation area usually stops around 5:15 PM.

However, during bad weather or on days when there are no people around, they tend to stay in their habitats for extended periods and can even be seen on cameras during the daytime.

Throughout the observation period, we collected approximately **20,500 files.** Of these, 12,600 files proved valuable with animal identification, indicating a camera detection and triggering capture rate of over 60% success.

10 species of mammals were identified, among which small groups of **Northern Chamois** *(Rupicapra rupicapra)*, which intertwine with each other, dominate. The cameras did not record any representatives of large carnivores (the larger carnivore was the **Red fox** *(Vulpes vulpes)* and the **European pine marten** *(Martes martes)*. The presence of the **Mountain hare** *(Lepus timidus)* was also confirmed in several locations (higher grounds). Interestingly, the cameras captured the occasional presence of bats at elevations above 1,600 meters. This suggests that their mating habitat may be nearby. **12 species of birds** were also identified, including the vulnerable and endangered **Black grouse** *(Lyrurus tetrix)*. However, unfortunately, despite suitable locations, the cameras did not record the presence of Western Capercaillie (Tetrao urogallus) or any other representative of the vulnerable grouse family. **A total of 25 animal species were identified.** To enhance the accuracy of our findings, it is essential to conduct additional observations and establish a higher density of observation points.

Through observation methods, we were unfortunately unable to confirm the presence of the Capercaillie in two known habitats. No physical evidence—such as tracks, droppings, feeding patterns, or feathers—was detected. Additionally, there was no response to calls in either habitat, and the species was not captured on wildlife cameras, despite their strategic placement for triangulation in the area.

The last confirmed sightings of the Capercaillie were in the 2022/23 season, which raises concerns that something has significantly impacted the habitats. A potential negative influence, exacerbated by tourism, is hunting in this area, where a male representative of the species can be harvested every five years (according to the hunting calendar, which coincides with the 2022/23 season). In environmentally stressed habitats, the absence or decline of numerous animals can have catastrophic consequences for the species. No species is exempt from this threat. Additionally, natural factors, such as weather conditions, age distribution, population size, potential diseases, and predators, must also be considered.

Best practices from initiatives like Rewilding Europe suggest that the first step in such situations is to limit human presence and potential introduction of new species. This may involve reducing or banning hunting (for a limited time of full protection of species), redirecting visitors away from sensitive habitats, and establishing rest zones during mating and nesting periods.

Despite these concerns, it is important to note that the presence of the Capercaillie cannot be completely ruled out. Further observations of the habitats are necessary before confirming a possible local extinction.

We have also begun to supplement data on the locations and presence of wild animals with the help of the local community (indirect data from photographers, guides, and visitors to the nature), following the same principle as the Citizen Scientist – direct approach. We have already successfully started to fill locations with several thousand data points on the presence of species, based on photo and video materials.

Data entry includes primary and secondary locations. Primary locations focus on already known protected or critical areas, while secondary locations cover the entire Geopark area.

4.4 Erosion

In collaboration with the University of Parma, we established ground and remote techniques to monitor soil erosion and sedimentation rates with centimetre accuracy at a selected location (a bike enduro trail). The comparison process is carried out in two comparative iterations throughout the project. The methods involve analysing 3D models and comparing point clouds to quantify erosion in a dedicated period.

The selected approaches were introduced to survey trail segments of varying lengths, which could also include narrow paths in wooded areas. For this project, we decided to use two different methods, both relying on photogrammetric sensors. One uses an aerial approach with a compact UAV to fly through forested areas, while the other uses spherical imaging with a backpack-mounted 360° camera. The two-technique approach was also selected with the secondary objective of verifying their efficiency and adaptability to specific scenarios, to provide more comprehensive guidelines on area and trail erosion monitoring approaches.

A monitoring method has confirmed that no area is immune to erosion caused by outdoor activities and human intervention, particularly in relation to the construction of standard hiking trails, regardless of their geographical location. Historically, only limited measures have been implemented to protect against erosion, such as preventing the sliding and displacement of larger material quantities. These efforts have typically been carried out by mountaineering associations on specific trails under their jurisdiction or by organisations responsible for managing tourist destinations. Moving forward, it will be essential to conduct additional visual inspections of existing trails. Furthermore, there is a need for appropriate standardisation in the strategies for mitigating the effects of erosion, which can be achieved by transferring and adapting successful practices from various locations.

A significant challenge in our case pertains to legal constraints, as we do not operate as a National Park. Consequently, we are unable to manage protected areas under the same legislative framework applicable to National Parks in the EU or under state orders. This limitation necessitates enhanced oversight in communication, coordination, and the integration of varying interests.

The Karawanken-Karavanke UNESCO Global Geopark faces several challenges that require targeted short-term actions for effective management and the long-term preservation of its natural values. The key issues include managing the growing pressure of tourism on sensitive ecosystems, particularly in areas that are home to protected and vulnerable species. We should also not ignore the impact on wildlife. Additionally, there is a need to address the management of invasive alien species, which can have harmful effects on local habitats and have an economically negative impact, due to overgrowth and potential alteration of the natural environment and values.

It is also essential to manage hiking and biking trails to promote sustainable development while minimising environmental impact and controlling erosion in the surrounding areas.

Establishment of improved coordination among landowners, local and state governments, environmental protection agencies, non-governmental organisations, and the administration of the Geopark. One of the main challenges here comes from the large number of owners in certain areas, which often makes communication tricky. Last but not least, through these elements, it is necessary to involve the general public, strengthen awareness, education, and the importance of approaches, protection, conservation, and measures.

To effectively address these challenges, it is imperative to enhance monitoring and observational methodologies through the deployment of appropriate data collection tools focused on biodiversity indicators, erosion, and its associated risks, as well as visitor impact assessment. Furthermore, the implementation of adaptive management strategies that incorporate both ecological and socio-economic considerations is essential.

5. Gaps/weaknesses to address

The Karawanken-Karavanke UNESCO Global Geopark faces several critical challenges that require targeted short-term actions for effective management and long-term conservation of its natural values. The primary

issues include increasing tourism pressure on sensitive habitats and insufficient coordination among landowners, tenants, municipalities, and the geopark administration. This lack of coordination mainly stems from legal restrictions on decision-making, as the organisation does not have the same powers as national parks. Therefore, we rely heavily on partnerships with relevant decision-making organisations (with whom we are in constant contact). It is essential to strengthen these relationships and establish clear legal guidelines from their side regarding the implementation of legal provisions.

To address these challenges, it is crucial to enhance monitoring and data collection tools, particularly for indicators related to biodiversity, erosion risk, and visitor impact. Additionally, implementing adaptive management methods that incorporate both ecological and socio-economic perspectives is necessary. This approach should involve the local community, tenants, tourism service providers, relevant development agencies, and decision-making organisations to ensure an effective long-term solution for managing natural resources and preserving natural values.

