Ochrana přírody 2021 Czech Nature Conservation

Transboundary Protected Areas Hydrological Balance in Forest

Adaptive Management Water Retention Grey Wolf Management Feasibility Study in Zambia



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Cover Photo: The Samotínská kamenice landscape in the Žďárské vrchy Protected Landscape Area. © Lubomír Dajč



Dear friends, dear readers

Allow us to present you with another issue of our Ochrana přírody/Nature Conservation Journal. This English language issue presents a summary of the articles published in 2020.

The pressure on natural ecosystems has not abated. Time poses several challenges for nature conservation such as continuing devastation of natural ecosystems, unsustainable exploitation of the landscape, negative effects of climate change, but also the ongoing

Wuhan coronavirus pandemic, which has already infected hundreds of millions and killed about 3.5 million people (The WHO estimates the reality to be 3 times higher). I am afraid that only a lack of knowledge and a certain degradation of our value system caused that only an inadequate proportion of people realize how dependent we are on nature and its services.

This issue is presenting a range of absorbing articles. All of them prove that quality nature protection depends on scientific knowledge, legal regulation, economic instruments and thoughtful public relations. In H. Härtel's article on the transboundary German-Czech national park, "The Saxon/Bohemian Switzerland National Park", we learn not only about its natural and aesthetic values, however threatened by a project aiming at navigability of the Elbe River. According to the available scientific analyses the project is environmentally unquestionably risky for the natural continuum of the river, while its economic context remains questionable. The impact of climate change on the water regime of the forest landscape and the necessary response to its economic exploitation is highlighted by the contribution of J. Hruška et al. The article on "Adaptive Management of Protected Areas" by P. Pešout and E. Knížatková is devoted to the need for a new principles for the implementation of management plans and their procedurally justified flexible modification in response to climate change

and other not always predictable factors. Another article in the current issue is devoted to the development cooperation in Zambia (written by F. Pelc and M. Lodin). The contribution highlights the systematic support of the ecotourism development in developing countries, despite the temporary negative effects of the pandemic as one of the prerequisites for biodiversity conservation and more consistent financing of protected areas and the necessary support aiming at the economic prosperity of local inhabitants. This intention is the implementation of the European Commission's Green Deal programme.

Preface -

Czech editions of the Ochrana přírody/Nature Conservation Journal are published six times a year. Every Czech issue includes an English summary of the feature articles. The www.nature.cz website offers an electronic form of each issue we publish. In addition to the Nature Conservation Agency of the Czech Republic and the Cave Administration of the Czech Republic, four national park administrations are also involved in publishing of the journal.

Hope you find our articles interesting

František Pelc

Director. Nature Conservation Agency of the Czech Republic Chairman. Ochrana přírody/Nature Conservation Journal Editorial Board

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European Transboundary Protected Areas: Bohemian-Saxon Switzerland

Handrij Härtel

With this article we start a series on transboundary protected areas certified under the Transboundary Parks programme of the EUROPARC Federation. The programme was a follow-up of initiatives taken earlier in the IUCN, inter alia, at the launch of the Parks

for Life programme (1994, Priority project 22), and started soon after the fall of the Iron Curtain in Central and Eastern Europe, opening up previously unimaginable possibilities. Jan Čeřovský was a Czech representative strongly engaged in these activities.

The whole Saxon-Bohemian Switzerland consists of extensive forested landscapes. © Václav Sojka



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Tab. 1: Saxon-Bohemian Switzerland – basic data on the transboundary protected area

Protected area	Landschaftsschutz-gebiet Sächsische Schweiz/ Saxon Switzerland PLA	Chráněná krajinná oblast Labské pískovce/ Elbe Sandstones PLA	Nationalpark Sächsische Schweiz/ Saxon Switzerland NP	Národní park České Švýcarsko/ Bohemian Switzerland NP
Country/State	Germany/Saxony	Czech Republic	Germany/Saxony	Czech Republic
Year of establishment	1956	1972	1990	2000
Present size	28,750 ha	24,261 ha	9,350 ha	7,927 ha
IUCN category	V	V	II	II
International protection	SCI ¹	SCI, SPA ²	SCI, SPA	SCI, SPA
Biogeographic region	Continental	Continental	Continental	Continental

Notes: 1SCI - Site of Community Importance under the EU Habitats Directive; 2SPA - Special Protection Area under the EU Birds Directive

In 1996, the IUCN published the proceedings of an international conference entitled as Biodiversity Conservation in Transboundary Protected Areas in Europe (Čeřovský 1996), which took place in the town of Chřibská. Thanks to this conference, the attention of nature conservationists from many countries was drawn to the transboundary region of Saxon-Bohemian Switzerland - a National Park already on the Saxon side, but in a (very demanding) prepara-

oration. mentioned by Hentschel et Stei n Switzerland – Suaaestions for a Transfron

- conservation cannot be prescribed by de-

- Acceptance of sustainable transboundary on authorities should not necessarily lead

tory stage on the Czech side. Lively experience with this Bohemian-Saxon collaboration and conclusions derived from it (Hentschel & Stein 1996) captured in this publication has been still relevant today (see Box).

In 1999, in collaboration with the EUROPARC Federation, IUCN also published an essential comprehensive publication entitled as Transboundary Protected Areas in Europe (Brunner 1999), which basically determined the direction of transboundary collaboration in Europe, its potential, but also its obvious restrictions, to a large extent. The ideas outlined there eventually led to the establishment of a relatively robust system of evaluation, verification and certification of transboundary collaboration. based on detailed criteria (Basic Standards). Transboundary Parks is one of the most successful EUROPARC Federation's programmes. moreover unique on a global scale. It was therefore presented at the IUCN World Park Congress in Sydney (2014) on the example of the Krkonoše/Giat Mts. and Saxon-Bohemian Switzerland (Hošek et al. 2015).

Since Europe consists of many, predominantly small countries, transboundary collaboration is not only a welcome benefit, but in many cases a necessary condition for a range of protected areas to function well. In some cases, the existence of a partner protected area on the other side of the border has played an essential role in protected area designation or strengthening the conservation level. Examples are the re-designation of (part of) a Protected Landscape Area (PLA) into a national park. The Sächsische Schweiz National Park (1990) played an essential role in the designation of the Bohemian Switzerland National Park (2000). Similarly, the Podyjí/Thaya River Basin National Park (1991) in the Czech Republic inspired the designation of the Thayatal National Park (2000) in Austria.

In many cases, transboundary protected areas have had a long tradition, dating back to a time long before the official pan-European activities. We consider the first one to be the Pieniny Mts. (1932, Czechoslovakia/Poland). In a range of other cases, transboundary protected areas unfortunately exist only on maps, where they border each other, but real collaboration is absent or very rare. Areas certified by the EUROPARC Federation thus represent a mere fraction of the total number of transboundary protected areas. They meet relatively strict certification criteria, while EUROPARC Federation membership and of course interest and determination to undergo the evaluation process are conditions as well. It should be mentioned that although the certification criteria are equal for all candidates, the conditions of the particular protected areas to be met can differ diametrically. Just imagine on the one hand the bilateral Krkonoše/Karkonosze National Park with a very low language barrier, a long tradition of collaboration and a practically absent border within the Schengen area, and on the other hand the extensive (1,889 km²) trilateral protected area (different categories) Pasvik-Inari on the territories of Norway, Finland and Russia with an almost impermeable border between the EU and Russia and a strong language barrier. Not without reason, transboundary collaboration runs there under the motto 'Borders sep*arate – Nature unites!*' However, from regular meetings of the European certified protected area, family called TransParcNet, it follows un-



Fig. 1 Areas left to spontaneous succession in the Bohemian Switzerland and Saxon Switzerland NPs. Elaborated by Ondřej Holešinský



Fig. 2 Central part of the Saxon Switzerland National Park around Großer Zschand Valley. © Václav Sojka

equivocally that despite all pitfalls, the collaboration is essential, not only for nature and its protection, conservation and management but also for the people living and working in these areas. It is exactly such a type of diversity that enriches much more than it burdens. The present series of articles aims at providing examples of good practice from these areas.

Bohemian Switzerland National Park 20 years, Saxon Switzerland National Park 30 years

It is unnecessary to introduce Saxon-Bohemian Switzerland to the readers (in contrast to 20 years ago). Basic data on the transboundary protected area are given in the Box.

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It clearly shows that a transboundary protected area certified under the Transboundary Parks programme consists there of not only two National Parks, but also two Protected Landscape Areas.

The following facts should be mentioned to briefly characterise Saxon-Bohemian Switzerland in superlatives and strong terms.

- It is the largest sandstone-rock area in Europe.
- It has the widest elevation range (over 600 m, between Mt. Vysoký Sněžník and the Elbe River, the lowest location in the whole Czech Republic) of all sandstone areas in the Bohemian Cretaceous Basin.
- Logically, a range of species reaches its lowest elevation in the Czech Republic there; they include mountainous and Artic-alpine species associated with climate inversion in deep ravines and gorges.
- Not only the extensive compact sandstone area of both National Parks, but also the Elbe River sandstone canyon and the table mountain landscape with Mt. Děčínský Sněžník in the west and a range of table mountains on the Saxon side are unique in Europe.
- We can find the largest sandstone arch in Europe (Pravčice/Prebischtor Gate National Nature Monument).
- Areas accessible to tourists have had a long history. The Gebirgsverein für die Böhmische Schweiz, established in 1878, is the oldest organisation of its type in the present Czech Republic.

Recently a number of scientific publications on Saxon-Bohemian Switzerland have been published. Monographies include Sandstone Landscapes, evaluating the position of the above area in the broader context of sandstone areas in Europe (Härtel et al. 2007), further the book Pravčická brána / Das Prebischtor (Vařilová et Belisová 2010), and especially the latest publication Geologie Českosaského Švýcarska (Geology of Saxon-Bohemian Switzerland – Vařilová 2020).

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Tab. 2: Examples of species which have undergone significant changes during the 20-year existence of the Bohemian Switzerland National Park: (i) species new to the NP found since NP establishment, (ii) species with a marked population increase during the past 20 years, (iii) species with a sharp decline during the past 20 years. The table only includes selected examples of species from various groups of organisms; this relates particularly to the species rich taxon of insects, where moreover many species 'new' to the NP are not the result of environmental change but intensive new research. (From: Härtel et al. (2020) – Proměna přírody Národního parku České Švýcarsko během 20 let jeho existence (Changes in Nature in the Bohemian Switzerland National Park during 20 years of Existence), České Švýcarsko – Zpravodaj Správy NP, 2020, courtesy of the editors)

Category	Species	Change, trend	Remarks
Ascomycetous fungi	Pyronema omphalodes	Temporary massive occurrence	Anthracophilous fungus abundantly spreading after fire at the Krkavčí kameny/ Raven's Stones site
Lichens	Beard lichens (<i>Usnea</i> spp.)	Return after 70 years	Discovered at the village of Jetřichovice in 2004, bioindicators of clean air; in the first five years mainly growing on Larix, presently also regularly found on broad-leaved deciduous trees
Bryophytes – Liverworts	Down liverwort (Trichocolea tomentella)	Species new to the NP	Found in the Vlčí potok/Wolf Brook valley in 2015
Bryophytes – Mosses	shining hookeria (Hookeria lucens)	Species new to the NP	Found near the village of Janov in 2010
Bryophytes – Mosses	Elegant bristle-moss (Orthotrichum pulchellum)	Species new to the NP	Found near U Sloupu/At Column lodge in 2006 as a species new to the CR; in the late 1990s, it started spreading from its native distribution range on the West European coast to the European inland; in the CR it has been now known from more than 20 sites (7 in the NP) situated at the W and SW state border
Bryophytes – Mosses	Ulota spp.	Species new to the NP	First representative of the genus found in 2003; mosses sensitive to air pollution, this genus and Orthotrichum spp. have seen a strong increase in number of sites in the past 15 years not just in the NP, but also elsewhere in the CR
Conifers	European silver fir (Abies alba)	Population increase	Result of intensive planting and support since NP establishment
Conifers	Norway spruce (Picea abies)	Large-scale necrosis of mature trees in most of the NP	Result of European spruce bark beetle activity; population of spruce in NP not endangered, regeneration from juveniles in large parts of the NP is probable
Conifers	Northern white pine (Pinus strobus)	Considerable population decline	Result of systematic eradication in the whole NP
Vascular plants – Dicotyledons	Japanese knotweed (<i>Reynoutria japonica</i>)	Population increase	Invasive species, long occurring in the NP, strongly spreading especially along the Kamenice River
Vascular plants – Dicotyledons	Himalayan balsam (<i>Impatiens glandulifera</i>)	Population increase	Invasive species, long occurring in the NP, strongly spreading especially along the Kamenice a Křinice Rivers
Vascular plants – Dicotyledons	Small balsam (Impatiens parviflora)	Population increase	Invasive species, long occurring in the NP, strongly spreading especially along the Kamenice River since the 2002 floods
Insects – Beetles	Ground beetle Sericoda quadripunctata	Massive expansion at burn sites	Obligate pyrophile (species restricted to burn sites)
Insects – Beetles	Sap beetle Haptoncus ocularis	Species new to the NP	Geographically non-native, recorded in the NP for the first time in the CR (Vávra et Průdek 2016)
Insects – Beetles	Longhorn beetle Pachyta lamed	Declining species – last record in 2003	Very rare mountainous species of spruce forests, larval development in root tips
Insects – Beetles	Double-spinned bark beetle (Ips duplicatus)	Species new to the NP	Species expanding from Nordic northern boreal forest (taiga), in the NP since 2015
Insects – Beetles	European spruce bark beetle (Ips typographus)	Massive population increase	Large-scale spreading in the whole NP since 2018
Insects – Hymenoptera	Alysson ratzeburgi	Single record in the NP from 2005	Boreal-montane psammophilous species
Fish – Cypriniformes	Atlantic salmon (Salmo salar)	Reintroduction of extinct species	2002, first returning adults, natural spawning
Fish – Cypriniformes	Common minnow (Phoxinus phoxinus)	Reintroduction of locally extinct species	2013, waters in the Kamenice River basin
Fish – Cypriniformes	Belica (<i>Leucaspius delineatus</i>)	Reintroduction of locally extinct species	2013, small stagnant waters in the Kamenice River basin
Fish – Cypriniformes	Topmouth gudgeon (Pseudorasbora parva)	Thorough eradication	2012, geographically non-native, invasive species
Fish – Cypriniformes	Goldfish (Carassius auratus)	Thorough eradication	2012, geographically non-native, invasive species
Birds – Piciformes	Three-toed woodpecker (Picoides tridactylus)	Species new to the NP	2020, Mezní louka site
Birds – Passerines	Greenish warbler (Phylloscopus trochiloides)	Species new to the NP	2001, first record, nesting season
Mammals – Insectivores	Mediterranean water shrew (Neomys anomalus)	Species new to the NP	2012, first record
Mammals – Bats	Lesser horseshoe bat (Rhinolophus hipposideros)	Species new to the NP	First recorded 2011, summer colony, slight increase
Mammals – Bats	Myotis myotis, M. mystacinus, M. bechsteinii, Eptesicus nilssonii, Vespertilio murinus, Pipistrellus pygmaeus, Barbastella barbastellus	Species new to the NP	Since 2015
Mammals – Rodents	European beaver (Castor fiber)	Species new to the NP	First recorded on the Kamenice River, 2018
Mammals – Rodents	Garden dormouse (Eliomys quercinus)	Considerable population decline	Causes unknown
Mammals – Carnivores	American mink (Neovison vison)	Species new to the NP	Geographically non-native, invasive species, first recorded in the NP in 2009
Mammals – Carnivores	Northern raccoon (Procyon lotor)	Species new to the NP	Geographically non-native, invasive species, first recorded in the NP in 2014
Mammals – Carnivores	Eurasian lynx (<i>Lynx lynx</i>)	Natural return	Irregular occurrence in the NP since 2005 (definitely evidenced with camera trap in 2011)
Mammals – Carnivores	Grey Wolf (Canis lupus)	Natural return	First recorded in NP in 2016
Mammals – Artiodactyls	European mouflon (Ovis aries musimon)	Considerable decline	Geographically non-native species
Mammals – Artiodactyls	Chamois (Rupicapra rupicapra)	Considerable decline	Geographically non-native species

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Fig. 3 Zonation of the Bohemian Switzerland National Park as of January 1, 2020. Elaborated by Ondřej Holešinský



Fig. 4 Tranquillity areas in the Bohemian Switzerland National Park as of March 4, 2020. Elaborated by Ondřej Holešinský

In 2020, both National Parks celebrate a jubilee: Bohemian Switzerland 20 years of existence, Saxon Switzerland 30 years. On the occasion of the previous jubilees (15th and 25th anniversary, respectively), a review was published in Ochrana přírody/Nature Conservation Journal (Härtel et al. 2015). Summarising the principal changes which the

Bohemian Switzerland National Park area and its Administration have undergone in the past five years, particularly the following facts should be mentioned.

(1) As the result of an amendment of the Nature Conservation and Landscape Protection Act, the NP Administration has become

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an organisation partly funded from the State Budget (unification of the economic model with other Czech National Parks) and now also performs public administration in nature conservation for the Labské pískovce/ Elbe Sandstones PLA (unification of the model with the Šumava/Bohemian Forest Mts. NP and PLA). This change ensures that the PLA will be able to fully perform its function as a 'buffer zone', which is not legislated as such with regards to the existence of a PLA.

(2) The NP territory has a new zonation (see Fig. 3) and has delineated Tranquillity Areas (Fig. 4).

(3) In 2018 the Saxon-Bohemian Switzerland Transboundary Scientific Council was established as an advisory, consultative and subsidiary body of the two National Park Administrations in research and documentation on both sides of the border. Its activity covers the whole area of both National Parks and the Elbe Sandstones and Saxon Switzerland Protected Landscape Areas. The council includes experts from various fields, and academics from the Bohemian and Saxon sides.

(4) The practically most important change is however the dramatic transformation of the National Park which has currently been taking place as a result of the European spruce bark beetle (Ips typographus) outbreak For the NP's area, it means, inter alia, a rapid growth in areas left to spontaneous succession. linked to an adjacent territory on the Saxon side with a similar regime (Naturzone), leading to a central transboundary area at a total size of approx. 10,000 ha (Fig. 1) where natural forest dynamics will prevail. However, systematic eradication of selected invasive species (especially Pinus strobus), one of the main and long-term management objectives since the establishment of the NP, will continue.

(5) Besides fundamental ecosystem changes, also many changes at the species level can be found, although these are far from being so dramatic. Examples of the species which have undergone significant changes during the entire 20-year existence of the Bohemian Switzerland National Park are given in Tab. 2.

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The Erzgebirge/Krušnohoří Mts. Mining Region as a World Heritage Site

Věra Kučová, Karel Kuča

In July 2019, the selected parts of the Bohemian and Saxon Erzgebirge/Krušnohoří Mts., also known as the Ore Mountains, were inscribed onto the UNESCO World Cultural and Natural Heritage List (World Heritage List). The area has long been associated in the public consciousness with the impacts of lignite/brown coal mining on the landscape and on forests at the foot of this extensive mountain range; we thus encountered a number of guestions and doubts at the time of preparing the documents for nomination. Therefore, the article additionally contri-

Depression on Komáří hůrka/Mosquito Little Hill. © Věra Kučová



butes to clarifying how the cultural and historical values of the Erzgebirge/Krušnohoří Mts. stand out, and it is an inspiration for deepening interdisciplinary cooperation. Simultaneously, it is a contribution to the reflection on how to deal with these border mountains from the point of view of national protection in the future. Despite the high proportion of interesting landscapes, unlike other border massifs the Erzgebirge/Krušnohoří Mts. are, paradoxically, a mountain range which has been declared neither a national park nor a protected landscape area.



A map of all components of the World Heritage Site Erzgebirge/Krušnohoří Mts. Mining Region with the boundaries of the core areas (red) and buffer zones (black). Cartographic processing by Karel Kuča 2020, thematic content: © NHI, © IWTG/Technische Universität Bergakademie Freiberg, map base: World Topo Map (© ESRI et al), © CENIA. Czech component parts: 1-CZ: Jáchymov mining cultural landscape, 2-CZ: Abertamy – Boží Dar – Horní Blatná mining cultural landscape, 3-CZ: Red Tower of Death, 4-CZ: Krupka mining cultural landscape, 5-CZ: Mědník/Copper Hill mining landscape. German component parts: 1-DE: High Middle Ages silver mines in Dippoldiswalde, 2-DE: Altenberg - Zinnwald mining landscape, 3-DE: Administrative seat Lauenstein, 4-DE: Freiberg montane landscape, 5-DE: Hoher Forst mining landscape, 6 -DE: Schneeberg mining landscape, 7-DE: Schindler's blue dye factory, 8-DE: Annaberg – Frohnau mining landscape, 9-DE: Pöhlberg mining landscape, 10-DE: Buchholz mining landscape, 11-DE: Marienberg historic city centre, 12-DE: Lauta mining landscape, 13-DE: Ehrenfriedersdorf mining landscape, 14-DE: Grünthal smelter complex, 15-DE: Eibenstock mining landscape, 16-DE: Rother Berg mining landscape, 17-DE: Uranium ore mining (Bad Schlema).



Měděnec, Marie Pomocná adit. © Věra Kučová

What is World Heritage in the Erzgebirge/Krušnohoří Mts.?

The main goal of the efforts to inscribe selected parts of the Erzgebirge/Krušnohoří on the World Heritage List was to preserve evidence of local polymetallic mining, which shaped the mountains for over eight centuries. As it turned out, it was unrealistic for the subject of nomination to be a larger continuous area. Thus, from a formal point of view, a series of 22 component parts, including several solitary monuments, become a World Heritage Site. There are seventeen component parts on the Saxon side, five on the Czech side; however, the size of the area in both countries is comparable.

In the Karlovy Vary region, these are the most valuable parts of landscape monument zones (hereinafter "LMZ"): the Abertamy-Horní Blatná-Boží Dar Mining Cultural Landscape¹, where the historical part of the town of Horní Blatná was already protected, and the Jáchymov Mining Cultural Landscape², with its base in the monument zone in the town of Jáchymov with, among others, the famous historical mint and the oldest uranium mine at the Svornost/Concorde Shaft. The Karlovy Vary part is complemented by Rudá věž smrti³ ('Red Tower of Death'), a national cultural monument near the village of Dolní Žďár.

In the Ústí nad Labern Region, it is the Krupka Mining Cultural Landscape⁴, where the already protected town of Krupka has been complemented by a landscape with the Starý Martin adit and a large pinge on Komáří Hůrka/Mosquito Little Hill⁵. All this is connected by the old Hornická cesta/Mining Road⁶, which has already been protected as a cultural monument. The whole unit is complemented by the chapel of St. Wolfgang⁷ and a unique historic cable car⁸, allowing a view of the landscape below it. Simultaneously, the extensive former Knötel mining district⁹ was declared a cultural monument. In the western part of the region, the Háj-Kovářská-Mědník/Copper Hill Mining Cultural Landscape LMZ¹⁰ was prepared, where Mědník/ Copper Hill with the Rudný důl – Panna Marie Pomocná/ Virgin Mary Help of Christians Adit and Země zaslíbená/Promised Land Adit Cultural Monument became part of the World Heritage Site.

It was a matter of course to include all three above-mentioned and (since 1992) protected mining towns. Uranium mining is also important in the history of the Erzgebirge/Krušnohoří Mts., misused to liquidate politically unsuitable people in labour

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Map of the Abertamy – Horní Blatná – Boží Dar and Jáchymov component parts and their relation to areas protected under the Monuments Act and the Nature Conservation and Landscape Protection Act. Cartographic processing Karel Kuča 2020, thematic content: © NHI, © IWTG / Technische Universität Bergakademie Freiberg, © NCA CR, map base: World Topo Map (© ESRI et al).



