Excursion guide

FORECOMON 2024 – The 11th Forest Ecosystem Monitoring Conference
Monitoring for Future Forests
Prague, Czech Republic, 10–12 June 2024

Excursion program

Wednesday, June 12, 2024

8:30	Departure from the Grand Hotel International
11:00 – 12:15	Forest Cooperative of Municipalities Přibyslav, forest district Nové Veselí – forest restoration on large-scale clearings
13:30 – 15:30	Želivka research facility - experimental catchment and ICP Forests intensive monitoring plot
16:30 – 17:30	Kutná Hora - UNESCO World Heritage Site
18:00 – 19:30	Dinner in Kutná Hora
21:00	Return to the Grand Hotel International

Practical information

Transportation

A bus will be provided for the entire excursion, departing from the Grand Hotel International at 8:30 AM. The bus will make several stops throughout the day, with the final return to the hotel by 9:00 PM.

What to bring

We will spend several hours in the forest, moving off the paths as well. We recommend hiking boots and appropriate clothing. The temperature is expected to be around 18°C (64°F), and you should also be prepared for the possibility of rain showers

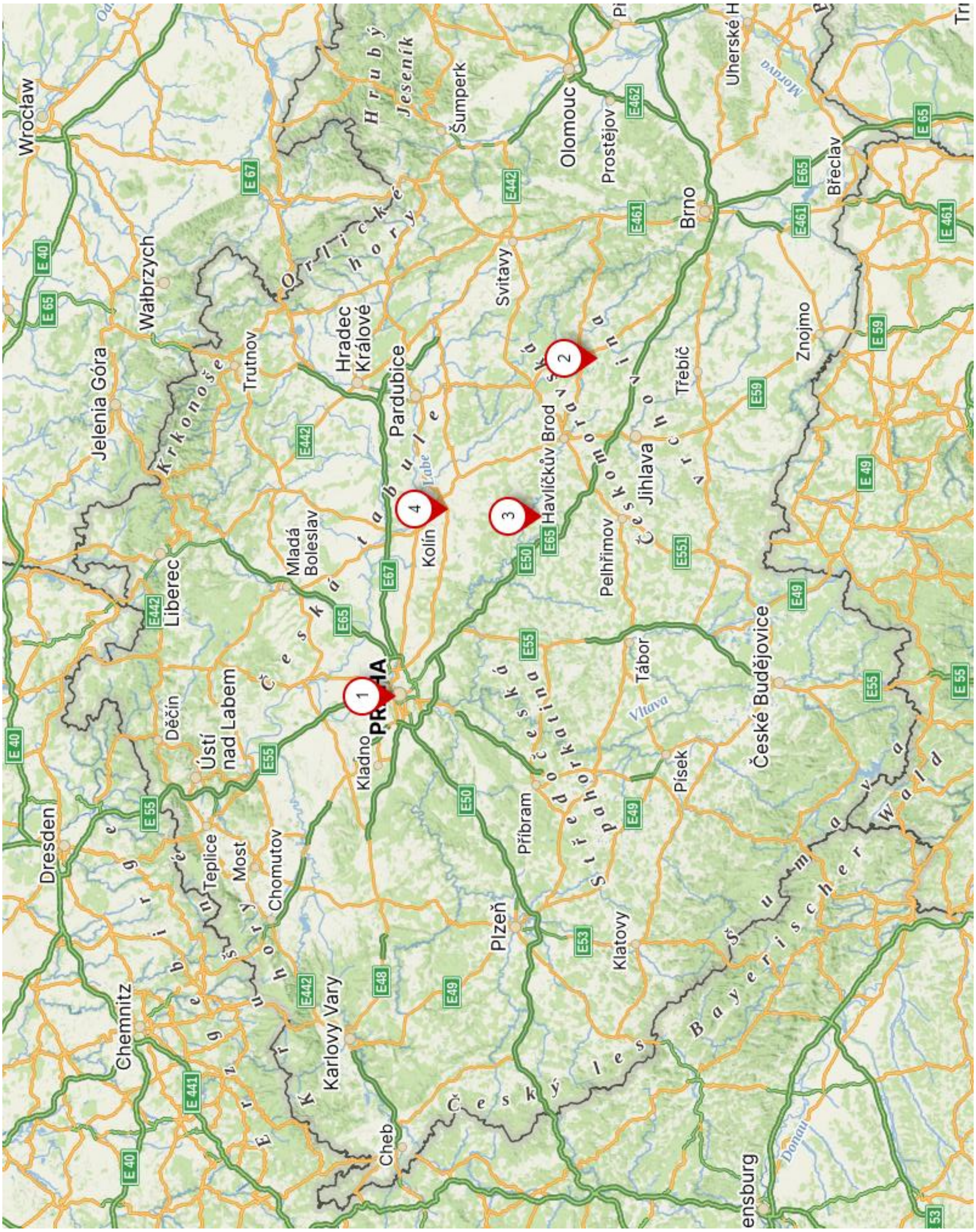
Contact

For any questions or in case of emergencies during the excursion, please contact:

Monika Vejpustková
+420 608 117 833
vejpustkova@vulhm.cz

Excursion – summary map

1. Prague
2. Nové Veselí
3. Želivka
4. Kutná hora



1. Forest Cooperative of Municipalities (FCM) Přibyslav – forest restoration on large-scale clearings

About FCM Přibyslav

FCM Přibyslav has an interesting history. It was established based on the first land reform in 1930, which divided approximately 12,500 hectares of forest belonging to the Žďár nad Sázavou estate into three parts. A significant portion, about 5,600 hectares, remained in the possession of Eleonora Kinská, the then-owner of the Žďár estate. The rest of the forest land was acquired by the newly formed forest cooperatives in Polná and Přibyslav. The forest land reform was part of broader reforms that followed the establishment of Czechoslovakia. In 1931, approximately 5,800 hectares of forest, ponds, and agricultural land were transferred to the forest cooperative. After World War II and the communist coup in 1948, FCM continued with certain restrictions until 1959 when its activities were terminated by government decree and its property was nationalized. FCM was restored in 1995 in connection with property restitutions.

Currently FCM Přibyslav manages 5,700 hectares of forest land. The cooperative is owned by 44 municipalities in the Žďár and Přibyslav region in the central part of the Czech-Moravian Highlands. The cooperative focuses on tasks related to forest management, including timber acquisition and transportation. Additionally, it provides comprehensive forestry services to small forest owners in the region. It also engages in the sale of timber and other wood products and operates a recreational facility near the Řeka pond.

Until recently, the tree species composition of the forest stands managed by FCM was dominated by Norway spruce (Fig. 1), which occurred mainly in pure even-aged stands. A large part of the spruce stands was established in the 1930s, when two vast calamities occurred in a short period. The first calamity was the extensive snow and wind breakage in 1930, caused by a large amount of wet snow and a windstorm on October 26, 1930. The second calamity, in the winter of 1932/33, was caused by hoarfrost. As a result of both calamities, more than 550,000 m^3 of wood had to be harvested, and nearly 2,000 ha of clearings appeared. Both calamities affected the forest management of FCM for many decades and played a significant role in the development of the bark beetle outbreak in 2017 – 2023 (Fig. 2). In this period, almost 550,000 m^3 of bark-beetle wood were harvested, and 633 ha of clearings were afforested.