Restoration efforts should focus on enhancing natural values while prioritising the protection of vulnerable species and their habitats. Key strategies include preventing and remediating erosion, restoring water sources, safeguarding wetlands, and managing, controlling, and eliminating invasive alien species. These initiatives should be informed by effective management of tourist flows with proper directions and redirections, education, awareness raising and foster coordinated coexistence, alongside long-term planning. Ultimately, the preservation of nature is of utmost importance. Nature is our main tourist product.

Building capacity within park administration, enhancing stakeholder involvement, and fostering cross-sectoral collaboration—especially with nature conservation organisations, tourism organisations, regional development agencies and local governance—are essential short-term priorities to ensure effective management and sustainability.

Enhanced communication and active engagement with local communities are essential, particularly when it comes to emphasizing the significance of conservation measures and the protection of natural resources. By fostering awareness and participation, we can collectively work towards safeguarding our environment.

6. Integration into the current tourism impact management strategy

The HUMANITA project has established a comprehensive framework for monitoring the impacts of visitors on protected areas, specifically at designated pilot sites. This monitoring framework accounts for the varying types of impacts and outcomes, which apply not only to the pilot areas but can also be expanded to encompass the entire Geopark region. As a result, the monitoring of vegetation, wildlife observations, and erosion is affected not only by visitor counts at specific locations but also by the broader distribution of impacts throughout the area.

Furthermore, through two additional Interreg projects, visitor monitoring has been extended to a larger area of the Geopark. This effort strategically focuses on entrances and exits to vulnerable areas and will be integrated into the existing visitor monitoring network.

The activities and measures outlined in the HUMANITA project action plan for managing the Karawanken-Karavanke UNESCO Global Geopark align with protected area and nature conservation laws, while also supporting the Geopark's operational guidelines and strategy in this connected field of work.

6.1. Objectives

- The project encourages more research, monitoring efforts, and species-specific management measures, helping to enhance the Geopark's database and support better decision-making.
- Initiatives such as guided tours, visitor education, and sustainable tourism planning complement existing tourism strategies, supporting responsible visitation and community and stakeholder engagement.
- The project boosts educational activities, awareness campaigns, and interactive programs by enhancing communication efforts and finding better ways to engage visitors, the public, and stakeholders.

6.2. Implementation

- A strategy to boost understanding and knowledge, align monitoring methods, and enhance research on protected and significant habitats and landscapes, along with proper analyses and results, to develop and ensure effective management measures for protected species and harmonious local coexistence.
- Develop a collaborative support network and apply sustainable tourism management to the administration of the Karawanken-Karavanke Geopark.
- Emphasis on offering natural tourism products focused on discovering the natural and cultural heritage of the Karawanken-Karavanke UNESCO Global Geopark, with added value.
- Promoting public awareness of the Karawanken-Karavanke UNESCO Global Geopark, its unique protection features, and the importance of protecting and preserving its natural treasures, while engaging in environmental education and outreach activities.

7. Linkages to national-regional plans

To help coordinate legislation on protected areas and nature conservation, the Geopark works closely with the Institute of the **Republic of Slovenia for Nature Conservation** (Maribor regional unit, a valued partner) and **E.C.O. - Institute for Ecology.** This collaboration plays a key role in offering guidance and ensuring alignment with regional, national, and EU regulations.

Connected link, which includes different levels and directions of planning and directives in this field of work:

natura2000.gov.si/fileadmin/user_upload/Dokumenti/LIFE_IP_NATURA_SI/Rezultati/PUN_2023-2028_sprejet/PUN_2023-2028_angl/Natura2000_ANG.pdf

Nature parks, nature reserves and natural monuments | GOV.SI

Slovenia - EUROPARC Federation

National Park Strategy Austria 2020

Scenery of protected areas in Austria

Nature conservation in the Austrian Rural Development Programme | EU CAP Network

8. Pilot site Action plan

> **ACTION 1**	**Visitor monitoring**
> **DESCRIPTION**	> Ongoing monitoring of visitors at key locations with automatic visitor counter devices in combination with indirect digital data collection methods to identify unauthorised/illegal outdoor recreational activities. This includes activities such as mass hiking outside designated trails and mountain biking in areas where it is prohibited, including hiking trails, mountain peaks, and other natural environments.
> **SPECIFIC OBJECTIVES**	> Gaining a better understanding of visitor dynamics, tracking the use of individual trails through vulnerable habitats, and collecting more data with improved insights on impact will help optimise directions and guide proper actions with redirections, restrictions or constructive management.
> **PROJECT MANAGEMENT TOOLS**	> Various visitor counters (hiking, biking, or combinations) and STRAVA Metro for digital data (illegal activities).
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner, Gerald Hartmann
> **INVOLVED STAKEHOLDERS**	> Local communities, Plot owners, Visitors, Tourism organisations, Geopark partners, Nature conservation groups, NGOs, Mountaineering associations, etc.
> **IMPLEMENTATION STEPS**	> **The process is already underway; it will not stop and will continue after the project is completed.**

> **IMPLEMENTATION PERIOD TIMELINE**	> Following an initial analysis of the pilot site locations, we will reposition certain visitor counter positions to strategically important locations for better coverage of directions of visitors in and out of the vulnerable areas. Currently, the relocation of three measuring devices is planned, which will be carried out in **early spring 2026** (as soon as weather conditions allow). > We will continuously monitor visitor activity at selected locations for the lifespan of the devices. The next step is to connect all devices to the network, which will be conducted in 2026. > **This is an ongoing process!**
> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> The devices were funded by the Interreg CE Humanita Project, while the ongoing expenses for visitor counters, including annual fees, maintenance, installation at new locations, new construction, and other related costs, will be covered by Geopark funds. **Annual costs range from €140.00 to €390.00 per year per device** (Satellite log or NB-IoT with Dashboard connection). Batteries need replacement every three years (€25.00 per device). **Personnel costs have not yet been determined.** **The network platform will be established through joint data collection APP (all in one place), combining the diversity of useful data collection.** Estimated value of the entire platform (API and digital maps): €5,000 (which will be covered by various financial structures). **Deadline:** beginning of 2027.
> **EXPECTED RESULTS / MONITORING**	> Redirections, restrictions, or constructive management. > An analytical approach to reducing the pressure on individual directions of movement in nature.

