

SPATIAL CONFLICTS MANAGEMENT IN HRANICE KARST WITH EMPHASIS ON NATURE PROTECTION AND TOURIST MANAGEMENT

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Abstract

The Hranice Karst is a unique karst area in Europe with hydrothermal genesis, specific caves microclimate of underground spaces and mineral waters genesis. The potential of the area is highly diversified and is influenced by various interests (agriculture, surface mining, nature protection, recreation, spa and research). There are often conflicts of interest in the use of this protected area. Long-term and continuous monitoring of natural conditions in correlation with the use of the site in the wider territorial and disciplinary context is lacking for comprehensive management. The basis of the solution is a comprehensive landscape analysis with emphasis on expert identification of potential impacts on ecosystems combined with participatory methods of mapping territorial values and conflicts.

The research method of the area is based on a multidisciplinary approach. Special attention is paid to the following territorial conflicts:

- 1) Conflict between nature protection and agricultural management (especially in relation to contamination of surface water and groundwater, with special attention paid to subsurface water). The long-term objective in this context is to refine conservation management in the area of interest.
- 2) Conflict between nature protection and visitor use of the area (especially in relation to the carrying capacity of the area). The intent is to spread recreational destinations across the broader area of interest and to identify gaps in tourism infrastructure with an emphasis on the development of everyday recreation.
- 3) Conflict between nature protection and land development (especially in relation to surface mining, transport, construction and spas). The aim is to design a consistent development concept that takes into account the different demands of the interested groups.

Key words: recreational potential, water contamination, nature protection, spa industry

Introduction

The management of karst areas is very specific. In these areas, there is usually a strong pressure on the development of the site on the one hand and the preservation of values on the other. Conflicts of interests between the exploitation of the potential of the area for the development of tourist, recreational, therapeutic and other activities and the protection of nature and landscape are very common (Faccini et al., 2012; Ilona et al., 2016; Telbisz, Mari, 2020). Spatial planning based on a participatory approach plays a very important role here (Pantić et al., 2019; Handayani et al., 2019). Hamilton-Smith (2016) emphasizes the need to take into account all relevant factors influencing the development of an area in the management of karst areas. A comprehensive approach to monitoring the development of these sites was thus not very common; research focused instead on the study of partial characteristics of karst areas (geology, hydrology, pedology, etc.) and generally within the Czech Republic. Thus, many works (e.g., Modrá et al., 2018), in the Hranice Karst (Pavlík et al., 2018), address in detail important questions of possible impairment of the karst environment, but their results are not flexibly adopted by other disciplines.

Current trends in landscape research and management follow the principles of a multidisciplinary approach as the basis for strategic management of specific areas. This fact is confirmed, for example, by Özyavuz et al. (2018), Mueller, Eulenstein, (2019). The participatory form of planning for these landscape changes is very effective and is gaining ground in practice (e.g. Nadin, V. et al., 2020; Gonzales et al., 2020). In this context, involving the local community in decision-making and working with the local authority is also important (e.g. McLoughlin, Hanrahan, 2019). The multidisciplinary approach to the study of the Hranice Karst is based on linking basic research in geology, hydrology and pedology with landscape architecture and planning. Possible changes in the area can be verified through a comprehensive study. The general principles can then contribute to a more precise

approach to designing sustainable land-use policies (including adaptation to climate change) based on the identified potential and carrying capacity of the area.

Hranice Karst

Hranice Karst is located SE of Olomouc (Czech Republic) and is formed from Paleozoic limestones. It is a unique karst area with hydrothermal genesis, a specific microclimate of underground spaces and carbonic acid springs, used also for balneology. There are a number of small protected areas. The most important karst phenomena are the Hranice Abyss – the world's deepest flooded cave – and the Zbrašovské aragonite caves with unique decorations and gas lakes (Fig.1).

