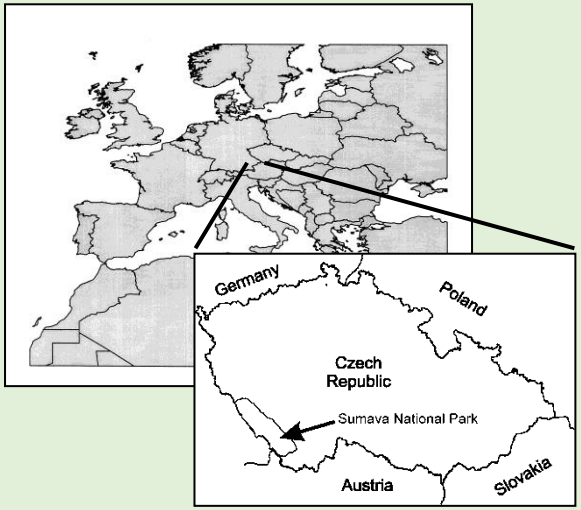
„ Experience of mire restoration in the Šumava National Park

Ivana Bufková

and all sumava LIFE people

„Landscape without wetlands is landscape without water“

Šumava National Park – important wetland area

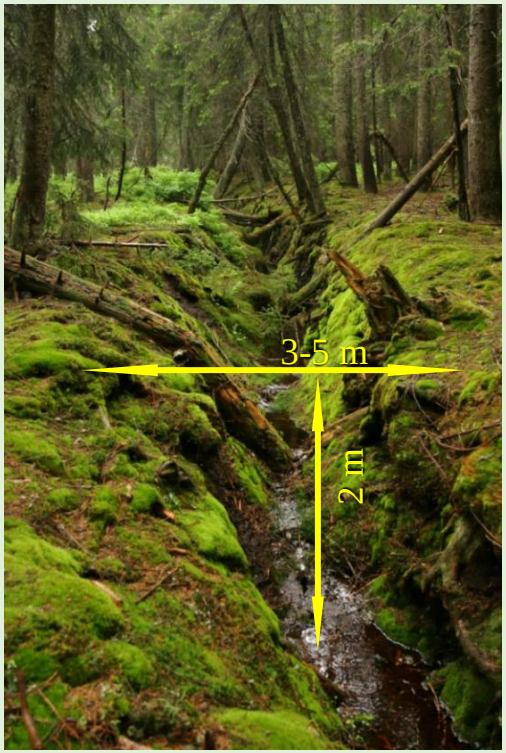


Code	Habitat* (abbr.)	Area (ha)
7110*	Active raised bogs	373
7140	Transition mires and quaking bogs	959
7120	Degraded raised bogs	83
91D0*	Bog woodland	3001
(9410 part)	Waterlogged spruce forest	6739
6410	Molinia meadows	120
91E0*	Alluvial forests with Alnus	155
3260	Water courses	76

ŠUMAVA NP (70 000 ha)	Area (ha)	% NP
Mires	6 566	**10**
Other wetlands	14 930	**21**
All wetlands - total	20 536	**31**

Šumava National Park – past intervences in hydrology

Drained meadow spring for agriculture



Drained bog forest for forestry

- **70% of mires drained in the past**
- about ½ **other types of wetlands drained**
- **2/3 springs drained**
- **for forestry, agriculture, peat mining**

Šumava National Park – hydrological restorations

- **longterm Restoration Programme**
- **first restored site - Kamerální slať (1999)**

- I.phase: 1999 – 2012 (budget NPS)
- II. phase: 2013 – 2017 (ERDF - EU)
- III. Phase : 2018 – 2024 (LIFE - EU)

Mires and wetlands

Mountain streams

Springs

Specific features of mountain restoration:

Headwater area

- **Sloping gradients**
- **Strong vertical erosion**

Important spring areas

- Frequent **springs** of helocrene type (wetland/mire springs)
- Prevailing small mountain streams of the first order

Oligotrophic or mesotrophic environment

- High proportion of mires (10% of the area)

High nature value – strong limits for implementation

- Valuable and vulnerable habitats
- Strict area protection – nature conservation
- Low accessability – limits for technique

Main solved problems

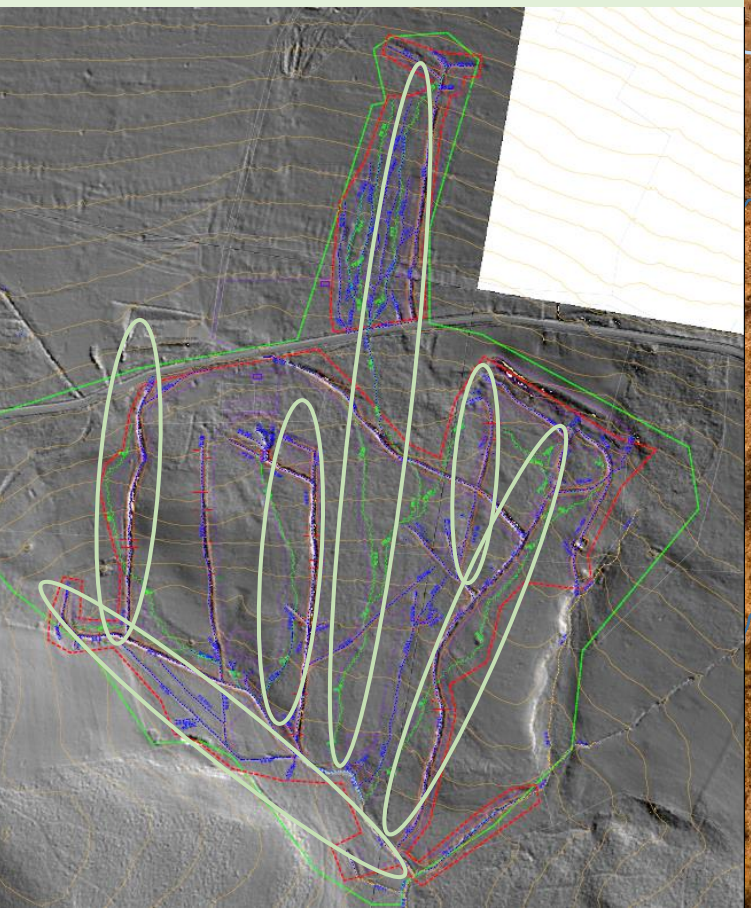
- Surface drainage
- Rill erosion
- Regulated small mountain straems – of the 1st and 2nd order, incorporated into drainage system
- Piped drainage – foothill
- Manual and industrial peat extraction

Restoration technologies have to be modified

Micro-catchment approach

- ❑ springs
- ❑ small streams (1. level)
- ❑ wetlands/mires

Water units are interlinked – complex solution is optimal



Primary question :

Are we dealing with stream or simple ditch?

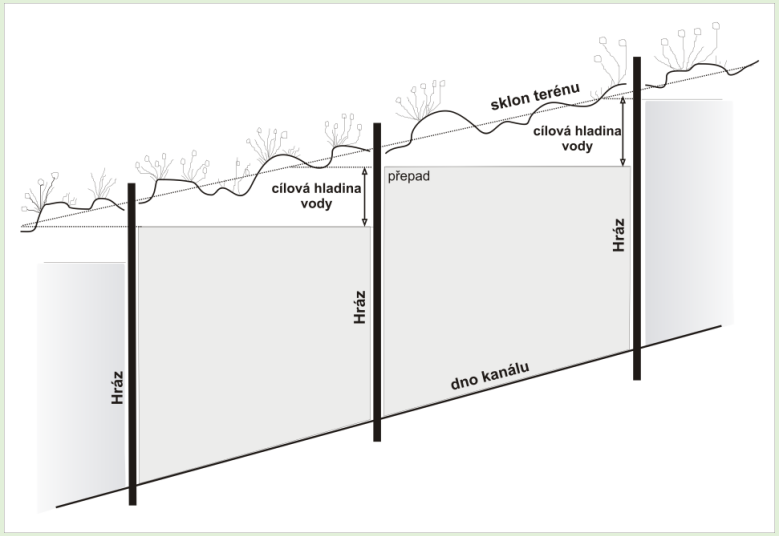
- **Drainage ditches have to be „eliminated “** – blocked and infilled
- Streams can not be blocked!
- **Streams have to returned to its natural courses**

DITCHES ARE ELIMINATED = BLOCKED

STREAMS ARE RETURNED TO ORIGINAL COURSE

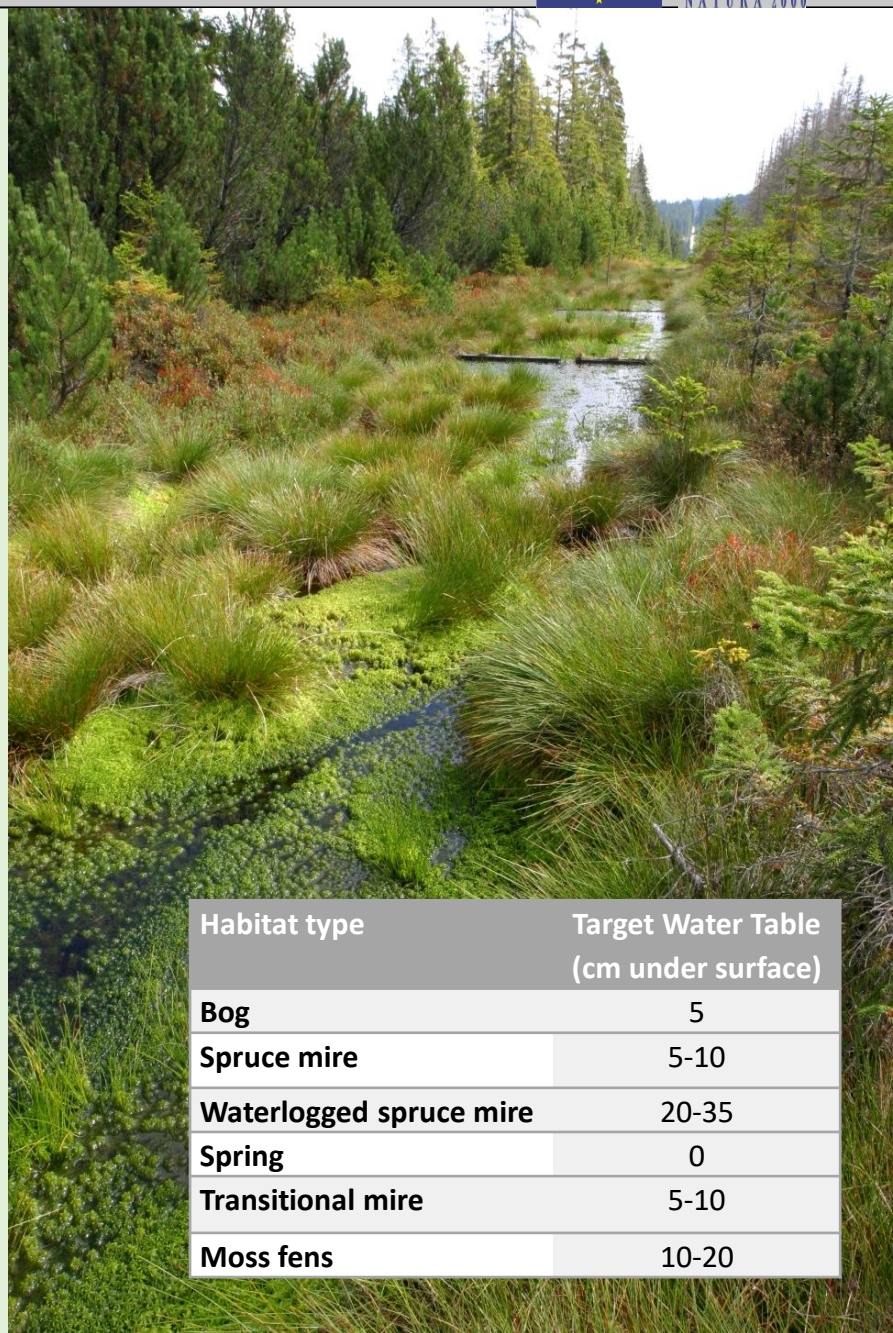
How to remove drainage ditches?

