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SINKHOLE CARE IN THE MORAVIAN KARST

Mendel
University
in Brno



Department of Landscape Management

INTRODUCTION

- Karst areas are quite a frequent phenomenon of the surface of the Earth – they form over 10% of the land.
- The most significant ones in the Czech Republic are the Moravian Karst and the Bohemian Karst.
- Agricultural usage of karst areas is limited by the bedrock solubility which leads to the partial washing away of the fertile surface layers of the soil.
- The unique nature of karst areas as a specific biotope diversifying the fauna and flora of the surroundings is the reason why these areas need to be taken care of and protected.

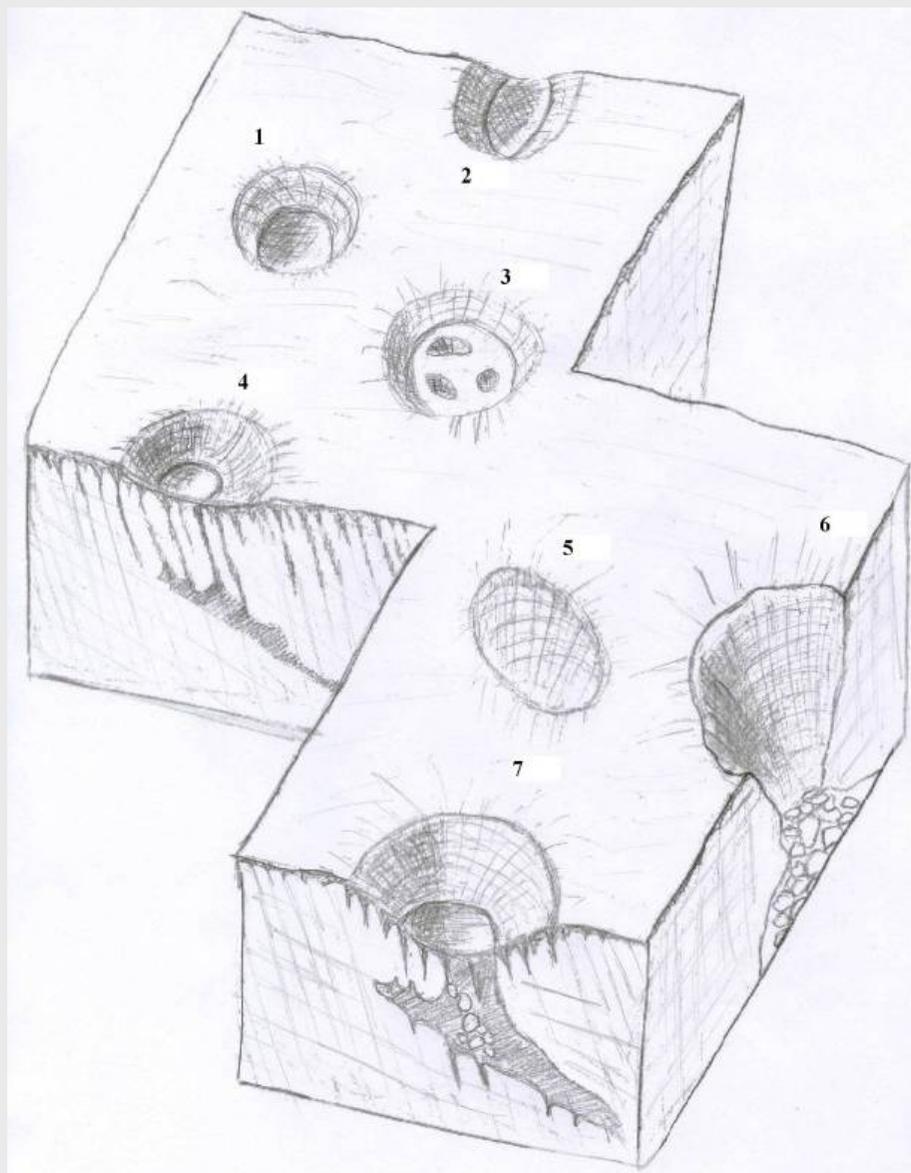


Sinkhole Blažek

Kudličková, 2012

LITERATURE REVIEW

- A sinkhole is a closed depression formed in karst conditions, such as in lime, dolomite, rock gypsum or rock salt.
- A sinkhole can have a circle, oval, elongated or irregular ground plan and several shapes, such as a funnel shape, can be cylindrical or dished.
- Diameters of sinkholes range from several metres to over a kilometre and depths from several decimetres to tens of meters.



