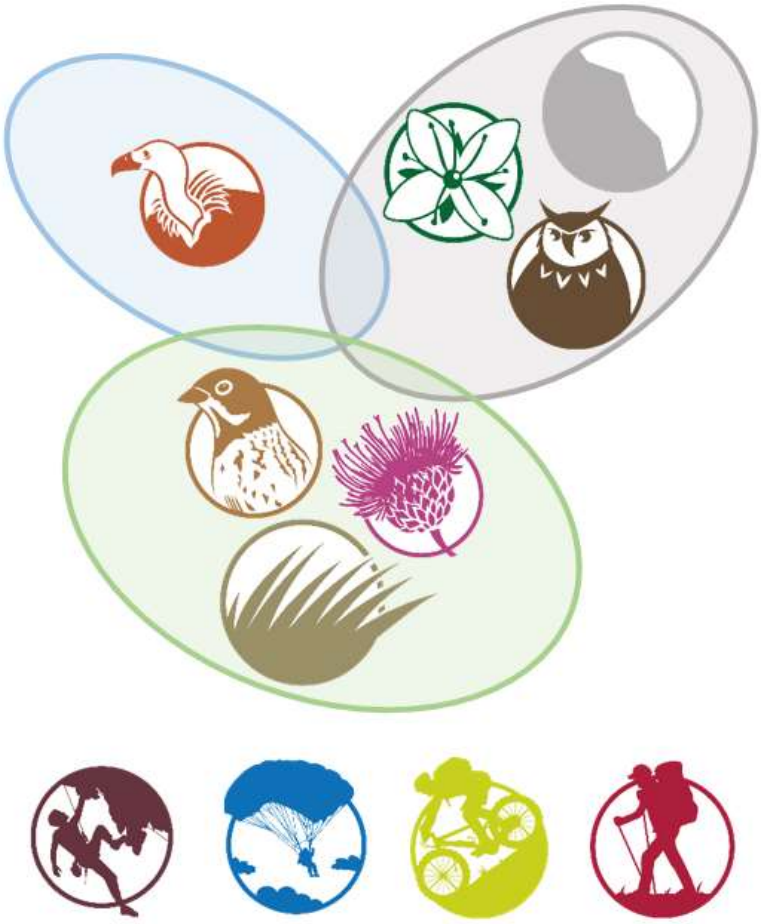
LIKE

Living on the Karst Edge



Educational program

NATURE 2000

PRIRODOSLOVNI MUZEJ RIJEKA
NATURAL HISTORY MUSEUM RIJEKA
PRIMORSKO-GORANSKA ŽUPANIJA • COUNTY OF PRIMORJE AND GORSKI KOTAR

LIKE

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Ana Barešić, PhD

Table of contents

INTRODUCTION

This educational program was developed in the Natural History Museum Rijeka as a part of the project „LIKE – Living on the Karst Edge“ 2018/19. It is intended for children of preschool and primary school age and persons with special needs, and its aim is to develop positive attitude towards the network „Natura 2000“ and the sense of responsibility towards nature protection in general. Five educational and creative cognitive and research-based workshops for children and 2 theme half-day workshops for the entire family were developed as a part of the program.

The project is accompanied by the Green Book of Knowledge which participants complete during the workshops and which they receive upon completion of the education.

The common objective of all workshops is to raise awareness of the reasons and the need for nature protection, which will be mostly conducted through group work and various games. The workshops have a theme plant and animal which will help to cover the terms related to nature protection and the “Natura 2000” area as well as specific terms related to biology and wildlife. In addition, special attention is paid to wildlife habitats which are researched through the “LIKE” project.

The duration of the workshop for pre-school children and children with special needs is between 45 minutes and an hour, and a maximum of two school lessons for primary school children.

In addition, at the end of the program there are specialized texts with the latest knowledge related to topics covered by the project which is the basis of information provided within the workshops.

General program objective:

- the common objective of all workshops is to raise awareness of the reasons and the need for nature protection

Additional objectives which will be achieved with the program implementation:

- developing positive attitudes towards the network Natura 2000
- developing a sense of responsibility for nature protection
- developing a sense of connection with nature in program users
- understanding the reasons of endangerment of the species covered with the project
- raising awareness of the importance of preserving the species in the area covered with the project, but also in general
- reducing the gap between the scientific advancements and science teaching in schools

Work method:

- ✓ frontal work (lectures, discussions)
- ✓ group work
- ✓ freedom of expression
- ✓ direct observation
- ✓ learning through games and fun
- ✓ *field work*

Expected results:

- development of contemporary educational contents related to the contents of natural sciences with the emphasis on nature protection

- increase in the offer of educational programs and acquisition of new knowledge in a fun and simple way
- increase in the offer and availability of contemporary cultural and educational programs

Themes and description of workshops for preschool age, children with special needs and primary school age

Duration of the workshops for preschool age and children with special needs is 45 minutes up to an hour, and for primary school children the workshops lasts up to hour and a half.

Themes and description of workshops for preschool and children woth special needs, as well as for primary school children are given in following chapters. *(Each workshop can also be adjusted for other ages.)*

The course of the workshop **(recommendation):**

Preschool age (3 – 6 years) and children with special needs (total duration 45 – 60 minutes):

Activity:	Approximate duration (recommendation):
The workshop starts with the introduction during which all participants introduce themselves. The participants are given name tags which they attach to their clothes with the help of the workshop presenter. During the introduction, the participants also state their favourite plant, animal or place in nature.	10 minutes
The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group.	10 – 15 minutes
The game which will take up major part of the workshop begins.	15 – 25 minutes
Additional clarifications and revisions with real-life examples and the end of the workshop. (The duration depends on the course of the workshop.)	10 minutes
Total duration	45 – 60 minutes

Primary school age (1st – 4th grade and 5th – 8th grade) (total duration up to 90 minutes):

Activity:	Approximate duration (recommendation):
The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group.	15 minutes
The activity which will take up major part of the workshop begins.	20 – 30 minutes
Additional clarifications and revisions with conversation about real-life examples.	10 minutes
Additional game for revising and consolidating knowledge.	10-15 minutes
Final comments and the end of the workshop.	10 minutes
Total duration	75 – 90 minutes

Topic introduction:

At the beginning of each workshop we introduce the topic through conversation, presentation and sub-questions in order to assess the level of knowledge about a specific topic and additionally clarify the topic and the terms.

We will then cover each topic in two parts: through *„conversation/discussion questions“* and *„activities“*.

Conversation/discussion questions – with the conversation/discussion questions we aim to assess how much the participants know about the given topic as well as to acquire new knowledge through conversation. In addition, it is important to entice the participants through questions to think about and become aware of, i.e. use all the existing knowledge and insights they have, as well as to be creative in discussion.
Examples of questions which might be asked in each workshop are given further in the text. The questions must always be adapted to the situation and the group since each workshop is special because of its participants, which is something we must always have in mind.

Activities – activities are actually various games through which we well learn about the topics covered in the workshop and which are used both for transferring knowledge as well as for revising and consolidating what we have learnt. Through these activities the participants also learn various ways of working, e.g. teamwork, group work, independent work, etc.

The participants also learn how to think critically and express themselves creatively both through conversation/discussion questions and activities.

At the end of the program there are separate specialized texts which constitute the basis for the information provided in the workshops.

How to use this program?

1. Choose the workshop you would like to hold.
2. Study the specialised text which follows the workshop and prepare a short topic presentation.
   Use the attached materials and photographs.
3. Define the age intended for the workshop.
4. Check all the activities for that age and prepare the space accordingly.
5. Prepare all necessary materials. If required by the program, print out enough copies for each participant. All supporting materials may be found in a separate section following this program called “The Green Book”.
6. Hold the workshop!

Be the Protector of Nature 1 (Natura 2000)
(1st workshop)

Basic topic:

Protection of nature, habitats and species of the Natura 2000 area.
NATURA 2000 is an ecological network of the European Union which comprises areas important for preserving endangered plant and animal species and habitat types, with the primary aim to protect biodiversity for future generations.

Key information to be transferred:

- ✓ Natura 2000 is an ecological network of the European Union which comprises areas important for preserving biodiversity
- ✓ the largest network of protected areas in the world
- ✓ there are 8 national parks and 11 nature parks in Croatia
- ✓ there is 1 national park and 2 regional parks in Slovenia

Topic introduction:

Conversation/discussion questions (example! – we always adapt the questions to the situation and the group!):
(for younger age group)

- ? In which city do you live? And country? And do you know on which continent you are, or what is a continent in the first place?
- ? What would you say, what is nature? Why is it important to protect nature, plants and animals?
- ? In what ways do we protect nature, plants and animals? How do you protect them (e.g. we protect them ourselves, the state protects them, etc.)?

(for older age group)

- ? What is the European Union? How many countries does it comprise? Is Croatia in the European Union?
- ? What would you say, what is nature? Why is it important to protect nature, plants and animals?
- ? In what ways do we protect nature, plants and animals? How do you protect them (e.g. we protect them ourselves, the state protects them, etc.)?

The course of the workshop (recommendation):

Preschool age (3 – 6 years) and children with special needs (total duration 45 – 60 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves. The participants are given name tags which they attach to their clothes with the help of the workshop presenter. During the introduction, the participants also state their favourite plant, animal or place in nature.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	10 – 15 minutes
Game (jigsaw puzzle) *„I was in a special park today!"*	The participants will put together a jigsaw puzzle of Croatia/Slovenia with marked protected areas – national parks and nature parks. We will divide the participants into groups of 3 – 4 persons, and each group will have their own jigsaw puzzle to solve.	15 – 25 minutes
Revision (day-night game)	Additional clarifications and revisions with real-life examples and the end of the workshop. We will revise the topic with the day-night game, and the terms will be e.g. national park, nature park, nature protection, etc. (The duration depends on the course of the workshop.)	5 minutes
Assessment	Brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes
Total duration		45 – 60 minutes

Primary school age (1st – 4th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation.	15 – 20 minutes

	Conversation/discussion questions (above).	
Game (jigsaw puzzle) *„I was in a special park today!"*	The participants will put together a jigsaw puzzle of Croatia/Slovenia with marked protected areas – national parks and nature parks. We will divide the participants into groups of 3 – 4 persons, and each group will have their own jigsaw puzzle to solve.	25 – 30 minutes
Revision	Additional clarifications and revisions with real-life examples.	10 minutes
Game (day-night)	Additional game for revising and consolidating knowledge, with real-life examples and the end of the workshop. We will revise the topic with the day-night game, and the terms will be related to Natura 2000 areas. (The duration depends on the course of the workshop.)	10 – 15 minutes
Assessment	Final comments and the end of the workshop, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes
Total duration		75 – 90 minutes

Primary school age (5th – 8th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	15 – 20 minutes
Game (jigsaw puzzle) *„I was in a special park today!"*	The participants will put together a jigsaw puzzle of Croatia/Slovenia with marked protected areas – national parks, nature parks, Natura 2000 areas. We will divide the participants into groups of 3 – 4 persons, and each group will have their own jigsaw puzzle to solve. There are two types of the jigsaw puzzle – with national parks and with nature parks. Once the jigsaw puzzle has been solved, each team marks the areas from their jigsaw puzzle on the shared poster and we get a joint illustration with all areas on the same map. Upon completion of the workshop, the participants	15 – 20 minutes

	receive a sheet with protected areas in Croatia/Slovenia, including national parks, nature parks and Natura 2000 areas.	
Revision	Additional clarifications and revisions with conversation about real-life examples	10 minutes
Game (Whizz quiz)	Additional game for revising and consolidating knowledge, with real-life examples and the end of the workshop. We will revise the topic with a short quiz related to the learnt terms. We will divide the participants into two groups and take turns to ask questions. If the first group does not answer correctly, the other group has the right to provide their answer. The group with the most correct answers wins. The quiz is a part of the „Green Book of Knowledge", and upon completion of the quiz all participants receive a sheet with the questions.	20 – 25 minutes
Assessment	Final comments and the end of the workshop, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes
Total duration		75 – 90 minutes

Game/activity description:

1. „I was in a special park today!" (protected areas in my region).
   The game objective is to learn more about nature protection and the „Natura 2000" area with the help of the map of Croatia/Slovenia with marked protected areas (national parks and nature parks). The participants will put together their own map, and then present the results in a joint group poster. Upon completion of the activities, we will talk with the participants about nature protection and how they can contribute. The participants will work in a team during the entire activity.
   Terms: nature protection, Natura 2000, national parks (NPs), nature parks (PPs)
   Material: jigsaw puzzle – map of Croatia/Slovenia with NPs, jigsaw puzzle – map of Croatia/Slovenia with PPs, sheets with quiz questions
   Procedure:
   We divide the participants into groups of 4 – 5 persons. Each group will assemble their own jigsaw puzzle. Each jigsaw puzzle has special marks on the back. We hide the jigsaw puzzle pieces in the area at our disposal (e.g. school) and tell the participants to find them and then return to the meeting point where they have to put each part into a corresponding box. When we collect all the parts, we assign each group one jigsaw puzzle (box) which they then have to put together. After they put it together, they have a task to mark national parks or nature parks from their jigsaw puzzles on special sheets which each group member has. Next, each group marks NPs and PPs on the big joint map according to their individual maps thus making a poster with all NPs and PPs areas in Croatia/Slovenia. In the end, connect all of the knowledge about protected areas with Natura 2000 network. (With this way of work, we encourage togetherness, teamwork and orientation towards a shared goal.)
   Material preparation:
   Print out all sheets from the Green Book in as many copies as necessary for the workshop regarding the number of participants. If possible, print out protected areas puzzle templates on a thicker paper and cut them out following the given lines. You can also glue the template to cardboard and then cut it out. Next, mark all the pieces of one puzzle in the same way on the back (e.g. with crosses of different colours). Print out as many maps as the number of

groups you'll have (e.g. for a group of 20 children, divide the children into 5 groups, and print out 3 maps of Croatia with national parks, mark all the pieces of the same map on the back with a different colour, and 2 maps of Croatia with nature parks whose elements should also be marked with a different colour on the back).

2. „Whizz quiz!“
   The game objective is to consolidate the knowledge acquired in the workshop and increase the level of knowledge and awareness of the Natura 2000 area and other protected areas.
   Terms: nature protection, Natura 2000, national parks (NPs), nature parks (PPs)
   Material: poster/board for writing down the score, markers
   Procedure:
   We divide the participants into two groups. We have 10 questions for which we take turns to ask. If the first group doesn't respond, the second group has the right to provide the answer. The group with more correct answers wins. We write down the responses on the poster/board so we could all follow the score.

Single-flowered Saw-wort and Ortolan Bunting (2nd workshop)

ortolan bunting
(*Emberiza hortulana*)

Eastern sub-Mediterranean dry grasslands

single-flowered saw-wort
(*Serratula lycopifolia*)

Basic topic:

Eastern sub-Mediterranean dry grasslands – flora and fauna and the reasons of endangerment. *These habitats are becoming more and more endangered due to the disappearance of human activity (specifically, the cessation of cultivation and mowing), so they are gradually becoming overgrown and turning into forest habitats. Some of the species which have become endangered due to their disappearance are the ortolan bunting and single-flowered saw-wort.*

Key information to be transferred:

- ✓ endangered due to overgrowing of grasslands (habitat disappearance)
- ✓ grasslands in the Učka area are habitats which couldn't survive there without human impact

Topic introduction:

Conversation/discussion questions (example! – we always adapt the questions to the situation and the group!):

- ? Have you ever been to Učka or Ćićarija? What is it like there (e.g. are there forests, meadows, rocky lands)? Have you ever been on a meadow, i.e. grassland? What does that habitat look like?
- ? Have you ever heard for the ortolan bunting?
- ? Have you ever seen this plant (*show single-flowered saw-wort*)? Where?