- **Blocking and infilling by soil**
- Both steps have to be always done!!!
- Simple infilling is not enough in sloping surface:
  - High risk of erosion near bottom
  - Increasing of water table is not sufficient
- Blocking by cascade of **woody dams**



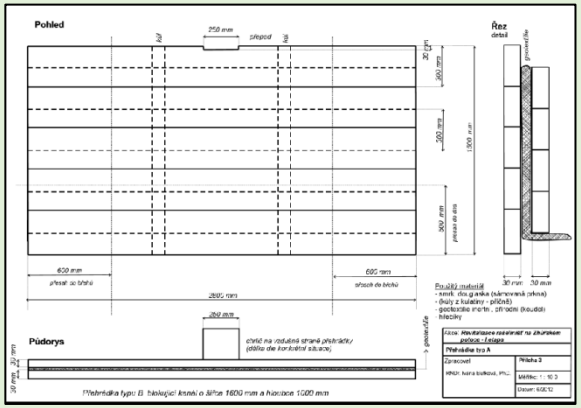
Target Water Table Concept

- Fore selected habitats (mires, springs)
- Target water table determinates number and position of dams
- It corresponds to the natural water table



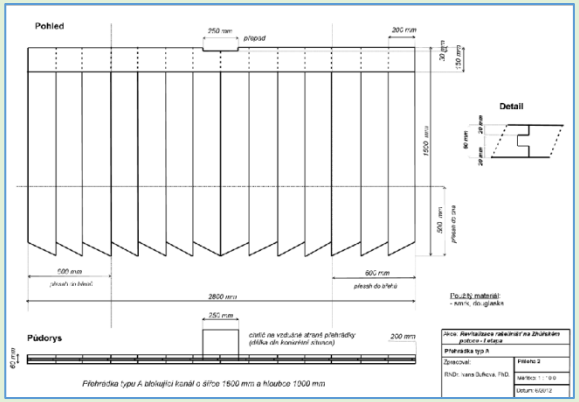
Habitat type	Target Water Table (cm under surface)
Bog	5
Spruce mire	5-10
Waterlogged spruce mire	20-35
Spring	0
Transitional mire	5-10
Moss fens	10-20

Type of woody dams



Horizontal board dam

- 2-3 layers
- Geotextilie



Vertical plank dam

Soil „packaging“ of each dam

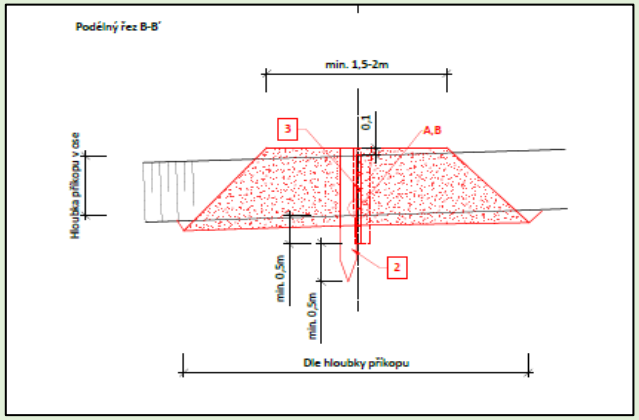


Schéma obsypu hrází – Koterová et al. 2019

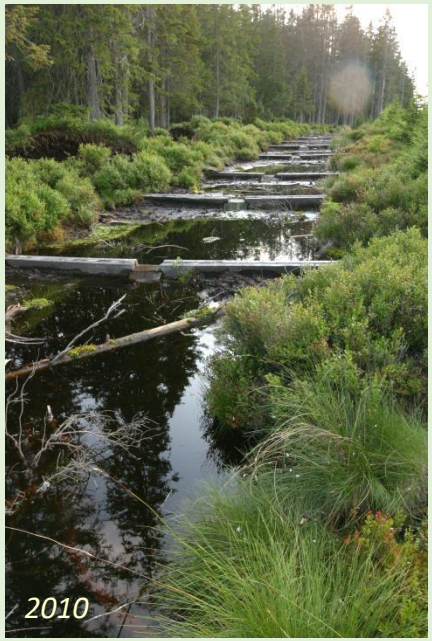
Peat dam

- Only mined bogs on flat surface

***Infilling of dammed ditches** – important phase of restoration*

- **Prevention of erosion**
- Enhancing **terrestrialisation**
- Enhancing **peat-forming processess**
- **Competition with time** (and decomposition)
- Upper shallow water (30-50cm) left

- **Peat** (optimal but lack of material)
- **Mineral soil, vegetation tussocks** (outside of bogs)
- **Hedges** (clustres of branches) – well used
- **Vegetation**



- **Shallow ditches** are able of quick spontaneous terrestrialisation
- **Large and deep channels** need support
- **Re-vegetation** by *Sphagnum* clusters and other mire and wetland species


Gradual disappearing of ditches from landscape

RESTORATION OF STREAMS

1. Simple returning into preserved **historical stream bed**

2. **Free releasing** into original course
(iniciation of spontaneous stream re-establishment)

3. Creation of **new stream bed** in the historical stream course

4. Increasing of stream bed and re-waving of eroded ditch
(ditch was created in line of former stream)

Use of machines wherever possible

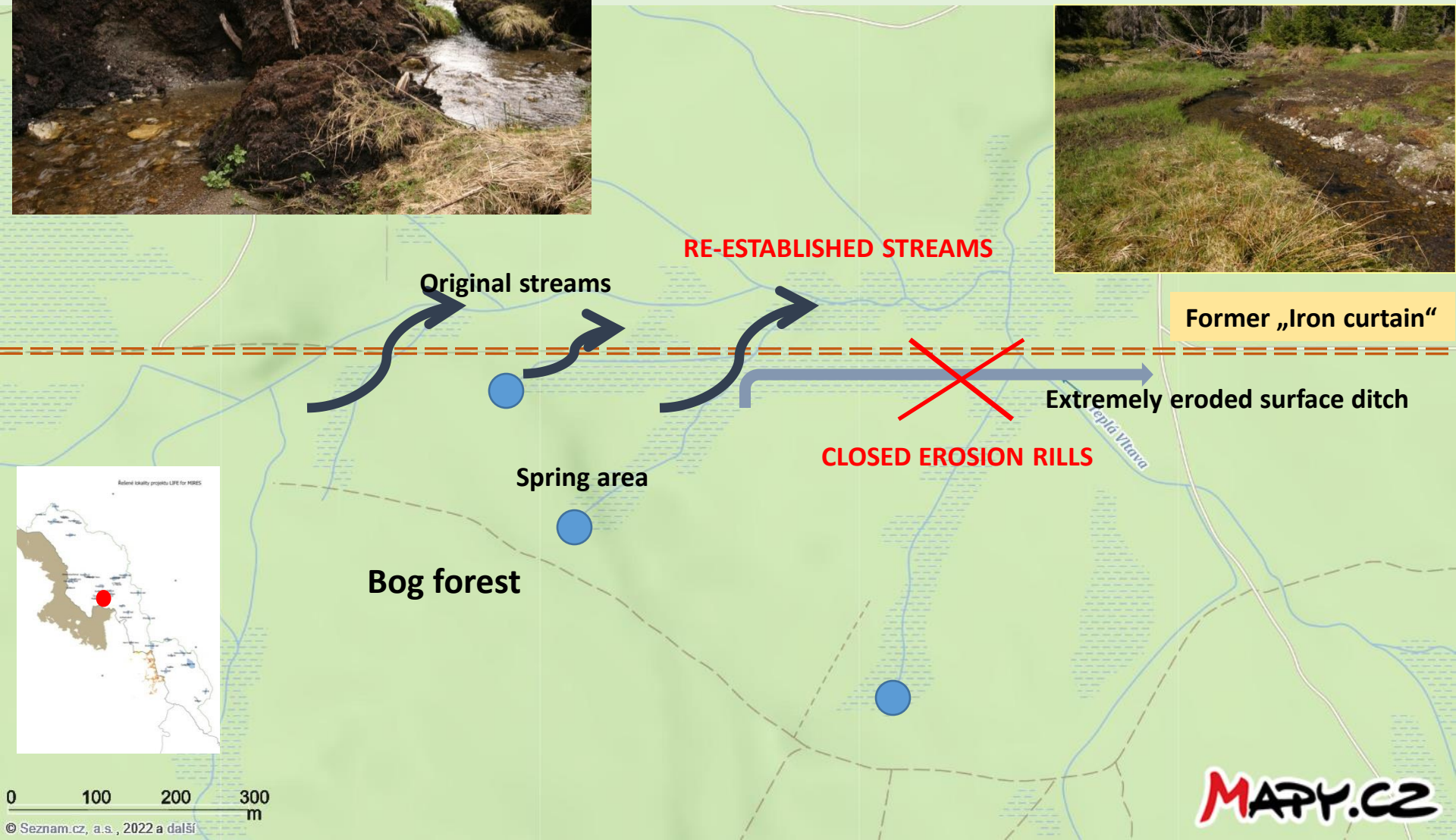
- Shift from manual work towards using of light machines
- **Limits**: risk of damage (peat subsidies, mechanical damage, surface erosion tracks)
- **Advantages**: more stabile and effective ditch damming and infilling, lower risk of erosion, restoration of capillar streams

Černohorský močál II etapa – BEFORE LIFE

Etapa II: 2013-2014

Former Iron Curtain

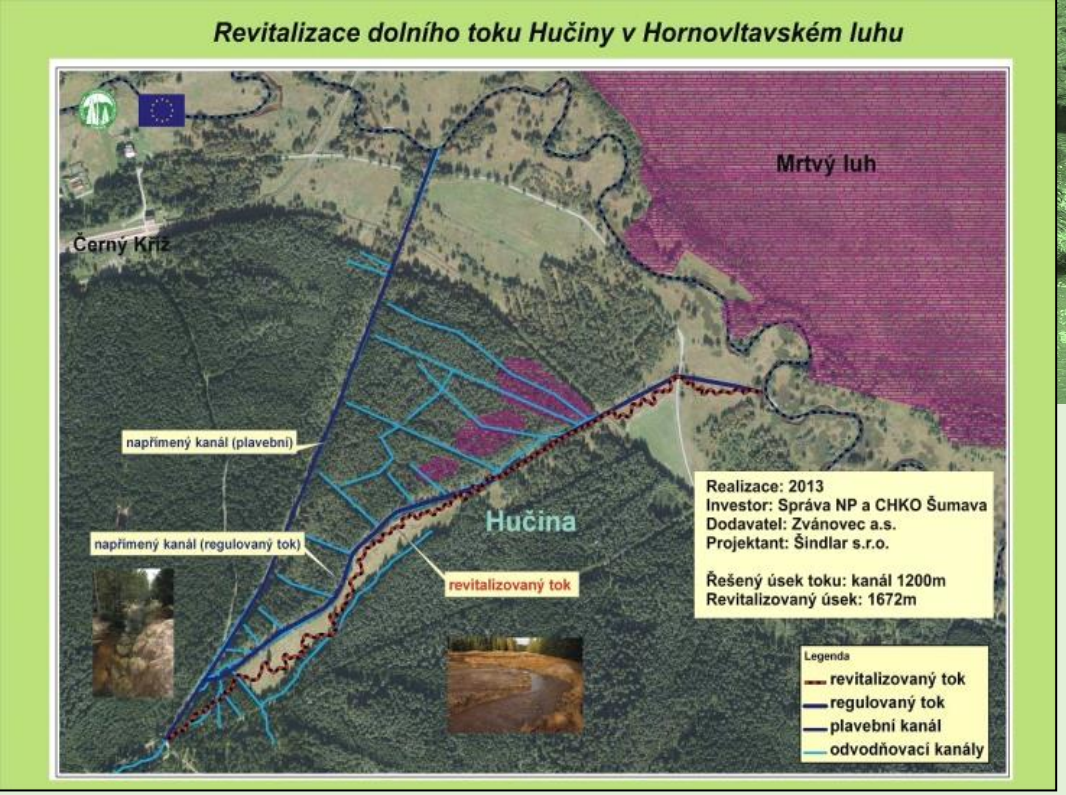
- 80ha
- 2013-2014
- 1,8km closed ditches
- Restored streams 0,6km
- 115 000 EUR



