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I-SWAMP

# Deliverable 1.4.1: Conservation report



**TESAF**



ZAVOD REPUBLIKE SLOVENIJE  
ZA VARSTVO NARAVE



GEOPARK  
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Cover photo: a restored pond in Dolga Brda (Prevalje, Slovenia; photo by Lenka Stermecki, 2024).

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# 1. Austrian sites

## 1.1 Introduction

In the frame of the INTERREG Alpine Space project with the acronym I-SWAMP the project partner EGTC Geopark Karawanken/Karavanke, supported by E.C.O. Institute for Ecology was able to implement ecological monitoring at all the six selected ecological valuable sites in the area. The monitoring took place from May to August 2023.

E.C.O. is a consulting company for nature conservation and protected area management, and therefore actively involved in wetland protection in the federal state of Carinthia and all-around Europe. The role in the implementation of measures was to link up with the observers and discuss the measures and to address the relevant topics during the implementation measure on the site.

Furthermore E.C.O. presented the proposed measures to the landowners and the volunteers. At Sonnegg Fen big attempt was done to organize the landowners, as there were many.

The Geopark organized the volunteers in the communities.

The pilot activities started in June 2023 on the six sites at different level and went on until February 2024.

The selection of small pilot restoration measures was done based on the ecological monitoring results.

Before the implementation of the pilot measures, the landowners were contacted and sensitized about the ecological threats and pilot restoration measure options. They could choose if they were willing to participate. After that, the target sites were visited by E.C.O. staff with groups of volunteers out of the communities and by the Geopark staff. The level of implementation at the sites was different in the project, depending on the respective tasks, the success of mobilization of volunteers and the commitment of the communities.

**Table 1.1:** Overview of pilot conservation measures: Sensitization **Level 1**, removal of invasive species **Level 2**, Cutting bushes **Level 3**, organization of further measures **Level 4**.

Site	Measures	Who	When	Further activities
<b>Wildenstein marsh</b>	Sensitization of landowners (Removal of small trees) (Digging of Amphibia ponds)	E.C.O. Institute of Ecology <i>Landowners</i> Construction company with experience of establishing amphibian ponds	Sensitization of landowners October 2022 and December 2023	Follow up project to be established
<b>Sonnegg Fen</b>	Sensitization of landowners Mowing of Goldenrod Removal of bushes Preparation of documents for the authorities (Reintroduction of mowing regime) (Digging Ponds)	40 Teachers who participate in Geopark annual school topic. 10 Volunteers NATOPIA Community of Sittersdorf/Geopark/E.C.O. 10 Volunteers	25 <sup>th</sup> of May 2023 16 <sup>th</sup> of August 2023 12 <sup>th</sup> of January 2024	Follow up project for reintroduction of mowing and for digging ponds is organized and in place



Site	Measures	Who	When	Further activities
<b>Kleinzapfen</b>	Sensitization of land manager (conservation agency) (Removal of Goldenrod) Cutting bushes	E.C.O. Institute of Ecology Organized by Nature conservation agency  E.C.O. Institute of Ecology	December 2023 October 2023 8 <sup>th</sup> of February 2023	Follow up project needed and kept up by nature conservation agency
<b>Lake Pirkdorf</b>	Removal of Goldenrod, Sensitization of the community Drafting a digital interpretation panel for sensitization	Geopark staff 4 Volunteers Geopark staff  E.C.O and Geopark staff	June - August 2023 December 2023	Follow-up measures (information)
<b>Swimming Lake Lavamünd</b>	Sensitization School and land owner Removal of Bamboo Cutting bushes next to ponds	E.C.O. and School of Lavamünd  Volunteers of the community organized by Geopark	13 <sup>th</sup> of July 2023  February 13 <sup>th</sup> of February 2024	Continued activities of School
<b>Pond Einersdorf</b>	Sensitizing the neighbours <i>(Restoring by digging the pond, initial planting, preparation and submittal documents, Involvement of School in Einersdorf is recommended)</i>	E.C.O. Institute of Ecology with adjacent neighbours <i>(Construction company with experience of establishing amphibian ponds)</i>	June 2023	Follow up project needed

Pilot measures apart from sensitization the landowners (Level 1) were implemented on four out of the six sites to a different extend (see **Table 1.1**) Second level of activities was one or two actions of removing invasive species. This was done on three sites. The third level was an additional action of cutting bushes or spreading more information. This was done at two sites. The fourth level of activities was organizing further measures for the future. This was done on one site.

Especially at Sonnegg fen close to the Geopark Management centre in Tichoja, a variety of pilot measures could be implemented. The community was involved and stepped in to mobilize several volunteers. The sensitization of the high number of landowners took more time than expected, as farmers did not see the value of keeping the fen open. Also, the Geopark schools' teachers were very active. They were involved in several sensitization activities and helped in the active removal of goldenrod. Additionally, the NGO Natopia worked together with experts from E.C.O. - Institut für Ökologie and removed the goldenrod and other invasive species at Sonnegg fen.

The aim was, to improve the situation of the habitats with pilot measures with volunteers and to sensitize the community on the ecological matters like the target species. This was done successfully at four of the sites; on two of the sites at least sensitization of the landowners and neighbours was done.

However, some of the proposed measures out of ecological monitoring turned out to be too big or too complex for the frame of the project. They will be addressed in follow up

projects, where the respective financing for further implementation will be organized beginning with the year 2024.

However, the sensitization of the communities will continue. Especially the Geopark schools will be handed over the wetland brochure and they can work on the topic with their pupils in the frame of school activity. Therefore, the activities will be ongoing at the Geopark until July 2024.

## 1.2 Wildensteiner Moor



**Figure 1.1:** Wildenstein marsh is a remarkable wetland area in the Geopark.

The greatest ecological threat at this site is the slowly drying out of the water level in the marsh areas especially in springtime. However, due to the heavy rainfall in 2023 over the season, the situation improved at that time. Increasing bush encroachment at the small fen at the eastern site is also visible. Along the road, invasive species like *Fallopia japonica* start to grow close to the marsh. If it gets dryer over time, they might be able to grow into the wetland as well.

Overgrowth can restrict or even destroy the natural habitat of native species. Especially amphibians and dragonflies rely on open water surfaces to reproduce or find food.

The drying out of the wetlands is a concerning phenomenon. Wetlands as swamps, marshes are vital ecosystems that serves a variety of functions and support rich biodiversity. Climate change is a significant factor, which lead to altered precipitation patterns. Irregular rainfalls and more frequent and intense drought periods have an intense effect on the water balance in these areas. The consequences are highly

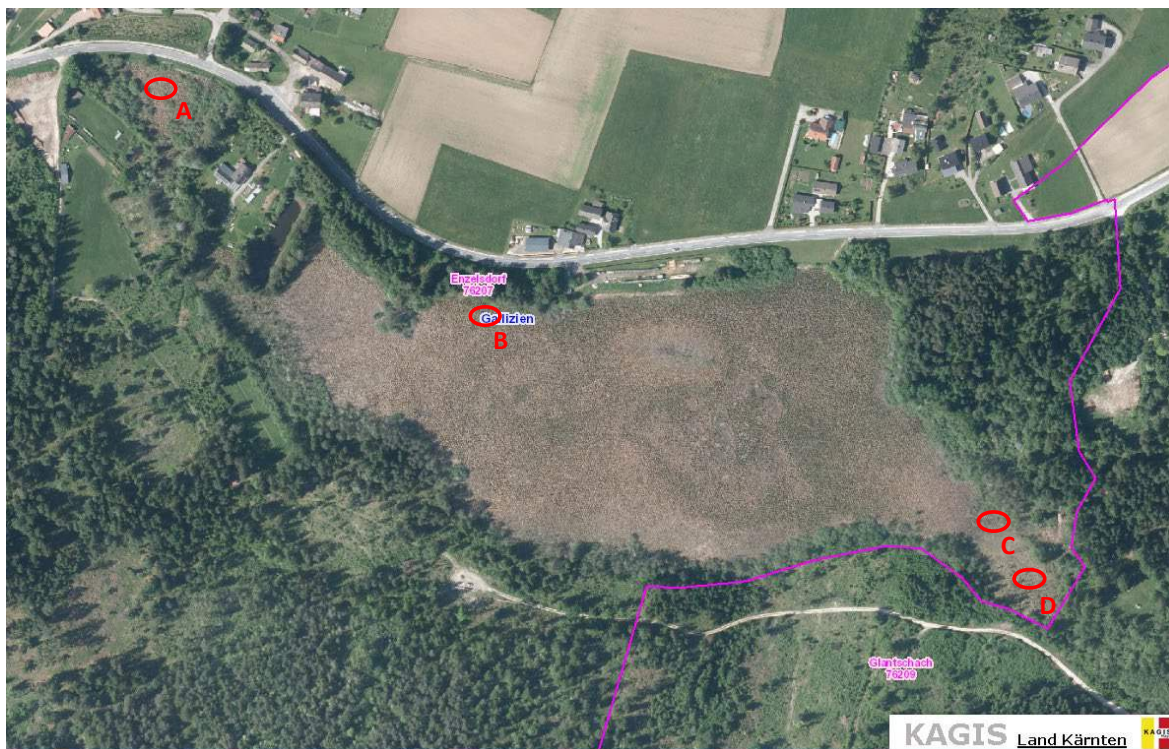


significant. The main problem is the loss of habitats of plant and animal species that are adapted to these environments. Wetlands also play a crucial role in water filtration and regulation. They are storing significant amounts of water and release it during floods and dry periods.

For years, the marsh was increasingly drying up prematurely. In some years there was hardly any water in the marsh when the amphibians spawned, so that the amphibians could only spawn in the north-western part, where artificially created ponds are available (residents, verbal communication). In March 2023, the Wildenstein marsh was largely dry again, but filled up due to the precipitation in April and May and was mostly water-bearing during the inspections on May 12 and June 7 and also in December.

The eastern part of the Wildenstein Fen is characterized by calcareous fens. In this area, encroaching shrub growth poses a significant concern.

### 1.2.1 Planned conservation and restoration measures



**Figure 1.2:** Establishment of spawning ponds for amphibians. Place options: A, B, C and D, removal of trees and bushes and removal of bushes

The eastern part on the Wildenstein fen is overgrown by bushes and phragmites starts to overgrow the area.

To counteract the increasing drying out of the fen and to ensure that the amphibians have spawning waters even in years with little rainfall, ponds of at least 100 m<sup>2</sup> should be created in several places in the fen by dredging and removing emerging woody plants if necessary. Possible locations for this could be, for example, the wetland in the north-west of the fen (site A, **Figure 1.2**), the northern edge of the fen (site B, **Figure 1.2**) and silting-up areas in the south-east of the fen (sites C and D, **Figure 1.2**). The area in the southeast was largely dry even with high water levels on June 7 and bushes are



appearing. The locations in the south-east would have the advantage of being farther away from the B85 Rosental road, which means there is less risk of roadkill for the amphibians spawning here and especially the migrating young animals.

In the southern part of the area, the fir and spruces that are causing increasing overgrowth should be removed. The overgrowth leads to shading areas, which can significantly impact the flora and fauna.



**Figure 1.3:** Eastern part of Wildenstein Fen 07.06.2023, Karina Smole-Wiener

### 1.2.2 Implementation

Contrary to the perception in the beginning of the project the vegetation turned out to be a marsh rather than a calcareous fen. As long as the hydrology stays intact, the marsh will remain in a good condition. Therefore, no urgent pilot measures are necessary, which are implementable with the help of volunteers. However, due to climate change the marsh is endangered because dryer periods will increase in future.

The measures with regard to remove bushes in the small eastern part of the fen are on private land. The landowners were invited to discuss the proposed measures. Only three of the landowners could be reached and sensitized. All of them did not want to be involved in pilot actions.

The proposed measures to improve the situation for the amphibia go beyond the frame and accessible funds of this project and would need more funds and resources for hiring an excavator.

Preparatory talks have been held with the respective landowners and the nature conservation association, which owns one of the plots where ponds are supposed to be dug.



However, even though no measures have been implemented so far, the project has resulted in the gaining of valuable ecological data and the establishment of contacts to the relevant stakeholders.

### 1.2.3 Problems and further management

The biggest problem for implementation is the accessibility of the marshland. Those areas, where measures would be useful (small fen part) are not accessible for the excavator with the existing road network. Additionally, the right time to dig would be wintertime and low water levels, to ensure that the ponds will not dry out. In the beginning of the year 2024 the water level is too high.

For the removal of bushes, the sustainability is not given, since the respective landowner is not willing to mow the small plot in a long-time regime. Therefore, the use of cost ratio of such a restoration project is not positive, when calculating the preparatory measures. To restore the site fully, it would need some long-time measurements with regards to hydrology and professional digging of ponds. The implementation would need more than the pilot actions, which can be addressed in the frame of this project.

Therefore, a follow up project will be drafted with the nature conservation association.



**Figure 1.4:** The area where ponds are proposed was filled with water (ice) in January 2024.

## 1.3 Sonnegger Moor



**Figure 1.5:** Sonnegg Fen, overgrown by goldenrod and bushes (Photo: Susanne Glatz-Jorde)

### 1.3.1 Planned conservation and restoration measures

Cutting bushes and mowing goldenrod (*Solidago gigantea*) were identified as essential management practices to maintain the biodiversity and ecological balance of the seminatural habitats in the Sonnegg Fen. By regularly cutting back overgrown bushes, it is possible to keep open spaces that encourage the growth of diverse plant species and provide suitable habitats for various wildlife. The area of around 1 ha Sonnegg fen should be partially cleared, taking into account the presence of *Salix repens ssp. Angustifolia* though leaving it grow.

Additionally, the construction of two to four amphibian ponds is important for the protection of the local amphibian and dragonfly species.