The course of the workshop (recommendation):

Preschool age (3 – 6 years) and children with special needs (total duration 45 – 60 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with an introduction during which all participants introduce themselves. During the introduction, the participants also state their favourite plant, animal or place in nature.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	10 – 15 minutes

Game (birds-beak) *„Why do I have such a beak?“*	The participants will play the game „Why do I have such a beak?“ through which they will learn more about the adaptations in wildlife. We will divide the participants into groups of 4 – 5 persons, and each group will represent a flock of birds. Each „bird“ in the flock will get a different beak with which they will try to collect as much food as possible.	10 – 20 minutes
Revision (drawing)	Additional clarifications and revisions with real-life examples and the end of the workshop. We will revise the topic by drawing single-flowered saw-wort and the ortolan bunting. (The duration depends on the course of the workshop.)	10 minutes
Assessment	Brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes
Total duration		45 – 60 minutes

Primary school age (1st – 4th/6th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	20 – 25 minutes
Game (birds-insects) *„Birds are looking for food!“*	The participants will play the game „Birds are looking for food!“, in which we will divide them into groups (2 – 4 groups, depending on the available space), and their goal will be to collect as many insects as possible. After the game we draw conclusions about the adaptations of various animals together.	15 – 20 minutes
Game (birds-beak) *„Why do I have such a beak?“*	The participants will play the game „Why do I have such a beak?“ through which they will additionally learn about the adaptations in wildlife. We will divide the participants into groups of 4 – 5 persons, and each group will represent a flock of birds. Each „bird“ in the flock will get a different beak with which they will try to collect as much food as possible. After the game we draw conclusions about the adaptations of various animals together.	20 – 25 minutes
Assessment	Final comments and the end of the workshop, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	10 minutes

Total duration	75 – 90 minutes

Primary school age (5th – 8th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	20 – 25 minutes
Game (birds-beak) *„Why do I have such a beak?“*	The participants will play the game „Why do I have such a beak?“ through which they will learn about adaptations in wildlife. We will divide the participants into groups of 4 – 5 persons, and each group will represent a flock of birds. Each „bird“ in the flock will get a different beak with which they will try to collect as much food as possible. After the game we draw conclusions about the adaptations of various animals together.	15 – 20 minutes
Game (campaign) *„Protect me!“*	We divide the participants into two groups. Each group is assigned a task to make a campaign for protecting a certain species, in this case single-flowered saw-wort or the ortolan bunting, based on the information about the issues related to these species which they have received during the presentation earlier in the workshop.	25 – 30 minutes
Assessment	Final comments and the end of the workshop, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes
Total duration		75 – 90 minutes

Game/activity description:

1. “Birds are looking for food!”

   All organisms are in various ways adapted to the habitat they live in. In the course of evolution, numerous animal species have thus significantly changed their appearance so they could survive in their habitat. The better the organism is adapted to its environment, the likelier it is that it will survive, procreate and pass on its genes to the next generation. Colour in animals has an important role in survival (e.g. mimicry is one of protective adaptations related to colour). During the workshop, the participants will imitate a flock of birds in pursuit of food thus learning through careful observation of the environment around them and working in a group. By observation and consideration through the game, we will draw common conclusions, like the one that it is more difficult to spot those animals which better fit into their environment, i.e. which are better adapted, and that colour has an evolutionary advantage for survival.

Terms: biodiversity, habitat, adaptations
Material: paper insects (bright and dark), scissors, adhesive tape
Procedure:
Before the workshop it is necessary to determine the space which will serve as the „habitat" in which the „flock of birds" will feed. A certain number of insects of various colours should be stuck to the walls and the floor (if the workshop is carried out in open space, the exact path should be determined, and the insects should be allocated on the path). The insects will be the food the participants will have to find. The students should be divided into groups, introduced to the area and explained that they are now birds that feed with insects and that they need to find as much food as possible. They should be given a certain time for feeding (e.g. 5 minutes).
Upon completion, discuss with students how colour affects the ability to find food and talk about mimicry (e.g. meadow insects are most commonly green, but those on the tree bark are dark, etc.) and adaptations for surviving. Through this activity the students learn how to observe carefully and work in a team.

2. "Why do I have such a beak?"
Each habitat has its limited sources and types of food. Animals which are better adapted to various types of food are more likely to survive and to pass on their genes to next generations. On the other hand, some animals are highly specialised for a certain type of food, which is why they adapt their appearance as well. The participants will be able to see that in this game. They will imitate birds with different beaks, and while feeding, they will have to select the type of food which they can most easily reach with regard to their beak. Each participant will get a different tool (spoon, tweezers, clothes peg, scissors, plastic knife) which serves as a beak, and they will collect different food with it (staples, rubber bands, toothpicks, pasta, beans, etc.) into their stomach (plastic cup). At the end of the exercise, the score will be written down in the table and then analysed.
Terms: adaptations, biodiversity, habitats
Material: scissors, spoons, clothes pegs, tweezers, plastic cups, staples, rubber bands, toothpicks, pasta, beans, etc.
Procedure:
We divide the participants into groups of 4 – 5 persons and ask them to sit down in a circle. Then we assign each participant in the group a different tool (spoon, tweezers, clothes peg, scissors, plastic knife) which serves as a beak. Next, we explain to them that they are now birds and that the tool is their beak. The other hand is their wing, they must keep it behind their back and are not allowed to use it as help. Then we throw the first round of food in the middle of the group (e.g. staples) and give the birds 1 – 2 minutes to collect as much food as they can. After that we stop, and the birds count how much food they have collected with their beak and write it down in the shared table (we instruct the younger participants to write down whether they have collected a little or a lot of food whereas older participants may write down the exact number). After the first round we repeat everything with the rest of the food (e.g. rubber bands, toothpicks, pasta, beans). At the end of each round they write down the score. At the end of the game we write down the score on the poster for specific types of beaks and food and analyse the results together. At the same time, we discuss the adaptions of bird beaks to specific food.
At the end we play another round in which we throw mixed food. Depending on the beak, each bird will start collecting food they can most easily pick up, i.e. for which they are specialised.

3. „Protect me! (devising a campaign for species protection)
We present single-flowered saw-wort and the ortolan bunting to the participants and explain why they are endangered and why we should protect them. In addition, we work out all the possible ways for protecting both species and their habitats (see specialised texts).

Next, we divide them into groups and assign a task to conduct research on the selected species and make a campaign for their protection.
Terms: protected species, single-flowered saw-wort, ortolan bunting
Material: scissors, glue, felt-tip pens, posters
Procedure:
We divide participants into groups of 5 – 6 participants. Each group is assigned a task to make a campaign for protecting a certain species, in this case single-flowered saw-wort or the ortolan bunting, based on the information about the issues related to these species which they have received during the presentation earlier in the workshop. We advise them to conduct research on the species and then devise a campaign for their protection which they will present to everyone.

Moehringia tommasinii Marches and Eagle Owl (3rd workshop)

eagle owl
(*Bubo bubo*)

carbonate rocks with
chasmophytic vegetation

Moehringia tommasinii
(*Moehringia tommasinii*)

Basic topic:

Carbonate rocks with chasmophytic vegetation – flora and fauna and reasons of endangerment. *These habitats are becoming more and more endangered because of the increased popularity of activities such as free climbing, due to which the species that used to be unavailable to people and thus protected have become endangered.*

Key information to be transferred:

- ✓ eagle owl – endangered because of disturbances in nesting areas due to free climbing
- ✓ Moehringia tommasinii Marches – endemic to the karst edge
- ✓ Moehringia tommasinii Marches – endangered due to free climbing

Topic introduction:

Conversation/discussion questions (example! – we always adapt the questions to the situation and the group!):

- ? Have you ever seen an owl? How does it look like? And are all owls the same? Have you ever seen this owl (show the photograph of the eagle owl)? Where?
- ? What do you think, is anyone endangering it in nature? Who? How?
- ? How would you protect it?

- ? Have you ever heard of Moehringia tommasinii Marches? What do you think, what is it?
- ? This is how it looks like (*show the plant or the photograph*) – have you perhaps seen it somewhere? Where?
- ? Could you conclude (based on the photograph) where it grows?
- ? It grows on rocks – who could endanger it there? How?
- ? How would you protect it?

The course of the workshop (recommendation):

Preschool age (3 – 6 years) and children with special needs (total duration 45 – 60 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with an introduction during which all participants introduce themselves. During the introduction, the participants also state their favourite plant, animal or place in nature.	10 minutes

Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above)	10 – 15 minutes
Game (jigsaw puzzle) *„Put Moehringia tommasinii together!"*	The participants will have to put together the entire habit from different parts of the plant and place it on a rock, where it usually grows in nature. In addition, they will have to put together an eagle owl from different parts and also place it on a rock where it sometimes nests.	15 – 25 minutes
Revision (tic-tac-toe)	We will revise the topic with the tic-tac-toe game, in which we will use Moehringia tommasinii Marches, the eagle owl and a climber as elements for playing instead of crosses and noughts. (The duration depends on the course of the workshop.)	5 minutes
Assessment	Brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes
Total duration		45 – 60 minutes

Primary school age (1st – 4th/5th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	20 – 30 minutes
Game (owls) *„Find the owls!"*	In the space we have at our disposal we hide 10 owl species (this is the number of registered owl species in Croatia). Each owl has a letter on it. We tell the participants to find all the owls and write down their names on the sheet they have received as well as to mark the letter next to each species. At the end, with the help of letters we try to find the message the owls have brought to us.	25 – 30 minutes
Revision	In the revision we additionally review the most important facts about owls through conversation.	15 minutes
Assessment	Final comments and the end of the workshop, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes

Total duration	75 – 90 minutes

Primary school age (1st – 8th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	15 – 20 minutes
Game (botanists) *„Little botanists"*	In this game the participants will become little botanists and research plant species in their environment. Their task is to bring (or draw) as many different plants as possible (leaves, flowers) which they will store into an herbarium at the end. Once we finish collecting, we will talk about the diversity of plant species and plant adaptations to environmental conditions (e.g. Moehringia has adapted seed dispersal to ants). We divide the participants into groups of 5 – 6 participants.	30 – 40 minutes
Revision	We will revise the topic while observing the collected plants and, on their example, explain the terms related to plant life, with the emphasis on Moehringia tommasinii Marches (and single-flowered saw-wort, the species covered with the project).	15 minutes
Assessment	Final comments and the end of the workshop, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes
Total duration		75 – 90 minutes

Game/activity description:

1. „Little botanists – protectors of Moehringia tommasinii Marches!"
   Biodiversity comprises diversity within specific species, among species, biological communities and habitats. As primary producers, plants make up the foundation of each ecosystem and the entire life on Earth depends on them. In the course of evolution, plant species have adapted to various factors which we can see today in the vast diversity of plant life. A part of that diversity will be observed by researching examples from a nearby meadow (forest, park). The participants will become researchers whose task is to locate and systemise as many plant species as possible and try to guess why they are formed the way they are. Through conversation we will learn why some plant species which grow in the Natura 2000 area have become endangered and how they have adapted to the life in their habitat, with special attention paid to Moehringia tommasinii Marches.
   Terms: adaptations, biodiversity, Moehringia

Material: papers and drawing kit, scissors, dish for collecting materials, herbarium labels
Procedure:
We send the participants to a garden/park with various tasks – to bring (or draw) as many different plants as possible (leaves, flowers). When they return, we talk about the diversity of plant species and plant adaptations (e.g. Moehringia has adapted seed dispersal to ants). We also explain the terms related to plants (root, stem, leaf, blossom, fruit, photosynthesis).

2. „Find the owls!"
There are 10 species of owls registered in Croatia which live in different habitats and different parts of Croatia. In this game we will get to know them.
Terms: eagle owl, owls
Material: cards with 10 owl species, task sheets
Procedure:
Briefly talk about owl species that live in Croatia and give several interesting facts about them. Then tell the participants that the owls have visited their institution and hidden, and that their task is to find them. We give each participant a sheet which will be completed. They have to write down on the sheet the Croatian name of the owl they find and the letter which comes on the card with each owl. When all owls are collected, they are returned to their place. Next, alone or together, depending on the group, the participants try to put together the message from the letters the owls have brought them (the message is „We love owls!").

3. „Put me together!"
The game in which the participants put together paper models of Moehringia tommasinii Marches and the eagle owl and place them in their habitat, vertical steep rocks.
Terms: Moehringia tommasinii Marches, eagle owl, habitat, carbonate rocks
Material: parts of the Moehringia tommasinii Marches habit, parts of the eagle owl, nest, drawing of carbonate rocks
Procedure:
The participants receive parts of Moehringia tommasinii Marches (4 – 5 flowers, plant habit) which they have to put together and subsequently glue on to a vertical carbonate rock which the plant inhabits in nature.
In addition, they receive an eagle owl in several paper parts which they also have to put together and place on a rock, where it nests. Apart from the eagle owl, they also need to place the nest on the rock. After they put everything together, they have a display of vertical carbonate rock habitats inhabited by two protected species they have learnt about through the game.

Griffon Vulture
(4th workshop)

griffon vulture
(*Gyps fulvus*)

Basic topic:

In the second half of the 20th century there was a rapid extinction of griffon vultures in our region. The reasons are numerous, but they are caused by human (in)activity. The largest impact on the extinction are abandoning traditional cattle breeding, disturbances in the nesting areas and poisoning caused by eating poisonous baits.

Key information to be transferred:

- ✓ endangered due to human (in)activities
- ✓ nests in the area of Kvarner and central Dalmatia (NP Paklenica)

Topic introduction:

Conversation/discussion questions (example! – we always adapt the questions to the situation and the group!):

- ? Do you know what a griffon vulture is?
- ? Have you ever seen it? Can you describe what it looks like (*have a photograph and encourage students to observe and describe*)?
- ? Do you see them often? Why not? Why are there so few of them?
- ? Where does it eat? What does it eat?

The course of the workshop **(recommendation):**

Preschool age (3 – 6 years) and children with special needs (total duration 45 – 60 minutes):

Activitys	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with an introduction during which all participants introduce themselves. During the introduction they state their favourite plant, animal or place in nature.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	10 – 15 minutes
Game (nest-egg)	The participants will play the game „Save the griffon vulture!“ in which they will try to save as many griffon	10 – 20 minutes

„Save the griffon vulture!“	vulture eggs as they can by carefully returning them into the nest. For this game we will divide the participants into two groups, and each will have their own nest and eggs which need to be saved.	
Revision (tic-tac-toe)	We will revise the topic with the tic-tac-toe game, in which we will use the griffon vulture and windmills as elements for playing instead of crosses and noughts. (The duration depends on the course of the workshop.)	10 minutes
Assessment	Brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	5 minutes
Total duration		45 – 60 minutes

Primary school age (1st – 8th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (see the example above – we always adapt the questions to the situation and the group!).	20 – 30 minutes
Game (senses – sight) *„Mmm…Look, something smells nice!“*	The participants will explore senses through a game. In the first part we will try to spot the differences and similarities on given sheets with sheep and griffon vultures.	15 – 20 minutes
Game (senses – smell) *„Mmm…Look, something smells nice!“*	The participants will explore senses through a game, focusing on the sense of smell. We will divide the participants into groups of 4 – 5 persons and ask them to sit down in a circle. Next, one by one they receive cards with different scents, and each group writes down on the given sheet which scent that is, or if they do not know, whether they like it or not.	20 minutes
Assessment	Final comments and the end of the workshop, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	10 minutes
Total duration		75 – 90 minutes

Game/activity description:

1. "Rescue griffon vulture!"
   The griffon vulture is our largest bird. By its nature, it is a vulture, which means it feeds with dead animals. In Croatia it only nests on several locations, and it has become endangered because its food source is disappearing (dead cattle), or because the birds get poisoned while eating poisoned carcasses. In addition, they also die because they fall out the nest, collide with windmills, etc.
   Terms: griffon vulture, vultures
   Material: ping pong balls, cardboard box, plastic spoons
   Brief:
   Divide the participants into two groups. Each participant tries to carry the egg in a spoon and place it in the nest (a cardboard box represents the nest). The game objective is to save all the eggs, i.e. to cause as little damage to the eggs as possible during the rescue mission. The group work develops cooperation during the game, as well as love and understanding for nature.

2. "Mmm... look, look, something smells nice!"
   We perceive the world through our senses – sight, hearing, touch, taste and smell. Animals in particular rely on the world of senses and use them in a much larger scope than people, and their survival usually very often depends on the senses, i.e. many animals live, for instance, in complete darkness and rely on the senses such as smell and touch, and they have atrophied eyes because they have no use of the sense of sight in such an environment. In these activities we will partially explore two out of five senses: sight and smell. We will try to understand the importance of senses in wildlife, especially sight on which the griffon vulture relies in order to find food and smell because vultures have the most developed smell out of all birds.
   Terms: senses
   Material: spot the difference sheet, word search, scented cards with various scents (essential oils and various scents, e.g. lavender, mint, almond oil, olive oil, etc.), task sheet
   Procedure:
   In the first part we give the participants the sheets with differences and certain time to spot them. After that we hand them out the word search they will also have to complete within a certain time. Next, we remind them of the importance of sight for the griffon vulture and that this is the sense it uses to find food.
   In the second part we prepare five scented cards. We put 1 – 3 drops of each scent (e.g. mint, lavender, almond oil, olive oil, water, i.e. we leave one paper unscented). We divide the participants into groups of 4 – 5 persons. We give 1 sheet to each group (or each participant, depending on the group). Then we give the first scented card to each group. We instruct them to take it slowly up to their nose and smell the given card after which they have to guess the scent together. If they cannot figure it out, let them write whether they like it or not, and what it reminds them of. Then they return the first scented card, and we repeat everything with the rest of the cards. After they have smelt all the scented cards, we check together which scents were involved, whether they know them or not.