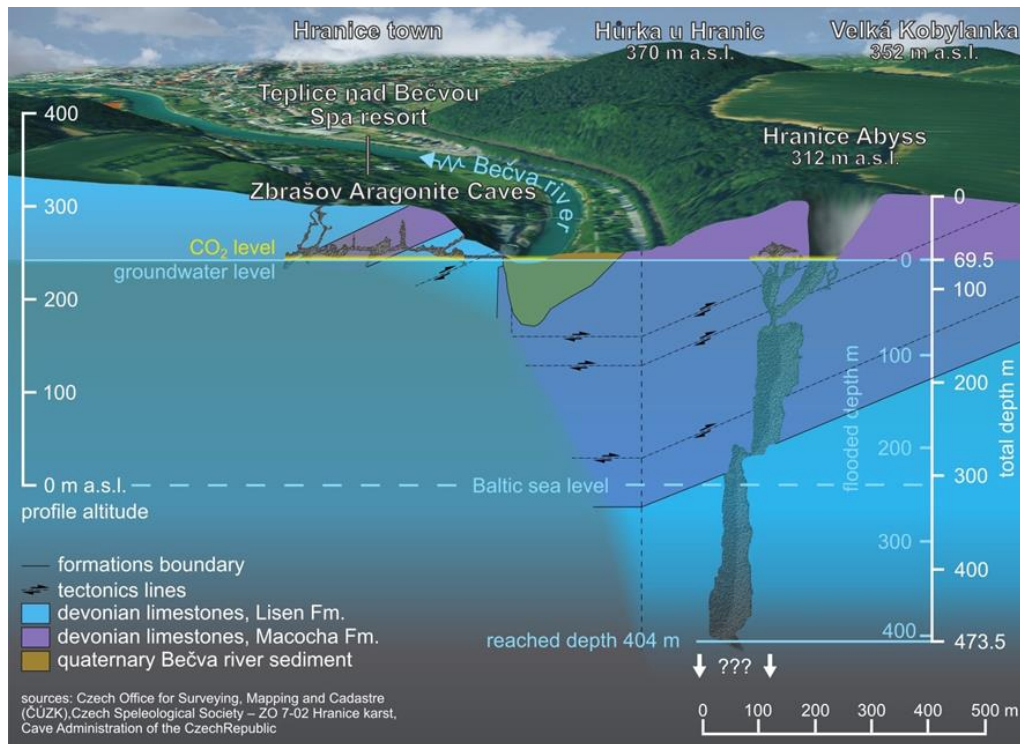


Fig. 1: Hranice Karst schematic illustration

Apart from the protected sites, the area is characterised by conventional agriculture (arable land, meadows). There are also active limestone quarries in the area, which are being further expanded. Recreation and the spa industry are also developed here.

The following territorial conflicts, which are relevant to the further development of the area, have been identified in the Hranice Karst area from a field analysis (Fig. 2), and their coordination should be part of the draft strategic plan:

- 1) Conflict between nature conservation and agricultural management (with special reference to water protection)

Due to the atypical and complicated geological development of the area of interest, not all connections in the Hranice Karst have been satisfactorily clarified yet, especially hydrological connections. These are mainly the mutual influences and relationships between surface flows (the Bečva River, the Krkavec stream), subsurface waters (including drainage waters) and groundwater springs (sours), which are also used for balneological purposes. Only long-term and careful monitoring can clarify these relationships and connections. Monitoring should focus on regime changes and correlations over seasons, high water levels, emergencies, etc.

The area of interest of the Hranice Karst is also agriculturally exploited, with drains located on a number of plots. These are, in many cases, damaged and non-functional, which in many places leads to waterlogging of agricultural land and the formation of caverns. In the context of intensive agriculture, water monitoring should focus on the possible contamination of deep mineral waters (acidification) not only with nutrients but also with pesticides and their metabolites. If long-term water monitoring, which started in 2021, shows findings of pesticides and their metabolites also in deep groundwaters, it will be necessary to focus on the protection of this unique karst system and propose a special management regime in the area of interest.

The most at risk are the plots of land in close proximity to the Hranice Abyss. These lands are highly erosion-prone and there are soil blocks of arable land over 50 ha. A major conflict is the unclear management of the legal protection zone of the Hranice Abyss and the ploughing of land up to the forest boundary in the immediate vicinity of the abyss.