- A sinkhole can appear where cracks and rifts are surfaced. Rainwater leaks to the underground and erodes and solves the surroundings of the cracks and rifts.
- The sinkholes in the Czech Republic are located on limestone bedrocks.



Sinkholes on the plateau Harbešská

Kudličková, 2012



Sinkholes on the plateau **Ostrovská**

Kudličková, 2012

BASIC DATA ON THE AREA

- The PLA Moravian Karst is located in the South Moravian Region.
- It is 25 km long and 3–6 km wide.
- There are over 1,100 revealed caves in the Moravian Karst.
- It was proclaimed Protected Landscape Area in 1956, thus becoming the oldest protected landscape area in Moravia and the second oldest in the Czech Republic.
- There are 17 small special protection areas, out of which there are 4 national nature reserves, 2 national nature monuments and 11 nature reserves.

KULTURNÍ PAMÁTKY

-  architektonické památky
-  zříceniny hradů
-  technické památky
-  archeologické památky

1. Chrám P. Marie Bolestné
2. Jeskyně Kůlna
3. Hrad Holštejn
4. Větrný mlýn Ostrov u Macochy
5. Hrad Blansek
6. Větrný mlýn Rudice
7. Huť Františka
8. Jeskyně Býčí skála
9. Chrám Jména P. Marie
10. Jeskyně Pekárna
11. Hradisko Chochola

PAMÁTNÉ STROMY

-  RAMSARSKÝ MOKŘAD
- Podzemní Punkva

-  VEŘEJNOSTI PŘÍSTUPNÉ JESKYNĚ

- A Sloupsko-šošůvské jeskyně
- B Jeskyně Balcarova
- C Punkevní jeskyně, propast Macocha
- D Kateřinská jeskyně

