egea

Scientific report

EMRC24

May 2024

Contents

EGEA European office, Buys Ballotgebouw, Winthontlaan 30C, 3526 KV Utrecht, The Netherlands
e: egea@egea.eu
w: www.egea.eu

Topic Introduction

Greener Alps for a sustainable tomorrow

The topic was chosen so that it is versatile enough to offer a variety of workshop topics. It encompasses **human** and **natural** geography. The focus was on climate change and how it affects the area. The topic also encompasses other problems in the region such as mass tourism, traffic pressures, fragile water sources and the loss of habitat. The topic was also chosen because it applies to the wider region of the accommodation location. Slovenia currently still holds the presidency over the Alpine Convention which began in February of 2023 (https://www.alpconv.org/en/home/news-publications/news/detail/slovenia-kicks-off-its-presidency-activities-with-alpine-convention-day/), this combined with the fact that in 2024 the Triglav National Park is celebrating its 100th anniversary (https://www.tnp.si/en/public-institution/special-anniversaries/100th-anniversary/) made a topic related to the Alps so much more attractive to us.

EGEA European office, Buys Ballotgebouw, Winthontlaan 30C, 3526 KV Utrecht, The Netherlands
e: egea@egea.eu
w: www.egea.eu

Workshops

Living Sustainably in the National Park

Key words: Sustainability, Nationalpark, Triglav National Park, Tourism, Digitalisation in Tourism, Sustainable Living

Contact Details: Franziska Berktold, franziska.berktold@uni-a.de

Summary

During a workshop, participants were informed about the trade-offs of living in national parks and sustainability strategies, using Triglav National Park in Slovenia as a key example. With the help of interactive tools the ideas and opinion of the participants were surveyed. Key recommendations included the promotion of local products, development of a European National Park app, implementing a ticket system to control overcrowding and exploring alternative activities like geocaching and NFC technology to enhance visitor engagement while protecting the environment.

Introduction

Triglav National Park in Slovenia stands as a symbol of natural beauty and ecological significance. To address the pressing need for sustainable living within this environment, a workshop was conducted with the expertise of Majda Odar and Sara Rendulic from the National Park Authority. The workshop aimed to explore conflicts and solutions around living sustainably in the national park. An exemplary main focus was put on the park's digital strategy and the requests or needs of younger generations when it comes to visiting National Parks.

Methodology

The workshop employed a multi-faceted approach to engage participants and foster innovative thinking. It began with informative presentations by Majda Odar, providing insights into the challenges and opportunities of sustainable living within the park.

Following this, the use of Mentimeter facilitated real-time interaction, allowing participants to share their perspectives and suggestions anonymously.

Group discussions were integral to the methodology, providing a platform for collaborative idea generation and constructive dialogue. Furthermore, an unconventional approach was adopted through the inclusion of the "worst possible idea" exercise. This creative strategy encouraged participants to think outside the box by envisioning ineffective solutions, thereby sparking innovative thinking and problem-solving. Another beneficial side effect of this workshop strategy is that participants lose their fear of saying something wrong.

[Figure 1: Mentimeter Survey (Source: Franziska Berktold)]

EGEA European office, Buys Ballotgebouw, Winthontlaan 30C, 3526 KV Utrecht, The Netherlands
e: egea@egea.eu
w: www.egea.eu

Results & Interpretation

The outcomes of the workshop revealed a diverse range of ideas and perspectives aimed at promoting all dimensions of sustainability within Triglav National Park and national parks in general. Participants emphasized the importance of digitalization as a tool for enhancing visitor experiences while minimizing environmental impact. Suggestions such as the development of a European national park app and digital trails reflect a forward-thinking approach to leveraging technology for eco-friendly tourism.

Marketing of local products emerged as a key strategy to support the region's economy while promoting sustainable practices. Visitors are encouraged to contribute to the local community while reducing their ecological footprint. Additionally, improvements to the public transport system were highlighted as essential for reducing traffic congestion and air pollution within the park.

[Figure 2: Participants during group work (Source: Franziska Berktold)]

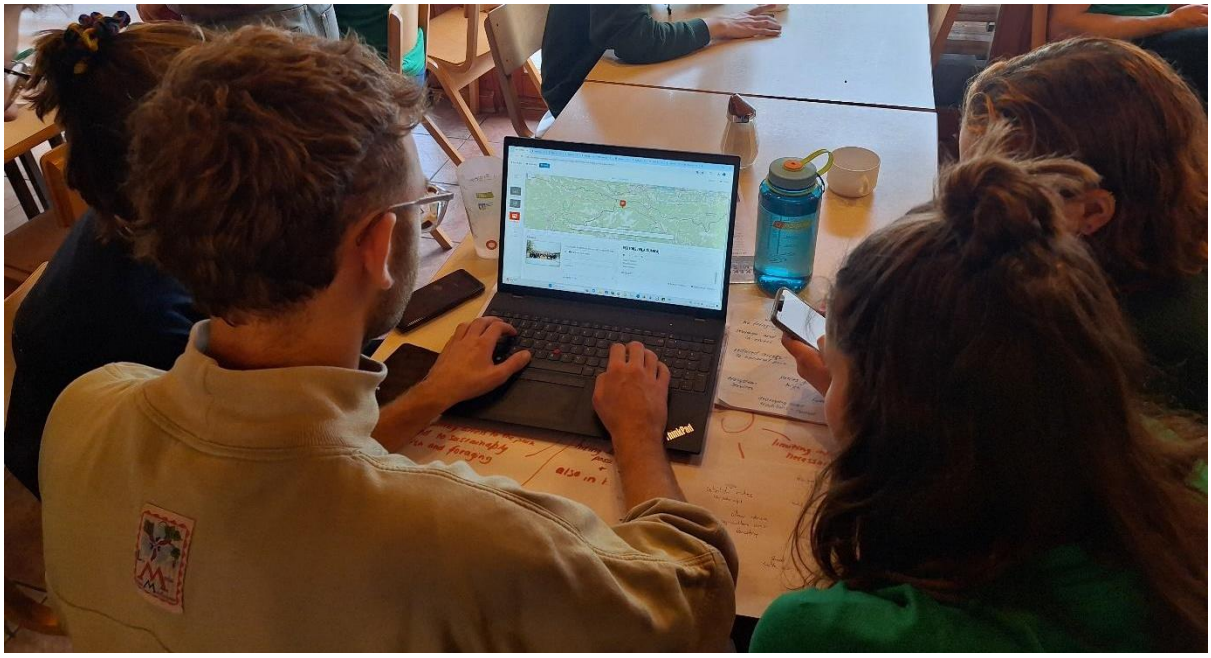
EGEA European office, Buys Ballotgebouw, Winthontlaan 30C, 3526 KV Utrecht, The Netherlands
e: egea@egea.eu
w: www.egea.eu

Addressing the issue of overcrowding, participants proposed the implementation of a ticket system to regulate visitor numbers effectively. This approach ensures the preservation of the park's fragile ecosystems while enhancing the quality of the visitor experience. Crucially, it was emphasized that the income generated from such initiatives should directly benefit the local community.