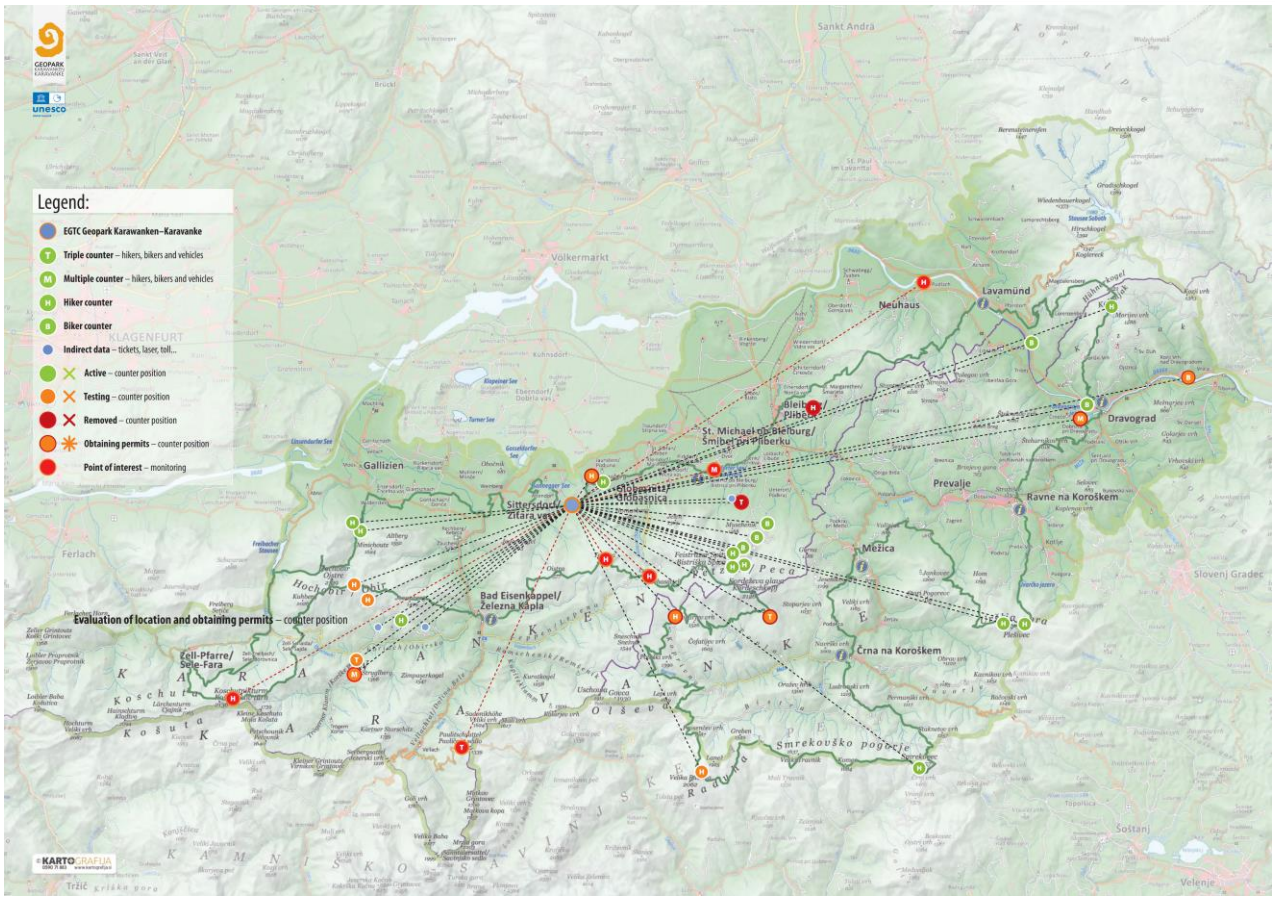

Fig. 8: Network example of all connected visitor monitoring devices.

> **ACTION 2**	> Citizen Scientist – Geopark Community
> **DESCRIPTION**	> There are various interest groups already active in the Geopark area, including both amateur and professional nature and wildlife photographers, nature enthusiasts, guides, and several associations involved in amateur natural environmental activities. This may also include municipal maintenance units responsible for green areas. These activities range from taking photographs and identifying species to recording and sharing information on social media, all of which can generate valuable insights and indirect data collection when properly connected. Following the principle of "**more eyes and more hands,**" we will foster a strong sense of community affiliation while also increasing public awareness. This awareness encompasses not only invasive alien plant species and their effects on

	habitats and ecosystems, but also understanding protected areas, vulnerable species, and the local flora and fauna. > The innovative concept for Citizen Scientist – direct approach, was thoughtfully developed by our Geopark colleague, Project Manager and photographer Urosh Grabner.
> **SPECIFIC OBJECTIVES**	> Creating such a community has a dual purpose: it encourages individuals to transition from mere observers to active participants and advocates. > The expansion of the data collection set is unlimited. From non-native species, flora and fauna, pollution, illegal activities, natural sights, geological finds, etc.
> **PROJECT MANAGEMENT TOOLS**	> Digital map of natural treasures for the entire Karawanken-Karavanke Geopark area (creation of API/APP).
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner
> **INVOLVED STAKEHOLDERS**	> Local communities, Nature enthusiasts, Wildlife photographers (pro and amateurs), Mountain guides, Geopark partners, Nature conservation groups, NGOs, Visitors, Municipal and local green space maintenance units, Mountaineering associations, etc.
> **IMPLEMENTATION STEPS**	> The implementation began with a test of the Citizen Scientist-Direct approach, which has proven to be an effective way to gather credible and verifiable information about non-native plant species. Moving forward, it is essential to establish connections with interest groups, motivate them through affiliation, and provide guidance.
> **IMPLEMENTATION PERIOD TIMELINE**	> **Spring 2026** (establishing connection with local community till the beginning of 2027) – never-ending process. > **This is an ongoing process!**

> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> The process of establishment and maintenance will be covered by the Geopark funds through lobbying potential partners who will benefit from the collected database. Annual costs are estimated **between €1,000 and €1,500.00 per year.** This includes potential T-shirts or other textiles to strengthen individual affiliation, personal training, and educational workshops. Personnel costs have not yet been determined. Promotional materials will be included through a secondary system of printed materials, social media posts, public notices, and direct communication.
> **EXPECTED RESULTS / MONITORING**	> Certain activities are already being carried out, and from the experience gained through the Citizen Scientist – direct approach (to the date more than 30.000 confirmed locations of IAS and non-native species), we can expect an appropriate yield of data sets on various topics (Invasive alien species, non-native plant species, protected plant species, flora and fauna in general, geology, pollution, erosion, etc.). So far, with the initial test communications directed at flora and fauna, a couple of thousands of valuable pieces of information and locations about them have already been gathered. > This effective approach is also the closest to establishing the "green ranger" principle, through which a network of volunteer interest groups, we gain not just an observer, but an active member of the community who passes on awareness and admonishment of the negative approach. > Creating a **comprehensive database** and **digital map** of natural treasures for the entire Karawanken-Karavanke Geopark area with the help of the community and experts.