Be the Protector of Nature 2 (human activity) – Why is nature endangered?
(5th workshop)

Basic topic:

Human activities which endanger nature.
Human activity is sometimes pernicious to nature and environment. Thus, there are various regulations as well as codes of conduct in nature whose aim is to preserve it and reduce detrimental influences of human activities. Through the workshop, we will elaborate their role and explain how to behave in nature in order to protect it.

Key information to be transferred:
- ✓ we need to preserve nature, man cannot survive without it

Topic introduction:

Conversation/discussion questions (example! – we always adapt the questions to the situation and the group!):
- ? What would you say, what is nature? Why is it important to protect nature, plants and animals?
- ? In what ways do we protect nature, plants and animals? How do you protect them?

The course of the workshop **(recommendation):**

Preschool age (3 – 6 years) and children with special needs (total duration 45 – 60 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves. The participants are given name tags which they attach to their clothes with the help of the workshop presenter. During the introduction, the participants also state their favourite plant, animal or place in nature.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	10 – 15 minutes
Game (*memory game*)	The participants will play a memory game with images related to human activity and NATURA 2000 and other protected areas.	15 – 25 minutes

Assessment	Brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	10 minutes
Total duration		45 – 60 minutes

Primary school age (1st – 4th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	15 – 25 minutes
Game (board) *„Don't stomp on me, man!"*	The participants will play an appropriate game with terms and species related to the project area and issues. The goal is to reach the finish as soon as possible.	35 – 45 minutes
Assessment	Final comments, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	10 minutes
Total duration		70 – 90 minutes

Primary school age (5th – 8th grade) (total duration up to 90 minutes):

Activity	Short description:	Approximate duration (recommendation):
Introduction	The workshop starts with the introduction during which all participants introduce themselves, they receive tags on which they write down their names and which they attach to their clothes.	10 minutes
Topic introduction (presentation and conversation/discussion questions)	The presenter then introduces the topic (title and short description) and starts a conversation with the participants in order to assess their level of knowledge and further course of the workshop. The duration of this part depends on the group. Then he/she presents the topic in more detail through the presentation and conversation. *Conversation/discussion questions* (above).	20 – 30 minutes
Game (hotel) *„Insects need a hotel, too!"*	The participants will make an insect hotel according to the instructions and with the help of the presenter.	35 – 40 minutes
Assessment	Final comments and the end of the workshop, brief conversation about the workshop, feedback from the participants and, at the end, cleaning up the space and used items.	10 minutes

Total duration	75 – 90 minutes

Game/activity description:

1. "Insects need a hotel, too!"

   Insects are one of the most important factors for preserving natural balance on meadows and in forests, as well as on fields and in our gardens. They assist plants in pollination and creating fruits, and they also serve as food for birds. In winter they hide in their lairs in order to survive. For this purpose, we will make a hotel in which they will be able to survive all winter adversities in peace. All we need is a little bit of skills and some materials and tools, and in return we will get numerous benefits through a much nicer and richer garden (as well as the ecosystem in which we live). By doing this we will also increase the number of insects in our garden or another habitat where we place the hotel, and we will also help ourselves to get to know these marvellous creatures in an easier way!

   Brief: Make a small insect hotel which the participants will be able to take with them and put in appropriate places in their surroundings.

   Terms: pollination, insects, solitary bees

   Material: bamboo sticks of various diameters, rope, string, wooden box, small wooden boards, bricks with holes, kindling, branches of various diameters, augers of various diameters (or drills), hammer, nails

   Procedure:

   With the help of adults, make a simple shelf with a roof in which you will then put other compartments. Make holes of various diameters in the prepared branches by using hand augers (or let the presenter do it with an electric drill). Tie the bamboo sticks with a string into bundles of various diameters. Use bamboo sticks of various diameters for each bundle. Put the prepared branches and compartments made of bamboo sticks onto a shelf and affix additionally. Do not touch the shelter for about a week or two, and after that observe which insects have moved in and where.


Examples of different types of insect hotels *(photographs from the Internet)*.

2. "Don't stomp on me, man!"

   Human activity is sometimes pernicious to nature and environment which is why there are various regulations as well as codes of conduct in nature whose aim is to preserve nature and reduce human influences. This game will help us to acquire more easily some of the rules required for protecting species at the karst edge, as well as to get to know better what actually endangers them. We will also learn how to behave in nature in order to protect it. Let's play the game and be careful not to stomp on someone!

   Brief: Board game with dice in which different spaces have meanings related to nature protection.

   Terms: nature protection

   Material: board game, pawns, dice

   Procedure:

   To play the game, roll the dice and move the pawns on the board for the number rolled. Follow the instructions based on the space you land on. The first person to reach the finish

space wins. While moving, the participants can have positive or negative impact on nature, and as a result, they can go extra spaces ahead or back, depending on the impact. The rules are attached to the game.

Carbonate rocks with Chasmophytic Vegetation (workshop A)

A family workshop in which we focus on the carbonate rock habitat and therefore use the activities from the workshop 1, 3 and 5.

The duration of the workshop is 4 hours.

Eastern Sub-Mediterranean Dry Grasslands (workshop B)

A family workshop in which we focus on the sub-Mediterranean dry grassland habitat and therefore use the activities from the workshop 1, 2, 4 and 5.

The duration of the workshop is 4 hours.

Green Book of Knowledge

After each workshop, the participants will keep the sheets and materials they have used which they will be able to file in a map that will eventually make up the „Green Book of Knowledge“.

APPENDICES

Specialized texts

a) Natura 2000 Ecological Network (1st and 5th workshop)
b) Eastern Sub-Mediterranean Dry Grasslands (2nd workshop)
c) Single-flowered Saw-wort (2nd workshop)
d) Ortolan Bunting (2nd workshop)
e) Moehringia tommasinii Marches (3rd workshop)
f) Eagle Owl (3rd workshop)
g) Griffon Vulture (4th workshop)

Ecological Network Natura 2000 of the Republic of Croatia and the Republic of Slovenia

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1. Introduction

Nature or environmental protection has changed its forms and definitions throughout the course of history depending on the way in which man depended on nature. Nature protection presents a human activity directed at preventing, reducing or removing damages incurred against the environment in which man dwells, from which he exploits resources or which he impacts with his activity. In addition, it presents human activity for maintaining undisturbed development and natural circulation of nature by primarily using biological solutions without a direct interference of man's interests or needs (Tišma et al., 2009; Grgić and Varga, 2013).

A protected area (PA) is: "*A clearly defined geographical space which is recognized with a purpose and which is managed with the aim to permanently conserve the entire nature, eco-system services it ensures, and corresponding cultural values, in a legal or any other efficient manner" (*International Union for Conservation od Nature, IUCN*).* C. 15% of Earth's surface is covered with areas of various protection categories. Protected areas are significant due to natural, economic and social factors. E.g., protected areas hold 15% of the world's carbon supplies, 10% of potable water, and they support the existence of over 2 billion people in a direct interaction (Pešić et al., 2017).

Table 1. Categories of protected areas in the Republic of Croatia (CAEN, CAEN protected areas, 2019)

Protection category	Purpose	Management level	Promulgated by
Strict reserve	conserving original nature, monitoring nature condition and education	state and county	The Government of the Republic of Croatia
National park	conserving original natural values, scientific, cultural, educational and recreational	state	Croatian Parliament
Special reserve	conservation due to its uniqueness, rarity or representativeness, and of particular scientific importance	state, county, municipal, city	The Government of the Republic of Croatia
Nature park	protection of biological and landscape diversity, educational, cultural and historic, tourist and recreational purpose	state	Croatian Parliament
Regional park	protection of landscape diversity, sustainable development and tourism	county	representative body of the competent regional self-governing unit
Natural monument	ecological, scientific, aesthetic or educational	county and municipal	representative body of the competent regional self-governing unit
Significant landscape	protection of landscape value and biological diversity or cultural and historic value or landscape of conserved unique features, rest and recreation	county and municipal	representative body of the competent regional self-governing unit

Forest park	conserving a natural or planted forest of a higher landscaping value, rest and recreation	county, municipal and city	representative body of the competent regional self-governing unit
Park architecture monument	conserving artificially formed area i.e. a tree trunk of aesthetic, stylistic, artistic, cultural and historic, ecological or scientific value	county	representative body of the competent regional self-governing unit

All countries in the world have a defined system of protected areas. In the Republic of Croatia there are nine categories of protected areas, and they are: strict reserve, national park, nature park, special reserve, regional park, natural monument, significant landscape, forest park and park architecture monument. Further information on each category is given in Table 1. Protected areas of state importance are: strict reserve, special reserve and nature park. A strict reserve is *"an area of the mainland and/or the sea with unaltered or insignificantly altered overall nature (...)"*, whereas a national park is *"a spacious, predominantly unaltered area of the mainland and/or the sea of extraordinary and multiple natural values (...)"* (OG 80/13, 15/18). The first proclaimed national park in the world was Yellowstone in 1872, and Engadin in 1902 in Europe.

The Republic of Croatia has adopted a series of legal regulations and complied with environmental protection standards. These regulations refer to air and water contamination, chemicals, waste management, biotechnology, protection from radiation and conservation of natural sources (Vlašić and Vlašić Feketija, 2006), and they were adopted with the aim to ensure ecologically sustainable development of the country. The umbrella law is *The Environmental Protection Act* (OG 80/13, 153/13, 78/15, 12/18, 118/18).

According to the *Register* of *Protected Areas* (CAEN, Register of Protected Areas, 2019), under the competence of the Directorate for Nature Protection of the Ministry of Environment and Energy (MEE), there are 450 protected areas in total in the Republic of Croatia, out of which there are: 2 strict reserves, 8 national parks, 83 special reserves, 11 nature parks, 2 regional parks, 116 natural monuments, 79 significant landscapes, 36 forest parks and 122 park architecture monuments. National parks and nature parks comprise almost 6% of the Croatian land area. Among the protected areas, the following stand out: strict reserves (Hajdučki and Rožanski kukovi and the white and Samarian rocks) and national parks (Brijuni, Kornati, Krka, Mljet, Paklenica, Plitvice lakes, Risnjak and the Northern Velebit).

Many systems of spatial data related to nature and environmental protection have been created in the Republic of Croatia thus far, e.g. Bioportal – web portal of the Information system for nature protection or the interactive map of geological and biological tourist sites in Croatia. The interactive map of all PAs may be found on (Bioportal, 2019), and a detailed list per category in Table 2.

The Republic of Slovenia has one national park (*Triglav*), two regional parks (*Kozjanske jame* and *Škocjanske jame*) and one nature park (*Sečoveljske solane*). The interactive map of PAs may be found on the following *link*.

Table 2. Protected areas in the Republic of Croatia. Data source: Register of Protected Natural Values, on 23rd June 2008, PA – protected areas, AUPP – areas under preventive protection, TPA – total protected areas (OG 143/2008, 2019)

Category	Number			Land (km^2)	Sea (km^2)	Total (km^2)
	PA	AUPP	TPA			
Strict reserve	2	0	2	24	0	24
National park	8	0	8	743	219	96135
Special reserve	79	4	83	324	530	853
Nature park	11	0	11	4063	179	4242
Regional park	0	2	2	1478	121	1600
Natural monument	116	0	116	3	0	3
Significant landscape	78	1	79	881	0	881
Forest park	35	1	36	89	0	89

Park architecture monument	121	1	122	10	0	10
TOTAL	450	9	459	7613	1049	8663
Parts under protected areas				1205		1205
TOTAL				6408	1049	7457
Percentage of protected areas in the Republic of Croatia				11	3	9

2. Natura 2000

With the aim to organize long-term environmental protection as an issue that should be addressed at the global level even though it is based on local issues (Vlašić and Vlašić Feketija, 2006), the EU member states initiated the creation of the ecological network Natura 2000. Natura 2000 does not depend on national, political and administrative borders, and its fundamental task is to respond to the requirements of conserving biodiversity in Europe which has been undermined over the past few decades (Grgić and Varga, 2013).

The Natura 2000 comprises two types of areas (European Economic Community, 1992, link, OG 124/13, 105/15, 80/19):

- areas significant for conserving and achieving a favourable state of wild bird species which are of the EU interest, as well as their habitats, and areas significant for conserving migratory bird species (bird conservation areas - BCA),
- areas significant for conserving and achieving a favourable state of other wild species and their habitats (species and habitat types conservation areas - SHCA).

BCA areas are also called Special Protection Areas – SPA in literature, whereas SHCA areas are known as Special Areas of Conservation – SAC, SCI.

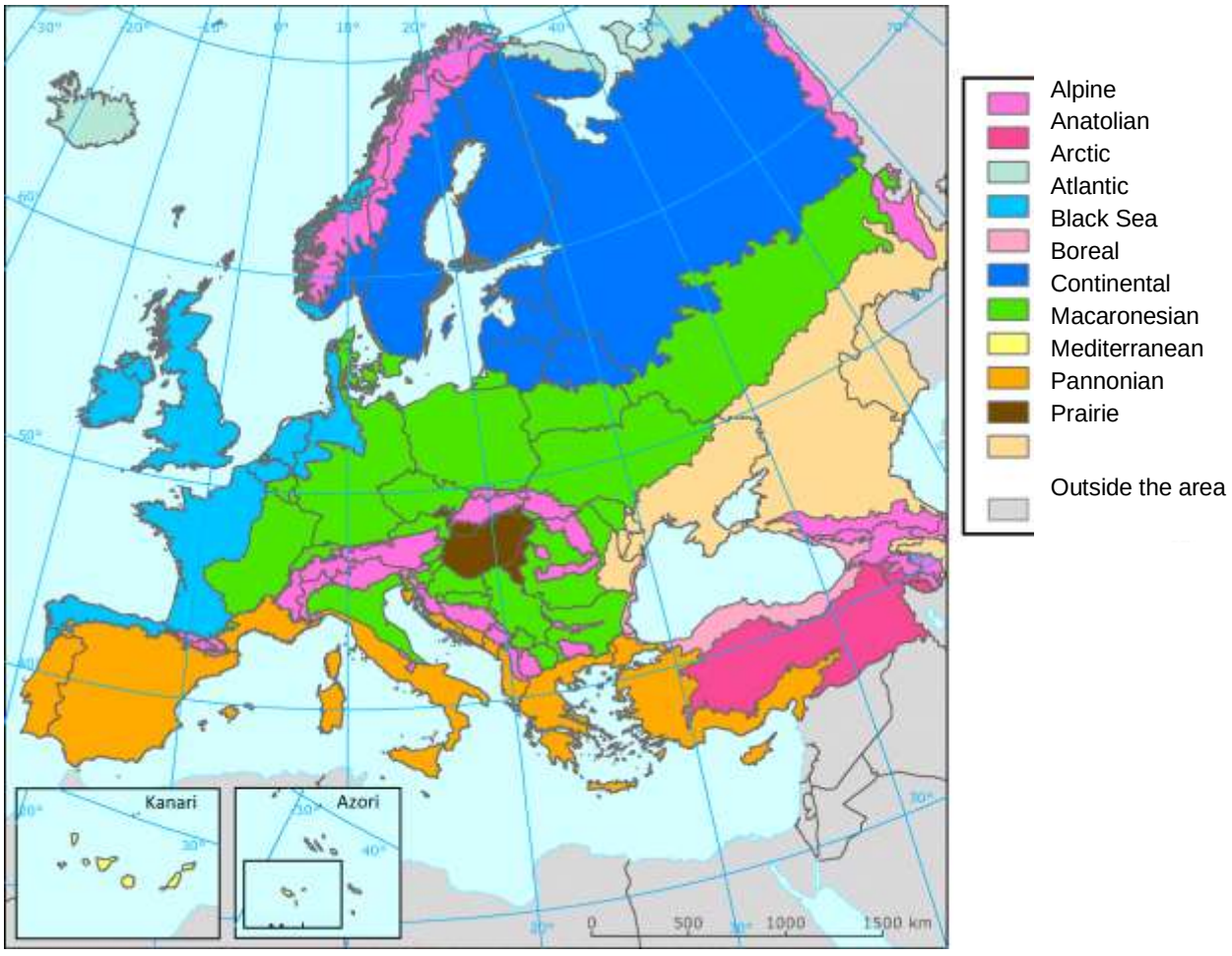

Figure 1. Natura 2000 areas (downloaded from the link, 27th November 2019)

The legislature grounds for creating the Natura 2000 network consist of two directives: *The Birds Directive* (European Parliament, 2009) and *The Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna* (European Economic Community, 1992). *The Birds Directive* of the European Community Council was adopted in 1979 in order to prevent a rapid drop in migratory birds' diversity. The EU member states independently define special protection areas. The European Union adopted *The Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna* in 1992 with the aim to expand the scope of protecting wildlife with regard to the species protected by *The Birds Directive.* It comprises over 2000 animal species and over 230 habitat types which are included in the special areas of conservation (*SAC*). Both directives regulate the activities which may be implemented regarding the plant and animal life in the Natura 2000 areas. For instance, the stated directives clearly restrict hunting and trading with the species under the areas of special importance (Duplić at al., 2012; Grgić and Varga, 2013).