Exploring alternative recreational activities, participants suggested the promotion of geocaching in less visited areas as a means of dispersing tourist traffic. Additionally, the concept of blind following using NFC technology intrigued participants, offering a novel way to engage visitors while minimizing environmental disruption.

Looking towards the future, the integration of mobile versions for smartphones was highlighted as essential for catering to modern visitor preferences. By embracing digital platforms, the park can enhance accessibility and engagement while promoting sustainable practices.

In conclusion, the workshop on Living Sustainably in Triglav National Park underscored the importance of collaborative efforts and innovative solutions in safeguarding natural environments. To conclude the workshop and present the results to the audience a presentation in StoryMaps Js was created.



[Figure 3: Designing a Presentation with StoryMaps (Source: Franziska Berktold)]

EGEA European office, Buys Ballotgebouw, Winthontlaan 30C, 3526 KV Utrecht, The Netherlands
e: egea@egea.eu
w: www.egea.eu

A piece of advice to future workshop leaders would be to plan with a high amount of flexibility, as the circumstances can change very quickly.

Sources

Triglavski Narodni Park, 2024. URL: https://www.tnp.si/en/(accessed 15.04.2024).

Three big Carnivores of Slovenian Forests and Caprecillies

Key words: Eurasian lynx, Brown bear, wolf, capercaillie, appearance, ecology.

Contact Details: Matic Levstek, matic.lesvtek11@gmail.com

Introduction

The workshop focused on discovering the mysterious life of Slovenian big carnivores. Those are brown bears (*Ursus arctos* Linnaeus, 1785), wolves (*Canis lupus,* Linnaeus, 1785) and Eurasian lynxes (*Lynx lynx* Linnaeus, 1785). Apart from topics such as habitat choice, other ecological aspects, and their appearance, we have also covered some of the problems regarding big carnivores. In the end we have also touched upon the susceptible population of capercaillie (*Tetrao urogallus* Linnaeus, 1875) on Vitranc and the solutions of keeping the population stable.

One day we were joined by two experts from the field of wildlife conservation and research Petra Muhič from the institution DINARICUM and Vita from ZRSVN. The first workshop started at 9 am and it was carried out outside. We gathered in a circle around Petra and Vita and listened to the lectures. Those were accompanied by different accessories, such as an examples of telemetry collars, models of carnivores' sculls, and epoxy models of their footprints, so it was easier for participants to follow the lecture. In the second half of the workshop, we organized a roleplay game. One group presented scientists and experts who tried to propose rational solutions based on observations and facts. Another group presented farmers whose opinion about big carnivores was influenced by the danger of wolves' attacks on domestic livestock. The third group was tasked with playing citizens whose opinion was shaped by fear of big carnivores. The last group consisted of activists who wanted to abolish the controlling of big carnivore population by specially permitted culls. Different groups then presented their interests on a forum and an interesting discussion unveiled. With the help of this roleplay game, we better understood the efforts and complexity of reaching compromises.

Physical Appearance

The first topic covered was the appearance of the carnivore species. Brown bears measure up to 250 cm in height and can weigh up to 300 kilograms. Females tend to be a little bit smaller and lighter. Bears are most commonly brown, but the color may vary.

The color of the wolf's fur is described as brown to grey, but that depends on the season. Furthermore, the wolf can be recognized by its long and pointy snout and ears. The Eurasian lynx is the smallest of the big carnivores in Slovenia, with males weighing from 18 to 25 kilograms. The attributes that characterize the lynx are a small black-ended tail, ears and fur on their cheeks ending in recognizable tufts (Lzs 2024). Those cheek-ending tufts are also called lynx tips (Kočevsko). They also have smooth, brownish fur covered with brownish spots (Lzs 2024).

Brown bear (*Ursus arctos* Linnaeus, 1785) (foto: Filip Markovič).	Wolf (*Canis lupus* Linnaeus, 1785) (foto: Hubert Potočnik).	Eurasian lynx (*Lynx lynx* Linnaeus, 1785) (foto; Marjan Artnak).
		

Figure 1: Physical appearance of big carnivores from Slovenia.

Recognizing Presence

From the monitoring point of view, it is also very important that we know how to recognize a carnivore presence in a certain area. With that knowledge we can better prevent some possible colliding interests. The most common signs left in certain area are tracks. Bears tracks consist of five toes with visible claws (Dina Pivka). When walking, a bear treads on his entire foot. That is the reason for big footprints on the ground (lzs 2024). Another sign that indicates a bear's presence is individual hairs or tufts of hairs found on conifers. This is because bears, especially during the mating season, rub their furs against those trees. It is important for many reasons, including marking their mating areas to let competitors know they are in the area (Dina Pivka) and also preventing infanticide. It was observed that male bears would kill the cubs of female

bears if they haven't mated with her (Penteriani 2020). Therefore, females with cubs-of-the-year avoid those areas. A bear's presence can also be recognized by their scats.

A wolf's presence can be recognized with the help of their tracks and scats as in the case of the bear. Wolf tracks are like those of the dog but are usually larger. Scats of dogs can be differentiated from those of wolves because they do not contain fragments of bones and hair. Another possibility for wolf monitoring is howling. Wolves use it to communicate the location of their pack to other packs (Dina Pivka 2024).

A Eurasian lynx leaves tracks that do not have visible claws because they are retractable. This enables him to keep them sharp and to creep silently (Kos 2004). It is worth noting that sometimes a Eurasian lynx's track can be mistaken for the one of a wolf, especially if the terrain is hard.

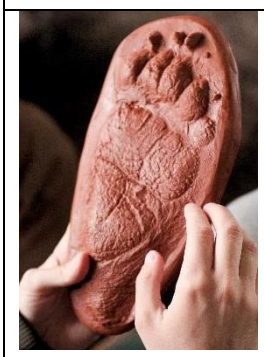
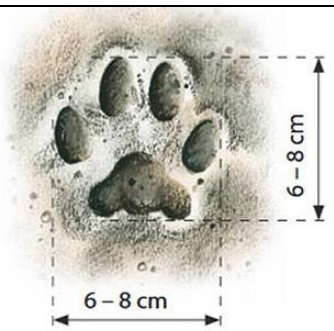
Bear's tracks (foto: EMRC 2024)	Wolf's tracks (foto: Franc Kljun)	Eurasian lynx's tracks (vir: Igor Pičulin)
		

Figure 2: Carnivores' track.

For all three carnivores, telemetry collars can be used for monitoring their movements. This method is used a lot in determining the home range of bears (Krofel 2010). Another important monitoring technique worth mentioning is called non-invasive genetic sampling (NGS). This one is used a lot in monitoring the Slovenian Eurasian lynx population since this population is smaller (Davoli 2012).