NAUČNÉ STEZKY

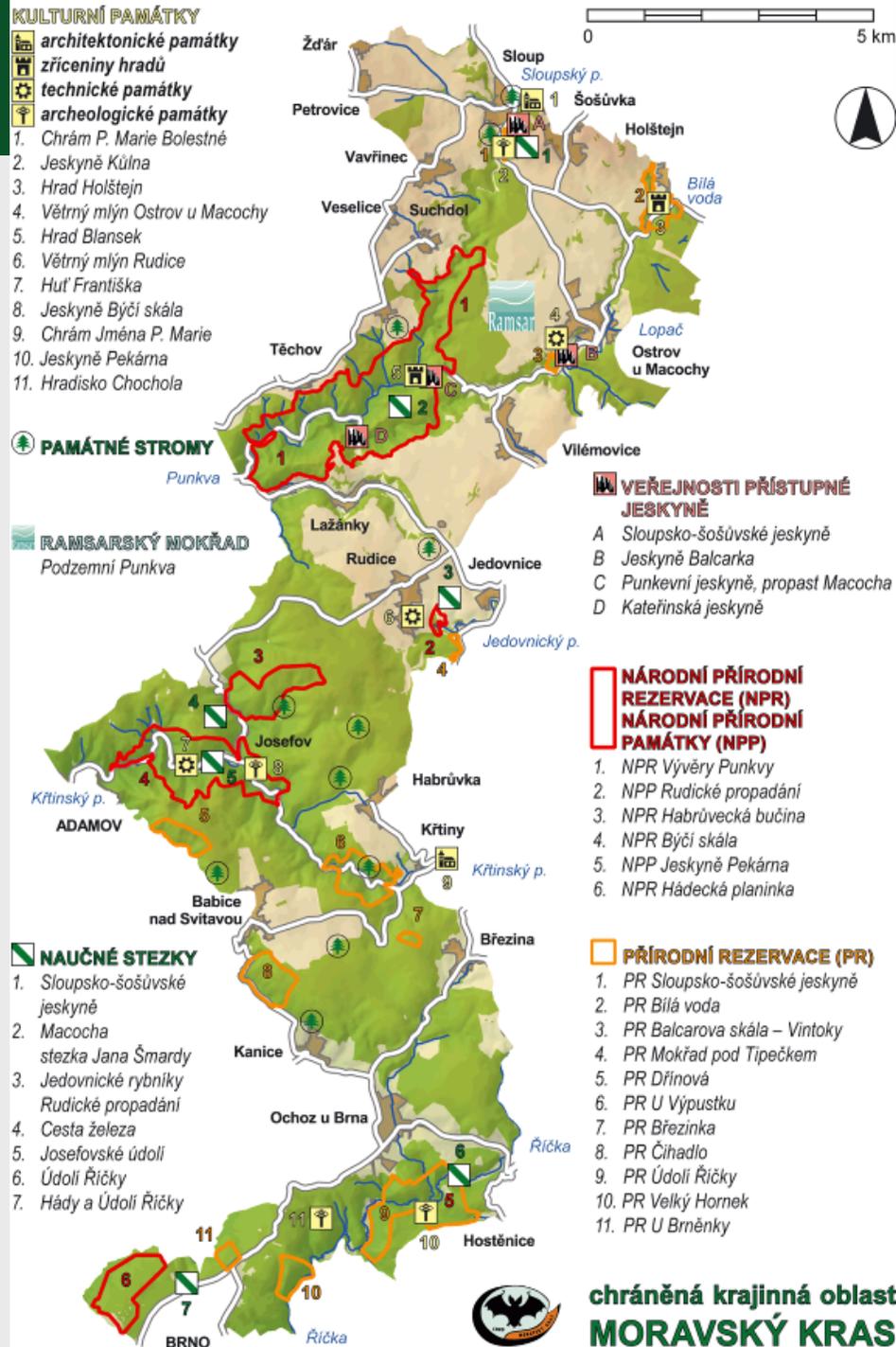
1. Sloupsko-šošůvské jeskyně
2. Macocha stezka Jana Šmardy
3. Jedovnické rybníky Rudické propadání
4. Cesta železa
5. Josefovské údolí
6. Údolí Říčky
7. Hády a Údolí Říčky

NÁRODNÍ PŘÍRODNÍ REZERVACE (NPR) NÁRODNÍ PŘÍRODNÍ PAMÁTKY (NPP)

1. NPR Vývěry Punkvy
2. NPP Rudické propadání
3. NPR Habrůvecká bučina
4. NPR Býčí skála
5. NPP Jeskyně Pekárna
6. NPR Hádecká planinka

PŘÍRODNÍ REZERVACE (PR)

1. PR Sloupsko-šošůvské jeskyně
2. PR Bílá voda
3. PR Balcarova skála – Vintoky
4. PR Mokřad pod Típečkem
5. PR Dřínová
6. PR U Výpustku
7. PR Březinka
8. PR Čihadlo
9. PR Údolí Říčky
10. PR Velký Hornek
11. PR U Brněnky




chráněná krajinná oblast
MORAVSKÝ KRAS



Sinkhole Dolina

Kudličková, 2012

METHODOLOGY

- The research area is the plateaus of the Moravian Karst, where sinkholes frequently appear. The field work was conducted in 2010 and spring 2012.
- The aim was to examine the current condition and care for sinkholes in the research areas of the Moravian Karst.
- The study was inspired by the Administration of the Protected Landscape Area Moravian Karst (hereinafter PLA Moravian Karst) and the focus of the study is care for sinkholes.