The European Union is divided into nine biogeographic land regions. Each region is characteristic for its vegetation, climate, topography and geology, and they are: Alpine, continental, Mediterranean, Pannonian, prairie, Boreal, Atlantic, Black Sea and Macaronesian (Figure 1), out of which three span Croatia entirely or partially: Alpine, continental and Mediterranean (see link). Each EU member state is obliged to include in the Natura 2000 network the most important areas for each individual species and habitat type listed in the corresponding appendices to the directives. With the expansion of the European Union and the discovery of new endangered species and habitats in the European territory, the ecological network Natura 2000 continuously expands as well. For each protected plant or animal species and the habitat listed in the Directive appendices, each member state proposed areas which should be included under the special areas of conservation of the ecological network Natura 2000 in the form of pSCI areas (Proposed Sites of Community Importance) (ibid.).

There is a difference among the protected areas of a certain country and Natura 2000 areas. Natural reserves, national parks and other areas protected at a national or regional level are established and regulated by a national regulation, which differs from one country to another. Such areas may, but they do not have to constitute a part of Natura 2000 areas. On the other hand, areas for the Natura 2000 network are chosen based on scientific parameters and are implemented in accordance with the selection criteria prescribed in the two stated directives. This way Natura 2000 areas shall only be the most eligible areas to ensure long-term conservation of each species and each habitat listed, across their natural range within the EU (ibid.).

The Natura 2000 network comprises over 27 000 areas which cover the total area of c. 1,150,000 km^2 of land and maritime areas of all EU member states. This makes it the largest network of conserved areas in the world. The total area covered by the Natura 2000 network is c. 18% of the total EU land area. National coverage by the Natura 2000 network areas ranges from 9% to nearly 38% depending on the state.

Table 3. The list of NATURA2000 areas in the Republic of Croatia, the Republic of Slovenia and the European Union (downloaded from the link, 24th November 2019)

Country	Area code	No. of areas	Country surface (%)
CRO	SHCA	741	28.3
	BCA	38	30.1
	SHCA + BCA	779	36.6
SLO	SHCA	324	32.7
	BCA	31	25.0
	SHCA + BCA	355	37.8
EU	SHCA	24194	13.8
	BCA	5646	12.5

	SHCA + BCA	27863	18.0

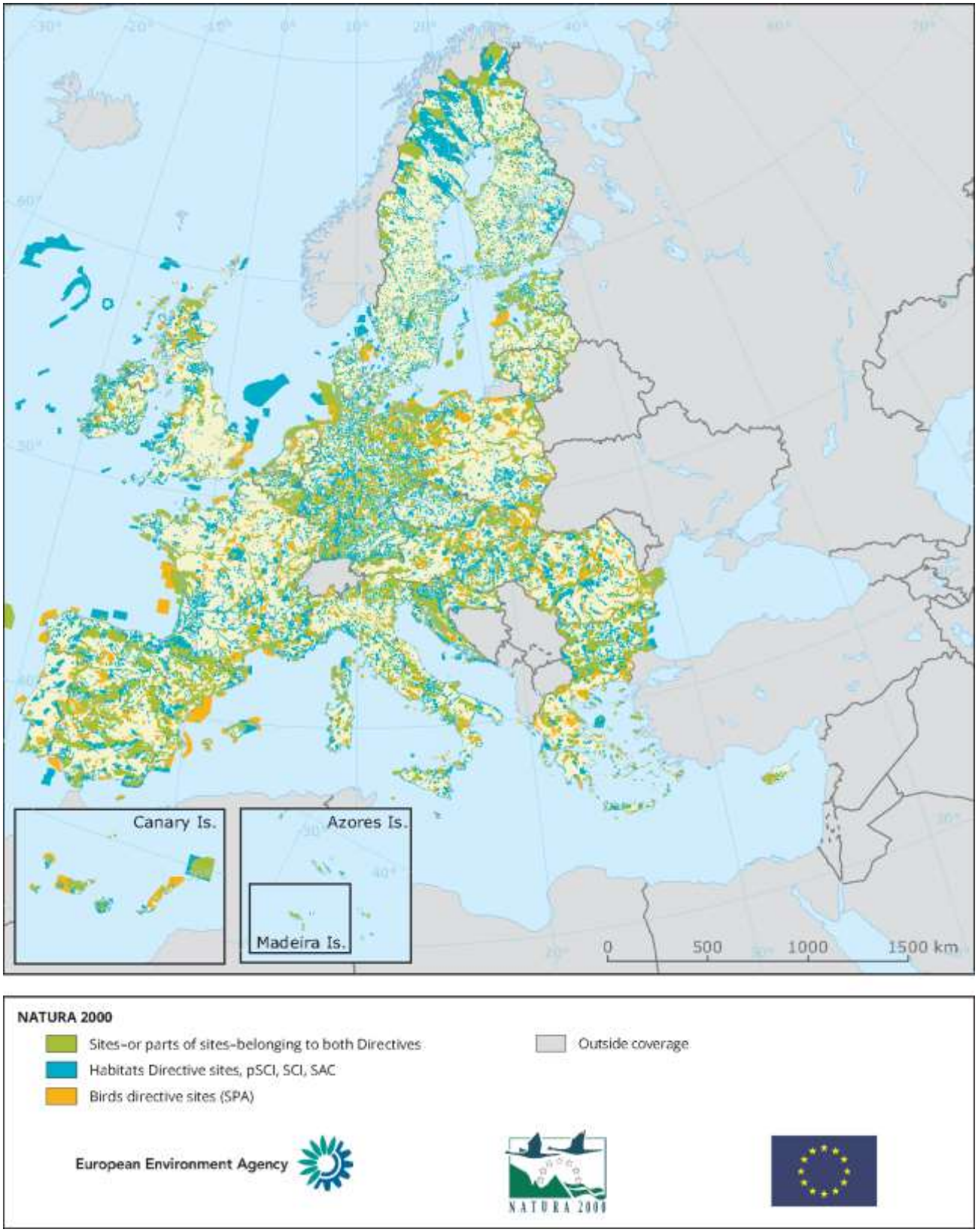

Figure 2. The map of Natura2000 areas in Europe (downloaded from the link, 24th November 2019)

The Natura 2000 network is reflected through a solidarity principle among the member states, and it requires financial investments to be fully operational (link). Thus, the requirements for managing the Natura 2000 network are integrated into various sources of EU funding, such

as structural and social funds and regional development funds (ESF and ERDF), the Fund for Rural Development (EAFRD), the European Maritime and Fisheries Fund (EFF), program LIFE, etc.

Natura 2000 in Croatia and Slovenia

The procedure for proposing special conservation areas (pSCI) includes complex procedures of evaluating a certain geographical area based on biological values, the level of conservation and spatial characteristics in accordance with *The Habitats Directive* guidelines (Grgić and Varga, 2013).

In the Republic of Croatia, the initial selection of SPA areas was made by the Institute for Ornithology of the Croatian Academy of Sciences and Arts in cooperation with the State Institute for Nature Protection (SINP) while preparing the Ecological Network of the Republic of Croatia which was adopted by the Government of the Republic of Croatia in 2007. The proposal for SPA network areas was amended with species of national importance for which there were distribution data on in the form of distribution maps required for making Red Books. The IUCN (International Union for Conservation of Nature) endangerment categories CR (critically endangered species), EN (endangered species) and VU (vulnerable species) were taken into consideration, as well the data from several Red Books by Croatian authors (Duplić et al., 2012; Grgić and Varga, 2013).

The proposals for special conservation areas and special protection areas were consolidated into a group of spatial data for the ecological network Natura 2000 proposal. The SINP was responsible for its creation as an institution dealing with professional activities for nature and environmental protection according to the *Nature Protection Act*. The making of proposal started in 2001 through the *Emerald Network* project of the *European Environment Agency – EEA* which laid the foundation for establishing spatial database of protected areas. Plant and animal species of interest and their distribution were defined within this project, so the distribution maps for selected species and habitat types were made. Carrying out of the *Emerald Network* project established *Areas of Special Conservation Interest – ASCI* which became potential areas of the Natura 2000 ecological network (Duplić et al., 2012; Grgić and Varga, 2013).

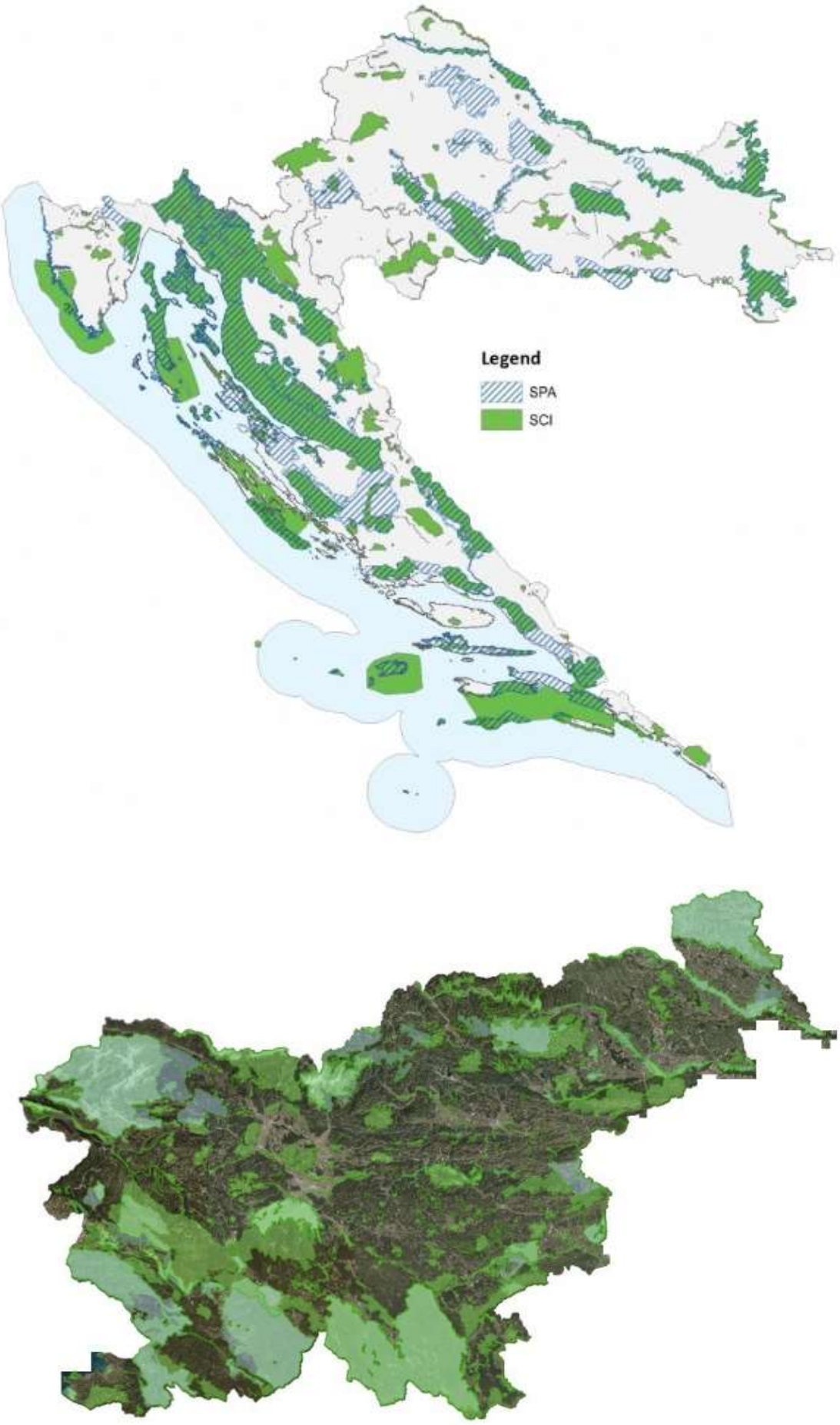

Figure 2. Natura 2000 areas in the Republic of Croatia (above, downloaded from the link, 24th November 2019) and the Republic of Slovenia (below, downloaded from the link, 25th November 2019)

From 2002 to 2006 spatial and other data obtained through the *Emerald Network* project were amended and updated during the projects for establishing the national ecological network LIFE III and establishing the ecological network Natura 2000. Thus, the base of spatial data and the corresponding metadata was created, which was eventually integrated into the proposal for protected areas of the ecological network Natura 2000 in the territory of the Republic of Croatia. In order to complete the spatial data of the proposal for the ecological network Natura 2000, and due to insufficient data on maritime areas which were supposed to be included into the ecological network because of their biodiversity, the SINP implemented the project *IPA 2007 – Identification and setting-up of the marine part of Natura 2000 network in Croatia – Marine Natura 2000*. Even though significant funds were invested in mapping of the areas of interest within the project, a part of the sea, especially outside the territorial sea boundaries, was left unexplored, and it will have to be mapped in the future once the funds and technical conditions have been ensured. The final proposal of the Natura 2000 network was obtained within the framework of the *PHARE* project and with the funding through the state budget, in which the agreements on the boundaries of the ecological network areas were made through on-site inspections and coordination at local levels. In its procedure of the EU accession, the Republic of Croatia asked for the amendment to *The Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna* with 13 species of plant and animal life (Balkan snow vole, Mosor rock lizard, meadow viper, Dalmatian barbelgudgeon, soft-muzzled trout, common nase, minnow-nase, Neretva dwarf goby, Adriatic dace, Makal dace, Dalmatian ringlet, Degenia velebitica, and sharp-snouted rock lizard) and two habitat types characteristic for the territory of the Republic of Croatia (travertine barriers of karst rivers and sub-Mediterranean grasslands of Molinio-Hordeion secalini) (Duplić et al., 2012; Grgić and Varga, 2013).

Figure 3. Endangered and protected animal species: grey wolf (*Canis Lupus*), Euroasian lynx (*Lynx lynx*), brown bear (*Ursus Actos*) (all images were downloaded from the link, 27th November 2019)

Figure 4. Protected natural species: Degenia velebitica (*Degenia Velebitica*), edelweiss (*Leontopodium alpinum*), bearberry (*Arctostaphylos uva-ursi*) (all images downloaded from the link, 25th November 2019)

The Natura 2000 areas in the Republic of Croatia were officially promulgated on the 26th September 2013, when the Government of the Republic of Croatia issued *The Regulation on the Ecological Network* (OG 124/13). The areas comprise c. 37% of the Croatian land area and 15% of the Adriatic Sea. There are 38 bird conservation areas (BCA), and 743 species and other habitat types conservation areas (SHCA). The GIS viewer of all areas can be found here.

The share of surface area covered by the Natura 2000 network with respect to the country surface is in accordance with the average of the EU member states for the continental part of Croatia. Karst area, known for its biodiversity, stands out from the European average with the surface share of the proposed network in the total surface, so the Republic of Croatia has a larger share of proposed areas for conserving nature and environment with respect to the EU average (Grgić and Varga, 2013).

The Natura 2000 network in the Republic of Slovenia

In the Republic of Slovenia there are 355 Natura 2000 areas, out of which 31 are BCA and 324 SHCA confirmed on 3rd December 2014. The total surface area comprises 7681 km^2 (which accounts for c. 38% of the total surface), out of which there are 7675 km^2 of land and 6 km^2 of sea.

The Republic of Slovenia and the Republic of Croatia border with 24 NATURA 2000 areas - 3 BCA areas and 21 SHCA areas, and these are: Učka and Ćićarija, Gorski Kotar and Northern Lika, Drava accumulations, Argile, meadows along the Malinska creek, Pregon, Žbevnica, Gomance, the Gerovčica creek, NP Risnjak, the Kupa river, Velika Belica, the Mala Belica creek, the surrounding area of the Kupa river, Kupa kod Severina, the Vrlovka cave, Žumberak, Samobor Hills, the Bregana creek, the Sutla river, the Sutla kod Razvora valley, Drava accumulations and the Mura river (Miholić, 2014).