Map of the Mědník/Copper Hill component part and its relation to areas protected under the Act on Heritage Care and the Nature Conservation and Landscape Protection Act. Cartographic processing Karel Kuča 2020, thematic content: © NHI, © IWTG/Technische Universität Bergakademie Freiberg, © NCA CR, map base: World Topo Map (© ESRI et al).

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camps around the town of Jáchymov. This is represented by parts of the Jáchymov region landscape and the nearby area of the Red Tower of Death National Cultural Monument, where negotiations on the handover to a departmental institution have been still ongoing.

In the Karlovy Vary region, the World Heritage Site is concentrated in the area covered by the municipality with extended powers (MEP) at Ostrov, relatively close to the city of Karlovy Vary/Carlsbad. At present, it is an area with a landscape which is especially attractive in the winter; well-explained values and tourism subsidiary infrastructure could increase interest there into year-round tourism. The Regional Office is the executive body of monument care/heritage conservation for the Red Tower of Death.

In the Ústí nad Labern region, the landscape north of the town of Krupka, with the executive body of monument care/heritage conservation within the MEP in the city of Teplice, is the traditional recreational area of the city of Ústí nad Labem, which is evidenced by the historic cable car just in the core area. The Mědník/Copper Hill component part is practically on the border with the Karlovy Vary region and falls within the responsibility of the Kadaň MEP.

How did it start and how was the selection made?

Saxony declared its intentions in the late 1990s. These efforts were temporarily delayed by the 2002 floods and Germany's frustration with the "deletion of Dresden" (2009) from the World Heritage List shortly after its inscription (2004). However, the locals did not give up and, on the Saxon side of the Erzgebirge/Krušnohoří Mts., monuments were repaired and provided with accompanying infrastructure. Simultaneously, cross--border communication between experts continued, with the Regional Museum in the city of Most in particular participating on behalf of the Czech partner.

Only in 2010 did the Ministry of Culture of the Czech Republic, thanks to intensive activity by the then Deputy Minister Anna Matoušková, include the nomination among the main tasks of the National Heritage Institute (NHI).

There was a difficult stage of decision-making in a short time period. It was not possible to get

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some municipalities and interesting places into the nomination for the concept of the region as a whole, to which Saxony was heading.

Some sites with already protected monuments had to be excluded so that the main concept would not become too "fragmented" into many subjects. Therefore, one of the few national cultural monuments in the region was not included in the wider selection - the large Cistercian monastery in Osek, whose grandiosity was related to silver and tin mining; however, it was not direct evidence of mining heritage. On the other hand, in the border villages of Cínovec, Hora Svatého Šebestiána, and Hora Svaté Kateřiny, the link to mining was closer; however, their construction authenticity and integrity suffered considerably in the second half of the 20th century.

Basic support was in the form of professional studies prepared for the Erzgebirge/Krušnohoří Mts. area by Michal Urban and his team, marking geologically significant places, including well-known ore districts, both in terms of area and sites.

The definition of suitable areas for protection in relation to already protected areas in the mining towns, solitary buildings, and important mining works was the basis for the preparation of LMZ. In the NHI, the topic of the cultural landscape was generally given more attention at the time: between 2011 and 2012, proposals were prepared for a total of five LMZ of various sizes. One of the goals was to obtain protection for the mining town of Mikulov, including the extremely interesting structure of Lehnschafter mine, but the municipality's management rejected the LMZ plan. Similarly, the original goal was to obtain protection for the surroundings of the flooded royal town of Přísečnice and the village of Kryštofovy Hamry. However, the plan had to be abandoned because the village preferred construction of a wind farm.

It was difficult to obtain area protection for the wider surroundings of Mědník/Copper Hill near the former mining town of Měděnec; in the end, the hill and the monument zone were declared a cultural monument, at least to a reduced extent.

Finally, the pragmatic approach of the Czech side to the selection of sites for nomination proved to be, paradoxically, more advantageous than that on the Saxon side; there, a lot of municipalities spent many years preparing for the nomination

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Map of the Krupka component part and its relation to areas protected under the Act on Heritage Care and the Nature and Landscape Protection Act. Cartographic processing by Karel Kuča 2020, thematic content: © NHI, © IWTG/ Technische Universität Bergakademie Freiberg, © NCA CR, map base: World Topo Map (© ESRI et al).



Explanatory notes for the maps on pages 4 and 5



Hřebečná, Červená jáma mine (Rote Grube/Red Hole) depression. © Karel Kuča

with the aim of including a much wider range of monuments, including areas that are not primarily related to the topic of mining but document, for example, the activities of a mining company in times outside the main mining season. Following reservations formulated by evaluators from the ranks of ICOMOS experts during 2015-2016, the number and extent of selected areas had to be

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Krupka, Steinknochen ore district and a depression on Komáří hůrka/Mosquito Little Hill. The depressions of individual shafts are clearly visible on the dumps. LLS data with composite visualization (WMS, Faculty of the Environment, Jan Evangelista Purkyně University in Ústí nad Labem). The main objects of anthropogenic mountain terrain are highlighted in red, vectorization by Ondřej Malina.

changed, especially on the Saxon side, and in the second draft of the nomination some monuments were excluded. On the Czech side, the reduction concerned only one of the selected cultural monuments, namely the limestone quarry and the adiacent former quarry in Háj u Loučné pod Klínovcem cadastre.

Where to find more detailed information?

The World Heritage List is not just a list - it allows information to be obtained on outstanding cultural and natural values across continents in the World Heritage Centre's information system in a user-friendly way (http://whc.unesco.org/).

Therefore, the aim there is not to repeat data that have already been available for the newly registered "Erzgebirge/Krušnohoří Mining Region" (http:// whc.unesco.org/en/list/1478). A presentation by the non-profit company Montanregion, which is behind the entire project on the Czech side, also discusses the nature of the area and its values in

more detail in three language versions. The portal http://www.montanregion.cz/cs/ also contains a number of illustrative photographs and has long reported on the entire course of the nomination. now a World Heritage Site. A joint presentation on the Erzgebirge/Krušnohoří Mts. is also provided by another multilingual portal called "Krušnohorsky/Erzgebirgisch" https://www.montanregion--erzgebirge.de/cz.html.

The Czech Republic must also provide information on its world monuments and update it in relevant publicly available data systems. Unlike national regulations which, after their adoption, usually enter into force several months apart, in the case of World Heritage, their status enters into force on the date of inscription. It is therefore advantageous if the nominated property and plots/territories have already been legally secured at the time of inscription and the state/public administration of them is stabilized both in terms of procedures and personnel. In the summer of 2019, therefore, basic information was prepared for the part of the

website where the NHI reports on World Heritage (https://www.npu.cz/pamatky-unesco) and from where there are links to the entire Integrated Information System of Monument Care, including an application named Památkový katalog/Catalogue of Monument Care (https://pamatkovykatalog.cz/).

The Erzgebirge/Krušnohoří Mts. as an opportunity for interdisciplinary cooperation

For nature conservation, it is important that when presenting the legal framework for the protection of valuable areas and mining evidence it was necessary to use areas protected pursuant to Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later. The aim was to obtain sufficiently large protection zones for culturally valuable areas ('buffer zone' in World Heritage terminology¹¹). For the purposes of nomination, protective regimes under other national legislation can be used to advantage if they are a guarantee that they will fulfil their conservation role.

These are Sites of European Importance (pursuant to Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, the term for Site of Community Importance, SCI under the European Union's Habitats Directive), Bird Areas (pursuant to the above act, the term for Special Protection Areas. SPA under the European Union's Bird Directive), some small-size Specially Protected Areas, as well as Nature Parks. A significant overlap with the areas protected pursuant to the Act on Nature Conservation and Landscape Protection is the Božídarské rašeliniště Peatbog, in which the Blatenský příkop/Blatná Ditch (National) Cultural Monument¹² is located. harbouring a unique artificial line working in the ridge of the mountains, established to improve the water regime at sites where panning took place, as evidenced by the name of the almost extinct village of Ryžovna/Seifen. The number of spoil heaps there is also interesting; thanks to their composition, they are distinguishable all year round by specific vegetation.

Of great interest in the Ústí nad Labem part of the Erzgebirge/Krušnohoří Mts. are, for example, large massifs of protective forests above the town of Krupka, in which there is an extraordinary density of medieval and early modern mining evidence.

Identification of preserved montane terrain with remains of mining activities has been made possible

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in recent years by the highly developed use of LI-DAR images, which NHI specialists used to create a series of detailed thematic maps documenting the preserved terrain. In areas outside forests, the terrain was mostly aligned. However, the wooded parts of the newly declared World Heritage Site will challenge the close cooperation of all affected sectors and branches in landscape management including forest management, so as not to lose the valuable evidence of the area's history.

Staffing is also important. Many people in the NHI were involved in the Erzgebirge/Krušnohoří Mts. We should mention Ondřej Malina from the NHI office at town of Loket and his professional approach; together with the Saxon partners, he helped to persuade foreign evaluators about the expert selection of areas with the potential of exceptional global value. The range of newly protected areas is large, yet there was no increase in staffing of territorially relevant workplaces (in Ústí nad Labem and at Loket); however, the agenda of project assessment and spatial planning documentation increased in leaps and bounds. For future monitoring and tracking of changes (or rather "stability") of protected values, targeted checking mapping will be one of the tasks where it is necessary to combine human as well as financial capacities.

On the Czech side, the interest of the Erzaebirae/ Krušnohoří Mts. landscape results from its small built-up area, or complete emptiness in some places, where only in recent years the history of the area has been remembered again. Mostly it is the individual and family nature of tourism, a certain remoteness from traditional centres and, last but not least, harshness of the local climate that are unique values. leading visitors to think about and imagine the processes that took place there during peak mining settlement. It would be a failure if the anticipated increased interest in new construction could not be managed so that the values set for World Heritage status for increased protection are not jeopardized by disproportionate investment, even if designed to increase attractiveness, visitor comfort, or bring more permanent inhabitants back to the area.

The future lies in cooperation

Cooperation between the State Nature Conservancy and National Heritage authorities will be needed in the development of management measures, both in Specially Protected Areas

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The mining town of Horní Blatná. © Karel Kuča

and in those parts of the Erzgebirge/Krušnohoří Mts. where there were not enough arguments or willingness to be included in the World Heritage, but which also possesses significant value for the historical cultural landscape. Increased visitor interest can accelerate the need for further interpretive activities by both disciplines so that they not only complement each other. but also prevent unnecessary damage, given the relatively new protection of these areas. In this context, it is impossible not to mention the impacts of wind energy development (which influenced, for example, the selection or delimitation in the vicinity of Mědník/Copper Hill) or lithium mining plans (around Cínovec and Krupka), for which it is necessary to discuss public interests carefully and timely.

The geological wealth of the Czech Republic and the associated heritage of mining activities is a little appreciated phenomenon, providing which is a challenge for cooperation between not only the NHI and the NCA CR, but also with the Czech Geological Survey (beyond geoparks, where occasional contacts through the Council of National Geoparks has already taken place).

Furthermore, with a high forest coverage, a number of watercourses and relict historical water works, the Erzgebirge/Krušnohoří Mts. provide many pilot areas for the search for optimal interdisciplinary and inter-sectoral cooperation for the protection, conservation and restoration of the specific cultural landscape.

It can therefore be assumed that inscription of parts of the Erzgebirge/Krušnohoří Mtzs. on the UNESCO World Heritage List has begun its social rehabilitation and will become the basis for interdisciplinary cooperation for at least the coming decades.

Notes

- https://www.pamatkovykatalog.cz/hornicka-kulturnikrajina-abertamy-horni-blatna-bozi-dar-7664010 https://www.pamatkovykatalog.cz/hornicka-kulturni-
- kraiina-iachymov-7664014 https://pamatkovykatalog.cz/pravni-ochrana/rudavez-smrti-v-ostrove-11347968
- https://pamatkovykatalog.cz/pravni-ochrana/ hornicka-kulturni-krajina-krupka-883868631
- https://www.pamatkovykatalog.cz/velka-pinka-nakomari-vizce-13734422
- https://www.pamatkovykatalog.cz/historicka-cesta-zkrupky-do-horni-krupky-13779449
- https://www.pamatkovykatalog.cz/kaple-svwolfganga-13734513
- https://www.pamatkovykatalog.cz/lanova-drahabohosudov-komari-vizka-1264543
- https://www.pamatkovykatalog.cz/hornicky-revirknotel-stoly-barbora-prokop-vaclav-a-vecernihvezda-1266127
- https://pamatkovykatalog.cz/hornicka-kulturnikrajina-haj-kovarska-mednik-7664018
- Nárazníková zóna ("buffer zone") by v naší terminologii odpovídala funkci ochranného pásma, nemusí ale nutně kopírovat hranice ochranného pásma podle národních předpisů, a proto užíváme tento pojem.
- https://pamatkovykatalog.cz/blatensky-vodniprikop-12581736

European Ground Squirrel – An Umbrella Species for Biodiversity Rich Farmland

Ester Ekrtová, Václav Křivan, Aleš Jelínek, Kateřina Poledníková, Lukáš Poledník

In the Czech Republic, a sharp decline in agricultural landscape biological diversity has recently become very urgent. The topic even now and then jumps from scientific journals and enters into mass media, thus confirming its weight and severity. The fact demonstrates the seriousness of this topic, which also starts to be noticed by part of the general public. Almost always negative cases are mentioned, but positive

Bird's eve view of mosaic of orchards, vinevards and small fields on the outskirts, the town of Velké Pavlovice, South Moravia. © Faculty of Science, Charles University Prague archive



examples of a biodiversity rich agricultural landscape appear rarely. The authors would therefore like to introduce the readers to the mosaics of vineyards, orchards, fields and steppes on the outskirts of the town of Velké Pavlovice (South Moravia). These may not only provide inspiration to those restoring varied agriculture landscapes, but mainly pose a great challenge to preserve them.

Visit to the ground squirrel in the land of wine and apricots

In the Velké Pavlovice's surroundings, a survey based on the local population of the critically endangered European ground squirrel (Spermophilus citellus), also known as the European souslik, was initiated. The animal, which we can regard an excellent umbrella species in the conservation of agricultural landscapes, is interesting in many ways. After World War II, the ground squirrel had still been a rather common species and was persecuted by farmers for the considerable damage causing to a wide range of cultivated crops. With the loss of mosaic agricultural landscapes, it rapidly disappeared and today it is rather considered to be an animal of airports, campsites and golf courses. When taking a view of the landscape with the original ground squirrel population on the western and northern outskirts of Velké Pavlovice, it can well be noticed that the substitute habitats do not have much in common with its original habitat.

It is a landscape where the tenure of most of the land has remained preserved and which has only marginally been affected by land consolidation. The hilly landscape is divided into narrow strips where ploughed and grassy vineyards and orchards alternate with fields of vegetables, cereals, alfalfa and other crops, fallow land, abandoned orchards and vinevards, thickets and scrub, but also remnants of steppe grasslands. All this is intersected by a network of cart tracks, most of which are not paved and have the original clay-grassy character. In the 500 ha large study area, the average tract area is 0.47 hectare, in the central part even 0.28 hectare, which corresponds to the situation in the Czech Republic around the year 1948. In comparison, the average land block size in the Czech Republic today is 5.9 ha.

Almost endlessly diverse and mosaic landscape

The high biodiversity of the area is based on several pillars. Botanically most important are undoubtedly remnants of steppe and fringe vegetation. but also the occurrence of segetal species (e.g. the Annual yellow woundwort Stachys annua, Monkswort Nonea pulla, the European stickseed Lappula squarrosa). It is exactly weed species that are generally rare in the common agricultural landscape today. This vegetation is partly restricted by the use of herbicides also in the study area,, but in the rich mosaic of variously farmed plots with a significant percentage of fallow land, there are



Picturesque landscape in sight of the Pavlov Hills, connecting variously managed farmland and remnants of steppe habitats. © Kateřina Poledníková



The main colony of the European ground squirrel (Spermophilus citellus) at Velké Pavlovice is situated at sites where the landscape mosaic is the finest and the cultivated crops the most diverse. © Hannah Findlay

always sites where weed species get a chance to flower and set seed. However, their occurrence varies with time and space. The dynamics is almost absent from the common agricultural landscapes. Large units with very uniform farming methods and crop composition simply make it impossible

The diversity in cultures and the land use, together with various preserved remnants of natural habi-

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View of fallow land with the strongly endangered weed Annual yellow woundwort (Stachys annua), nowadays an absolutely unique situation. Mostly small populations of just a few plants are found in the margins of arable fields or vineyards. © Libor Ekrt.



The strongly endangered grape-hyacinth Muscari neglectum is locally common in the surroundings of Velké Pavlovice. It is a plant which tolerates shallow ploughing well and therefore accompanies hoed and ploughed vineyards and orchards. C Libor Ekrt

tats, manifests itself much more pronounced in the available within flying distance. Out of the many diversity of animals than plants. For xylophagous recorded endangered species e.g. the conspicuinsects, regularly scattered old and dying fruit trees ous Cherry borer or Colorful cherry jewel beetle are present. When the appropriate habitat disap-(Anthaxia candens) should be mentioned. In the pears, another suitable substrate is almost always hollows of old fruit trees, the development of the

Flower chafer (Protaetia speciosissima) larvae takes place, and we can sometimes also encounter here our largest beetle, the European stag beetle (Lucanus cervus), whose larvae live on the roots of dying old trees. Dry old wood and often also wooden poles in vineyards host the colourful longhorn beetle, the Grape wood borer (Chlorophorus varius), which can be found on flowers of the Field eryngo (Eryngium campestre) and varrow (Achillea spp.) species in the middle of summer. The endangered ironclad beetle Colobicus hirtus has been recorded under the bark of dead walnut trees. The small Wine jewel beetle (Agrilus derasofasciatus) lives in dry grapevine twigs.

Frequent crop rotation in combination with the vegetation of abandoned orchards, baulks and steppes provides the landscape with a high proportion of transient (ecotone) structures which are lacking from the present landscape. Also these host a range of important species. An example recorded at Velké Pavlovice is the rare crab spider Tmarus stel*lio*, which is in the Czech Republic found only rarely in southern Moravia. It lives in margins of thickets and on lower branches of solitary trees, where it actively looks for prey. Other very rare fauna species include the small longhorn beetle Glaphyra kiesenwetteri, whose development takes place in drying rose shrubs in xerothermic habitats.

The local mosaic landscape is absolutely essential for species preferring various types of fallow land, disturbed plots and margins of arable fields and paths. These species are found in protected areas only sparsely. Their occurrence is concentrated in open agricultural landscapes where these organisms are substantial part of biodiversity there. They include many endangered and rare species for which the almost endlessly rich mosaic landscape in the surroundings of Velké Pavlovice is a real paradise. A good example are weevils, beetles which mostly prefer various open places with sparse vegetation, path verges, fallow land and other disturbed places in open landscapes. Many of them are endangered species and their occurrence demonstrates the high biological value of the area. A common species in the study area is the weevil Pseudocleonus cinereus, which occurs in the Czech Republic only locally just in southern Moravia. It lives on different plant species of the Asteraceae family in sparse non-forest vegetation. Another endangered thermophilous weevil species Lixus angustus, is associated with the Hawkweed oxtongue (Picris hieracioides). Lixus vilis

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View of an enclave of valuable steppe vegetation in a broad baulk surrounded by vineyards. In

several places, low steppe scrub vegetation with the European dwarf cherry (Prunus fruticosa) is

The weevil *Pseudocleonus cinereus* is a rare species of disturbed sites with sparse vegetation. It occurs rather commonly on cart tracks and in vineyard margins. © Václav Křivan

lives on the Redstem stork's bill (Erodium cicutarium), whereas the larvae of another weevil, Rhab*dorrhynchus seriegranosus*, develop in the roots of the Viper's bugloss or Blueweed (Echium vulgare). Also the fauna of epigeous predators, particularly ground beetles, is very rich there. Significant steppe species living in disturbed places with sparse vegetation include e.g. ground beetles Callistus lunatus, Poecilus punctulatus and Pterostichus longicollis. The species Dyschiriodes bonellii and Harpalus zabroides are the rarest ground beetles of exposed loess terraces. Important thermophilous spider species, which regularly farmed vineyards on loess terraces suit well can also be found there. Examples are the conspicuous metal-coloured running spider Micaria dives, a small spider by the name of *Phrurolithus* pullatus, and the contrastingly coloured false crab spider Rhysodromus histrio, which was recorded here for the first time in the Czech Republic in 2002.

Natural habitats should be cherished

The isolated natural habitat remnants, mostly represented by various types of steppe vegetation and scrub in the study area, are undoubtedly essential from a biodiversity perspective. Their size and species saturation cannot compete with the South Moravia extensive steppe sites, but the patchwork of these habitats closely connected with a mosaic agricultural landscape is exceptional.

South-facing slopes of dry baulks among vineyards or in the upper parts of abandoned farmland on slopes host remnants of steppe pasture communities with the Volga fescue (Festuca valesiaca), Hairy feather grass (Stipa capillata) and the Field wormwood (Artemisia campestris). Steppe vegetation with the significant European feather grass (Stipa pennata) is represented to a lesser extent. Locally, especially on more disturbed land, vegetation with the heavily dominating Transylvanian melic grass (Melica transsilvanica) is found. North- to northeast-facing slopes on the other hand host broad-leaved Pannonian dry grassland vegetation with rich populations of the Prostrate Canary Clover (Dorycnium pentaphyllum agg.), yellowhead Inula ensifolig and many other species. Exceptionally attractive plants include the rare Military (Orchis *militaris*) and Fragrant (*Gymnadenia conopsea*) orchids. The Leafless hawksbeard (Crepis prae*morsa*) and the parasitic broomrape, the Wormwood broomrape (*Phelipanche arenaria*), both arowing there, belong to the most endangered species of the Czech Republic's flora. Concerning shrubby vegetation, low steppe scrub in which the European dwarf cherry (Prunus fruticosa) dominates should be mentioned.

richly developed. © Libor Ekrt

Looking at the invertebrate fauna diversity, the local steppe vegetation fragments reflect the large steppe sites in the region. Particularly phytophagous beetle families, such as weevils and leaf beetles, are richly represented. Important species of relict steppes include e.g. the jewel beetles Cylindromorphus filum and Trachys problematicus, and the leaf beetles Cheilotoma musciformis, Coptocephala chalybaea, Pachnephorus pilosus and Pachybrachis fimbriolatus.

As for spiders, steppe remnants host the most significant, critically endangered species like the slender crab spider Tibellus macellus, which is in the Czech Republic traditionally known only from the nearby Pouzdřany Steppe, and in the Czech Republic critically endangered money spider Metopobactrus ascitus, individuals of which have only been observed at a few steppe sites in the very south of Moravia.

How much longer will there be anything to admire?