**Figure 1.6:** Establishment of spawning ponds for amphibians. Construction of amphibian ponds, place options A, B, C and D



**Figure 1.7:** Site plan with landowners: A high number of landowners need to agree on the project



### 1.3.2 Implementation

In the frame of the project various pilot actions were implemented successfully in the Sonnegg fen in summer 2023 and in January 2024.

#### MEASURE 1

In May 2023 around 40 teachers who attended a seminar/workshop in the frame of the Geopark annual school topic met in Tichoja at the Geopark Management Centre to address the topic of invasive species. Within the workshop, they were guided to walk to Sonnegg fen and tried out different ways to remove the invasive species goldenrod. They removed and cut down the plants in and around the fen and learned about the plant and various measures. Geopark organized and implemented the seminar and restoration action together with Leadpartner, projectpartner and E.C.O. Institute of Ecology.



**Figure 1.8:** The group of teachers and educators that helped remove invasive plants (especially goldenrod) in the frame of the seminar of Geopark Karawanken/Karavanke annual school topic (photo: Susanne Glatz-Jorde)



**Figure 1.9:** Neophyte mown material with mown area behind. (photo: Susanne Glatz-Jorde)

#### MEASURE 2



**Figure 1.10:** Targeted removal of invasive vegetation (goldenrod) by forming a human chain (photo: Kathrin Albrecht, Natopia)



**Figure 1.11:** Natopia participants at work (photo: Kathrin Albrecht, Natopia)

In August 2023 the nature conservation and education association Natopia participated in the next pilot measures addressing the invasive species in the fen. The association members (about 10 People) cleared a plot at the edge of the wetland successfully and remove the invasive species there. The plant of interest was goldenrod. **(Figure 1.9)**. During the measures, the danger and impact of the invasive species were explained. The enormous importance of wetlands and fens was also emphasised during the excursion. The group was invited to have dinner after the volunteering at a nearby restaurant.

### MEASURE 3 (PREPARATION)

In September 2023 the landowners were contacted again to address the overgrowing with bushes and the plans for restoring the fen. They were invited to a meeting on site, additionally letters were sent to them with the proposed measures. Some of them agreed to the removal of bushes, some of them preferred to let the wetland overgrow. The community major supported the communication with the respected landowners. The measures were presented on an additional meeting at the community of Sittersdorf in December 2023. After the major came in to mobilize the community, all of the landowners, with only one exception, could be convinced that they and also the general public will benefit from the activities. Additional consultations resulted in an action in January 2024.



**Figure 1.12:** Sittersdorf fen on January 12<sup>th</sup> before the measures started



**Figure 1.13:** The Fen is partly overgrown by bushes

### MEASURE 3 (IMPLEMENTATION)

On January 12<sup>th</sup> a group of the community, E.C.O. Institute of Ecology and the Geopark staff cleared the bushes in the southern part of the Sonnegg fen (in total 9 people). Due to the perfect weather conditions in the morning, the area could be accessed by a tractor for professional timber removal. Willows and spruce were removed. Bigger trees and some of the bushes were left as structure for birds and other species. After implementation the area is more open, and the dryer part can be mowed again. It was ensured also by the ecological supervision, that very wet parts and areas with rare species like *Salix repens angustifolia* were not harmed.





**Figure 1.14:** Fallen Trees were removed with the help of a Tractor



**Figure 1.15:** Especially willows (*Salix cinerea*) were removed



**Figure 1.16:** The soil was frozen and could bear the tractor



**Figure 1.17:** As a next step the milling machine can prepare the area for mowing



**Figure 1.18:** After the measure the area is more open

#### MEASURE 4 (PREPARATION)

The idea of constructing amphibian ponds was also presented to the community of Sittersdorf. The community administration itself and especially the major was interested in establishing a pond on its own plot. Additionally, a land owner with a big wetland plot

on the northern side of the Sonnegg Fen agreed to allow digging the ponds on his land in the reedbelt.

Plans were prepared accordingly by E.C.O. Insitute for Ecology and submitted to the authorities. The implementation of the ponds is planned in the frame of a follow up project.

### **FOLLOW-UP SENSITIZATION**

An article for the newspaper of the community on the species of the wetland is in preparation. An excursion for the community will be conducted in June 2024.

#### **1.3.3 Problems and further management**

To restore the site fully, it would need some long-time measures and heavy machines like excavator for digging ponds and a remote-controlled motor tiller.

The implementation would therefore need more than pilot actions, which can be addressed in the frame of this project.

However, activities to sensitize the citizens of Sittersdorf were implemented in December 2023 and pilot measures were implemented in the fen in January 2023. Additional measures are planned for February 2024.

A problem in the implementation was to convince the landowners, that the fen is something valuable for various species, though it does not bring a valuable product in terms of agriculture. They would prefer to let the forest grow, so they could at least harvest the timber after some decades.

A problem was also so wait for the right weather conditions, because for working in the middle of the fen the soil needs to be frozen, but there should be no snow. So, there is just a short time window when measures can be set.

The fen is now on the agenda of the community and some of the landowners and the community administration want to continue with the measures.

Documents for the authorities were prepared for further restoration measures like digging the amphibian ponds. A follow up project is already in place and can start directly after receiving the starting permission by the authorities.

## **1.4 Kleinzapfen *Molinia* meadow**

### **1.4.1 Planned conservation and restoration measures**

Due to the stopping of maintenance around 10 years ago, the most significant impairment in Kleinzapfen is the proliferation of bushes, which inhibits the undergrowth. Additionally, the extensive stands of the invasive goldenrod *Solidago gigantea* causes impairments to site specific species.

Rare species like orchids are not able to grow anymore.

Therefore, the proposed measures include regularly mowing of the goldenrod *Solidago gigantea*, to hinder the invasion into the *Molinia* meadow. The emerging bushes within the *Molinia* meadow should be removed, to prevent the inhibition of site-specific species.





**Figure 1.19:** Fallow *Molinia* meadow Kleinzapfen (behind the trees), overgrown by goldenrod and bushes in front (Photo: Susanne Glatz-Jorde)



**Figure 1.20:** Fallow *Molinia* meadow – bringing back a mowing regime would allow rare species to grow

### 1.4.2 Implementation

In the frame of the project no active on-site pilot measures were implemented in the *Molinia* meadow of Kleinzapfen because it would need some long-time measures and



heavy machines to restore the site. Additionally, it will not be sustainable to invest in the restoration of the site due to the danger, that the neighbouring goldenrod (*Solidago gigantea*) could grow into the meadow by opening up the soil and giving it space.

The implementation would need more than pilot actions, which can be addressed in the frame of this project. However, with the wetland protection handbook and the presentation of the project at community level the citizens were sensitized about conservation of semi-natural wetland habitats.



**Figure 1.21:** Young Spruce trees are growing into the area



**Figure 1.22:** Spruce and pine were cut by volunteers in February 2024



**Figure 1.23:** The part which was overgrown by goldenrod was mowed by the nature conservation agency to avoid spreading in August 2023

### 1.4.3 Problems and further management

The Carinthian nature conservation agency Arge NATURSCHUTZ had worked already on the plot in a project to try out machines for removal of the goldenrod in the past. Unfortunately, it turned not out to be feasible. The removal of this invasive species at that site would need intensive maintenance over a minimum of decade of time and consuming a lot of nature conservation funds due to total removal of the soil by excavators and professional waste disposal. Therefore, the use for the costs is not given in a sustainable way.

The minimum action for the future should be to mow the goldenrod at least once a year to hinder it from further spreading. However, the landowner in this case is not willing to spend money on the maintenance of this plot.

One important topic is to sensitize the community about the harm of invasive species. The site of Kleinzapfen shows an area, where the uncontrolled spreading of invasive species hinders the restoration of the neighbouring wetland.

## 1.5 Pirkdorfer See



**Figure 1.24:** Lake Pirkdorf (photo: Susanne Glatz-Jorde)

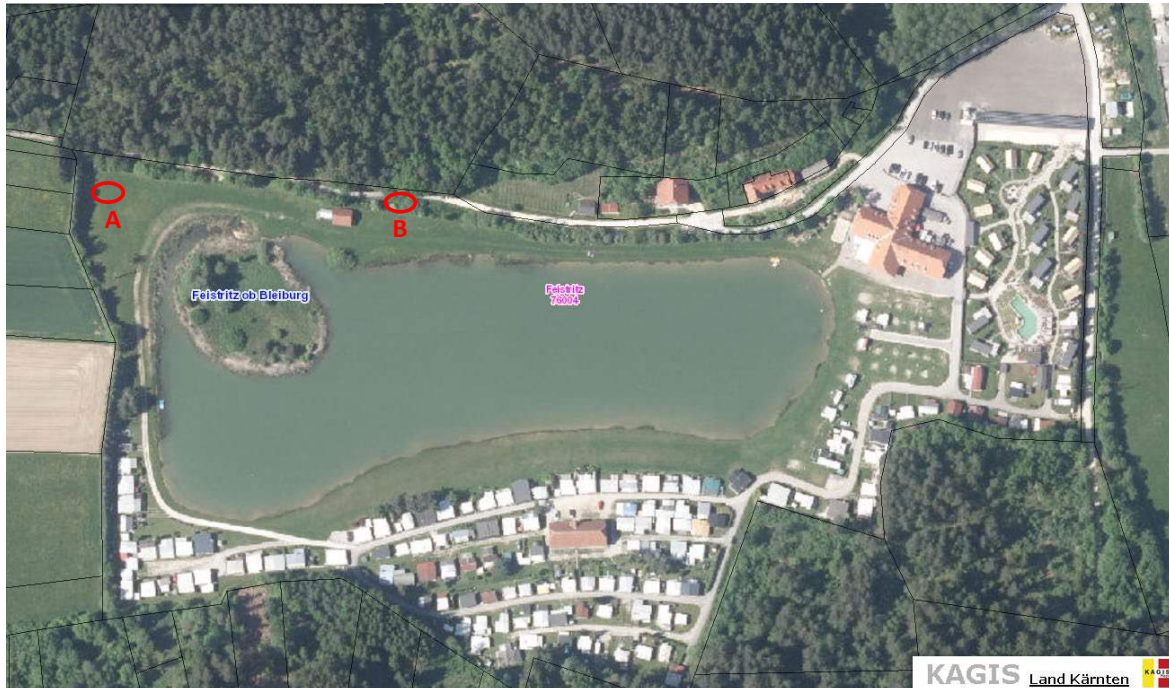
### 1.5.1 Planned conservation and restoration measures

The area around Lake Pirkdorf is heavily influenced by tourism. The mowing at the camp site is carried out intensively also at the northern part, where wetland vegetation composes the lake shore. On the island, an extensive spread of goldenrod *Solidago gigantea* inhibits the natural vegetation.

The main measure in this area should be raising awareness and visitor management. The frequency of mowing should be changed in the northern part, or some sub-areas with valuable species should be fenced. Another proposed measure is the abandonment of some areas to allow for natural regeneration of the shoreline. Regular mowing of goldenrod *Solidago gigantea* on the island is highly desirable.



To protect the amphibians, the establishment of two ponds (**Figure 1.25**, A and B) is proposed. These should remain free of fish to provide spawning grounds for amphibians with higher demand on the habitat conditions.



**Figure 1.25:** Site plan of the proposed measures. Establishment of amphibian breeding ponds at location A and B

## 1.5.2 Implementation

### MEASURE 1

Pilot measures to remove neophytes were carried out by volunteers and Geopark staff during the summer months (June – August 2023). Reduced mowing was also observed in the northern area. People of the Geopark and some tourist supported the measure. The removal was also documented in a short video, available at the following link: <https://youtu.be/TGsnEedusTU?si=BIFrfjYlgKRdOvqX>



**Figure 1.26:** Participant cutting back goldenrod (photo: Urosh Grabner)



**Figure 1.27:** North-western part of Lake Pirkdorf with the island with a reed belt and natural vegetation (Author: Susanne Glatz-Jorde)

**MEASURE 2**

An information board was drafted by E.C.O. and finalized by the geopark staff. The information was gained from the ecological monitoring. It contains information about the lake, the species to be protected and the measures to be taken.

Text proposal for information panel:

**Nature at Lake Pirkdorf**

**Photo 1:** The narrow strip of natural shoreline vegetation is essential for preserving the ecological diversity at Lake Pirkdorf. (Author: Doris Gitschthaler)



**Photo 2:** The marsh sedge grows in shallow water. Photo: Christian Fischer  
[https://de.wikipedia.org/wiki/Gew%C3%B6hnliche\\_Sumpfbirse#/media/Datei:EleocharisPalustrisAspekt.jpg](https://de.wikipedia.org/wiki/Gew%C3%B6hnliche_Sumpfbirse#/media/Datei:EleocharisPalustrisAspekt.jpg)



**Photo 3:** The blue-winged damselfly *Calopteryx virgo*, endangered according to the Red List, likes to stay at the lake outflow. Author: Doris Gitschthaler



**Photo 4:** The king dragonfly *Anax imperator* lays its eggs on a raw bulb. Author: Doris Gitschthaler

Despite its intensive recreational use, the man-made Lake Pirkdorf is a habitat for numerous animal and plant species. Typical marsh plants such as the pond sedge (*Schoenoplectus lacustris*), the broad-leaved bulrush (*Typha latifolia*), the yellow iris (*Iris pseudacorus*) and the endangered species of marsh sedge (*Eleocharis palustris*) and bladder sedge (*Carex vesicaria*) from the Carinthian Red List can be found along the northern shore of the lake.



The stiff stems of the marsh grasses on the shore provide resting places for the 13 dragonfly species found here. These live as larvae under water and undergo a metamorphosis on their way to adulthood.