3. Managing protected areas

Protected areas are managed in accordance with legal regulations of each country in a way that the country grants a concession for each individual activity. In some countries, managing concessions in protected areas is a comprehensive operation which employs a large number of people and ensures substantial funds for protected areas (e.g. the USA or Australia). The concession may refer to a lease, licence or easement for an activity, and it may be issued for various periods of time (Pešić et al., 2017). The concession in the Republic of Croatia is granted based on a public tender in accordance with *The Concessions Act* (OG 69/17). The decision to grant a concession is issued by the Ministry of Environment and Energy (MEE) for national parks and special reserves and nature parks, whereas the areas of various categories of protected nature are regulated by *The Nature Protection Act* (OG 80/13, 15/18, 14/19), and the concessions are granted by local and regional self-governing units. The notifications and calls for the intent to grant a concession, apart from the data prescribed by *The Concessions Act*, must also contain the nature protection requirements which they determine. A concession may be granted in a national park, special reserve and speleological object. In a nature park, regional park, forest park, significant landscape and park architecture monument, a concession may be granted in accordance with a special regulation with the MEE's opinion. Nature protection requirements are a constituent part of the decision to grant a concession and the concession agreement (Pešić et al., 2017).

All activities, which a concession enables in protected areas, impact the area, and all potential impact must be analysed in order to avoid negative consequences. Environmental impact assessments (EIA) have become a legal obligation in the world for planning projects in protected areas. The environmental impact assessment procedure is a constituent part of the process for granting concessions in protected areas, their audits and possible extensions (Pešić et al., 2017).

With regard to the average increase in the number of visitors in protected areas, legislators improve management plans in order to avoid potential permanent environmental devastations and ensure resource sustainability. One of the indicators in making plans for managing protected areas is the so-called *Tourism Carrying Capacity* (TCC), i.e. the maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction (Thompson et al., 2014; Pešić et al., 2017). The three TCC levels are (ibid.):

- Physical carrying capacity – the limit above which activity increase leads to unacceptable degradation of natural and cultural resources of the destination.
- Economic carrying capacity - the limit above which the growth becomes economically unacceptable because it has a negative impact on the local economy.
- Social carrying capacity - the limit above which there is a rapid decrease in satisfaction and/or unacceptable harmful impact of the visitors on the local community.

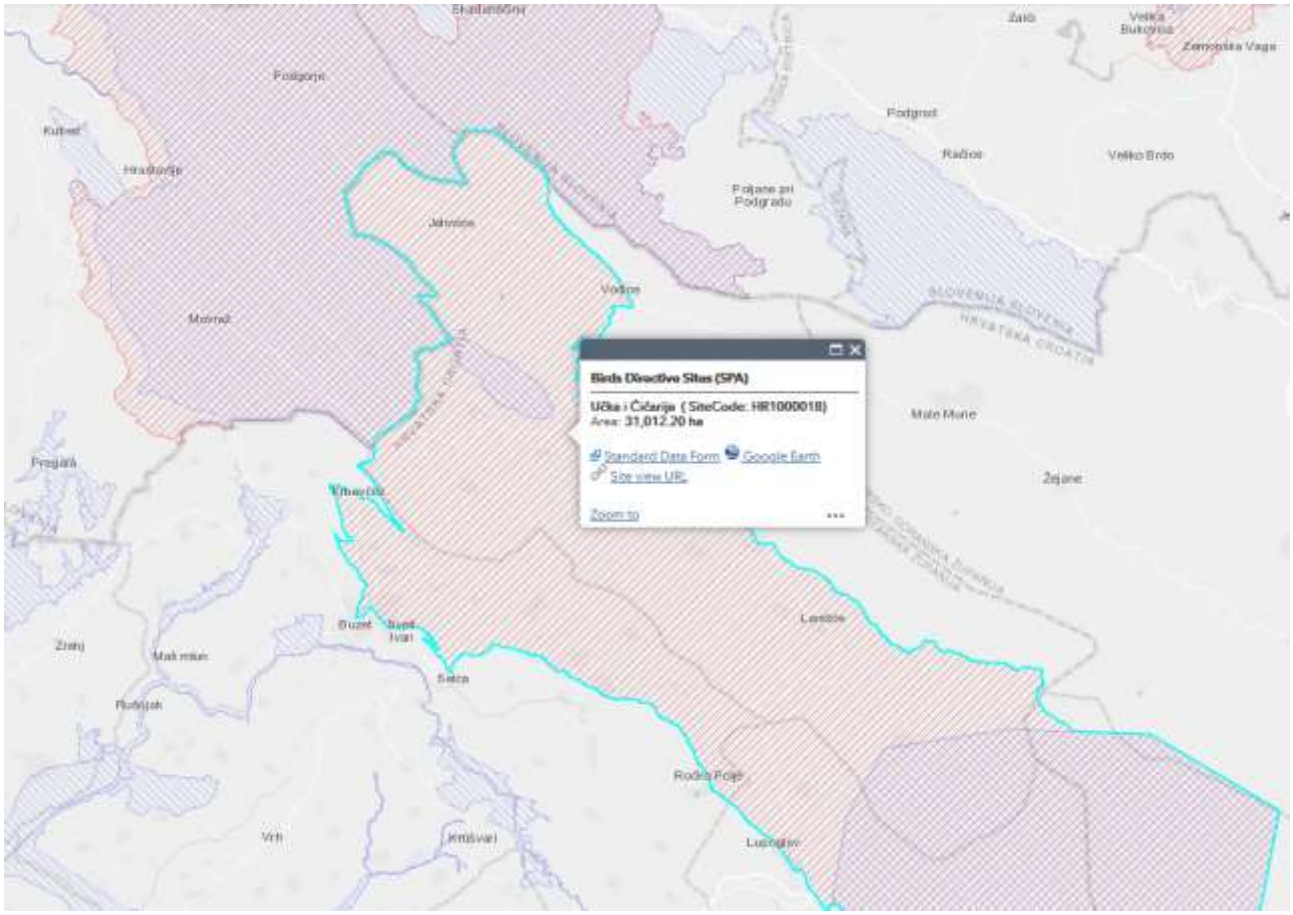

Figure 5. The map of the Natura2000 areas of Učka and Ćićarija (downloaded from the link, 24th November 2019)

4. Mechanisms for protecting natural values

The principles of sustainable use of natural resources are applied through procedures for prescribing nature protection requirements prescribed in the appropriate assessment of planning documents (strategy, plans and programs), as a part of strategic environmental impact assessment or through separate procedures, and they refer to the values of protected areas, strictly protected species, and endangered and rare habitat types. Specific requirements for nature protection are prescribed by the MEE as proposed by the Croatian Agency for Environment and Nature or a competent administrative body of a regional self-governing unit (link). For planned individual interventions, nature protection requirements are prescribed with the following procedures (link):

- obtaining building acts – a part of the appropriate assessment of the intervention,
- obtaining acts for building in a protected area,
- obtaining licenses for interventions in a protected area and for research in a protected area,
- obtaining a decision to grant a concession.

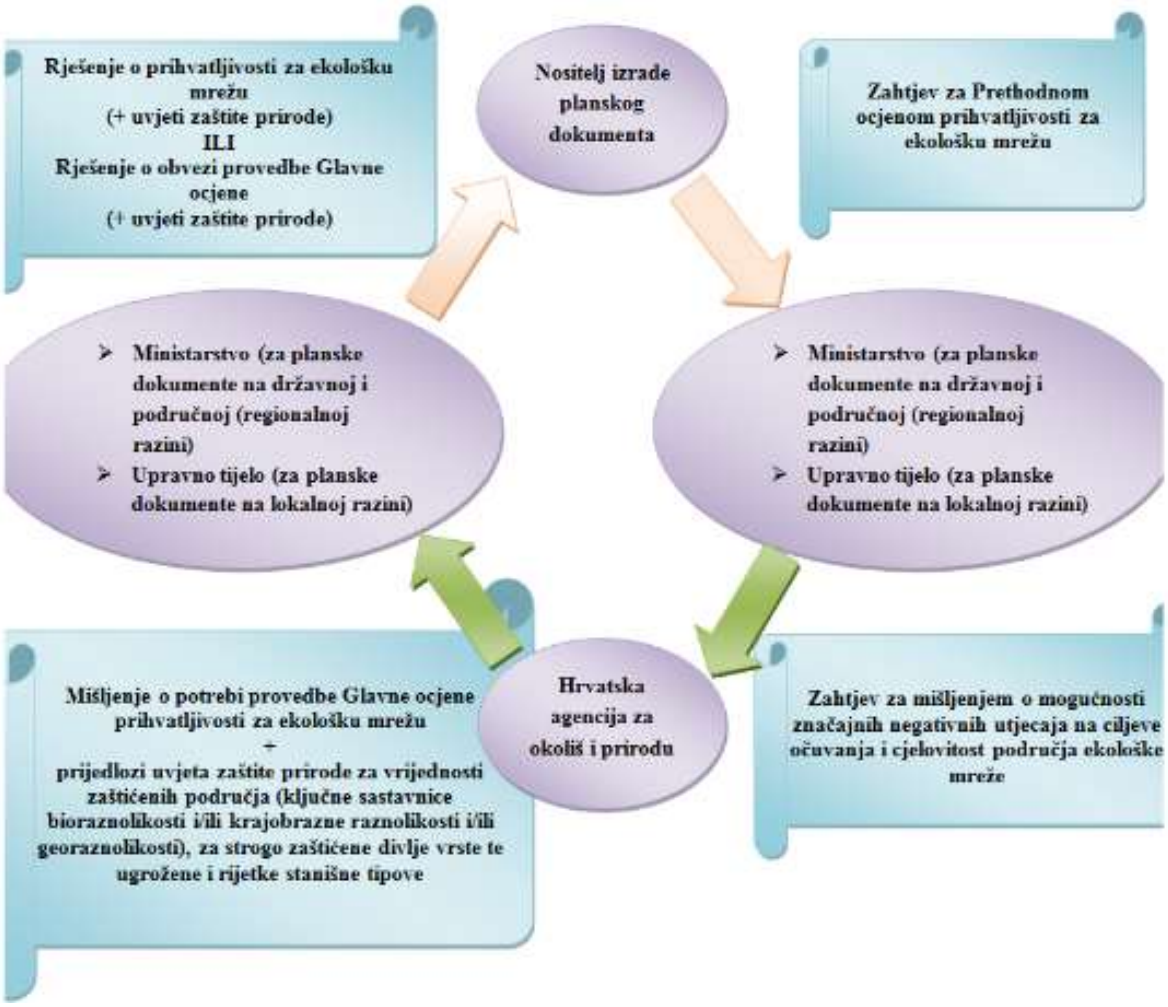

Figure 6. Sustainable use of natural resources through nature protection requirements in the appropriate assessment of planning documents (downloaded from the link, 26th November 2019)

5. Human activity at the Karst edge area

Although many protected areas have been established with the aim to protect the landscape value, wildlife and biodiversity, human activity is, of course, expected there as well, e.g. soil fertilization or crop plantation. The fact that man is a constituent part of nature is taken into account in protected areas, which includes the fact that the prescribed economic, tourist, educational or recreational activity is allowed under conditions determined by the legislator and/or the concession holder. This includes activities such as: hiking and climbing tours, swimming, cycling, kayak, rafting, hunting and fishing. In addition, ski resorts, adrenaline sports, accommodation capacities and economic activities such as beekeeping or mining are generally allowed in protected areas. However, it is crucial that human activities are used reasonably in order to ensure that the habitats of plant and animal species are not destroyed (link).

In numerous areas, the survival of the present animal species and habitats may entirely depend on the continuation of economic activities. for instance, for a survival of a certain species it is sometimes necessary to increase the number of haying or grazing activities. In certain cases of the Natura 2000 areas, it will be necessary to make adjustments in order to protect the species and habitats for which the area was determined even though in a large number of cases the existing activities are carried out in the same manner as they had been before a certain area was proclaimed the Natura 2000 area (link).

Human activities which are allowed and prohibited in protected areas are listed in continuation (all according to the link).

Walking and staying in parks

- it is prohibited to:
  - enter without an entrance ticket
  - drive or park outside the areas intended for that purpose
  - climb on cliffs
  - camp (except in areas foreseen for that purpose)
  - keep pets out of control

Starting a fire, littering, noise, carrying weapons, park equipment

- it is prohibited to:
  - start a fire (except in areas foreseen for that purpose)
  - litter and throw cigarette butts
  - create excessive noise
  - bring fire and other weapons
  - damage park equipment

Local inhabitants, park staff and park activities

- it is prohibited to:
  - take videos or photographs for commercial purposes without an approval
  - carry out a tourist, hospitality or commercial activity without a concession approval
- it is necessary to announce and obtain an approval if the visitors would like to carry out specific recreational activities (e.g. paragliding, hang gliding, climbing)

Plants, animals, mushrooms, environment, minerals, fossils, caves

- it is prohibited to:
  - pick, collect, damage or destroy plants and mushrooms
  - feed, chase off, pursue, scare, disturb, hunt, collect or injure animals
  - damage animals' nests and holes
  - collect snails and mushrooms
  - pick herbs
  - contaminate watercourses, water sources and tanks
  - contaminate air, soil and water
  - destroy protected minerals and fossils
  - contaminate, destroy and remove speleothems, living world of speleological objects, fossil, archaeological and other findings
  - dispose of waste and discharge waste material
  - contaminate, destroy, carry out and misappropriate anthropological findings and material remains of various cultures, archaeological and fossil findings, cultural and historical buildings and cultural monuments.

Fishing

- in some areas permitted, in some allowed
- spearfishing is prohibited
- it is prohibited to collect and extract shellfish and other maritime organisms

Swimming and diving, sailing, vessel anchoring and mooring

- swimming is permitted in some areas
- SCUBA diving is permitted with a park approval
- when swimming and diving, it is necessary to pay attention in order to avoid damages and disturbances to sea organisms
- vessel movements should be adjusted to park restrictions
- vessel anchoring and mooring are permitted only in the foreseen and marked places.

Mountain climbing and rock climbing

- climbing is exclusively on one's own responsibility
- climbing is permitted only in climbing areas
- it is mandatory to use full climbing equipment
- free climbing is prohibited
- it is prohibited to set up new and change the existing directions without the park's approval

Caving

- it is prohibited to:
  - damage, destroy and remove speleothems, living world of speleological objects, fossil, archaeological and other findings, dispose of waste or discharge waste material in speleological objects
  - destroy and collect fossil and fossil remains and ornaments in caves and other speleological objects
  - contaminate, destroy, carry out and misappropriate anthropological findings and material remains of various cultures found in caves and other speleological objects
  - capture, touch and disturb bats.

6. Nature protection measures

The Nature Protection Strategy and Action Plan of the Republic of Croatia (OG 72/2017) for the period from 2017 to 2025 is the fundamental document for nature protection which determines long-term goals and guidelines for conserving biological and landscape diversity and protected natural values, as well as the forms of its implementation, in accordance with overall economic, social and cultural development of the Republic of Croatia (link).

„Rich and diverse nature is one of the most valuable resources available to the Republic of Croatia. Conserved nature contributes to ensuring all functionalities necessary for livelihoods and economic development.“

The following bodies are competent for performing administrative task for nature protection in the Republic of Croatia and implementing the Nature Protection Act (Pešić et al., 2017):

1. Ministry of Environment and Energy (MEE),
2. Croatian Agency for Environment and Nature (CAEN),
3. administrative bodies of regional self-governing units,
4. public institutions for managing national parks and parks.

In protected areas, economic activities, such as forest harvesting or hunting, may be carried out providing there are no negative impacts on plant and animal species for which the area was determined and that they meet conservation objectives. Thereby, it is necessary to observe each area separately. If there is a negative impact, testing will contribute to determine its scope and find solutions how to decrease it. For instance, hunting is permitted, but under supervision, in order to ensure long-term conservation of healthy and sustainable population of species, especially the endangered ones (European Commission 2018; link).
With conservation objectives, the desired state or the conservation level of each protected area is determined for all habitat types and species present in the area, with the help of exact values, e.g. maintaining the population of a certain species at the level of a minimum number of specimens for a period of 5 years. A series of objectives is determined in practice for each area or species which are classified based on priorities, from the most endangered and urgent ones to those which have a lower priority. (ibid.). Competent bodies of each member state are responsible for determining conservation objectives, and they also decide on measures, forms and methods for the implementation of the provisions of these directives. Apart from ensuring that conservation

objectives are based on facts, all stakeholders must be actively involved in the procedure to define conservation objectives. For instance, non-governmental non-profit civil organizations may operate in protected areas, such as Croatian Ranger, which has c. 90 members and promotes professional development and improvement of supervisors and keepers and their role in conserving protected natural values in Croatia (European Commission 2018; link). Such and similar keeper services carry out immediate protection and are authorised to penalize situations in which rules have been broken.