Drainage along former „Iron curtain“ – Černohorský močál mire II phase

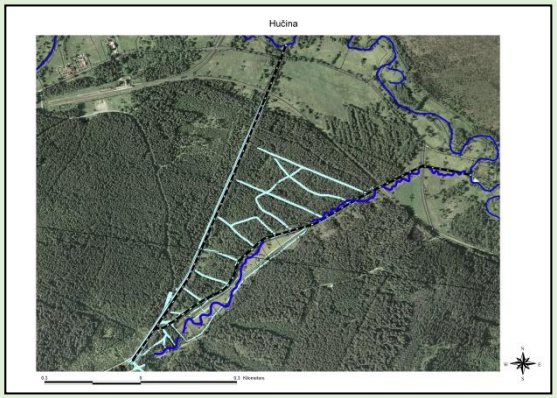
- 80ha
- 2013-2014
- 1,8km of blocked ditches
- restored small stream
- 115 000 EUR

Černohorský močál II etapa – železná opona

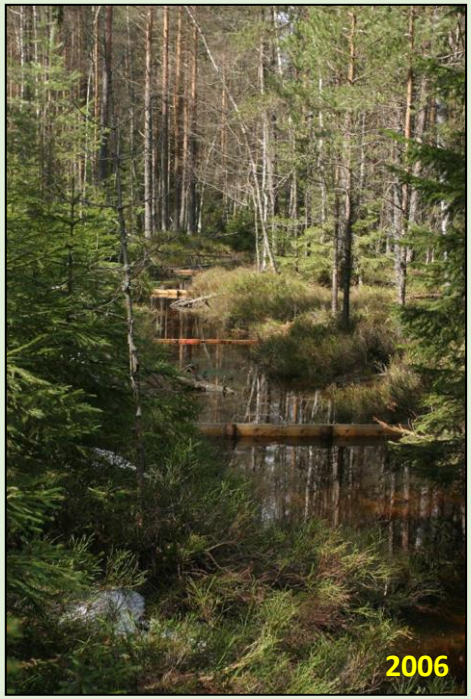


First restored stream Hučina - 2013

Revitalizace potoka Hučina – closed surface ditches in bog forest



- implementation **2005**
- 17ha
- 2,8 km ditches
- 221 woody dams
- ca 13000 EUR

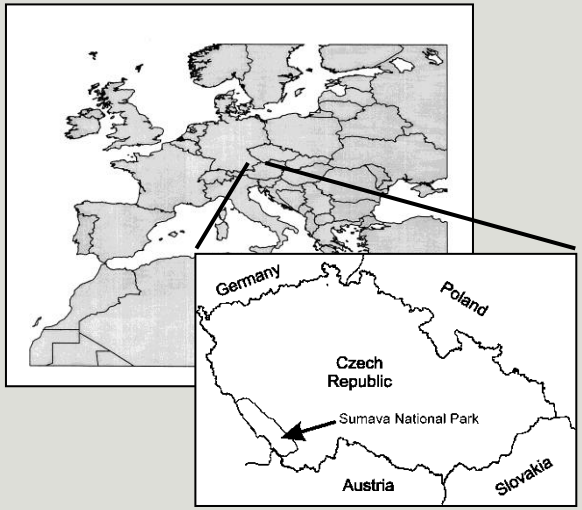


Examples of streams restored in bog forest

„LIFE for MIRES“ – *3. phase of restoration*

TRANSBOUNDARY PROJECT – 4 PARTNERS

- Administration of Šumava NP – coordinating beneficiary
- NP Bavarian Forest
- BUND Naturschutz in Bayern e.V.
- The University of South Bohemia in České Budějovice



MAIN GOALS:

- **Hydrological restoration of mires and wetlands on the area 2059 hectars**
- **Improvement of habitats for black grouses (*Tetrao tetrix*)**
- **Involvement of public into mire restoration and increase of public awareness**

Start: 01/08/2018 - End: 31/12/2024

http://life.npsumava.cz/

LIFE for MIRES – expected outputs

EXPECTED OUTPUTS:

47 project sites

- > Restored **drained** mires and wetlands on the area 1672ha
- > Restored **industrially mined** peatbog Vlčí jámy on the area 17ha
- > Restored **bog forests** (spruce mires) (4ha)
- > Improved habitats for **black grouses** on the area 152ha
- > Restored **hydrological links** in landscape on the area 418ha
- > Restored disturbed **mires** in the vicinity of **settlements** (21ha) - GER

- ➢ **2059 ha in total**
- ➢ **80 km of blocked drainage ditches**
- ➢ **14 km of restored mountain streams**

- Reduction of CO_2 emissions by 125t/year
- Increasing of water accumulated in wetlands by 170 000 m^3
- Improvement of cooling effect of wetlands in landscape

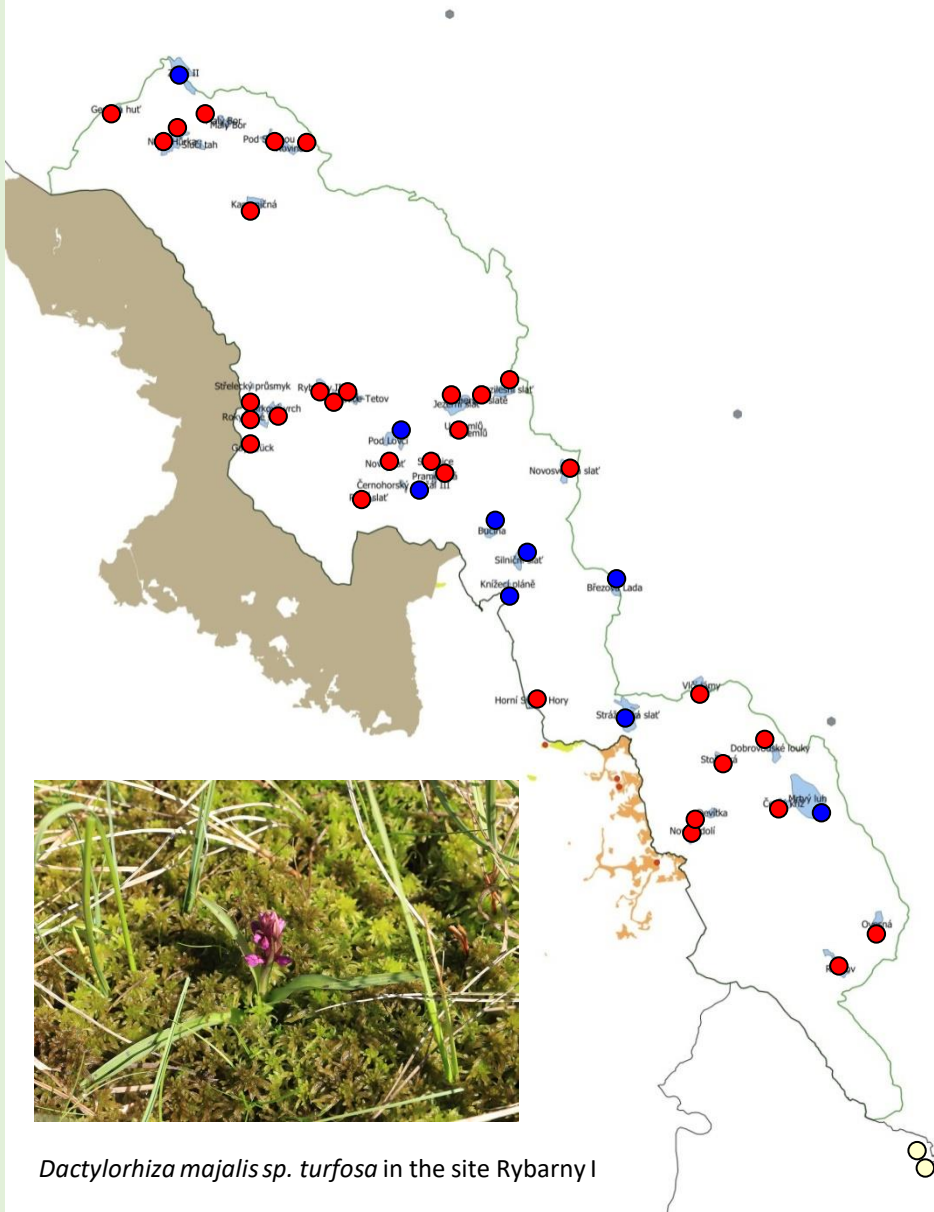
Vlčí Jámy (2016)

Current state of 30.8.2023

Total project sites (CZ)	43
Restored sites	32
Ongoing restoration	9
Restored area	1450 ha
Restored streams	26 km
Dammed and infilled ditches	155 km

Restored natural stream, blocked ditches and created small pools in the site Rybarny I

All sites implemented in 2019-2022



Dactylorhiza majalis sp. turfosa in the site Rybarny I

LIFE for MIRES – restoration measures

Blocking and infilling of ditches

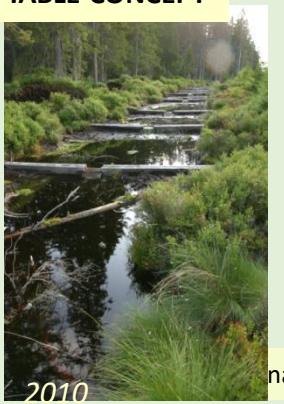
Restoration of small streams

Release of tree canopy

Removal of piped drainage

Tree felling

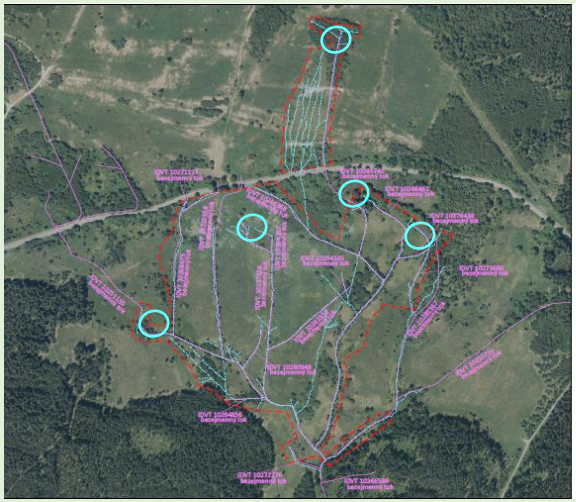
Target water table concept

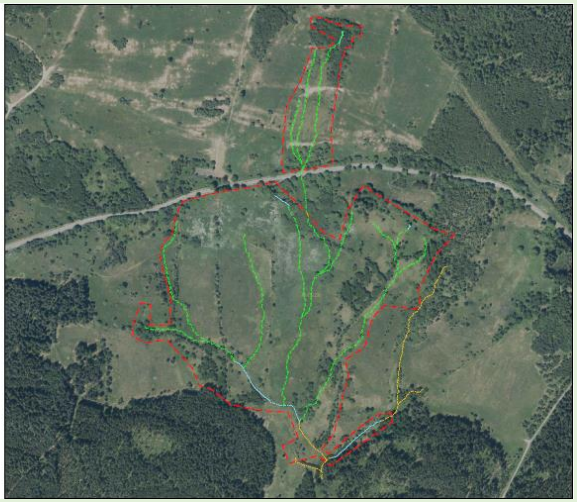


- Mulch application on bare peat
- Surface treatment
- Removing of degraded surface soil layer in fens

Manual mowing

Pod Skelnou





Area (ha)	**42**
Blocked ditches (km)	8,1
Restored streams (km)	3,9
Implementation	2020 - 2021
Costs	238 043 EUR