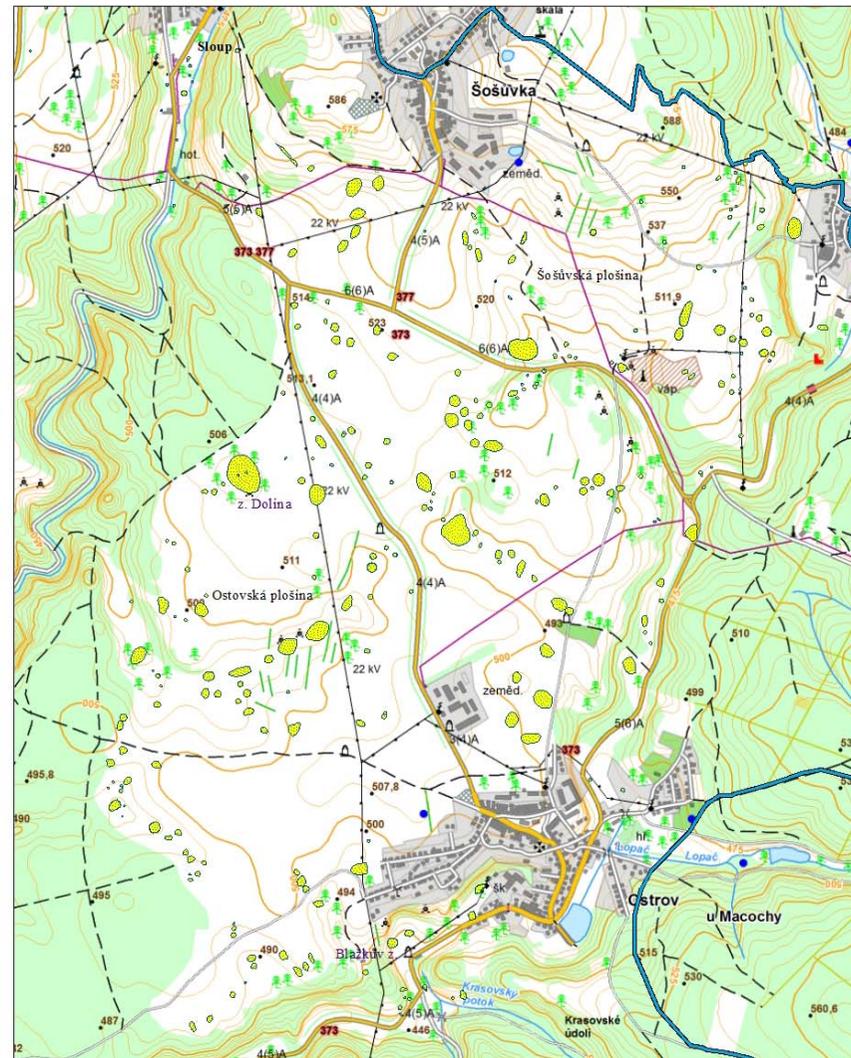
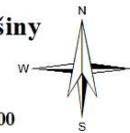
- The field survey gave basic information on the provided care.
- Maps to establish the plots for budget calculations were created based on the data obtained through sinkhole mapping in Ostrovská plošina in 2010 and data obtained from the Administration of the PLA Moravian Karst.
- As the most suitable for grazing animals are sheep and goats, because there is such a high risk of erosion with other livestock (cattle, horses), which are significantly larger. Also do not have so great demands on water.