Habitat choice and presence in Slovenia

A bear's habitat consists of three major subdivisions. Those are Zahodni visoki kras, Notranjska and Kočevsko-Belokranjska regija. The biggest one is Kočevsko-belokranjska regija, but because of the increasing livestock farming, the habitat is not that suitable for

bears. Common to all three subdivisions is the association. In all three regions the *Abieti-fagetum* association can be found, which is an important source of a bear's food (Life dinalp bear).

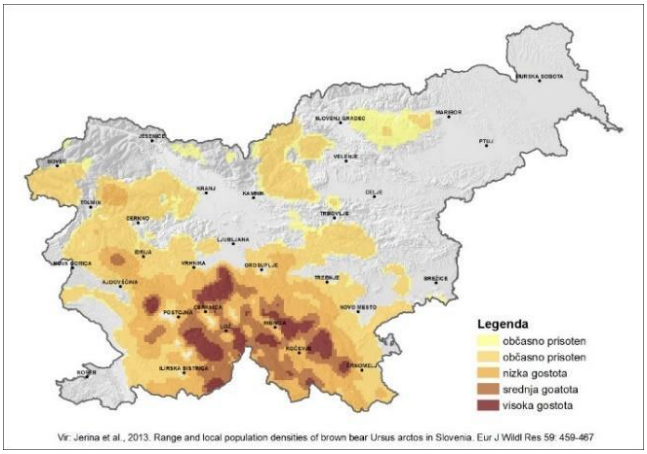


Figure 3: Bears presence in Slovenia (vir*:* https://dinalpbear.eu/sl/rjavi-medved/rjavi-medved-v-sloveniji/).

A Eurasian lynx's home range has been in Slovenia estimated for four lynxes. It has been concluded that female territories range from 132 to 222 km^2 and for males 156 km^2 to 200km^2 (Kos 2004). It is also worth noting that male home ranges overlap with the ones of the females. Males usually share their home range with up to 2 females and during the mating season they try to dispel competitive males out of their territories. (Breitenmoser 2000). A Eurasian lynx is in Slovenia common in the Dinaric alps in the south of the country (Dina pivka) but has in recent years moved up into the Alps as well (LIFE lynx).

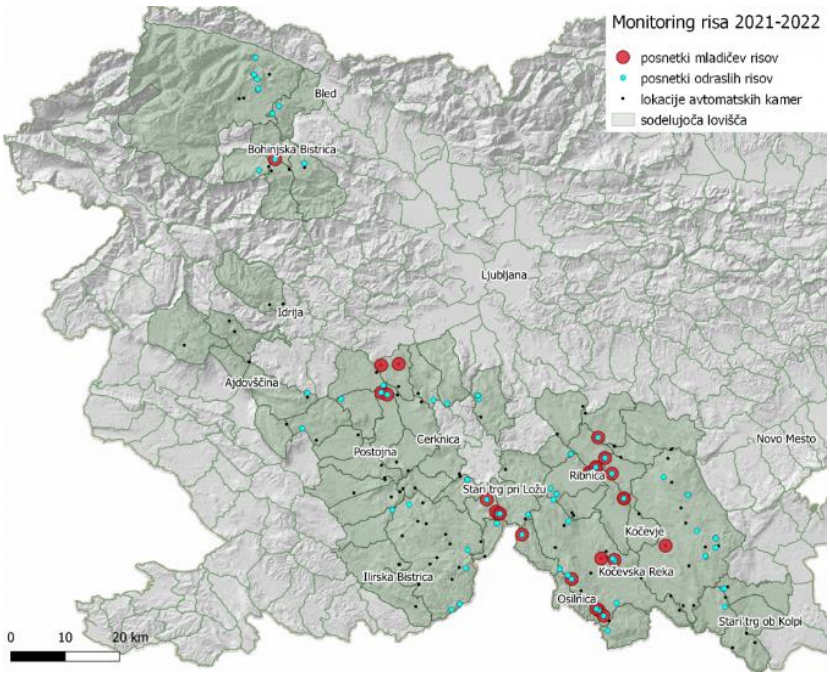


Figure 4: Map of camera trapping locations (black dots) in the monitoring season 2021-2022 with locations of recorded adult lynxes (blue dots) and kittens (red dots). Vir: Urša Fležar, LIFE Lynx.

EGEA European office, Buys Ballotgebouw, Winthontlaan 30C, 3526 KV Utrecht, The Netherlands
e: egea@egea.eu
w: www.egea.eu

A wolf presence in Slovenia was last estimated between 2020 and 2021. Researchers came to conclusion that there are now 12 wolf packs. That means that in Slovenia there are 121 to 168 wolves present (Life Wolfalps EU). A wolf, as all three big carnivores, needs a lot of space. It has been estimated that each individual wolf needs around 25km^2 of continuous forest cover (lzs 2024).

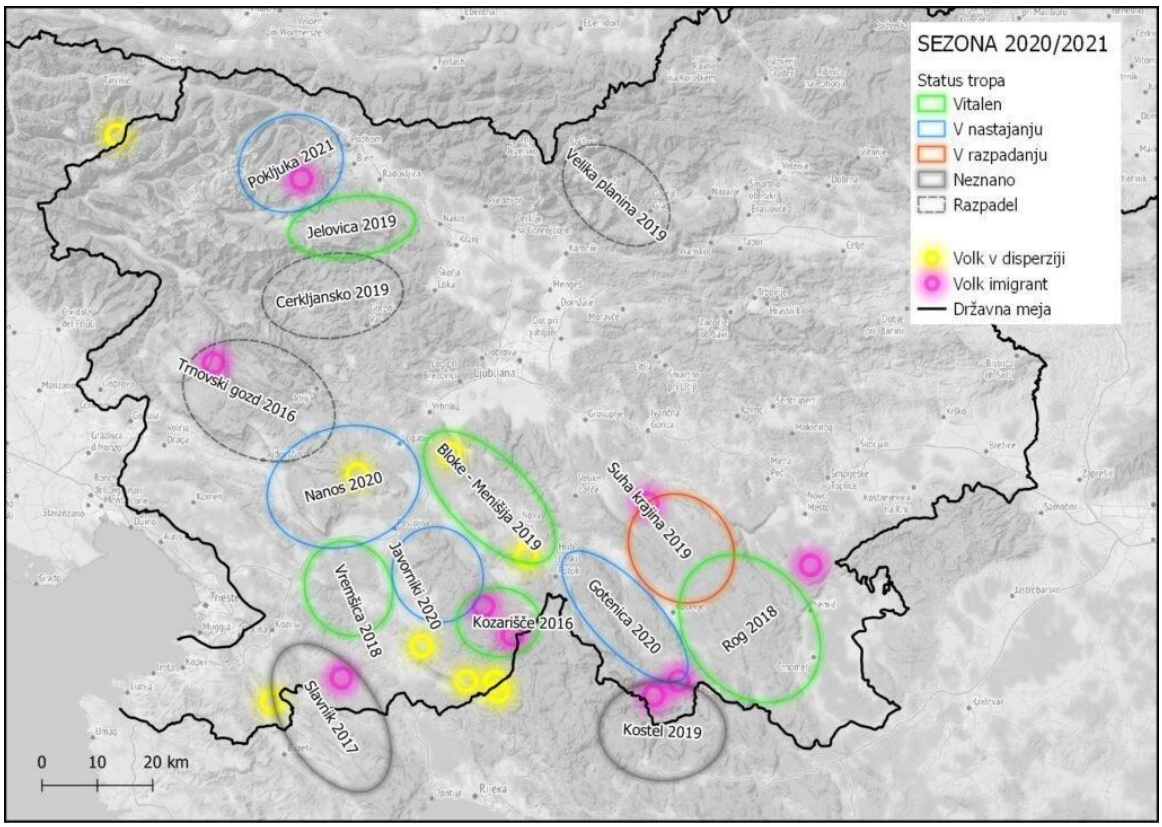


Figure 5: Approximate spatial distribution of wolf territories in the 2020/2021 season. (Vir: Prepared by Gregor Simčič; Data: Tomaž Skrbinšek.)