- **large springs**
- **small streams**
- **fens and meadow wetlands**

Large, drained and totally destroyed spring

Blocking of drainage ditches, infilling of large pits from bank soil deposits

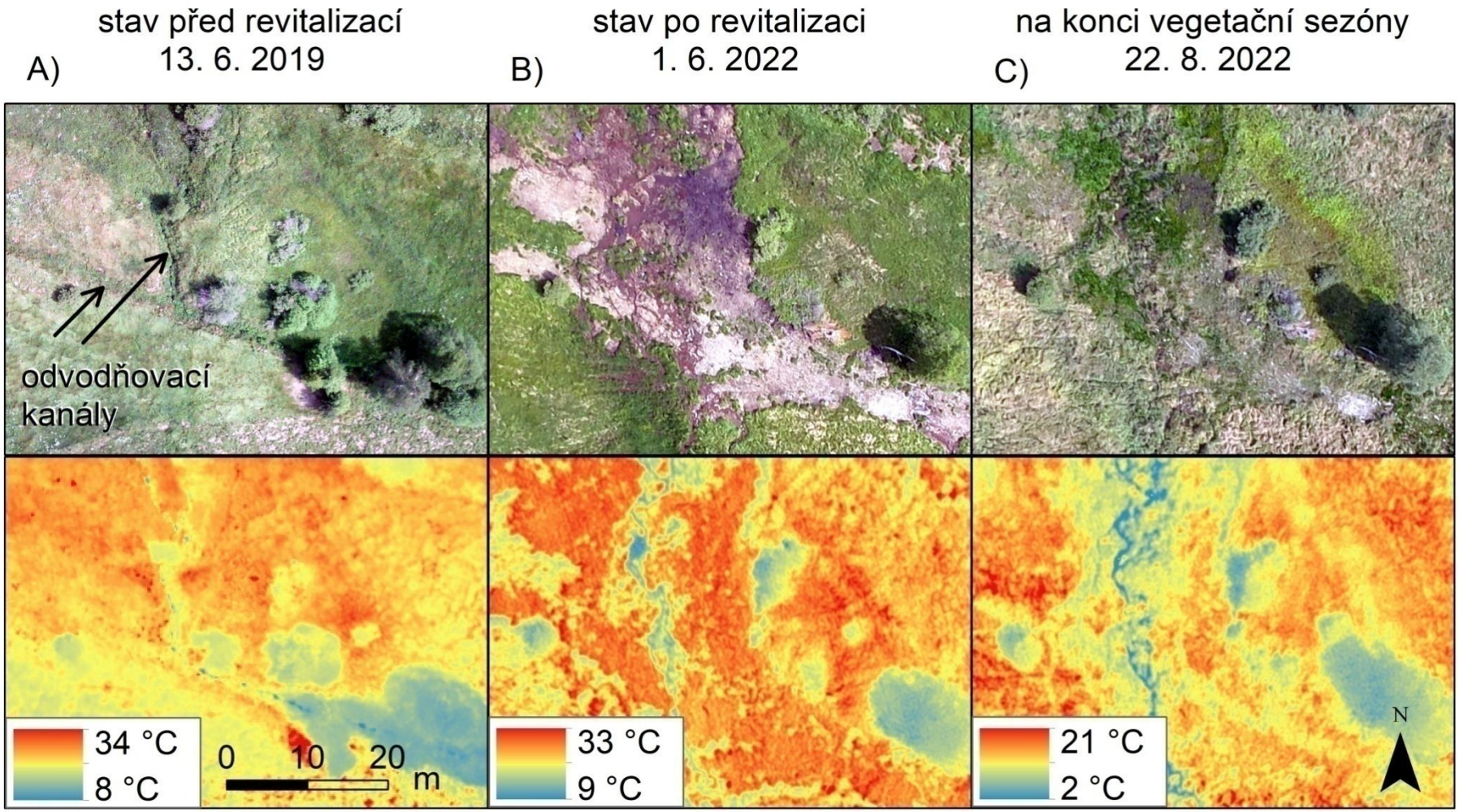

Po revitalizaci říjen 2022


Po revitalizaci prosinec 2021

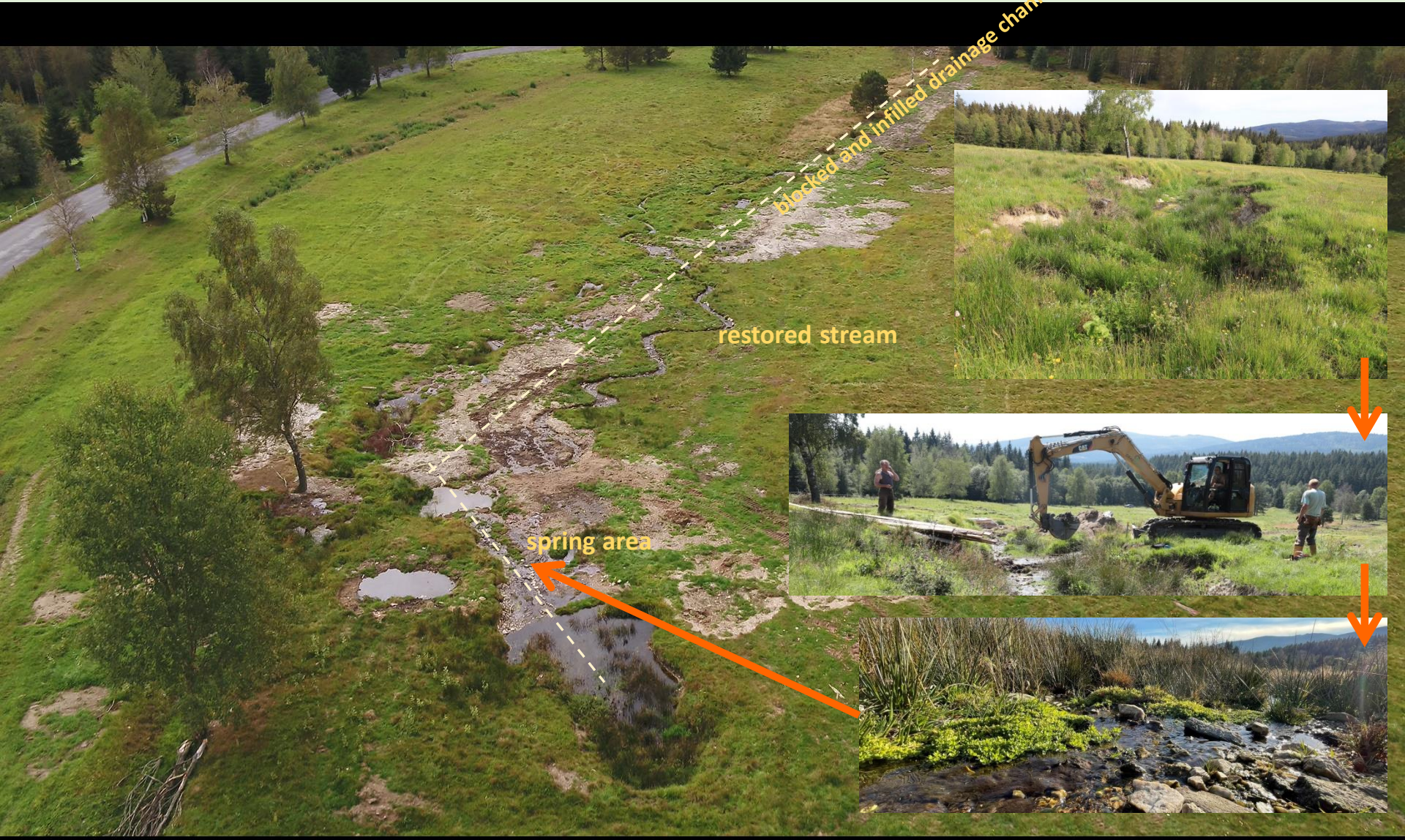
Odvodněné prameniště před revitalizací (2019)

Trasa potoka rýhou před revitalizací (2018)

LIFE for MIRES – Pod Skelnou

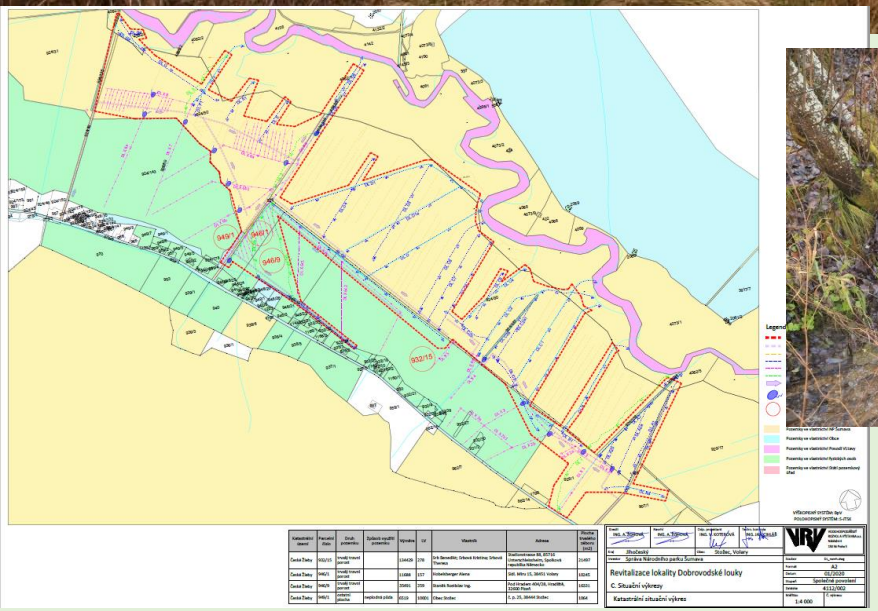

A)
stav před revitalizací
13. 6. 2019
B)
stav po revitalizaci
1. 6. 2022
C)
na konci vegetační sezóny
22. 8. 2022
odvodňovací
kanály
34 °C
8 °C
0
10
20
m
33 °C
9 °C
21 °C
2 °C
N

Malý Bor


blocked and infilled drainage channel
restored stream
spring area

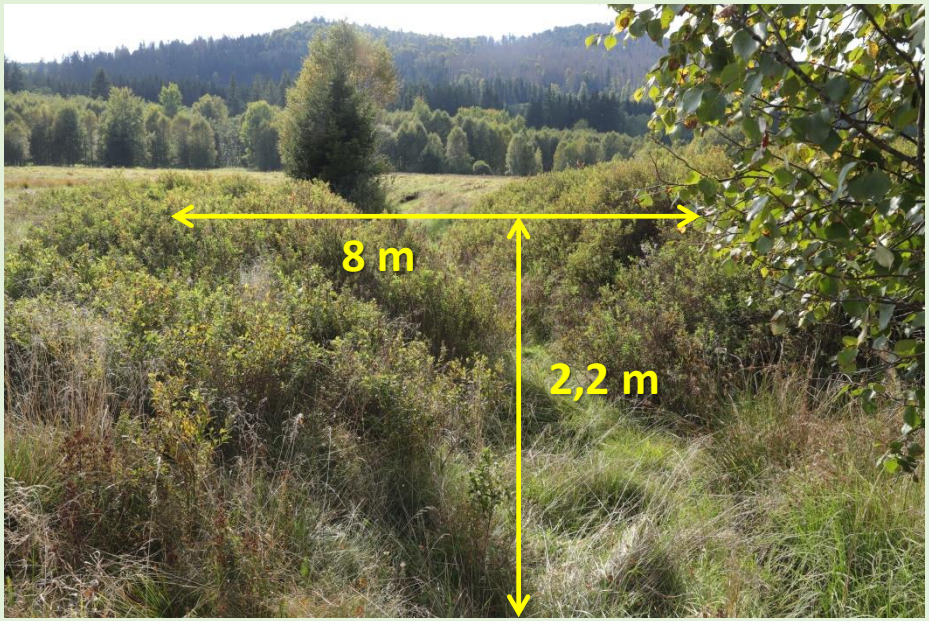
Drained alluvial fens – *Dobrovodské louky (DO)*