Slika 7. Hrvatski rendžeri (lijevo: Marko Mrkonjic PIXSELL, desno: International Ranger Federation, 26.11.2019.)

According to *The Habitats Directive,* measures for nature conservation include all practical actions which aim at conservation in a certain area, and they must comply with ecological requirements of habitat types and species present in the area. Economic, social and cultural context, as well as regional and local characteristics are taken into consideration for defining conservation measures. Required conservation measures are only possible if there are data on all types of conditions in a certain area, conservation and species and habitat types' needs, while taking into account social and economic situation. https://ec.europa.eu/environment/nature/natura2000/faq_hr.htm In Natura 2000 network areas, various measures may be necessary, including renewal of activities which require performing works at a specific time, such as works for restoring wetland hydrology, replanting of certain species, reintroduction or reinforcement of populations, setting up required infrastructure, haying, clearing maquis, managing hydrological regimes (European Commission 2018; link).

Useful web pages

- Natura 2000 network viewer with exact locations of each Natura 2000 area in the EU network
- NATURA 2000 Barometer: data on the number of areas and surface coverage in each member state and at the EU level
- Natura 2000 network viewer all Natura 2000 network areas
- Croatian Agency for Environment and Nature which runs the information system of nature protection in the Republic of Croatia
- Nature Protection Strategy and Action Plan of the Republic of Croatia
- Environmental Protection Act

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- https://www.zakon.hr/cms.htm?id=12072
- https://www.zakon.hr/cms.htm?id=27155
- https://www.zakon.hr/cms.htm?id=35943
- https://hr.wikipedia.org/wiki/Hajdu%C4%8Dki_i_Ro%C5%BEanski_kukovi
- https://hr.wikipedia.org/wiki/Bijele_i_Samarske_stijene
- https://hr.wikipedia.org/wiki/Nacionalni_park_Brijuni
- https://hr.wikipedia.org/wiki/Nacionalni_park_Kornati
- https://hr.wikipedia.org/wiki/Nacionalni_park_Krka
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DRY KARST GRASSLANDS

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LIKE (Living on the Karst Edge) project activities are aimed at the Istrian karst edge and sustainable management of that highly valuable and sensitive, yet often neglected space. As the name itself suggest, the karst edge is the name for an area with a developed karst relief spreading from the Trieste hinterland through the Slovenian part of Istria in the Koper hinterland, and all the way to Ćićarija and Učka. The main characteristic of the karst relief is the fact that is created through a karstification process, i.e. corrosive activity of water on porous carbonate rocks, which is why the karst relief is characterised by a lack of water on its surface. In addition, processes under the surface are extremely important on the karst where underground drainage network and fissure (secondary) porosity are developed. The other, "edge" part of the name refers to the fact that the karst edge is an area in which a relatively dry limestone plateau over a series of steep, tectonically pre-disposed limestone cliffs turns into lower and wetter flysch hills with a developed surface network of flowing waters.

Today's appearance of this area is a result of a long-term interaction of geological, geomorphological, climate and biological processes. The key role in landscape formation was also played by man with his continuous impact on natural base, whereby many anthropogenic (secondary) habitats were created from natural (primary) habitats. In addition, we can also distinguish semi-natural habitats (e.g. grasslands which are maintained by haying or grazing) and artificial habitats (pools, canals, buildings, mines…). The mentioned human impact has led to the situation in some areas where the habitats diversity has drastically increased with regard to the primary natural state, which has indirectly impacted the increase in biodiversity. Human impact on primary natural state mostly concerns traditional agriculture and the use of grassland surfaces for grazing or haying where the grasslands were efficiently managed which prevented succession as a natural process of spreading forest areas at the expense of grasslands. In all primary forest areas, and at the karst edge as well, grasslands were created with human activity. Through deforestation process, forest vegetation was removed in order to open areas for the purpose of obtaining fodder (hayfields, meadows), or as a product of intensive grazing (pastures). Thus, it is impossible to ensure the survival of grassland habitats if we exclude human impact from a sort of a sustainability equation. Today's landscape of the karst edge has been changed to a large extent in comparison with the same landscape of several years ago. Karst grasslands that used to be a rule, nowadays are more and more becoming an exception. They are mostly limited to the areas where traditional agriculture has been conserved, where the bora's impact can be felt on vegetation development and to those areas where there was no forestation with the black pine *(Pinus nigra)* in the past. In addition, human impact is also visible through miles of drystone walls built and a large number of karst pools which were used as water for cattle, as sources of potable water, for extinguishing fires, or simply as a place for gatherings of local inhabitants. Due to the porosity of limestone base, karst pools are the only significant surface water in the karst, and much like in grasslands, they pose an example of where human activities have a positive impact on biodiversity. Due to the aforementioned, the karst area is researched and protected to conserve the natural, but at the same time significant cultural heritage.

When we talk about the karst edge, we are talking about an area in which there is a close encounter of several climate zones, so the impact of Mediterranean climate is felt from the South, whereas the impact of continental climate reaches the Mediterranean Sea from the North. In addition, the karst edge is a contact point for two different geological bases. Impermeable, wet and colder flysch, and permeable, warm and mostly dry carbonate rocks. The mentioned contact climate zone is the

very reason why the karst edge is the edge area of distribution for many plants and animals which is why they are more sensitive to changes in this area than the area with optimal living conditions closer to a more stable part of their range. At the same time, we are dealing with the northern edge of the Mediterranean which is considered one of the focal points of European, but also of the world's biodiversity. Generally, karst habitats belong to the most endangered habitats in the world because, apart from a large surface pressure, they also hide an underground dimension through which contamination and threats may spread to large distances, whereby underground connections and spread vectors are not fully known.

Since carbonate rocks have a relatively low share of insoluble substances (often called "impurities") in their composition, during the karstification process an extremely thin surface layer of the soil is created as an insoluble residue which is very susceptible to erosion and washing out. Karst grasslands are developed on that thin layer, and they belong to the most varied and richest habitats in Europe, even though they are significantly smaller with regard to their surface than other land habitats in Europe. Thus, they are included on the list of habitat types of interest for the European Union (Appendix I, The Habitats Directive) and are protected as habitat type "62A0 – eastern sub-Mediterranean dry grasslands *(Scorzoneretalia villosae)*". These grasslands are developed under conditions where there is a lower impact of the continental climate, so they include many Mediterranean floristic elements in their composition. Apart from the Istrian karst edge, they also prevail in Primorje, Lika, Ravni kotari and Dalmatinska zagora. The loss of suitable habitats poses a threat for the survival of numerous grassland species or flora and fauna, among others, for single-flowered sawwort *(Serratula lycopifolia)* and the ortolan bunting *(Emberiza hortulana)*. Thus, LIKE project activities aim at monitoring the state and further research of those species.

Under the term karst grasslands, we can distinguish among karst pastures and karst meadows. Pastures are found in drier and warmer areas with predominantly rocky base whereas meadows are located in somewhat wetter areas where the soil layer is thicker and have a larger share of humus in their composition. As it was mentioned earlier, in both examples we are dealing with semi-natural habitats which were created and survived owing to traditional agricultural practices and local inhabitants who carried them out. Taking into consideration climate and relief limitations, to a significant extent flexible grazing impacts the pastures' plant composition which depends on nitrate availability. A pasture with quality and adjusted management (cattle number and species, grazing time, pasture surface rotation…) regularly results in a more complex and richer plant composition with regard to the species composition in the areas with an advanced succession. By following the state of bioindicators, i.e. certain species which illustrate the environmental condition, it is possible to monitor with quality the impact of certain managing activities on the biodiversity state (e.g. changes in the composition and number of ornithofauna due to pasture overgrowing and the loss of the optimal habitat).

For a long time, the karst edge area was isolated from economic and population development of larger urban centres located at the Adriatic coast, thus the extensive (traditional) agriculture remained in the area for many years. As the time passed by, younger generations decided to look for their place under the sun in the mentioned urban centres, and older generations which remained at the karst edge had no strength and possibility to deal with agriculture to the extent as they had before. The industrialisation process following the World War II, depopulation (especially of younger population) and the related deagrarisation, jointly led to pasture overgrowing and spreading of forest areas. In places where agriculture endured, it has mostly assumed an intensive character and is aimed at high revenues on a small surface, so there is often an excessive use of plant treatment agents, artificial fertilisers, etc. Apart from the direct harmful impact on biodiversity, the existence of a thin soil layer with limited possibilities for filtering harmful substances and karst underground rich in fissures below such agricultural surfaces should also be taken into consideration. It is evident that this form of agriculture can have a negative impact on a wide area. Since a large number of karst pools is neglected and left to succession, today there is a shortage of permanent water sources for dealing with agriculture. Farmers often reach for digging out wells and water boreholes which may have a negative impact on underground water level and the stability of the entire karst eco-system.

We can conclude that the conservation of traditional extensive agricultural practices, with the emphasis on extensive cattle breeding and the adjusted haying regime, are the only way to conserve dry karst grasslands. Promoting native breeds and sorts, creating recognizable offer of local gastronomy, subsidising farmers for dealing with „nature-friendly“ agriculture and branding agricultural products are only some of the examples of measures and activities which can impact grassland conservation. Close cooperation of agricultural and nature protection sector with the inclusion of local inhabitants is the only way to conserve grasslands and numerous species which depend on them.

SINGLE-FLOWERED SAWWORT (*Serratula lycopifolia*)

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Single-flowered sawwort *(Serratula lycopifolia)* is a European species with a centre of distribution in eastern Europe. It is found in a wide range from France, central Italy, Slovenia, Croatia, Hungary, Slovakia and the Czech Republic, all the way to Ukraine and Russia. As far as for the Croatian population, the centre of distribution is in Lika and Zadar hinterland, and the most significant populations are also present in Istria where the population in the area of Žbevnice on Ćićarija is also located across the border in the Slovenian part of Ćićarija. Single findings are also known in Primorje and Gorski Kotar.

The species is related to open karst grasslands and meadows on deeper soils, so it can be found on meadows and pastures of black salsify *(Scorzonero villosae – Danthonietum)* and pastures of erect brome and *Danthonia alpina (Bromo – Danthonietum calycinae)*. The species is anemochory, so the fruits are spread by wind following the time of blooming (June – July). In addition, it may also propagate vegetatively with creeping rootstalks. During the time of blooming, it is closely connected with ants which help with the opening of the flower head by feeding with a sticky juice exuded on the membrane scales. Thus, one of the LIKE project activities is also monitoring insects responsible for pollination and blooming of *Serratula lycopifolia*. The species is generally poorly researched, so it is currently listed under the category DD, insufficiently known taxon, in the Red Book of Vascular Flora in Croatia. The implementation of LIKE and similar projects, whose activities are aimed at grassland species and habitats, strives to obtain new data and in such a way conduct protection and conservation of single-flowered sawwort and other grassland species with more quality.

The stated habitats where single-flowered sawwort can be found present a classic example of degradation of semi-natural habitats. We are dealing with grasslands which are endangered due to the absence of human impact and traditional agricultural practices, so ensuring that haying is conducted at least every two or three years is stated as a recommended protection and conservation measure. Establishing regular haying rotations will positively impact succession decrease, prevention of grassland shading and the conservation of open grassland surfaces required for heliophytic plants. In addition, while encouraging rural development (especially tourism), special attention should be paid on uncontrolled construction and spreading of anthropogenic structures. It can be rightfully said that *Serratula lycopifolia* is an ambassador of all grassland species which have been endangered due to the overgrowing of grassland surfaces, so with a detailed elaboration and implementation of protection and conservation measures, as well as conservation of this species, the survival of other endangered and rare plants of Croatian flora (e.g. *Gentiana lutea* ssp *symphyandra* – hayek*, Gladiolus palustris* – gaudin) and cross-border area of the karst edge is also ensured. At the same time, the conservation of grassland areas also has a positive impact on numerous species of birds, butterflies and other animals, which additionally increases the need for grassland conservation and a systematic approach to this complex issue.

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Ortolan Bunting (*Emberiza hortulana*)

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Species: ortolan bunting (*Emberiza hortulana*)
Order: *Passeriformes* – songbirds
Family: *Emberizidae* – buntings
IUCN Red List: LC (Least Concern) – Europe, Europe 27
Red Book of Birds of Croatia: LC, Red List of Slovenia: EN (base from 2011)
European protection status: SPEC 2

The ortolan bunting is a species in "The Birds Directive" Appendix, as well as in the 3rd Bern Convention Appendix. In Croatia, it is protected under the Nature Protection Act, and in Slovenia under the Nature Conservation Act and the corresponding rulebooks. In special protection areas (SPA) "Kras" (Slovenia) and "Učka and Ćićarija" (Croatia), the ortolan bunting is a target species of protection, and both states are obliged to conserve its population in a good condition.
Despite a documented fall in the population in the majority of European countries, this species is on the IUCN Red List for Europe listed as least concern since there is a highly large species range and a vast number of population, which is estimated from 6,660,000 to 14,100,000 of adult specimens in Europe.

Distribution
The ortolan bunting is a sub-Saharan migratory bird, the only among our buntings. It overwinters in sub-Saharan Africa. In southern and eastern Europe, the ortolan bunting is distributed locally, but in large numbers, whereas in western, central and northern Europe it is less common and less numerous. In the most northern part of the continent and the British Islands, there is a lack of ortolan buntings. The largest populations in Europe are present in Poland, Romania, Russia and Spain.
In Slovenia, by 1979, when it was relatively numerous in the whole south-eastern Slovenia, the ortolan bunting range had decreased to a single remaining nesting area in dry karst grasslands above the villages of Mvraž and Dvori in Slovenian Istria. The ortolan bunting population in Slovenia is extremely low in numbers. During 2019 we counted only 7 specimens, and there was no proof of nesting (e.g. a nest or food in the beak).
In Croatia the ortolan bunting is more numerous. Based on the research conducted as a part of the LIKE project, on Učka, mostly on the Brgud plateau and south-western slopes of Učka descending toward Čepić polje, there are still between 150 and 200 singing males present. The ortolan bunting is relatively common in the Dalmatian mountain hinterland, e.g. on Velebit or Dinara. The population size of this species in Croatia is estimated from 3500 to 6000 pairs. Recently it was also discovered in the Croatian part of Fruška gora.

Habitat
The ortolan bunting dwells in habitats without or with a few trees, similar to prairies. The layer of herbaceous plants must be rare and allow for certain areas without vegetation since this is where the ortolan bunting feeds. Their singing location is a tree, a bush or a higher rock. It nests on the ground, usually hidden in low vegetation or a smaller bush. It inhabits dry and warm places. Within these requirements, we find the ortolan bunting in various habitats, from dry

karst grasslands and forest fire sites in the Mediterranean to mosaic and cultural landscape in northern Germany or Poland. The ortolan bunting population may rapidly increase locally if an area with suitable habitats is created, e.g. following a forest fire, and in that sense, the bunting is a pioneer species. In the time of nesting it feeds with invertebrates, and in other times it mostly feeds with seeds. Thus, dry karst grasslands with a rich fauna of invertebrates, as well as a plenty of bare soil, which facilitates hunting, are important for this species in the karst edge area. The ortolan bunting males create significant singing groups, whereby males which are paired with females inhabit the central area. The lack of females is significant for isolated populations of this bird as young females usually have a larger dispersion after nesting than young males. Thus, the number of unpaired singing males increases until a local extinction occurs, so some nesting areas eventually have no females at all. The percentage of males in the remaining population in Slovenia is high (15 males and only 5 active nests in the area above Movraž in 2013 means that there are 75% males present in the population). This high percentage of males indicates that the population is facing issues. The ortolan bunting commonly feeds in a habitat different from the one where it nests, which is unusual for songbirds.
In Norway, the feeding and nesting habitats are at a distance of 2.7 km. At the karst edge (on Kras, in Ćićarija) the ortolan bunting inhabits dry karst grasslands with sparse trees, away from settlements. The comparison of nesting areas on Kras and Učka shows that Kras grasslands, where the ortolan bunting has already disappeared (Golič region), are significantly higher and denser, and the lower grazing intensity is also important here. On Učka, the ortolan bunting inhabits the areas of active sheep pastures, with a plenty of bare soil.