With regards to the abovementioned facts it must however be stressed that this favourable situation definitely need not last forever. On the contrary, as in most natural habitats, a considerable degree of degradation is evident there. In some cases, valuable communities are on the brink of extinction. The most serious problem is the absence of at least occasional management of steppe habitats, which undergo succession and become slowly encroached with shrubs, trees and/or expansive grass species. Land is grazed by horses in only one case, but neither the desired gradual reduction of shrubs and trees is achieved there. Besides native trees and shrubs (e.g. the Common dogwood Cornus sanguinea, Rosa spp., Blackthorn Prunus spinosa, European wild privet Ligustrum vulgare, Sessile Oak Quercus petraea, Silver Birch Betula pendula, European ash Fraxinus excelsior), some places are strongly invaded by geographically non-native species (the Black locust Robinia pseudoacacia, Chinese wolfberry Lycium barbatum, Desert false indigo Amorpha

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Slender crab spider Tibellus macellus, preferring steppe grasslands and forest steppes, is a critically endangered European species whose occurrence is concentrated in the Pannonian region and Eastern Europe. © Radek Šich

fruticosa, the Box elder Acer negundo, etc.). Without systematic restoration and at least occasional management, the remnants of preserved natural habitats degrade, some may disappear completely, and the area loses its uniqueness. Moreover, gradual restoration of at least a minor part of the currently strongly degraded steppe vegetation is important.

Negative changes are also taking place in farming cultures. Most visible are the abandonment of old orchards and vinevards, and encroachment of these cultures by shrubs, trees and expansive grass species. However, farming is also significantly intensified in many places. Small vinevards and orchards are consolidated into larger blocks. Formerly mosaic areas are becoming monotonous maize fields or uniform vinevards without scattered solitary fruit trees. Some small fields with a variety of vegetables and root crops disappear. The regular use of herbicides has a very negative impact on the weed vegetation diversity.

Ground squirrel as an umbrella species

European ground squirrels occur across the whole study area, but in various densities. The main ground squirrel colony is situated at site where the land mosaic is the finest and the cultivated crops are the most diverse. Every ground squirrel has a part of a vineyard, fruit trees, a small vegetable field, a path verge, *i.e.* various food sources, in its territory. In early spring, freshly sprouting grass blades, dandelion leaves

and roots are the basic nutrition. Over time, various grasses and herbs flower and their seeds and fruits ripen. In June the ground squirrels find fallen cherries and in July apricots, in between they feed on various crops from fields, vegetables and fodder plants. Also animal food, consisting of invertebrates and occasionally also small vertebrates, is an important component of the ground squirrel's diet. Just like amount and diversity of available food influence the around squirrel population, these rodents also influence other animal species. Ground squirrels used to be an important component in the diet of predators like the Saker (Falco cherrug) and the Steppe polecat (Mustela eversmanii), but today these species are critically endanaered just as the ground squirrel itself is. In their holes, around squirrels host a specific fauna. which is also present at this site, e.g. the coprophagous dung beetle Onthophagus vitulus and O. semicornis. The dead bodies of ground squirrels, hares and other vertebrates also host important necrophagous steppe species such as Nicrophorus germanicus, the largest burying or carrion beetle occurring in the Czech Republic and the hide beetles *Trox cadaverinus* and *T*. eversmannii.

The present situation of farmland biodiversity is very unfavourable in the Czech Republic. Besides a dramatic decline in many species of birds, invertebrates and formerly common segetal vegetation, the fact is very well documented by the occurrence of the European ground squirrel.

The Mallow skipper (Carcharodus alceae) can most often be encountered at diverse steppe sites with disturbed patches, on fallow land and in path margins. © Václav Křivan

Conclusion

Apart from current 'Noah's Arks' like airports and campsites, ground squirrels only occur at a few original sites in southern Moravia, e.g. at Velké Pavlovice, Hrušovany u Brna, Čejč and Hovorany, and Újezd u Brna. For all of them, a rich mosaic of small fields, vineyards and orchards, but also high biodiversity of plant and animal species in comparison to the surrounding agricultural landscape is a common feature.

Despite the claims of some farmers that agriculture can only be performed on large tracts. there have still been varied agricultural landscapes with a high biodiversity in our country. which is interesting for part of the local population even from the perspective of livelihood. The combination of diversified agricultural use and presence of valuable natural habitats makes the surroundings of Velké Pavlovice a verv significant site in southern Moravia. The area would therefore deserve targeted support, management and gradual restoration to be implemented in close cooperation with the State Nature Conservancy authorities and local communities.

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Is the Hydrological Balance in Forest Catchment Areas Influenced More by Climatic or Vegetation Drivers?

Jakub Hruška, Filip Oulehle a Anna Lamačová

Between 2014 and 2019, Central Europe experienced unprecedented drought and heat. However, what was an unpleasant episode for most people and for ecosystems made it possible to answer some questions related to the hydrological regime in the Czech Republic's landscape and, together with climate models, to outline the expected future.

A new forest after the European spruce bark beetle (Ips typograhus) outbreak at Plešné jezero Lake, the Šumava/Bohemian Forest Mts. © Filip Oulehle

Climate change

The Central Europe climate is characterized by a long-term increase in temperatures (Fig. 1) and a large variability in precipitation totals (Fig. 2), in which, however, no statistically significant trend can be found. Temperatures from Prague's Clementinum observatory (Czech Hydrometeorological Institute data) from 1844–2019 show a rise in the second half of the 20th century (Fig. 1). The ob-

served increase in temperature is about 1.5–2.0 °C from the early 1960s to the present. Precipitation (Fig. 2) does not change much but it does show great variability. If we look at the five-year precipitation averages, we find that a very dry "five-year period" was recorded in the 1860s, even drier than 2014–2018. The then catastrophic drought, when springs dried up and the harvest failed, is also mentioned in chronicles from that period.

If precipitation does not change for a long time and the temperature rises, the landscape dries up. The best theoretical concept of the intensity of the drying can be given by the calculation of potential (baseline/benchmark) evapotranspiration - this indicates how much water would evaporate from the landscape with standard vegetation as physical evaporation of water (evaporation) and transpiration (respiration) of plants. Furthermore, the quantity is potential - it is calculated for ideal conditions, where the plants always have enough water available for maximum transpiration. Potential evapotranspiration is then only a function of temperature and air humidity, the total precipitation does not matter. Potential evapotranspiration (in this case, calculated according to lyanov) has significantly increased at Prague's Clementinum observatory since 1844, when the measured air humidity is available (Fig. 2). While in the 19th century this was about 700 mm, in the 20th century it increased to 800-900 mm. However, it has grown dramatically in the last three decades - now about 1200 mm. While precipitation did not change, temperature-accelerated potential evapotranspiration increased by about 50% as the temperature increased.

Hydrological balance in forest catchment areas

While long-term data from the Clementinum observatory mainly show climate change, the ecosystem change of the water cycle in the last three decades is shown on the water balance in small forest catchment areas. The Czech Geological

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Figure 1: Average annual air temperatures in Prague's Clementinum observatory, 1844–2019 (CHMI data). Prepared by Filip Oulehle.

Survey, in cooperation with the Institute of Global Change Research of the Czech Academy of Sciences (CAS) and other institutions (especially the Czech Hydrometeorological Institute, Forestry and Game Management Research Institute, Institute of Hydrodynamics of the CAS, Institute of Geology of the G CAS, and the Czech Technical University) operates and monitors a globally unique network of small river catchment areas (GEOMON) in mountain and foothill areas in the Czech Republic (Fig. 3). As it is now, the network has been in operation since 1994 (Oulehle et al. 2017). The river catchment areas are small (25-300 ha), concentrated in sensitive spring areas with homogeneous geological subsoil, and are forested, without agriculture or built-up areas. Thus, they allow the study of a relatively natural hydrological cycle.

The network consists mainly of commercial forest stands with a predominance of the Norway spruce (Picea abies) from about 450m above sea level (a.s.l.) to mountainous locations with an average altitude of 760m a.s.l. The network does not include forests with access to shallow groundwater resources (floodplain forests).

Precipitation total and the amount of rainfall on forest soil

Evaporation from the ground into the atmosphere is called evapotranspiration (ET) and, in a hydrogeologically well-defined river catchment, we can relate evapotranspiration to balance evaporation, which is given as the difference between precipitation and runoff (Ward and Robinson, Fendeková et al. 2018, Krám 2019). Average precipitation in the studied forest

Figure 2: Annual precipitation (1844–2020), its five-year average, and potential evapotranspiration (1844–2019), Clementinum observatory, Prague (precipitation data from CHMI)

catchment areas ranges from 600 to 1800mm per year, while total precipitation increases non-linearly with the altitude and increases on average by about 140 mm per year per 100 m in height. A part of the total evaporation in forests outside the direct evaporation from the soil is interception – capture and then evaporation of precipitation from the surface of trees (Klimo 1989, 1990, Ward and Robinson 1990, Černý et al. 2014). Only in the highest altitudes can capture of precipitation by trees (trapped fog and frost) be higher than interception losses, in which case more water falls onto the surface of the forest soil than in places without trees (Kopáček et al. 2020). In the vast majority of forests in the Czech Republic, however, the amount of precipitation is reduced by interception directly in the treetops. Long-term data show (Fig. 4) that interception in spruce forests in the Czech Republic is about 240 mm per year and decreases only very slowly with increasing altitude. Simultaneously, it is evident that the reduction of precipitation by interception is relatively most significant at lower altitudes; in our case, in forests around 500 m a.s.l., precipitation is reduced by 250 mm per year (i.e., by 40%).

A limited number of measurements of throughfall precipitation in beech stands (four river catchment areas) suggests that interception losses are lower in beech forest. The difference in interception between coniferous and deciduous broad-leaved stands is mainly due to reduced interception by the former in winter. In connection with the influence of stand structure on the amount of precipitation falling on the forest soil, it is necessary to mention precipitation captured by vegetation and flowing to the soil surface along the trunk (stemflow). This phenomenon is negligible in spruce forests, but in beech stands it can be an important source of water for forest soils (especially due to the architecture of the crown).

Transpiration and runoff of water from a catchment area

Physiological evaporation (*i.e.*, transpiration) is the loss of water from a plant and is very closely related to photosynthesis and nutrient intake. Although direct transpiration losses by vegetation are not measured, its estimate will be close to the difference between the amount of water falling on the soil surface and measured surface runoff In our conditions, when average forest cover of the studied river catchment areas reaches about 80%, average transpiration is $320 \pm 60 \text{ mm per}$ vear. However, the value also includes direct evaporation from the soil, so actual transpiration will be slightly lower. Derived transpiration in forest catchment areas correlates with average annual temperature (Fig. 5). This relationship also shows that for each degree of average annual temperature the requirements for transpiration increase by about 40mm. Evapotranspiration, including physical and physiological evaporation, is an average of 510 \pm 90 mm per year for forest catchment areas in the Czech Republic (i.e., 60% of average annual precipitation).

In connection with climate change, the most striking phenomenon is the continuous increase in average annual air temperature. At medium altitudes (about 450-800m a.s.l.), the years 2014-2018 were more than 2 °C warmer than the long-term average in 1961-1990 (5.4 °C). The

Figure 3: Location of the GEOMON network forest catchment areas, Czech Hydrometeorological Instutute weather stations, and the Načetín research area in spring areas of the Czech Republic (average catchment area altitude 760 m a.s.l.). Prepared by Filip Oulehle

trend in the amount of precipitation for the individual years is not conclusive, mainly due to the high year-on-year variability in precipitation totals. Nevertheless, average precipitation in 2014-2019 was on average 14% lower compared to 25 years ago, when river catchment area monitoring began. Lower annual precipitation totals in combination with higher temperatures resulted in a significant decrease in flows, which in 2014-2019 was 42% lower than the average for the same length period 1994-1999 (Fig. 6).

The decrease in flows was due to a reduction in the input of precipitation into the river catchment area and higher demands on evapotranspiration. It increased by an average of 55mm, with a temperature increase of 1.4 °C. This value agrees with relationship between transpiration and annual average air temperature derived from the temperature gradient of the studied river catchments. Simultaneously, this transpiration increase was recorded in catchment areas above 600 m a.s.l. In forests below 600 m a.s.l., transpiration even

decreased in 2014-2018 compared to the longterm average because of withering of stands due to low availability of water in soil. In these areas, the situation was critical for small streams, where natural demands for evaporation were already close to or even exceeding annual precipitation totals. Simultaneously, the year-on-year decrease in precipitation and increase in temperature may increase evaporation to such an extent that the situation may result in periodic drying of forest streams (Fig. 7). This is often preceded by a drop in the groundwater level, as it is able to temporarily subsidize the basic minimum flow.

However, the studied forest catchment areas have a relatively small groundwater supply. According to research using the natural stable oxvgen isotope ¹⁸O, the average water retention period in a river catchment area is in months and the mobile water supply in a river catchment area is in the low hundreds of mm (Buzek, unpublished data). Therefore, groundwater in the river catchment areas (mainly on crystalline rocks at medium and higher altitudes) is not able to further subsidize surface runoff for a long time - a rapid decrease in flows usually occurred in the year following a year with relatively lower precipitation compared to the long-term average.

Commercial forest decline and influence on the hydrological balance

Water evaporation from vegetation (transpiration) is the main way water evaporated from continents returns to the atmosphere (Jasechko et al. 2013).

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Figure 4: Relationship between annual total precipitation in open areas (outside the forest) and sub-crown precipitation (total precipitation in forest stand) for spruce stands. The difference is equal to interception losses (evaporation in the treetops). Prepared by Filip Oulehle

Figure 5: Relationship between average annual transpiration (with proportion of evaporation from the soil) on average annual air temperature in the river catchment area. Data include river catchment areas with current forest cover higher than 70%. Prepared by Filip Oulehle

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Figure 6: Changes in annual runoff in forest catchment areas of the GEOMON network. Figure 7: Hydrological balance of the Modravský potok/Modrava Brook catchment Average annual runoff for the period 1994–1999 and 2014–2019. Prepared by Filip Oulehle area in the Šumava/Bohemian Forest Mts. (1971–2019). CHMI data.

Simultaneously, the share of evapotranspiration in total precipitation is surprisingly stable globally, reaching about 60-70% of total precipitation, regardless of the ecosystem type. When an ecosystem is disturbed, either naturally or artificially (e.g., by logging), the water cycle is disrupted; however, acting feedback dampens extreme events, whether drought or floods. During the collapse of the mature tree layer (especially coniferous stands), in the vast majority of cases, interception decreases and the amount of water falling on the forest soil surface increases, while transpiration decreases. It is important to realize that transpiration is a basic property in all vegetation, so the decline in transpiration will be proportional to the ecosystem's ability to replace this failure with yeaetation caused by succession in disturbed areas (Jančo et al. 2017). The undisturbed development of subsequent vegetation, whether grasses. shrubs, or pioneer tree species, thus becomes an important element in water balance, as it very effectively replaces the transpiration of the original forest (Oreňák et al. 2014).

The phenomenon can be documented in the Modravský potok/Modrava Brook catchment area in the Šumava/Bohemian Forest Mts. National Park (Hruška et al. 2015). In this catchment area (92.7 km²), where the hydrological balance has been monitored since the early 1950s (CHMI), there was a rather fundamental change in vegetation cover after the declaration of the National Park in 1992. In about one third of the catchment area, mature forest underwent European spruce bark beetle outbreak, and was left to develop spontaneously without removing the dead tree biomass. In another third, the

Another example is the hydrological balance of several small river catchment areas (Uhlířská and Jizerka) in the Jizera Mountains, where the spruce forest died in the 1980s due to acid deposition and was harvested almost immediately. There, runoff increased by about 10% in the short term (2-3 years). After that, no change was apparent compared to the situation before harvesting due to air pollution. These river catchment areas, in contrast to the Šumava/Bohemian Forest Mts., were felled and biomass was removed in about 80% of the catchment area. There too, however, new vegetation (herbs) very guickly hydrologically replaced the transpiration and interception of dead commercial spruce.

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forest was harvested within the fight against bark beetle and replanted, and the remaining third remained a living mature forest. Simultaneously, peat-bog restoration was carried out in part of the brook catchment area, consisting of the damming of drainage ditches. This mosaic of various management measures had no effect on the hydrological balance of the watercourse catchment area – no statistically significant changes in annual runoff or evapotranspiration were recorded (Fig. 8). The reason was that the immediately emerging vegetation relatively guickly increased interception of precipitation and transpiration, and thus dampened the decline in evaporation by the missing mature spruce stands. The peat-bog restoration (and thus an increase of water supplies in the catchment area) probably also had an effect.

In both cases, it was a change in the vegetation structure under relatively stable precipitation

and temperature conditions. In contrast, results from the GEOMON catchment areas show a relatively stable catchment cover, but significant changes in precipitation and temperature The comparison clearly demonstrates that the long-term hydrological stability of the Central European forest landscape was until recently very robust and the current influence of vegetation cover did not have much importance The role of the "favourable" forest influence on runoff conditions has never been confirmed by data, and the requirement of continuous coverage of the area with a "green" forest is not absolutely necessary. Plant transpiration (which is the main source of water evaporation into the atmosphere, climate cooling, and contribution to a small water cycle), acts very similarly both in the forest and on other types of vegetation (meadows, pastures). The decisive factor is the amount of precipitation and the change in temperature, not the type of vegetation. However, it is obvious that the microclimate is much more favourable in a landscape where green vegetation is present throughout the growing season and, needless to say, that in built-up or poorly farmed areas there is a (permanent/seasonal) decrease in evaporation and thus the landscape loses its ability to cool naturally.

What to expect from climate change?

Climate models for Central Europe quite consistently predict an increase in average temperatures with precipitation keeping as it is, or even an increase in totals (e.g., Lamačová et al. 2018) However, the extremization of precipitation will be important in the future - especially higher frequencies of large precipitation (floods and ex-

Figure 8: Daily runoff from the Loukov forest catchment area in the Bohemian-Moravian Highlands, recorded from November 1994 to October 2019. Orange fields indicate dry periods without obvious surface runoff. Prepared by Filip Oulehle

Table 1: Changes in hydrological characteristics of the Modravský potok/Modrava Brook catchment area. Prepared on the basis of scenarios elaborated by Lamačová et al (2018)

	1981–2010	2021–2050	2071–2100
Number of days with extreme precipitation*	63	86	97
Average annual number of days without precipitation	157	150	151
Average daily maximum flow (m ³ /s)	32	39	41

* number of days with precipitation higher than 48.9mm, which is 99% quantile of all days when it rained in the period 1981–2010

ceeding saturation capacities of river catchment areas), but also an increase in the frequency of periods with very low precipitation, and thus also periods when there will be water shortages in river catchment areas. It was the period of 2014-2019 that probably offered us a hydrological excursion into the future. However, so far only a "dry" variant without extreme precipitation.

Specifically, for the already mentioned Modravský potok/Modrava Brook catchment area. climate models (a combination of many scenarios of climate change different levels) predict an increase in the number of days with extremely high precipitation (Tab. 1). Although in the thirty-year control period (1981–2010) there was a total of 63 days with precipitation higher than 49mm (99% quantile: *i.e.*, 1% of the highest precipitation totals), for 2021–2050 it will increase to 86 days and for 2071-2100 to 97 days (i.e., by about a third). The number of days without precipitation will not change much. Alongside an increase in the frequency of extreme precipitation, there will be an increase in the maximum daily flows, namely up to values of about 20-30% higher than those recorded so far (Tab. 1). Total precipitation totals will increase by about 10–15% for the whole Czech Republic (Štěpánek et al. 2019).

Thus, a combination of drought and short-term high rainfall and floods can be expected. And, in both cases, more extreme than we have been used to. Both the extremes will occur regardless of vegetation cover in a catchment area, which will probably not change very much

Conclusion

The current collapse of commercial forests (especially spruce) is a consequence of the low ability of monoculture/plantation management to cope with rapidly changing environmental conditions, such as rising temperatures and increased variability in the total and distribution of precipitation. Forest production, obviously and purposefully set to the conditions experienced in recent centuries, has been reaching its limits, especially in areas where the demands for evaporation are close to the precipitation amount. These areas can be roughly defined in the range of altitudes 450–600 m a.s.l. Monoculture/plantation spruce management leads to a reduction in the input of precipitation into forest soil due to high interception losses (up to 40% of precipitation loss when the rain passes through a treetop) and to high transpiration demands of forests primarily grown to maximize biomass production there. Reducing precipitation input, often combined with higher temperature, then results in drought stress due to reduced soil moisture and groundwater levels, followed by reduced photosynthetic activity in trees. At such sites, it is essential to adapt forest management to conditions with an expected increase in temperatures (increase in transpiration requirements) and the possible periodic occurrence of years with below-average precipitation. Growing and managing structurally rich forests with a natural species composition should reduce interception losses and strengthen the use of available water in the entire soil profile. This is best achieved by

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growing mixed forests with variable root zone depth and varied crown architecture.

The landscape and water regime would greatly benefit from restoration of streams and their floodplains, as well as restoration or building of new wetlands. Drainage, with the aim to gain productive land for growing trees, has been carried out in forests since the end of the 18th century. The water was more of an obstacle in the forest. However, this situation is changing dramatically today, and rapid runoff of water from the landscape is not desirable. Capture the expected large rainfall on the spot, and not guide and direct it elsewhere. Dams are not known to protect against major floods, nor can they hold back water. Wetlands and restored valley floodplains will contribute to a better groundwater supply which can then subsidize runoff and soil profile for longer. The goal of current landscape protection should be to retain water in the places where it has fallen, because only there can it provide the landscape with water and keep it functional, even under the conditions of expected and projected climate change. We must consider water retention in the landscape context, and not as a medium that has primarily economic functions. Of course, we cannot do without drinking water; however, reducing the water cycle to supplying the population and industry with water would certainly be short-sighted and counterproductive.

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Vladimír Dolejský

"Presumption is our natural and original malady. The most calamitous and fragile of all creatures is man, and at the same time the proudest. He goes installing himself in his imagination that he makes himself God's equal, that he ascribes himself divine attributes,

Extermination of the wolf in the Czech lands and Moravia

Before the mid-18th century, Grey wolf (Canis lupus)

numbers had dramatically declined and during the reign of Maria Theresa of Austria, Holy Roman Empress and Queen of Bohemia (1740–1780), wolves were rare. In 1747 the last wolf in the Novohradské hory Mts. was killed, in 1750 the last wolf in the Brdy Hills, and in 1756 the last two wolves in the Dominion of Vimperk. In Bohemia, wolves

The wolf has recolonized the Czech Republic. © Jaroslav Vogeltanz.

The Grey Wolf Management Programme in the Czech Republic – An Introductory Presentation

that he winnows himself and separate himself from the mass of other creatures, determines the share allowed the animals, his colleagues of faculties and powers as seem good to him." (Montaigne, An Apology for Raymond Sebond).

survived for the longest time in the Dominion of Krumlov, namely by 1795, thanks to its remotness.

In the 19th century, wolves were only exceptionally captured in Bohemia (e.g. the Doupov Hills in 1825, near the castle of Opočno in eastern Bohemia in 1837, in the Jizerské hory (Jizera Mts. in 1842 and 1866, in the Krkonoše/Giant Mts. 1861. near the town of Vimperk 1874). These were apparently often migrating animals. The last wolves

in Bohemia were caught in the Šumava/Bohemian Forest Mts.in 1874 and 1891. In both cases these were also migrating animals.

The situation was different in Moravia, particularly in the Beskydy Mts., where the Grey wolf occurred much more frequently in the 19th century. There, 38 wolves were caught in 1815-1851, and after 1852 at least another three. The last historical records of hunted individuals in Moravia are known from the Kouty Forest District in the Jeseníky Mts. (1907), close to the Town of Zábřeh (1908) and finallv from Červený Grúň near Jablunkov from 2014.