Area	67 ha
Ditch removal	5 km
Stream restoration	4,6 km
Implementation	2021 - 2022

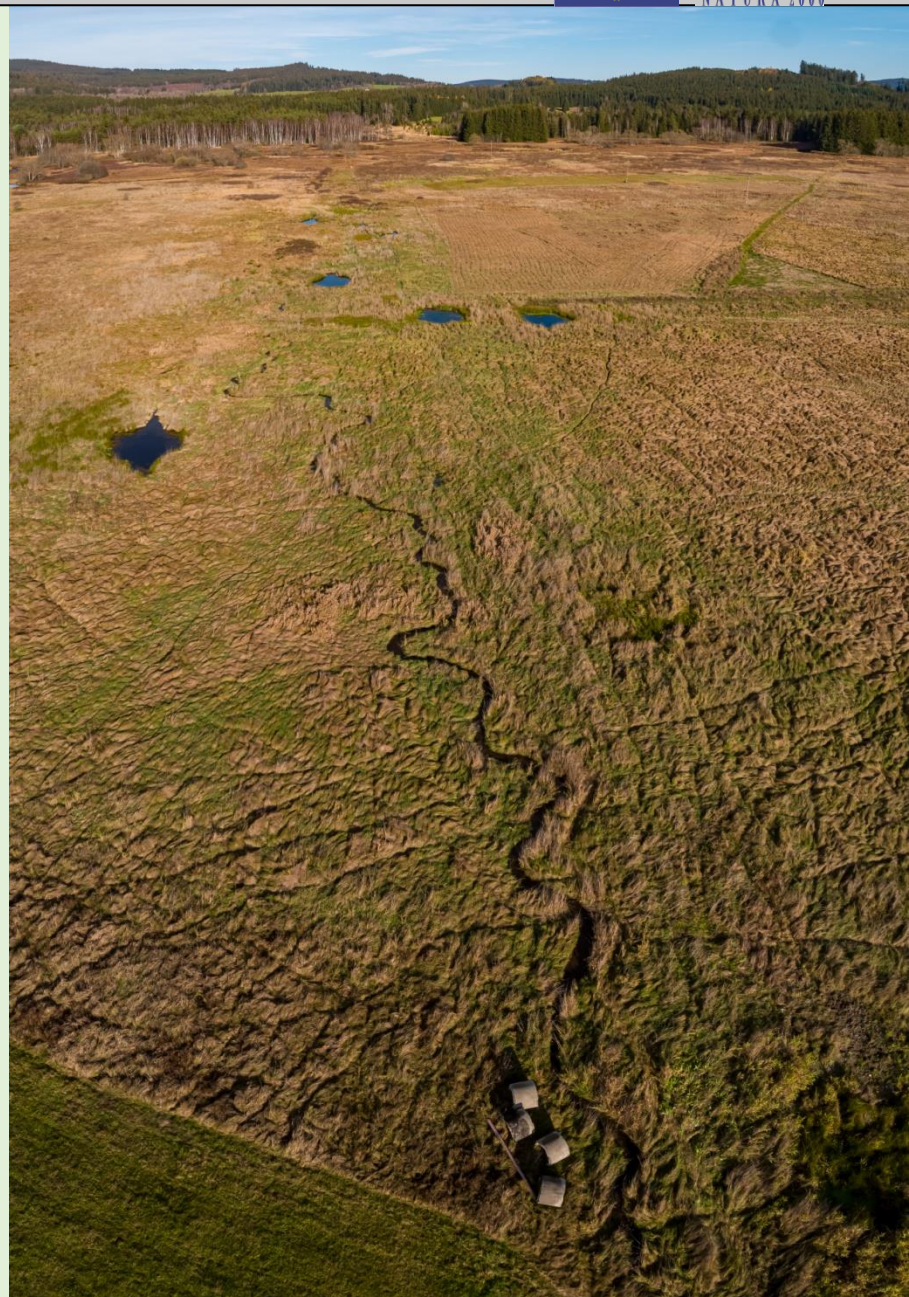


LIFE for MIRES – mountain stream released from piped drainage

LIFE for MIRES – Dobrá: restored stream

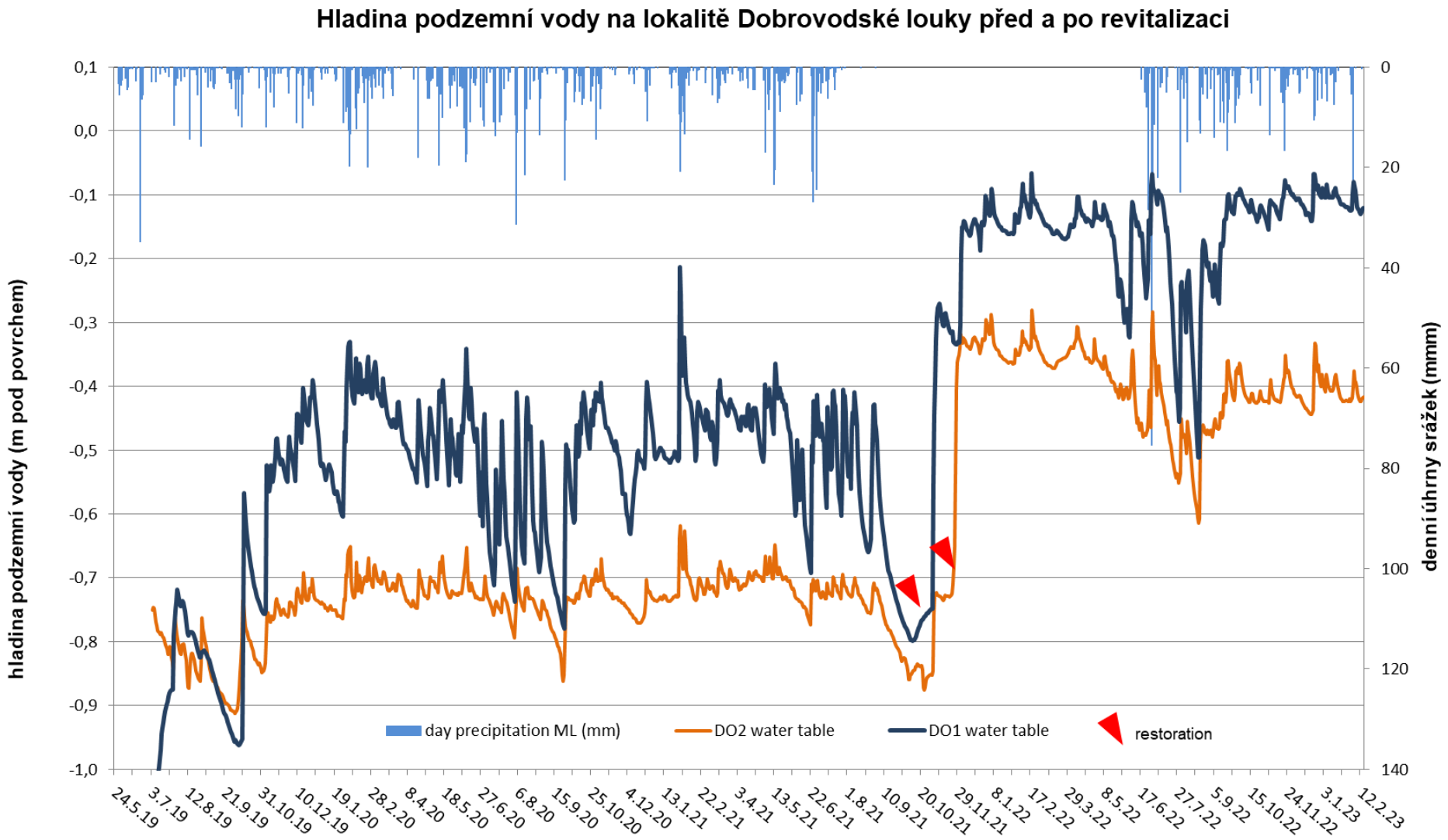


Dobrovodské louky – re-establishment of streams from piped drainage

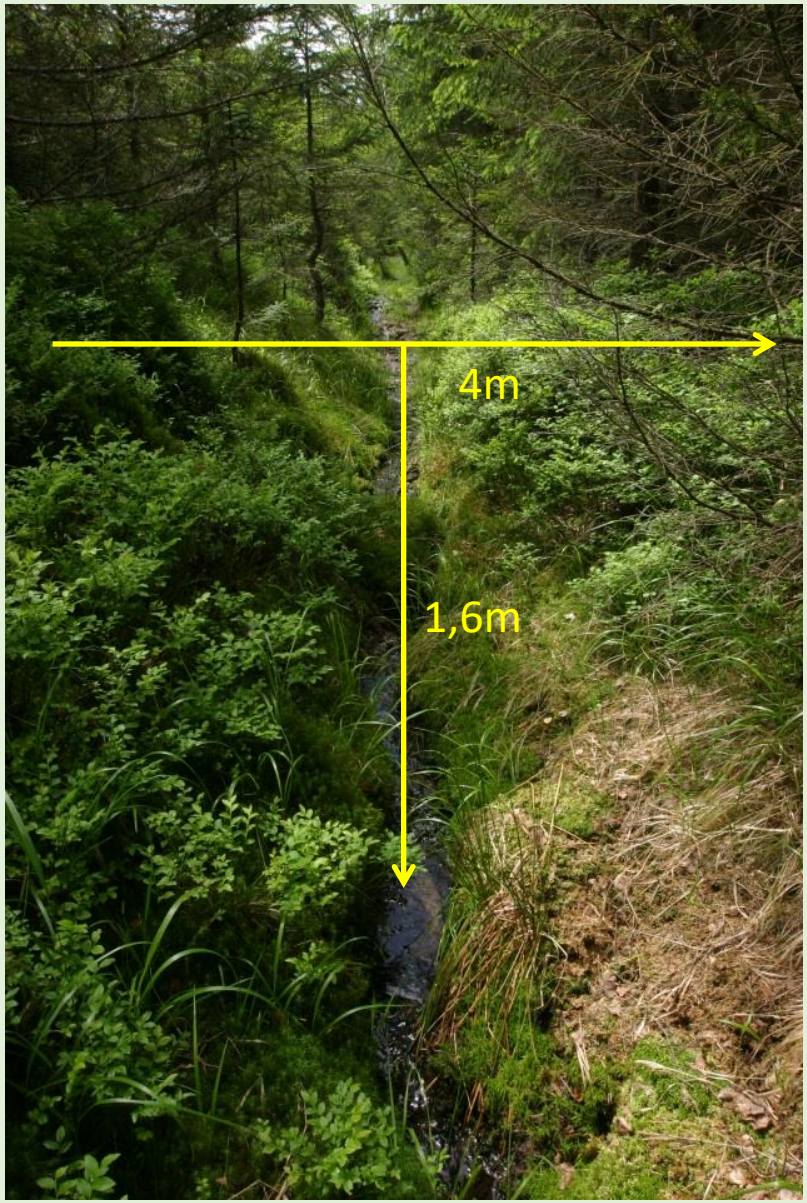


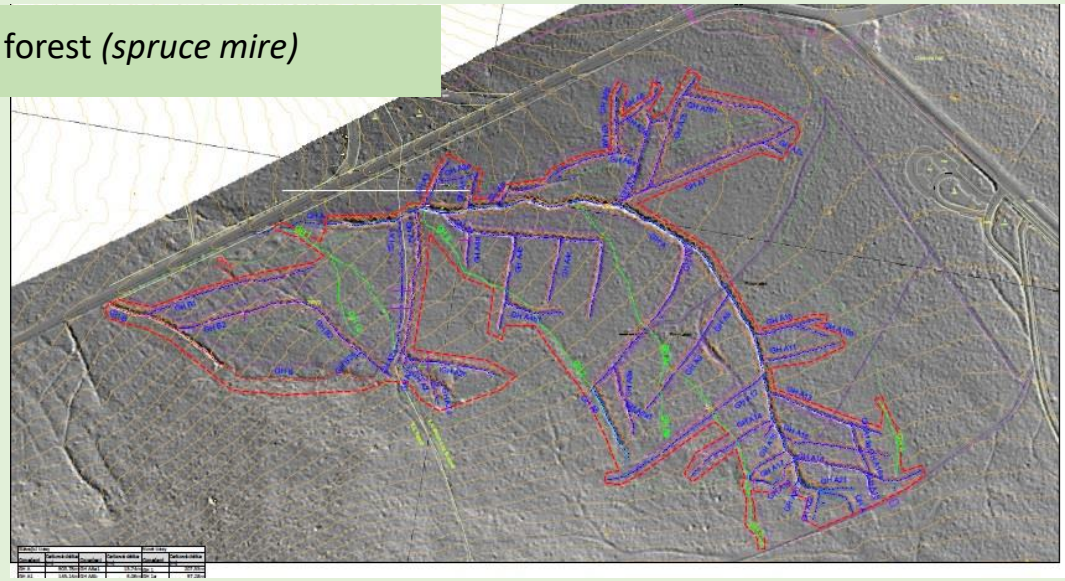
Dobrovodské louky – re-establishment of streams from piped drainage