> **ACTION 3**	**Monitoring: Invasive Alien Species and Non-native Plant Species**
> **DESCRIPTION**	> Ongoing monitoring and observations of Invasive alien species and non-native plant species in the Geopark Karawanken-Karavanke with the currently existing Citizen Scientist system – direct approach. > **The innovative concept for Citizen Scientist – direct approach, was thoughtfully developed by our Geopark colleague, Project Manager and photographer Urosh Grabner.**

> **SPECIFIC OBJECTIVES**	> Filling gaps (remote locations and locations where there was no database yet), complementing existing locations, and transitioning from observer to activist.
> **PROJECT MANAGEMENT TOOLS**	> Citizen Scientist - Direct approach, with transition to Citizen Scientist – Geopark community.
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner
> **INVOLVED STAKEHOLDERS**	> Local communities, Nature enthusiasts, Wildlife photographers (pro and amateurs), Mountain guides, Visitors, Geopark partners, Nature conservation groups and organisations, NGOs, Municipal and local green space maintenance units, Mountaineering associations, etc.
> **IMPLEMENTATION STEPS**	> Activities are already underway and will continue in the future. To date, we have more than **30,000 confirmed locations** of invasive alien species and non-native species, with **over 80 identified non-native species** found in the natural environment of Geopark Karawanken-Karavanke.
> **IMPLEMENTATION PERIOD TIMELINE**	> **November 2024** – Spring 2026 – continuation of never-ending process. > **This is an ongoing process!**
> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> The continuation of the process and maintenance of the database will be covered by Geopark funds through lobbying potential partners who will benefit from the collected database. Annual costs are estimated **between €500.00 and €1,000.00 per year.** However, with the transfer of connectivity to the Citizen Scientist – Geopark community, these costs will be eliminated or minimised. Personnel costs have not yet been determined. Promotional materials will be included through a secondary system of printed materials, social media posts, public notices, and direct communication.
> **EXPECTED RESULTS / MONITORING**	> Implement an extensive database with the maximum yield of embedded locations of all known non-native plant species in the Geopark. Creating a comprehensive database and digital map of natural treasures for the entire Karawanken-Karavanke Geopark area with the help of the community.

	To create a transition from observer to activist, who will be able to implement measures directly from the observation position through appropriate approaches and training.

> ACTION 4	Actions: Invasive Alien Species and Non-native Plant Species
> DESCRIPTION	> Ongoing monitoring and observations of Invasive alien species and non-native plant species in the Geopark Karawanken-Karavanke, where, with proper training, observers become activists.
> SPECIFIC OBJECTIVES	> Initial analyses of the data obtained on confirmed Invasive Alien Species locations show that more than 8,500 of the total of over 30,000 locations (up to date) have presence a smaller number of plants (on average less than 25 plants), which indicates potential hotspots of spread and are currently easier to manage than locations with a few hundred or thousands of plants, which are spreading more slowly due to already invasive occupancy. > The primary approach will concentrate on containment procedures for smaller known locations. > The secondary approach will focus on highly infectious locations with strategies for containment and long-term eradication.
> PROJECT MANAGEMENT TOOLS	> **Citizen Scientist - direct approach** and **Citizen Scientist - Geopark Community** (primary approach). > **Organised campaigns** with a larger number of participants in dealing with major hotspots (secondary approach)
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner, Gerald Hartmann
> INVOLVED STAKEHOLDERS	> Local communities, Nature enthusiasts, Wildlife photographers (pro and amateurs), Mountain guides, Visitors, Geopark partners, Nature conservation groups and organisations, NGOs, Municipal and local green space maintenance units, Mountaineering associations, etc.

> **IMPLEMENTATION STEPS**	> Integrating the current smaller set of participants of Citizen Scientist – direct approach with a transfer to a larger elementary approach by involving a larger number of interested individuals in the **Citizen Scientist – Geopark Community** system. In this way, we will get with proper training a transfer from observer to activist, who can more easily approach solving the infection of an area with a smaller medium number of plants.
> **IMPLEMENTATION PERIOD TIMELINE**	> **2026** (data analysis and adoption of priority measures) – never-ending process > **This is an ongoing process!**
> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> Effective analysis and planning must be tailored to the specific area affected by invasive alien species (IAS). The complexity of the intervention required will influence both the cost and the approach necessary. Not all areas present at the same level of difficulty, and some may not be fully understood. > Cost is the variability in the removal and management process and can only be determined by careful analysis and management planning of the individual zone. Not all approaches to managing invasive alien species are equally demanding. > The Geopark funds will cover the process of establishment and maintenance through lobbying potential partners (Municipalities, etc.). > **Annual costs are yet to be established.** However, since the process of elimination predicts transfer from observer to activist with the principal, when you locate the threat, you resolve the threat on the spot (in combination with Citizen Scientist – Geopark Community). High costs are not expected in this matter and are calculated in **ACTION 2.** This includes tackling smaller infestation areas. **Personnel costs have not yet been determined.** **For larger hotspots:** The Geopark funds will cover the process of establishment through lobbying potential partners (Municipalities, sponsors, Ministry of the Environment and Spatial Planning, etc.). One of the options is also finding and securing funds through new EU funding projects (for which there is a good database of created and obtained data on IAS locations).

> **EXPECTED RESULTS / MONITORING**	> The expected outcome is the start of an action-oriented approach to managing smaller hotspots and eliminating potential outbreaks from these locations. This approach certainly represents greater activity than has occurred in this field of work in the last 25 years. > Elimination of the spread and potential outbreaks of invasions to the wider surrounding area. > Management, containment and remediation of all hotspot areas of Invasive Alien Species.

> **ACTION 5**	**Wildlife observations**
> **DESCRIPTION**	> Ongoing monitoring and observations of Wildlife at key locations with photo traps and physical observations in combination with indirect data collection from Citizen Scientists – Geopark Community.
> **SPECIFIC OBJECTIVES**	> Filling gaps (remote locations and locations where there was no database yet), covering crucial habitats with vulnerable species to understand behaviour patterns and to determine the presence of animals. > The collected information is crucial for conservation efforts, identifying areas of various biodiversity, and assessing the impacts of human activity on wildlife. > Educational materials created from collected photographic and video evidence of animal presence, aimed at raising awareness.
> **PROJECT MANAGEMENT TOOLS**	> Wildlife cameras.
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner
> **INVOLVED STAKEHOLDERS**	> Local communities, Nature enthusiasts, Wildlife photographers (pro and amateurs), Mountain guides, Geopark partners, Nature conservation groups and organisations, NGOs, Plot owners, Tenants, Visitors, etc.