**Photo 5:** Male common toads (*Bufo Bufo*) sunbathe in spring while waiting for a female. Author: Susanne Glatz-Jorde



**Photo 6:** The more demanding tree frogs require richly structured banks. Author: K. Smole-Wiener

In spring, despite the abundance of fish, the pond provides spawning grounds for individual amphibian species. The grass frog and the rarer tree frog visit Lake Pirkdorf and the lake outflow every year.



**Photo 7:** The shy oriole makes itself known with its characteristic "Bülow" call. Oriole Author: B.Huber



**Photo 8:** The reed warbler lives in dense reed beds Author:

<https://www.gettyimages.at/detail/nachrichtenfoto/tiere-voegel-teichrohrsaenger-mit-jungen-am-nest-nachrichtenfoto/645829223>

The lake with the island, which is overgrown with bushes, solitary trees and tall grassland, is an interesting habitat for bird species of the cultivated landscape such as yellowhammer, goldfinch and greenfinch. For house martins (*Delichon urbicum*), which are already in decline in the cultivated landscape, the lake provides a perfect hunting ground and the surrounding buildings offer nesting opportunities.

The reed warbler (*Acrocephalus scirpaceus*) can be observed in the reed belt. The oriole can be found in the adjacent forest areas.

**Endangerment**

Too frequent mowing of the shore zone on the north side of the lake leads to a decline in the natural shore vegetation. Goldenrod (*Solidago gigantea*) is spreading on the island and displacing rare species.

**Protective measures**

By leaving a three-metre-wide shore zone in the northern area, the biodiversity of Lake Pirkdorf can be significantly increased. This benefits not only the animals, but also the bathers, who are offered a nature experience. Small areas with natural vegetation enrich the diversity of the lake.

Interreg Alpine Space project I-SWAMP, Author: Susanne Glatz-Jorde, Graphics: Urosh Grabner

**MEASURE 3**

The owner of the site and the campground was sensitized by the geopark with regard to the measures.

**1.5.3 Problems and further management**

There were no major problems regarding the implementation. The collaboration with the owner of the campground is good and the maintenance will be changed accordingly. Unfortunately, the integration of a summer school could not be realised in 2023 due to organisational challenges but will continue in future. At least once a year in August, the goldenrod should be removed on the island. To get rid of it, a series of long-term removal (Mowing in May, June, July and August) or alternatively pasturing sheep) must be implemented for several years.

The digging of the ponds needs further resources, which go beyond this project. A follow up project shall be organised.



## 1.6 Lavamünder Badesees

### 1.6.1 Planned conservation and restoration measures

The widespread occurrence of invasive plants (e.g., Bambusoideae, *Solidago canadensis*) in the area poses the greatest threat. Also, the trees tend to overgrow the existing natural ponds behind the swimming lake. The shading of the pond leads to an absorption of the sunlight. Overgrowth can restrict or even destroy the natural habitat of native species. Especially amphibians and dragonflies rely on open sunny water surfaces to reproduce or find food. The presence of fish in the pond negatively impacts the fauna.

As a part of the summer camp of the Lavamünd school, the participants of the excursion were introduced to the threats of invasive plants. Bamboo and *Solidago canadensis* were largely removed and taken out of the area. In the classroom, using the collected materials (Bamboo tubes), insect hotels were built.

To preserve this habitat, regular measures are required, such as the removal of invasive plants and shrubs. Willow and ashes are hanging above the Water, which causes shading. These and the invasive species (Bamboo tubes, *Solidago canadensis*) should be removed in recurring interventions.



**Figure 1.28:** Natural pond behind the swimming lake





**Figure 1.29:** Bamboo vegetation spreading at natural pond (photo: Susanne Glatz-Jorde)



**Figure 1.30:** Proposed measures: removing dense vegetation and invasive species control



## 1.6.2 Implementation

### MEASURE 1

In July 2023 committed pupils (around 15 pupils and one teacher) of the summer school cut back the bamboo vegetation. The children were very motivated and learned the handling with the saw during this exercise. The pupils were also sensitized on the habitat and species in the ponds. A small insect monitoring programme was elaborated and explained to them. The importance of combating invasive species were explained and carried out several times during summer school.

Instructions on how to build an insect hotel were handed out for sustainability and to ensure that the pruning was beneficial. As a result of their work and insect hotel was build and put close to the site by the pupils.



**Figure 1.31:** The participants to the summer school cutting bamboo stems together (photo Susanne Glatz-Jorde)



**Figure 1.32:** The result of the hard work, the bamboo sticks for further processing (photo Susanne Glatz-Jorde)



**Figure 1.33:** The bamboo sticks provide nice material for insect hotels



**Figure 1.34:** The pupils were sensitized about amphibians and water insects. Photo: Susanne Glatz-Jorde





**Figure 1.35:** Dragonfly larva. Photo: Feldbacher-Freithofnig



**Figure 1.36:** Looking for Insects. Photo: Patrick Kueschnig, Lavamünd



**Figure 1.37:** Demonstration of Plants. Photo: Patrick Kueschnig, Lavamünd



**Figure 1.38:** Insect Hotel as result of the work. Photo: Patrick Kueschnig, Lavamünd



**Figure 1.39:** Preparation for Disposal. Photo: Patrick Kueschnig, Lavamünd



**Figure 1.40:** Use of Handsaw. Photo: Patrick Kueschnig, Lavamünd



**MEASURE 2**

In February 2024 a small group of Geopark staff, Community workers and E.C.O. staff removed the bushes leaning into the waters to allow more light falling into the ponds. This will make it more attractive as spawning ground for dragonflies and amphibians. The wood was placed next to the pond to avoid visitors from entering the ponds. This is necessary to keep up the attractive for breeding birds, which act sensitively to disturbance.



**Figure 1.41:** Cutting of willows close to the pond



**Figure 1.42:** Working on the barrier for visitors

**1.6.3 Problems and further management**

The collaboration with the school of Lavamünd was very good due to the motivated teacher who held the summer school. The pupils will continue to remove the bamboo also in future.

However, the long-term removal of the invasive species like bamboo needs an excavator and professional disposal, and this goes beyond the scope of the pilot measures. The community workers were sensitized with regards to the bamboo and an article for the community news was provided.

The removal of bushes with Geopark staff and the community workers was also very valuable; the ponds will get more light in future. Additionally, it is necessary to keep enough bushes to hinder the bamboo from spreading.

To improve the ponds ecologically, there is a need to remove the fishes out of the ponds. Sensitization will be done as a follow up project.

## 1.7 Pond in Bleiburg/Einersdorf



**Figure 1.43:** Temporary pond in Einersdorf (photo: Daniel Wuttej)

### 1.7.1 Planned conservation and restoration measures

The pond in Einersdorf is a result of a former clay brick manufacture. It is just temporarily filled with water. The water level correlates with the rainfall. The ecological threat is that the pond dries up prematurely, during the breeding season of amphibians. These conditions promote a decline of the amphibian population. The introduction of garden compost and organic waste (e.g., *Spirea* sp.) in some areas is a main problem for conserving a natural habitat.

The former clay pond was disturbed by digging measures in the past. There is a need to find out where exactly it is losing water and probably to fill it up with clay again. This would need a permission of the administration and machines like an excavator.

### 1.7.2 Implementation

The landowner and the neighbours were sensitized with regards to the disposal of organic waste next to the pond. Additionally, they were informed that the use of the pond as fish breeding pond would harm the amphibians. Therefore, from ecological point of view it is even an advantage, the pond temporarily dries out.





**Figure 1.44:** Stakeholder sensitization

### 1.7.3 Problems and further management



**Figure 1.45:** Pond full of water in March 2023



**Figure 1.46:** Dried out pond in June 2023

In the frame of this project no other feasible pilot measures can be implemented. The pond is privately owned and not used by the community of Einersdorf. However, it is a valuable spawning ground for amphibians like agile frog and common toad and could be used in future for sensitization. The loss of water would need further investigation and restoration measures turned out to be quite complex in this case. To enable and carry out these implementations, it is necessary to develop a follow-up project.

## 1.8 Summary and lessons learned

The monitoring results have gained valuable data on the biodiversity in the Geopark. However, it has also brought up some challenges which should be addressed in future. All the pilot sites suffer from the presence of invasive species. Even close to the wetlands, the goldenrod can be found. Therefore, invasive species should be addressed at least next to important habitats.

The second major topic in the Geopark is the stop of maintenance due to socio-economic changes. The farmers changed their practise of haying, and this has a long-term negative impact on the biodiversity of the semi-natural habitats. Programmes are in place in the

federal state of Carinthia, where landowners could participate. This shall be addressed in future.

The third major topic is the change of hydrology (dry springs because of climate change) which threatened the wetlands. This needs to be addressed to avoid the loss of wetlands in future.

The project has brought a first step towards wetland protection in the Geopark. It requires two major prerequisites: firstly, good ecological data are needed to understand the ecological problem and to propose feasible measures. Secondly communication and lobbying for wetlands on landowners and other stakeholders. Sensitization about the value of wetlands is still needed in the area.

The project was very important for the Geopark because it helped to set focus on the valuable wetlands in the Geopark.

The project was important in terms of getting touch with the respective landowners and communities. Contacts to communities could be established and pilot measures could be addressed and implemented. Additionally, valuable monitoring data were collected on the sites and give a base for further monitoring.

The pilot measures have shown that only one regular action per site and year would help to maintain the habitats in good condition.

Additionally, some follow up projects could be drafted in the frame of this project to address wetland restoration also in the near future.



# 2. Italian sites

## 2.1 Pozze di Costa della Spina



**Figure 2.1:** Pond in Costa della Spina. Many of these elongated ponds originated from bombings during World War I; all the ponds are eutrophicated and show signs of trampling along their banks (07.07.2023, photo by Giulio Menegus)

The pressure exerted by cattle and horses on the ponds of Costa della Spina (Comelico Superiore, Italy, see **Figure 2.1**) was previously documented (Bonometto, 2020) and confirmed during our site visit on 22.10.2022. As a result, we recommended protecting a small number of ponds distributed across the area.

Our surveys revealed, as anticipated due to the high altitude of the site, that the biodiversity of the ponds, especially for plants, is limited. Nevertheless, improved pond management could create a safer reproductive environment for dragonflies and amphibians.

Considering the availability of both permanent and temporary ponds as water sources for livestock in the area, implementing these measures is expected to have minimal to no impact on pasture use. The Regola Comunione Familiare di Dosoledo, representing the collective ownership of the traditional heritage of the community of Dosoledo (Comelico Superiore, Italy), has joined the project and endorsed the proposed measures.

### 2.1.1 Planned conservation and restoration measures

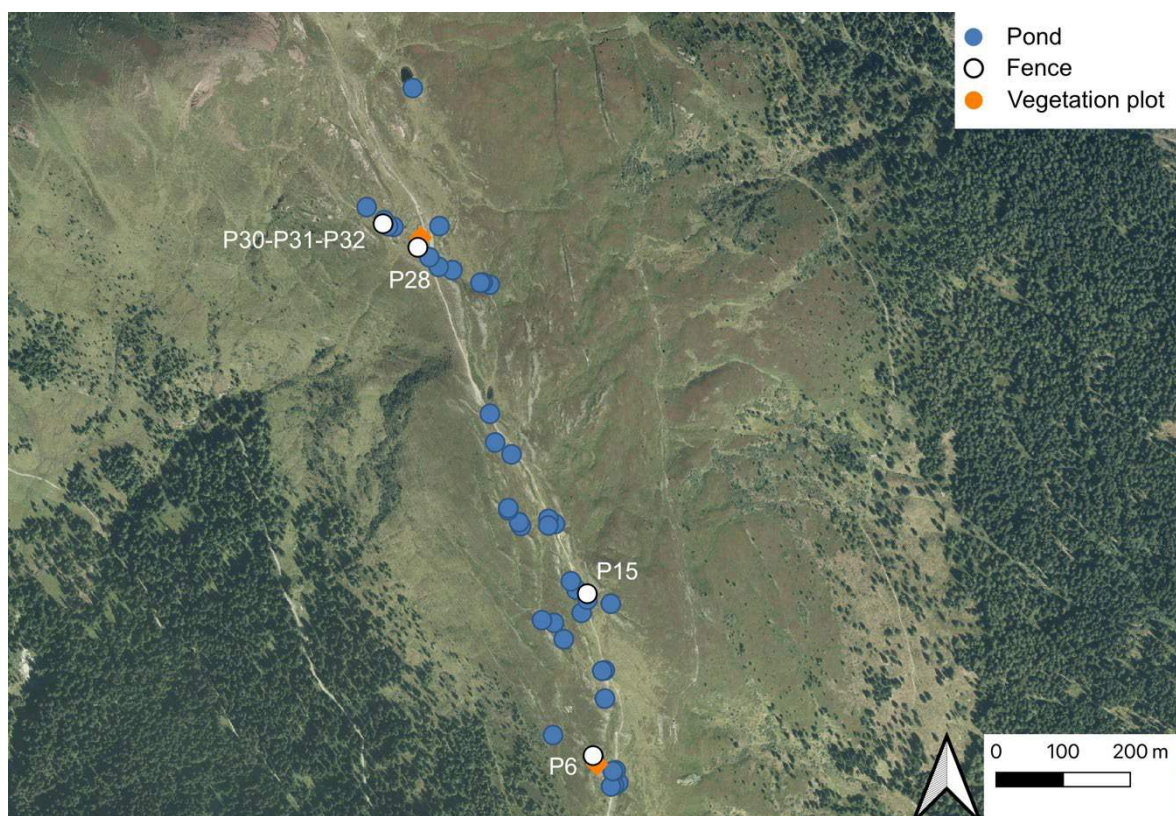
In collaboration with the Regola, we chose to enclose three ponds. To minimize the impact on cattle and establish protected habitats across varying altitudes, we decided to strategically selected ponds for fencing along the entire length of the ridge.