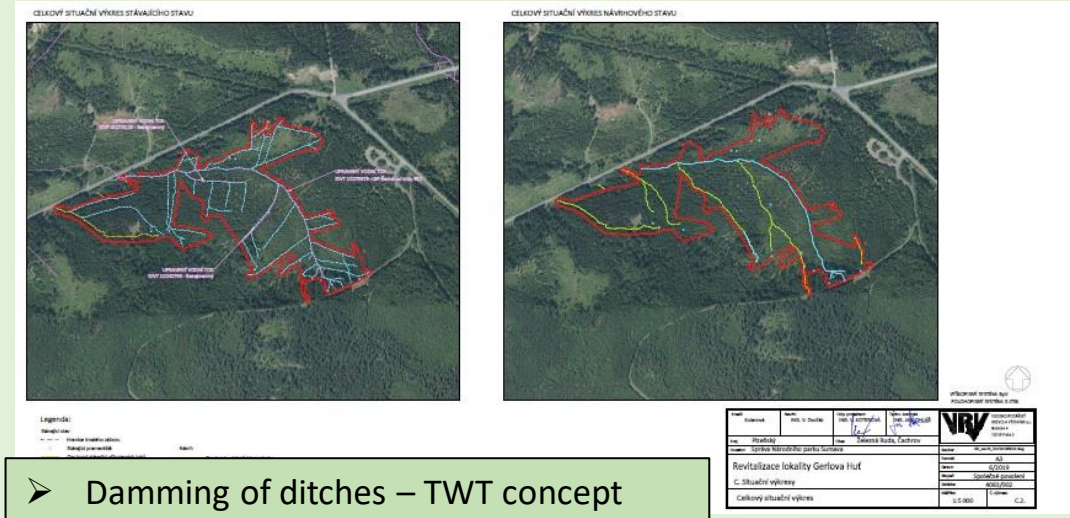
Dobrovodské louky hladina podzemní vody před a po revitalizaci



Gerlova Huť – drained clear-cut and planted bog forest *(spruce mire)*



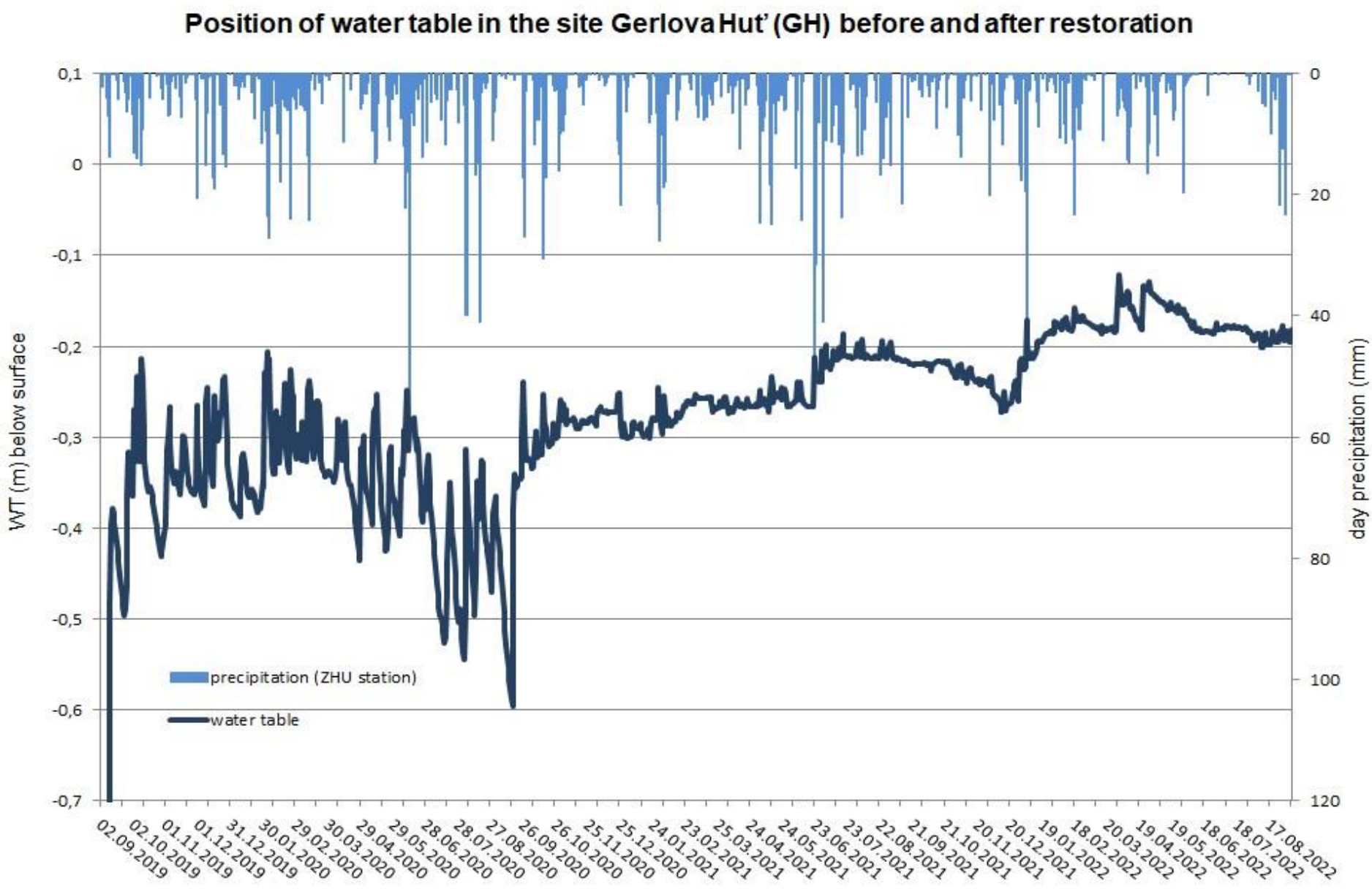




- Damming of ditches – TWT concept
- Restoration of springs and small stream
- Release of dense tree canopy
- Support of peat-forming vegetation

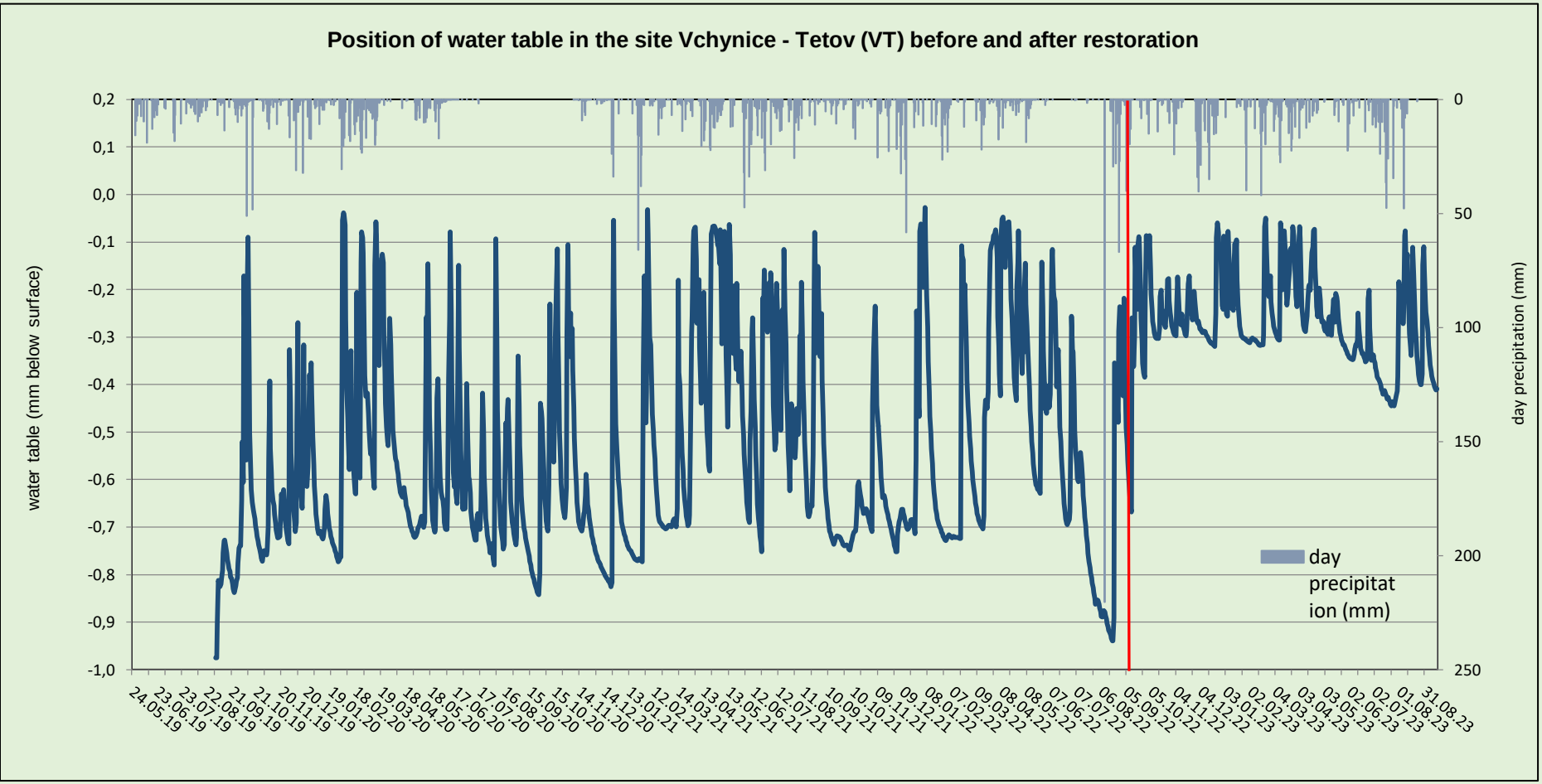
LIFE for MIRES – Gerlova Huť – blocking surface ditches

Raising stream bed – up to 60 cm higher, re-waved stream course


Position of water table in the site Gerlova Huť (GH) before and after restoration
WT (m) below surface
day precipitation (mm)
0,1
0
-0,1
-0,2
-0,3
-0,4
-0,5
-0,6
-0,7
0
20
40
60
80
100
120
precipitation (ZHU station)
water table
02.09.2019
02.10.2019
01.11.2019
01.12.2019
31.12.2019
30.01.2020
29.02.2020
30.03.2020
29.04.2020
29.05.2020
28.06.2020
28.07.2020
27.08.2020
26.09.2020
26.10.2020
25.11.2020
25.12.2020
24.01.2021
23.02.2021
25.03.2021
24.04.2021
24.05.2021
23.06.2021
23.07.2021
22.08.2021
21.09.2021
21.10.2021
20.11.2021
20.12.2021
19.01.2022
18.02.2022
20.03.2022
19.04.2022
19.05.2022
18.06.2022
18.07.2022
17.08.2022