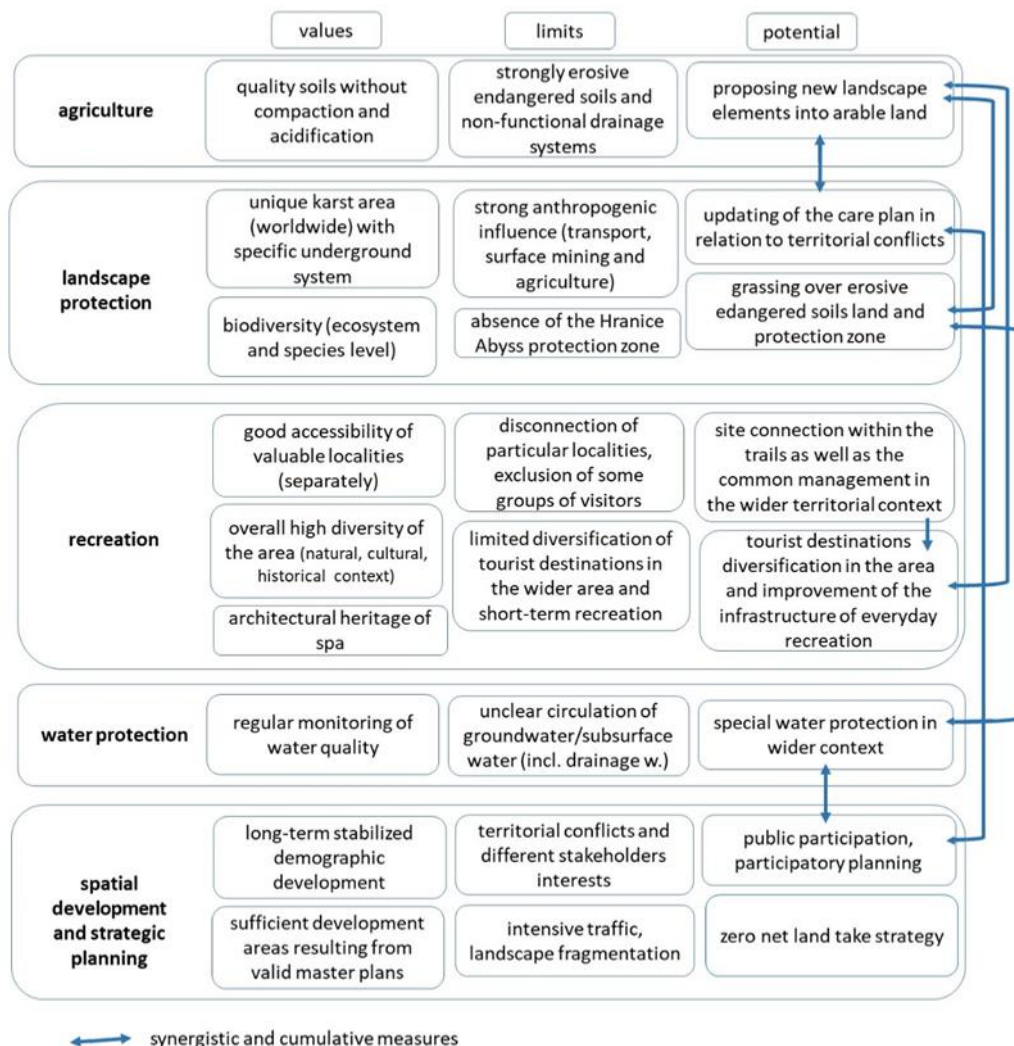


Fig. 2: Overview of the main areas of coordination of territorial conflicts

2) Conflict between nature conservation and visitors to the area

The area is characterised by short-term recreation and limited tourism services outside the central area of Hranice. The area has great potential for the development of coordinated destination management, which is not being exploited. In order to establish the visitor profile and determine their needs, annual quantitative and qualitative monitoring of visitor numbers to the Hranice Abyss was initiated in 2022. From this, it will be possible to propose strategic measures to diversify the tourist attractions on offer in the Hranice Karst area. In addition to the town of Hranice and the Hranice Abyss, the Zbrašov Aragonite Caves are among the key destinations. Huge potential can be seen in the spa industry, which is linked to the natural occurrence of Teplice mineral water. The spa itself is an important set of functionalist buildings. Both the individual buildings (e.g. the train station by Josef Danda, the villa of Ladislav Říhovský by the Oehler family) and the whole and the natural framework are unique in the Czech Republic. The Teplice nad Bečvou Spa can be a key player in the development of the Hranice Karst if properly managed.