Závrtý na zemědělské půdě - oblast Ostrovské a Šošůvské plošiny

Legenda

-  závrtý
-  hranice CHKO Moravský kras

1:15 000



0 150 300 600 900 1200 m

Martina Kudličková

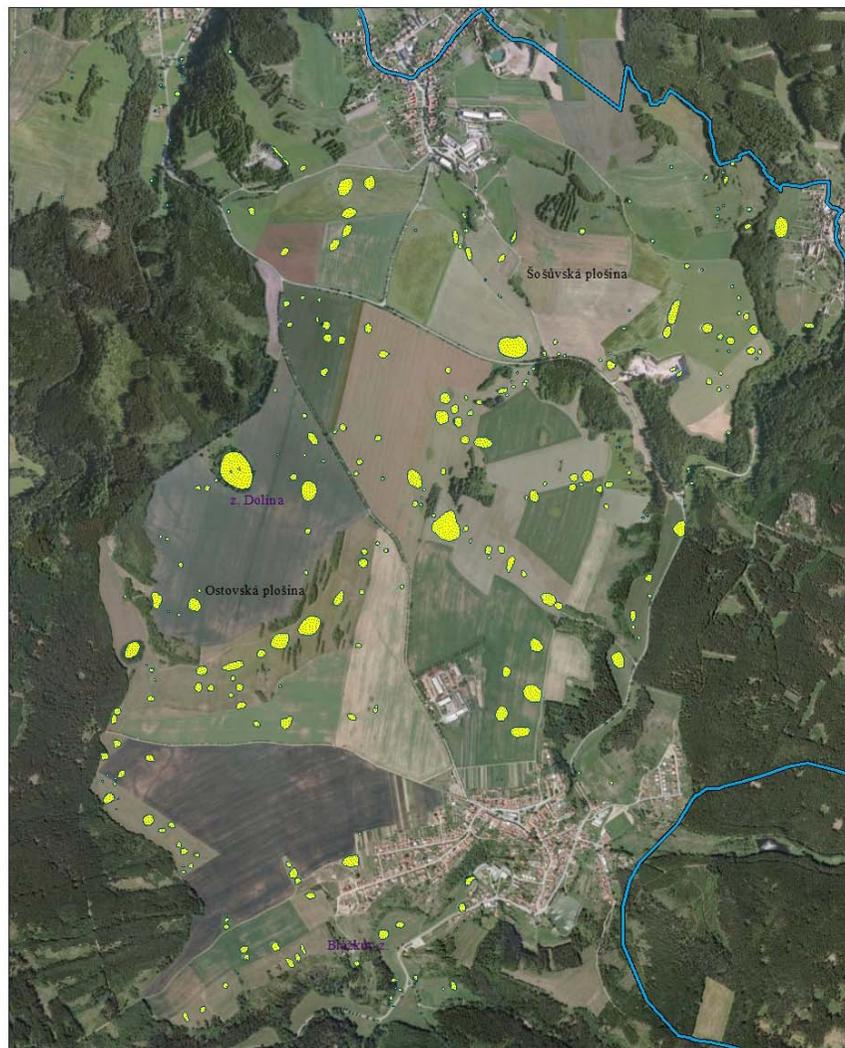
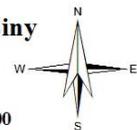
Závrtý na zemědělské půdě - oblast Ostrovské a Šošůvské plošiny

Legenda

 závrtý

 hranice CHKO Moravský kras

1:15 000



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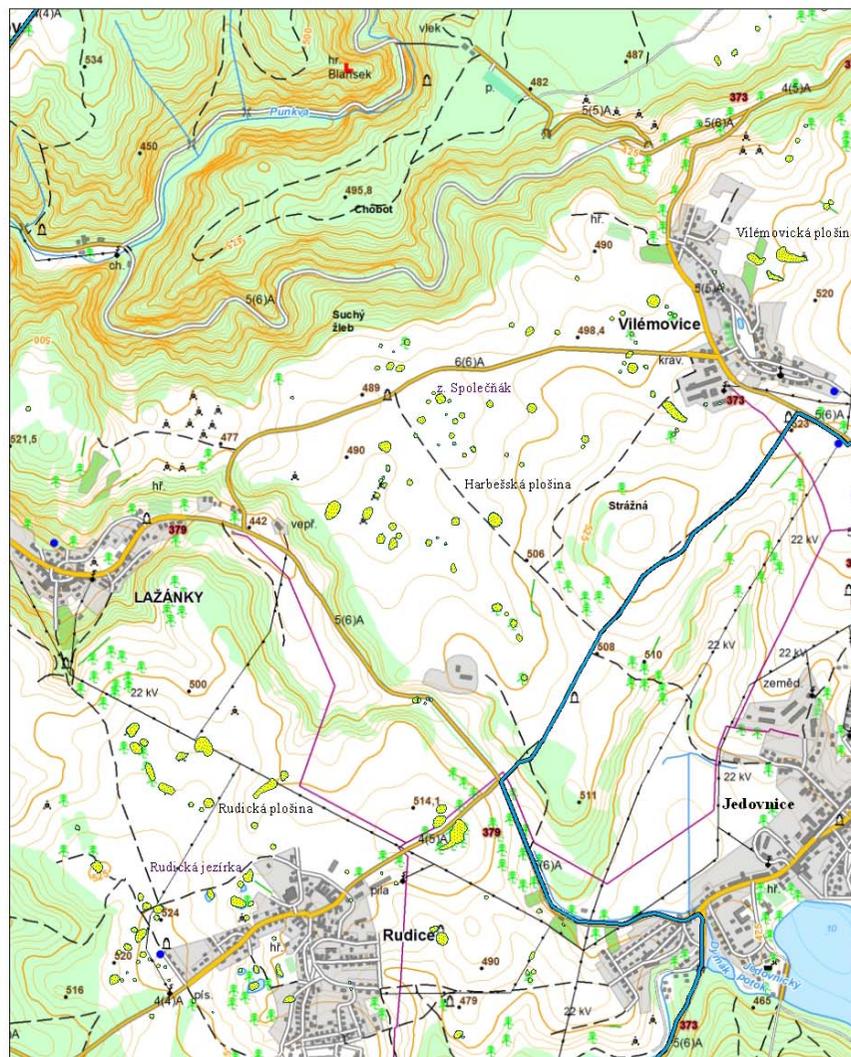
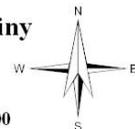
Martina Kudličková