From the first wolf return to the present situation

The first wolf record in the Czech Republic after the World War II came from the surroundings of Staré Město pod Sněžníkem in northern Moravia in 1947. Other documented records are from Štáblovice in the Opava region (1963) and Kunčice on Mt. Kralický Sněžník (1965). During the 1970s, a strong increase in the number of records. i.e. shot animals, occurrence, observations, occurred. Migrating animals appeared in the Šumava/Bohemian Forest Mts. (1976), Krkonoše/Giant Mts. (1977), Rakovník region in Central Bohemia (1988), and the Krušné hory/ Ore Mts. (2002). Observations and shot animals are known from the Hrubý Jeseník, Kralický Sněžník and the Bílé Karpaty/White Carpathians Mts.

Migration of individuals from the Carpathian wolf population in Slovakia and Poland has led to the situation that a group of wolves regularly has been appearing in the border area of the Beskydy Protected Landscape Area (PLA) since 1995.

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Their presence gave hope for the establishment of a viable, reproducing subpopulation. In 2008, the number of wolves in the Beskydy PLA was estimated at 7 animals, based on observations as well as footprints and other traces. However, in 2003–2012, based on systematic monitoring, the occurrence in the Beskydy PLA and the adjacent territory in Slovakia was assessed as extremely sporadic. Since 2012, wolves have yearly again been captured in camera trap images there.

Since 2017, several individuals have been appearing sporadically in the Bílé Karpaty/White Carpathians. In spring 2018 the occurrence of a new 'Carpathian' pack was documented in the Beskydy Mts. and in 2019 reproduction was confirmed for this pack. This is the first documented reproduction in the area since wolves returned there in the 1990s.

The Grey wolf's current occurrence in the Czech Republic is mostly related to the Central European lowland population. Wolves from northeastern Poland have recolonised western Poland and eastern Germany. Since 2000 they have regularly reproduced in the area of German Lusatia, from where they have spread. The latest monitoring in the 2018/2019 season in Germany confirmed the existence of 105 wolf packs, 27 pairs and 12 territorial individuals. In 100 cases also reproduction was confirmed.

The first reports of possible wolf expansion from Upper Lusatia to the Czech Republic come from 2012, when a wolf was captured with a camera trap close to the Czech border for the first time. Credible observations also come from the Krkonoše/Giant Mts. (2011) and the Broumov region in north-eastern Bohemia (2013). There is also a record of its presence in the Ralsko region, a former military training area, from 2013. In 2014, the presence of two adults and three young wolves was documented there. Therewith the first pack of Bohemia was established and since then, its reproduction has been recorded yearly.

In autumn 2015, a wolf couple had settled in the Broumov region and produced at least two cubs already the following year. Reproduction of this pack around the Czech-Polish border has also been recorded in later years. According to images from camera traps, three wolf cubs were born in 2017 and four in 2018 there. Another area in Bohemia where occurrence of wolves has repeatedly been reported, is the Sluknov Promontory. Since 2015, wolves have also regularly been observed

Park, Bayerischer Wald National Park, Nature Conservation Agency of the Czech Republic, Veterinärmedizinische Universität Wien, Charles University Prague and Mendel University Brno

Wolf occurrence in the Czech Republic in May 2018 – April 2019.

(1. 5. 2018 - 30. 4. 2019)

Night shot from a camera trap. © Miroslav Kutal

Ambush

foothills, Novohradské hory Mts., Český les Mts., Krušné hory/Ore Mts., České Švýcarsko/Bohemian Switzerland, Jizerské hory/Jizera Mts., Krkonoše/Giant Mts. and the Jeseníky Mts.

In 2017, a pack was documented in the Šumva/Bohemian Forest Mts.' central part. Newly, evidence of reproduction has also been found in the Šluknov region.Recordsofwolveshavegraduallybeenreported also from other places in the Czech Republic.

In 2018 the occurrence of wolves was confirmed in the Lužické hory /Lusatian Mts. and the České Švýcarsko/ Bohemian Switzerland NP, and reproduction in the Třeboň region (south Bohemia).

Wolf management plan as a reaction to its expansion

The return of the strictly protected Grey wolf to our region has brought a range of ambiguities and conflicts with it in the past two years. Particularly damage to domestic animals has been increasing-

Damages paid for losses caused by wolves, Czech Republic 2002–2019, as of November 2019.

Source: Ministry of Finance of the Czech Republic

Female wolf in the Broumov region. © Miroslav Kutal

ly reported, but also concerns of the public about a possible attack by the large carnivores have been raised. A new strategy of the Ministry of the Environment of the Czech Republic titled Grey Wolf Management Programme will make way for a systematic response to the Grey wolf's expansion in the Czech Republic. It is a set of measures aimed at reducing damage to livestock and other conflicts connected to the presence of wolves in the Czech Republic's landscape, including a future determination of the so-called species/population favourable conservation status and a uniform procedure by the competent authorities in the case of non-standard wolf behaviour. The management plan has been prepared by the Ministry of the Environment of the Czech Republic with the Nature Conservation Agency of the Czech Republic and scientists. It has

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Count

are not displayed.

) Territorial individual

Single observations of individuals

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	Year	CZK (EUR = 25.5 CZK)
+	2002	9 000
	2003	48 000
+	2004	203 000
	2005	45 000
	2006	15 000
	2007	35 000
	2008	63 000
_	2009	11 000
	2010	9 100
	2011	66 025
	2012	17 140
	2013	34 300
	2014	98 861
	2015	102 458
	2016	293 189
_	2017	788 089
19	2018	1 554 336
20	2019	4 648 269

also been commented on by representatives of livestock breeders' associations, the Bohemian-Moravian Gamekeeper Association and the Ministry of Agriculture of the Czech Republic. The management programme will be updated after two years.

The Grey wolf is protected by European legislation, namely the EU Habitats Directive and the Bern Convention practically throughout Europe. The Management Programme does and will not change the fact. It is thus not a legislative norm but a plan of the strategic approach, the different measures of which will now be implemented by the Ministry of the Environment of the Czech Republic in collaboration with the competent State Nature Conservancy authorities as well as the Ministry of Agriculture of the Czech Republic, livestock breeders' associations, hunters/gamekeepers and other stakeholders in the countryside.

The Management Programme is a strategic document which sets basic steps needed to prevent and solve conflicts with the presence and development of the wolf population. According to the Management Programme, the Ministry of the Environment of the Czech Republic has already been working on legislative changes in the field of damages, aimed at simplifying the provision of compensations to affected entities and facilitating all related administration.

The Nature Conservation Agency of the Czech Republic has been preparing documents such as specifications of effective livestock herd protection measures and guide for dealing with trouble-making wolves.

Collaboration with neighbouring states is necessary

The Management Programme also includes the task to collaborate with Germany and Poland (and with Slovakia in the Carpathian region) on the determination of the so-called favourable conservation status, *i.e.* a population size (and its corresponding proportion for the Czech Republic) which, when reached, gives the Czech Republic and neighbouring states the right to negotiate with the European Commission on amending the EU legislation and possibly setting wolf hunting quotas. The specific target numbers of wolves have as vet neither been set in the surrounding states (such as Saxony, where the wolf population has been developing since 2000 and the first programme was adopted in 2009). One of the few EU Member States with a specific 'viable wolf population' value (not a threshold) for its territory is France. However, the country has been dealing with development of the wolf population for many years and the figure is the only part of the latest, third management plan from 2018.

Concerning the setting of the favourable conservation status value from the conservation perspective, the European Commission recommends for large carnivores and their transboundary populations (see Guidelines on Population Level Management Plans for Large Carnivores) not to apply these values to the territory of the single country only (where, given the low carnivore population density, it may not even be realistic to achieve a favourable species population), but to the popu-

Wolf captured with camera trap in the Krušné hory/Ore Mts. © OWAD Project

lation as a whole. It is obvious that particularly the so-called European lowland population from which wolves have recently been spreading to the Czech Republic, shows a long-term growth, but a specific favourable population size (and its possible proportion corresponding with the area of the Czech Republic) must be determined in collaboration with neighbouring states. This figure could therefore not be incorporated into the programme, although it is a priority measure at the very beginning of its implementation. If the moment of reaching the favourable conservation status has to be an impulse for the abovementioned initiative. leading to a change in the legal status of wolf protection, it is essential that well-documented and evidence-based data not disputed by any of the involved parties are available and there is at the same time agreement. if possible, on a joint approach with neighbouring countries sharing the same population.

The programme includes measures which should react to the situation that a wolf behaves abnormally. Such behaviour must be evaluated properly, and individuals with disturbed, trouble-making behaviour posing a security risk should be removed from nature. Such an individual can only be eliminated based on an exemption according to the Nature Conservation and Landscape Protection Act (and relevant European legislation). The Management Programme requires the introduction of a detailed procedure in these cases up to the level of the implementation, in which both the State/Public Administration in nature conservation and hunting/gamekeeper authorities, *i.e.* specific hunting ground tenants, participate. For the determination of conditions and method of elimination of problematic wolf individuals, the basics

Wolf captured with camera trap in southern Bohemia. © Nature Conservation Agency of the Czech Republic archive

are generally obvious (reasons and conditions for a possible exemption). It is however necessary to specify more precisely how to assess if the statutory reasons and conditions are met, *i.e.* specify the procedure for nature protection authorities in granting exemptions. At the same time, there also are needs to be clarified how to proceed in the case of the trouble-making individuals. There, collaboration between the Ministry of the Environment and the Ministry of Agriculture and between State Nature Conservancy authorities, hunters/ gamekeepers and other specialists is essential, iust like their joint understanding of legislative conditions and requirements (not only the Nature Conservation and Landscape Protection Act. but also the Hunting/Gamekeeping Act and possibly other relevant regulations) and the practical possibilities and circumstances of a solution.

Prevention of damage to livestock and compensation for such damage

The most serious problem with the occurrence of wolves in the Czech Republic's landscape is the damage caused to livestock. The main objectives of the Grey Wolf Management Programme therefore include particularly the establishment of a functional system for the provision of financial support for the implementation of preventive measures to protect herds, and the improvement of the investigation procedure and the compensation payment for the damages caused. It is also important to provide the public with quality information on e.g. ensuring the necessary monitoring and collecting further information, and to share it with the stakeholders (State/Public Administration authorities, livestock breeders, hunters/gamekeepers).

An important issue in the programme is the mentioned financing of preventive measures. At the moment these can be funded from the Operational Programme Environment. This is however a complicated and administratively demanding instrument. Therefore, attempts should be made to set up more effective conditions to make support easily accessible to livestock breeders. Logically, the most appropriate solution would be to link them with other subvention programmes/subsidy schemes for farmers. However, the Ministry of Agriculture of the Czech Republic has not yet agreed to the proposal. The matter needs to be discussed further and alternative solutions must be found.

Species management programmes are as a rule adopted for a ten-vear term, but the Ministry of the Environment of the Czech Republic counts with an update after already two years in the case of the Grev wolf. By then, several important measures should be implemented. e.a. determining the population size (so-called favourable conservation status values according to European requirements) and determining conditions for supporting the introduction of measures to protect herds in the programme period 2021-2027.

In the Western world and in the natural sciences, we have extraordinary instruments at our disposal to study animals, we have a system for their classification, and thanks to libraries and periodicals we also have a system of spreading information. However, if we want to learn more about animals, and by that I mean real knowledge, not more factual information, we have to go to the forests to observe them. (Barry Lopez, Of Wolves and Men)

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Butterfly Conservation in the Era of Climate

Václav John, Jiří Beneš, David Číp, Miloš Andres, Martin Konvička

Europe has considerably warmed up during the past decades, which is reflected in changes in the insect fauna. The most recognizable example is an expanding distribution range of the Praving mantis (Mantis religiosa), which has occupied, starting from the south, the whole of Moravia including the Jeseníky and Beskydy Mts during the 1990s, and has arrived in Bohemia via the Svitavy region.

Effect of year-round free grazing by native European grazers, horses and "aurochs", at Milovice, Central Bohemia. © Miloň Jirků

Some expansions have been very recent. Examples include the Adonis blue (Polyommatus bellargus), which has been returning to eastern and central Bohemia from Moravia only in the past five years, and the Spotted fritillary (Melitaea didyma), which has been occupying its historic sites in southern Moravia since 2017. Some species are colonising new areas: e.g. the Short--tailed blue (Cupido argiades) has reached the north of Moravia. Other ones are completely new to the Czech Republic, the Eastern pale clouded

At present it occurs not only in Central Bohemian lowlands but also in the foothills of the Krkonoše/Giant Mts. or in the Bohemian-Moravian Highlands. Expanding butterflies include the Large copper (Lycaena dispar), which spreads at the same rate and in the same direction as the mantis, Great banded gravling (Brinthesig circe) and the Scarce swallowtail (Iphiclides podalirius).

yellow (Colias erate) already since the 1990s, and the European beak (Libythea celtis) since 2019. In a total, 20 diurnal butterflies display recent expansion in the Czech Republic. There are of course more nocturnal moths showing expansion. The probably most prominent are arrivals of the well-known migratory Death's-head hawkmoth (Acherontia atropos) and the Oleander hawkmoth, known as the Army green moth (Daphnis nerii), whose numbers have been higher in the last decade than in the past fifty years.

Paradoxically, warming has a positive effect on species diversity. Since the number of species increases from north to south, there are more species profiting from warming than those driven to the north or into the mountains. Warming will however not solve the increasingly acute and pressing of insect extinction (cf. Čížek et al., Živa 5/2019, 247–250). In the past, the largest declines were seen in species of open-canopy forests, park landscapes and all non-forest vegetation types, *i.e.* habitats typical of the 'ancient' cultural landscape, which has been destroyed by industrialising farming on the Czech Republic's territory in the past 150 years or so. Today mainly generalist species in southern regions expand to the Czech Republic. More specialised species, dependent on high-demanding management of their (often protected) habitats, do not spread there nor in neighbouring countries. Besides, also the abundance of hitherto common species has been declining.

North-south and altitudinal shifts in the distribution range of butterflies were the first evidence of the climate change influence on the occurrence of organisms (Parmesan et al., Nature 399, 579-583). Knowledge of the mechanisms of these changes also comes from Western Europe. Until the 1990s, the Silver-spotted skipper (Hesperia comma) had been very rare in Great Britain. Then an expansion to the north took place. It has been shown that larvae currently develop in different conditions than a few decades ago. The butterfly used to develop on south- or west-facing short grasslands. Today it prefers taller grassland, even on north- or east-facing slopes. The caterpillars still require the same microclimate, but that is found elsewhere in hot summers (Davies et al.,

Volunteers working on rehabilitation management on Hermit (Chazara briseis) habitat on the top of Raná Hill. © David Číp

J. Anim. Ecol. 75, 247–256). Similar changes were found for the Adonis blue by O'Connor et al. (Oecologia, 174, 1463–1472). It only used to live on the most arid calcareous rubble, but today it has occupied a wide range of grasslands. If the climate changed in a landscape rich in habitats, insects would not have a problem, but in the unified Central European landscape it **is** a problem.

Steppe habitats

The Hermit (Chazara briseis) used to be a common species of warm regions until the mid-20th century. Today it survives on a handful of volcanic hills in the České středohoří/Bohemian Uplands (northern Bohemia), belonging to one of the most endangered butterflies in the country. Before 2015, the Louny population was on the brink of extinction. Out of ten basalt mounds occupied in 2007

(Kadlec et al., Animal Conservation 13, 172–183) its occurrence shrank to a single one. LIFE+ proiects and a regional action plan secured, besides resumption of grazing and recovery breeding for the transfer of individuals to former sites, also 'horticultural' site management, *i.e.* litter raking in short fescue grasslands used for larvae development. The situation started to improve, but then came the extreme heat waves and drought of the past few years. The top parts of Raná Hill, where the core population had developed during the past decade, completely lost its nectar sources indispensable for egg-laying females. The butterflies shifted to areas wetter and richer in flowers at the foot of the hills. If fescue grasslands outside the top parts of the Raná and Oblík hills had not been intensively restored, the drought in 2018-2019 would have been the final nail in the coffin of the Hermit.

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been becoming extinct everywhere in Central Europe. It has been lost in Poland, Slovakia and Hungary, and with the exception of the Alps also in Austria and Germany. Its food plant is sainfoins (Onobrychis spp.), a rather late flowering legume. The butterfly demands rather scrubby steppe grasslands and does not tolerate intense sheep grazing. In the Czech Republic, until 2005, it did well in the Hustopeče region (South Moravia), where it inhabited steppes with shrub encroachment near the village of Kurdějov. The site has received 'European' protection becoming a Site of European Importance (pursuant to Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, the term for Site of Community Importance, SCI under the European Union's Habitats Directive) targeted at the Red-flowered viper's grass (Echium russicum), a herb of the earliest succession stages. The broadminded delimitation of the Site of European Importance boundaries, far exceeding the occurrence of the bugloss, was among others motivated by the effort to cover the occurrence of the Damon blue. Unfortunately, site management has varied from one extreme to the other, inappropriate sheep grazing alternating with shrub encroachment. After the most promising population had been eliminated, the butterfly remained limited to three small populations, one in the Kviov region (South Moravia) and two in the distant Lounské středohoří/Lounv Uplands area in northern Bohemia. The Damon blue is regularly monitored and experiments with consolidating vegetation harbouring its host plant have been carried out. Nothing of this has helped because sainfoins desiccate at all sites in hot summers. In the České středohoří/Bohemian Uplands, in 2019, only a handful of imagoes survived, which fortunately managed to lay eggs on the host plants.

Drought also damages other blues whose larval development is associated with legumes, not only the rare Turquoise blue (Polyommatus dorylas) (developing in inflorescences of the Kidneyvetch Anthyllis vulneraria, only two populations in the Czech Republic), but also the much more widespread Chalk hill blue (Polyommatus coridon) (developing in inflorescences of the Purple crown vetch Securigera varia). Butterflies whose occurrence is concentrated in southern Europe and which should benefit from heat and drought, are disappearing before our eyes, but not everywhere. The decline in numbers of the Chalk hill blue has not been observed at higher elevations (e.g. the Sušicko-horažďovické vápence/Sušice--Horažďovice Limestones) or sites managed by early-spring grazing (e.g. Týnčanský kras/Týnčany Karst in Central Bohemia) and free all-year-round grazing (Milovice, reserve with large ungulates also in Central Bohemia). Spring grazing and mosaic mowing in spring, in contrast to summer mowing and grazing, allows rapid regeneration of the herb layer. Otherwise the steppe vegetation grows taller, desiccates completely in the summer and does not provide the blues with nectar or substrate for larval development.

Woodland habitats

Two species, one the most often mentioned by mass media the other the least explored, have seen an unexpected development. The Scarce fritillary (Euphydryas maturna), which has recently evoked many arguments among conservationists (Čížek & Konvička, Živa 6/2009, 271–273; Krása & Pavlíčko, Ochrana přírody 1/2014, 6-9), experienced a population boom in the area of the Dománovický les/Dománovice Wood in the Kolín region (Central Bohemia), its last site, in 2017 and 2018. It had allowed to take some individuals for controlled breeding and to transfer their offspring to the Libický luh/Libice Floodplain National Nature Reserve in 2018. The species had gone extinct there due to shading a long time ago, but today appropriate clearings are available. The following year the authors experienced a shock. The intensive monitored population at the Dománovický les/Dománovice Wood fell down to less than 10% of the previous vear's numbers. Declines in its populations occur commonly, but it is a guess why the 2019 decline was so deep. Higher population densities and extremely hot weather could have increased the rate of infection by parasitoids. In 2018, imagoes hatched two to three weeks earlier than in common years. In recovery breeding, the authors noticed the unique phenomenon that a third of the caterpillars developed into the last instar already in the summer (this normally happens in the spring of the following year), they pupated and produced a September imago generation. Even though nobody verified the situation in nature in autumn, such an autumn generation is lost for further reproduction because the butterflies cannot find enough nectar or substrate to lay eggs. Fortunately, the repatriated population

at the Libický luh/Libice Floodplain established

utself successfully. If the transfer had taken

Detail of top parts of Raná Hill after rehabilitation management. © David Číp

Outdoor facility for breeding endangered butterflies, including the Hermit. © David Číp

place just one year later this might never have succeeded.

The Rock grayling (*Hipparchia alcyone*), generally widespread in the warm Povltaví/Vltava River Basin and Předšumaví/Bohemian Forest Mts. Foothills regions 30 years ago, is surviving at a handful of sites in the surroundings of the Orlík and Slapy water reservoirs (Central Bohemia). The last sites where it occurred were open-canopy deciduous forests on steep slopes and some types of forest clearings and fringes. A well-prepared support programme (see https://motyli.csopvlasim.cz/) consists of thinning south- and west-facing forests, which the species preferred in former years. However, the year 2019 displayed the collapse also for this species. Despite an intensive search, only two individuals were recorded, each at an-

The Damon blue (Polyommatus damon). © Václav John

Na Adamcích National Nature Monument. © Jiří Beneš

other site. However, the sites where it occurs are varied and difficult to access, and the butterflies might have been rather hard to find (reduced activity or shift into tree crowns during hot weather). The question arises if clearings on sunlit slopes, which were earlier suitable for the species, are also suitable now when experiencing extremely hot weather conditions/heat waves. It may be necessary to create clearings also on slopes with a cooler exposure in the future, thus allowing butterflies to make a choice depending on the specific conditions of the year.

We could long continue in a similar way. The Scotch argus (Erebia aethiops) has vanished from the Povltaví/Vltava River Basin region, but has newly been found upstream of the Vltava River, in the Šumava/Bohemian Forest Mts. Foothills.

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Conversely, the critically endangered grayling (Hipparchia semele) was found to occur at most of its remaining sites in rather large numbers in 2019. It is a species of sands, rocks and similar habitats, which is very well adapted to temperature extremes, because their imagoes manage to survive the critical period thanks to aestivation.

Not only heat and drought reduce butterflies. Also the extremely cold and rainy month of May 2019 followed by an early start of the vegetation season must have had a negative impact. After the insects came to life, they suffered several weeks of hardship. If we have to predict, then 2020/2021 winter without deep frost and snow cover (causing repeated interruption of hibernation, which puts bioenergetic demands on species) will be comparably disastrous. These are drastic changes whose further course and direction cannot be predicted.

Climate change as an opportunity

The efforts to maintain residual populations by 'horticultural' management of their last sites are doomed to failure in the long term. All that we have learned so hard about the timing of mowing, dosing and timing of grazing, etc. is rapidly becoming obsolete. If we do not know how to manage a site, the only advice is to do it in a way as diversified as possible. However, the most valuable species survive at miniature sites. It is further typical of non-forest habitats that Specially Protected Areas often consist of the only single habitat. The Na Adamcích National Nature Monument (south-eastern Moravia), the last Moravian site of the Damon blue, is a 15-hectare steppe grassland. Until recently, it provided the blue and other xerophilous species with optimal conditions, but not anymore. In the former varied landscape, the blue would probably have moved on a bit, but today it has nowhere to go.

We must not give up, however. Species whose present response to a warmer climate worries us survived several warm periods of the Holocene in our regions. At the European level, they survived much more pronounced Quaternary climatic fluctuations. If the conditions deteriorated somewhere, appropriate new ones arose elsewhere. In the era of fast climate change, we must enforce nature conservation approaches allowing butterflies and other invertebrates to find climatically suitable habitats. Of the recommendations formulated a decade ago (Konvička et al., 2010, Butterfly conservation in the Czech Republic - An analysis of the present state and a long-term strategy,

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Free grazing by a mixed herd of horses and "aurochs" at Milovice, southern pasture. © David Číp

expert opinion for the Ministry of the Environment of the Czech Republic), the present ones do not differ in substance, but in urgency.