In the Hranice Karst area, the tourist attractions are offered independently with no sense of interconnection, e.g. by a navigation route or common promotion. A joint promotion of sites under the Hranice Karst brand would be very beneficial. The proposal of nature trails connecting the sites and suggesting other tourist destinations is also a suitable solution.

Another problem is the exclusion of selected groups of visitors and the related lack of infrastructure. Access to the Hranice Abyss from the east (from the village of Černotín) could solve the accessibility of the site not only for cyclists but also for the disabled. A dense network of cycle paths is available in the area, but there is a lack of facilities for bicycle storage along the way.

Visiting caves and the need to protect them is a very specific issue. Visiting inaccessible caves as part of hobby and professional speleology is often neglected. However, in the context of the ever-increasing interest in so-called outdoor activities, these activities cannot be neglected either. Visiting inaccessible caves is a potentially dangerous activity (Geršl et al., 2017). In Hranice Karst, the danger is increased by the presence of underground lakes and suffocating carbon dioxide.

3) Conflict between nature conservation and land development

The management of territorial conflicts is a task of spatial and strategic planning. Territorial demands are highly diversified and often in conflict with each other. The influence of opencast mining, intensive traffic and sprawling development is evident in the area. These activities have a fundamental impact on other interests in the area, especially nature and water protection, including the spa industry. In the Hranice Karst area, the regulation of land use is a very topical issue.

The diagram (Fig. 2) summarizes the values and limits of the area and presents the potential for strategic management and direct actions in the area. The diagram shows that the coordinated management of individual problems and the protection of values are complementary and mutually reinforcing.

Conclusion

Due to the as yet unclear water circulation system in the karst area, conflicts of interest in the Hranice Karst need to be addressed in a comprehensive and coordinated manner in the wider area of interest. The strategic management of the protection of the values of the Hranice Karst should focus on the implementation of these measures:

- Optimisation of landscape structure to mitigate erosion risk to land, split large blocks of arable land and improve landscape permeability (and site accessibility). Extinct historic roads that are still owned by municipalities are identified as potential areas to reduce land blocks and improve accessibility. These measures are also related to the modification of management in at-risk sites (grassing, reduction of chemigation and heavy machinery movements) in order to promote infiltration of rainwater while eliminating potential pollutants. In this context, long-term monitoring of surface, groundwater and drainage water quality should be continued.
- Creation of a common destination management of the Hranice Karst and physical connection of individual sites by nature trails. In particular, the potential of Teplice's promenade and architectural heritage should be exploited. Furthermore, the interconnection of the backbone sites (abyss, cave, promenade, nature trail in Černotín and Ústí) should be improved. The long-term plan is to distribute recreational destinations and complete the tourist infrastructure including services in the wider area of interest based on verified tourist demand.
- The creation of a consistent territorial development concept should be based on a participatory approach.