Our focus was on permanent, well-preserved ponds, especially those in close proximity to other stable water bodies. The enclosure should encompass the entire pond, including its banks, and, when applicable, the surrounding wet meadows or marshy areas.

To carry out this plan, the most effective approach is to choose an electric fence. It should be set up before the arrival of cattle and dismantled when they depart at the end of the season. This measure helps minimize the impact of cattle trampling on the vegetation along the pond banks, thereby reducing damage to plants and damage affecting immature emerging dragonflies.

The fencing also serves to decrease the release of excreta by livestock in the immediate vicinity of the ponds, consequently slowing down the process of eutrophication.

### 2.1.2 Implementation



**Figure 2.2:** Map of the ponds in Costa della Spina, showing the position of the fences

The implementation phase commenced on 20.06.2023. 44 ponds were mapped on the same day (refer to the map in **Figure 2.2**), and individual codes were assigned (from P1 to P34; note that clusters of interconnected ponds often share identical numbers, e.g., P25a, P25b, etc.). Following this mapping, we selected three ponds: P6, P15, and P28. P6



and P28 are clearly originated from World War I bombings, while P15 retains a more natural shape (see **Figure 2.3**). The straight-line distance between P6 and P15 is approximately 250 meters, and between P15 and P28, it extends to about 570 meters. In the case of P28 (see **Figure 2.5**), its water source is partly derived from the discharge waters of a small system comprising three temporary ponds upstream (P30, P31, P32, see **Figure 2.4**), prompting our decision to enclose this group of ponds as well. The initial fencing, carried out on 20.06.2023, was without electrification, and general maintenance was done with the collaboration of the Regola.



**Figure 2.3:** Pond P15 has a natural shape; the fence encircled the pond, its banks and part of the prairie (20.06.2023, photo by Giulio Menegus)



**Figure 2.4:** P31 and P32 were fenced, along with P30, in order to protect the source of water feeding P28 (20.06.2023, photo by Giulio Menegus)



**Figure 2.5:** TESAF personnel enclosing pond P28 with an electric fence (24.08.2023, photo by Giulio Menegus)

On 24/8/2023, with assistance from Regola representatives, we repositioned the fences, this time incorporating electrification (see **Figure 2.5** and **Figure 2.6**). The enclosed areas around the three permanent ponds were expanded. These electrified fences remained deployed in the field for the entire remaining portion of the season, concluding on 23.10.2023.

This approach resulted in the enclosure of six ponds, comprising three permanent ponds and a cluster of three temporary ponds, each presenting diverse morphologies, altitudes, and positions along the ridge. Interestingly, despite these variations, the plant communities displayed noteworthy similarities, as corroborated by vegetation surveys.



**Figure 2.6:** Pond P15, enclosed by the electric fence (24.08.2023, photo by Giulio Menegus)

The protective measures spanned the majority of the season, encompassing the entire duration of cattle presence on the pastures and coinciding with the critical emergence period of certain dragonfly species, such as *Aeshna juncea* (immature individuals were observed at P28, while a mating couple was observed at P15). This approach ensured the safeguarding of reproductive populations during this vulnerable stage.

Two representatives of TESAF department and four representatives of the Regola took part in the implementation phase.

### 2.1.3 Problems and further management

The implementation phase proceeded relatively smoothly; however, the site's altitude and the conditions of the access road pose potential challenges, especially during adverse weather conditions, making site access and conservation activities challenging



(this happened in the second part of the season, delaying the deployment of electrified fences).

The effectiveness of the fences was evident: even when non-electrified, only a few cattle trespassed the enclosed areas. The collaboration with the Regola facilitated prompt fence restoration. After electrification, there were no instances of cattle intrusion.

Considering the interesting dragonfly community present, fencing the same ponds in the following years could prove beneficial. Particularly, electrified fences help protect dragonflies from trampling during their delicate emergence phase. They also limit access for wildlife and reduce tourist-related disturbance, serving as a visual cue to emphasize the sites' significance.

Given the limited richness of the wetland vegetation and of the butterfly communities (especially considering wetland-adapted species), we decided not to implement measures specifically tailored for these groups. However, periodic mowing interventions at the end of the season could enhance the conditions of bankside vegetation and surrounding wet meadows.

The amphibian community appears in a good situation, with reproductive populations of two species identified in many ponds despite disturbances: for this reason, we didn't foresee any measure to favour these species, apart from protecting a few reproductive sites.

A more complete conservation of wetlands in the area should include: fencing and restoring the small peatlands located in the northern part of the ridge; fencing additional ponds, and building small artificial water troughs to alleviate cattle pressure on ponds without restricting water access for cattle. Protection efforts should extend to the fen systems west of the ridge.

## 2.2 Torbiera di Polget-Fontanabona

The site of Torbiera di Polget-Fontanabona (Lozzo di Cadore, Italy) is extensive and complex, primarily showcasing a landscape drained by artificial ditches that contribute to a reduction of water presence in soil (see **Figure 2.7**). Consequently, a substantial portion of the area is characterized by wet meadow. Notwithstanding, this habitat is interesting, considered the low cover of *Deschampsia cespitosa* (dominant in other sites of the plateau). Fragments of peatlands, particularly bogs, are preserved as remnants in small areas, mainly within the eastern section.

The area serves as grazing land for both cattle and horses (see **Figure 2.8**), exposing it to the pressures of trampling, herbivory, and the release of excreta. Despite these challenges, the peatland remains ecologically significant.

Given its vast size, it was not possible to fully restore or protect the entire peatland in the frame of I-SWAMP. So, we focused on a remnant bog habitat at the east end of the area, drained recently for road construction and often trodden by cattle and horses in summer.



**Figure 2.7:** Drainage ditch in Polget; most of the wetland is now a wet meadow (29.05.2023, photo by Giulio Menegus)



**Figure 2.8:** Horses in grazing in Polget (03.08.2023, photo by Athanasios Fitsios)

Our surveys revealed its lasting ecological importance. About half of it hosts bog mosses in hummocks/hollows, with some noteworthy plant species. Even the drained part, displaying typical vegetation of drained bogs, held interesting stands of *Menyanthes*



*trifoliata* in the wet areas inside ditches. Proper management could bring significant benefits to the vegetation community.

### 2.2.1 Planned conservation and restoration measures

Focusing on the bog, we identified two primary issues: drainage ditches and trampling by livestock.

The extensive system of drainage ditches helps discharge water to the western part of the bog. Notably, there are no signs of natural occlusion or erosion in these channels. This widespread drainage contributes to lowering the water table in the peatland, fostering the growth of dry-adapted plants and restricting the presence of wetland species within the ditches.

The more preserved section, untouched by drainage channels, faces damage from frequent trampling by livestock. This activity disrupts the typical structure of hummocks of bog mosses.

To counteract the impact of drainage channels, it's necessary to raise the water table (a process called rewetting)

To mitigate the effects of livestock grazing, it is necessary to exclude cattle and horses from the area, safeguarding the more intact portions of the bog and preserving the characteristic hummock structure of *Sphagnum* mosses.

In the frame of I-SWAMP, we decided to focus on the latter, since the former would require a more complex authorisation process and a more delicate intervention.

### 2.2.2 Implementation

In the implementation phase, we proposed to fence off two small sections of the peatland. This measure aimed to safeguard the most ecologically significant plant communities within the site, and was approved by the Municipality of Lozzo di Cadore (owner of the area).

We considered that restricting access to the peatland would have negligible effects on animals: peatland plants do not provide suitable grazing grounds for animals. Given the absence of streams or even temporary ponds in this particular part of the peatland, we deemed it feasible to install non-electrified fences around the key areas.

We decided to fence off the higher portion of the peatland (see **Figure 2.10**), protecting the more preserved and upstream section, as well as a portion of the drained area (see **Figure 2.9**). Two strategically positioned fences were deployed to shield the most preserved zones and simultaneously discourage animal movement across the peatland (see **Figure 2.11**). Both fences protected about 500 m<sup>2</sup> of habitat.

The fences were installed on 03.10.2023, with the help of a volunteer, and remained in place until 17.10.2023, effectively safeguarding these two core habitat areas for over two months.



**Figure 2.9:** TESAF personnel fencing a part of the Polget peatland with *Carex rostrata* and *Menyanthes trifoliata* (03.08.2023, photo by Athanasios Fitsios)



**Figure 2.10:** the fence encircling the best-preserved part of the bog remnant in Polget (08.08.2023, photo by Giulio Menegus)



**Figure 2.11:** overview of the two fences in Polget (08.08.2023, photo by Giulio Menegus)

Three representatives of TESAF department and one volunteer took part to the implementation phase.

### 2.2.3 Problems and further management

The deployment of fences was delayed due to inclement weather and landslides along the main access road to Pian dei Buoi, blocking the road in several occasions.



Consequently, we positioned the fences only in early August, utilizing a forest road to access the plateau.

Once in place, the fencing proved effective in restricting access to the two sensitive areas by animals. The area suffered some minor damages because of the presence of livestock in the first half of the season.

Given the site's nature, a comprehensive exclusion of animals from the bog remnant would be optimal. This could be achieved through collaboration with the municipality, considering the limited impact on grazing activities.

Simultaneously, it appears evident that tangible results for the peatland are unattainable without addressing at least a portion of the drainage ditches. Damming the ditches with small wooden and peat dams could create a more suitable habitat for peatland species, also creating temporary pools for amphibians and insects.

As the environment is well-connected to neighbouring sites, such interventions could significantly impact the conservation of wetland species in Pian dei Buoi.

### 2.3 Laghetto delle Sepolture



**Figure 2.12:** Cattle trampling on a dry Laghetto delle Sepolture in 2018 (photo by Lorenzo Bonometto)

The pressures associated with Laghetto delle Sepolture (Lozzo di Cadore, Italy) were previously documented, as the pond had been studied in the past (Bonometto, 2020;

Menegus et al., 2021). Furthermore, conservation management efforts were undertaken in 2021 and 2022. Located within a pasture regularly utilised by cattle, the pond and the surrounding wet meadow exhibit various signs of the effects of their use as pasture and water trough, such as trampling, herbivory, and eutrophication. Additionally, the pond, once permanent, has transitioned to a temporary state, often drying up in the latter half of the season or during particularly dry periods, as it relies solely on precipitation for water input (Menegus et al., 2021). In the summer of 2018, a drought event led to intense cattle trampling on the pond floor (see **Figure 2.12**). To address these challenges, an electrified fence, supported by wooden and plastic posts, was positioned around the site in 2021, encompassing both the pond and a portion of the wet meadow; the same area was fenced in 2022. Each of these two years, the wet meadow has been mowed at the end of the summer season, and sedges along the bankside have also been partially mowed or reduced. Observations in 2023 suggest that these management interventions are yielding positive outcomes, with aquatic vegetation reverting to a pre-2018 state (see **Figure 2.13**). The presence of indicators of eutrophication and trampling, such as *D. cespitosa*, appears to have diminished, at least in certain parts of the enclosed area. Some positive signs emerge from the dragonfly community, indicating the presence of new species, including one of conservation interest such as *Coenagrion hastulatum*, alongside stable populations of other relatively sensitive species like *Libellula quadrimaculata* and *Coenagrion puella*.



**Figure 2.13:** Laghetto delle Sepolture with *Eleocharis palustris* (03.08.2023, photo by Athanasios Fitsios)

### 2.3.1 Planned conservation and restoration measures

Building on the favourable outcomes achieved through the actions undertaken in 2021 and 2022, we decided to continue with the same management approach, involving the enclosure of the area and seasonal mowing. The fencing has the purpose of restricting



access to the site by cattle, and minimizing trampling, grazing, and the deposition of excrements. This protective measure not only safeguards the vegetation but also benefits the fauna, particularly dragonflies during their delicate emergence phase. Indirectly, the enclosure has proven effective in preventing access by wild boars and serves as a visual cue to tourists about the site's ecological significance.

The seasonal mowing is aimed at restoring a normal disturbance regime, primarily affecting dominant species while promoting the growth of rarer or slower-growing species. Simultaneously, the removal of the clippings helps reduce nutrient levels in the soil, contributing to disadvantage species adapted to eutrophicated environments.

Additionally, we decided to repeat the mowing of a portion of the bankside sedges. This practice slows down the overgrowth of sedges, which tends to cover the pond, limiting the available aquatic habitat for fauna and flora.

Given the presence of indicator species for eutrophication and frequent desiccation in the aquatic vegetation (*Alopecurus aequalis*, *Glyceria notata*), we decided to remove a portion of the aquatic vegetation.

### 2.3.2 Implementation



**Figure 2.14:** volunteers fencing the area of Laghetto delle Sepolture and the surrounding wet meadow (13.06.2023, photo by Francesca Minucci)

In order to protect the pond and the wet meadow from the impact of cattle presence, we decided to fence the area at the beginning of the season. The fence was installed along the same perimeter as in previous years on 13.06.2023, with the assistance of two



volunteers from the environmentalist group Gruppo promotore del parco delle Marmorole-Antelao-Sorapiss and some students from the CFP Bauer photography school in Milan (see **Figure 2.14**). The electrification of the fence took place on 06.07.2023, with maintenance interventions conducted on 6.07.2023 and 11.07.2023. The fence was subsequently removed on 17.10.2023 by personnel from the TESAF department.