> **IMPLEMENTATION STEPS**	> Implementation will be based on habitat identification and animal presence and will be specialised according to the type of animal species. Installations before the mating season. Installations during migration, Installations during periods of greater impact on habitats...
> **IMPLEMENTATION PERIOD TIMELINE**	> Installations before the **mating season** aligned with a critical mass of species. > Installations before migration of individual species. > Installations during periods of greater impact on habitats (Summer season: May – October). > Never-ending process. > **This is an ongoing process!**
> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> The devices were funded by the Interreg CE Humanita Project, while the ongoing expenses for Wildlife observations, including subscriptions, maintenance, installation at new locations, and other related costs, will be covered by Geopark funds. **Annual costs range from €100.00 to €250.00 per year (subscriptions – SIM cards).** The batteries can be recharged and last up to six months before requiring a refill. **Personnel costs have not yet been determined.**
> **EXPECTED RESULTS / MONITORING**	> Implement an extensive database with the maximum yield of embedded locations of all known species in the Geopark, focusing on the vulnerable and protected species in habitats under pressure from tourism. Identify and determine the actual presence of species in critical locations. Creating a comprehensive database and digital map of Wildlife for the entire Karawanken-Karavanke Geopark area with the observation process, the help of the Citizen Scientist – Geopark Community and various monitoring techniques.

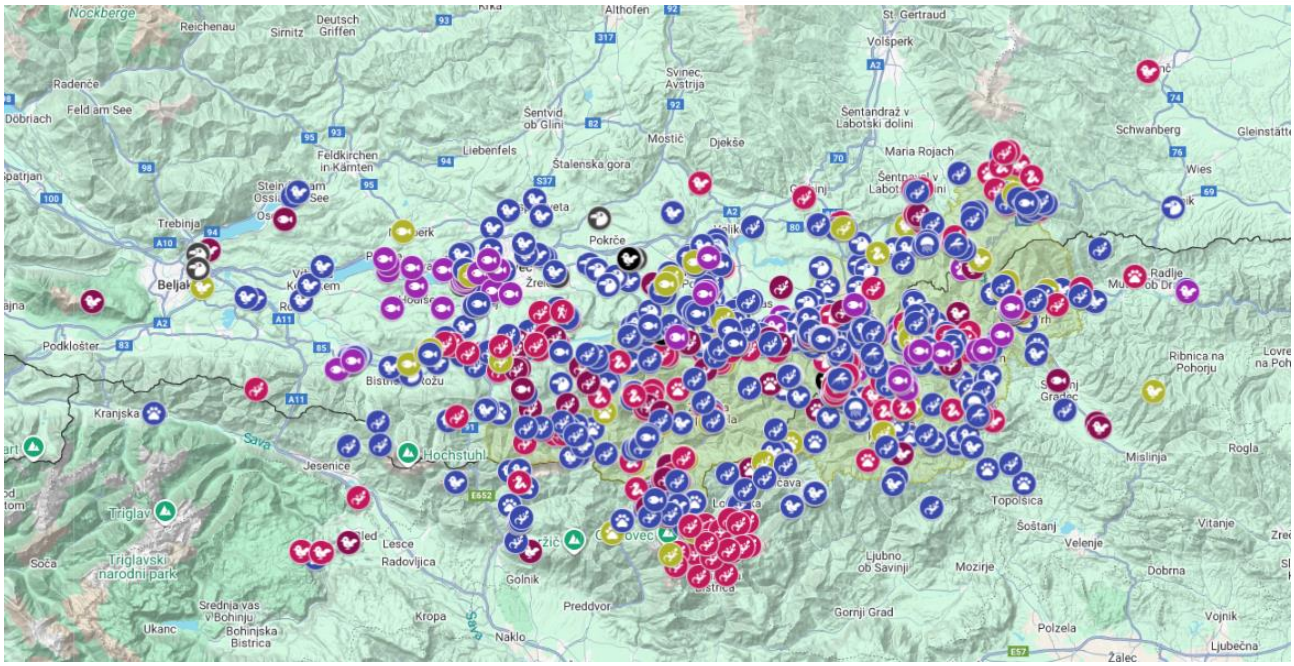

Fig. 9: A schematic illustration of the first data entry into the digital base map of the Geopark – layers of wildlife data collection.

> **ACTION 6**	Communications – Geopark Karawanken-Karavanke MGZN
> **DESCRIPTION**	> Connecting with the public and visitors is a big part of building communication networks and gaining recognition both inside and outside of the Geopark area. This can be done through various channels like social media, local and regional news outlets, and traditional printed materials. > Each of these approaches has advantages and disadvantages, largely because the means of communication are narrow and often disconnected or inadequate. They usually don't have sufficient or suitable directional reach. > The main idea is the creation of the Geopark MGZN (read: Magazine) with a circulation that covers all households in the Geopark (each household receives its own copy at its own address, Slovenian households in Slovenian, Austrian households in German) and additional copies in English, distributed at all major tourist entry points to the Geopark (accommodations, restaurants).

> **SPECIFIC OBJECTIVES**	> The content will cover the Geopark area in an attractive newspaper format, where general topics will be discussed in the style of a journalistic approach. Tourism, important points, general topics, cuisine, presentation of other geoparks, important achievements, Nature, culinary... and the content will also include the presentation of projects in a readable manner with a touch of awareness, highlighting achievements and purpose. > The magazine will be published twice a year. Before spring (March) and mid-autumn (October).
> **PROJECT MANAGEMENT TOOLS**	> Printing edition in Slovenian language, Printing edition in German language, Printing edition in English language, and e-edition for download in three languages (Slovenian, German and English).
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner, Gerald Hartmann
> **INVOLVED STAKEHOLDERS**	> Local communities, households, Visitors, Tourism organisations, Geopark partners, Nature conservation groups and organisations, NGOs, Municipalities, etc.
> **IMPLEMENTATION STEPS**	> The implementation is based on a set of themes and coordination of content that will be interconnected and strengthen the recognition of the Geopark both locally and globally. The first meetings have already taken place, and the structure of the content has been determined. At the beginning of next year, we will start collecting and editing the content. The magazine will be in a classic large newspaper format (59.4 x 42 cm), which will be A4 format when folded without binding elements (staples). Full colour on 20 pages. The total circulation is planned to be 25,000 copies, which covers all households in the Geopark and important tourist destinations (accommodations, restaurants). Distribution will be carried out through established local postal services. The plan is designed so that no one is excluded. Everybody will get their copy.

> **IMPLEMENTATION PERIOD TIMELINE**	> **First release is scheduled for October 2026.** > Printed edition twice a year in Slovenian and German languages (backed with English online edition). > **This is an ongoing process!**
> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> The primary cost will be covered by Geopark funds. The estimated expenses for each magazine print run range from **€6,000 to €7,000.** We will also seek to offset part of these costs through advertising and sponsorships, as well as by reaching out to potential partners who may benefit from the content. It is expected that **the municipalities will cover the distribution costs to local households. Personnel costs have not yet been determined.**
> **EXPECTED RESULTS / MONITORING**	> Greater visibility of the Geopark at the local and global level. Connectivity with the local community. Presentation of the work and purpose of the Geopark. Bringing the contents of the Geopark closer to the general public. Awareness, guidance, and cooperation.

