

RECREATIONAL POTENTIAL OF NEWLY BUILT POOLS

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Abstract

Water retention in the landscape is an important activity for improving the hydrological and microclimatic conditions of a particular site. The current trend of building pools in the landscape is certainly one way to contribute to stabilising the hydrological regime in times of climate change. The presented research focuses on the recreational potential of newly built pools, at the Hastman locality in the cadastral area of Janovice u Polné, which are managed by the Czech State Forest. Water quality monitoring in the pools is also part of the research. The recreational potential of the constructed pools is not insignificant for monitoring the increasing biodiversity on the site and in the surrounding area. The evaluation of the measured data was undertaken after one year of monitoring. The development of emergent vegetation and the gradual integration of the pools into the forest ecosystem was monitored at the site of interest.

Keywords: Water retention in the landscape, water quality, emergent vegetation

Introduction

Pools and wetlands are unique and attractive places for recreational activities. People can use these sites to watch birds, admire the diverse flora and relax in connection with nature. They offer space for fishing, hiking, and photography. This recreational use can contribute to public awareness of the importance of wetland conservation. Wetlands are crucial to the ecosystem, providing many ecosystem services. For example, they retain water and use their self-cleaning capacity, transform flood events and store carbon, which contributes to climate regulation. Raising awareness of these services can strengthen wetland conservation. Wetlands and pools are sites of biodiversity. They provide habitat for many species of plants and animals, including endangered and rare species. Ensuring the protection and restoration of wetlands can lead to an increase in overall biodiversity in the landscape. To increase biodiversity around pools and wetlands, it is important to look after the overall landscape. This means minimising water and soil pollution, maintaining the surrounding vegetation and preventing massive deforestation. A diverse landscape is key to maintaining and developing the habitat for wetlands and associated ecosystems. Public involvement in wetland conservation and restoration is also important. Education about the importance of these environments and community involvement in volunteer activities such as wetland cleanup and restoration can help to protect and enhance biodiversity in the landscape. Strategies that combine recreational use, wetland protection and biodiversity enhancement in the surrounding landscape are key to sustainable environmental protection and strengthening the human-nature connection.

Materials and methods

The area in question is located in the municipality of Janovice u Polné (657069), at an altitude of 603-607 m above sea level. (Fig. 1) In the foot of the dam there are currently massive specimens of maple and lime trees. The site is located on a stream: Poděšínský potok, IDVT 10239008 (ČHP 1-09-01-010), administration: Czech State Forest.

In the area of the former floodplain, surface drainage ditches have been used to drain off the forest in the past. The system of ditches is connected to a straight and deepened watercourse. Subsequently, planting of a production forest was carried out in the area of the floodplain. Prior to the implementation of the pools, there was an overgrown stand of alder (*Alnus glutinosa*), 5-10 years old, in the central part of the area in a forestry fence, which drained a significant amount of water through transpiration processes. The stand contained several pieces of old alder stumps, some of which are potentially valuable not only as naturally decaying wood but also as a source of coppice. Most of the area in question was waterlogged, with water being quickly drained away by drainage ditches. The vegetation on the site can be described as fragments of natural alder woodland in combination with production forest of spruce stands. The area has been affected by a high level of ruderalisation of the forest weed

plants, dominated by nettle (*Urtica dioica*) and wood small-reed (*Calamagrostis epigejos*). (Marková, Pelikán, 2022)



Fig. 1 Localization of the area

Five pools with different surface area, depth and bottom diversification were excavated at the site. A small wooden log weir approximately 0.3 m high with a rockfill stabilization was built in the stream bed in front of the culvert inlet at km 0.00650 at upstream slope of a historical dam. The raising of the water level ensured the filling of the pools and also the development of littoral zones with very low water depths - wetland areas. The pools were constructed as separated from the stream by land, except of pool T5 in the northern part of the area. This is connected to the stream, but its deepest part is separated from the part connected to the channel by a cross dam made of riprap up to 80 kg (3×5 m). The terrain has been suitably modelled to protect part of the alder coppice from permanent flooding. In the centre of the site, the existing deepened and straightened Poděšínský stream was undulated in its alignment by the design of six counter-curves - part of the revitalisation measures in km 0.025-0.090. The lengthening of the stream route resulted in a slight reduction in the longitudinal slope of the bed level and therefore in the zone with flowing water to create more favourable conditions for animals and plants associated with this type of ecotope. Pools: total water level area 2288 m², accumulated volume 1229 m³.

Water level area of individual pools:

Pool 1 – 105 m²; Pool 2 – 105 m²; Pool 3 – 1290 m²; Pool 4 – 53 m²; Pool 5 – 735 m². Max. excavation depth 1.5 m. Length of the revitalised section of the stream 65 m.

The landscaping of the excavation of the pools also included the creation of reptile shelters, leaving part of the branches from tree felling on the site in the form of piles, as a possible shelter for fauna. In addition, some tree logs were also left in place, both in the transition area between the aquatic and terrestrial zone and around pools. Solitary stumps were placed in the pool area, with the trunk driven into the bottom. (Tlapák, Pelikán, Marková, 2020)

In April 2022, the site was flown by drone and a digital terrain model was created.

A sensor was installed at the site in May 2022 to continuously monitor local air temperature and humidity. (Fig. 2)

Selected water quality parameters were also monitored at monthly intervals from May 2022. Temperature, O₂ content, pH and conductivity were measured directly in situ. Phosphorus and nitrogen content were then determined in the laboratory.