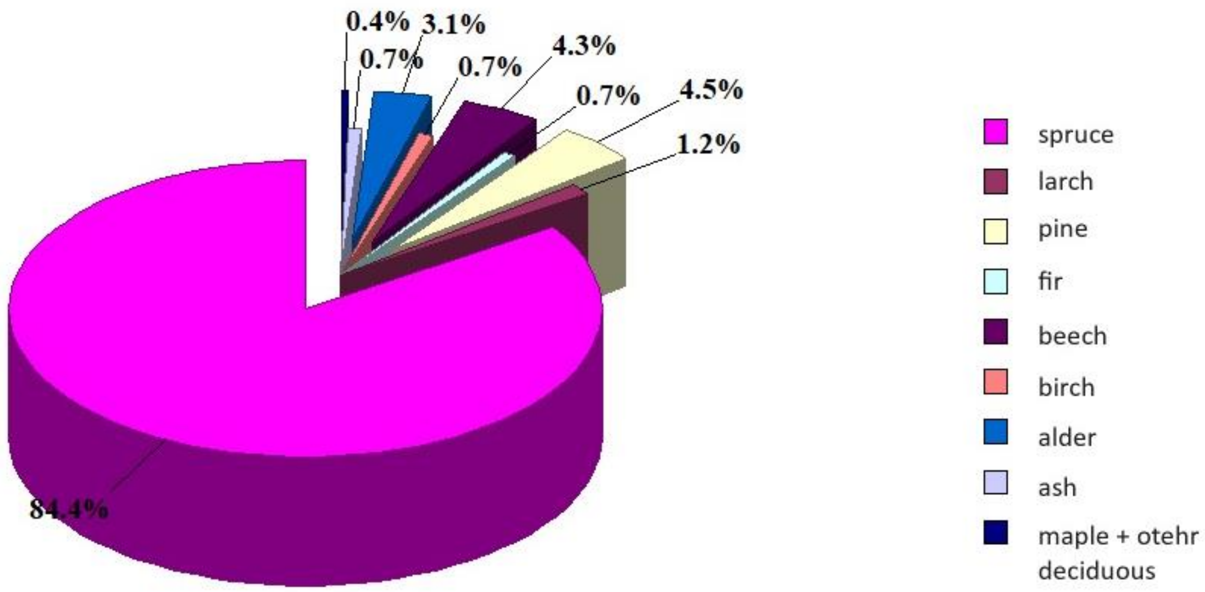


Fig. 1 Tree species composition of forest stands managed by FCM Přibyslav

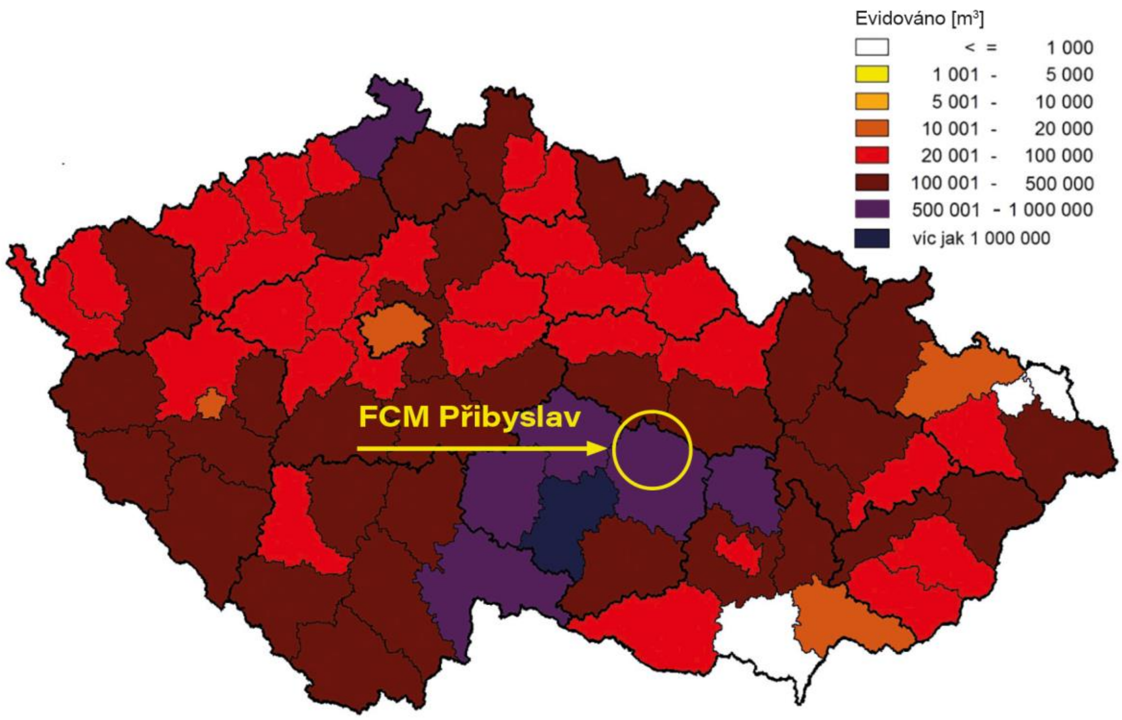


Fig. 2 Recorded volume of spruce wood [m^3] infested by bark beetle in 2020 in individual districts of the Czech Republic.

Project **“Implementation of innovative forest regeneration procedures on large-scale clearings with regard to the support of biodiversity and increasing the functionality of forest ecosystems”** was a joint project of Forestry and Game Management Research Institute (FGMRI) and FCM Přibyslav running from April 2022 to April 2024.

The aim of the project was to restore the forest on large-scale clearings resulted from the bark beetle outbreak using the alternative restoration procedures leading to higher species, age and spatial diversity of emerging stands and promoting biodiversity through the preserving of habitat trees and active management of dead wood. The restoration procedures were designed based on a detailed mapping of site conditions and the evaluation of biodiversity parameters. During the project, a total of 39.4 hectares of plots were afforested. A total of 13 tree species were used, including oak, beech, alder, maple, birch, linden, aspen, cherry, elm, fir, spruce, pine, and larch.

The main outputs of the project are three realized examples of good practice showing different alternative options for establishing a new generation of forest on clearings. The first example shows forest restoration in several stages when fast-growing pioneer tree species (birch, aspen) are first planted on the clearing or can spread naturally, and with an interval of 10-15 years, target shade-loving trees (beech, fir) are planted under the cover of this preparatory stand. A second example of good practice is the restoration procedure using a combination of artificial afforestation and natural regeneration, which allows establishing a new stand as a diverse mixture of tree species. The third example demonstrates the establishment of new young stands on small patches in the surrounding mature spruce stands, thereby preventing extensive clearings in the future if the mature spruce stands would be disturbed.

During the excursion, we will visit afforested plots in the forest district Nové Veselí 49.50675°N, 15.94741°E (Fig. 3 and 4). The flat terrain and gleyed soils with significant soil water influence are typical for this area. The altitude is 550 m a.s.l., the average annual temperature is 7.9°C, and the average annual precipitation is 675 mm.

The project was supported by Norway grants and State Environmental Fund of the Czech Republic (project no. 3211100015).

Norway grants

STATE ENVIRONMEN
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CZECH REPUBLIC

a) b)

Fig. 3 Forest district Nové Veselí, location of project implementation. State of forest stands in (a) 2018 and (b) 2022. Excursion route marked in red.

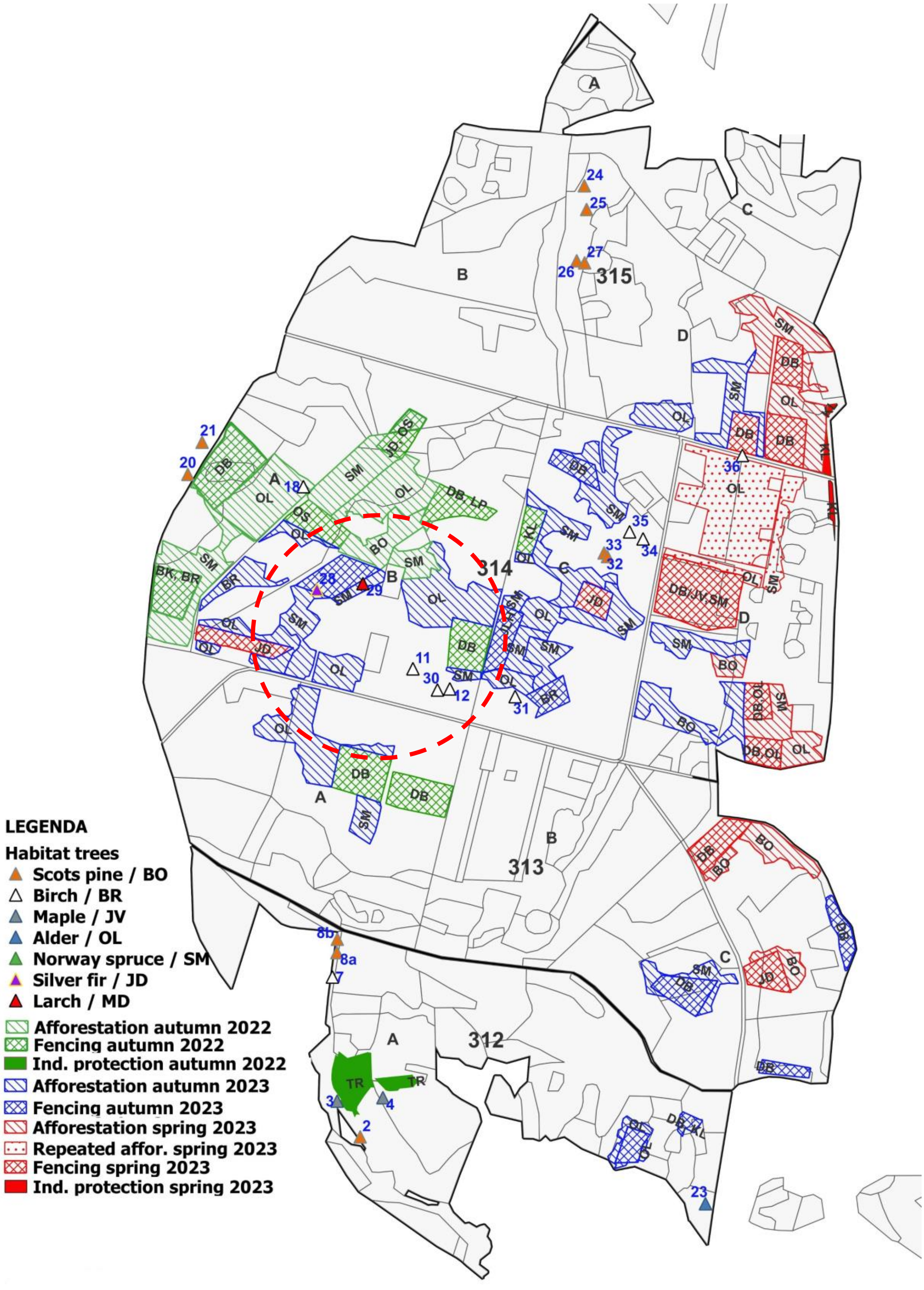


Fig. 4 Map of plots restored as part of the project at forest district Nové Veselí. The forest restoration was realized in three stages: autumn 2022 (in green), spring 2023 (in red) and autumn 2023 (in blue), during which a total of 24.2 ha of plots were afforested**.**

Tree species abbreviations: BK beech, BO pine, BR birch, DB oak, JD fir, JLH elm, LP linden, KL maple, MD larch, OL alder, OS aspen, SM spruce, TR cherry.