> **ACTION 7**	**Communications – awareness-raising and educational materials**
> **DESCRIPTION**	> Engaging with the public and visitors is essential for building communication networks and gaining recognition both within and outside the Geopark area through efforts in protection, conservation, and raising awareness. This can be achieved through various channels such as social media, workshops, and targeted sessions.
> **SPECIFIC OBJECTIVES**	> The content will be captured using wildlife observation cameras and our video equipment to showcase the diversity of wildlife in our geopark. The footage will feature short clips of wildlife and plants, with a focus on short facts and guidelines to raise awareness about conservation, preservation, and protection of nature.
> **PROJECT MANAGEMENT TOOLS**	> Short video content up to 1 minute (15, 20, 30 – 60 sec). > Video contents. Reels and Stories.

RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner
> **INVOLVED STAKEHOLDERS**	> Local communities, Visitors, Tourism organisations, Geopark partners, Nature conservation groups and organisations, NGOs, Municipalities, etc.
> **IMPLEMENTATION STEPS**	> Collection and selection of video and image material (in progress). > Production and post-production. Distribution (social media and appropriate directive educational channels).
> **IMPLEMENTATION PERIOD TIMELINE**	> **Starting in 2026** (summer). > **This is an ongoing process!**
> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> The video equipment and wildlife cameras were funded by the Interreg CE Humanita Project, while the ongoing expenses for recording content, production, maintenance, and other related costs will be covered by Geopark funds. **Annual costs have not yet been estimated, as well as personnel costs have not yet been determined.** > Software (video and content editing): **€62,80 monthly**
> **EXPECTED RESULTS / MONITORING**	> Counterbalancing negative public opinion about species protection and the importance of biodiversity. > A positive approach with visual storytelling of flora and fauna species.

> **ACTION 8**	Management of vulnerable areas and rehabilitation of critical trail locations

> **DESCRIPTION**	> Geoparks and areas of vulnerability and protected areas are not immune to trampling, erosion and habitat destruction due to human impact. Many hiking and mountain biking trails deal with these challenges, and the higher the altitude or steeper the terrain, the more significant the effects of erosion and slippage become. > One of the various approaches that is established as good practice in the world is: bridging or floating trails, where a wooden trail is created, raised above the ground with supports that prevent direct contact of the visitor with the natural surface, which also protects the flora around the trail. To prevent erosion, we know of some good examples of practice, where critical locations are protected by stepping (most often wooden) or redirecting with zigzag supports, which prevent terrain slippage and damage to the surface and protect the fauna around the trail.
> **SPECIFIC OBJECTIVES**	> Preventing the effects of increased erosion. > Preventing the increased impact of trampling. Preventing departure from the planned path direction. Blocking the outflow of material. Blocking the visitor from changing direction.
> **PROJECT MANAGEMENT TOOLS**	> Integration of good practices.
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner, Gerald Hartmann
> **INVOLVED STAKEHOLDERS**	> Local communities, Tourism organisations, Geopark Partners, Nature conservation groups and organisations, NGOs, Mountaineering associations, Plot owners, Tenants, Municipal and local green space maintenance units, etc.
> **IMPLEMENTATION STEPS**	> Identification of vulnerable areas. Spatial development plan. Implementation and reconstruction.

IMPLEMENTATION PERIOD TIMELINE	The shortest possible time approaches with the identification of hot spots. In the initial plan, it is essential to implement additional measures for effective risk assessments and to develop a suitable strategy for each identified critical area. The first step involves identifying these areas, defining critical thresholds, and establishing long-term remediation and prevention measures to mitigate impacts. Without good logistical preparation, which will be defined for the entire Geopark area (2026/2027), the measures may only be short-term and represent a recurring, unnecessary financial burden without adequately addressing the problem.
POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION	Without proper analysis, planning, and appropriate assessment of criticality, priority, and individual action, it is impossible to define a financial structure. Each approach has its own value. Based on our experience, we know that the cost range for minor limited renovations is approximately €1,000, while costs for long-term limited space renovations can reach around €10,000 and more (not including the cost of personnel). The Geopark funds will cover the process of establishment and maintenance through lobbying potential partners (Municipalities, sponsors, Ministry of the Environment and Spatial Planning, etc.). One of the options is also finding and securing funds through new EU funding projects.
EXPECTED RESULTS / MONITORING	Restoration of the condition and further prevention of the effects of increased erosion. Restoration of the condition and further prevention of increased trampling impact. Restoration of the condition and further prevention of deviation from the planned route. Restoration of the condition and further blocking of material runoff. Restoration of the condition and further blocking of the visitor's change of direction.

Fig. 10: Good practice example: floating trails.

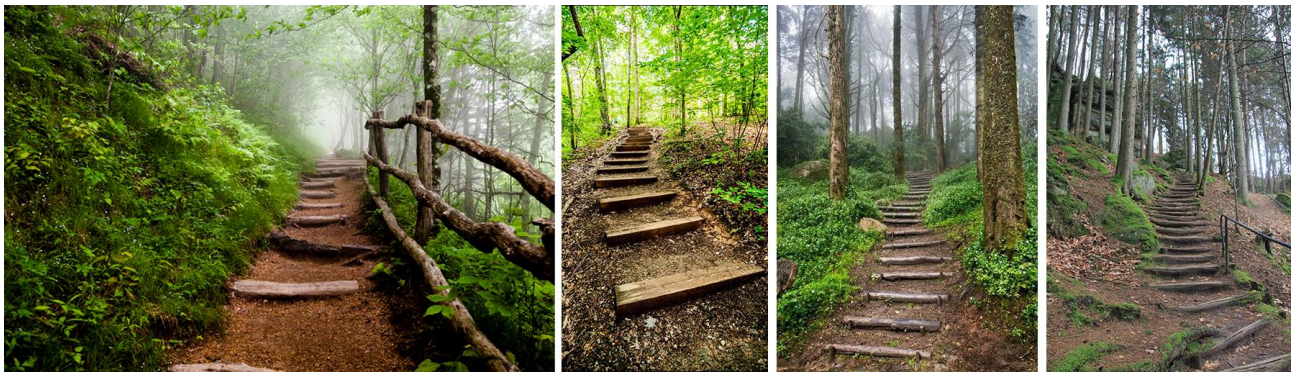

Fig. 11: Good practice example: blocking and stepping.

> ACTION 9	Digital map of Karawanken-Karavanke UNESCO Global Geopark Database
> DESCRIPTION	> **Facing a Problem with a Solution** The large volume of data generated from various projects, involving both internal and external collaborators, presents a significant challenge in coordinating similar content and finding the necessary information for current or future work. The organisational system for the collected data associated with individual projects is often not user-friendly. This dispersion of data creates logistical and time obstacles in locating and coordinating the required information. Therefore, there is an urgent need for a systematic organisation of this information in a single location. A digital map of the Geopark serves as an effective solution, visually and logically connecting different levels of data in one consolidated platform. Creating a comprehensive database and digital map of all collected data for the entire Karawanken-Karavanke Geopark area.