The ortolan bunting (Emberiza hortulana) on Učka

The difference in vegetation density and height of the grasslands on Golič (below) and on Učka and Ćićarija (above).

Species trend
The numbers of the species population are rapidly decreasing on Kras, and it can be expected that in that area, and therefore in the entire Slovenia, the ortolan bunting will become extinct in several years. In addition, due to overgrowing, the bunting has lost a significant part of its nesting areas on Učka. In the moderate range of western Europe, in the period between 1982 and 2008, the ortolan bunting experienced a drop in population numbers as high as 82%, and in many countries it disappeared completely. In eastern Europe its population is stable, and in Catalonia it is even increasing, most likely as a result of numerous fires.

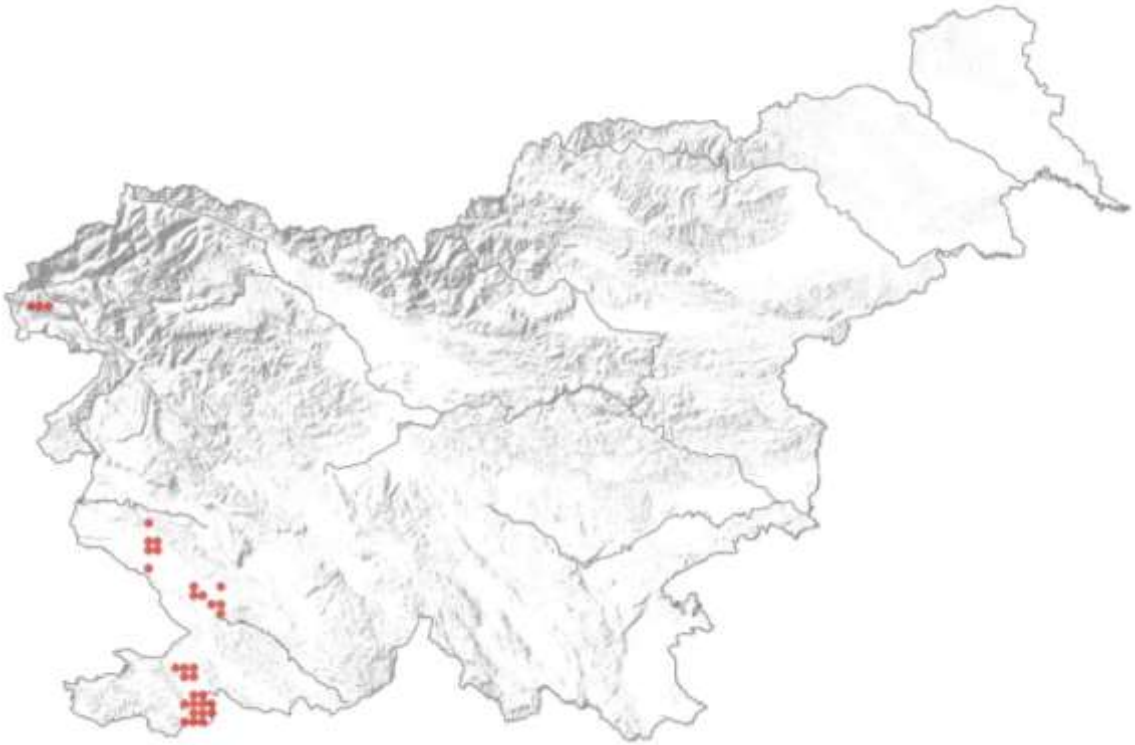
The most important endangerment factors are:

(1) Habitat overgrowing and fragmentation. In the decades following the World War II, the entire Kras and Ćićarija experienced the abandonment of grassland use; extensive haying, small livestock grazing, and transhumance cattle breeding became less profitable compared to other, non-agricultural activities. In addition, the prevailing policy for using Kras area was forestation, and a part of that policy was fighting against fires which are highly favourable for ortolan buntings. After a forest fire, the number of invertebrates rapidly increases, and along with them, the number of ortolan buntings. The result of both processes (the abandonment of traditional use and forestation) is a large fragmentation (size degradation) and a reduction in grassland surfaces suitable for the nesting of the ortolan bunting.
(2) Abandoning of the Mediterranean cultural landscape. The cultural landscape is a habitat in which the ortolan bunting feeds. Deagrarisation of Istrian land occurred due to the after-war policies. The inhabitants started to gravitate towards employment in larger industrial and administrative centres. Once mosaic cultural landscape with various cultures turned into overgrowing thickets.
(3) In its migration to sub-Saharan Africa, the ortolan bunting flies over unsafe poaching areas in Italy and northern Africa. The poaching has a large impact as miles of poachers' networks span across the Mediterranean African coasts at that time.

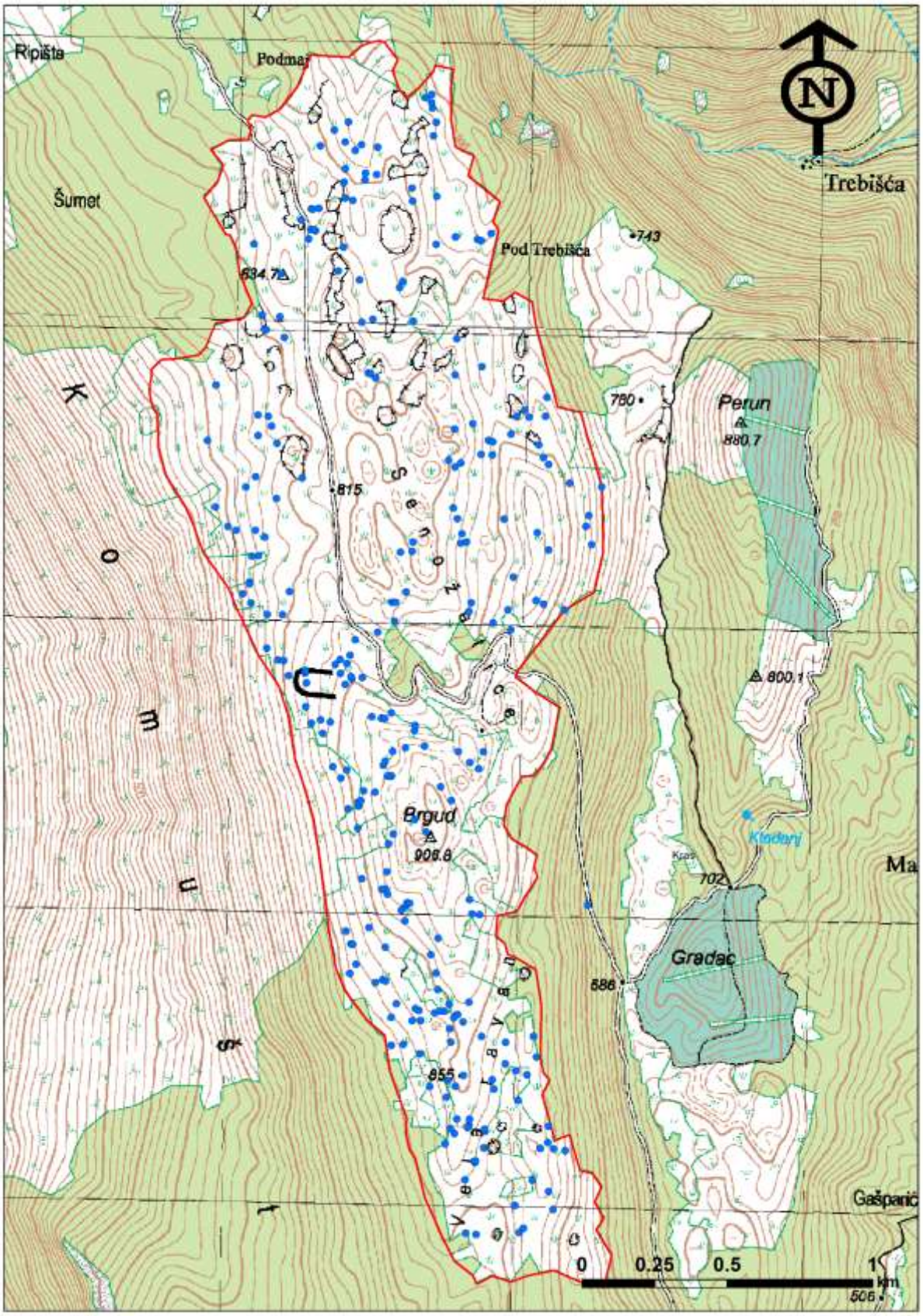
The most efficient measures for protecting the ortolan bunting are:

(1) suitable agricultural offsets, which encourage grazing and haying in dry grassland areas inhabited by the ortolan bunting
(2) clearing thickets and forests, which would ensure a suitable connection among the remaining nesting areas, as well as additional dry grasslands for nesting, possibly with controlled fires with the purpose of nature protection
(3) international activity and fight against poaching birds on their migratory routes

Distribution of the ortolan bunting in Europe (according to BirdLife International 2019)



Distribution of the ortolan bunting in Slovenia between 2012 and 2017. In 2019 we recorded only 7 single singing males above the villages Movraž and Dvori in Slovenian Istria



Recordings of ortolan bunting specimens in the researched area on Učka during 2018 and 2019 (red line), recordings are marked with blue circles – the LIKE project results.

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Moehringia tommasinii Marches (*Moehringia tommasinii*)

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Moehringia tommasinii Marches (Moehringia tommasinii March., family: Caryophyllaceae, cloves)

General information
Moehringia tommasinii Marches is a small plant from the cloves or carnation family, with linear-subulate leaves and tiny flowers, which have four leaves, petals and sepals placed opposite one another. It belongs to a group of related, mostly highly endemic species of the southern Alps, north-eastern Apennines and western Balkan Peninsula. It usually grows in a form of a cushion, and it can be distinguished by somewhat "meatier" leaves from the related mossy sandwort (*M. muscosa*), which also has four-numbered flowers and nearly always grows in shade. Most specimens of Moehringia tommasinii Marches blossoms in April and May, or possibly in June, and certain cushions even during the entire summer. The seeds have an oily structure (elaiosome), and they are spread by ants.

Distribution
Moehringia tommasinii Marches is a highly spread species (narrow endemic, steno-endemic plant), which grows in the karst edge area between Glinščica in the Trieste hinterland and Istarske toplice, in only five locations; in addition to the two previously mentioned locations, it also grows near Osp, Črni kal and Podpeč.

Ecology
Moehringia tommasinii Marches is a semi-cave plant species in the karst edge area. Certain specimens, which grow in rock fissures, are only occasionally reached by water and its dissolved nutrients. Even though it grows in sunny rock complexes, in most cases it dwells in fissures in shaded and wetter parts of rocks. In these edge habitats, where there is not much competition among species, it also grows in the community of *Asplenio lepidi-Moehringietum tommasinii* Martini 1988, where is, in addition to *Sesleria juncifolia*, chimney bellflower (*Campanula pyramidalis*), tender spleenwort (*Asplenium lepidum*), winter savory (*Satureja montana* subsp. *variegata*) and pellitory of the wall (*Parietaria judaica*), accompanied by only c. thirty flowering plant species.

Endangerment causes
Moehringia tommasinii Marches grows in fissures of natural rocks. Since they are unavailable to majority of people, at first it seems that active protection of moehringia and its habitats is not important. However, it seems that human activity has moved from grasslands and pastures to unavailable rocks at the karst edge, in the form of sports climbing which takes place here. There were warnings about the negative effects of climbing on Moehringia tommasinii Marches even back in the 1990s since climbers, mostly inadvertently, physically remove cushions of this plant. In the rocks above the Nugla village, where the botanists recorded moehringia in places which are today equipped for climbing routes, nowadays, unfortunately, it can no longer be found.

Protection measures and legal protection

Moehringia tommasinii Marches is a rare and endangered species whose specimens grown only in five locations in Italy, Slovenia and Croatia. It is included in the list of endangered and protected plant species in all three countries where it grows, and in addition, it is protected by the Habitats Directive (92/43/EEC). Nowadays, moehringia tommasinii Marches is not endangered by anyone except the climbers but placing any form of protected trails and the supporting infrastructure in rocks where moehringia grows seems unacceptable.

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Eurasian Eagle Owl (*Bubo bubo*)

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General information
Eurasian eagle owl (*Bubo bubo*)
Order: Strigiformes – owls
Family: Strigidae – owls
Subfamily: Buboninae – typical owls
IUCN Red List: LC (Least Concern) – Europe, Europe 27
Red Book of Birds of Croatia: NT, Red List of Slovenia: NT (base from 2011)
It is listed in the Appendix 1 of the "Birds Directive", in Croatia it is protected under the Nature Protection Act, and in Slovenia under the Nature Conservation Act and the corresponding ordinances. In special protection areas (SPA) "Kras" (Slovenia) and "Učka and Ćićarija" (Croatia), it is a target species, and both states are obliged to conserve its population in a good condition. Despite the estimation that the Eurasian eagle owl population is decreasing globally, mostly due to events in Asia, its endangerment category in Europe is LC (least concern) since its population trend is on the rise. The assessment of European population numbers is 18,500 – 30,300 specimens.

Distribution
The Eurasian Eagle owl is distributed nearly across the entire Europe. It is only absent on Mediterranean island, in Great Britain, in Iceland and western France, and it is extremely rare in certain lowlands in central and northern Europe (Hagemeijer & Blair 1997). In Slovenia it is distributed across the entire territory, with the exception of the south-eastern and north-western part of the country. Kras with the karst edge is known as one of the most important nesting grounds for this species. In 2019 in the KRAS SPA area in Slovenia, as many as 9 eagle owl territories were recorded. The distribution of this species continues in the Učka and Ćićarija SPA area, and the species is further distributed in Croatia along the entire seaside: in Istria, on Kvarner and in Dalmatia with its corresponding islands.
The eagle owl is mostly a species with lowland distribution. Its distribution nowadays in Slovenia and in Croatia indicates that this is a mostly lowland bird species. Thus, the highest nesting ground of this species in the Alps was recorded at the height of somewhat over 1000 m above sea level, whereas over 90% of the population lives below 800 m above sea level. We primarily attribute these occurrences at higher positions to sexually immature specimens. This species also avoids large forested areas.

Ecology
The Eurasian eagle owl primarily inhabits area where suitable rocky nesting grounds are surrounded by open surfaces.
It mostly nests in rocks, so the availability of nesting grounds is strongly conditioned with the terrain orography. A small part of the population (<10 %) nests in other places as well, e.g. on the ground, in the forest i.e. on trees, branches or in tree hollows. It is not particularly picky when it comes to choosing rocks for nesting, and it mostly opts for high, dry and well fragmented rocks. The fragmentation enables its nesting since it does not build its own nests but can rather nest exclusively on appropriate shelves or cavities in rocks. We will primarily find it in south-

oriented rocks and semi-caves. In addition, it nests in quarries, mostly abandoned ones, and it can tolerate the presence of humans and mechanisation in parts of the quarries. It is interesting that it more easily adapts to permanent presence of construction machinery, cars or trains, than to the presence of walkers near the nest, so we can still say that the nesting grounds of this species must be remote and quiet. A pair of eagle owls is present in the nesting ground throughout the entire year.
Nest-related activities often begin as early as December, even though laying eggs in our conditions starts at the end of February or beginning of March. The eaglets leave the nest in June and become independent in October. The eagle owl is known as a food generalist and opportunist. The composition of its diet here shows that it mostly hunts in open areas, and the thickness of its nest primarily depends on the area structure and prey availability. The highest local nesting density in Slovenia was recorded at the Kras edge, where 3 pairs nested in the area smaller than 10 km2, whereby the smallest distance between the two nests was 1.9 km, which can be compared with certain densities recorded in Europe. Similar densities were also recorded on the Dugi otok in Croatia.
The data from the program for monitoring the state of this species, conducted in the period from 2004 to 2019, indicate that the population of the eagle owl in the Natura 2000 areas Kras and Vipavski rob in Slovenia is stable, but with a lower nesting success in comparison with similar areas in Europe.