Problems concerning big Carnivorous Species

In the second half of the workshop, we covered issues that pester our three big carnivores. Each of them faces problems that are unique to their species and require solving. A Eurasian lynx faces many problems, including poaching. But one of the more evident is inbreeding to which the lynx as a species is quite susceptible (Kos 2004). It is estimated that the Slovenian lynx population is going to stay at a safe level for the next 30 years. However, without further endeavors and solutions, such as green bridges over highways, lynx population might be threatened with inbreeding (LIFE lynx).

The wolf is manly threatened with human intervention in its habitat. With highway construction and other ways of habitat fragmentations, the wolf is more threatened with run- overs (Dina pivka). Another problem in wolf management is attacks on livestock, which became more frequent since the protection of the wolf in Slovenia was introduced. It has been confirmed that fences in combination with electrical fences reduce wolf attacks. Additional protection in form of shepherd dogs is also effective (Muhič 2013).

Bear population is threatened with habitat fragmentation as well (Dina pivka). Apart from that, bears are also threatened with traffic collisions (Life dinalp bear).

Susceptible Capercaillie Population on Vitranc

The capercaillie is the biggest member of the family *Tetraoninae* in Slovenia and despite its size, it is easily disturbed. Especially with logging, tourism and gathering activities (Bevk 2019).

The colliding tourism and environmental interests became evident with an introduction of a plan for a new cable car. Because of the threat of capercaillie habitat destruction a study was conducted, and the results were not favorable for capercaillie population. Therefore, some solutions were proposed such as the establishment of a quite zone and construction in the area can only be carried out between July 1st and November 30th. It is also mandatory that visitors stay on tracks and do not take photos of the mentioned bird.

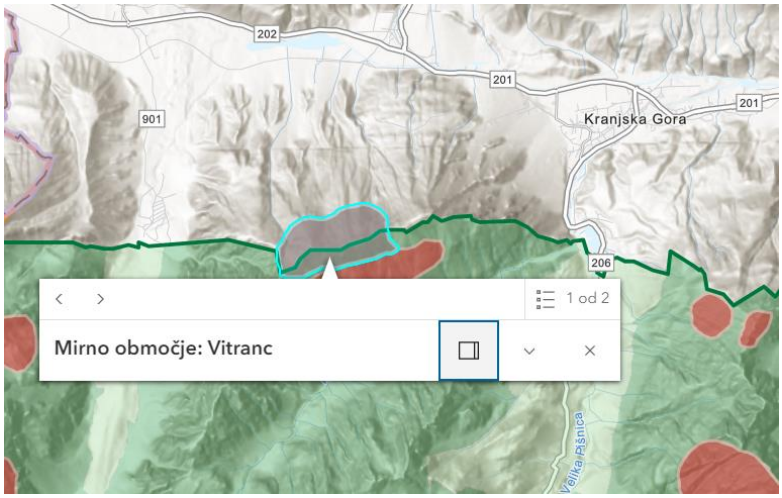


Figure 6: Location of quite zone Vitranc (vir: https://www.tnp.si/sl/park/narava/mirna-obmocja/).

Conclusion

To sum up, we can see that big carnivore species really are somehow unique and special in Slovenia. On one hand, they are praised and admired, but on the other despised and feared. As such, their management is often a heatedly debated topic, especially when their populations reach the limits of the carrying capacity of the environment and different ideas of problem solving arise. In cases like these it is important that we all trust researchers, who spent many hours studying those animals, and that we do not get deceived by our own viewings, which are oftentimes based on too small samples. Additionally, it is also important that government officials and others who contribute to decision making gradually and constantly inform the public. To really conclude this writing, the importance of listening to opposing groups should be stressed out once more, since this is the most effective and best way to reach compromises.

Sources

LZS https://www.lovska-zveza.si/

Project LIFE lynx. https://www.lifelynx.eu/

Life dinalp bear. https://dinalpbear.eu/sl/domov/

Life Wolfalps EU. https://www.lifewolfalps.eu/sl/

Kočesvsko. Colaborators of LIFE lynx projects. (accessed 18.5.2024) https://www.kocevsko.com/en/stories/everything-you-wanted-to-know-about-the-eurasian-lynx/

Center dina pivka. https://www.dinapivka.si/

Penteriani V., Zarazo-Arias A., Mar Delgado M., Dalerum Eliezer G., Peón Torre p., Sánchez Corominas T., Vázquez M. V., Vázquez García P., Ordiz A. 2020. Female brown bears use areas with infanticide risk in a spatially confined population.

Krofel M., Videmšek U., Jerina K. Preučevanje dejavnikov habituacije rjavega medveda na človeka z uporabo GPS telemtrije. 3. Vmesno poročilo – Spremljanej medvedov in terensko snemanje lokacij. 2010. Univerza v Ljubljani, Biotehniška fakulteta, Oddelek za gozdarstvo in obnovljive gozdne vire.

Davoli F., Schmidt K., Kowalczyk R., Randi E. Hair snaring and molecular genetic identification for reconstructing the spatial structure of Eurasian lynx populations. 2012. Mammalian Biology.

Breitenmoser U., Okarma H., Breitenmoser-Würsten C. Kaphegyi T., Kaphygyi U., Müller M. U. Action plan for the conservation of the Eurasian lynx in Europe (*Lynx lynx)*. 2000. Nature and environment.

MUHIČ, Petra, 2013, Analiza učinkovitosti zaščite drobnice pred napadi volkov (Canis lupus L.) v jugovzhodni in jugozahodni Sloveniji : diplomsko delo - univerzitetni študij [na spletu]. Diplomsko delo. Ljubljana : P. Muhič. [Dostopano 20 maj 2024]

Kos I., Potočnik H., Skrbinšek T., Majić Skrbinšek A., Jonozovič M., Krofel M. 2004. Ris v Sloveniji : strokovna izhodišča za varstvo in upravljanje. 1. Izdaja. Ljubljana, Biotehniška fakulteta.