> **SPECIFIC OBJECTIVES**	> **A high level of data protection** that divides content into two levels: publicly accessible and confidential (example: locations of protected species). > **A customised search engine** that allows for various result options, from keyword, content, specific file or individual data to specific topic, geographic location, and combinations of different data compatibility. > Different levels of users: **creator** with full access to all elements and content, with the ability to create new content, **administrator** with access to all content, upload, download, the ability to approve participants, without the ability to create content, **moderator-expert** with access to protected data, **visitor** with access to public content.
> **PROJECT MANAGEMENT TOOLS**	> API or APP
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner, Gerald Hartmann
> **INVOLVED STAKEHOLDERS**	Geopark Partners, Citizen Scientist - Geopark Community, Local communities, NGOs, Nature conservation groups and organisations, Nature enthusiasts, Tourism organisations, Mountaineering associations, etc.
> **IMPLEMENTATION STEPS**	> Preparation of content and editing of the first data sets is already underway.
> **IMPLEMENTATION PERIOD TIMELINE**	> **2026/2027** > (Spatial analysis and determination of priority measures) > **This is an ongoing process!**
> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> After the research work is completed and the appropriate approach and tools are determined, the financial structure of the implementation will be formed. > **Personnel costs have also not yet been determined.** **Combined costs (ACTION 1):** Estimated value of the entire platform (API and digital maps - all in one place): **€5,000** (which will be covered by various financial structures). **Deadline:** beginning of 2027.
> **EXPECTED RESULTS / MONITORING**	> All the collected data from various projects and databases is gathered in one place, organised by groups, layers, meaning, locations, connectivity, significance, use of tools, approaches, participants, and more.

ACTION 10	Pilot action suggestion: traffic restriction in Trögerner Klamm – gorge
DESCRIPTION	In the Trögerner Klamm gorge area, we monitored the entry of vehicles, pedestrians, and bikers as part of the Hochobir/Ojstrc pilot site. Although our monitoring with automatic visitor counters was not 100% accurate due to the complexity of the location, a partial data set indicated a significant number of motor vehicles entering the Natura 2000 protected area. Through additional physical monitoring—consisting of five occasions of traffic counting—we discovered that most cars only enter the gorge for a short period. The road allows access only in and out of the gorge, with the drive taking a maximum of 15 minutes, leading many vehicles to simply pass through, because the narrow terrain does not provide parking spaces in the gorge. This situation causes unnecessary impacts on the protected area, contributing to increased noise, pollution, and space occupation, as well as occasional accidents (vehicles hitting a fence or rock wall) and, due to the narrow passage, also a danger for visitors on foot. Hiking or biking through the gorge is not particularly strenuous and lacks significant elevation changes, and it is also more friendly to the environment. The starting points for hiking trails within the gorge also do not offer any parking. This creates an additional obstacle in the already congested environment created by parked vehicles along the narrow road.
SPECIFIC OBJECTIVES	Extended protection of the protected area. Restriction of motorised traffic to local owners, maintenance work, and economic activities.

> **PROJECT MANAGEMENT TOOLS**	> Establish a restricted zone. > Restrict access by motor vehicles by blocking access to the gorge (best: electronic ramp), which allows entry to plot owners, residents, maintenance workers and the business sector. > Enlarge and arrange a parking area with a certain limited number of vehicles before entering the gorge.
RESPONSIBILITIES	**EGTC Geopark Karawanken-Karavanke (team)** **Responsible persons:** Urosh Grabner, Gerald Hartmann
> **INVOLVED STAKEHOLDERS**	> Local communities, Plot owners, Households, Visitors, Tourism organisations, Geopark partners, Municipality of Bad Eisenkappel-Vellach/Železna Kapla-Bela, Nature conservation groups and organisations, NGOs, Local authorities, etc.
> **IMPLEMENTATION STEPS**	> Research, analysis, proposal, and project documentation. > Setting up a financing approach and securing funds, possibly through future EU projects.
> **IMPLEMENTATION PERIOD TIMELINE**	> **Not determined yet (Steps: analysis, planning, and proposal for a spatial planning solution)!**
> **POSSIBLE FUNDING SOURCE AND COSTS ESTIMATION**	> In this case, the proposal is a high financial investment that neither the Geopark nor the competent municipality can afford. **A cost estimate will be required;** the next step is establishing a financing method and finding and securing funds (possibility: EU projects, state financial assistance). > The total cost can range **from €0.5 million to €1 million,** depending on factors such as the arrangement of parking lots, restricting vehicle access for visitors, ensuring vehicle access for residents and maintenance personnel, and installing surveillance units.
> **EXPECTED RESULTS / MONITORING**	> Preservation of protected areas, reduction of environmental pollution input, and noise reduction.