2. Želivka research facility

The Želivka research facility (49.67450°N, 15.23015°E) consists of the experimental catchment of the Pekelský stream, where the ICP Forests intensive monitoring plot 2161 Želivka and other research plots for bioclimatic measurements are located (Fig. 5).

The Želivka research facility is one of the longest-monitored research sites of FGMRI. The Pekelský stream catchment was selected in connection with the construction of the Švihov reservoir (1965-1972), which is the fourth largest reservoir (16.03 km²) in the country and serves as the main source of drinking water for Prague. Pekelský stream is a right-bank tributary of the reservoir, with a catchment area of 124 hectares and an altitude of 360 – 460 meters above sea level. According to forest typology, the forest stands mainly belong to acidic or nutrient-medium beech or oak-beech forest sites. The average annual temperature is 9°C, and the average annual precipitation is 628 mm.

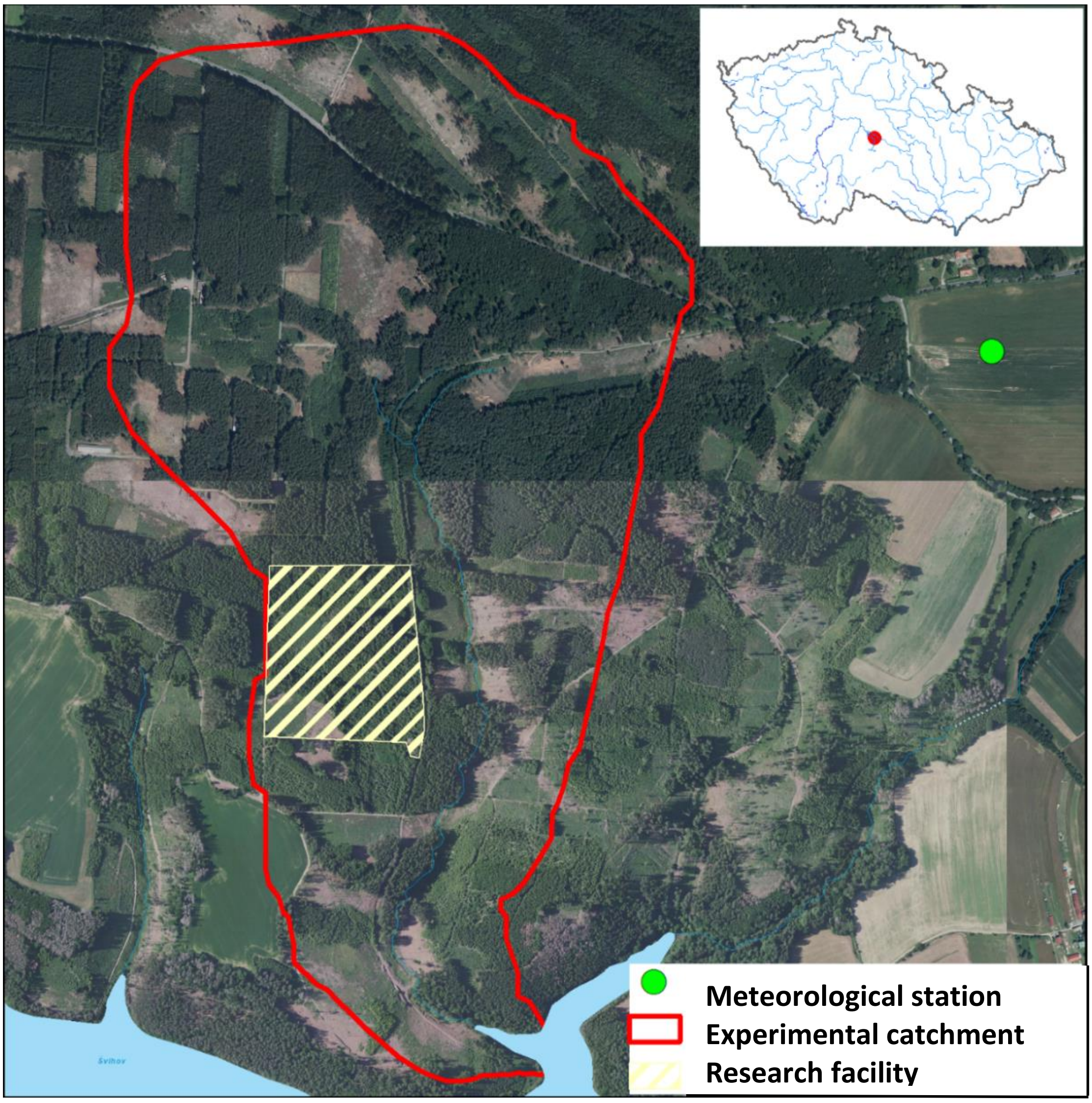


Fig. 5 Localization of research facility and meteorological station within the experimental catchment of Pekelský stream

A bit of history

The decision to establish the research facility was made in 1971. The research was primarily focused on the water cycle in spruce stands concerning the quantity and quality of water flowing into the water source (reservoir Švihov). During the 1970´s, research infrastructure was built. In the central part of the catchment, about 6 hectares of forest were fenced off, where rain gauges, gutters for capturing precipitation water, tensiometers, and gravitational lysimeters were installed. The chemistry of precipitation, soil water, stream and spring water has been regularly monitored since 1973. In the same year, regular measurements of precipitation and temperature at the meteorological station on the open area began. The construction of the measuring spillway with a limnigraph was completed in 1975, and the construction of the measuring gradient tower and the arrangement of instruments and their connection to the recording center were completed in 1977.

Current status of Želivka research facility

In the fenced part of the research facility, the ICP Forests monitoring plot of level I was established in 1986. In 1995, measurements on the plot were extended to level II (intensive monitoring). Currently, in addition to forest health monitoring on the already mentioned level II plot and monitoring of precipitation-runoff relationships, other bioclimatic measurements are carried out (Table 1, Fig. 6).

Table 1 Overview of measured parameters on individual plots within the Želivka research facility

Plot ID	Precip.	Radiation (GR/PAR)	Precip. stand	Soil moist.	SWP	Soil temp.	Stem flow	Sap flow	Growth
1	x	x							
2*			x	x	x	x			x
3			x	x	x	x			x
4			x	x	x	x		x	x
5	x			x	x	x			
6		x	x	x	x	x	x	x	x
7					x	x			
8					x	x			x
9					x	x			

* *until 2023 throughfall precipitation and growth were also measured*

Fig. 6 Sites with measurements of bioclimatic and soil parameters in the Pekelský stream catchment (sites with totalizers are not included)

1. meteorological station
2. ICP Forests intensive monitoring plot 2161 Želivka (spruce 120 years old)
3. spruce young-growth stand (13 years old)
4. spruce pole-stage stand (52 years)
5. fresh clearing (spruce stand 74 years old by 2019)
6. beech stand (68 years)
7. beech plantation
8. oak young-growth stand
9. spruce plantation
10. overflow

Intensive monitoring plot 2161 - Želivka

Currently, the Forestry and Game Management Research Institute (FGMRI) has 16 Level II plots. The Želivka plot is among the so-called "core plots", where intensive monitoring is conducted including continual measurement of meteorological parameters (air temperature and humidity, global radiation, precipitation, wind speed and direction), soil characteristics (soil temperature and moisture, soil water potential, chemistry of gravitational soil water), litterfall analyses, phenological observations, growth measurements, throughfall deposition (Fig. 7), bulk deposition in open areas, and stream water chemistry at the overflow. Also the soil and foliage chemistry is analysed on regular basis.

The plot is equipped with instruments and data loggers from EMS Brno. Precipitation and soil water samples for chemical analyses are collected three times a month (10-day intervals), litterfall samples are collected at the end of each month, assimilation apparatus samples (needles) are analysed once every two years, and soil samples are analysed every five years. Phenological observations are conducted once a month, and during the budburst period at least three times a month.

Fig. 7 The plastic gutters for capturing precipitation water under the stand

In 2009, part of the plot (about 1/4) was cut down due to bark beetle infestation. Another bark beetle outbreak followed in 2023, when another third of the plot was cleared, and it was necessary to terminate the deposition and precipitation measurements in the stand. Most dendrometers were also dismantled. Soil characteristics measurements (soil moisture, soil temperature, soil water potential) and evaluation of other parameters (health status, phenology, leaf analyses) continue.