Závrtý na zemědělské půdě - oblast Harbešské a Rudické plošiny

Legenda

-  závrtý
-  hranice CHKO Moravský kras

1:15 000



Závrtý na zemědělské půdě - oblast Harbešské a Rudické plošiny

Legenda

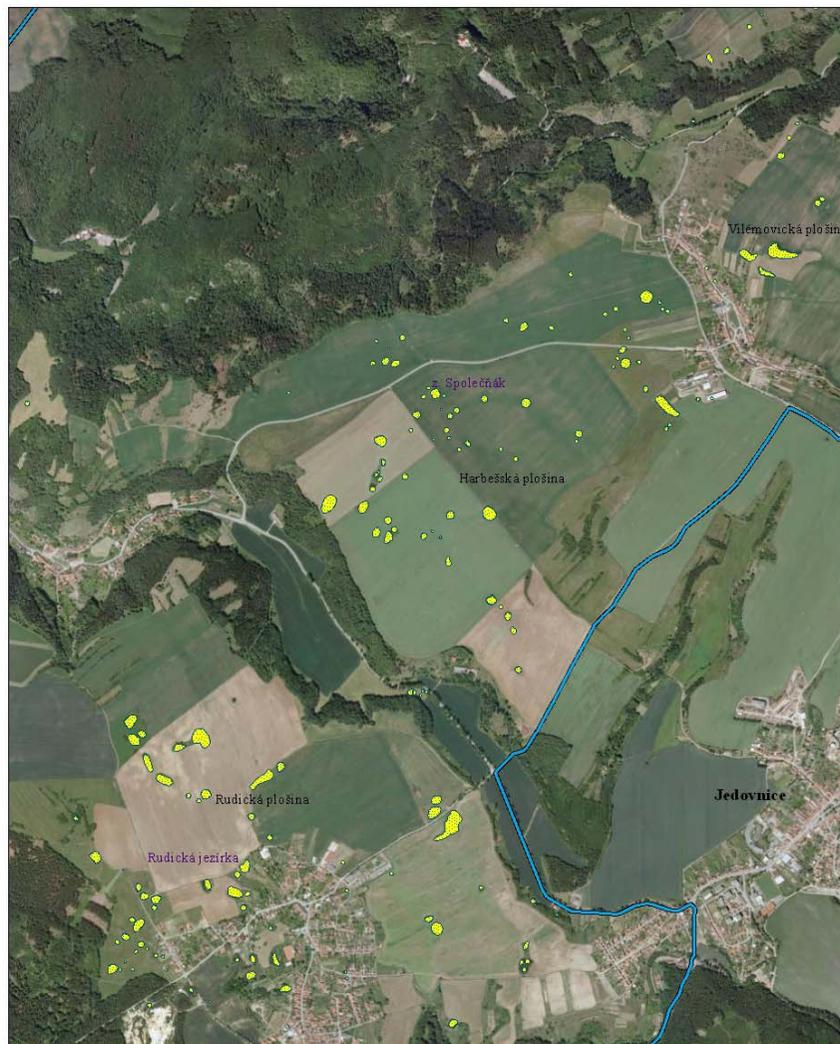
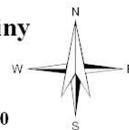