1. Expanding habitat management to the largest possible area

All the above-mentioned examples show that sites of endangered species cannot anymore be managed in a minimalist way or spotwise, *i.e.* by concentrating on areas or patches where the target species used to occur. reproduced or developed in the last few seasons. It is necessary to proceed more generously. Therefore, we have not to leave the principles of mosaic management and diversity. However, it implies that we will cut (graze, remove scrub, coppice, etc.) or, conversely, leave areas unmanaged on slopes of various exposures, on hilltops and in foothills, adjacent to or in the vicinity of the present populations' distributions. Sometimes it will be appropriate to enlarge the current Specially Protected Areas with adjacent sites of lower quality, where diversified conservation management shall be introduced. This does not mean that small and isolated Specially Protected Areas will lose their importance, but we also urgently need large areas or a dense network of smaller sites.

2. Including new sites in the landscape in addition to protected ones

The national network of small-size Specially Protected Areas is so comprehensive in critical areas like south-east Moravia and the Elbe River lowlands that it cannot be expanded. And what is not protected is 'de-insected'. Elsewhere, especially in mountain foothills, at least the most valuable sites have been protected. The current extent of Specially Protected Areas does nevertheless not provide enough space for sufficiently varied management necessary to preserve their species diversity. The Specially Protected Area network therefore needs to be complemented, not necessarily by legislative protection, but definitely by real conservation in the field. Opportunities are provided by areas where other activities have been abandoned, even on farmland, private and municipal land, by initiatives like Živá zahrada (Living Garden) and Pestrá krajina (Diverse Landscape), and by introducing management of biota along roads and other linear infrastructure. All these measures increase the density of potential habitat areas and stepping stones, even in intensively management landscapes, which are necessary to maintain the metapopulation dynamics of more sensitive species.

3. Working with nature in conservation management

The cases of the Hermit and the steppe blues have shown the importance of free year-round or early-spring grazing, which is much closer to nature than mowing or summer grazing in fenced enclosures. In the pre-industrial agricultural landscape, sites like municipal tracts were used by domestic animals continually, and rather in spring (when forage in the barns runs out) than in full summer. In pre-agricultural times, herbivorous ungulates alternated sunlit slopes in early spring and wetter habitats or higher elevations in summer. The cases of woodland butterflies demonstrate the importance of disturbance, clearings and open woodland of all types, not only at existing sites where rare insects occur. Their permanent presence is secured by return to forgotten management methods like coppicing or local rehabilitation of silvopasture as well as by prolongation of reforestation terms and more space for spontaneous shrub and tree succession ('natural regeneration' in forestry terms) The dying of forest plantations opens up unsuspected space. We should not see this as a tragedy, but as an opportunity.

4. Keeping the baseline in mind

Although it is seldom openly articulated, Central European nature conservation – perhaps with the exception of remote mountainous areas - has hitherto been related to the supposed state of the rural landscape before the onset of agricultural (and silvicultural) intensification. Our ideas about the appearance and dynamics of vegetation come from the 19th century, when the landscape type had begun to disappear. We have forgotten that the post-baroque landscape and its biota had developed through a millennium-long transformation of the Early Holocene landscape and that the pre-industrial era, just like the Early Holocene, were influenced by the presence of large animals – wild horses, aurochs and European bison. Not even the best active management can replace large animals completely. Free grazing at the Milovice former military training area in Central Bohemia, shows that year-round grazing by large animals supports butterflies (and other insects) in a way which cannot be achieved by other methods. It is no coincidence that Dalibor Dostál, author of the Milovice project, was awarded the Josef Vavroušek Prize in 2019 for excellent actions for the healthy environment and sustainable development. It is a pasture landscape – a diverse and dynamic 'savannah' rather than a uniform habitat - which should become the baseline for landscape and conservation activities. This is also true in places where we have to do without animals and replace them with technological tools.

5. Working at the level of landscape components

Maintaining diversity and returning it to the land scape must really act together with the landscape, its history, function and potential. We should prepare conservation measures comprehensively, at the level of components like mountain ranges, catchment basins, river valleys and largesize protected areas (National Parks, Protected Landscape Areas, Nature Parks). Regional Action Plans (RAP) prepared by the Nature Conservation Agency of the Czech Republic for integrated conservation of species and populations, for which the national scale is unnecessarily large but the scale of particular sites is too small, are becoming an excellent new instrument.

6. Assisted colonisation: making room for translocations

If a species disappears for climatic reasons, it does not mean that no suitable climate for it has emerged somewhere else, on the opposite side of a river canyon slope, higher up in the mountains or further north. The state of the current landscape and of endangered populations unfortunately prevents new habitats to be colonised even when they are created somewhere else. For several years, the authors have warned about ill- conceived insect reintroductions and have absolutely refused transfers outside historic distribution ranges. However, climate and habitats change so quickly that translocations are gaining more and more importance for the maintenance of the Czech Republic's natural heritage (Sedláček & Kadlec, Živa 6/2019, 306–308). It is high time to increase the capacity of recovery breeding, to support genetic screening of Central European biota, and to make reintroductions and transfers an effective tool for biodiversity conservation. Reintroductions and translocations must of course not be performed in a 'wild' manner. The objective should not be ill-conceived 'enrichment' of the natural world, but survival of most endangered species in the country.

If we want to protect butterflies in this time of fast climatic change, we need more and larger protected areas (or areas which we will treat as protected ones), more diversified, broadminded and generous management imitating the prehistoric pasture landscape, and greater effort to preserve populations, including reintroductions and transfers to suitable though unoccupied sites. All this may make insect conservation more expensive, but in the situation when climate change has hit a landscape

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The Scarce fritillary (Euphydryas maturna). © Václav John

The Rock grayling (Hipparchia alcyone). © Václav John

heavily affected by intensification, there is no other way but to take it. It is becoming increasingly clear that refaunation of habitats by large herbivores is one of the biologically and economically most efficient approaches. When Donlan et al. (The American Naturalist, 168, 1–22) described refaunation plans as an 'optimistic agenda for the 21st century', they consider that the restoration of completely functional ecosystems can give them back their

dynamics and return species their evolutionary potential. These are aspects which come to the forefront during rapid change in climatic conditions.

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Targeted Application Methods or a New/ Old Tool for Controlling Invasive Alien Woody Plants: the First Experience from the Podyjí/Thaya River Basin

Robert Stejskal

Invasive alien woody plants are a significant long-term problem of protected nature. Although we have been trying to control invasive alien woody plants, e.g. the most common Black locust (Robinia pseudoacacia), in many Specially Protected Areas in the Czech Republic, an effective management tool has been missing yet. In practice, there are various approaches differing in their philosophy and effectiveness

The Podyjí/Thaya River Basin – a paradise of invasive woody plants

The Podyjí/Taya River Basin National Park (NP) is rich in invasive alien trees and shrubs. The most important is the Black locust, occurring on a total area of approx. 150 ha as continuous forests but also hundreds of isolated patches of various size and density in a broad range of habitats. It is an almost ubiquitous species in the NP's eastern part. Old locust monocultures/plantations showing some stability as well as recent outbreaks with often stormy dynamics can be found in the area. The strongest threat to biodiversity is posed by black locust stands on steep slopes of the Dyje/Thaya River canyon, where it spreads into rock steppe and thermophilous oak forest habitats, not only vegetatively but thanks to the favourable conditions also by means of seed.

Insignificant in area, but more dangerous is the occurrence of the Tree of Heaven (Ailanthus altissima) and the Box elder (Acer negundo), which have recently spread precariously. Xerothermic habitats are locally threatened

and very often repeating mistakes, thus making sometimes the state of the art even worse instead effectively solving the problem. In this contribution, divided into several parts, the author would like to introduce the first experience from applying new measures in controlling the Black locust and other invasive trees and shrubs in the Podyjí/Thaya River Basin National Park (South Moravia).

Havraníky Heath - stand with hundreds of black locust trees, caused by felling approximately ten full-grown trees and repeated cutting of root shoots in the following ten years. © Robert Stejskal

by the Lilac (Syringa vulgaris) and the Chinese wolfberry (Lycium barbarum), whereas humid forests are invaded by the overlooked Green ash (Fraxinus penssylvanica). The Oregon grape, also known as the Holly-leaved Berberry (Mahonia aquifolium) has so far gone unnoticed. It is locally invasive, similarly to Virginia creeper (Parthenocissus spp.). Less dangerous, though important in terms of size of the area of their occurrence, are the Norther red oak (Quercus rubra), Austrian or black pine (Pinus nigra) and te Douglas fir (Pseudotsuga menziesii). In the following text we will mainly focus on the issue of the Black locust.

How to defeat the Black locust

Efforts to control the Black locust began soon after the establishment of the NP in the early 1990s and have been a great conservation challenge to this day. Like anyone else who has dealt with the woody plant, also we had initially believed that black locust can be 'overcome' by ordinary felling. It soon became clear that the invasive alien speciesforming dense stands of unpleasant shoots, requires a special approach.

During the past 20 years, various mechanical, chemical, biological and combined methods have been used. The most frequent method was felling and smearing the saw cut in autumn, followed by yearly shoot elimination by applying a leaf herbicide for several years. Despite its high effectiveness, the method poses the risk of affecting the surrounding with the spray: it not only leads to a possible threat to valuable vegetation, but also to exposure of the soil surface, which increases the chance that invasive alien species or other undesirable vegetation re-establish there.

In order to minimalize or completely ban herbicides in a valuable area, particularly the high-stump method followed by breaking off shoots over 3-5 years has been recently practised. In addition to high labour and time demands, the method is limited by the fact that it can only be applied at sites with sufficient shade, thus it is not recommended in black locust monocultures/plantations or at non-forest sites. Besides, a relatively high survival rate of the root system has been observed and black locusts creep by means of root shoots to surrounding clearings and ve-

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Distribution map of black locust in Podyjí NP. Compiled by Robert Stejskal and Jaroslav Willmann

Dead black locusts (after injections) on loess among a rich population of Alcea biennis in the undergrowth. © Robert Stejskal

getation gaps. In rainy years, seemingly dead stumps rejuvenate.

On valley slopes and in the Dyje/Thaya River floodplain, technically and physically demanding girdling, otherwise practically ineffective in non-forest habitats, has locally proved to feasible.

In some places sheep and goat grazing has suppressed the black locust on heathland, but it has resisted grazing pressure in dense thickets and extensively grazed margins. Nevertheless, grazing can be recommended as an ideal management tool at sites where black locust has been removed successfully, since it reliably eliminates germinating -

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These methods are a targeted treatment of invasive trees in which a herbicide is applied in a wound of the stem or trunk of each treated individual. The herbicide gets directly into the conductive tissues of the tree. If the treatment is performed correctly, the herbicide is distrib uted throughout the plant, stopping its growth until the plant dies off completely, moreover without forming unpleasant shoots. It is not enough to kill the above-ground part. The objective is to affect especially the root system, which is the brain of the plant. In practice, most often glyphosate preparations are used. The distinguished methods differ in the technique used and the trunk dimensions of the treated trees.

Basic method for the treatment of full-grown and middle-aged trees, in which the herbicide is applied into openings drilled at regular intervals on the circumference of the trunk

Method for the treatment of young trees with approximately 3-5 cm thick stems which are too thick to peel off the bark and too thin to drill effectively. This method can also be applied to thicker trees (trunks up to 15 cm in diameter) with thin bark.

Basic method for the treatment of young individuals with 2–3 cm thick stems. The herbicide is applied in places after the bark has been peeled off on half the circum ference of the stem.

- The methods allow regardful treatment of invasive trees of any size at the most valuable natural sites.
- They are especially intended for the treatment of small to medium-sized stands of invasive trees (single trees to a few hundred individuals).
- They are ideal in places where trees can be left to die gradually after treatment and the wood can be retained at the site temporarily or left to natural decay.
- They concentrate on killing mother plants while minimalising or completely eliminating shoot formation.

plants from the seed bank and sporadically appearing shoots. On a larger scale, grazing is unfortunately hindered by high technological and organisational demands.

Simply cutting shoots has shown to be completely inappropriate. Even after cutting for several years, the black locust not only remains, but rejuvenates even better when more is cut. Similarly, grubbing and digging up stumps or milling shoots were rejected. Just when the roots are disturbed, young shoots are formed in very high density.

In some stands we have relied on stand 'aging', i.e. leaving selected old black locust stands to natural decay. Unfortunately, when dead trees uproot, they start regenerating from the roots. Black locust thus does not even seem to recede in the competition of heliophobe sciophilous trees and shrubs, as is described by some authors (e.g. Vítková 2014), because even the smallest vegetation gap is enough for the successful rejuvenation.

Time for a change

Although the black locust has been successfully suppressed, comprehensive assessment has shown that removed stands not only regenerate, but also the number of new outbreaks rapidly increases. The exact data is not available, but the black locust is clearly spreading faster than we can control it applying the available management measures. Its spread is supported not only by human interventions but also by natural factors.

The Black locust spreads most often vegetatively when it is felled without using herbicides, either out of ignorance or in the naïve faith that shoots will later be eliminated by repeated cutting. A frequent problem is also insufficient management following up on deliberate felling. Black locust easily spreads when paths and tourist trails are maintained by shrub and tree cutting. A certain role maybe played by selective felling and tree theft.

The Black locust also finds good spreading conditions in oak forests where coppicing has been resumed. It occupies fresh clearings there, often together with the Tree of Heaven. Recently, it has been spreading considerably in pine stands which massively die as the result from long-term droughts. Uprooted pine trees damage admixed black locusts, which evokes a production of lots of shoots. The spread is also supported by roe deer shaking out their antlers. Black locusts girdled that way then rejuvenate vegetatively. In recent years, the spread of other invasive trees has also accelerated in a certain way, either as a result of climate change or by increasing populations of invasive alien trees, e.g. the Tree of Heaven, Box elder or Green ash, in the open landscape.

In an effort to change the negative trend, we have started to look for new ways to manage invasive alien woody plants. After a range of trials and errors made in efforts to eliminate them mechanically, we have come to the conclusion that effective black locust management requires the use of herbicides, which is a fact on which a broad group of professionals agree (e.g. Vítková & Sádlo 2018, Pergl et al. 2016, etc.). But can the herbicide also be used without the risk of damaging the natural environment?

We have found the answer in Hungary, where our colleagues have been dealing with the regulation of invasive woody plants for several decades. The results of their efforts can be seen not only in Hungarian national parks. but also in other protected areas. All methods used in Hungary are clearly summarised in the publication Practical Experiences in Invasive Alien Plant Control by Csiszár & Korda (2017). Exactly their elaborate measures, verified by extensive field experiments, have become the basis for our further activity.

What are targeted control methods?

After thorough checking and considering all details by conservationists, broad discussions with many foreign experts and professional internships just 'at the scene' in the Kiskunság NP, we concluded that the Hungarian methods of controlling invasive trees and shrubs are worth trying out, at least experimentally. Management successes achieved with applying these methods in other countries such as

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Slovakia, Italy, Cyprus and Israel were of great inspiration. The methods are also widespread in both parts of the American continent and in New Zealand.

The Hungarian methods are collectively referred to as targeted (direct) chemical control methods (TCCM). They basically are various modifications of herbicide injections directly into the invasive alien woody plant trunk, therefore combining a mechanical and a chemical treatment. Herbicide injections are not new to the Czech Republic. They have been known for decades and are included in the standard methodology Likvidace vybraných invazních druhů rostlin (Management of the Selected Alien Plant Species, Pergl et al. 2016). Here and there, injections were experimented with, but for unknown reasons the method has never been applied more and hardly any reports on practical experience in the Czech Republic have been published.

TCCM have been specially developed to control invasive alien plants at natural sites and in protected areas without negatively impacting sensitive habitats and non-targeted organisms, but their possible use is very universal in all types of the environment. TCCM eliminate the herbicide application on woody parts of a plant and exclude the spraying of its leaf surface because even very careful spraying affects the surroundings.

Why exactly targeted control methods

Regulation of the Black locust with common methods usually fails because we are not able to ensure regular suppression of shoots after the mother stand has been removed. After felling, the Black locust is able to rejuvenate at an exponential rate, particularly when no herbicide is used. We have always regarded the struggle with shoots a necessary evil. In practice it is strongly underestimated. Interventions (e.g. shoot cutting) usually have just a short-term effect and the original stand regenerates, only changing its form and age structure. The Hungarian experience therefore looked like incredible sci-fi to us, as black locust individuals really die off without later forming shoots (or with just minor rejuvenation) when correctly treated with TCCM.

(Acidophilous) thermophilous oak forests in Podyjí on valley slopes are habitats most endangered by black locust invasions. Besides former incidental exploitation, erosion and activity of wild animals contribute to this. © Robert Stejskal

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Another typical aspect of TCCM is leaving treated trees to die gradually or to complete decay. Such an approach is completely opposite to conventional methods, which include wood removal. Practice has shown that especially the retention of young and middle-aged individuals is without any problems. Dry thin black locust shoots disintegrate rather quickly and practically 'merge' with the habitat. Medium-sized trunks can be left at the site or removed when the trunks accumulate in places where this is not desired. Full-grown trees may pose a risk to the surrounding as they may eventually fall down. It is recommended to leave black locust trees in forests in case they occur singly or in small

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At several sites, overmature black locust stands disintegrate naturally. The trees do not die off, unfortunately, but regenerate successfully after uprooting. © Robert Stejskal

Podyjí NP has over 100 hectares of forest in which black locust predominates. These stands are mostly found at sites of former pastures. © Robert Stejskal

groups/clusters. TCCM are particularly ideal in the above situations. For extensive black locust growths, it is usually the best to remove the dead stand and replace it with a more valuable community. We follow the simple rule that the greater the risk of dry trees for the surrounding is, the sooner they must be removed or arboristically adjusted to a safe

torso. It is usually recommended to remove dead trees in the second season after treatment with TCCM. Close to paths and in other strongly exposed places, however, the trees must be removed earlier, but not before a clear effect of the applied herbicide appears, *i.e.* after complete defoliation of the treated trees, which occurs roughly a month

after application. We must however count with the formation of shoots and the need to adapt the follow-up management to that. The issue of retaining dying trees is very specific, requiring a separate article, so beware of simplified conclusions.

At first sight, it looks like treating each invasive tree individually is extremely laborious and slow. It is true that, mainly when dealing with high tree densities, in low-grade multi-stem stands or there where black locust grows in dense rose and bramble thickets, it is a time-consuming and physically demanding activity. However, considering that most trees die after a single treatment, combined with minimal or no shoot formation, this 'investment' pays off richly. Moreover, when comparing with the commonly used approach of smearing stumps after cutting and the subsequent several-year long spraying of shoots, TCCM are actually very fast and simple.

In my opinion, the most essential for conservationists is that thanks to target control we can afford to treat black locust trees growing directly among rare and endangered plants. In Podyjí NP, black locust often grows in valuable heathland habitats, on rock steppes and in species-rich dry grasslands, as well as in forest clearings, directly between tufts of Pulsatilla grandis, in Dictamnus albus populations and at orchid sites. In these situations, it is hard to imagine that black locust would be removed in the traditional way, i.e. by smearing the stumps after felling and subsequent spraying, which would devastate the site.

In conclusion, TCCM can be regarded a very powerful (but not almighty) instrument in the invasive alien woody plant control, applicable in almost every situation, not only in natural habitats. The first experience with applying these methods in the Podyjí/Thaya River NP has provided promising results. We can only try to pass the experience gained on to others interested in this issue. Following contributions will explore how the treatment of trees by means of TCCM is carried out, which equipment is needed, and what should be respected and taken into account during the procedure.

Water Retention in Urban Agglomerations

Jiří Karnecki

When mentioning the water retention, it mostly is related to water management in the open landscape. From a long-term point of view, a lot of issues should be improved and enhanced there, but water can be very well managed also in urban agglomerations. Historically, the priority in

towns and cities had been to safely and as soon as possible drain off water from there. The efforts, of course, resulted in significant interventions into watercourse beds and consequently in adjacent floodplains, thus influencing the water regime.

The Čihadla dry polder restoration. ©Jiří Karnecki

Historical views

In Prague, an increasing in watercourse capacity (increase in cross-section of the flow) had been implemented as soon as in the 19th century, when particularly lower stretches of the Rokytka, Botič, Daleje or Motol Brooks, *i.e.* the biggest Prague brooks, were closed into riverbank walls and sometimes they totally disappeared under ground. The main reason for these activities was to protect adjacent built-up areas against floods and to gain new land to be built-up. Other new increasing in the wa-

tercourse capacity was carried out in connection with housing estate building in the mid-20th century. On the other hand, due to the building the prefab housing estates many water retention reservoirs collecting water from paved surfaces were established in Prague. At present, such project has not been unfeasible. Filling brook and river floodplains with everything what had not been needed in the city, from building rubble and construction waste up to boiler ash from a heating plant, was another important shortcoming. Thus, many sites/areas where water could harmlessly spill over and do not harm the city were lost.

Brooks for life

The current view of water retention in towns or cities is completely different. Starting with obligations of building owners to infiltrate or retain rainfall water and only consequently to drain off it to watercourses (the obligations is directly pursuant to the Prague building regulations which are binding for every building owner) to extensive restoration of brooks and their floodplains. Due to the long--term Brooks for Life project implemented across the whole Prague's territory and aiming at brook restoration in the city, some society-wide demand for water ecosystem restoration has been created in Prague. Citizens begun to consider water as a city's integrated part and space with high aesthetic value, at the same time suitable for rest and restoration.

Although the Brooks for Life project was launched in 2005, its beginning can be dated back to the late 1990s. At that time, the Capital City of Prague became a managing authority of some small watercourses which had previously been in charge of the Prague Sewerage and Watercourses, state enterprise. The new manager immediately commissioned some big restoration studies, e.g. those on the Litovice-Šárka Brook in Liboc and Ruzyně city quarters, Nebušice Brook, Řepy Brook, etc. Despite the fact that the approach was guite revolutionary (even if the individual solutions were con-

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form to the time) the projects were due to huge extent and unfinished property rights doomed. Moreover, after some years, some individual partial stretches have been successfully implemented, but with completely different concept.

The beginning of new millennium was a substantial milestone because the team dealing with the issue and led by Tomáš Just participated in some field excursions to water ecosystem restoration projects in Bavaria. The participants were amazed at the simplicity, naturalness and ideas of the projects carried out there. It was clear that in Bohemia and particularly in Prague there it had a lot of catching up to do.

First projects

To avoid mistakes made by the predecessors proposing indiscussable projects, the team first of all selected a suitable area/site owned by the Capital City of Prague which could be relatively easily restored. The Čihadla dry polder covering 19 hectares where three brooks, namely the Rokytka, Hostavice and Svépravice ones, were straightened and channelized in the 1980s seemed to be ideal. The project documentation was elaborated by the Ekotechnik Inženýring Company Ltd. and in 2008, the building was made with support from the European Union's funds. The finished building has been appreciated by the general public and experts, presented on some expert conferences and workshops and visited by many excursions. Just as a matter of interest, the project has been living and in addition to building new pools for amphibians every year, other three small water reservoirs have been established there, the Svépravice Brook restoration has been prolonged, inert waste made-up ground with a dog-training grounds was eradicated and nature-based management on meadows including cattle grazing has been introduced there.

The other important project was opening the arched Litovice-Šárka Brook bed along the Hvězda/Star game-keeping preserve in 2010. The brook was arched in relation to building the Džbán/Jug water

Launching the Litovice-Šárka Brook near the Hvězda/Star game-keeping preserve. ©Jiří Karnecki

The Rokytka Brook restoration below the Čihadla site. ©Jiří Karnecki

reservoir used for recreation. The reason officially presented for the bottomless arch culvert was improving water quality and elimination of contamination/pollution sources. It was just one of the fragments from the project commissioned as early as in the 1990s which had been negotiated

more than ten years. For the first time in Prague, heavy stone-packing from boulders weighing up to 500 kilograms was applied there. Therefore, just shortly before starting the project, there was an indignation levelled against the project among local people. Finally, they were

Building the Řepy Brook bed. ©Jiří Karnecki

convinced by the finished building itself. Due to high costs, accounting for CZK 10 million (EUR 390,000.00), of them most were spent for demolition of huge concrete constructions, a study on the return of investments of the project from a point of view of ecosystem services was commissioned. The results showed that due to climate change mitigation and adaptation. the return was 9.5 years.