Bevk D., Mihelič M., (2019): Divji petelin *Tetrao urpgallus.* pp 74-75., Mihelič T., Kmecl P., Denac K., Koce U., Vrazec A., Denac D., (eds): Atlas ptic Slovenije. Popis gnezdilk 2002-2017. - DOOPS, Ljubljana.

The blue gold and how to protect it: Alpine water sources

Key words: Water sources, quality, preservation, river, tourism, development, Alps, Pišnica, Slovenia

Contact Details: Authors: Bartosz Pietrak, b.pietrak@student.uw.edu.pl and Jan Jurkiewicz, jp.jurkiewic@student.uw.edu.pl

Summary

The workshop was organised by a cooperation of a geographer specialising in hydrology topics, and a spatial planner, with substantial help of our scientific co-leader, MSc Andreja Škvarč, from Institute of the Republic of Slovenia for Nature Conservation. Because of that, the focus had been put on the matters of sustainable development of areas, where the value of water is crucial. The workshop was divided into three separate scientific sessions, in which we learnt about the importance of the characteristics of water sources, rivers and lakes, and how to prevent them from degradation.

Introduction

The topic of our workshop forces us to take a closer look at the preservation of mountain water sources. In the surroundings of Julian Alps, students from all around Europe met to discuss potential threats to the environment in that place. Our previous experiences with this topic include similar fieldwork done by us already in the course of our studies, and also in extracurricular academic projects. Having researched this matter before, we were asking ourselves if the water quality of Pišnica could be weakened by any external factors, or is it as clean as its appearance would suggest?

Methodology

The first session wouldn't settle our overall work properly without the broad introduction to the topic. It was previously agreed that the emphasis should be put on the tourist infrastructure, since it's the most notorious threat to mountain areas. MSc. Andreja Skvarc from The Institute of the Republic of Slovenia for Nature Conservation told our participants about the changes in mountain tourism that occurred in the period of the last century. The driving factors for the development of tourism were the changes in mobility and the upgrade of equipment. One factor on which the presentation focused was the case of mountain huts. Mountain huts serve as a part of tourist

infrastructure, yet their functioning makes the area more vulnerable to the negative processes, such as: overcrowding, water pollution, noise pollution, interference in natural landscape, or difficulties in maintaining a supply chain to the hut. The exemplary dilemma mentioned was the case of wastewater treatment. Two most reliable options for the mountain huts are small sewage plants, or dry toilets. Although the sewage plants require a stable source of energy and special maintenance, they are more reliable and profoundly reduce the risk of pollution.

Photo 1: Roleplaying board game with our scientific co-leader (Jan Jurkiewicz)

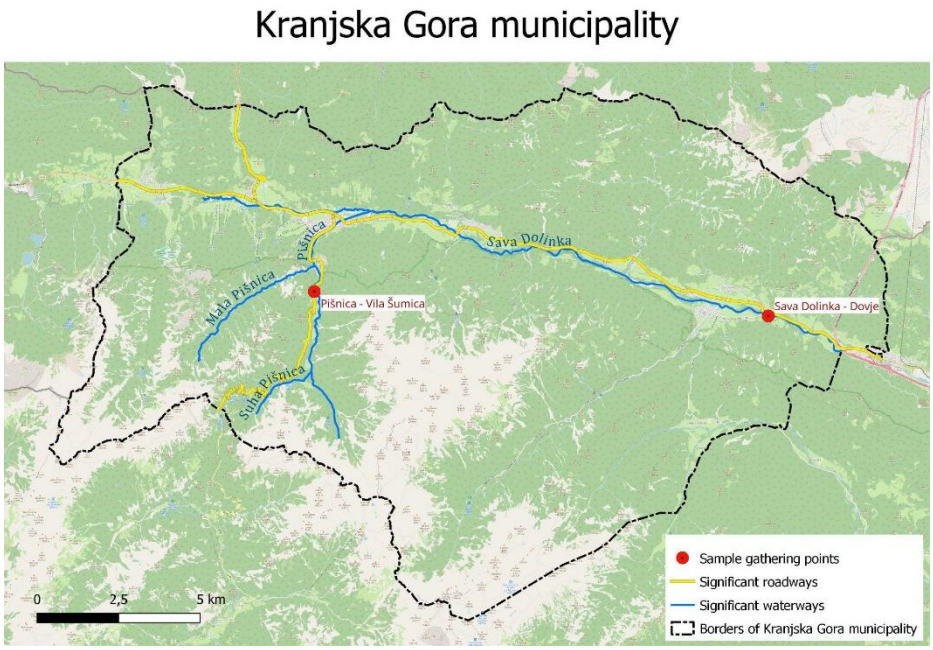
In the second part, thanks to the input of our scientific co-leader, the participants had a chance to work on the topic from the perspective of different groups of potentially concerned stakeholders, which were: members of the local community, businessmen, farmers, foresters, politicians, and the tourism society. With the roles and groups assigned, we conducted a roleplaying game, which also was a proper preparation for the upcoming sessions. Each group had been given a map with three possible variants

for building a ski slope with its infrastructure. According to the map, some places on the proposed routes were marked as areas with the presence of special species of flora and fauna. The main task was to align the interests of all representatives. As for the results, all of the participants were able to outvote the proposals of people, who were representing businessmen within their groups. The key during the exercise was to keep the balance between the potential influence on the environment and tourists' satisfaction (the second matter also had its special coverage during the third session).

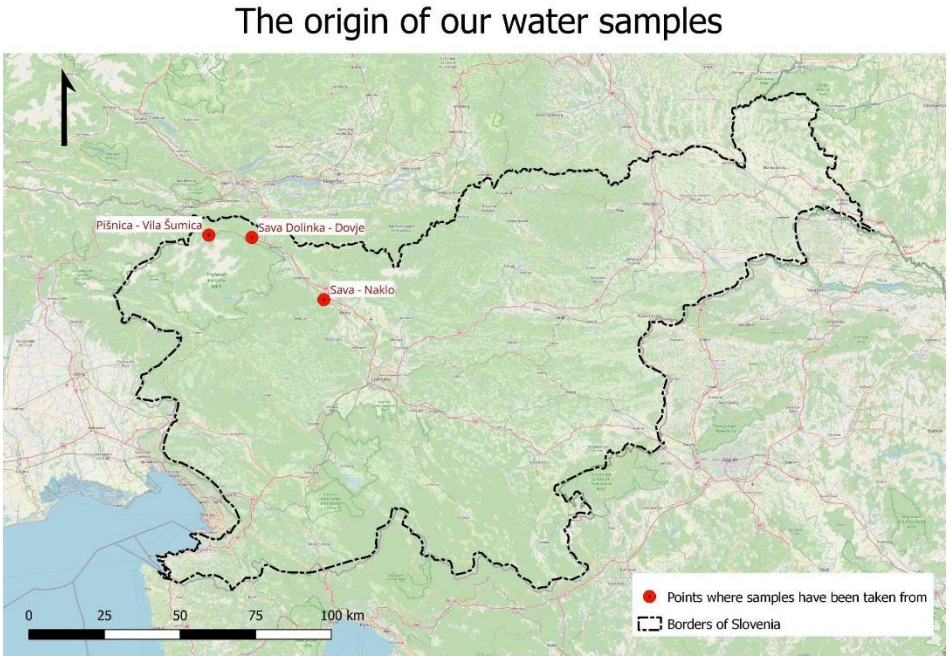
Photo 2 & 3: Fieldwork (Karol Atys).