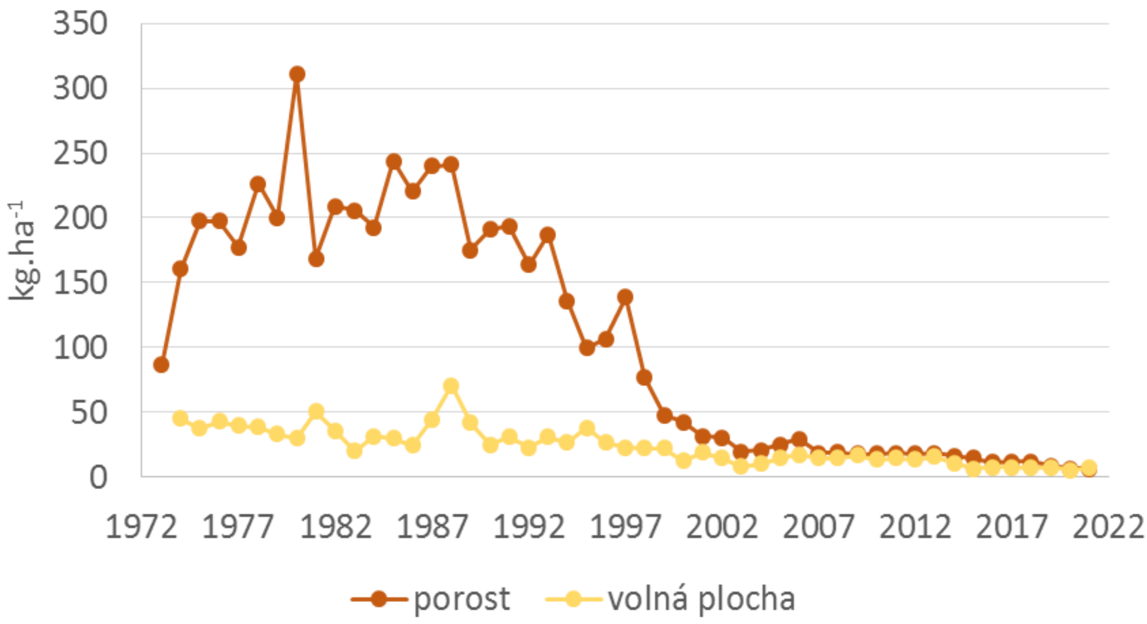


Fig. 8 Annual deposition of sulphate (SO_4^{2-}) in the N. spruce stand (in red) and in the open area (in yellow)

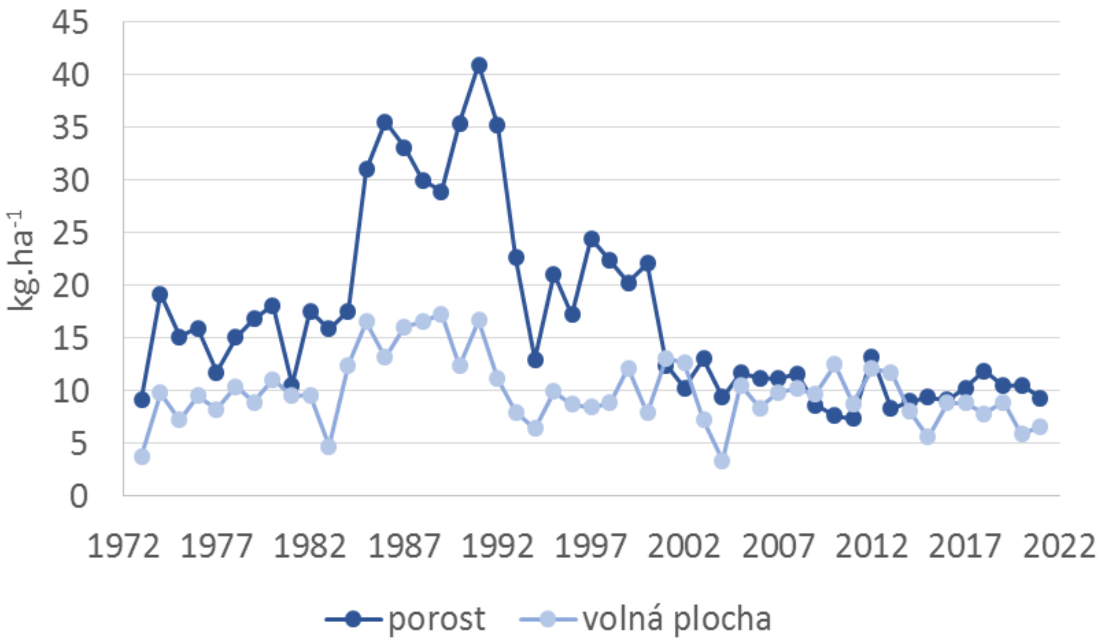


Fig. 9 Annual deposition of nitrogen (NO_3^- + NH_4^+) in the N. spruce stand (in dark blue) and in the open area (in light blue)

Bioclimatic measurements in forest stands

Throughfall precipitation, soil temperature (PT100), soil volumetric moisture (Campbell CS616), and soil water potential (gypsum block) are measured at depths of 10 cm, 30 cm, 50 cm, and 80 cm on the plots. The interception of spruce stands during the vegetation periods of 2017 – 2021 in relation to the total precipitation is illustrated in the Figure 10. The results of precipitation measurements in the form of cumulative lines for the vegetation periods 2017 – 2022 for the open area and the spruce stands are presented in Figure 11.

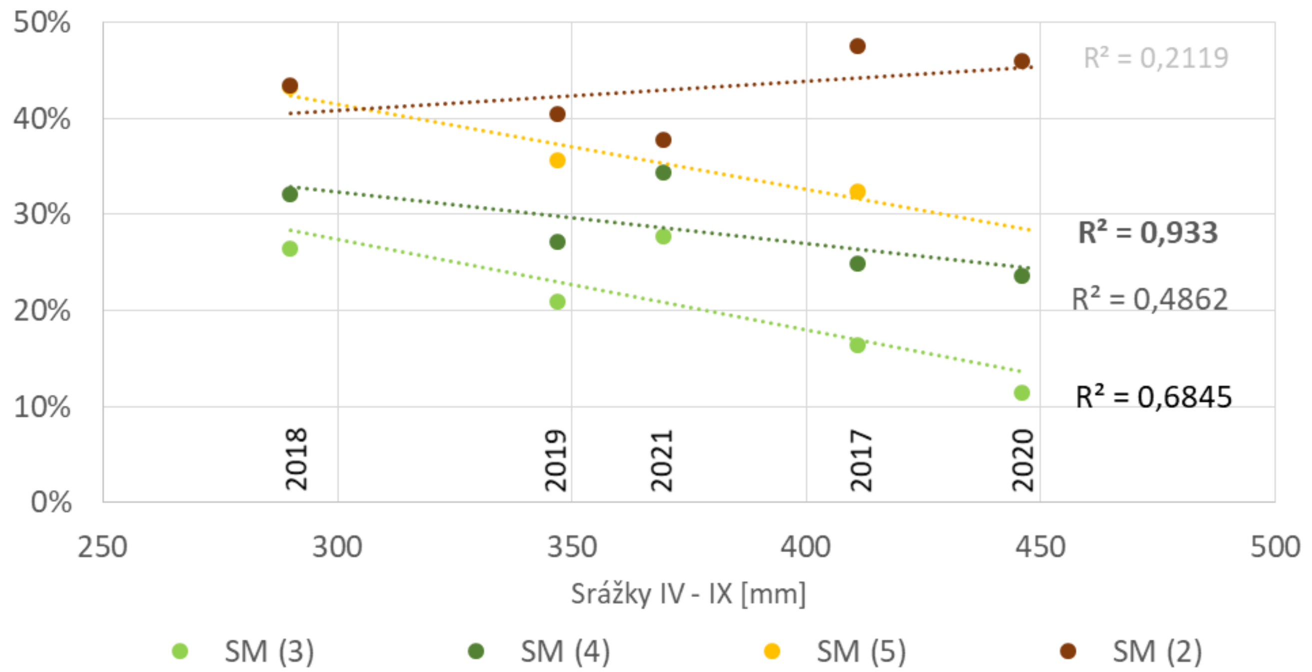


Fig. 10 Interception of spruce stands (plot no. 2, 3, 4 and 5) during the vegetation periods of 2017 – 2021 in relation to the total precipitation

When comparing individual years, the very low precipitation total in 2018 is noticeable. In 2020, the precipitation total during the vegetation period was lower than in 2017 and 2021 but was balanced by above-average precipitation during the winter period.

The development of soil water potential (SWP) during the period 2017 – 2021 on plot 4 (52-year-old spruce stand) and on plot 5 (74 years old spruce stand until 2019, then felled due to bark beetle infestation) (Fig. 12) again documents that in 2018 the water availability for forest stands was reduced for almost the entire vegetation season. In 2021, significant drought stress with SWP dropping below -1.4 MPa occurred on plot 4, particularly in the uppermost soil layer. However, in September and June, the entire soil profile dried out. On plot 5 with the felled stand, a short drop in SWP in the uppermost soil layer occurred in June.

The development of SWP in different types of stands and at different soil depths is recorded in the graphs in Figures 13 – 19.