The success of both the projects stimulated another more extensive action, this time again on the Litovice-Šárka Brook. Three abandoned historical meadows, namely at Žežulka, Zlatnice and Jenerálka owned by the Capital City of Prague which had been overgrown by reed and self-seeding vegetation were chosen in the Šárka Valley. In addition, the brook had been shifted to a valley margin and straightened followed a road there. In 2013, the brook was successfully brought back into the floodplain meadows. Thanks to this action, many remarkable and specially protected wild plant and animal species which had been surviving there were saved. Currently, due to the restoration and consequent management they have spreading across the site. The Common frog (Rana temporaria) is a flagship species there: thanks to a set of pools at Jenerálka, its vanishing population was saved and at present, up to some hundreds of individuals have been reproducing at the site.

Restoration on the Rokvtka Brook – An outdoor classroom

Extensive restoration of the Rokvtka Brook from the Kyje to Vysočany city quarters iust displays a natural classroom of water ecosystem restoration. On the five-kilometre- long stretch, bringing a meandering brook back into a floodplain meadow, stretches reinforced by stone-packing, one-side broadening of the bed, boulder slides, stone built-ins to split the bed, dead wood application, pools and walls for kingfishers can be seen. The last addition is an increasing in the Rokytka Brook capacity in the Kyje city quarter where a part of land plots had been purchased from private owners and an ecological narrow terrace up to 10 meters wide for directing flood flows was built. The Rokytka Brook itself was divided and stabilized by the stone-packing.

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Thanks to presenting the Rokytka Brook restoration, awareness of stone-packing as a suitable nature-based solution in stabilizing watercourse beds has been raised. Similarly to the Čihadla dry polder restoration, all the projects have been continuing and further stages of these restoration actions have been under preparation.

Restoration of vanished brooks

Within the Brooks for Life project, attention was paid to the Řepy Brooks. I the 1950s, there had still been some fishponds fed by the Řepy Brook in the Řepy city guarter. Due to building development, fishponds were step-by-step conversed and the brook itself vanished. Therefore, the only fishpond called Prasečák/Hog Pen and a small part of the brook's dried bed near the fishpond remembering that once there was a brook there left by the 21st century there.

Efforts to bring the brook back dated back to the 1990s and among Prague watercourse restorations, this is the most lasting one. In 2014, the last acceptances had been finally gained and the project's implementation could begin. The adjacent Hliník Lake has become a water source. Getting over a railroad and a road by controlled boreholes below them was a piece of cake compared to building a new open bed. The project clearly demonstrated the difficulties related to building a new brook in an urban area. Below approx. 0.5 m soil laver a concrete slab had been found: thus, building a new bed resembled more building a pavement than a brook. Therefore, the concrete slab had to be put away and an excavation was filled by clayey soil; only in such prepared corridor a new bed of the Řepy Brook could be ditched. Now, the area has become overgrown by vegetation, refreshing the nearby Řepy housing estate.

In 2017, another bringing back a vanished brook was implemented on the Brusnice Brook in a green strip along Patočka Street where the brook had been historically piped. It was a 900-meter-long stretch where an open bed accounted for 620 me-

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ters. Based on the experience raised during the Repy Brook restoration, possible occurrence of landfills and waste disposal sites had been expected there. Thus, a bed sealed with a clay layer and protected by a gravel riprap was proposed from the project's very beginning. Moreover, at the beginning of excavation works unknown heat line and water supply and piping were discovered there: later it was found that both the facilities have been defunct, so they could be abolished. Consequently, activities followed the project's plan and at present the Brusnice Brook water has been flowing through a new open bed.

The author's experience confirmed that building new brook beds in a built-up area is guite complicated and the fact should be in advance taken into account. At least it is necessary to consider larger or smaller sealing of the beds because the terrain in a built-up has been modified so that there could be historical landfills and waste disposal sites which are mostly well permeable: therefore, brook water can be disappearing. Crossing the underground utilities and services which are often built in various depths could also make difficulties: the fact should be reported by land plot manager. Nevertheless, most of these difficulties can be solved. Thus, there should be no worries to bring water back to the surface and near it to citizens.

Current restoration

The Říčanka Brook near the municipality of Lítožnice had long ago lost its natu-

The Říčanka Brook and its floodplain below the Litožnice Fishpond. ©Jiří Karnecki

ral character. Maps drawn in 1848 show that the bed was guite straightened. The brook modifications could be related to building the original Lítožnice Fishpond or with the necessary use of farmland in the brook's floodplain.

In the 1960s, the brook was channelized by wood small fences because in the past such a measure was considered as close-to-nature channelizing: nowadays, we should not be satisfied with this. The stabilization possibly be done in relation to amelioration of adjacent plots of land.

Within the Landscaping the confluence of the Rokytka and Říčanka Brooks project, the whole Říčanka stretch on the lands owned by the Capital City of Prague was proposed to be restored. The brook near a fishpond left its original bed and for the restoration, the whole brook's floodplain was used. The length of the new bed accounts for 1,075 and the brook was lengthened by 300 meters. The new meandering bed was supplemented by a set of larger and smaller pools in total covering 5,980 m² and retaining 2,169 m³ of water. In a pool, a bank was shaped so that a vertical wall for kingfishers was created. Wade stretches were stabilized by a stone riprap and trees which had had to be fallen down were used as dead wood both in the brook and the pools. The original brook bed was – except one site where a pool was created - filled. Because the floodplain had been in the past used as arable land. the whole area was sown by a grass mixture of herb-rich meadows. Two wades from stone-packing and two ceiling pedestrian bridges were also built there.

In this case, the author had a fiddle with numbers. In addition to making the brook bed longer and creating a system of pools, he compared the water volume in the original bed during a ordinary flow and that in the restored bed. In the latter, 2.5 times more water than in the former is captured. Thus, this is a clear indicator on necessity and suitability of water ecosystem restoration projects.

Conclusions

Due to the increasing number of watercourses restored, the awareness of water ecosystem restoration among the general public has been significantly raised and Prague citizens can enjoy themselves the benefits provided by the restoration. In other words, they can physically touch the water. Thus, in Prague, there has been the society-wide demand for water ecosystem restoration and some hundreds of meters of watercourse beds are restored each year and new projects have been becoming more and more ambitious. Inter alia, extensive restoration of the Rokytka and Běchovice Brooks as well as connecting the Berounka River and the Krňák cut-off meander at the Lipence city quarter have been under preparation.

For more detail on the water ecosystem restoration projects in Prague, see www.praha-priroda.cz.

Adaptive Management in Specially Protected Areas Implemented by the Nature Conservation Agency of the Czech Republic

Pavel Pešout, Eva Knižátková

In the Czech Republic, Specially Protected Area¹ management has been one of the most important tasks of the State Nature Conservancy since the 1990s. Due to improving the knowledge of species and natural habitat distribution and their development as well as increasing uncertainty caused by incomplete knowledge of impacts resulted from extensive anthropogenic land-use changes and current and predicted climate change, a traditional long-term planned blueprint management has been untenable. Therefore, the Nature Conservation Agency of the Czech Republic (NCA CR) decided to apply in practice adaptive management (AM) and to introduce necessary information and economic tools for its implementation.

Why we establish protected areas?

Since the beginning, a main motive for territorial protection has been effort to provide valuable and extraordinary natural or semi-natural sites with an effective protection against destruction or damage, either by mining, building-up, intensive grazing or anthropogenic disturbance, so that they will be maintained also for future generations. Moreover,

it has step-by-step been becoming clear that just establishing a protected area is mostly not enough. For keeping quality, patterns and diversity of protected areas, it is necessary to apply other measures aiming at preserving or as the case may be at improving the state of the subject of the protection/ conservation. The subject of the protection/conservation concept as having been applied nowa-

In the Lednické rybíky/Lednice Fishponds National Nature Reserve (South Moravia), the Nature Conservation Agency of the Czech Republic has been implementing adaptive management. © Jan Miklín

days was born from the necessity to in a reasonable way sort and unambiguously name what is the most important for the State Nature Conservancy at the respective site/area. In newly declared protected areas, particularly in the European Union's Natura 2000 network of protected areas, the subject of the protection/conservation has been defined in a declaring regulation. Nevertheless, such an explicit legislative embedding can be missing.

Habitats/ecosystems having been protected. including all their natural components, are preferably identified as the subjects of the protection/conservation. If herb-rich beech forest is the subject of the protection/conservation, not only the phytosociological aspect is taken into account: the subject of the protection/conservation also includes animals and fungi, because their presence is considered as a habitat quality indicator, thus metaphorically also indicating protection, conservation and management quality. The particular species as the explicitly expressed subject of the protection/conservation is usually highlighted, only if its importance from a point of view of the particular site/area is higher than that of the ecosystem and if the species requires the specific measures and attention above and beyond management of the respective ecosystem. Thus, it would be an umbrella species representing by its habitat requirements and selection the biotic community/assemblage as a whole. For the subjects of the protection/conservation,

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long-term goals and consecutive steps to reach them are set in planning documentation for the individual sites/areas. The Specially Protected Area network as a whole aims to contribute to halt biodiversity decline and loss in the Czech Republic.

Current Management Planning

At present, Specially Protected Area management is based on a Management Plan elaborated and approved usually for ten years. Before the plan is produced, the subject of the protection/conservation within the respective Specially Protected Area has been assessed including assessment of the previous management and other information on stressing drivers/forces or external risks. The Management Plan's author tries to take into account the results gathered. Inclusion of Management Plans into Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, was a progressive tool closely connected with former protected area planning and health-checking (Knížetová et al. 1987).

Moreover, it has recently been more and more evident that the above tool has to be modified. The NCA CR only produces more than 80 Management Plans annually, thus involving a lot of human and material resources: the same is in the case of discussing and negotiating Management Plans with appropriate stakeholders and approving them. Because they are consequently used marginally, the efforts to produce them is to a large extent wasted. There are some reasons for the above fact.

Small-size Specially Protected Area Management Plans are static detailed documents whose changes require quite high administrative efforts. Small-size Specially Protected Area Management Plan outline (MoE CR 2019a) is the same for all the subjects of the protection/conservation and includes some repeated parts of the content (Knotek 2019). For a significant proportion of the Small-size Specially Protected Area's subjects of the protection/ conservation, ten years is a long time, since it is necessary to flexibly react to changes within the site/area. On the other hand, in other, e.g. geomorphological or geological phenomena, it is not necessary to rewrite always the same each decade.

In the case of Protected Landscape Area (PLA) Management Plans there is the completely different situation, because although these are elaborated also for ten years and they include nature conservation goals and management principles (MoE CR

Without high-quality information on the state of the subject of the protection/conservation it is not possible to effectively implement territorial protection. A significant part of the knowledge gathering is provided by the Nature Conservation Agency of the Czech Republic's staff itself: the picture presents bird monitoring in the Lednické rybíky/Lednice Fishponds National Nature Reserve (South Moravia). © Jan Miklín

2019b), their management authorities, i.e. PLA administrations, are in charge of setting management objectives and particular measures. Therefore, as compared with the Small-size Specially Protected Area Management Plans which contain description of management up to the individual partial patches. the former would be more flexible. Anyhow, a missing part of the adaptive management cycle should be completed there. A significant proportion of resources (human, financial or institutional ones) allocated for management of all the areas, having been in charge of the NCA CR is spent by the differentiated PLA management. Thus, it is necessary to continuously assess whether they are spent effectively, i.e. for priority measures, and whether nature conservation goals have been met, therefore whether management objectives have been correctly set and whether they have been achieved.

What is adaptive management?

As a response to high biological system dynamics, a huge range of uncertainty and nonsufficient knowledge of external factors, adaptive management (AM) was developed by C.S. Holling and C. Walters as a system to assess and manage natural resource exploitation as soon as in the 1970s (Holling 1978, Walters & Hilborn 1978). The AM is a never-ending cycle or a helix in the respective

Specially Protected Area management: it substantially is based on an iterative decision-making, *i.e.* evaluating results and outputs of the given protected area management including measurements having been applied in the field and adjusting actions on the basis of what has been learned (cf. Fig. 1). Therefore, it can be characterized as a process of repeated and permanent assessment of lessons learnt that takes into account changing ecological. social and political conditions. Contrary to the traditional blueprint management. AM is a permanent process that incorporates the outputs of previous measures, allowing to react in time and flexibly to ecosystem changes. In other words, contrary to blanket management, it is a structured, iterative process of optimal decision making in the face of uncertainty or a quasi-experiment, flexible "learning by doing" or an intentional approach to making decisions and adjustments in response to new information and changes in context.

At the same time, AM does not mean a continuous improvisation: it is an approach which simultaneously uses conservation planning methods including scenario analysis (Plesník 2010a, 2010b). Recently, the AM has been related to supporting ecosystems in providing services to humans (Birgé et al. 2016).

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The AM applies knowledge gathered from formalized processes, e.g. outputs of regular monitoring or external random findings, as well as from results of intentional controlled experiments. According to presence of the methods, active AM (AAM) and passive AM (PAM) can be distinguish (Walters & Holling, Rist et al. 2012). In the Czech Republic, mostly PAM, i.e. a set of measures based on the best knowledge available, modelling and predictions, has been currently applied in Specially Protected Area management. These measures are updated and amended according to the improved and enhanced knowledge and experience. Moreover, there are dynamic ecosystems where the AAM has been in fact involved by the NCA CR (cf. Fig. 2).

Newly, the NCA CR aims at not linking the knowledge of Small-size Specially Protected Area management with the period of updating and amending their Management Plans, but at setting it as a continuous and permanent process. For that purpose, it is necessary to develop adequate information tools. While there was a lack of such knowledge in nature conservation, nowadays a lot of useful information which can be applied in practice and of comprehensive datasets has been available. The NCA CR's intention is to use its own intentionally gathered data, to identify relevant external information sources and to involve them into continuous assessment of the state in the subjects of the protection/conservation and fulfilling nature conservation and landscape protection goals. The permanently updated knowledge is a precondition for in time initiating changes in the management objectives. consequently also in particular measures in the field.

Management planning has been a basis of the AM cycle. In a Management Plan, long-term goals in the respective small-size Specially Protected Area have to be defined and also prioritized, or to set a process for their prioritization. The recent management plan outline (MoE CR 2019a) constitutes the cornerstone of such approach, when newly strongly highlighting definition of goals for the individual subject of protection/conservation and setting indicators; the latter will help to monitor reaching the goals².

To meet the long-term nature conservation goals set for the individual subjects of the protection/conservation within the respective small-size Specially Protected Area, management objectives should be defined: contrary to the long-term nature conservation goals, the objectives can be flexibly changed ac-

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Fig. 1 Adaptive management (AM) cycle in the Specially Protected Areas in the Czech Republic

Setting long-term nature conservation goals for each subject of the Specially Protected Area management and indicators on their fulfilment is a basis of the applied AM there. The goals are most often defined as preserving or improving of some habitat size or quality, state in populations of the targeted species, etc. For fulfilment of the long-term goals, it is furthermore necessary to specify the management objectives using the best knowledge available. The latter define the state of the environment (conditions necessary to preserve the subjects of the protection/conservation) caused by the given management. Indicators allowing to assess fulfilment of the management objectives, the so-called management indicators, are also set. The data is a part of the nature conservation planning phase. The next phase is the implementing one, covering elaboration of the particular way of the implementation and the implementation itself, either as conservation measures in the field or within the public administration performance. A key element within the AM cycle is the monitoring phase and particularly assessment of the data gathered in relation to the in advance defined indicators. The assessment together with the outputs of the targeted experiments is directly applied in possible changes or modifications of the decisions on management at all its levels, i.e. annual ones on modification of the implementation phase, ongoing on enhancing setting the management objectives or indicators and in the case of fundamental findings exceptionally on long-term nature conservation goals. Elaborated by Pavel Pešout, Eva Knižátková & Tomáš Pekárek

Fig. 2 The adaptive management cycle in the Lednické rybíky/Lednice Fishponds National Nature Reserve (South Moravia) presented on the example of two long-term nature conservation goals and of the elaborated management objectives of one of the goals. Elaborated by Pavel Pešout, Eva Knižátková & Tomáš Pekárek

cording to assessment of monitoring the state of the subjects of the protection/conservation. Based on the management objectives, the particular activities in the field shall be consequently proposed.

Prioritization in nature conservation and landscape protection³ must be carried out and also carries out at all levels where decision on using available resources for nature conservation, particularly financial, human and institutional ones, but recently

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more and more contractor's capacities, is made. Also at the lowest decision-making level, *i.e.* at the level of the single particular small-size Specially Protected Area with more subject of the protection/conservation, it is necessary to develop a appropriate procedure for setting priorities. While at the national level, natural resource exploitation by humans has been driven particularly by priorities given in governmental strategic and policy documents, in the case of the particular small-size

Specially Protected Area especially knowledge of how the individual parts of the site/area contribute to meet the nature conservation goals, are taken into account. The prioritization should furthermore include the level of urgency of the measures (whether the particular is deferrable or non-deferrable), the expected effects, resources having been spent at the particular site/area (possible impairment of investments) or possible alternative solutions.

For ongoing AM's applications within the small--size Specially Protected Areas it is necessary to shift to digital Management Plans, thus supporting their possible linkage with information tools incorporating the recent knowledge into decision-making and in the future replacing usual periodical updating by permanent validity with updating if appropriate. Periodical checks can be, of course, kept. Side, but non-negligible effect of the digitalization is reducing their elaborateness, when only the part requiring improving due to new findings and knowledge is updated

For PLAs, the NCA CR has been geo-differentially delineating areas of the field measures and has been annually prioritizing their implementation according to finances available. For the sites, nature conservation goals and management objectives are going to be defined and their fulfilment shall be systematically assessed. In this respect, the management plan for the Krkonoše/Giant Mts. grassland/meadow sites (Hošek & Janata 2017) can provide a suitable inspiration.

Changes in Conservation Measures Implementation in Practice

Already now, when implementing conservation measures in the field, the respective Specially Protected Area's manager seeks in the absolute majority of cases for involving the current knowledge. Difficulties emerge when there is no support for the necessary measure in the valid Management Plan, or even if the Management Plan goes against the measure. Within the AM, taking new knowledge, findings and experience into account shall be on the contrary a fully standard and common procedure. Decision should be made by the staff responsible for the particular Specially Protected Area management who well knows the site/area.

Particularly when responding to climate change impacts and permanent changes in land-use caused by humans it shall be necessary to allow to imple-

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ment to a very large extent and a lot more than now alternative and experimental measures in the Specially Protected Area management. It has to be, of course, a managed and controlled procedure which at the beginning presents reasons why the experimental procedure should be applied, namely which information is wanted, as well as the description how the outputs from the experiment shall influence future decision-making in the particular Specially Protected Area or commonly applied measures.

For supporting the measures implemented within the AM framework, it is necessary to review and newly set some parameters and conditions in subvention programmes/subsidy schemes.

Cooperation with stakeholders within AM

At present, Management Plans are negotiated with important land owners and managers every ten years. Moreover, seeking for more flexibility in Specially Protected Areas planning and management, particularly in decision-making on priorities, extent and implementation of measures in the field, must not reduce the cooperation. On the contrary, land owners and managers have to be involved continuously in planning, so that the consequent decisions on changes in the particular Specially Protected Areas will be understandable to them. This would not make difficulties, because nowadays each nature conservation measure or intervention has been negotiated with each land owner/manager. On average, in one third of the cases, namely in 33.2% in 2019, the NCA CR concludes a public contract with land owners and tenants on providing management measures by them and the proportion has been continuously increasing. In addition, there have been more and comprehensive contracts on management with owners which directly set such a bilateral communication (Pešout & Šmídová 2012).

Adaptive management risks

When considering a shift to continuously applied AM we should be aware of the related risks (Walters 2007). The AM is subject to huge requirements on expertise and knowledge in decision--making. On one hand, a Specially Protected Area manager is provided with higher competence, on the other hand it means higher responsibility for him. The above fact can be related to the risk of higher possibility to make a bad decision under inadequate competence, but also to the unwillingness of Specially Protected Area managers to take

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For preserving the subject of the protection/conservation in the Lednické rybíky/Lednice Fishponds National Nature Reserve fishpond management is needed. For fulfilling the management objectives, the Nature Conservation Agency of the Czech Republic concludes long-term leasing/rental contracts setting the conditions and commitments to meet the management objectives measured by key performance indicators, e.g. water clarity or transparency and the state of macrophytes and zooplankton. © Vlastimil Sajfrt

responsibility. Lack of resources for monitoring the management, particularly under more extensive range in applying alternative and experimental approaches, processes and procedures, poses another risk. In addition, AM places exact higher demands on expert/technical knowledge of executives and managers during the decision-making procedure in promoting the AM's whole cycle.

By the year of 2027

For implementing full-fledged continuously applied AM, the NCA CR has developed and has been implementing some complementary projects.

Without high-guality up-to-date information on the occurrence and state of the selected species in Specially Protected Areas, AM cannot be carried out. Gathering such information is a part of the project entitled as Monitoring and Mapping of the Selected Wild Plant and Animal Species and Inventory of Small-size Specially Protected Areas in Nationally Important Sites/Areas in the Czech Republic funded by the Operational Programme "Environment" (OPE) financed from the European Union's budget and co-financed from national sources.

In one of its key activities, the Planning Documentation for the Selected Sites/Areas of National Im*portance* project, also supported from the OPE aims at assessing fulfilment the nature conservation goals at the Sites of European Importance (pursuant to Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, the term for Site of Community Importance, SCI under the European Union's Habitats Directive), whereas it focuses on assessing the state of the subjects of the protection/conservation in relation to affecting factors or drivers and implemented management. The data gathered will be used both to improve future management in the field and to make possible changes in the planning documentation, if appropriate

Although the NCA CR has currently had a lot of high-guality background information sources in relatively user-friendly environments of electronic tools (e.g. the Nature Conservancy Species Occurrence Finding Data Database. National Habitat Mapping Layer, database on implemented management measures funded from landscape management subvention programmes/subsidy schemes and many others) there are data sources and processes which have not been linked with the former: therefore, taking into account the latter in decision-making has been excessively time-consuming. The Unified Information Nature Conservation System of the Czech Republic – a Tool for Supporting Assessment of the State of Protected Areas and Protected Species project, abbreviated as ISOP 2 has also been funded from the OPE and its target is digitalization of some important processes, e.g. the above Management Plans elaboration digitalization that would consequently strongly facilitate

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Most activities necessary for applying AM in practice 🔰 a full understanding and a mutual consensus on the have been implemented by the Nature Conservation long-term management on their land are among the Agency of the Czech Republic (NCA CR) as well as by other State Nature Conservancy authorities. Moreover, something has still be missing for the functionally interlinkage among the individual components of the AM cycle and for setting such innovation into motion. The integrated LIFE project One Nature aims shall be implemented at all the sites. Nevertheless, ing the above element

e capacity development. Therefore, in addition to developing practical tools within the project, tected Areas in the Czech Republic. education of the State Nature Conservancy staff has become an integral part of the project. Thus, not only the NCA CR´s staff, but also colleagues from Rec Authorities, Military Training Area Offices and National Park Administrations shall be offered to participate in the education and training courses.