**Figure 2.15:** Volunteers and TESAF personnel mowing the wet meadow surrounding Laghetto delle Sepolture (08.09.2023, photo by Athanasios Fitsios)



**Figure 2.17:** participants removing the clippings with rakes and forks (08.09.2023, photo by Athanasios Fitsios)



**Figure 2.16:** the group that took part in the event (08.09.2023, photo by Athanasios Fitsios)

To establish an appropriate disturbance regime, we conducted mowing of the wet meadow surrounding the pond on 08.09.2023. The operation employed light machinery,



including a motor mower, two disc-mowers, and sickles (see **Figure 2.15** and **Figure 2.18**). Clippings were moved downstream using rakes and traditional sheets known as mantui or varote (see **Figure 2.16**). Approximately one-third of the sedge belt was mowed, and aquatic vegetation consisting of *Callitriche palustris* and *A. aequalis* was cleared from an area of approximately 4 m<sup>2</sup>. These activities engaged two representatives from the TESAF department and six volunteers (see **Figure 2.17**).



**Figure 2.18:** the area after the mowing; note that some parts of the sedge bank were mowed and that we left a 3x3 m<sup>2</sup> part unmowed (08.09.2023, photo by Athanasios Fitsios)

### 2.3.3 Problems and further management

The conservation and restoration activities proceeded without major issues. The fencing effectively prevented access by cattle and horses, and the intervention was coordinated with the Municipality of Lozzo di Cadore, the owner of the area.

Mowing operations in the wet meadow and sedge belt, along with the removal of part of the aquatic vegetation, were successful. However, in certain sections of the field, mowing proved challenging due to the presence of large tussocks of *D. cespitosa*. Despite conducting the intervention at the end of the season, there remains a risk of inadvertently harming ground-dwelling animals, especially amphibians and reptiles.

These activities should be repeated in the coming years, with an annual perimeter fencing during the summer and mowing of the area at least once every two years, always at the end of the season (September-October). Currently, the Gruppo Promotore del Parco delle Marmarole-Antelao-Sorapiss seems willing to participate in at least some of the interventions.



Simultaneously, the maintenance of open water spaces should be a priority, considering that this pond represents the last standing water in the area and, consequently, the final reproductive environment for various amphibian and dragonfly species.

Interventions aimed at stabilizing parts of the banks (especially in the Northern side), as well as facilitating the accumulation of runoff water within the basin, could have a positive impact.

Restoring two nearby water bodies, currently drained (Lago da Porse and Lago Valdaporte), would increase the available reproductive habitat for various interest groups.

Management interventions for *D. cespitosa* should extend beyond the enclosure, preferably handled by pasture managers. Concurrently, other areas of interest, particularly the fens in the Valle delle Sepulture and the nearby Palù Gran fen, should be fenced (at least the best-preserved areas) and subjected to minor restoration efforts to promote the preservation of the wetland system in the Pian dei Buoi.

## 2.4 Laghetto di Vedorcia



**Figure 2.19:** the electric fence enclosing Laghetto di Vedorcia and the surrounding wet meadow (10.08.2023, photo by Giulio Menegus)

Laghetto di Vedorcia (Pieve di Cadore, Italy) faces various challenges due to its location in an area frequented by tourists and hikers visiting the nearby Rifugio Tita Barba (see **Figure 2.19**). Since the surrounding meadow is connected to grazing areas used by



cattle, it experiences significant pressures, including trampling, herbivory, and eutrophication resulting from the presence of cows, along with potential disturbances caused by tourists. Despite its small size, isolation, and high-altitude setting, the pond does not harbour a rich community for any of the considered groups.

Although it lacks species of conservation interest, excluding *C. hastulatum*, the pond holds significance as the last remaining natural water body in the Vedorcchia area: in fact, nearby, there is only a small ephemeral pond. Consequently, the Laghetto di Vedorcchia is worthy of conservation interest.

Simultaneously, engaging in conservation efforts in an area frequented by tourists provides an opportunity to communicate the importance of wetlands to the local community.

#### 2.4.1 Planned conservation and restoration measures

Given that the primary pressure on Vedorcchia Pond arises from the presence of cattle, we decided to fence both the pond and the upstream wet meadow to prevent animal access, restoring the protected habitat that was already fenced in the past. This measure aims to mitigate the impacts of trampling, herbivory, and eutrophication.

Additionally, there was consideration for a small excavation intervention to enhance the available aquatic habitat in the pond. However, despite the potential benefits, obtaining the necessary agreement and authorizations for this intervention within the project's timeframe proved unattainable.

#### 2.4.2 Implementation

We opted to install an electrified fence to protect the area from cattle. Initially scheduled for end of July, following our initial site inspection, inclement weather forced multiple postponements. The intervention was eventually carried out on 10.08.2023, with the assistance of two volunteers from the Gruppo Promotore del Parco delle Marmarole-Antelao-Sorapiss (see **Figure 2.20**).

The electrified fence was positioned, encircling the pond and the small upstream wet meadow to the edge of the clearing. In the southern part of the pond, where pond waters discharge into a degraded wet meadow, an access point for cows was left open in agreement with the pasture managers and the owner of the Rifugio Tita Barba. The fence protected an area of about 500 m<sup>2</sup>.

The fence was removed on 17.10.2023, by three representatives of the TESAF department.



**Figure 2.20:** TESAF staff and a volunteer fencing the pond in Vedorcia (10.08.2023)

### 2.4.3 Problems and further management

The electrified fence effectively limited cattle access to the site, maintaining a controlled access point in the southern part of the pond, ensuring water availability for cows. The fence also had the effect of signalling the pond's importance to tourists. It is advisable to continue fencing the site during future summer seasons.

The delayed installation of the fence allowed cattle access for the initial part of the season, potentially impacting vegetation and dragonflies. Nonetheless, stable populations for several dragonfly species were observed, and no significant damage to the sedge belt was found.

Extended timelines for securing agreements and obtaining necessary authorisations hindered the implementation of additional beneficial interventions during the limited duration of the I-SWAMP project. The high altitude ruled out winter interventions.

The site could benefit from a small excavation to reclaim some of the aquatic habitat that slowly filled with sediment. Simultaneously, stabilising the southern bank of the pond with a small dam would limit water discharge downstream, maintaining a higher water level. Establishing an artificial water trough outside the fenced area could further reduce cattle access. Naturalization of the troughs close to the nearby Casera Vedorcia and the enhancement of other wetland sites downstream could contribute to wetland species conservation in the Vedorcia area.



Regarding vegetation and amphibians, as expected, these groups exhibit few species of conservation interest. However, interventions would sustain a suitable breeding site for the two amphibian species present and protect and foster dragonfly populations.



**Figure 2.21:** excavating the upstream part of the habitat could help reclaim some aquatic environment (10.08.2023, photo by Giulio Menegus)

## 2.5 Risorgive di Mosigo

The complex of streams and ponds of Risorgive di Mosigo (San Vito di Cadore, Italy) is fed by discharge from the upstream Lago di Mosigo and groundwater. The area has been partially artificialised in the past, with abandoned concrete structures now dotting the area (see **Figure 2.22**). Nonetheless, it offers interesting possibilities of restoration

The site's potentials and pressures were documented in a previous study (Lasen & Scariot, 2006). It was then observed that specific interventions could guide the vegetation towards a nitrophilous tall herb fringe, a habitat type of community interest (6430).

In several site visits we observed that the site currently lacks adequate management. Tree and shrub zones are encroaching upon the tall herb fringes; some areas, especially the ones near tourist attractions like the minigolf area, trails, and the lakeside lawn, are regularly mowed at the beginning of the season (June-July). Several areas are overrun by monospecific stands of nitrophilic species, such as *Urtica dioica*.



The introduction of fish into the lake has led, in some instances, to their reaching the streams and ponds through lake overflow. However, these populations seem small and unstable at present. Additionally, the influx of tourists poses concerns related to trampling, waste disposal, and noise pollution.



**Figure 2.22:** the resurgence stream in Mosigo, with abandoned concrete structures (06.04.2023, photo by Giulio Menegus)

In the frame of I-SWAMP we decided to focus on the conservation of the tall herb fringe vegetation. All our conservation measure had to be planned in order to avoid any possible disturbance or damage to the protected species *Lopinga achine*.

### 2.5.1 Planned conservation and restoration measures

The monitoring conducted at the site Risorgive di Mosigo has revealed some potential, particularly concerning the vegetation and the butterfly community. We considered essential to address the primary pressure arising from the natural succession of tall herb fringe grasslands towards shrub and tree-dominated environments. Maintenance of these grasslands emerges as a priority due to their rarity in this relatively anthropized area, preventing landscape homogenization that could dichotomize the local landscape between heavily frequented, anthropized tourist areas and the *P. abies*, *F. excelsior*, and various *Salix* species woods.

In response to this, we decided to focus on the utilization of light machinery, such as a string trimmer, for mowing herbaceous vegetation. Subsequently, the clippings should be removed using rakes and wheelbarrows. This approach aims not only to curtail the encroachment of woody vegetation but also to maintain the ecological integrity of the grasslands, essential for biodiversity conservation.



Simultaneously, our monitoring underscored the significance of the butterfly community, with a particular emphasis on the presence of *Lopinga achine*, a protected butterfly listed in Annex IV of EEC "Habitats" Directive 92/43/CEE. In accordance with Article 8 of DPR 357/97, the Italian law which incorporates strict protection measures for Annex IV species, activities such as killing, capturing, or disturbing the species, destruction of eggs and larvae, and disruption of reproductive sites are strictly prohibited.

Considering the butterfly's ecological niche, our mowing activities must be meticulously planned to avoid any harm to this protected species. *L. achine* is known to inhabit clearings and forest margins, predominantly in the months of June and July in the northeastern Italian regions (Paolucci, 2010). While the species exhibits a preference for various *Poaceae*, especially within the *Brachypodium* genus, and several *Carex* species for nutrition (Bergman, 1999; Domingo, 2018), it is crucial to respect its habitat and breeding preferences. At the same time, inaction leading to habitat loss should be avoided too.

Egg deposition typically occurs in a narrow margin under trees and shrubs, and the species overwinters as larvae, generally at the base of vegetation tussocks (Domingo, 2018). Thus, our conservation efforts had to maintain a balance that allows interventions to maintain the habitat of the species, with positive effects for vegetation, avoiding any possible disturbance of the endangered and protected butterfly species inhabiting the Mosigo resurgence site.

We have opted not to intervene in the tree and shrub vegetation, acknowledging that several logging operations have been executed, with additional plans in place for the area.

Given the difficult accessibility to these wet prairies, we considered that direct frequentation of the wet prairies by tourists is somewhat limited. We have currently refrained from proposing specific interventions in response to tourist pressures.

We also decided not implement any interventions in the aquatic environments associated with the Lago di Mosigo area, including the aforementioned streams and ponds. Such an intervention should be done in a more comprehensive project on the restoration of Lago di Mosigo.

### 2.5.2 Implementation

At the beginning of the season, we established an agreement with the workers of the Municipality of San Vito di Cadore, owner and manager of the site, to identify an area exempt from the usual mowing in mid-June to early July within the Mosigo area, in order to minimize disturbance to both vegetation and fauna during the summer and to allow our surveys. The untouched area, approximately between the minigolf facility and the pedestrian pathway from the lake to the town, facilitated undisturbed monitoring and enabled the accurate planning of conservation measures.

To foster the evolution of wet grassland environments towards a tall herb fringe (habitat type 6430), we organised a late-season mowing intervention with clipping removal downstream.



**Figure 2.23:** volunteers mowing the wet meadow in Mosigo (13.10.2023, photo by Giulio Menegus)

To ensure the preservation of the protected butterfly species *Lopinga achine* and other associated species, the intervention was organised on 13.10.2023 (see **Figure 2.23**). The mowing involved about 500 m<sup>2</sup>. This date falls well outside the flight and mating period of *L. achine*, while also considering the wintering stage of young individuals as larvae at the base of vegetation tussocks. This timing minimises the risk of accidental disturbance or harm to adult individuals.

To avoid any potential impacts on butterfly larvae, selective mowing practices were adopted. Areas with marginally wet conditions, especially those regularly subjected to flooding and monospecific stands of *Urtica dioica*, were targeted. Many areas were left intact. The cutting was conducted at a height of approximately 15-20 cm above the ground, avoiding the destruction of basal plant parts and particularly the tussocks providing refuge for caterpillars.

It is essential to emphasize that the intervention's positive effects extend beyond habitat conservation, potentially benefiting *L. achine* by maintaining one of its typical reproductive habitats—clearings and forest margins.



The mowing was implemented by three employees of TESAF department, with the help of four volunteers from three different environmentalis groups (WWF, Cortina Bene Comune, Gruppo Promotore del Parco delle Marmarole-Antelao-Sorapiss, see **Figure 2.24**).



**Figure 2.24:** the group that took part in the restoration of the wet meadow in Mosigo (13.10.2023, photo by Giulio Menegus)

### 2.5.3 Problems and further management

The mowing activities were executed efficiently and without significant issues, providing an initial positive step towards the conservation of the Risorgive di Mosigo. However, a brief and isolated intervention, while beneficial in the short term, raises concerns regarding the long-term conservation of achieved results and the progression of the wet meadows towards a tall herb fringe habitat (type 6430). To address these challenges and ensure sustained success, additional mowing interventions in the coming years are necessary to consolidate and maintain the accomplished outcomes.

Considering the broader context, the area is subjected to various ongoing and forthcoming projects, necessitating a comprehensive evaluation of their potential impacts on the local *L. achine* population. It is imperative to assess how these interventions might affect the habitat and whether mitigation measures, such as recreation of clearings or forest margin environments on both sides of the Boite River, can be implemented to minimize, mitigate, or compensate for any adverse effects.



In parallel, specific interventions dedicated to the protection of amphibians and dragonflies should be devised. This entails contemplating modifications to the existing management of the fish fauna in Lago di Mosigo, ensuring the conservation of these critical components of the local ecosystem.

Furthermore, proactive measures aimed at limiting the impact of tourists are crucial for the sustained success of conservation efforts. Implementation of strategies such as fencing and informative signs should be planned.