závrtý



hranice CHKO Moravský kras

1:15 000





Sinkhole Společňák

Kudličková, 2012



Sinkhole Společňák

Kudličková, 2012

RESULTS

- The care for any area, including sinkholes, can be divided based on two basic methods: rehabilitation and regulation.
- First, rehabilitation measures are taken if necessary, then regulation measures. Rehabilitation measures concentrate on the return to a natural state by a removal of undesirable elements and phenomena.
- The sinkholes in the research area are of two kinds: sinkholes in arable land and sinkholes in permanent grassland (meadows, pastures).
- The care for these sinkholes also depends on the surroundings. This can be a problem in the arable land mainly as the sinkholes there are more isolated.

- We assumed that sinkholes in the PLA Moravian Karst take about 40 ha of agricultural land, out of which 15 ha is in permanent grassland and 25 ha in arable land.
- We disregarded the fact that some of the sinkholes in arable land had been ploughed.
- If the sinkholes in arable land were scythed manually twice every year, the care cost would be 1,000,000–1,400,000 Czk (without VAT) in dependence on the terrain profile, slopes, distance from roads and distance between individual sinkholes.
- For the purposes of the budget we considered the average – 1,200,000 Czk (without VAT).
- If a brushcutter was used, the costs would be about 10% lower, dropping to 900,000–1,100,000 Czk (without VAT).

- The sinkholes in permanent grassland can be treated by either grazing or scything.
- For scything we calculated only the area of the sinkholes, not the area of the grassland where the sinkholes are located.
- Grazing cannot be performed in the sinkhole alone, the surrounding area needs to be taken into account. Only sheep and goats were considered, as cattle induce erosion.

- The lower limit of load is 0.3 head of cattle/ha, which corresponds to approximately 2 sheep or goats per a hectare. I.e. for 10 ha of permanent grassland a herd of 20 heads would be needed. The costs would be 200,000 Czk (without VAT) for the livestock purchase and 63,000 Czk (without VAT) to organize grazing.
- The costs of cutting the remaining grass would be, based on conditions, 15,000–70,000 Czk (without VAT). Again, the average will be taken into account – 40,000 Czk (without VAT). Other expenses would go to fencing of the grazed areas. However, this cannot be included in the budget as it is unknown what amount of fencing would be necessary.

- Cutting an area of 15 ha twice a year would cost 540,000 Czk (without VAT).
- The cost could increase based on the terrain profile, slopes, distance from roads and distances between individual sinkholes by about 10–40%.
- This means that the cutting costs would range between 540,000 and 756,000 Czk (without VAT).
- The average – 650,000 Czk (without VAT) – will be considered for the purpose of the budget creation. In the case of scything, the costs would be 10% higher.



Sinkhole on an arable land Ostrovská plateau,
Kudličková, 2012

DISCUSSION

- The effect of grazing on different meadow ecosystems is a hot issue that is frequently discussed.
- It has been proved that stands maintained by grazing are related to a number of critically endangered species of plants and animals.
- The results of most studies dealing with species diversity in grazed lands and lands left without any care for some time show that there is the same amount of species in both but the grazed areas manifest a higher abundance of significant species.

- The studies on the Moravian Karst show that the biodiversity of sinkholes of the Moravian Karst is constantly rising in most cases.
- The above mentioned data show that at the current level of knowledge a combination of cutting and grazing appears to be optimum for the care of sinkholes in the PLA Moravian Karst.



Sinkhole on an arable land Ostrovská plateau
Kudličková, 2009

CONCLUSION

- Based on the found information, the main objective of the care for sinkholes appears to be reinforcement of the surfaces as a way of protection against erosion and sustaining or increasing the biodiversity.
- This is best provided through grassing by regional mixtures and planting of suitable woody plants to troublesome places.
- In the meadows, a combination of grazing and cutting is the most suitable. In this way biodiversity is promoted as well as natural succession of plants and animals.
- The financial aspect of the individual care elements should not have top priority when selecting types of care; yet it cannot be totally ignored. When the costs related to grazing are added up, this type of care is more expensive than grass cutting only.



Grassing on the sinkhole Ostrovská plateau
Kudličková, 2010

Slovakia







Hungary





THANK YOU FOR YOUR ATTENTION

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