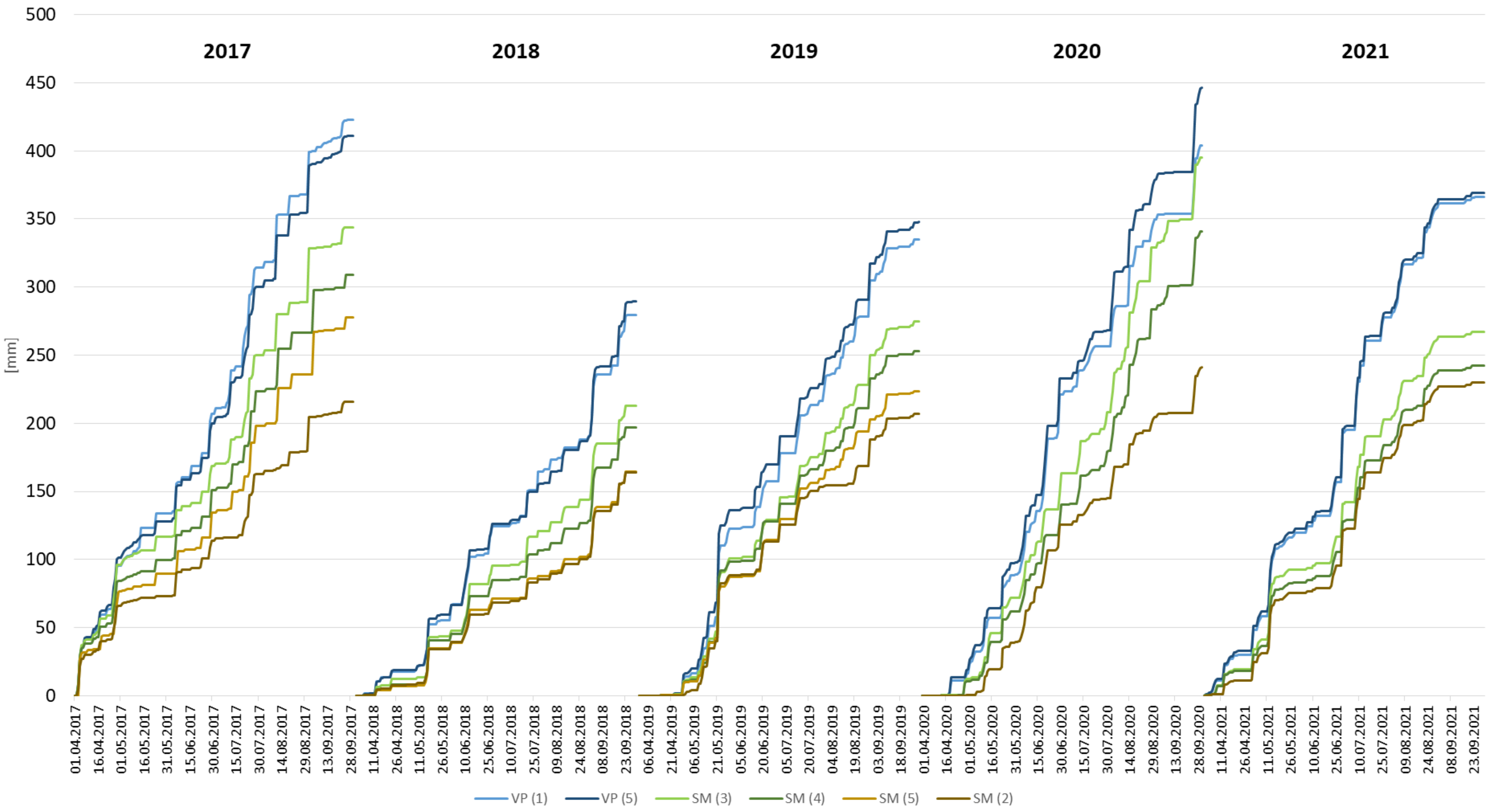


Fig. 11 Development of precipitation interception in spruce stands during the vegetation periods of 2017 – 2021 (VP – open area precipitation; SM – throughfall precipitation in spruce stand; plot ID in parentheses)

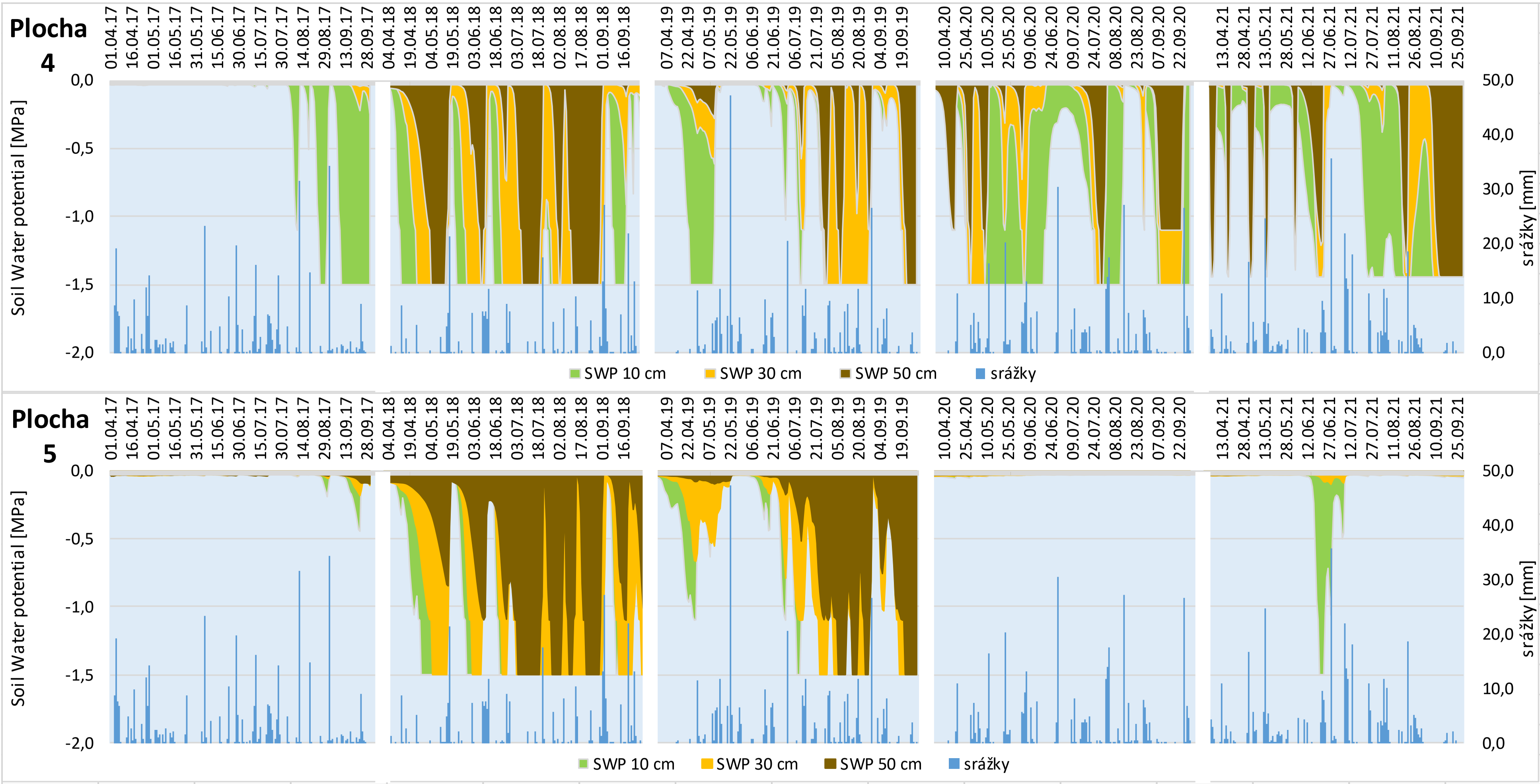


Fig. 12 Development of soil water potential during the periods of 2017 – 2021 on plot 4 (52-year-old spruce stand) and plot 5 (74 years old spruce stand until 2019, then felled due to bark beetle infestation)

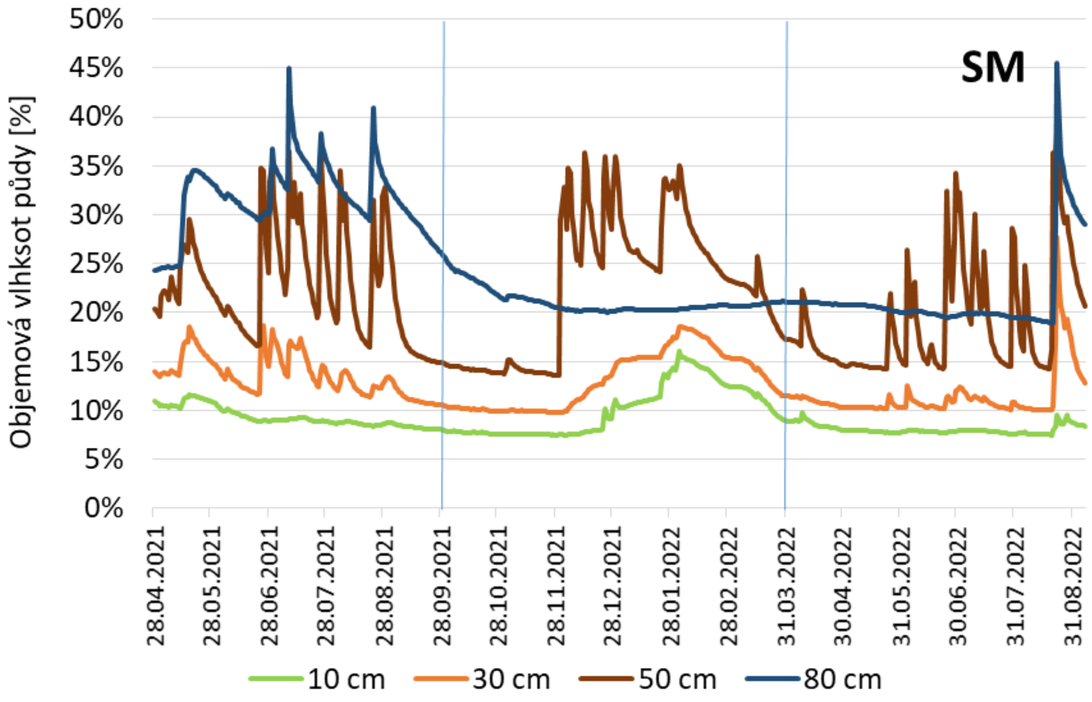


Fig. 13 Development of soil moisture from May 2021 to August 2022 in a spruce stand (plot 4)