Endangerment causes
The Eurasian eagle owl is a larger bird. Electric shocks often occur on medium-voltage overhead power lines, and they are known to be the most common cause of death of the eagle owl. The impact of medium-voltage power lines was recognized as the reason for decreasing the density of the population, missing out on nesting opportunity or even completely abandoning traditional nesting grounds. The most problematic are open areas, and since power lines in open areas are excellent hunting opportunities, the eagle owl often uses them as a hunting blind. Such areas often prove to be seemingly stable habitats since the population stability is only ostensible there. Another issue in death cases caused by power lines is the fact that the largest number of killed specimens are adult, territorial birds.
The species is also endangered by nest disturbances, whereby sports rock climbing is the main factor. What is dangerous here is the fact that both climbers and eagle owls choose similar rocks, and the similarity in their choice can be explained with the eagle owls' ecological requirements and the climbers' sports needs. They both purposely look for high, steep rocks; the eagle owl for the nest safety, and the climbers for climbing challenges. The sunlight exposure of rocks is another reason why they choose the same rocks since sunny rocks are appealing in early spring when the eagle owls nest. The rock position in the landscape is also important as the rocks located above the cultural landscape mean that the eagle owls can bring the prey to the nest more easily, and on the other hand, they facilitate the access to the climbing sites for the climbers. We are talking about the phenomenon of selecting the same rocks, therefore, it is not surprising that climbing sites are set up in the very locations where the eagle owls nest. Thus, nowadays we have a larger number of climbing sites from which the eagle owl completely disappeared with the onset of climbing, as witnessed by empty remains of nests in rock shelves.

Protection measures
One of the most significant protection measures is to repair dangerous medium-voltage power lines (insulating wires next to poles) or the replacement of unsafe poles or insulators with safe ones.
It is also important to have as accurate judgement as possible on the acceptability of introducing sports activities into rocky areas. The most important thing here is to properly manage sports climbing, as well as cycling, hiking and paragliding. An extremely important protection measure is individual nesting ground protection. A large number of eagle owls does not nest in protected areas, so daily monitoring of nesting and determining and solving reasons for the absence of

nesting has proved to be an extremely efficient measure. This action is called Eagle Owl Guardians.

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Griffon Vulture (*Gyps fulvus*)

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General information

The griffon vulture (*Gyps fulvus,* Hablitz 1783) is a type of a *Gyps* order*,* from the family to which also includes the osprey, hawks, common buzzards, eagles and vultures (Accipitridae) within the order of birds of prey (Accipitriformes), class birds (Aves). Vulture types from the *Gyps* order, 8 in total, together with another 8 types of vultures out of which each is the sole species in its order, belong to the Old World vultures, i.e. Eurasian and African vultures (Botha *et al.*, 2017).
In Croatia the griffon vulture is an endangered species (EN, endangered).

Distribution

The griffon vulture has two recognized subspecies, *G. fulvus fulvus*, which is distributed from northern Africa and the Iberian Peninsula to the Middle East, and *G. fulvus fulvescens* which is distributed from Afghanistan to the Altai through central Asia and from Pakistan across the entire northern India up to the very northeast of India. The Croatian population belongs to the subspecies *G. fulvus fulvus*.
Back at the beginning of 20th century, the griffon vulture nested in a larger part of Croatia. According to numerous recordings (summarised in the Red Book, Tutiš et al., 2013), they nested from Papuk to Srijem. In the areas where there were no rocky cliffs, they nested in trees in the nests of the cinereous vulture, the white-tailed eagle and possibly of other birds (today a similar pattern of nesting on trees is recorded in Spain where the population density is extremely high). They also nested on loess walls along the Danube. In the coastal area they nested in suitable habitats all the way from Istria to Dubrovačko primorje and on eleven islands (Cres, Lošinj, Plavnik, Krk, Prvić (near Krk), Sveti Grgur, Goli Otok, Dugi Otok, Rab, Pag and Brač), and they used almost the entire coastal and hinterland area for feeding (Sušić, 2013a). The last griffon vulture colony, which was not from the Kvarner Islands, was located in the area of Velika and Mala Paklenica. Back in the 1980s c. 15 pairs nested there. However, in 1999 the last nesting with a total of three pairs was recorded in Paklenica (Lukač, 1999).
Today the griffon vulture nests only in the Kvarner Islands area, yet it may be regularly spotted in a much wider area, including Istria (Učka and Ćićarija), Gorski Kotar and Lika, Velebit and north-western Dalmatia and the islands of Pag and Rab (Lucić, Katanović and Kapelj, 2019). It only nests on Cres, Krk, Prvić and Plavnik. Nearly all nests are located on the cliffs above the sea.
The latest research on griffon vulture nesting was conducted in 2019 when its distribution area was confirmed.

Ecology

The griffon vulture dwells on warmer areas of moderate range and there it particularly prefers areas with steep slopes as potential nesting grounds and with sufficient availability of carcasses of medium-large and large mammals as a source of food. Generally, it avoids particularly rainy and foggy areas as well as areas covered in snow even though it can tolerate them in order to ensure a source of food or a nesting ground. To pursue food, it needs a wide range of upward air currents above hilly and mountain areas or daily thermals above deserts, prairies or other open, dry terrains. It avoids forests and overgrown terrains, marshes, lakes and vast sea areas, but it uses springs, creeks and pools for drinking water. Even though it is a bird that likes heights, it

spends a lot of time resting on the ground where it moves well. In a flat terrain it requires a lot of space for taking off in order to fly off the ground. It generally does not dwell near people unless it is necessary for nesting or feeding. The decrease in extensive and transhumance cattle breeding, changes in the way of cattle keeping and the decline in the number of wild herbivores resulted in several decades of reduction in the habitat scope and carrying capacity (Cramp, Simmons and Perrins, 1994).

Griffon vultures are social birds. They often look for food independently, but they can also pursue it in groups, and as a rule, they rest together in suitable places. During the feeding time, they gather in groups of temporary nature. After feeding, the specimens scatter. They can often be seen flying in smaller flocks, but they are most commonly temporary since they are needed for reaching the height by using thermals (upward currents of warm air) or during migratory flights.

Although some specimens revisit the same places often throughout the year, e.g. cliffs on which they nest or cliffs on which they rest, they do not form territories, neither individually nor as a group. In the morning the griffon vultures set out to find food from their nesting colonies or resting areas. They regularly fly over areas which are 50-60 km away from their colonies and resting areas. Even the specimens that nest go away equally far from their nests (Cramp, Simmons and Perrins, 1994; Genero, 2017).

During the feeding time, when larger groups of griffon vultures gather at the source of food, conflicts and fights among them ensue, which are primarily of ritual nature and serve to establish a hierarchy for each feeding. Such social structure exists only during the feeding time. Apart from intraspecific aggression (among specimens of the same species)during feeding, such aggression is also recorded at the time of the arrival to the resting location and in nests, but also without any particular reason (Grubač, 2014). In rare occasions, a more significant long-term aggression with inflicted injuries may also occur (Blanco *et al.*, 1997).

Griffon vultures almost exclusively feed on soft tissues of carcasses of domestic and wild animals, mostly medium-large and large mammals. They dig their long, poorly feathered neck deep into the carcass through body apertures or wounds on mammals. On average, they need c. 500 g of food each day, whereas this quantity is bigger for parent birds which feed their young.

In the morning the griffon vultures set out to find food from their nesting colonies or resting areas. They regularly fly over areas which are 50-60 km away from their colonies and resting areas, and the daily distances they fly over can be measured in hundreds of kilometres (Genero, 2017).

Endangerment causes

There are numerous reasons why griffon vultures are endangered. Among them we can distinguish pressures and threats. Pressures are current endangerments, those that have already been affecting the population. Threats are endangerment types they may yet happen, and if they do, then they will leave a mark on the population. Some endangerment types may be considered both as pressures and threats, e.g. if there is a difference between their current and potentially expected intensity. In addition, some endangerment types are only of a temporary nature and only then do they cause a pressure, but the possibility of their occurrence is always present and real, thus, they pose a permanent threat. Such an example is poisoning.

The increase in food availability is both globally and nationally important endangerment type. A part of vultures which embark on migration or wandering falls victim of exhaustion and inability to find food in the area of other countries. The reason of food loss for vultures lies in agricultural changes – more and more cattle are enclosed, intensively bred, so when they die, they cannot be food for vultures. In order to ensure the survival of vultures, but also to cut costs of animal waste disposal, feeding grounds for vultures have been set up across southern Europe.

The main pressure on griffon vultures at the global level is inadvertent poisoning with poisoned baits. Numerous specimens die from poisoned carcasses – baits set up with the intent to poison cattle or game predators (such as jackals and wolves). A lot of such cases were recorded in Croatia but monitoring specimens from Croatia with GPS signals has confirmed that our specimens die from poisoning in other countries as well. The feeding ground network for supplemental feeding of vultures set up along the griffon vulture distribution area helps to mitigate this endangerment

type as the food in the feeding grounds is generally of solid quality and monitored.
Electrocution (dying of electric shocks on power lines) is the second among the main endangerment types for the griffon vulture at the global level, and a similar case is here as well. Electrocution poses a threat wherever griffon vultures go, i.e. regardless of the state of this endangerment in Croatia, for each vulture that leaves Croatia, and these are mostly young and subadult vultures, there is a possibility of being killed on risky elements of the power grid.
A part of ship operators who transport guests disturbs vultures during the time of nesting which often results in falling of young vultures out of the nest off the cliffs and down into the sea. 5-10 vultures are saved from this situation annually, but how many of them actually die, it is difficult to say.
The collision with the energy infrastructure, especially with windmills, is considered a significant endangerment type. Croatia recorded one death of a griffon vulture who was killed in that way whereas the actual number might be even bigger. The development of wind energy poses a special kind of danger in south-eastern Europe, where our young vultures move, as well as on the Middle East.
Poisoning from non-steroid anti-inflammatory drugs, such as diclofenac, has led to the brink of extinction of several *Gyps* species types in India (see under Pogreška! Izvor reference nije pronađen.). The use of this medicine is allowed in certain countries of the European Union and, even though there have been no recordings thus far, it is possible that our vultures are exposed to this medicine in other countries.
Unintentional lead poisoning is probably a larger problem in Croatia than abroad where there are functional feeding grounds. There were recordings of vultures in Croatia which had an ingrown buckshot in their bodies after being shot. It is quite possible that they were shot in another country which consequently resulted in chronic lead poisoning due to lead discharge in the organism. Apart from chronic lead poisoning which might occur in shot birds, lead poisoning can potentially occur anywhere where our vultures migrate or wander, through lead exposure from ammunition remains in game carcasses.
Since bird poaching is present in parts of Croatia and other Mediterranean countries (Brochet *et al.*, 2016), it is plausible that more vultures form Croatia die as a consequence of poaching.

Protection measures and legal protection; what can we all do?
In Croatia the griffon vulture is a strictly protected species. It can be found as a target conservation species in 5 areas of the ecological network Natura 2000 where there are 4 special reserves (3 ornithological, 1 botanical-zoological) which were established, among other things, for conserving griffon vultures.
Each of us can contribute to griffon vulture conservation only by visiting the Beli Visitor Centre and Rescue Centre for Griffon Vultures. If you are travelling by ship or boat, avoid cliffs where vultures nest. Agriculture, especially sheep breeding, is necessary for conserving griffon vultures, therefore, buy agricultural products made on the Kvarner Islands. Should you find an injured or dead bird, report it to the competent authorities.

Overview of the area under the project scope (karst edge)
Today vultures use the karst edge area most intensively as a flyover corridor, from the area of the Kvarner Islands to northern Italy where there is another nesting population. Apart from flyovers, vultures also use this area for feeding if they find carcasses of domestic or wild animals.

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Additional interesting facts and figures partially collected during the research as a part of the LIKE project:

Appearance

The griffon vulture is an extremely large bird, visibly bigger than most eagles and other larger birds. Its body is between 95 and 110 cm long whereas its wing span most commonly ranges from

240 to 280 cm. Based on the foreign literature, the specimens of the G. fulvus fulvus species weigh between 7.5 and 11 kg (Snow and Perrins, 1998). According to the available weight data, the specimens from the Croatian population are somewhat heavier than the nominal population average, and they range between 9 and 14 kg whereas one-year old birds weigh between 8 and 9 kg (Sušić and Radek, 2010).
The griffon vulture has wide wings, long and seemingly bare neck which is crooked in flight. It can be recognized in flight by its wide wings with very long "fingers" i.e. primary flight feathers. Its secondary flight feathers are often slightly "convex" compared to the "concave" internal primary flight feathers; thus, the back-wing contour looks seemingly S-shaped. Its tail is short, curved or slightly wedged. During the flight, we can see dark, seemingly black flight and tail feathers which stand out from the brown covert feathers of the underwings and body. Its head is light, nearly white. A loose, feather neckless at the neck base in young birds is brown, and in adults white. The beak is dark, grey, in young birds, and yellowish in adult birds. A long neck can se be observed in birds that are resting, which is covered with dense and tiny feathers, and from a distance it may seem as bare skin. Its claws are short, in comparison to other birds from the birds of prey order, and the tarsometatarsi (fused metatarsal bones, bird "leg") are featherless (Svensson, Mullarney and Zetterstrom, 2018).
The sexes are mostly distinguished only by size, often with a usually insignificant difference. As with most other birds of prey, the females are larger than males, but the difference is poorly prominent (Cramp, Simmons and Perrins, 1994).

Behaviour

Unlike other vultures from the Gyps order, the griffon vulture nests in colonies, in groups ranging from several pairs up to over 100 pairs (Snow and Perrins, 1998). Probably the most numerous colonies in Europe are in Spain, on cliffs over the rivers Duratón (566 pairs) and Riaza (402 pairs) (Del Moral, 2009).

Reproduction

For nesting, the griffon vulture chooses shaded cliffs on which it can nest (Del Hoyo, Sargatal and Elliot, 1994). It chooses hollows on cliffs, such as smaller caves or fissures, which can provide solid protection from unfavourable weather conditions, rock shelters (semi-circular cavities on rocks), overhangs and flat shelves or terraces. Both parents, which form a life-long partnership, build or extend the nest, which is c. one meter wide, 10-30 cm high, and they use the same nest from one year to another (Cramp, Simmons and Perrins, 1994; Grubač, 2014). The female lays one egg, in the period from the end of December to March. Most European vultures lay eggs later than the Kvarner vultures which most commonly lay their eggs from mid-January to mid-February (Sušić and Grbac, 2002). The male and the female take turns to sit in the nest during the incubation which on average lasts 52 days, after which a chick is hatched. The young stay in the nest between 110 and 115 days (Cramp, Simmons and Perrins, 1994), and after they leave the nest, they remain in its vicinity and keep close to their parents for two more months (Sušić, 2013a; Grubač, 2014).

Migrations and trends

Adult griffon vultures are mostly non-migratory birds whereas young and immature specimens are mostly migratory and nomad (Del Hoyo, Sargatal and Elliot, 1994). Previous research and newer satellite monitoring determined that young vultures mostly from the Kvarner Islands head north-west to the Italian and Austrian Alps, where they often stay on the feeding grounds while some continue their flight over France all the way to Spain. Another common line is South-East, along the eastern Adriatic coast, in various directions, towards Greece, Turkey and further away over the Middle East towards Africa. In addition to these, there are other migratory patterns such as moving to the South of Italy or to the North and North-East all the way to Russia (Sušić, 2013b; Genero, 2017).
The griffon vulture, along with other vultures, was up until recently irreplaceable in nature due to its role as a cleaner. In the European region, it was the only bird, along with other vultures,

specialised for feeding with the remains of large animals and complete carcasses. We are dealing with food which is, apart from the griffon vulture, used by vertebras, mostly by opportune species such as the dog family (Canidae) among mammals or the crow family (Corvidae) among birds. The griffon vulture is in a sort of competition with these species, yet it still finds carcasses significantly faster than dogs, and it still feeds with the same prey faster and in larger numbers than crows.
The speed at which griffon vultures remove the remains of other animals from the environment is extremely high – griffon vultures can eat an entire sheep within several dozen minutes. It is significant that they can eat the remains of carcasses which are in an advanced state of decomposing, and even if the meat is contaminated with illnesses such as anthrax, nothing will happen to them. They will remove all the remains which pose a threat to other animals and humans, very fast and highly efficiently.
At one point, vultures were the only way in which we could dispose of dead animals whereas today this has almost been forgotten. The values that vultures used to provide to people is mostly seen in the data that nowadays we spend at least c. 120.000.000 HRK for the disposal of animal remains in Croatia, and vultures used to do that for free.

Final words

Dear all,

we hope that this educational program will help you design workshops or activities related to the protection of nature, and that it will serve as a tool to learn more about the species that have been studied as part of the LIKE project. It is conceived as a starting place where you can get basic insights about these species, the difficulties we face in protecting them as well as the habitats they inhabit, but it also provides us with knowledge on how to help them. We hope that it will be the starting point for developing your own educational activities and transferring these insights to future generations. If you have any additional questions or comments regarding the program itself, please direct them to edukacija@prirodoslovni.com, thank you.

Good luck with the workshops!