LIFE for MIRES – Vchynice – Tetov – bog forest

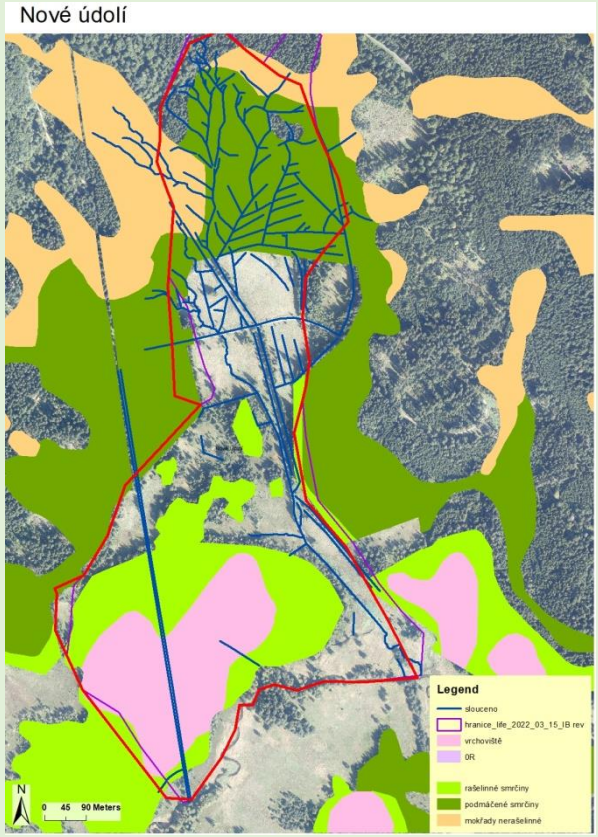
Vchynice–Tetov: hladina podzemní vody

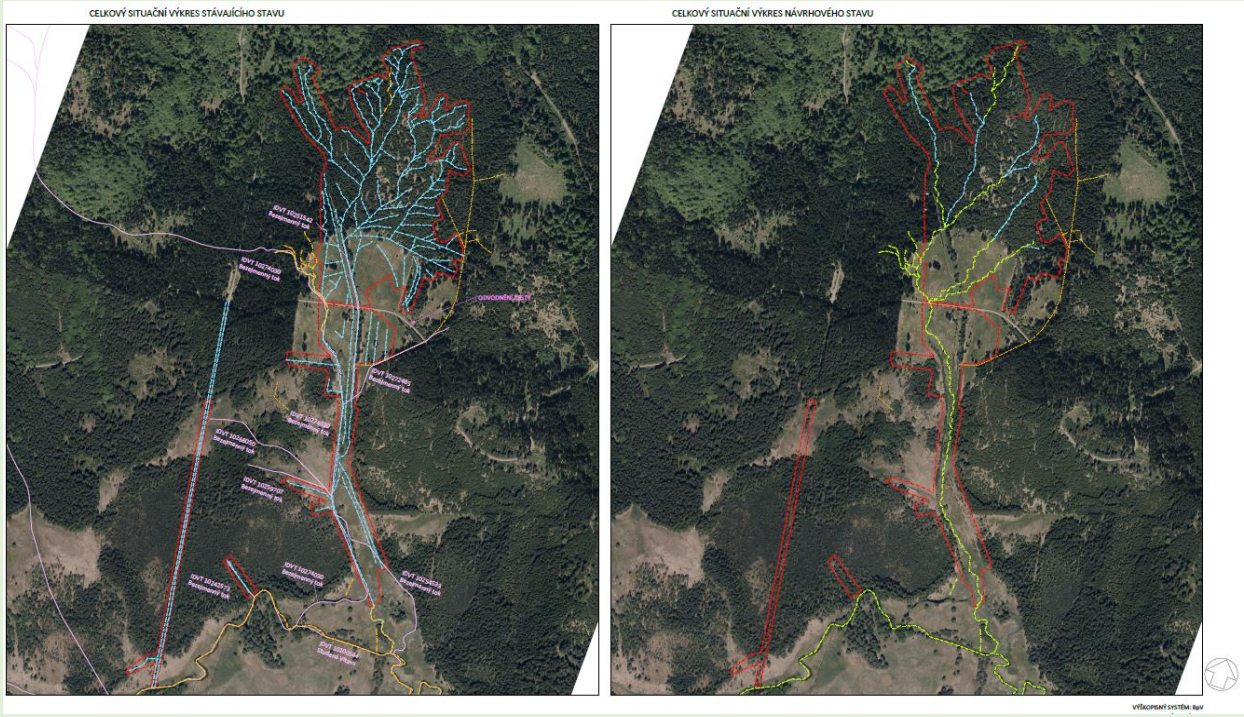


Nové údolí

Area	59 ha
Closed ditches	9 km
Restored streams	1,6 km
Implementation	2020

Beech forest





Before restoration

After restoration

LIFE for MIRES – Nové Údolí – restored forest spring and stream


Prameniště před revitalizací 2019

Revitalizace 2020


Prameniště před revitalizací 2019 – dolní část


Stav po revitalizaci 2022

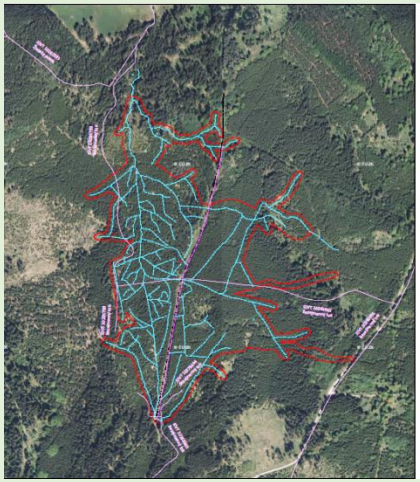
Nové Údolí – obnova lesního potoka, převedení do zachovalého původního koryta

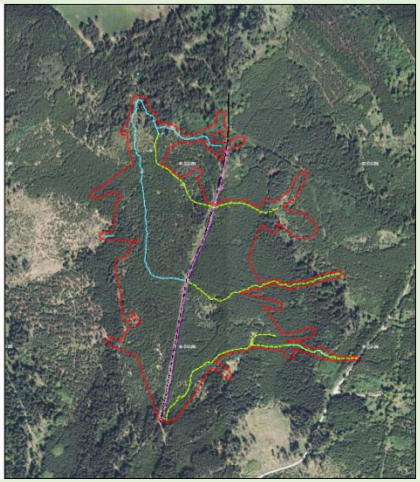
Nové Údolí – obnova lučního potoka, převedení do původního koryta

LESY OBHOSPODAŘOVANÉ

Stožecká

Rozloha	**29 ha**
Odvodňovací kanály	8,6 km
Obnova potoků	2 km
Doba realizace	2020 - 2021





LESY OBHOSPODAŘOVANÉ

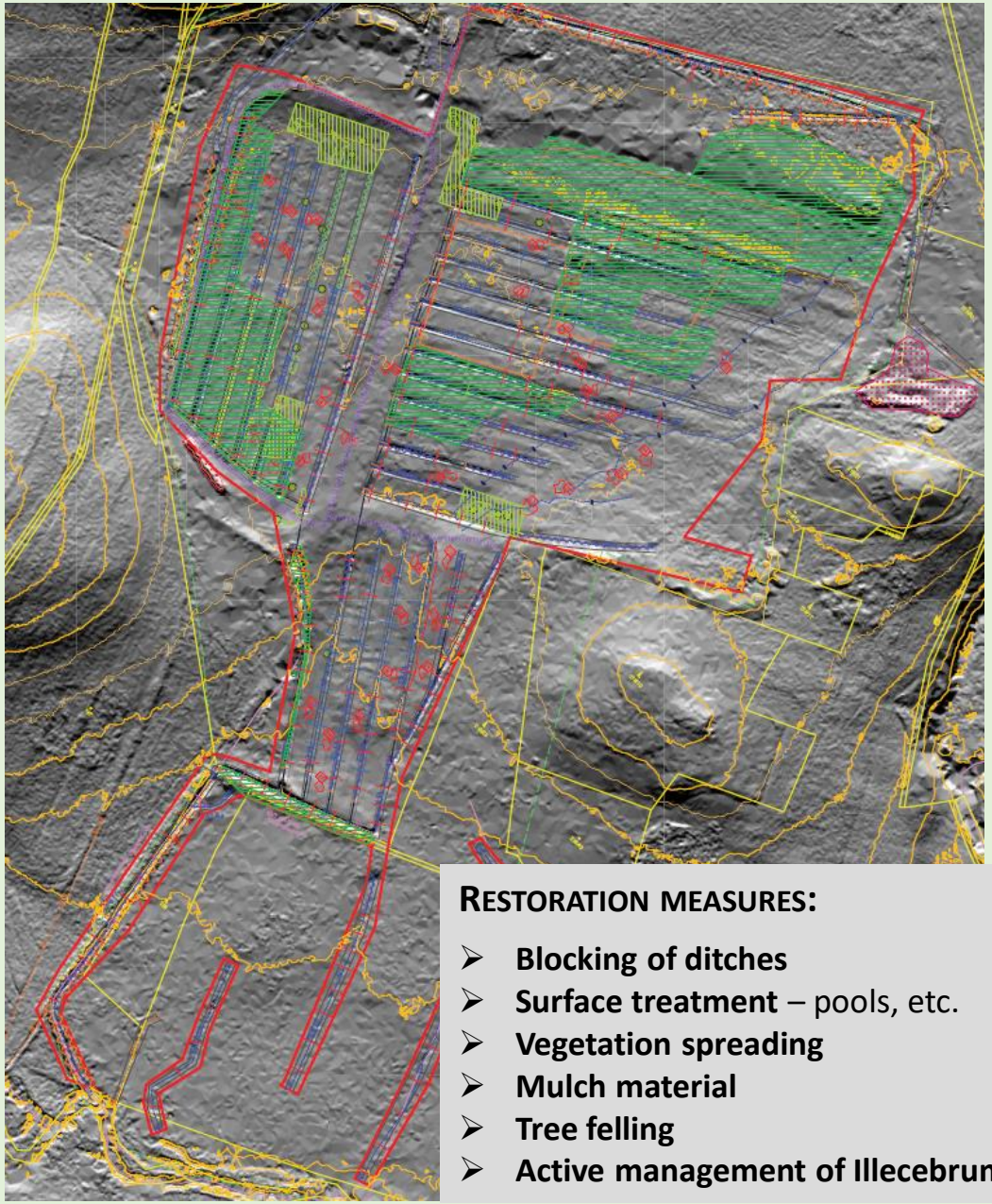
Stožecká – výsledek rozvlnění a vymělčení napřímeného erodujícího potoka, pohřbené hráze ve dně

POTENCIÁL LČR A VLS - spolupráce

Vlčí jámy – *mined peatbog*

Vlčí Jámy

Area	**46 ha**
Blocked ditches	9 km
Implementation	2021
Costs	61 122 EUR



Illecebrum verticillatum
– rare CI species
- specific measures

Intensive both surface and subsurface drainage

RESTORATION MEASURES:

- **Blocking of ditches**
- **Surface treatment** – pools, etc.
- **Vegetation spreading**
- **Mulch material**
- **Tree felling**
- **Active management of Illecebrum**