During the second session, the participants went to the edge of upstream Pišnica river in Kranjska Gora (around 3 km of distance from its sources), in order to take part in the fieldworks. The preceding hypothesis was, if current spatial development of the mountain areas can profoundly affect the quality of waters. In order to make needed comparisons, workshop leaders provided the participants with two pre-collected samples of water. The first one was collected from the Sava Dolinka river, which flows through the town of Dovle, meanwhile the second sample was gathered from the Sava river (in the town of Naklo), for which the tributary is also Pišnica. The purpose of the session was to collect water samples, and then test each of them for the presence of potentially dangerous substances: sulphates, chlorides, ammonia, nitrates, nitrites and

phosphates The results of the measurements were crucial for drawing the conclusions in the end of the workshop. The groups of 2-3 people proceeded to take necessary measurements by special testers. After the verification, results were noted and put into the table.



Map 1: Map of Kranjska Gora municipality with two of our sample gathering points marked (author: Jan Jurkiewicz)



Map 2: Map of Slovenia with all of our sample gathering points marked (author: Jan Jurkiewicz).

The third scientific session was planned to be a presentation of the fieldworks' results. Also, the leaders provided the participants with examples of other potential threats to water regime and quality, and many comparable case studies, which were supposed to present both good and bad practices. The final presentation began with the characteristics of each river, from where the water samples were taken. The science team was expecting to record the highest pollution in a sample coming from the Sava river, since the collecting point was the furthest from river's springs, compared to other points, and it's the biggest of the researched rivers. Also, the samples from Sava Dolinka and Sava were collected on Sunday, the 21st of April. Later on, the scientific leaders initiated the part about the human influence on the condition of water.

Firstly, it was the case of hydroelectric power plants (HPP). Hydropower stands for 86% of total energy generated by renewable sources in Slovenia (Hocevar et al., 2022). However, research says that the ecological impact in case of small hydroelectric power plants (SHPP, capable of producing less than 10 MW of energy daily) costs more than its revenue. There are also many other ongoing threats, such as changes in daily fluctuations level or breaking of fish trails. Related to that, the scientific leaders prepared a comparison between well-planned and badly-planned examples of HPPs, respectively Brezice (Slovenia) and Włocławek (Poland). The Brezice HPP have introduced the innovative fishways, which are designed to seem nearly-natural. Meanwhile Włocławek HPP, built in the 1960s, provided solutions, which are nowadays blamed for causing the near extinction of salmon from Polish rivers. Other research also confirms such negative influence - after the construction of HPP in Czorsztyn, certain fish species' population (e.g. trout) has decreased, and more common species like bream or roach began to appear more often (Augustyn, 2010). Also, Włocławek HPP is very vulnerable to sedimentation and deep erosion - that's why construction of another water dam will be necessary in the near future. Another topic was the overall impact of concentrated tourism on the environment, and the strategies for preservation of the natural landscape. The main concerns are: water, air and noise pollution, transport pollution, excessive trash (Kurek, 2007). Among the good practices, we may highlight Austria, where the focus is put on maintaining and upgrading already existing tourist infrastructure, e.g. ski slopes.

For a better understanding of the results, it was necessary to present a list of the substances for which the tests were done, what their presence in the waters could mean, and what could be the possible sources of them:

- Ammonia (NH_3) – domestic sewage, volcanic activity, lightnings

- Sulphates (SO_4) – mineral weathering, decomposition of organic matter, wastewater, fertiliser runoff
- Nitrates (NO_3) – septic waste, nitrogen-based fertilisers, animal fertiliser
- Nitrites (NO_2) – nitrogen-based fertilisers and sewage waste
- Phosphates (PO_4) – intensive farming and fertilisation upstream
- Chlorides (Cl) – solution of sedimentary rocks in water, road salting

	Ammonia	Sulphates	Nitrates	Nitrites	Phosphates	Chlorides
Pišnica (Tuesday)	0,02 mg/l	<25 mg/l	1 mg/l	0 mg/l	0 mg/l	5 mg/l
Sava – Dovle (Upstream, Sunday)	0,01 mg/l	0mg/l	3 mg/l	0 mg/l	0 mg/l	1 mg/l
Sava – Naklo (Downstream, Sunday)	0,02 mg/l	<25 mg/l	3 mg/l	0,02 mg/l	0 mg/l	4 mg/l

Table 1. The contents of selected substances in every measured sample.

Results & Interpretation

According to table no. 1, we could see the expected results – water from the downstream river (Naklo) contains more substances, than the water from the upstream (Dovle and Kranjska Gora). The other thing that drew leaders' and participants' attention was the unexpectedly high level of chlorides in the water from upstream Pišnica river. The reason for that could come from the weather conditions and human intervention. On Tuesday, the day of fieldwork, unlike two other spots on Sunday, Kranjska Gora was covered by a thick layer of snow. Also, the localization of the measurements could be crucial – the participants were working under the bridge, from where the melted snow was falling back into the river. To make the road safe in such conditions, road workers are using road salt, which mainly contains sodium chloride (NaCl).

In order to sum up the workshop, the participants were divided into 2 groups, created posters, where they included the threats and the sustainable solutions for keeping the water sources and rivers clean and safe.

Photo 4: Presentation of the results - poster and mindmap (Karol Atys).

Sources

Kurek W., 2007, Turystyka, PWN

Ho ˇcevar, M.; Novak, L.; Drešar, P.; Rak, G. The Status Quo and Future of Hydropower in Slovenia. Energies 2022,15, 6977.

Augustyn L., 2010, The influence of the Czorsztyn-Niedzica and Sromowce Wyżne hydroelectric power station on the ichthyofauna of the Dunajec River in the Pieniny region. Monografie Pienińskie 2: 227-239

Wodociągi Warszawskie, 2019. Małże i ryby testerami wody. URL: https://mpwik.com.pl/view/malze-i-ryby-testerami-wody&i=678 (accessed 12.04.2024)

Melting glaciers and dying forests: Climate change and its effects in the Julian Alps

Contact Details:

Michał Purta; mic.purta@gmail.com

Jennifer Sadowska; jennifer.sadowska@gmail.com

Summary

The workshop provided a comprehensive overview of the severe impacts of climate change on the Julian Alps region, with emphasis and examples focusing on the Triglav glacier, which has significantly receded over the past century.