## 2.6 Biotopo umido di La Zopa

The Biotopo umido di La Zopa (San Vito di Cadore, Italy) is a partially anthropized environment: it is dotted by several artificial features, including ponds, small artificial channels, pathways, footbridges, a traditional wooden washing basin, and is a regular tourist visitation. Similar to the site of Risorgive di Mosigo (see **2.5**), this area faces primary pressures linked to the natural succession towards wooded or shrub-dominated areas, disturbances resulting from trampling and litter left by tourists, and the invasion of invasive species. Notably, invasive plant species were observed in both the *Petasites* wet meadows (*Impatiens glandulifera*, see **Figure 2.28**) and the water bodies (*Elodea canadensis*, see **Figure 2.25**).

We decided to focus on preserving the wet meadow habitats, with an emphasis on sustaining the protected species *L. achine*. Additionally, a targeted intervention involving the removal of the aforementioned invasive plant species is planned to mitigate their impact on the biodiversity of La Zopa.



**Figure 2.25:** part of P3 in La Zopa is occupied by a stand of *Elodea canadensis* (29.04.2023, photo by Giulio Menegus)



### 2.6.1 Planned conservation and restoration measures

The Biotopo umido di La Zopa, while sharing some similarities with the site of Risorgive di Mosigo, has a better state of conservation. Several patches within the habitat align with the characteristics of habitat type of community interest 6430 (hydrophilous tall herb fringe) with *Petasites* and *Filipendula* meadows. Notably, the presence of young trees, especially *F. excelsior*, is observed in various parts of the habitat, indicating the potential evolution towards wooded environments.

A mowing intervention was planned to maintain open habitats conducive to the conservation of *L. achine* species. This intervention aims to prevent the progression towards shrub or wooded environments, ensuring the preservation of suitable conditions for the protected butterfly. Additionally, the mowing activities are designed to introduce a controlled level of disturbance, fostering increased diversity within the vegetative component of the wetland.

We decided not to intervene on the tree cover, considering the recent logging carried out in March 2024 for electrical line maintenance.

The pond environments, relatively well-preserved and exhibiting typical communities associated with lowland marshy areas (e.g., *Carex rostrata* stands), are deemed to require minimal interventions. However, a targeted removal of *Elodea canadensis* was planned to address the presence of this invasive species. The same applied for rare *I. glandulifera* plants in the *Petasites* meadow.

### 2.6.2 Implementation

The considerations regarding the conservation of the *L. achine* during interventions mirror those outlined for the Risorgive di Mosigo site (see **2.5.2**). The mowing intervention was carried out on 07.10.2023, employing lightweight equipment such as string trimmers (see **Figure 2.26**). Clippings were collected using rakes and forks, then disposed of in the section of the meadow closest to the Boite River. The mowing specifically targeted the *Filipendula* meadow, focusing on the wettest environments while avoiding margin zones and shrubs to prevent accidental damage to the overwintering larvae of *L. achine*. The cutting height was maintained at 15-20 cm above the ground to minimize any potential harm to the basal portions of the vegetation tussocks. An area of about 1200 m<sup>2</sup> (about a quarter of the habitat) was mowed (see **Figure 2.27**).

We decided not to mow the *Petasites* vegetation due to the disturbance already caused by the removal of fallen tree trunks after heavy weather events in summer 2023 and the clearing for electrical line maintenance of March 2023.

Several square metres (about a third of the stand) of *Elodea canadensis* were removed in pond P3. Within the *Petasites* meadow, several individuals of *I. glandulifera* were selectively removed to impede its expansion within the biotope.



These actions were implemented by one employee of TESAF department with the help of four volunteers from the Regola di Vallesella-Resinego-Serdes and two members of local environmentalist groups (WWF, Cortina Bene Comune).



**Figure 2.26:** volunteers mowing La Zopa wet meadow with lightweight equipment (07.10.2023, photo by Giulio Menegus)



**Figure 2.27:** the wet meadow of La Zopa after mowing (07.10.2023, photo by Giulio Menegus)



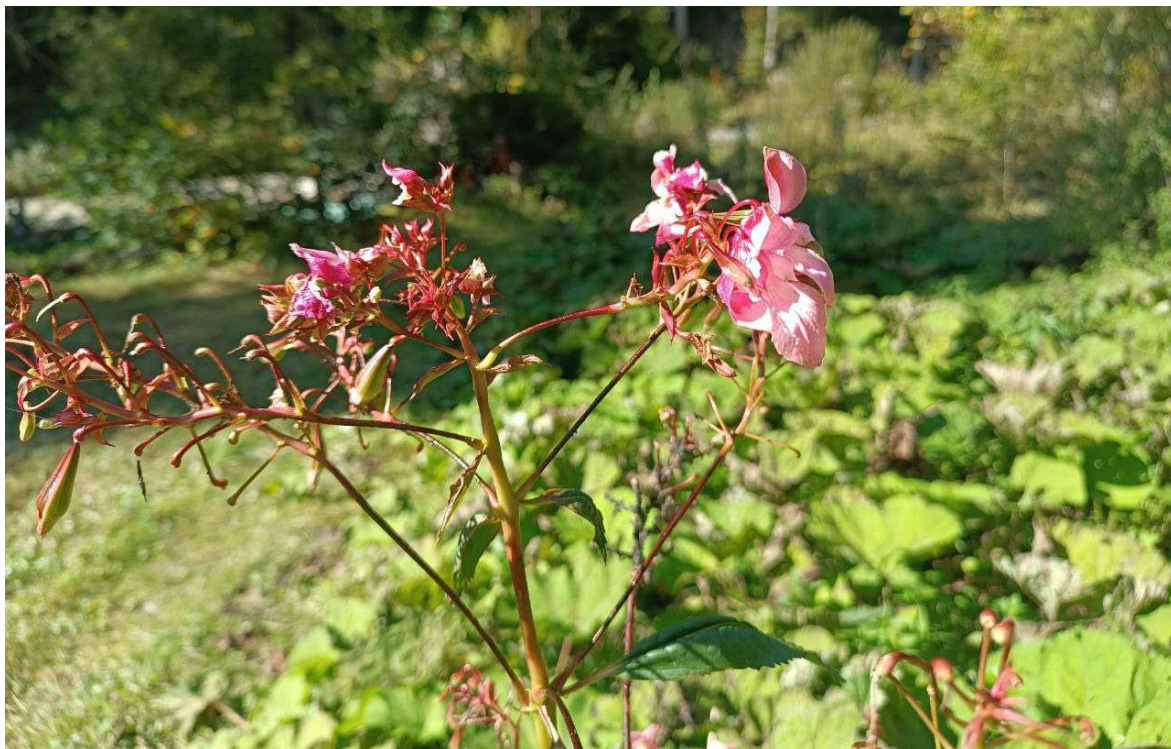
### 2.6.3 Problems and further management

The mowing interventions proceeded seamlessly. However, the ongoing management of the area is imperative to prevent the progression towards shrub or wooded environments and should be conducted with careful consideration for the presence of *L. achine*. Ensuring the sustained success of these interventions calls for a collaborative management strategy between the La Zopa and Mosigo sites.

Furthermore, the concurrent implementation of various construction projects in the area, the anticipation of future projects and consistent tourist presence, necessitates a comprehensive assessment of the collective pressures exerted on the site. This evaluation is crucial to formulate strategies that prevent or minimize damage to the site and the species of interest that inhabit it. Establishing effective communication and cooperation with stakeholders involved in nearby projects becomes essential.

Moreover, given the presence of the invasive species *I. glandulifera* (see **Figure 2.28**), a broader monitoring initiative should be implemented across the area of San Vito di Cadore. This approach allows for a comprehensive understanding of the distribution and prevalence of *I. glandulifera*, enabling informed management strategies that extend beyond the specific biotope.

Finally, minor interventions aimed at enhancing the condition of the ponds are advisable.



**Figure 2.28:** The invasive species *Impatiens glandulifera* in La Zopa (07.10.2023, photo by Giulio Menegus)

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# 3. Slovenian sites

## 3.1 Helenski potok povirje (Helena Stream spring – upper and lower part)

Swamp meadows and smaller fragments of bogs. These smaller bog valleys are surrounded by a predominantly coniferous forest. The entire area of the headwaters lies on impermeable sediments, and the surrounding uplands are carbonate. The habitat type of basic low marshes, mesotrophic wet meadows, in some places stream oases appear.

Despite the fragmentation of marshy habitats, a few species of butterflies are found here, which in Carinthia are limited only to the habitat type of transitional and partly low bogs with marshes. Here were found, e.g., the false heath fritillary (*Melitaea diamina*) and the critically endangered *Coenonympha tullia* (last confirmed 1992). This area is also home to one of the last swamp populations of the Marsh fritillary (*Euphydryas aurinia*) in Carinthia.

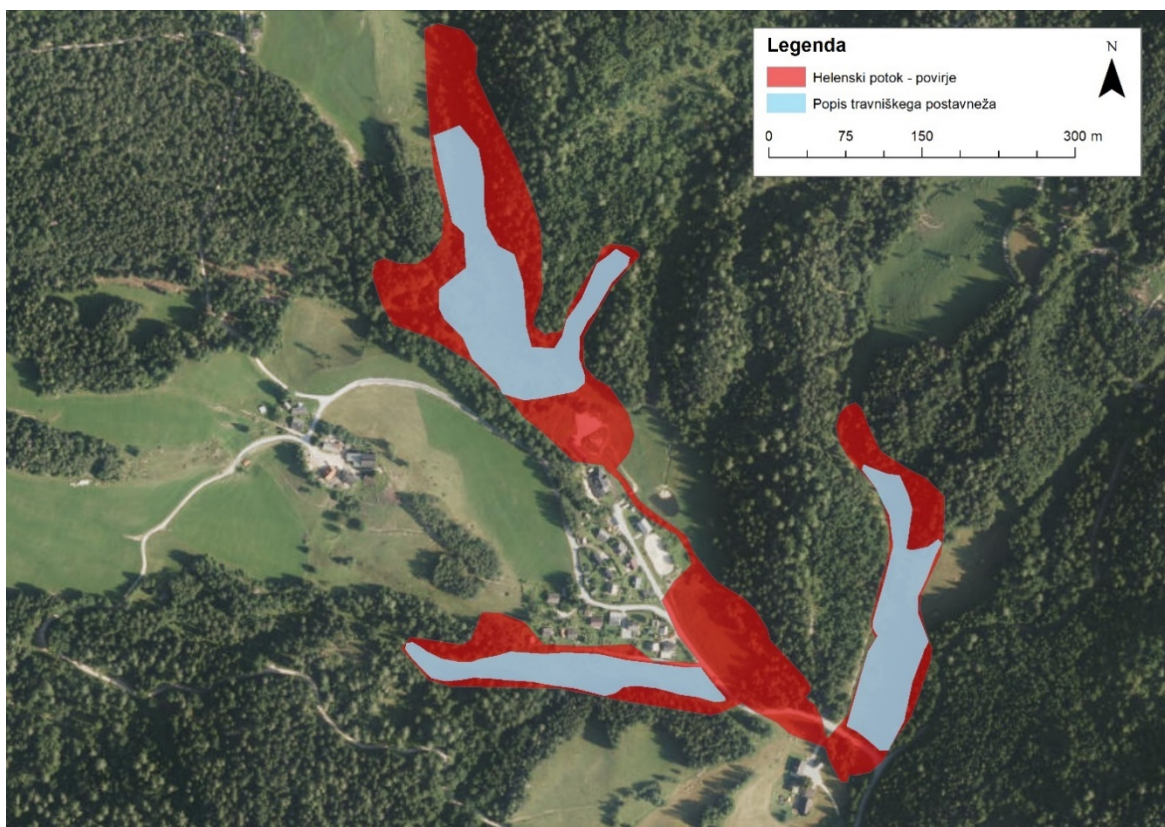


Figure 3.1: Helena Stream spring location



**Figure 3.2:** Helena Stream spring

### **3.1.1 Planned conservation and restoration measures**

The first stage of successional forest vegetation is present in the area. The coverage of shrubs and younger trees is between 20-40%. The tree composition is dominated by conifers, especially spruce. The surfaces have not been used in the past couple of years, which is visible by the compaction and depth of the grass debris in the thick vegetation of sedges. Consequently, the wetland plants lost their potential growing site relatively quickly.

Main activity measure was the removal of forest vegetation to address alterations in the water dynamics of the area and the preservation of habitat space for wetland plants. Subsequently, a long-term mowing plan was presented to the owner to maintain optimal environment balance. Mowing should be carried out every few years. Mowing should take place in a mosaic pattern across the area of the wetland. It is important that mowing is conducted across the entire area at least once every 5 years to prevent re-growth of forest vegetation.

### **3.1.2 Implementation**

Once we confirmed that the area meets all the activity criteria, we include it in the project. We obtained information about the landowner. For this purpose, we acquired an official extract from the national online platform “e-sodstvo” (This platform obtains information about the official plot owners in Slovenia). We have established contact with the owner. The particular area is state-owned, therefore the official representative for the management of state agricultural and forest land was a local official of the Farmland and Forest Fund of the Republic of Slovenia. Local official (Olga Pogorevčnik) was one of the main stakeholders in the project. After a joint field visit of the area and the presentation



of project activities the local official approved the actions. Despite the verbal agreement on field visit, it was still necessary to obtain official permit from the Farmland and Forest Fund of the Republic of Slovenia (Sklad kmetijskih zemjišč in gozdov RS, številka: 47820-271/2023-11, 4. 10. 2023).

The project area is connected and intertwined with the nearby forest mask. That is why we included the Slovenia Forest Service as an important stakeholder of the project.