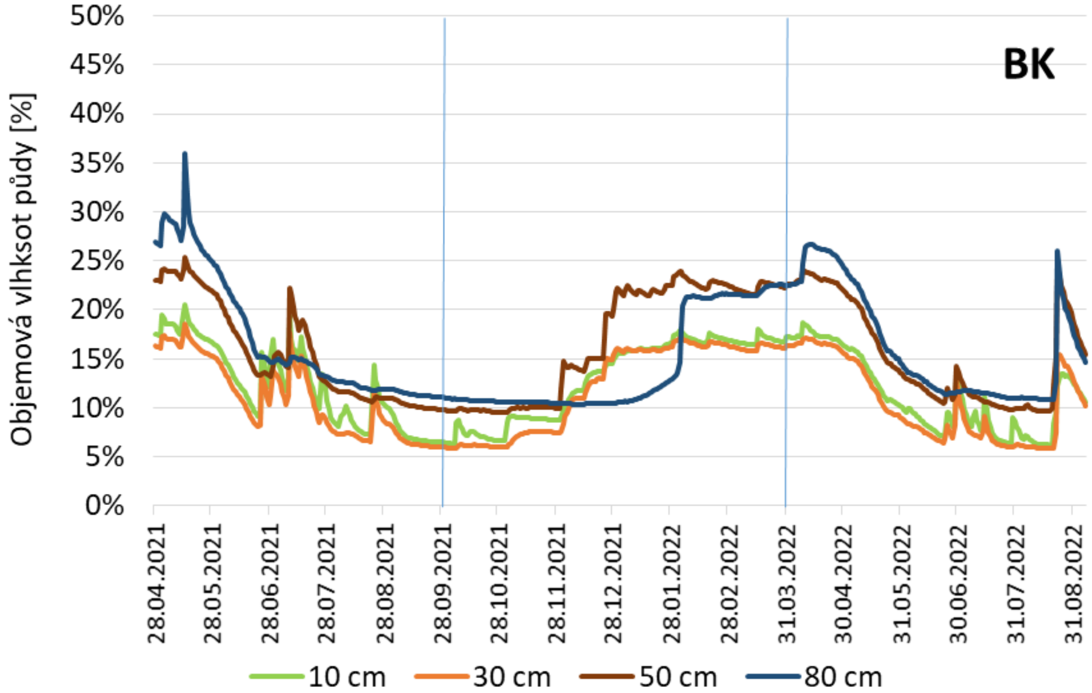


Fig. 14 Development of soil moisture from May 2021 to August 2022 in a beech stand (plot 6)

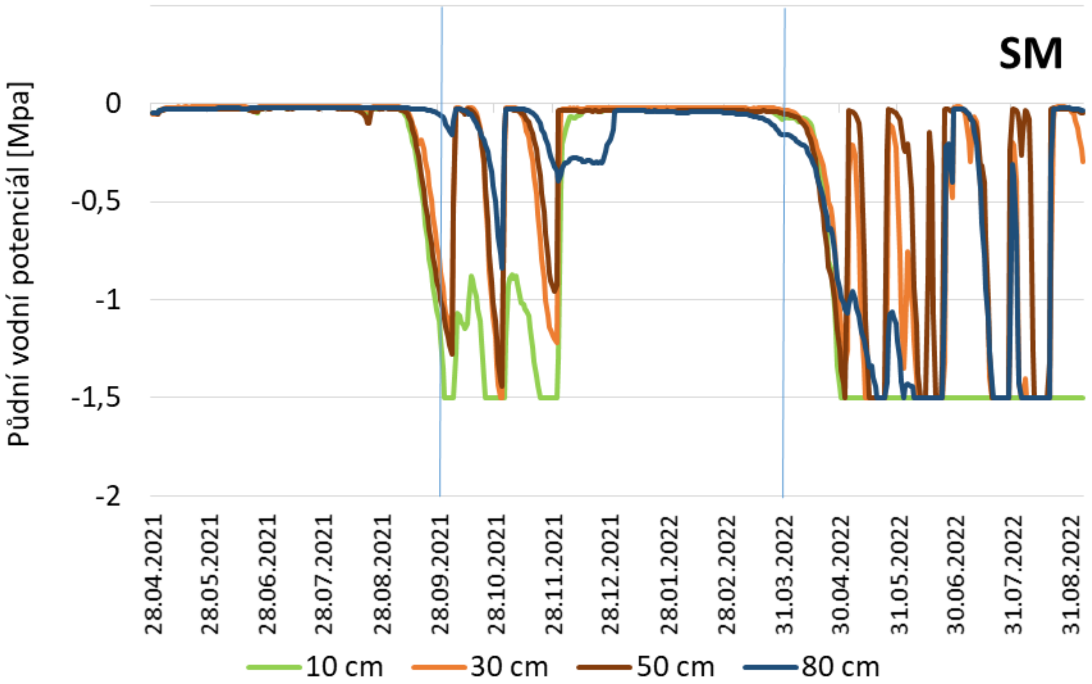


Fig. 15 The development of soil water potential from May 2021 to August 2022 in a spruce stand (plot 4)

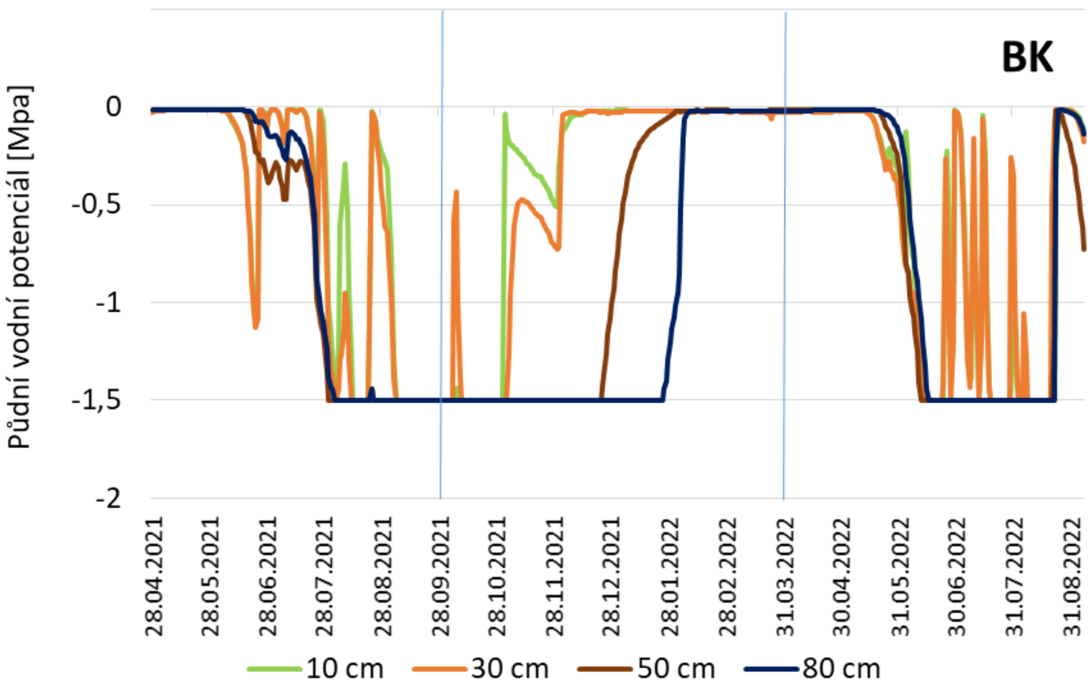


Fig. 16 The development of soil water potential from May 2021 to August 2022 in a beech stand (plot 6)

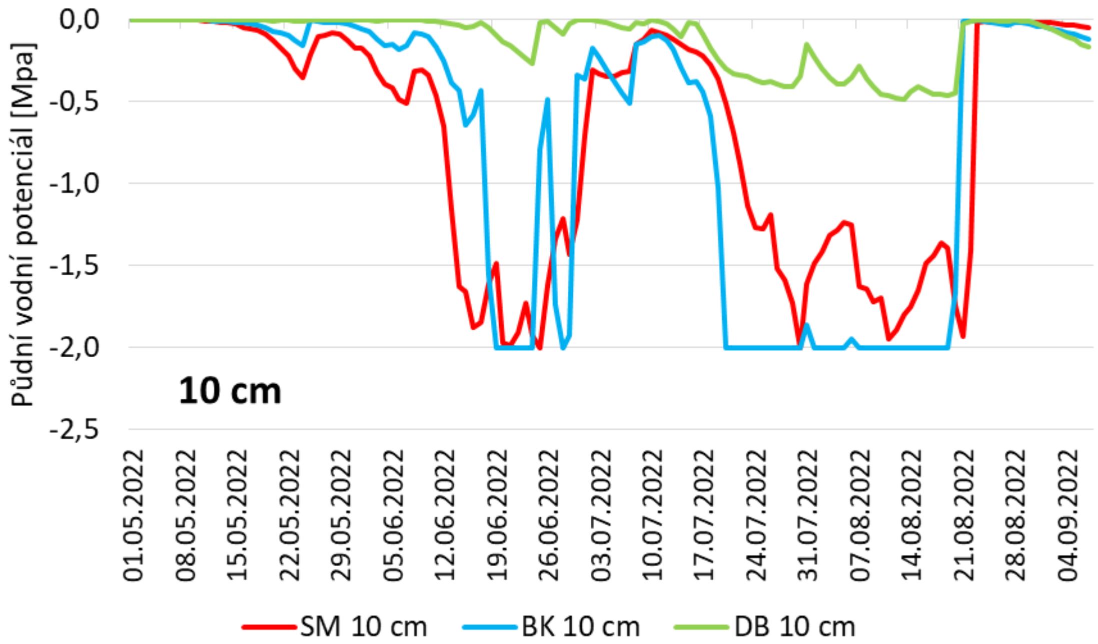


Fig. 17 Development of soil water potential during the 2022 growing season in spruce (in red) and beech (in blue) plantations and oak (in green) young stand (plots 7, 8 and 9) at a soil depth of 10 cm