The workshop featured two insightful presentations by esteemed professors from the University of Ljubljana, mag. Miha Pavšek, head of the Triglav glacier monitoring team, expert on climate geography and glaciology, and dr. Jure Tičar, a specialist on climate change, the retreat of glaciers into caves and ice caves.

After the theoretical presentations mag. Pavšek and dr. Tičar together with the participants went outside to continue the lectures in practice. The experts demonstrated real-world applications of scientific concepts. Participants engaged in dendrochronology to interpret climate impacts recorded in tree rings and later created three-dimensional clay models to visualize and comprehend the complex dynamics of karst hydrology, glacier structures, and ice cave formations.

Introduction

The Julian Alps, a prominent mountain range in north-western Slovenia, serve as a crucial site for studying the impacts of climate change on alpine environments. This region, known for its distinctive geological formations and diverse ecosystems, is undergoing significant transformations due to global warming. The Triglav glacier, a key feature of the Julian Alps, has shown considerable recession over the past century, acting as a clear indicator of the broader climatic shifts affecting the region. This workshop aimed to delve into the scientific aspects of these changes, focusing on the

interplay between climate change, glacial dynamics, and karst processes, particularly the formation and evolution of ice caves.

Climate change has led to increased temperatures and altered precipitation patterns, significantly affecting glacial mass balance and the stability of ice caves. The Triglav glacier,

like many alpine glaciers, has been receding due to increased ablation and reduced accumulation. This retreat has profound implications for the hydrology and geomorphology of the region. Ice caves, which form through the interaction of glacial ice and karst processes, are particularly sensitive to these climatic changes. The melting and refreezing cycles within these caves are disrupted by rising temperatures, leading to structural instability and eventual degradation of these unique features.

Methodology

Before we started the workshop session we used ice breakers for participants to get to know each other with the lecturers. During the workshop sessions participants were attendees of presentations, and went outside for a hike to continue the lectures, and at the end participants prepared models made of clay.

Results & Interpretation

During the workshop, participants engaged in hands-on activities that involved creating three-dimensional clay models representing various karst hydrological zones, glacier series, and ice caves within karstic systems. This practical approach allowed participants to gain a deeper and more tangible understanding of the formation and dynamics of these geological features.

The construction of detailed models of karst landscapes enabled participants to highlight features such as sinkholes, underground rivers, and aquifers. By visualizing these models, they were able to grasp the complex water flow and storage mechanisms characteristic of karst systems, including how water percolates through porous limestone and forms subterranean drainage networks. This process illustrated the intricate hydrological processes within karst terrains, emphasizing the significance of underground water systems and the importance of preserving these fragile ecosystems, which are particularly vulnerable to pollution and over-extraction of water resources.

The creation of glacier series models provided participants with a clear understanding of the layered structure of glaciers, including the accumulation zone, the ablation zone, and the equilibrium line. Manipulating the clay allowed them to observe how glaciers

advance and retreat in response to climatic conditions, simulating the processes of ice formation, melting, and movement. Through this exercise, participants gained a clearer picture of glacial dynamics and the critical role glaciers play in the Earth's climate system. The alarming rate at which glaciers are retreating due to global warming was highlighted, underscoring the urgent need for climate action.

Modeling ice caves within karstic systems offered insights into their formation within these unique geological settings. Participants illustrated the interaction between glacial ice and karst topography, demonstrating how ice caves develop through the melting and refreezing of

water within limestone formations. This activity showcased the interplay between glacial and karst processes, highlighting the delicate balance required for the formation and maintenance of ice caves. Participants appreciated how climate fluctuations can disrupt this balance, leading to the loss of these distinctive geological features.

The hands-on modeling activities proved to be an effective educational tool, enhancing participants' understanding of geophysical processes and the impact of climate change on these systems. The clay models served as a visual and tactile aid, bridging the gap between theoretical knowledge and real-world phenomena. Overall, the workshop's practical approach facilitated a comprehensive understanding of complex geological and climatic interactions. Participants left with a heightened awareness of the consequences of climate change on karst landscapes and glacial environments, inspiring a commitment to environmental action and advocacy for sustainable practices.

Photo 1: One of the oldest photos of the Triglav glacier from late 19th century (photo: Benedikt Lergetporer)

Photo 2: The Triglav glacier in 2021 (photo: Miha Pavšek)

Photo 3: Participants at work (photo: Jennifer Sadowska)

Photo 4: Participants modelling the Karst Hydrological Zones (photo: Jennifer Sadowska)

Photo 5: Workshop output (photo: Jennifer Sadowska)

Photo 6: Workshop excursion (photo: Jennifer Sadowska)

Photo 7: Workshop excursion (photo: Jennifer Sadowska)

Excursions

We had 3 different scientific excursions planned for the congress. They were designed to visit the **Soča valley**, **Mojstrana and Vrata** and **Planica and Zelenci**. The excursion to the Soča valley had to be cancelled due to freak weather, we had lots of snow. We decided to combine the Soča and Mojstrana excursions into one excursion to **Bohinj and Bled** where the participants saw Lake Bled and the Triglav National Park center in Bohinj. The excursion to **Planica and Zelenci** was carried out more or less the way it was intended, the participants visited the Nordic center Planica and the Zelenci Nature Reserve where the Sava river has its source. The modified excursions were very successful regarding that we had to abandon two of the excursions last minute.

EGEA European office, Buys Ballotgebouw, Winthontlaan 30C, 3526 KV Utrecht, The Netherlands
e: egea@egea.eu
w: www.egea.eu

Bled and Bohinj Excursion

We visited another part of the Triglav National Park, the only national park in Slovenia. The location was different to the part of the park our accommodation was located in, but quite close. In addition to a lot of information from Job, we picked up our guide in Bled, who is a ranger of the national park and also one of the managers of the park.

Our first stop was Ribčev Laz, from where we walked along the eastern shore of Lake Bohinj / Bohinjsko jezero and saw the beauty of the snow-capped and mist-shrouded mountains. And met very cute and trusting ducks.

Both pictures are from the Bohinjsko lake shore.

Arriving at the northern tip of the lake, we learned not only that the nearest settlement is so far away from the lake because the water level can rise by several meters, but that it is also located on an old glacial moraine.

What was also unusual and memorable for many is the fact that there are many used fields in the national park, which belong to private individuals. In other countries, where many of the visitors come from, this would be unthinkable. I guess that is the most impressive thing which I will remember even in years.

Presentation by the Bohinj lake-

We were informed about the difficulties that the park administration is facing, and also that they deliberately decided not to become a part of UNESCO in order not to have even more fragmentation (also in the administration) and to put the protection and preservation of nature higher than the notoriety of the Triglav National Park.

Farm in the Triglav National Park.

EGEA European office, Buys Ballotgebouw, Winthontlaan 30C, 3526 KV Utrecht, The Netherlands
e: egea@egea.eu
w: www.egea.eu

The protection in the national park is not only about the preservation of nature, but also about the authentic representation that can be seen in the architecture of the houses. This is done with strict guidelines on the part of the National Park, which are developed in cooperation with the Ministry of Culture.