Expert foresters helped with the preparation protocol for the removal of forest vegetation, foresters marked the forest vegetation and were our communication support with the contract workers as well as supervisors of work. We cooperated with the local head of the hunting department, and the local district forester. We conducted several joint field visits. The professional work performed by the employees of the Slovenia Forest Service exceeded their job description (project areas that lie outside the forest area), so we hired them as professional external assistance. After the work was done, we got the report of the work (POROČILO o izvedbi storitve..., Zavod za gozdove Slovenije, Območna enota Slovenj Gradec, Služba za načrtovanje razvoja gozdov).

Since the project area is part of the watercourse, we obtained a permit from the Slovenian Water Agency to carry out the project activities (Direkcija RS za vode, Sektor območja Drave, štev. 35506-2116/2023-2, 30. 8. 2023).

Since the area is outside Natura 2000 (protected area), an official permit from the Institute of the Republic of Slovenia for Nature Conservation was not required. However, it is necessary to inform about similar activities in the area of natural values the local department of the Institute of the Republic of Slovenia for Nature Conservation.

As part of the presentation of the I-SWAMP project to the students who attended the “biologists research camp”, we informed the students, representatives of the local community and the municipality Črna na Koroškem, about the project area and the course of the planned activities (22.7. 2023).

Based on past species diversity data, we decided to carry out a target inventory of the butterfly species Marsh Fritillary (*Euphydryas aurinia*) in this area. The implementation of the inventory and the results are part of the Deliverable 1.3.1: Biodiversity report. The end report carried out by the Slovenian Center for the Cartography of Fauna and Flora included recommendations and guidelines for the long-term management plan, which we pointed out in the above chapter.

The guidelines for the long-term management plan were the basis for the selection of the field work contractor. We invited more local contractors to send an offer for the execution of the works. We have clearly defined the competences that the contractor needs and the goals that he needs implement in the field. After choosing the appropriate contractor, we conducted a field visit together. The main stakeholders is the Slovenia Forest Service and the Farmland and Forest Fund of the Republic of Slovenia also took part in this field visit (18. 10.2023).

**Table 3.1:** Review of the activities at Helena Stream spring

Date	Activity	Stakeholder
start of the project	selection of the project area	
<b>17.11.2022</b>	obtained information about the landowner	
<b>11.01.2023</b>	establishing contact with the Farmland and Forest Fund of the Republic of Slovenia, presentation meeting	local official (Olga Pogorevčnik)

Date	Activity	Stakeholder
28.03.2023	field trip with the forester, area tour discussion of field actions	Slovenia Forest Service
25.05.2023	field visit with the leading partner, area tour discussion of field actions	Università degli Studi di Padova (Giulio Menegus)
22.07.2023	presentation of the I-SWAMP project, and activities	students, local community and the officials of municipality Črna na Koroškem
30.08.2023	official permission to carry out activities	the Slovenian Water Agency
04.10.2023	official permission to carry out activities	Farmland and Forest Fund of Republic of Slovenia
12.10.2023	recommendations and guidelines for the restoration and a long-term management plan	Center of Cartography of Fauna and Flora
18.10.2023	field visit and the presentation of the actions	contractor, local official, and forester, the contractor
03.02.2024	execution of works	External contractor



**Figure 3.3:** Field trip with the forester (28. 3. 2023)

### 3.1.3 Problems and further management

The project area, despite its small size, exceeded the financial framework that we intended for the activities of forest vegetation removal, for this reason, we have determined priority areas where the measure will be most effective.

The scope of work and the professional support of the Slovenian Forestry Service exceeded the time frame that could be allocated to the project support free of charge, so we had to allocate part of the funds to pay for their services. The time frame for the



execution of the works was tied to the final report of the the Slovenian Center for the Cartography of Fauna and Flora. The report could only be completed when the butterfly nests were inventoried and marked. The butterfly develops nests in autumn (2. 10. 2023 Označevanje gnezd travniškega opstavneža). The removal was carried out in the area where the highest density of the butterfly Marsh Fritillary.



**Figure 3.4:** Removing woody vegetation



**Figure 3.5:** Field trip (18. 10. 2023)





**Figure 3.6:** The cleared area after shrub removal

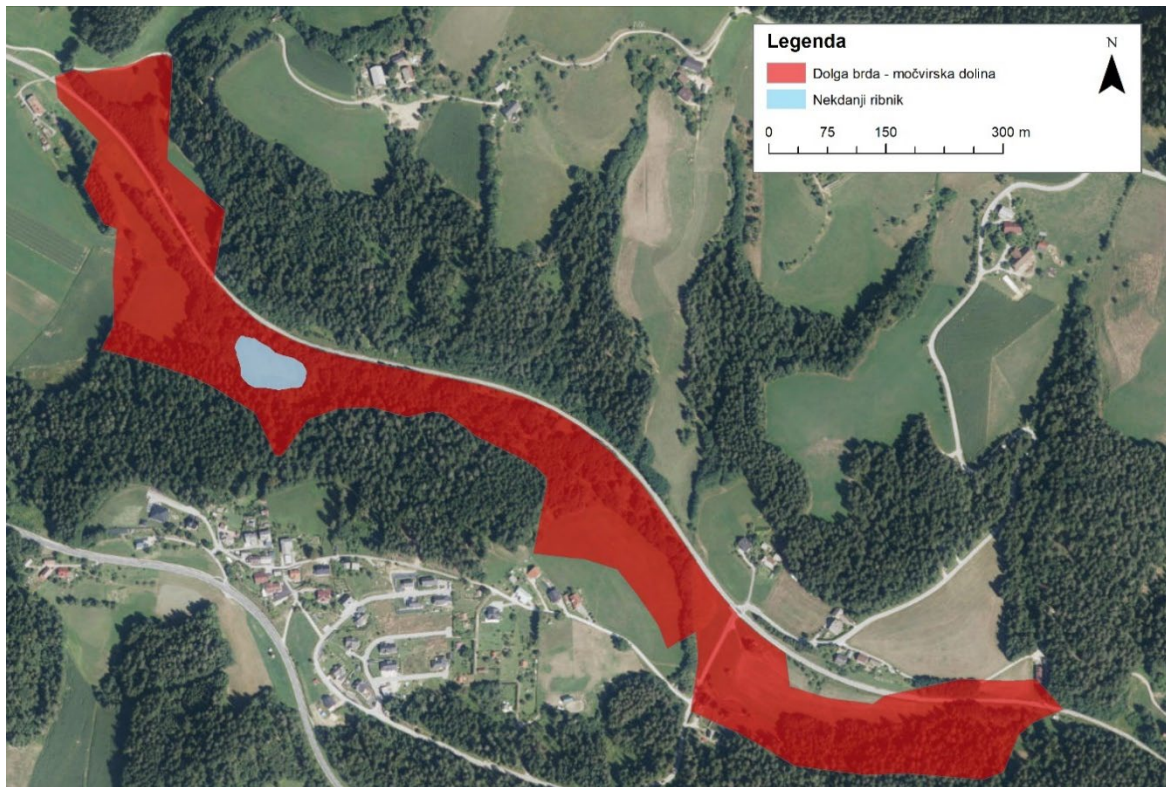
The characteristics of the wetland terrain represented organizational problems in the execution of the works. Due to the very wet terrain the planned execution of the work was thus postponed several times. The wet terrain made it impossible to drive with the tractor, so it was necessary to remove all the wooden biomass by hand. The uneven wet terrain required the workers to be especially cautious when walking.

Main long-term problem for this project area is the distance from the surrounding farms, low-quality forage and difficult terrain conditions (only manual mowing possible), therefore the owner (Farmland and Forest Fund of the Republic of Slovenia) does not get an interested tenant who would manage the area according to the above recommendations.

Optimal management of the area is unfortunately not possible to ensure. Best Strategy to implement a long-term mowing plan through related projects and voluntary activities to prevent of forest vegetation.



### 3.2 Dolga brda (“Long hills”)



**Figure 3.7:** Location of Dolga Brda



**Figure 3.8:** Dolga Brda (“Long hills”)

This is a marshy valley on the left tributary of the Meže river along the railway line Holmec – Dravograd. Wet mesotrophic and eutrophic meadows are scattered in the area. Slowly they pass into hygromesophilic lowland meadows in the surrounding area. There are stands of black alder along the watercourses, there are some small headwaters, overgrown ponds or water windows and a small transitional bog.



Some species of orchids thrive in the area. The abandoned pond within the area represents a miniature transitional bog with peat mosses. On the acidified meadows with wolfberry (*Nardus stricta*) in the eastern part of the railway crossing, there is a small growth of arnica (*Arnica montana*). The area is a habitat for endangered dragonflies. In the wider area of the transitional bog, the swamp beetle (*Carabus variolosus nodulosus*) occurs. The grasslands have an extremely diverse fauna of diurnal butterflies, which has not yet been recorded elsewhere in Carinthia. The swampy valley is the habitat of amphibians. The stream has a largely preserved natural riverbed, where native brown trout (*Salmo trutta*) still lives.

### 3.2.1 Planned conservation and restoration measures

The area of natural value extends over one kilometer. The black alder forest and the stream are well preserved. This is the reason why we decided from the beginning to devote the majority of our activities to the best possible renaturation of the silted pond.

The main goal of the restoration was the partial removal of forest vegetation and improving the water dynamics in a silted pond for the preservation of habitat space for wetland plants, amphibians and dragonflies.

### 3.2.2 Implementation



**Figure 3.9:** Field trip (21.06.2023)

The course of activities that we carried out in this area is identical to that in the area of the Helena Stream spring. The land is state-owned under the same supervision of the local official.



The area was also connected and intertwined with the nearby forest so the expertise and support of Slovenian Forest Service was included. We obtained all the necessary permits that we obtained in the Helena Stream spring (official permission from the Farmland and Forest Fund of the Republic of Slovenia (Sklad kmetijskih zemjišč in gozdov RS, številka: 47820-271/2023-11, 4.10.2023, MARTIN BRUS) and the Slovenian Water Agency, (Direkcija RS za vode, Sektor območja Drave, štev. 35506-2116/2023-2, 30. 8. 2023).



**Figure 3.10:** Field trip (18.10.2023)

We conducted a joint field trip (21.06.2023) with representatives of the local hunting association. Hunters said the pond was dammed in the 1960s and used for duck breeding. Since interest in duck hunting in the local area died down, the pond was abandoned after 1990 and slowly silted up. We presented the important role of the pond to the hunters and verbally agreed that it would be maintained again in the future.

One of the conceptual project activities in this area was the removal of forest vegetation. Based on past species diversity data, we decided to carry out a target inventory of the vegetation, habitat types, amphibians, and dragonflies in this area. The implementation of the inventory and the results are part of the Deliverable 1.3.1: Biodiversity report. The

end report carried out by the Slovenian Center for the Cartography of Fauna and Flora. We presented the financial framework for the project activities to the experts of the Center for the Cartography of Fauna and Flora and they suggested that the most effective for all the species included in the inventory is the re-establishment of a larger permanent water body in the area. The botanists of the pointed out that the transitional states between an abandoned pond and land are also an extremely rare succession habitat type. Thus, we removed the accumulated silt and aquatic vegetation only in part of the pond.

The funds intended for implementation in this area were thus used to rent an excavator that excavated part of the silted pond.

For the sake of rationality, we included the public order for the execution of works in both project areas in to one contract with the same contractor.

During the preparation for the implementation of the works, we visited the project area several times. (7.12.2023 field visit with an excavator driver and a district forester. final agreement on the execution of the works and the access route of the excavator to the pond).

**Table 3.2:** Review of activities in Dolga Brda (“Long Hills”)

Date	Activity	Stakeholder
<b>start of the project</b>	selection of the project area	
<b>15.12.2022</b>	obtained information about the landowner	
<b>11. 01. 2023</b>	establishing contact with the Farmland and Forest Fund of the Republic of Slovenia, presentation meeting	Local official
<b>28.03.2023</b>	field trip with the forester, discussion of field actions	Slovenia Forest Service
<b>22.05.2023</b>	field visit, presentation to students	student in practice
<b>25.05.2023</b>	field visit with the leading partner, discussion of field actions	Università degli Studi di Padova (Giulio Menegus)
<b>21.06.2023</b>	field trip, discussion of field actions	The forester, local official, local hunters
<b>30.08.2023</b>	official permission to carry out activities	The Slovenian Water Agency
<b>04.10.2023</b>	official permission to carry out activities	Farmland and Forest Fund of the Republic of Slovenia
<b>12.10.2023</b>	recommendations and guidelines for the restoration and a long-term management plan,	Center for the Cartography of Fauna and Flora of Slovenia
<b>18.10.2023</b>	field visit and the presentation of the actions	The contractor, This local official, and forester
<b>07.12.2023</b>	field visit and the presentation of the actions	The contractor, the excavator driver, local forester
<b>15.-18.12.2024</b>	execution of works	The contractor, the excavator driver,
<b>11.01.2024, 20.12.2023</b>	control of work performance	IRSNC and forestry service





**Figure 3.11 (top and bottom):** Control of work performance

### 3.2.3 Problems and further management

The marshy valley is in general well preserved. The broader area, therefore, does not require a long-term management plan. It is important not to interfere with the stream banks and allow the water to flow freely and naturally.

The main problem in this area is the abandoned use of the pond and the resulting siltation. The only potential long-term manager of the pond is the local hunting society. So far, we have only managed to achieve an oral agreement with the hunters. In the long term, the goal should be to integrate pond maintenance into the local game management plan for the area and, ensure adequate funding for these activities.



Due to natural processes occurring in the pond, sediment will need to be removed again in 15 to 20 years.

In the border zone, especially where the area transitions into spruce forest, invasive species appear - Himalayan balsam (*Impatiens glandulifera*). The immediate vicinity of a railway track can represent an additional potential source of invasive species entry.