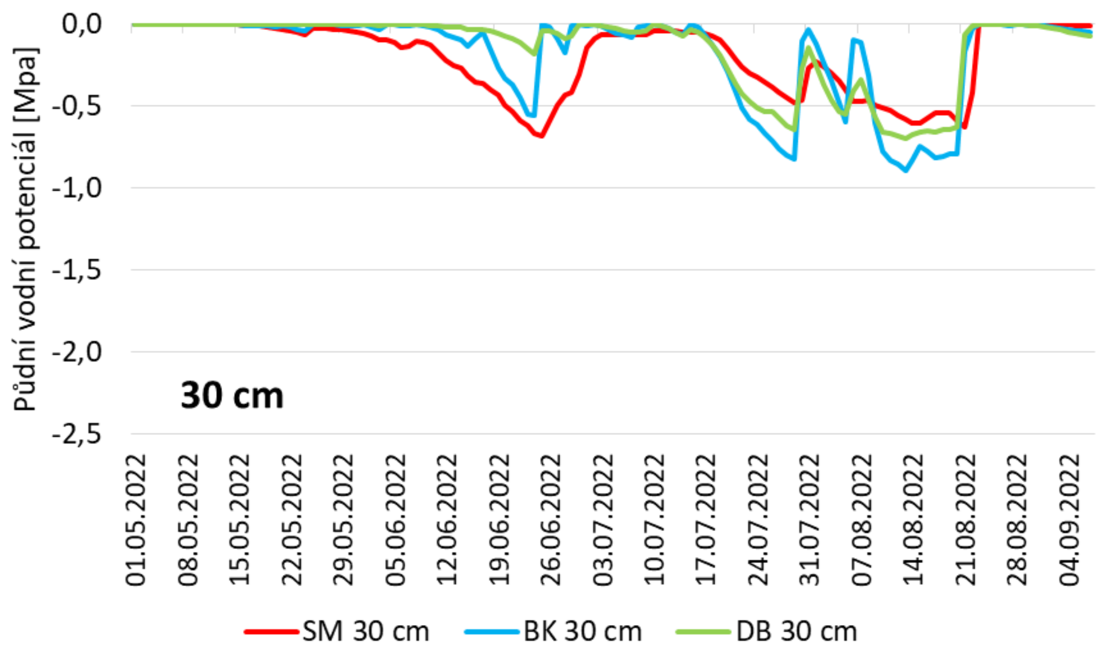


Fig. 18 Development of soil water potential during the 2022 growing season in spruce (in red) and beech (in blue) plantations and oak (in green) young stand (plots 7, 8 and 9) at a soil depth of 30 cm

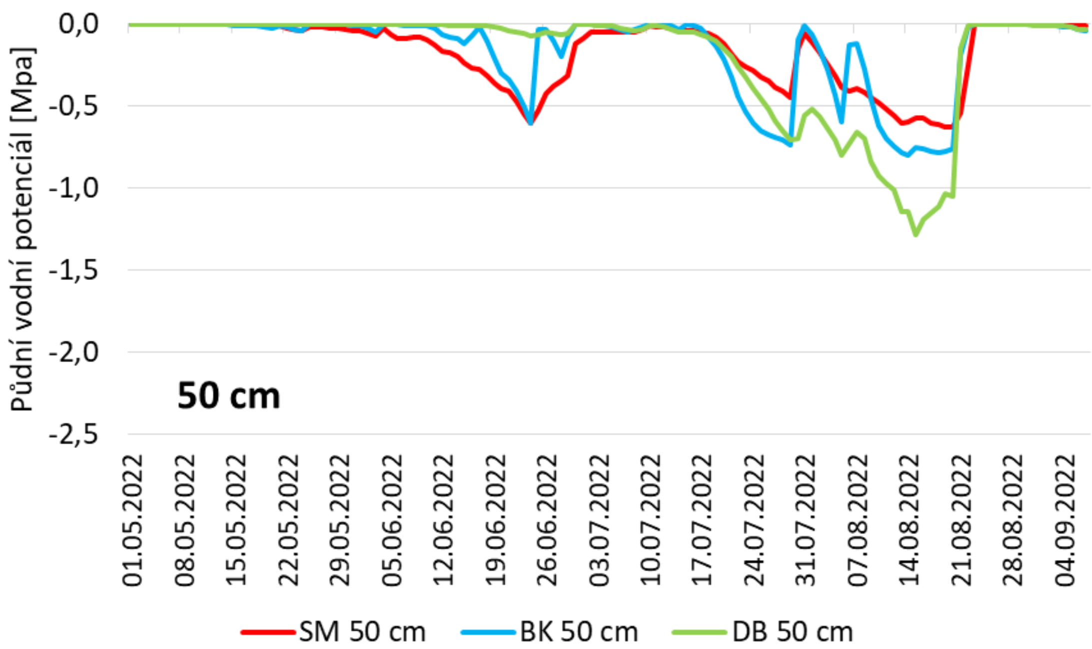


Fig. 19 Development of soil water potential during the 2022 growing season in spruce (in red) and beech (in blue) plantations and oak (in green) young stand (plots 7, 8 and 9) at a soil depth of 50 cm

Experimental catchment

Water discharge from the catchment is measured in an open rectangular gutter. The water level is also measured in it, from which the discharge volume is then calculated according to the consumption curve. The measurement of water level is done using a continuous float water level transmitter PSH-30, ultrasonic probe, and submersible pressure water level gauge. The operation of sensors and access to archived data are ensured through the control and registration unit Fiedler M4016. The average annual discharge height from the catchment is 106.4 mm. The average flow rate is 3.4 $l/s.km^2$.

Basic climatic data (air temperature, air humidity, duration and intensity of radiation) are also measured. These measurements are performed by sensors connected to an automatic unit. A standard equipped meteorological hut is used for measurement control.

The development of precipitation amount and runoff height in the catchment is shown in Figure 20.

Graphs in Figures 21 and 22 document changes in the chemistry of surface water draining from the catchment. pH values as well as concentrations of sulfates and nitrates show an increasing trend, which is statistically significant.

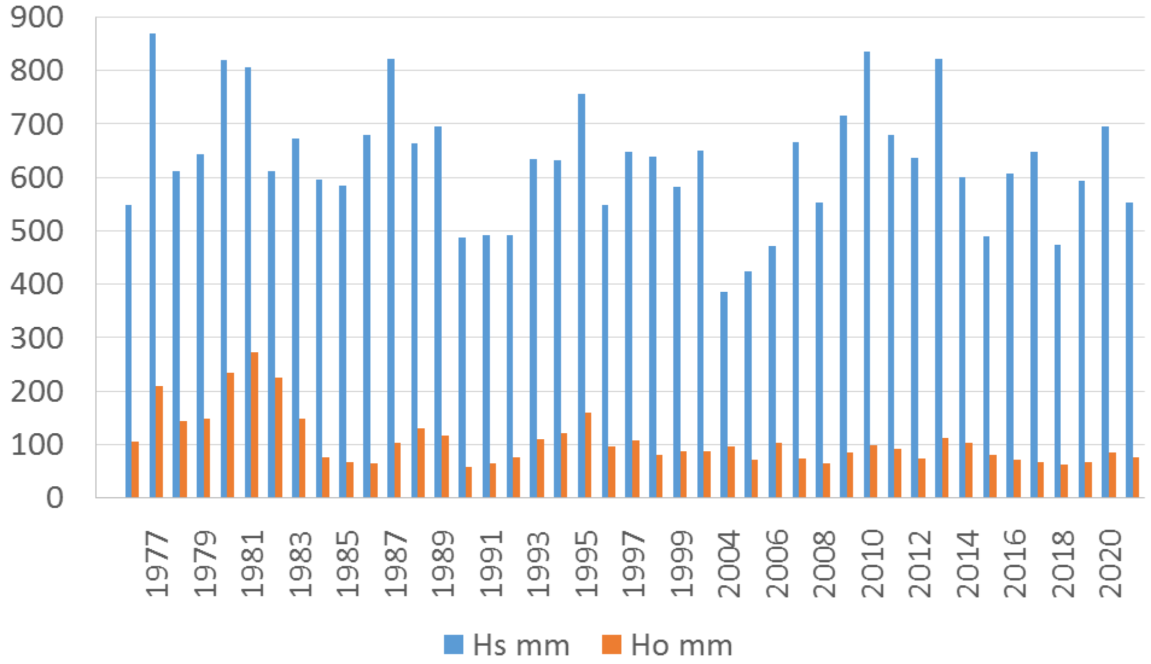


Fig. 20 The development of precipitation amount (Hs) and runoff height (Ho) in the Pekelský stream watershed