Fig. 2: View of site 4/2022, sensor located near pool T1 point S1

Results

Despite its remoteness from human settlements, the area has undergone quite dramatic changes, from forest cover to water area, reforestation, drainage to a system of pools. The system of pools built in the autumn of 2021 is certainly a suitable solution for retaining water in the landscape and making the wetland area more attractive.

It was already evident in the first growing season that the site would soon become a habitat for aquatic and wetland species after completion of earthworks. The photo documentation shows the progressive development of aquatic and riparian vegetation. Water-bound insects and small animals were recorded during visits/sampling.

By the beginning of the second growing season, the involvement of the pools in the surrounding area is already visible, with the presence of a diverse range of aquatic and wetland plants such as common cattail (*Typha latifolia*).

In the third growing season, seedlings of alder trees that have been cut down begin to appear on the site, except for a no-intervention zone with coppice alders in the centre of the area. Natural alder regeneration is evident here.

It can be assumed that the current "attractive" state of the pools will persist for about another 5 years. Gradually, the pools will be silted-up and overgrown. Without maintenance, the whole area will gradually become a wetland. This condition is ecologically beneficial and the area will continue to provide ecosystem services such as influencing the microclimate, water retention in the landscape, self-cleaning processes, and act as an important ecotope in the area. In terms of recreational potential, however, the attractiveness of the area will be reduced.

The monitored water quality parameters have been evaluated according to Government Regulation No. 401/2015 Sb. on indicators and values of permissible pollution of surface water and wastewater, details of permits for discharge of wastewater into surface water and sewers and sensitive areas, Annex 3: Indicators reflecting the status of surface water, environmental quality standards and requirements for water use. The established limits of the annual average concentration according to the regulation are for P_{sum} up to 0.15 mg/l and for N_{sum} up to 6 mg/l. Tab. 1 presents the results of the sampling of total nitrogen and phosphorus. The average annual concentration of phosphorus was exceeded for Pools T1, T2 and T4, only Pool T5 met the surface water limit, Pool T3 is at the 0.15 mg/l limit. P_{sum} measurements had the greatest fluctuation at Pools T4, with zero concentrations in May 2022 and a maximum (of all pools) in April 2023, with a P_{sum} value of 0.82 mg/l. The greatest extreme of N_{sum} measurements was registered at Pool T3 with zero N_{sum} values in November 2022 and May 2023, and conversely a maximum value (of all pools) of 13.1 mg/l in February 2023. The annual average N_{sum} concentrations were not exceeded at the pools and met the limits as per the government regulation. Measurement of water quality parameters was also assessed in the stream channel, the sampling point was just above the pools.

Tab. 1: Pool parameters and annual average phosphorus and nitrogen concentrations

Sample point	Level area m ²	Pool area m ²	Volume m ³	Depth m	P _{sum} mg/l	N _{sum} mg/l
Pool T01	105	248	27	0.3	0.159	1.10
Pool T02	105	159	45	0.4	0.222	2.05
Pool T03	1290	1703	798	0.6	0.15	3.82
Pool T04	53	143	12	0.2	0.215	2.54
Pool T05	735	1020	347	0.5	0.138	2.80
Stream	-	-	-	-	0.138	2.37



Fig. 3, 4: Photo of the area 6/22 (Pelikán 2022); 12/23 (Marková 2023)



Fig. 5: Photo of the area 5/23 (Marková 2023)

Conclusion and discussion

The pools in the locality of Hastrman, in the cadastral area of Janovice u Polné, have been monitored since their realization in 2022. Photodocumentation has been taken showing the gradual integration of the pools and the growth of wetland vegetation. In spring 2022, a drone survey was carried out, a digital terrain model was created and a sensor for continuous monitoring of air temperature and humidity was installed. Beginning in May 2022, the water quality of individual pools and the stream is being assessed at monthly intervals.

In the third growing season, it can be concluded that the pools are fully engaged with the surrounding environment. Population by both wetland flora and fauna has occurred. A stable ecological element is established also due to the stable water level in the all pools. The water quality assessment in the first year showed that the water in the pools meets the parameters set by Government Regulation No. 401/2015 Sb. in Annex 3 in the average annual values. The results of water quality measurements and their evaluation (analysis) in the context of Decree No. 401/2015 Sb. may not be relevant to the ecological development of the pools and the entire site. The measurements show a dynamic development of the individual parameters depending on the vegetation development phase. The

gradual overgrowing of the pools and the whole area with wetland vegetation may cause an apparent reduction in the attractiveness of the area, but the ecological function and value of the area will still be high, with possible benefits for observation not only of waterfowl.

References

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Souhrn

Tůňe v lokalitě Hastrman, v katastrálním území Janovice u Polné, jsou sledovány od jejich realizace v roce 2022. Je pořizována fotodokumentace dokládající postupné začleňování tůní a vzrůst mokřadní vegetace. Na jaře 2022 byl realizován průzkum pomocí dronu, vytvořen digitální model terénu a bylo instalováno čidlo pro kontinuální sledování teploty a vlhkosti vzduchu. Od května 2022 je v měsíčních intervalech vyhodnocována kvalita vody v jednotlivých tůních a v toku.

Ve třetí vegetační sezóně lze konstatovat, že tůňe jsou plně zapojeny do okolního prostředí. Došlo k osídlení jak mokřadní florou, tak faunou. Je vytvořen stabilní ekologický prvek i vzhledem k tomu, že hladina vody je v jednotlivých tůních relativně stálá.

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