References

- Faccini, F., Benedettini, A., Firpo, M., Perasso, L., Poggi, F. (2012). Land-management and planning in karst areas: the ligurian case-study (Italy). *Rendiconti Online Società Geologica Italiana*. 21. 611.
- Geršl, M., Koutecký, B., Pavlík, I. (2017). Speleology as adrenalin phenomenon and current security risks. In FIALOVÁ, J. -- PERNICOVÁ, D. Public recreation and landscape protection - with nature hand in hand. 1. vyd. Brno: Mendel University in Brno, 2017, s. 365--370. ISBN 978-80-7509-487-2. URL: http://www.utok.cz/sites/default/files/data/USERS/u24/RaOP_2017.0003.pdf
- Gonzalez-Urango, H. Inturri, G., Le Pira, M., García-Melón, M. (2020). Planning for Pedestrians with a Participatory Multicriteria Approach. *Journal of Urban Planning and Development*. 146. 05020007-1/05020007. 10.1061/(ASCE)UP.1943-5444.0000585
- Hamilton-Smith, E. (2016). Management Assessment in Karst Areas. *Acta Carsologica*. 31. 10.3986/ac.v31i1.400.
- Handayani, W., Nurteisa, Y., Sadali, M. (2019). The role of detail spatial data resulted from unmanned aerial vehicle for tourism area planning in Karst Area, Gunungkidul. 20. 10.1117/12.2548391.
- Ilona, B., Kiss, M. 2016. Biogeomorphological feedback in karst areas. *Landscape & Environment* 10 (3-4) 2016. 101-108. 10. 10.21120/LE/10/3-4/1.
- McLoughlin, E. Hanrahan, J. (2019). Local authority sustainable planning for tourism: lessons from Ireland. *Tourism Review*, Vol. 74 No. 3. pp. 327-348. <https://doi.org/10.1108/TR-12-2017-0198>

- Mueller, L., Eulenstein, F. (2019). Current Trends in Landscape Research. 10.1007/978-3-030-30069-2.
- Modrá, H., Gruberová, E., Konečný, O., Ulmann, V., Kaucka, P., Vlková, M., Tůma, A., Kudělka, J., Geršl, M., Pavlík, I. (2018). Influx and concentration of triazine pesticides in the Amaterska cave system, Moravian Karst, Czech Republic. *Journal of Soils and Sediments*. 2018. 18, 2, 640-647. ISSN 1439-0108. URL: <https://doi.org/10.1007/s11368-017-1831-0>
- Nadin, V., Stead, D., Fernandez-Maldonado, A., Dąbrowski, M. (2020). Integrated, adaptive and participatory spatial planning: trends across Europe Integrated, adaptive and participatory spatial planning: trends across Europe. *Regional Studies*. 10.1080/00343404.2020.1817363.
- Özyavuz, M. (2018). *Sustainable Landscape Planning and Design* Paperback. Peter Lang GmbH, Internationaler Verlag der Wissenschaften; Illustrated edition. 2018. Pp 524 pages. ISBN-13 : 978-3631734391
- Pantić, M., Zivanovic Miljkovic, J., Milijic, S. (2019). Land use and building regulations: The case of spatial plans for protected natural areas (Serbia). *Facta universitatis - series: Architecture and Civil Engineering*. 17. 173-187. DOI: 10.2298/FUACE190315010P.
- Pavlík, I., Geršl, M., Bartoš, M., Ulmann, V., Kaucka, P., Čaha, J., Unc, A., Hübelová, D., Konečný, O., Modrá, H. (2018). Nontuberculous mycobacteria in the environment of Hranice Abyss, the world's deepest flooded cave (Hranice karst, Czech Republic). *Environmental Science and Pollution Research*. 2018. 25, 24, 23712--23724. ISSN 0944-1344. URL: <https://doi.org/10.1007/s11356-018-2450-z>
- Telbisz, T. Mari, L. (2020). The significance of karst areas in European national parks and geoparks. *Open Geosciences*. 12. 117-132. 10.1515/geo-2020-0008.

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Souhrn

Hranický kras je unikátním krasovým územím se specifickou genezí a vznikem uhličitých kyselek. Potenciál území je značně diverzifikován a je ovlivňován různými zájmy (zemědělství, těžba, ochrana přírody, rekreace, lázeňství). Velmi často dochází ke střetům zájmů při využívání tohoto chráněného území. Pro komplexní management chybí dlouhodobý a kontinuální monitoring hydrogeologických a půdních poměrů v korelaci s využíváním lokality v širších územních i oborových souvislostech. Základem řešení je komplexní krajinná analýza s důrazem na expertní identifikaci potenciálních vlivů na ekosystémy, kombinovaná s participativními metodami mapování územních hodnot a konfliktů. Metoda výzkumu oblasti je založena na multidisciplinárním přístupu.

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