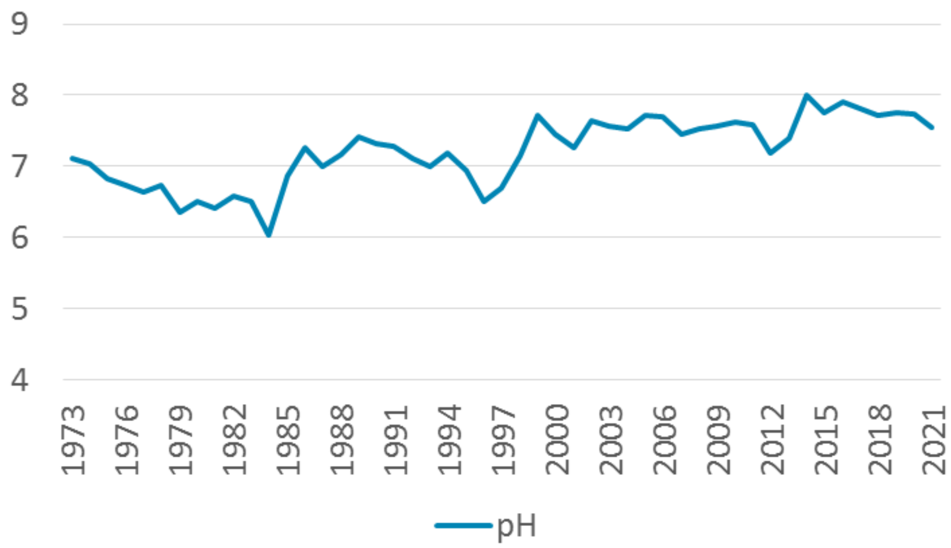


Fig. 21 The development of pH values in the Pekelský stream

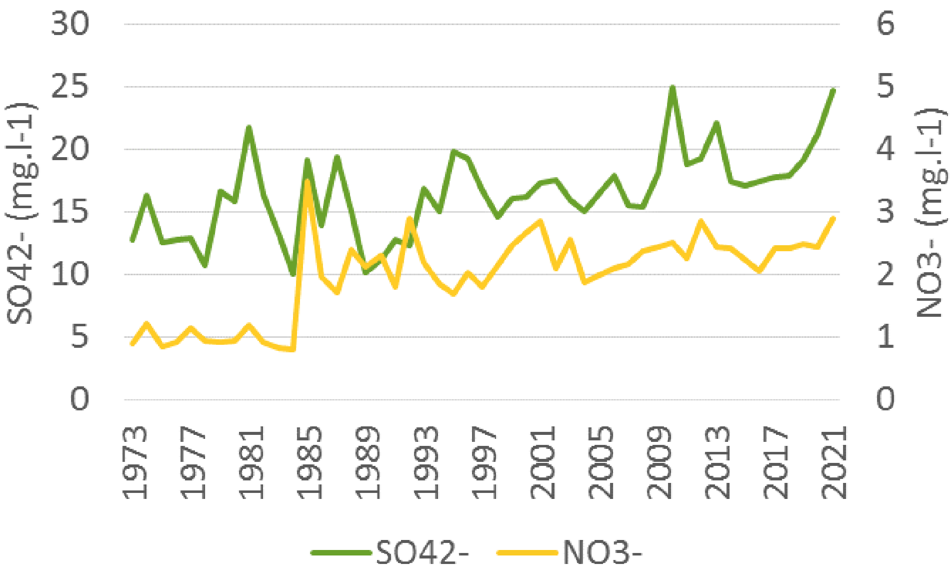


Fig. 22 Average annual concentrations of SO_4^{2-} and NO_3^- in the Pekelský stream

3. Kutná Hora

Kutná Hora, located in the Central Bohemian Region of the Czech Republic, boasts a rich and fascinating history that dates back to the 13th century. The city's prominence began with the discovery of rich silver deposits in the area, which quickly transformed Kutná Hora into one of Europe's most important mining centres.

In the late 13th century, silver mining brought immense wealth to Kutná Hora, leading to its rapid development. By the 14th century, the city had become the economic backbone of the Kingdom of Bohemia, second only to Prague in importance. One of the pivotal moments in Kutná Hora's history was the establishment of the Royal Mint at the Italian Court (Vlašský dvůr) in the late 13th century. This mint produced the Prague groschen, a currency that became widely recognized and used throughout Europe.
In recognition of its historical and cultural value, Kutná Hora was designated a UNESCO World Heritage Site in 1995.

Places of interest in the Kutná Hora centre

1. St. Barbara's Church is a UNESCO World Heritage Site. This stunning Gothic cathedral, dedicated to the patron saint of miners, is renowned for its intricate vaulted ceilings and exquisite frescoes.

2. Italian Court This historic building now houses the Czech Museum of Silver, where you can learn about the city's mining heritage and view medieval minting equipment. The elegant courtyard and Gothic chapel are also worth exploring.

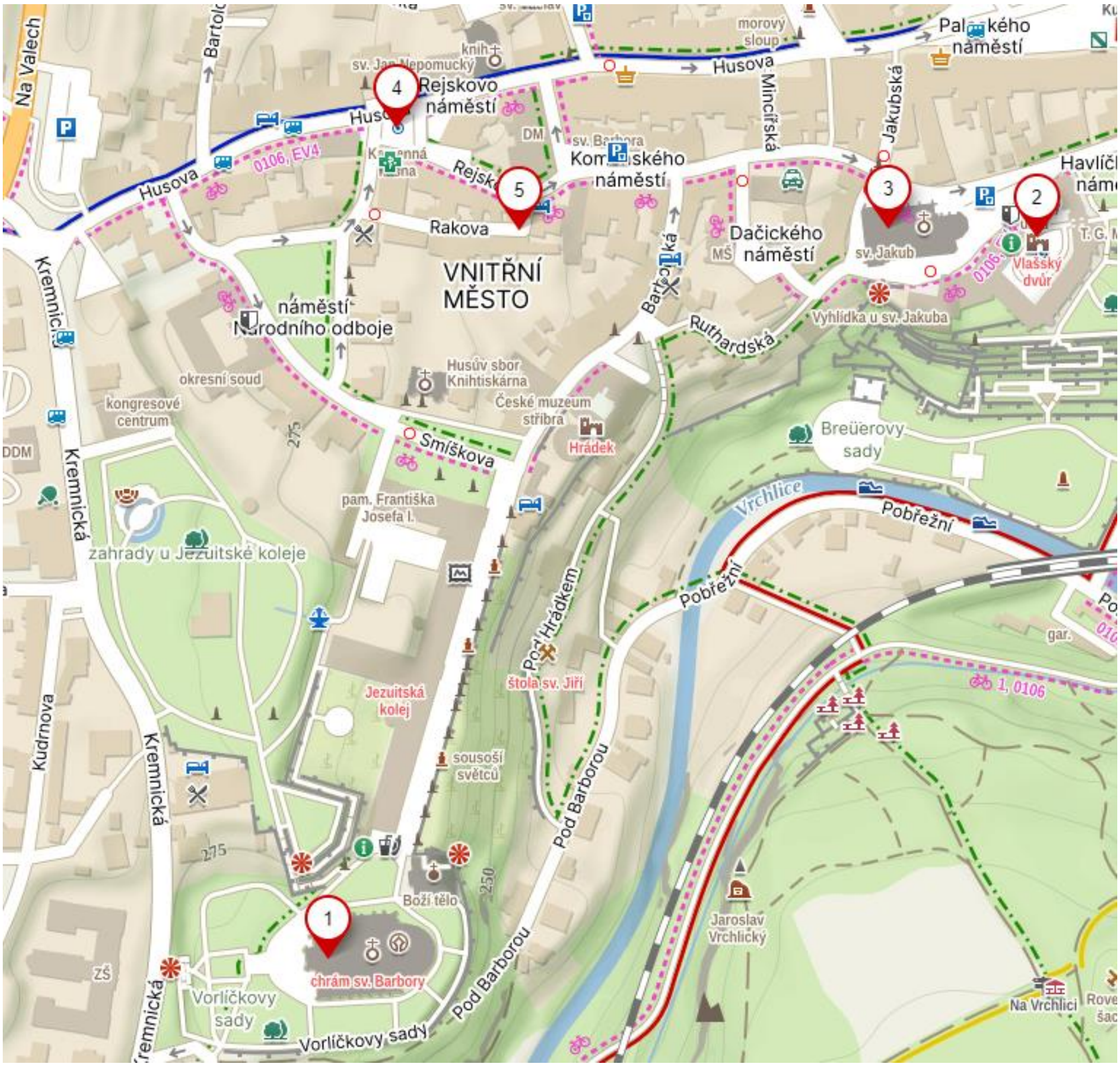
3. Church of St. James This imposing Gothic church is known for its slender tower, which dominates the city skyline. Inside, you will find remarkable medieval art and a peaceful atmosphere perfect for reflection.

4. Stone Fountain A short walk brings you to the Stone Fountain, a beautifully crafted Gothic structure dating back to the 15th century. This intricately designed fountain was a crucial part of the city's water supply system and remains a picturesque landmark to this day.

5. Excursion dinner will be served in **Dačický restaurant** at 6 PM., Rakova 8, GPS: 49.9483497N, 15.2647361E

Map of Kutná Hora centre:

1. St. Barbara's Church
2. Italian Court
3. Church of St. James
4. Stone Fountain
5. **Excursion dinner in “Dačický Restaurant“ at 18:00 !!!**



The text of excursion guide was prepared with the help of information provided by Microsoft Copilot and ChatGPT, an AI language model developed by OpenAI.

When you sit on the bus pass the time with Sudoku ☺

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