It is well known that nature conservation is not all that one and only player influencing viability of specially protected species populations and the state of habitats. Consequently, when assessing the manaement we shall take into account, if the available data allows that, also external factors/drivers, e.g. climate change or atmospheric nitrogen depos Significantly, the project also includes more intensive communication with land owners and managers. Their activity (or on the other hand, inactivity) substantially influences the Specially Protected Areas future direction. Thus, establishing new relations to these partners and maintaining old ones, raising their awareness of nature conservation and reaching

their application in annual considering priorities in implementation of nature conservation measures in the field and introducing supporting and subsidiary tools for mostly missing monitoring the state and assessment of the particular sites/areas.

Finally, the Integrated LIFE project One Nature (LIFE-IP: N2K Revisited - LIFE17 IPE/CZ/00000) develops a lot of processes and relations which are essential for introducing the effective AM. In the AM's context, it is particularly important that the project pays attention to assessing the state of the subjects of the protection/conservation at the sites/areas, management having been implemented, active management prioritization, experimental management, involving knowledge into planning documentation and into negotiations on management measures with land owners and managers (for more details, see Box up).

important project's goals

The project primarily deals with the EU Natura 2000 network sites managed by the NCA CR, moreove some activities, e.g. monitoring and assessing the state of the subjects of the protection/conservation the project's goals also include transfer all the tool Applying AM in practice cannot be possible without made and know-how gathered and learned to all sites/areas within a national network of Specially Pro-

> Benefits provided by the EU Natura 2000 network sites and natural ecosystems in total to human well-being shall be assessed during the course of the project, too. The topic will be more elabora ted by a special article to be published in some of next Ochrana přírodv/Nature Conservation Journa

> The project is scheduled from 2019 to the end of 2026 and the Ministry of the Environment of the Czech Republic is its coordinating body. In addition to the NCA CR. the Charles University Envi ronment Centre Prague, Global Change Research nstitute (Czech Globe) of the Czech Academy of Sciences Brno and the SoWa (Soil and Water) Research Infrastructure, a part of the Biology Centre the Czech Academy of Sciences České Buděiovice have also been participating in the project. Furthe information is available on the project's webpage www.jednapriroda.cz.

> > (Elaborated by Iva Höniaová & Zdeněk Brož)

After implementation of the above projects, management of most of the small-size Specially Protected Area in charge of the NCA CR shall be carried out as the continuously updated AAM.

What is a main benefit?

An AM successful introduction in the Specially Protected Areas managed by the NCA CR is conditioned by facilitating use of many results gathered during biodiversity monitoring provided by the NCA CR as well as of a huge range of external data and findings. It will allow taking the current knowledge into account within the operational decision-making on setting or changing management objectives, choice of the particular nature conservation measures as well as within public administration performance. At the same time, the conservative traditional approach has been main-

tained in changes in the long-term nature conservation goals set for the individual subjects of the protection/conservation within the respective Specially Protected Area. Well-set AM supported by fully built information tools and modified economic tools would significantly reduce routine activities of Specially Protected Area managers and conversely guarantee early knowing the state of implementing the management indicators and longterm nature conservation objective indicators. Moreover, all automatized and standardized processes do not reduce individual decision-making of Specially Protected Area managers. Nevertheless, the AM success will depend on their correct interpretation of the current knowledge, assessment long-term development in the subjects of the protection/conservation and on experience.

Notes:

¹Pursuant to Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, in the Czech Republic Specially Protected Areas are areas which are highly important or unique from the point of view of natural science or from the aesthetic point of view. There are six categories of Specially Protected Areas (in brackets number as of April 30, 2021): National Parks (4), Protected Landscape Area (26), National Nature Reserves (111). National Nature Monuments (125). Nature Reserves (814) and Nature Monuments (1.591). National Parks (NPs) and Protected Landscape Areas /PLAs)are considered to be large-size Specially Protected Areas and they can include small-size Specially Protected Areas, i.e. the other categories which are also located outside the NPs and PLAs. PLAs are managed by their administrations which are a part of the Nature Conservation Agency of the Czech Republic. The NCA CR also manages National Nature Reserves and National Natural Monuments (they are at least of national importance) outside the National Parks. In total, the Specially Protected Areas cover 16.7% of the Czech Republic's territory.

²The authors are going to deal with elaboration of small-size Specially Protected Area Management Plans in some of next Ochrana přírody/Nature Conservation Journal issues.

³A new discipline – conservation planning – aims at setting priorities in species, territorial and ecosystem protection/conservation/management (Margules & Pressey 2000, Pressey 2004, Hurford 2017).

Assessing Clogging the Dobroměřice Fishpond by Sediments

Josef Krása, Tomáš Dostál, Miroslav Bauer

Particularly in farmland, there are consequences of erosion and soil transportation into watercourses and further to fishponds and water reservoirs. How to correctly assess the current state of a river basin/ catchment areas and of a reservoir and to identify the sources of pollution? Therefore, for proposing appropriate conservation measures both in the landscape and directly on watercourses, mathematical model-

ling can be successfully combined with Geographic Information Systems (GIS), remote sensing and photogrammetry.

When surveying a site, archive data of aerial photography it is a good resource, and Unmanned Aerial Vehicles (UAVs) or drones are useful, both for making overview images and for photogrammetric processing of a ortophotomaps, or of a detailed surface model

Figure 1: The Dobroměřice Fishpondand its catchment area with Oblík Hill (509 m a.s.l.) on the horizon. © Josef Krása

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Description of the area and basic characteristics

The Dobroměřice Fishond (Fig. 1) is a unique water body with extensive littoral vegetation within the dry steppe part of the Lounské středohoří/Louny Uplands. In terms of aquatic and semi-aquatic vertebrates, it is one of the most valuable areas in the whole České středohoří/Bohemian Uplands Protected Landscape Area (PLA). In addition, it is a very important nesting site for waterfowl, with a number of rare species associated with riparian areas with shallow submerged vegetation offering sufficient food and nesting availability. It is an equally important site as a stopover during spring and autumn migration for birds (long-term capture site), again mainly due to its location and the absence of similar sites in the wider region.

According to the 2015-2024 Management Plan for the České středohoří/Bohemian Uplands PLA, the Dobroměřický rybník site is proposed to be declare as a new Specially Protected Area, mainly due to its extremely high natural science value. A very important factor in the site's quality is the low fish stock. For further negotiations with the entities concerned, it is necessary to know the degree of siltation and sediment movement sediment into the site. These findings will be a necessary background for the NCA CR to outline a longer-term proposal for management of the entire site and protection of its species richness.

The subject of the study is mapping sediments in the fishpond, determining the rate of clogging with regard to erosion and transport processes in the catchment area, and identifying sources of surface pollution from erosion processes. The fishpond is within the property of Rybářství Třeboň/Třeboň Fishery Hld. Plc, to whom Rybářství Mariánské Lázně/Marienbad Fishery Ltd. leases the pond as a fry or nursery fishpond, not as a main or production/harvest pond.

The Dobroměřice Fishpond catchment area is located in the District of Louny, extends into the cadastral areas of Dobroměřice, Nečichy, Raná u Loun, and Chraberce, covering a total of 906.5 ha. Farmland occupies a total of 678 ha, *i.e.* almost 75% of the catchment area. The vast majority of the remaining land consists of forest and scrub on peaks on the catchment area watershed. Thanks to its fertile soil and favourable climate, the entire area has long been intensively used for agriculture.

As far as agricultural land is concerned, arable land currently (2019) covers 544.65 ha (80% of Agricultural Land Resources) and consists of 65 plots, according to the Land Parcel Information System (LPIS) records. Permanent grasslands occupy 117.7 ha, vineyards 2.12 ha, orchards 1.62 ha, and there are about 12 ha of gardens around the built-up area (Fig. 2).

Although these are not particularly steep areas, the manifestations of excessive erosion processes and subsequent damaged and washed away soils are clearly visible from aerial photographs (Fig. 3). The vast majority of soils in the Dobroměřice Fishpond catchment area can be characterized as non-structural, fine-grained, and not very cohesive. Such soils are difficult to cultivate, but very fertile for agricultural production. However, from an erosion point of view, it is a very dangerous material because such soils usually have very low permeability, but at the same time they are easily leached.

Current state of the Dobroměřický rybník and its catchment area

According to available map data, the Dobroměřice Fishpond catchment area has been intensively used for agriculture since time immemorial. Throughout the period for which relevant map data are available (more than 200 vears), land use has remain approximately the same and it is clear that the proportion of forest and grassland has not been higher in the past than today.

Figure 2: Proportion of the main land-use categories

The situation around the development of Dobroměřice Fishpond itself is surprisingly dynamic. As documented by the historical maps and aerial photographs below (Fig. 4), the fishpond had been there at least before 1850 (in approx. its current dimensions). However, 1937 images show that the floodplain was drained and the area was used as agricultural land. Soon after that (documented by a picture from 1952), the area was re-wetted and economic use limited or even excluded – the area is wet and lving fallow

Figure 3: The north-east part of the catchment area, washed-out soils and the character of the tributary bed. © Josef Krása

nberg

Explanatory notes

----- Drainage divide

Rother Berg

Subsequently, even before 1989, the fishpond is again mentioned on the map as a free water surface, which has been gradually getting smaller in the last 20 years due to the growing littoral zone and the influence of infill by sedimentation.

The Dobroměřice Fishpond itself currently has an extensive littoral zone around the open water surface. However, it is not entirely clear whether this is a wet area around the original fishpond capacity or a sedimented part of the original fishpond capacity.

Part of the described study was also a detailed survey of the fishpond catchment area in order to identify obvious traces of erosion and transport processes.

No direct traces documenting the current erosion or transport and deposition of erosive alluvium were found by field survey; however, long-term erosive damage to agricultural soils is clearly documented by aerial photographs - see e.g. Figure 5.

However, all watercourses in the catchment area are intensively cultivated up to the bank edge without any vegetation protection against the entry of eroded material from fields. Any inflowing material has free entrance to the fishpond. Smaller water reservoirs in the catchment area are heavily clogged and cannot fulfil any capture function.

The next step was to measure the volume of water and sediment in the reservoir from a boat with a draft of 10 cm, using a depth gauge and probe: the measurement points were recorded with an accuracy in units of cm using Real-time kinematic positioning GPS. The volume of sediment in the area of the current flood (Fig. 6 – September 2019 - marked in blue - 7.42 ha) is 54,260 m³. The total volume of sediment in the floodplain identified in 2008-2017 (marked in brown – 8.06 ha) is 58,815 m³.

The water depth at the time of the survey (August 2019) ranged from 134 cm at the dam to 10 cm at the littoral border, where it was possible to get with the boat. The average water depth calculated from the area of the current water surface was only 26 cm; a large part of the area is up to 20 cm deep (see Fig. 7).

During the measurements, samples were taken from the sediment surface layer to a depth

Figure 4: Historical photographs – 1840 (upper left); 1938 (upper right), 1952 (bottom left and right). Photo background data by CENIA and the national archive of aerial survey photogtraphs, State Administration of Land Surveying and Cadastre (SALSČ), compiled by Josef Krása

of 20 cm, and then a homogenized mixed sample of sediment was formed to determine its bulk density and nutrient content. The bulk density of sediment in the Dobroměřice Fishpond is on average 1,269 kg/m³; thus, the total volume of sediment 54,260 m³ accounts for 68,856 tons of deposited sediment.

Determination of the total organic carbon (TOC) content and total phosphorus was performed by the accredited laboratory of the Povodí Vltavy/Vltava River Basin Management Authority, State Enterprise. The TOC values are 50 g/kg dry weight and the total phosphorus 840 mg/kg dry weight.

The result shows that it is a highly organogenic sediment, which can contain up to 58 tons of total phosphorus (an extremely high load).

The fact suggests that a significant part of the deposited material consists of decomposing plant residues directly from the fishpond area. In contrast, the bulk density of around 1,300 kg/ m³ also confirms the presence of a mineral (erosion) component.

Sediment transport in the catchment area in 2019

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Explanatory notes

- Water level in 2019

The distributed mathematical model WaTEM/ SEDEM was used for the calculation, successfully tested and validated for use in the Czech conditions on a number of experimental and case studies. The mathematical model calculates the average annual soil loss based on the Revised Universal Soil Loss Equation and includes transport and deposition of eroded material within the catchment area (Krása et al. 2013).

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Figure 5: State of the catchment area in 2013 (archive orthophoto © SALSC)

Figure 6: Sediment depths in the Dobroměřice Fishpond in 2019 (figure elaborated by Josef Krása)

Figure 7: Water depth in the Dobroměřice Fishpond, September 2019

Overall results of the model for the current management of agricultural land (2019) show significant values for long-term land loss (a total of 4372 t/year), or an average value of 7.47 t/ha/year on arable land, which is the largest source of eroded material.

To interpret the calculated values, it is necessary to recognise that the vast majority of material (97%) which is released from farmland (erosion) settles in the catchment area (deposition), *i.e.* before entering watercourses. Thus, the part of the material is not directly involved in clogging the stream or fishpond; however, it causes problems locally at the points of removal or deposition. In other words, it seriously damages agricultural land. High risk sites for excessive transport in the catchment area can be seen in red on the map (Fig. 8). On a long-term average, every year approximately 80 tons of sediment reaches the Dobroměřice Fishpond via watercourses.

Figure 8: Sediment transport from land and values of accumulated transport by watercourses (t/year) (prepared by Miroslay Bauer, map base by SALSC)

What are the conclusions?

The results of the calculation presented above show that the erosion processes in the area of interest are highly developed; it is an important degradation factor in terms of soil protection. The average values of land loss (both on arable land and on all the Agricultural Land Resources significantly exceed the recommended limits of permissible land loss, i.e. 4 t/ha/year). The average loss on arable land in the catchment area is 7.5 t/ha/year. On the other hand, the use of a fully distributed mathematical model (WaTEM/ SEDEM), which includes a description of deposition processes in the catchment area, has shown that a significant part of erosion alluvium is captured directly within the catchment area and does not reach watercourses.

Transport of erosive alluvium to the fishpond is thus essentially done exclusively by its tributaries, of which the branched network to the east of the fishpond is clearly more important, as confirmed by the calculation and field research.

The input of erosive sediments can be effectively reduced below the current value – in principle in three possible ways:

- Introducing protective measures directly onto potential source areas;
- Creating good guality and well maintained protective grass belts along watercourses;
- Constructing collection tanks (sedimentation traps) on both tributaries of the Dobroměřice Fishpond (the SE branch is more important).

The outlook for the next decade can be formulated as follows:

The fishpond will slowly clog up, mainly from the tributary and in the entire littoral zone.

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In the area of the tributary, the input of erosive sediments from the catchment area will have a decisive influence; in the whole remaining area of the littoral, organic material from dead vegetation will be decisive. Due to the minimum water depth and water deficit in the catchment area in the summer months, it is possible to expect water level fluctuations in the future and, therefore, faster spread of emergent vegetation (reeds) into the existing free water surface; this is because the water depth would probably already allow the type of vegetation to grow, as seen for example at the time of the research. The process is also supported by extremely trophic sediment covering the entire bottom of the fishpond.

In its current state, the fishpond is basically unable to fulfil its fish farming function and, due to the declining volume of retained water and its minimum depth, it is extremely susceptible to fluctuations in water level and significant variability of water surface area during droughts and torrential rain. Related to this are the risks of fluctuations in oxygen level and transitions to anoxia or anaerobia - a condition that is not suitable for fish and many other organisms.

In the case of mud removal, it is first necessary to limit the input of erosive sediments from the catchment area into the fishpond.

The Dobroměřice Fishpond is a good example of a valuable site, created historically thanks to human activity in an otherwise extremely intensively agriculturally used landscape. At present, however, both its economic functions (fish farming) and probably also its natural functions (site with a free water surface) are endangered, partly due to intensive infill by sedimentation and partly due to high nutrient load. The problem of infill is technically relatively easy to solve with sufficient funds. However, the problem of nutrient input and retention is very difficult to manage in an intensively used agricultural landscape and would mean careful and demanding management of the fishpond itself with a system of protective equalizing reservoirs, or careful management of the entire catchment area, which could become a pilot site. According to CTU research, similarly problematic sites occur very often in the Czech Republic's landscape.

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The Latest Epigraphic Research Has Shifted back the Age of the Oldest Cave Drawing Traces in the Czech Republic

Petr Zajíček

Since 2016, epigraphic research has been carried out in the caves of the Moravský kras/Moravian Karst (South Moravia), with the participation of the Cave Administration of the Czech Republic (CACR), Palacký University Olomouc (PU), and the Nuclear Physics Institute of the Czech Academy of Science Prague (NPI CAS). In 2019, the surprising results of radiocarbon dating of some black charcoal dra-

The old part of the Kateřina Cave has been known since time immemorial and its massive portal served prehistoric people in the late Neolithic as a settlement. Earlier archaeological findings and remains of fireplaces testify to this. There was speculation as to whether people were already visiting a huge area during this period - namely the Main Dome, which is located behind a 60-metre--long low corridor. The fact that there have been frequent visits in the past centuries is obvious, as evidenced by the signatures and inscriptions on the walls in various parts of the Main Dome and in its branches. Fragments and traces of black charcoal drawings dated in 2019 using radiocarbon analysis showed that the spaces were visited by humans even in prehistory.

After finding other interesting objects, clusters of lines and abstract shapes, some of them were selected for further study and black charcoal sampling for dating. Once again, a team of experts from the CACR, PU, and NPI CAS took part in this stage of research. However, the sampling was carried out with the participation of other experts - Czech and Slovak archaeologists on August 29, 2019. A total of six samples were taken using a proven sensitive methodology: three in the Ice Corridor (located near prehistoric objects dated from the previous series of samples); two from the Main Dome walls; and one in the nameless corridor (also near the previously dated prehistoric

wing traces in the Katerina Cave had revealed them to be of prehistoric age (approx. 6,300 years). For more details, see Ochrana přírodv/Nature Conservation Journal. 74. 5. 39-41, 2019. During detailed documentation of these objects, some other interesting clusters of lines and shapes were discovered there. Analysis of one of them revealed that they are even older, namely more than 7,000 years.

Rock protrusion in the north-east part of the Main Dome with drawing fragments about 7,000 years old. © Petr Zajíček

drawing traces). The processing of the collected material was again performed by the NPI CAS. The analyses themselves were performed in laboratories in Debrecen, Hungary.

7,000 year age limit has been passed

Relevant results of the analyses were available only in March 2020. Samples from four collected objects did not have enough black charcoal for exact analysis. Only two samples were dated, both taken from drawing fragments in the north--east part of the Main Dome. The first of them with an age of approx. 2,500-2,800 years, fits into the Hallstatt period. The fact is also surprising, because a drawing or a fragment/trace from this period has not previously been found in the

Sampling of charcoal from drawing fragments taken for analysis. © Petr Zajíček

Moravský kras/Moravian Karst. The second sample was dated to a period approx. 7,000–7,200 years ago. Coincidentally, these are irregular clusters of black charcoal lines on a prominent rock protrusion, from which black charcoal samples had already been taken twice for analysis, but the amount was not sufficient. The surprising result was supported by the fact that humans in the late Neolithic repeatedly visited various places in the Kateřina Cave's old part and left evidence on it there. Thus, the last dated drawing fragment is thus the oldest document of such type in the caves in the Czech Republic.

Drawing fragments in the Main Dome, approx. 2,600 years old. © Petr Zajíček

Interesting drawing traces that could not be dated

It was not possible to exactly analyse the black charcoal drawing fragments from which black charcoal samples were taken due to the small amount of extracted black charcoal. This is a clusters of lines in the Ice Corridor, reminiscent of primitive drawings of human figures. Similar drawings were found in the Bestažovca Cave in Slovenia and dated to an age of approx. 6,700 years ago. The similarity of the drawings in the Slovenian cave and those from the Kateřinská Cave is striking. It is a great pity

Map of the old part of Kateřinská Cave with marked locations of dated drawing fragments. © Cave Administration of the Czech Republic Prague

that it was not possible to date the objects from the Kateřinská Cave. The only fact that can be stated is that they are located near two prehistoric, previously dated drawing traces in the Ice Corridor (approx. 6,300 years old). Thus, there is a high probability that the drawing fragments resembling figures could also come from the late Neolithic period.

The purpose of prehistoric drawing fragments

The question is whether these are random abrasion marks from torches or whether the line or primitive drawings were created by prehistoric humans intentionally.

The character of some of these objects does not indicate that it is a mere abrasion. Interestingly, in the nearby Koňská jáma/Horse Hole Cave, where archaeological findings from the same period have been made, there are no similar black charcoal fragments. Therefore, archaeologists thus assume that in the Kateřinská Cave it was probably an intentional activity. In certain parts of the cave, humans could thus mark places that served them, e.g. for underground ritual ceremonies. However, in the Main Dome of the old Kateřinská Cave and in the adjacent corridors, no detailed archaeological research has yet been carried out to confirm the assumption. Prehistoric drawing traces found in the Kateřinská Cave shall be further studied and documented in detail. The aim of the ongoing research is to find out other connections with earlier archaeological findings in the Kateřinská Cave portal and in surrounding caves.

Ochrana přírody/The Nature Conservation Journal

How We Do (not) Implement the Water Framework Directive in Improving the Morphological Status of Watercourses?

Kateřina Kujanová

Data show that, in the 1990s, 28.4% of the total length of the Czech Republic's watercourses were unfavourably modified, which is tens of thousands of kilometres of the river network. According to the current National Biodiversity Strategy of the Czech Republic, the country's current optimistic targets are at least 300 km of restored watercourses for the 2016–2025 period. The status of watercourses and related floodplains has therefore not seen any significant improvement since

Water Framework Directive requirements

In joining the European Union (EU), the Czech Republic (CR) committed itself to transpose the

Figure 1: WFD objectives: To prevent further deterioration and protect and enhance the status of aquatic ecosystems through specific measures (source: Peter Pollard, the responsible author of the European Union Water Framework Directive)

the 1990s. Compared with biological and physical/chemical guality elements, monitoring and enhancement of the morphological status of the country's watercourses has enjoyed a less significant position in the long term. However, apart from the "aesthetical" point of view, its improvement is also of unquestionable importance in terms of water retention in the landscape, flood protection, and drought management. It is therefore a topical issue in society.

Water Framework Directive (WFD, European Commission, 2000) into its legislation and to consequently implement it. The WFD's main aim is to avoid further deterioration of water

ecosystems, to protect and conserve them and to enhance their status by appropriate measures (Fig 1). Pursuant to the WFD, the status of surface waters is determined by ecological or chemical status, depending on which is worse. The essence of the approach is to determine the current status of watercourses and, if good status has not been achieved, to design and implement measures that will achieve the good status. Simultaneously, active factors are set in each water body and related to the assessment of that body's status. Ecological status is determined on the basis of the status of biological. hydromorphological, chemical, and physical/ chemical quality elements. The purpose of evaluating the status of hydromorphological guality elements is (as is the case with chemical and physical/chemical quality elements) to obtain information on whether hydromorphological conditions enable achievement of the required quality of the biological quality elements and the required ecological status (e.g. potential) of the watercourse.

Hydromorphology – where did it come from?

The WFD requirement for the quality of hydromorphological elements (see Tab. 1) was far from being the first-ever impulse in monitoring the hydromorphological status of watercourses.

In both Western Europe and North America, where fluvial morphology research had had a long tradition, methods for assessing the hydromorphological quality of rivers had been developed, along with studies defining the target status of restoration measures, for several decades by the time the WFD was adopted. It was therefore very important and necessary to anchor the trend in the EU legislation.