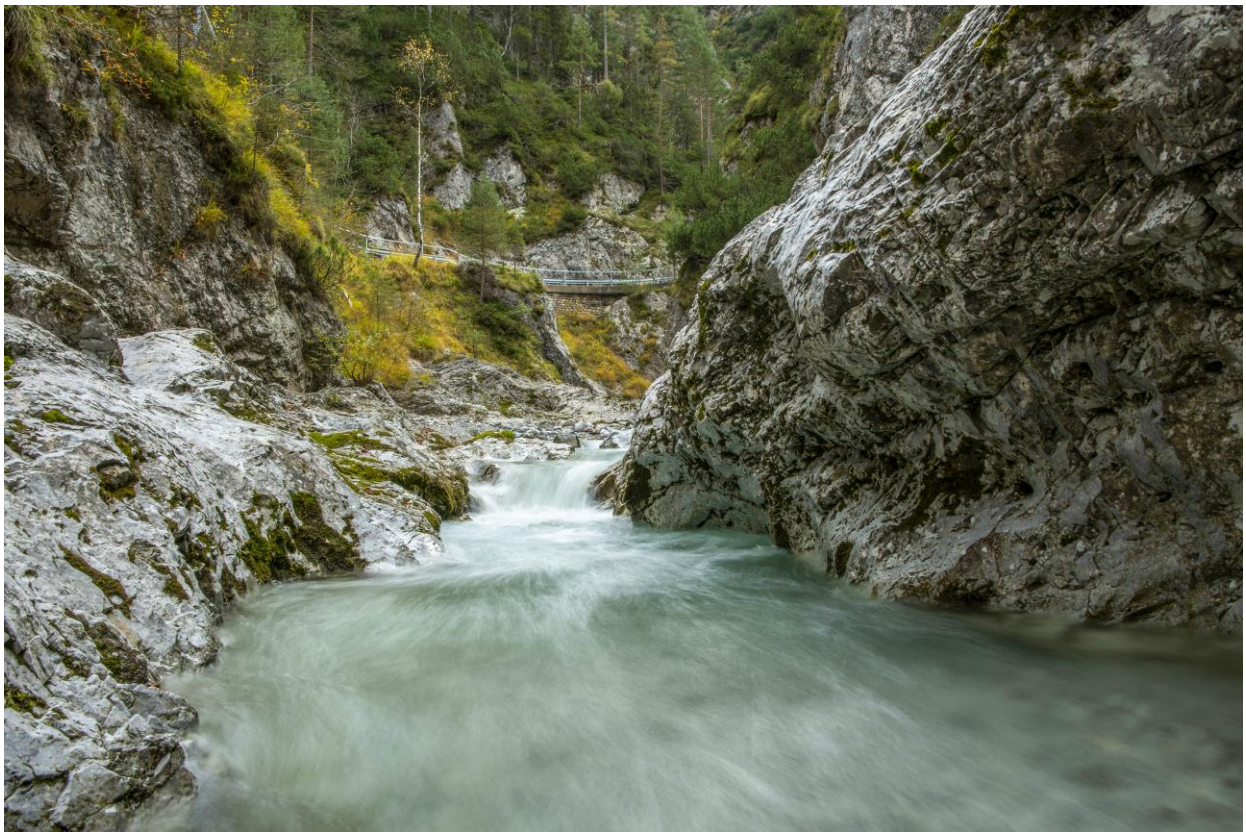

Fig. 12: Trögerner Klamm – gorge, Natura 2000 area.

9. Zone Plan

As Geopark, we do not have the jurisdiction to carry out such activities. The Institute of the Republic of Slovenia for Nature Conservation (Maribor regional unit, a valued partner) will handle zoning in protected areas with vulnerable and protected species in the Geopark. They have the authority to carry out these measures on the Slovenian side and will work with E.C.O. – Institute for Ecology to coordinate activities on the Austrian side.

Through introductory meetings, we set guidelines that we will jointly develop and implement.

The activity will be conducted in alignment with local, national, and European Union directives, as well as the established protected acts, designated protected areas, and recognised protected species.

The zoning plan and proposal will be coordinated after conducting analyses, comparing existing data and guidelines for zoning regulations. The first draft is predicted to be presented at the beginning of the year 2026, including potential new zones, as well as managing already known zones in Natura 2000 areas (already legally defined zones that are aimed at protecting individual endangered and vulnerable habitats).

In this area, we want to strengthen cooperation between the competent organisations and the Geopark administration. The introductory meetings showed the reserved approaches of those responsible in the field of implementing measures that are legally stipulated. The shortcomings are mainly reflected in the lack of appropriate staff, financial and time constraints and, above all, communication with the public (awareness, education, etc.). In the field of communication, the Geopark can play a more important mediator role. Especially in the Natura 2000 areas in the geopark area and certain zonal restrictions, which are already established in Slovenia and Austria in this context but are not always feasible.

We are also aware that such restrictions, which are an important factor for the conservation of species and critical habitats, are not always liked by the public concerned. Thus, an important aspect of resolving such situations is not only appropriate communication based on a positive approach, but also the provision of appropriate targeted funds through potential EU projects, appropriate implementation of well-considered good practice and potential compensation funds that cover costs, potential loss of income, rehabilitation materials, etc. and solve the whole in the long term, as a coexisting natural space with a win-win solution.

10. Remarks and Conclusions

The Karawanken-Karavanke UNESCO Global Geopark is an esteemed tourist destination renowned for its breathtaking landscapes, diverse ecosystems, and a plethora of outdoor activities available throughout the year. During the summer months, visitors can engage in hiking, biking, and rock climbing, while winter attracts outdoor enthusiasts for skiing, snowboarding, ski touring and snowshoeing across its picturesque alpine terrain.

This influx of tourists plays a crucial role in strengthening the local economy, benefitting a network of nine municipalities in Austria and five in Slovenia that fall within the boundaries of the Geopark. However, the significant rise in visitor numbers brings forth considerable challenges regarding sustainable management practices. It is imperative to implement strategies that prioritise the conservation of the area's exceptional natural beauty and geological features, ensuring that these invaluable assets are preserved for future generations to explore and enjoy.

Our region is not exempt from the impacts of increased human activities on natural environments. These activities—ranging from outdoor recreational pursuits, tourism, excessive picking of wild fruits, mushrooms, and herbs, agriculture, hunting, to forestry—underscore the pervasive presence of humans in various ecosystems, resulting in a wide array of environmental and ecological consequences. The human footprint has contributed to habitat degradation, soil erosion, disturbances in wildlife populations, endangerment of species, and even local extinctions of both flora and fauna. Notably, the broader implications of tourism are particularly pronounced due to the popularity of mountain biking and ski touring outside of the official trails, which intensify these pressures, especially during critical periods such as mating and resting times for wildlife and the reproductive time of plant species.

Balancing tourism development with nature conservation is a complex challenge. The Natura 2000 designation, along with the presence of rare habitats and species, underscores the necessity for strict protection measures and adherence to zonation and trail regulations.

Existing mitigation measures, which include monitoring, trail maintenance, educational panels, and field inspections, are crucial but need enhancement, particularly regarding visitor awareness and compliance. Effective conservation in the Geopark Karawanken-Karavanke requires a combination of habitat protection, visitor regulation, sustainable tourism planning, and adaptive management strategies.

Consistent ecological monitoring, along with the assessment of tourism impacts, is essential for the sustainable development of the Geopark while maintaining its ecological integrity. Collaboration with local communities, tourism operators, and relevant stakeholders is vital to ensure that development initiatives align with environmental preservation. Promoting low-impact recreational activities and incorporating environmental education are effective strategies for striking a balance between enhancing visitor experiences and conserving natural resources. In the face of economic and recreational demands, the preservation of biodiversity and unique habitats should remain the primary focus, thereby ensuring that ecological and socio-economic benefits endure for future generations.

It is also necessary to address illegal outdoor activities, which are on the rise due to easier access, better equipment, and a larger number of visitors to nature. In this area, communication with all stakeholders involved, the public and visitors, as well as responsible institutions that can exercise physical control over

this issue, is also crucial. The solution is certainly not simple. Warning signs have proven to be more of a negative than a positive approach. Despite this, we cannot completely exclude them, because this is the only way to legally define restrictions on public access (a warning sign at the location where the restriction is implemented). The awareness-raising technique has proven to be a positive approach, where the individual visitor to nature takes care of appropriate behaviour and visits, while also transferring this practice to those who consciously or subconsciously violate it.

The Geopark carefully guides visitors in this area in a way that promotes only legal trails and legal activities in nature. Printed and digital materials and presentations.