Once back on the bus we drove to Bled, where we were shown a film about the beauty of the national park in the information center and the current location of the administration, as well as the small but exciting permanent exhibition. We also learned that there is not only the national park, but also a biosphere reserve, which completely surrounds the national park, and both together make up the largest part of the Julian Alps.

After all the input, most of us took a short nap in the bus while it rolled towards the mountaineering museum in Mojstrana. This museum was less about nature conservation like in Bled and more about the development of alpine tourism, especially hiking. It was first German-speaking clubs that climbed the Slovenian Alps, as they also had more money and, above all, time for such a strenuous hobby.

Over time, however, hiking has also developed more and more into a Slovenian sport, which is still practiced today with enthusiasm and is also very identity-forming. Thus, every citizen of Slovenia should climb Triglav at least once.

Or maybe the most impressive thing today was that the organizing team did an outstanding job again (sorry, it was necessary) and was able to put together such a varied program at such short notice, after which the snow prevented our hike.

Planica and Zelenci Excursion

Author: Max Buchhart & David Verges from EGEA Jena

During the Euromed Regional Congress 2024 of the European Geography Association (EGEA) we participated in an excursion that took us to the Planica Nordic Centre und the Zelenci Nature Reserve. After a brief bus ride the snowy alpine landscape and cold mountain air brought back our spirits we arrived at the Nordic Centre and a coffee break, where we were picked up by our guide. We started our tour at the very top of the building where we had a perfect view of the eight ski-jumping/flying hills. We learned a lot about the construction of the site and talked about its importance for the region. This was especially interesting to us because our knowledge of this topic was quite limited. Next, we went to the basement where we were shown the Indoor Cross-Country Skiing facility. The floor of this large hall is cooled to -1°C for the whole year so athletes can train even in the warm summer months. On the first floor there was a sort of a hall of fame where the accomplishments of successful Slovenian athletes were displayed. A large section of this was dedicated to Peter Prevc. We learned about the path of his career and got the picture that he was worshipped as a national sport legend. Here our guide also told us about the history and development of the ski jumping methods. We were especially surprised by the fact that the popular V-technique was only discovered because of an athlete's faulty bone structure. In the end of the tour, we had the chance to reinforce the acquired knowledge and prove our skills in an VR ski jumping simulator.

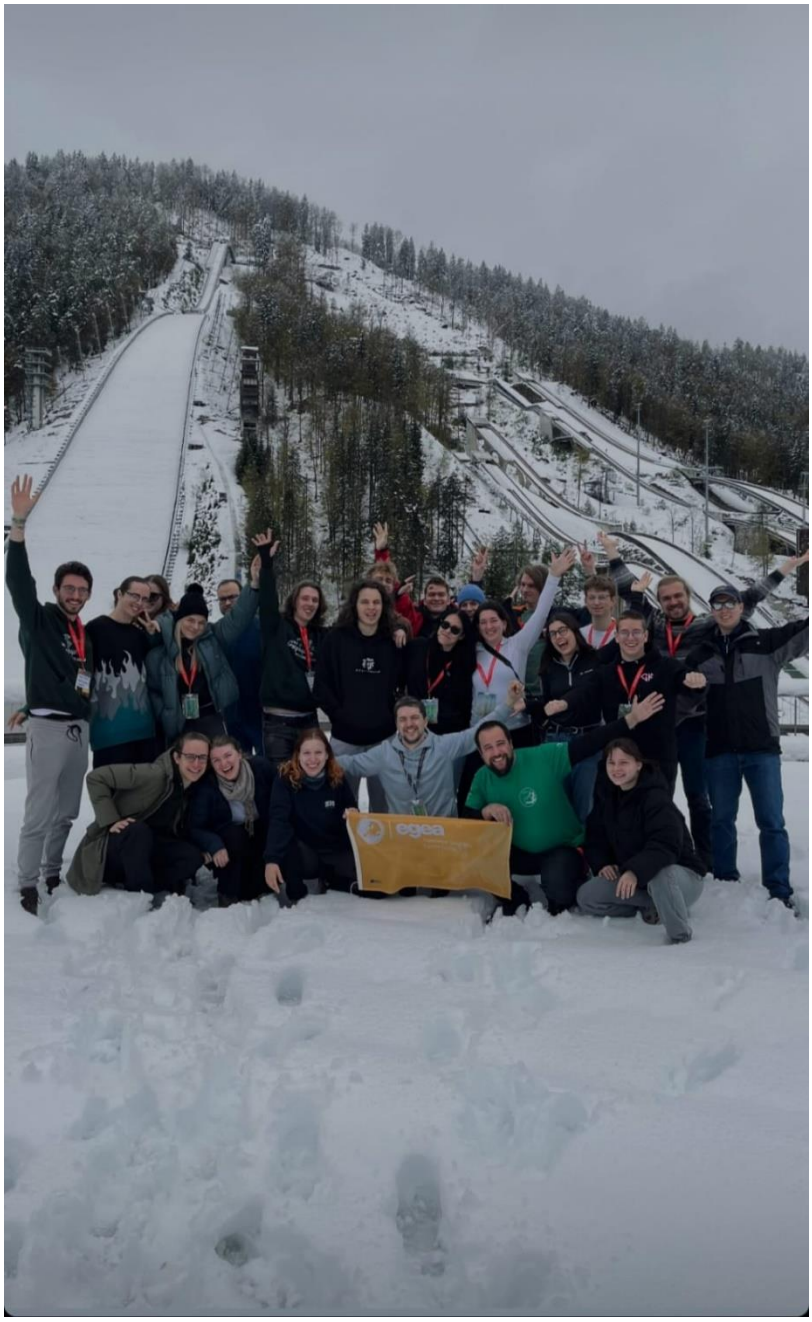
After the end of the tour two women of the Slovene institute for nature protection took over the excursion. They started with a presentation about the difficulties of the ski jumping facility being build right at the border of Triglav national park. This results in a conflict between nature conservationists and regional stakeholders who want to promote tourism. After a short walk through the valley our bus drove us to the Zelenci Nature Reserve. We walked through the swamp to a karstic spring. We were astonished by the beautiful blue colours of the small lake embedded in the snowy mountain landscape.

For the culinary ending of the excursion, we visited a local goat farmer in Rateče. The small family business prepared a tasting of their various products (i.e. yogurt, cheese, cream, milk and homemade jam). In their small shop the whole group was able to stock up on their homemade goat delicacies. After this eventful day we were happy to get back to the accommodation to take a short brake before participating in the rest of this wonderful congress.

Planica Nordic Centre tour.

Indoor cross-country skiing facility.

Karstic spring in the Zelenci Nature Reserve.



Group picture in front of the ski jumping facilities.

The European Geography Association for students and young geographers

Experience Geography, Explore Europe

EGEA European office
Buys Ballotgebouw
Winthontlaan 30C
3526 KV Utrecht
The Netherlands

e: egea@egea.eu
w: www.egea.eu