With voluntary work or related projects, we have to prevent the spread of invasive species, especially in the area of the pond, which is botanically most interesting.

### 3.3 Zadnji travnik (“The last meadow”) – Olševa

The “Last meadow” bog is a typical high bog in the last stages of the succession. The central part of the bog is overgrown with mountain pine (*Pinus mugo*) and peat moss (*Sphagnum fuscum*, *Sphagnum pulchrum*, *Sphagnum centrale*). The characteristic plants of the high barrens, the knife-edge (*Eriophorum vaginatum*) and the round-leaved sundew (*Drosera rotundifolia*), which are among the rare and endangered plants of Carinthia, also grow here. A small stream flows on the south side of the bog, and on the west side, the bog passes into a pasture with a small basin, which is filled with water for a long time during the rains.

The basin is closed in the west by the frontal moraine of a small glacier, and Quaternary moraine material is also visible in the wider area of the basin itself and the entire northern slope of Olševa. At the Last meadow, slope gravel is also deposited under the steep northern slopes of Olševa.



Figure 3.12: Location of Zadnji travnik (“The last meadow”)





**Figure 3.13:** Zadnji travnik (“The last meadow”)

### **3.3.1 Planned conservation and restoration measures**

Some forest vegetation is present in the area. The coverage of shrubs and younger trees is low and does not affect the characteristics of the wetland. The dominated tree mountain pine at the center of the bog represents the typical landscape appearance. Some small spruce and willow are already growing in the bog. Cattle grazing in the area affects the state of the wetland.

The main goal in this area was an establishment of a long-term grazing plan. The partial removal of mountain pine and forest vegetation.

### **3.3.2 Implementation**

The course of activities that we carried out in this area is identical to that in the previous areas. The land is state-owned under the same supervision of the local official. Unlike the previous project sites, there is no larger water body in this area needs no official permission from the Slovenian Water Agency was needed here. For the better communication with stakeholders the Slovenian Forest Service was included.

We conducted a field trip (23.06.2023) with the local official and representatives of the pasture community Olševa. We presented the I-SWAMP project to the representatives of the pasture community, emphasizing the significance of the wetland area and its conservation. We gathered information about the needs and goals of the pasture community in the broader area of the wetland.

We conducted a field trip (21.07.2023) with a group of students who participated in a Biological research camp. Together, we conducted a survey of vegetation and other present species.

We presented the I-SWAMP project (22.07.2023) to the students who attended the “biologists research camp”, we informed the students, representatives of the local community and the municipality Črna na Koroškem, about the project area and the course of the planned activities.

Based on past species diversity data, we decided to carry out a target inventory of the vegetation, with emphasis on moss species inventory (Determining moss species is more challenging than regular botanical identification).

The results are part of the Deliverable 1.3.1: Biodiversity report. The presence of certain plants indicates, that in parts of the wetland, nitrification is occurring, leading to suboptimal conditions for wetland plants. The botanical experts of the Center for the Cartography of Fauna and Flora therefore suggested the complete abandonment of grazing in this area. The overgrowth of mountain pine is slow due to the high altitude and does not adversely affect other plant species. The presence of forest workers and activities for cutting the undergrowth could potentially cause more harm than benefits in the fragile wetland ecosystem. That's why we have decided not to remove the undergrowth.

We communicated this recommendation to the pasture community and the land owner, agreeing that grazing activities would be withdrawn from the broader wetland area.

Due to the change in location, we bought and give to the pasture community new wooden stakes for the electric fence.

**Table 3.3:** Review of activities in Zadnji travnik (“The last meadow”)

Date	Activity	Stakeholder
<b>start of the project</b>	selection of the project area	
<b>15.12.2022</b>	obtained information about the landowner	
<b>11. 1. 2023</b>	establishing contact with the Farmland and Forest Fund of the Republic of Slovenia, presentation meeting	local official
<b>17.5. 2023</b>	establishing contact with the pasture community Olševa - a phone call	president of the pasture community Olševa
<b>23. 6. 2023</b>	field trip- the presentation of the actions, information about the needs and goals of the pasture community	local official, president of the pasture community Olševa
<b>21. 7. 2023</b>	field trip - the presentation of the actions, species inventory	group of students of Biology
<b>22. 7. 2023</b>	presentation of the I-SWAMP project, and activities	University students of Biology, the local community and the officials of the municipality Črna na Koroškem
<b>12.10. 2023</b>	recommendations and guidelines for the restoration and a long-term management plan,	Center of the Cartography of Fauna and Flora of Slovenia



Date	Activity	Stakeholder
18. 10. 2023	We communicated this recommendation to the land owner (on the field trip to Long Hills)	local official
20. 10. 2023	We communicated this recommendation to the president of the pasture community Olševa - a phone call	president of the pasture community Olševa
3. 2. 2023	The delivery of wooden stakes to the pastoral community	The president of the pasture community Olševa



**Figure 3.14:** Field trip (23.06.2023)



**Figure 3.15:** Relocation and reparation of the old fence



### 3.3.3 Problems and further management

The grazing management plan surrounding the wetland area has already been established in the past. The inner zone with a buffer zone of the wetland has been fenced with an electric fence. The cattle population in the areas was kept low, with only 2 adult cows with calves. Nevertheless, the negative impact on the wetland area is still significant. In the future, due to the cessation of grazing, it will be necessary to periodically mow the area every few years.

Although the mountain pine and other forest vegetation overgrowth is not currently at a critical stage, it will be necessary to remove a section (up to 20%) of the undergrowth from the central part of the wetland in the coming decade.

Due to the remoteness of the wetland from the road and hiking trails, it is not expected that the area would be at risk from the impacts of tourism and forestry in the broader region.



**Figure 3.16:** Field trip (21.07.2023)



### 3.4 Šumc – Mežica Municipality



**Figure 3.17:** Šumec



**Figure 3.18:** Forest vegetation in Šumec



This swamp includes various types of wet meadows and transitional bogs which are surrounded by intensively cultivated meadows and pastures. The slopes and forests above, and partially in the area, lie on carbonate Triassic aquifer rocks, and the greater part of the settlement on impermeable Miocene clays, in which layers of brown coal occur. There are three marshy meadows in the area, which in some places turn into a typical alluvial bog.

### 3.4.1 Planned conservation and restoration measures

The area around the swamp is agriculturally intensified. The coverage of shrubs and younger trees is present and begins to have an impact on the characteristics of the wetland.

The main goal in this small area was to acquaint the owner with the importance of the small wetland and its conservation.

### 3.4.2 Implementation



**Figure 3.19:** Field trip (21.07.2023)

Unlike previous areas, this wetland is entirely in private ownership. We obtained official information about the landowner (“e-sodstvo” 13. 2. 2023).

We conducted a field trip (12. 5. 2023) and walked through the area to assess the state of preservation and inventory of the vegetation. We established contact with the owner, presented the I- SWAMP project, explained the importance of the swamp bog, and asked for permission to carry out nature conservation activities. The owner was against the removal of the shrubs and forest vegetation. He wishes to retain the harvested biomass



for heating, but due to windfall in previous years, he currently has enough supply of biomass. The owner did not oppose other project activities.

We revisited the owner (21. 6. 2023) and again explained the importance of the swamp bog.

We conducted a field trip (21. 7. 2023) with a group of students who participated in a Biological research camp. Together, we conducted a survey of vegetation and other present species.

We presented the I-SWAMP project (22. 7. 2023) to the students who attended the “biologists research camp”, we informed the students, representatives of the local community and the municipality Črna na Koroškem, about the project area and the course of the planned activities

**Table 3.4:** Review of activities in Sumeč

Date	Activity	Stakeholder
<b>start of the project</b>	selection of the project area	
<b>13. 2. 2023</b>	obtained information about the landowner	
<b>12. 5. 2023</b>	field trip - established contact with the owner, presented the I-SWAMP project	owner
<b>21. 6. 2023</b>	field trip - explained the importance of the swamp bog.	owner
<b>21. 7. 2023</b>	field trip - the presentation of the actions, species inventory	group of students
<b>22. 7. 2023</b>	presentation of the I-SWAMP project, and activities	students, the local community and the officials of the municipality Črna na Koroškem

### 3.4.3 Problems and further management

The main problem during the implementation was the owner's unpreparedness for the removal of shrubs and forest vegetation. The owner will remove the forest biomass from the bog area, in the coming years, when the forest work following the windbreak is completed. We agreed that he would inform us (IRSNC) before the start of the works so that we can suggest the best time frame and conservation restrictions for carrying out the biomass removal.

Intensive fertilization and mowing of the surrounding area pose a significant problem for this fragile swamp bog. Unfortunately, we do not have an operational solution for this problem, except further communication activities.

### 3.5 Smrekovec – Krnes I and Krnes II

Two small bog areas located on top of the ridge of Smrekovec. The surrounding area of the bogs is a high mountain meadow, which is grazed and mowed once a year at the end of August. Around the first bog 10 spruce trees grow on the north side. The size of the trees is on average below 2 m. Some trees have already grown over 3m in height. Trees provide shelter from the sun and retain moisture, thus creating a unique microclimate. The southern part of the bog is devoid of tree vegetation, and as a result is somewhat drier. In this place, mossy vegetation appears in smaller patches. Around the second bog there is no vegetation. The footprints of cattle that are drinking water from the bog are visible.

#### 3.5.1 Planned conservation and restoration measures

The main goal in this small area was to acquaint the owner with the importance of the small wetland and its conservation. The Smrekovec area is a popular hiking destination, so we have decided to inform visitors about the importance of alpine wetlands. The removal of shrubs and forest vegetation was planned around one bog. Activities of deepening the bogs water level and lowering the level of the slopes were planned.



Figure 3.20: Location of the bogs





**Figure 3.21:** Bog Krnes I



**Figure 3.22:** Bog Krnes II



### 3.5.2 Implementation

The Bogs lie on territory that is privately owned (one of the larger private owners in the region). We established contact with their local representative (Metropolitana d.o.o.), whose primary activity is forest management for the owner.

We conducted a field trip (01.06.2023), with the local official, and assessed the state of the area and presented the importance of small alpine wetlands. The representative stated that he allows all renaturation activities but is not willing to take on any costs or long-term management of the wetlands. we obtain an official written permit from the central unit representative of the owner.

Due to the distance, difficult access, and a small amount of forest vegetation that does not significantly impact the state of the bog, we have decided not to intervene in the area. We have thus focused the main emphasis of the activities on raising awareness among the public and visitor of this area. Because the Smrekovec area is located on the administrative border of IRSNC, we attended a workshop (21.04.2023), organized by the Celje regional IRSCN unit as part of the ZAGON project (project focused on the restoration of ponds in the Savinja Alps region). The I-SWAMP and ZAGON projects cover very similar topics of nature conservation, so the exchange of ideas and measures was excellent added value. 21.06.2023 we attended a workshop of the ZAGON project on the topic of managing ponds in the Alpine region. At this workshop, we briefly presented the I-SWAMP project. A representative of the landowner also attended this workshop.

In early August (08.08.2023), we planned a joint hike to the bogs with geology students who would visit the EGCT Geopark Karavanke area. Unfortunately, the event was cancelled due to the August floods.



**Figure 3.23:** Workshop for the project ZAGON (21.04.2023)



On 24.09.2023 we conducted a joint seminar for stakeholders' presentation with EGCT Geopark Karavanke, the presentation seminar took place as part of the promotion of annual event at the Smrekovec mountain. We conducted a field visit to the bogs with members of mountain clubs and managers of mountain huts. We presented to them the importance of preserving mountain nature and small Alpine wetlands and the project activities as well as further management measures for preserving their good natural state. "In the afternoon, we conducted a presentation for the students of Črna na Koroškem Primary School in the mountain hut.

**Table 3.5:** Review of activities in Smrekovec

Date	Activity	Stakeholder
<b>start of the project</b>	selection of the project area	
<b>19.12.2023</b>	obtained information about the landowner	
<b>21.04.2023</b>	workshop of the ZAGON project-exchange of ideas and measures	IRSCN- Celje , IRSCN central unit, Slovenia Forest Service (regional Nazarje), Slovenian forest institute
<b>10.04.2023</b>	establishing contact with the local representative (Metropolitana d.o.o.)- a phone call	local official
<b>14.04.2023</b>	request for execution of works - written permit	Central unit of Metropolitana
<b>01.06.2023</b>	field trip - explained the importance of the swamp bog.	local official
<b>21.06.2023</b>	workshop of the ZAGON project-management of ponds in the Alps, I-Swamp presentation	IRSCN- Celje, Slovenia Forest Service (regional Nazarje), Slovenian forest institute, local official, local farmers
<b>24.09.2023</b>	joint stakeholder seminar with EGCT Geopark Karavanke	mountain clubs members, managers of mountain huts, students (and their parents) of Črna na Koroškem Primary School



**Figure 3.24:** Field trip (21.06.2023)

### 3.5.3 Problems and further management

Despite repeated attempt and convincing the local representative about the importance of the ponds in the area, he did not internalize their specific role in the area. The local official was not willing to take on any financial or long-term managerial responsibilities. However, he did not oppose nature conservation activities if they were financed from other (project) sources.

In the long term, the ponds will be subject, like all Alpine regions, to climate change and increasingly warmer summers, which will have an extremely negative impact on the water level and living conditions in the pond. Artificially importing and maintaining the water level during the summer would not be economically reasonable.

In future monitoring will be carried out and at the end of the project we agreed with the local association "Smrekovec nature conservation alliance" to carry out volunteer actions of scrub removal, periodical fencing of the small bogs and communication activities to inform about the importance of wetlands and nature at the Smrekovec mountain in general.



**Figure 3.25:** Stakeholders seminar field visit (24.09.2023)