LIFE for MIRES – mined bog (VJ) – daming of surface ditches

Blocking of subsurface ditches

Blocking of surface ditches

LIFE for MIRES – MINED BOG (VJ) – surface treatment

Surface erosion

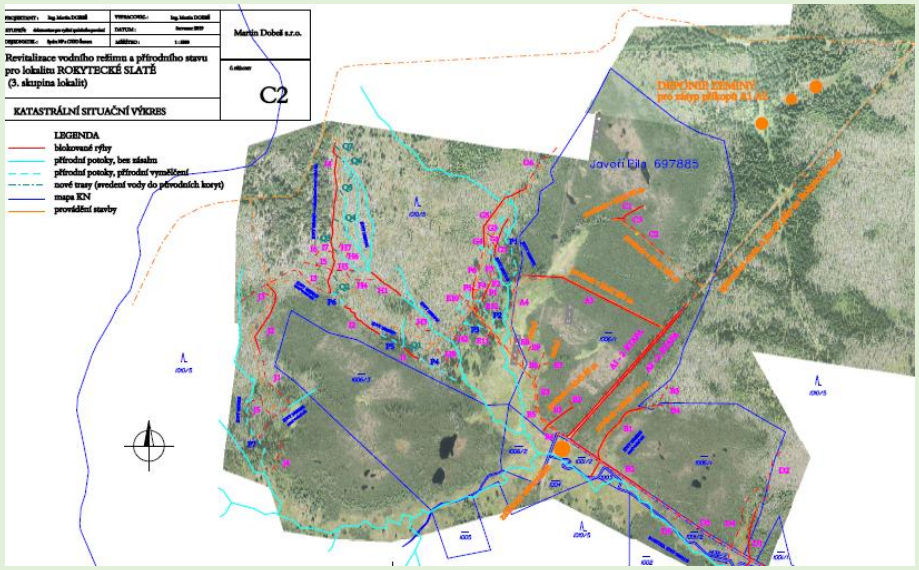
Surface treatment

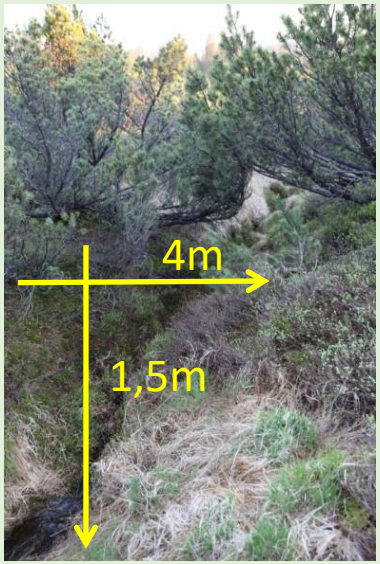
Digging of shallow surface depressions and pools

Re-establishment of peatforming processes

- Returning of *Sphagnum* mossess
- Spreading of mulch material

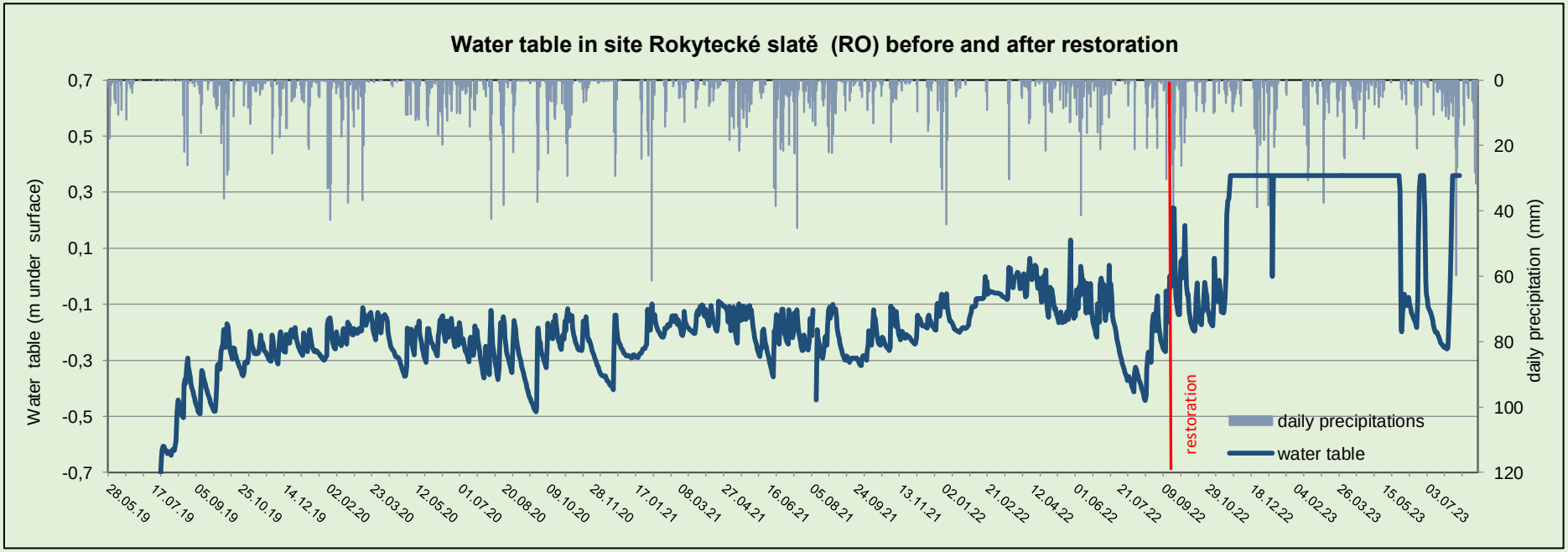
Drained ombrotrophic bogs *in the upland area – Rokytecké slatě bogs*





Area	**83 ha**
Ditches (km)	5
Restored streams (km)	0,3
Implementation	2021 - 2022

Drained ombrotrophic bogs *in the upland area – Rokytecké slatě bogs*



LIFE for MIRES – Jezerní slať drained bog and manualy extracted pea

LIFE for MIRES – Hamerská slať – „estonské vany“

Total summary 1999 – 2023 in Sumava Mts.

Restoration 1999 - 2022	
Total restored area	1910 ha
Restored natural streams	28 km
Blocked and infilled ditches	190 km

LIFE for MIRES – project structure - actions

RESTORATION

MONITORING

SHARING EXPERIENCE

COMMUNICATION

Monitoring and assessment of restoration success D1 - NPS

EVALUATION OF RESTORATION EFFECT ON:

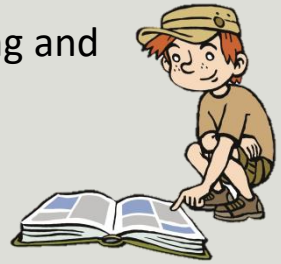
- > **Water table**, runoff and water retention in landscape
- > **Water quality** in catchment
- > **Species diversity** and populations of rare species (black grouses)
- > **Soil processes – peat decomposition, gas emissions**
- > **Cooling effect of restored mires and wetlands**
- > **Socio-economic impacts i**

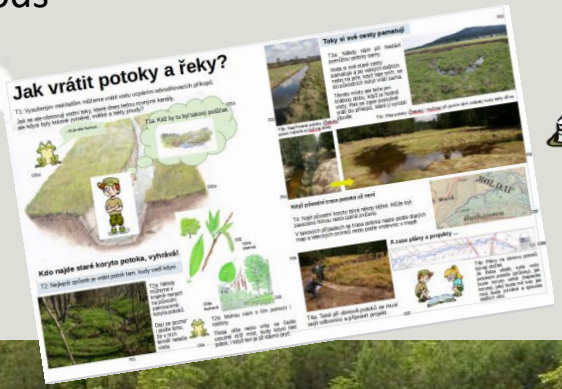
„LIFE for MIRES“ – *inspirative dissemination actions“*

> **Voluntary actions „Days for mires“**

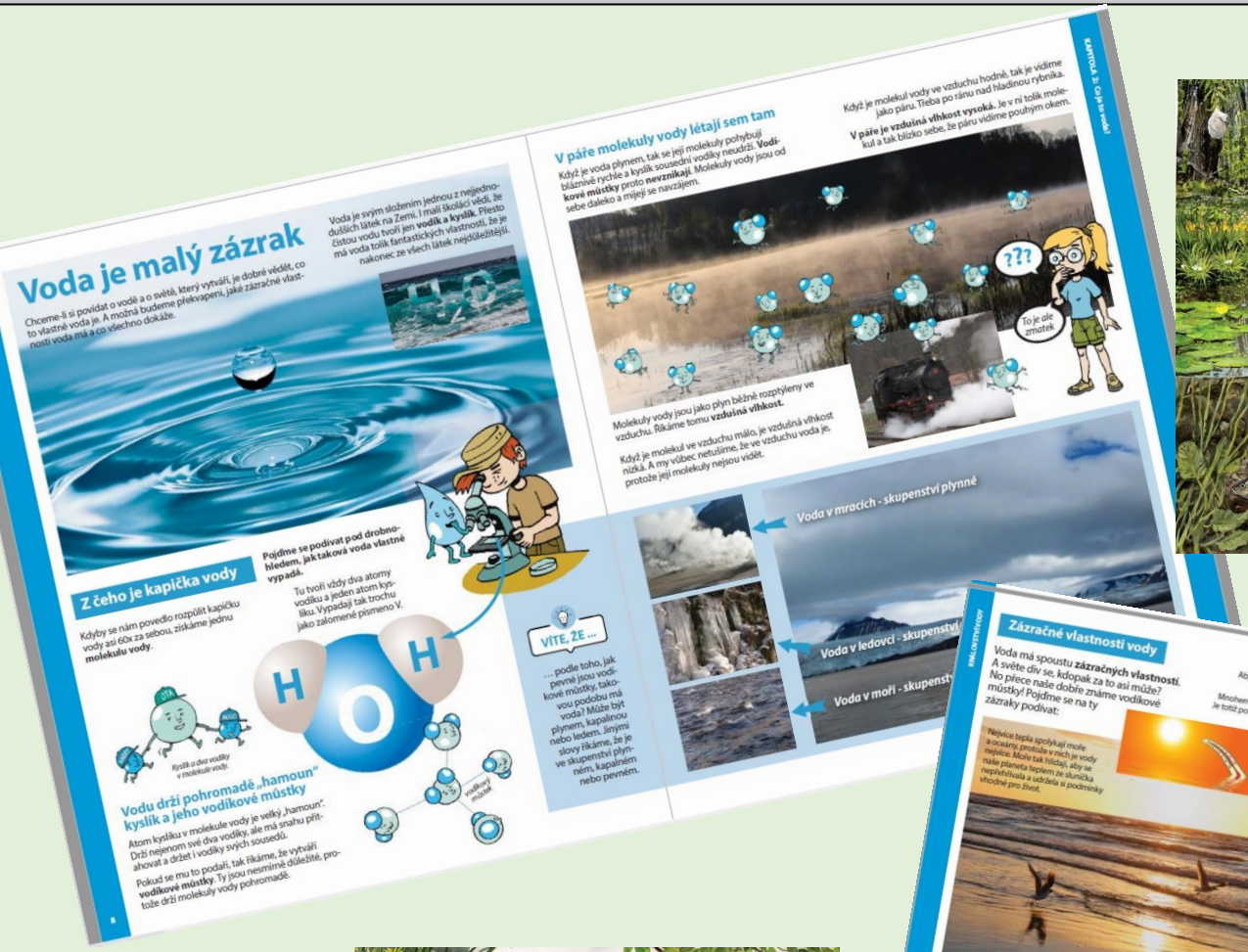
> **Tutorial programme** for schools and **textbook** about water and wetlands

- Popular **educative film** about wetlands
- Pictured popular **book „Water lost and returned “**
- **Manual** for restoration of mountain wetlands
- Two **professional conferences** – about monitoring and restoration methods





LIFE for MIRES – pictured book for school children



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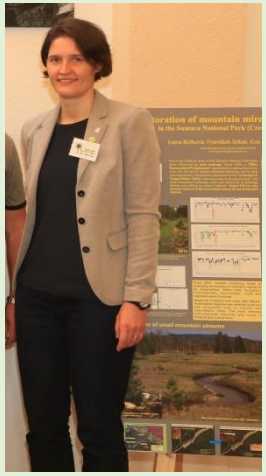

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Thanks´ for attention

Landscape without wetlands is landscape without water