Subsequently, efforts to develop evaluation methods as well as design and implement restoration measures have increased in the EU Member States since the time the WFD entered into force. Many methodological approaches have already been developed, as mentioned by Belletti et al., (2015). Methods have been elaborated for the specific contions in the Czech Republic, whether based on field surveys (e.g. Matoušková, 2003, 2008; Langhammer, 2007, 2008, 2014; Langhammer & Hartvich, 2014) or evaluation using available input data (Králová 2013; Kožený et al., 2019).

When evaluating biological elements, hydromorphology is only auxiliary, so do we need it at all?

The role of hydromorphological elements as a part of the ecological status is, pursuant to the WFD, "only" in establishing conditions for biota: however, this is the very point that seems to be a problematic issue since the relationship between biological elements and hydromorphological conditions of watercourses (i.e. the response of the biota to hydromorphological conditions and changes) has still not been described to a sufficient extent.

In addition, there is a relatively large degree of variability in physical and geographical conditions in the Czech Republic, which also applies to the types of watercourses (Fig. 2 & 3). Consequently, to evaluate hydromorphological conditions, it is essential to establish baseline conditions for each type of watercourse (i.e., find sites or establish conditions of river systems with minimal anthropogenic influence) that serve as a benchmark in the assessment and represent the target status of the measure.

As a starting point for the draft measure, it is necessary to assess which effects are of such importance that they cause changes in hydromorphological conditions, thereby preventing

Figure 2: Naturally straight channel of the upstream stretch of the Jizera River with a considerable gradient. © Kateřina Kujanová

Table 1: Definition of very good status for each of the hydromorphological quality elements for the category of Rivers (source: European Commission, 2000)

Hydromorphological elements	Very good status
Hydrological regime	The quantity and dynamics of water flow and resulting connection to groundwater bodies are fully or almost fully compatible with undisturbed conditions.
Watercourse continuity	The continuity of the watercourse is not impaired by anthropogenic activities and allows both the free migration and other movements of aquatic organisms and transport of sediments.
Morphological conditions	The structure of the riverbed, the variability of its width and depth, the flow velocity, substrate characteristics, and both the structure and characteristics of the riparian zones are fully or almost fully consistent with undisturbed conditions.

the achievement of good status in biological elements. According to the data model (Vyskoč et al., 2019) based on the EU indicative document for the reporting river basin management plans, the types of effects on the hydrological regime and morphology are divided into four areas: water abstraction/transfer; modifications along a watercourse; dams, obstacles/barriers and locks; and hydrological changes. There is also a need to specify the reason why these changes were made (agriculture, hydro power, fish farming, flood protection, water transport, etc.).

Opponents of EU requirements would certainly argue how complicated the process is. However, it should be noted that, even without

any EU framework, measures such as the revitalization and restoration of watercourses and floodplains must be designed and implemented systematically, that is to say, on the basis of monitoring, through the stewardship and management of watercourses, and within a much larger number of watercourses. At the same time, the implementation of measures should be supported by a change in legislation. Removing unnecessary engineering (in particular the longitudinal technical regulation of channels, as well as treatment of weirs) is crucial in promoting restoration at a higher scale. Furthermore, it is very important that the disappearance of property linked to such engineering works is not perceived as negative, as it has been so far.

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Figure 3: A meandering channel of the Rokytná River before its confluence with the Jihlava River. © Kateřina Kujanová

What data do we actually have?

We have long been monitoring physical/chemical parameters in watercourses in the Czech Republic and we have set up monitoring of biological elements. In both cases, this is a monitoring process underway in one established profile, representing the whole water body.

Hydromorphological elements were not systematically monitored in the Czech Republic in the first and the second cycle of planning. For the third river basin management plans. state-controlled river basin management authorities applied a procedure to determine major effects on morphology and the hydrological regime (Kožený et al., 2019). This was a procedure to assess the backbone watercourses (water bodies), rather than looking for impacts in the water body catchment area. Morphology, including watercourse continuity, was assessed through the available data for straightening (historical maps), provision of capacity (floodplain areas of flood frequencies for return intervals of 5 years $Q_{_{5}}$), vegetation and construction development (ZABAGED -Fundamental Base of Geographic Data of the Czech Republic), agricultural drainage (Agricultural Water Management Authority of the Czech Republic/AWMA data, 2010), migration/

movement barriers and storage levels (Nature Conservation Agency of the Czech Republic's data from the project "Developing a Strategy to Reduce the Impact of Fragmentation of the Czech Republic's River Network": here it should be noted that the data from this project do not cover the total length of the country's water bodies). The influence on the hydrological regime was developed with a view to regulating the flow rates of water reservoirs, the abstraction of surface water and groundwater. and the re-discharge into surface water.

Thus, hydromorphological effects were identified to some extent, but the actual monitoring of hydromorphological parameters was not performed to a sufficient extent even for evaluation for the third river basin management plans. This is mainly due to the long time required for field mapping according to the officially approved hydro-ecological monitoring (HEM) methodology (Langhammer, 2014), as well as the generally underestimated significance of knowledge of the status in hydromorphological parameters. Since the Czech Republic has already been criticised by the European Commission (EC) for the absence of the status of hydromorphological elements, the above assessment of the significance of the effects was converted into

a scale of evaluation of the status of hydromorphological elements. However, such an assessment of the hydromorphological status may not always be appropriate to the real situation, which may cause problems for the country in the future, e.g. in assessing the situation in future planning periods or in terms of the need for implementing and financing measures.

In the field or in the office?

An eternal discussion around hydromorphology is whether it is necessary to go into the field to collect new data or if evaluating the available remote data is enough. The truth lies, as usual, somewhere in the middle. An assessment should not be lacking input background data (e.g., historical route maps, facilities on watercourses, channel modification information). Some of the other indicators being assessed can indeed be established in the office by operation engineers of river basin management authorities or NCA CR water specialists; however, they do not know all the watercourses equally well in their territory. The field validation of certain parameters therefore only appears realistic if it were spread over the next few years, rather than weeks, and supported by a database application to process the information sourced. Another prerequisite is the rational range of parameters to be determined and the least degree of subjectivity in their determination as possible. This approach was successfully verified by the NCA CR in the monitoring of migratory/movement barriers implemented within over 11.000 km of watercourses (the previously mentioned project "Developing a Strategy to Reduce the Impact of Fragmentation of the Czech Republic's River Network". www.vodnitokv.ochranaprirodv.cz). This supports the conclusion that we need a place to start from, and the sooner we start, the better. At the same time, it would be useful to take into account that many small watercourses are very similar to each other and that even a systematic approach can be based on "monitoring typical examples" and the similarity between these, which can be refined over time.

Current situation

In December 2018, the Czech Republic reported to the EC that almost 20% of the measures proposed in the second river basin management plans were focused on hydromorphological effects, that is, mainly on restoration

projects. Of these, 7% have been completed and 41% are in progress. So everything seems to be fine, or at least on track. Although it has still not been possible to evaluate the change in morphological status due to the lack of data, when you go out and along watercourses across the cuntry, it is clear that the situation is not very optimistic...

Although the topic of improving the morphological status of watercourses has gradually become a common part of strategy papers and policies since the 1990s (including, obviously, the currently applicable second river basin management plans providing a number of measures to this end), many of the proposed measures remain just on paper. Despite available funds in the Operational Programme Environment funded from the EU budget and the landscape management schemes of the Ministry of the Environment of the Czech Republic, a maximum of twenty km of watercourses are revitalized annually across the Czech Republic. The reason usually mentioned for that fact is difficulty in preparation and consultation measures, particularly in terms of legal ownership. Although the improvement of the status of aquatic ecosystems and thus improvement of the morphological status of watercourses is the WFD's primary objective and considerable efforts have been made in this regard. any improvement of the morphological status through restoration projects has been seen at the minimum percentage of poor-condition watercourses. There is much more improvement (in terms of extent) due to spontaneous restoration processes during succession in the ecosystems, meaning without human actions or perhaps despite such efforts.

While the implementation of watercourse restoration projects has been lagging behind, similarly complex flood-protection projects proposed by municipalities have been doing much better over the long term, while watercourse management authorities are often those that carry out such measures. The question therefore arises as to whether or not a similar "design and implement" model could be applied in the case of restoration or investment measures to promote restoration. However, this issue is strongly linked to the motivation for watercourse management authorities to implement such measures.

Figure 4: Promoting the restoration of the Morava River near the town of Štěpánov by the removal of historical

bank fortification; new elements to divide the channel morphologically and hydraulically were produced from material from the dismantled fortification. © Jan Koutný

Promotion of restoration projects

Revitalization of regulated watercourse channels and measures to promote restoration processes (Fig. 4) are undoubtedly actions improving the morphological status of watercourses in line with WFD requirements. However, due to their complexity, revitalisation projects cannot "heal" any substantial portion of watercourses in the foreseeable future. As nature has been telling us for some time, a much simpler tool to improve the morphological status of a considerable length on watercourses is to encourage spontaneous restoration processes (natural processes gradually removing engineered watercourse channels), or to initiate such processes. Combined with ecologically-oriented management and maintenance of watercourse channels, the potential of such natural processes is considerable - restoration processes are underway gradually but constantly throughout the river network and are not subject to any administrative initiative. Therefore, identifying stretches of watercourses suitable for the restoration process should be a priority among the measures to improve the morphological status of watercourses for the third planning period.

Conclusion

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Are we just trying to achieve the desired in the simplest way possible or have we really understood the meaning of the WFD and try to actually improve the status of watercourses through slow, gradual steps? Any systematic approach to identifying, in a consistent manner, significant effects across a water body's catchment area and establishing the ecological status of the water body (including the relationship between biota and morphology) has still significantly been lagaing behind. The same is true of proposing and. in particular, implementing measures in the event of a failure to achieve good status. We are at the end of the second planning period and it is clear that the morphological status of watercourses has not improved significantly in the Czech Republic. We could say that "perhaps in the next planning period we will do it", but I would rather call on all the stakeholders (whether biologists, water engineers, planners, science, research and innovation foundations, watercourse managers, staff of the relevant authorities or the general public, who are not indifferent to the status of watercourses) to help include the hydromorphological aspect in putting the idea of systematic stewardship and improvement of watercourses into real life.

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Introducing a Transboundary Socio-economic Monitoring Scheme in the Šumava and Bavarian Forest Mts. National Parks BAYERISCHER WALD NÁRODNÍ PAR

Pavel Bečka, Martin Starý, Josef Štemberk, Barbora Kučeravá

National parks are large, specially protected areas. They aim to protect natural ecosystems, support undisturbed natural processes, as well as human-determined biodiversity. However, as the national park mission, in addition to the above mentioned, also includes enabling sustainable

The long road to the project

In 2014, there was a major turning point in cooperation between both National Parks. A joint definition of objectives for the direction of both the parks opened up the possibility of new projects and new cooperation. Joint monitoring of visitors was among the first ideas because this type of blanket monitoring activity had been missing, although studies did exist which focussed on specific sub-problems or longer-term monitoring of the selected sites. On the Bavarian side of the border, however, there had been some experience; more specifically, basic surveys were underway there. The activity was conducted by a research team from the University of Natural Resources and Life Sciences, Vienna (BOKU). The aim of the project under preparation was to carry out a similar basic survey on the Czech side, and to subsequently elaborate the qualitative characteristics of visitor satisfaction and their impact on the functioning of the two protected areas. Unfortunately, a suitable funding title had been awaited from 2015 onward as the then INTERREG scheme supporting cross-border cooperation between the Czech Republic and Bavaria was in its final period. Nevertheless, the goal was clear: prepare a project that assesses both the number of visitors and their opinions, wishes, and expectations that they bring with themselves when entering the territory. During the approval process at the Minis-

development, national park management authorities urgently need to ensure long-term monitoring of the fulfilling both the conservation goals and the mission. A transboundary project of the administrations of the Šumava/Bavarian Forest Mts. has mainly addressed the latter point.

Conducting the questionnaire survey in the field. © Josef Štemberk

try of the Environment of the Czech Republic, the project was supported and subsequently recommended for implementation in all the other National Parks in the Czech Republic.

Following a successful application, a projectentitled "Transboundary Socio-economic Monitoring Scheme in the Šumava/Bohemian Forest Mts./Bohemian Forest Mts. and Bayerischer Wald/Bayerischer Wald/ Bavarian Forest Mts. Mts. National Parks" was launched on January 1, 2017 under the cross-border cooperation scheme "Czech Republic - Free State of Bavaria, Goal ETC 2014-2020 (INTERREG V), Priority Axis 2". The Bayerischer Wald/Bavarian

Forest Mts. Mts. National Park Administration became a lead partner, while the Sumava/Bohemian Forest Mts. National Park Administration was a project partner. The project's aim was to establish and implement a permanent transboundary scheme of visitor monitoring as the main building block of socio-economic monitoring activities in both National Parks. Total project duration was 39 months, including a three--month extension. The project budget was € 672,025.00 (Czech portion of the project: \in 280,000); the rate of funding was 85%. Experts from the BOKU (a working group led by Professor Arne Arnberger) were selected as external methodology experts by the tender procedure. They elaborated a methodology (selection of census and survey sites, draft questionnaires, etc.), along with project coordinators from both National Park administrations, and took over the entering data into the database, evaluating the data, and writing internal project reports.

The project was divided into six sections. The basic survey was to determine the number and essential characteristics of visitors. In addition, the following five modules were included: Module 1: Information for visitors, to find out how aware visitors are of National Parks and regions: Module 2: Transboundary recreational use, quantifying cross-border movement of visitors between the two National Parks: Module 3: Rate of acceptance by the local population. examining the attitudes of local residents toward the Šumava/Bohemian Forest Mts. National Park: Module 4: Natural experience looked at the reasons why visitors come to the National Parks, what they expect from their visit, and whether or not their expectations are met; Module 5: Economic benefits from having visitors, which measured the economic effect of visitors on the Šumava/Bohemian Forest Mts. region. The present paper only covers the most important results from the first section, *i.e.*, the basic survey in the Šumava/Bohemian Forest Mts. National Park. The results from the other project modules exceed the possibilities of a single journal article in terms of significance and quantity and therefore, they shall be presented later.

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Installing a bicycle counter at a border-crossing point. $\ensuremath{\mathbb{C}}$ Josef Štemberk

Overcrowding of some tourist destinations at the expense of enjoying the natural world. © Josef Štemberk

Basic survey

In order to establish a joint transboundary monitoring scheme, some of methods were adopted that had worked well for the Bayerischer Wald/Bavarian Forest Mts. National Park (automated/manual counting and a highly standardized questionnaire) and were tailored to the needs of the Sumava/ Bohemian Forest Mts. National Park. In ad-

dition, new methods were developed and tested to some extent.

A territory-wide visitor census for the basic survey was carried out between 24 November 2017 and 23 November 2018 in the Šumava/Bohemian Forest Mts. National Park. Automatic counters were installed at 34 different sites to keep records for all incoming and

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Table 1: Comparison of the Šumava/Bohemian Forest Mts. National Park (NP) and the Baverischer Wald/Bavarian Forest Mts. NP: Questions about National Parks; the sum of the categories "Fully agree" and "Rather agree"; figures in %, *for locals and weekend home/ cottage owners only, N = 230-985.

Consent to statements on National Park Sum of categories: Fully agree & Rather agree	Šumava/ Bohemian Forest Mts. National Park	Bavarian Forest Mts. National Park	Difference
NP protects rare animal and plant species and their habitats.	96,0	97,8	-1,8
I consider the establishment of the Šumava/Bavarian Forest Mts. NP to make sense.	94,7	95,3	-0,6
I consider it meaningful to set up National Parks.	93,9	94,5	-0,6
Šumava/Bavarian Forest Mts. NP gives me a unique natural experience.	91,3	85,4	+5,9
The task of the NP is to preserve / restore the natural landscape in its most original form possible.	90,3	94,6	-4,3
In the Šumava/Bavarian Forest Mts. NP, restrictions on use for recreational purposes can be accepted for nature conservation purposes.	83,5	87,5	-4,0
In the Šumava/Bavarian Forest Mts. NP, conservation should take precedence over other uses.	82,0	79,8	+2,2
The task of the NP is to provide an offer of communication, education and public awareness programmes.	79,6	90,7	-11,1
Tourism outside marked trails/paths has a negative effect on fauna and flora in Šumava/Bavarian Forest Mts. NP.	76,7	87,2	-10,5
Šumava/Bavarian Forest Mts. NP increases the quality of life in the region. *	76,6	81,1	-4,5
NP improves the quality of life in the region.	74,7	88,9	-14,2
NP enables high-quality recreation activities.	73,7	93,2	-19,5
The Šumava/Bavarian Forest Mts. NP has a positive effect on the economic development of the region. \ast	72,6	76,4	-3,8
In my opinion, the existence of dry trees with young trees thriving below them is a particularly interesting and attractive phenomenon in the Šumava/ Bavarian Forest Mts. NP.	54,0	75,8	-21,8
More NP should be established in the Czech Republic / Germany.	50,8	68,7	-17,9

outgoing visitors. In particular, thermal sensors from Eco Counter were used (they can detect all types of visitors and identify their direction of movement). In addition, inductive loops and pressure sensors from Eco Counter were involved to count bikers. A census was also carried out in person at entrances into the Park: this operated for 12 days `(6 working days and 6 Saturdays) in the course of the survey period. Based on the intensity of using each site (a total of 79 locations), 2, 4 or 6 days were spent counting visitors at the respective entry sites.

A total of 2,020,000 visits were identified during the monitoring period, with an average of 9.1% of visitors saying they had discontinued their visit on the day of the survey. This makes a total of 1,840,000 visitors to the Šumava/Bohemian Forest Mts. National Park. In comparison, the same period covered about 1,360,000 visits to the Bayerischer Wald/Bavarian Forest Mts. National Park.

The distribution of visitor attendance throughout the year significantly peaked in the summertime, when numbers were up to nine times higher than in the least busy month of November. Saturdays were the peak days, followed by Sundays and holidays. Visitors mostly started their trips between 10 a.m. and midday (31% of the total daily number of visits). Almost no one entered the Šumava/Bohemian Forest Mts. National Park after about 8 p.m. With 126,933 visits per year Modrava/Roklan Brook was the most visited site monitored by the automatic counters, followed by the visitor centre (wolf enclosure) at Srní (116,510 visits). This was confirmed by the evaluation of trip routes that the surveyed visitors plotted on a map. The maps made it possible to assess the territory-wide intensity of use and link it to, for example, visitor types, sizes of visitor groups, and visitor motivation. The northern part of the National Park was generally used more intensely than the southern one. Visitors used almost all roads in the area of Srní, Modrava, Kvilda, and Bučina. On the other hand,

Focusing on the Public ——

in National Park's other parts, visitors concentrated on a maximum of half of the road network.

The questionnaire used for face-to-face interviews included closed and open-ended questions and was available in Czech and German. The interviews were conducted by trained employees of the Šumava/Bohemian Forest Mts. National Park (Czech and, partly, German--speaking persons), students, guides, and the National Park's temporary staff. Each visitor $(\geq 14 \text{ years old})$ who passed one of the interview sites was asked to participate in the survey. In 12 days, a total of 1,053 people completed the questionnaire in November 2017 to October 2018 at 79 various entry sites into the Šumava/Bohemian Forest Mts. National Park. The interviewing days took place in every season of the year (3 days per season in autumn, winter, spring, and summer), both on working days (6 days on Friday) and at weekends (6 days on Saturday).

Visitor profile

The average age of the person interviewed was approximately 47 years. 17.6% of the respondents were residents of the so-called Šumava/Bohemian Forest Mts. districts, i.e. those covered by the Šumava/Bohemian Forest Mts. National Park. Overnight guests. who spent on average 4.7 nights in the region. accounted for slightly more than half of the respondents (57.2%). Most visitors had already visited the National Park in the past, saving they would visit it again in the next five years with more than 90% certainty. The main motivation for visiting the Park was "have experience of the landscape and nature". "draw energy", "have a rest, relieve mental strain/ stress" or, for example, "spend time with family". In contrast, the least motivation was "learn more about nature", followed by "thrill/adventure", and "spend time on one's own".

More than two-thirds of the respondents (70.6%) said that recreational opportunities in the Šumava/Bohemian Forest Mts. National Park are not at all limited or not rather limited because the territory enjoys the status of a national park. 15.7% of visitors specifically stated why they feel limited in a negative sense.; they most often mentioned limited access and a ban on leaving marked trails/visitor paths. Three per cent of the respondents perceived

zákazy chování návštěvníků nerovtaval nerovtava nerovtava i tlející dřevo parkování spatná údržba Chybějící odpadkové koše parkování stavební činnéhtkurat vzdal nerovtava parkování stavební činnéhtkurat stavební činné parkování omezení příliš málo turistických tras kůrovec jádrová zónak příliš málo turistických tras kůrovec opušení opušení příliš málo turistických tras kůrovec asfaltové cesty oteviraci doby restauraci cykliotray cykliotray oteviraci doby restauraci zákaz vstupu mimo značené trasv nepořádek sjezdovky poplatky za parkování málo restaurac gastronomie Značení cest zničené cestv

A word cloud covering the outcome of the open question "What do you not like in the National Park?" Developed by Josef Stemberk

some limitations; however, they evaluated them in a positive manner. Almost 90% of respondents assessed the number of visitors' facilities and the number of tourist trails/visitor paths as an ideal condition. At the same time, over 90% of respondents said they were very satisfied or satisfied with their visit. In terms of quality, trails/paths signage and marking, visitor centres, and information boards scored best. On the other hand, the quality of public toilets, mass public transport, and catering were ranked as the worst. Overnight quests were significantly more satisfied than locals, weekend house/cottage owners, and day-visitors. The open question "what the visitor likes in the National Park" mostly received the following spontaneous answers: "nature". "guite settings", and "the landscape". More than a third of respondents said: "I like everything" when asked "what visitors don't like". Others replied: "people" followed by "rubbish", "visitor behaviour", "construction activity", "no entry", and "asphalt roads".

Over 90% of the visitors surveyed agreed that National Parks protect and conserve rare species, that they consider declaring National Parks makes sense, and that the task of National Parks is to protect the natural landscape in its most original form possible. In contrast, only 54% of respondents agreed that the existence of dry trees with young thriving trees below them was an attractive phenomenon in the Šumava/ Bohemian Forest Mts. National Park, and 49.5% agreed that dead wood was a National Park's attraction with rich forest vegetation. The compaOchrana přírody/The Nature Conservation Journal

A completely full car park at Modrava. © Josef Štemberk

rison with the Bayerischer Wald/Bayarian Forest an emotional rejection of something new that a person in Central Europe could only know from a few small remnants of well-preserved primary or old-growth forests before the onset of the European spruce bark beetle (*lps typographus*) outbreak in commercial forests that arrived

> Introduction of the transboundary socio-economic monitoring scheme in the Šumava/Bohemian Forest Mts. National Park has not only brought a number of new findings and the data collected according to a methodology identical for the Czech and Bavarian sides of border. The objective of the now completed project is also to establish a permanent system of feedback on the Šumava/Bohemian Forest Mts. National Park Administration functioning and performance. The Administration will be able to incorporate the findings and lessons learned in its daily activities as well as in communication with, infomarmation of and rasing awareness among the general public, marketing and public relations. Therefore, the scheme on interviewing and monitoring visitors in both neighbouring National Parks will continue and be further developed.

> more recently in to the Czech Republic. All of

this is subject to further data evaluation.

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A Feasibility Study on: "Improvement of Local Economic Prosperity and of Nature Conservation in Zambia supported by the Czech Development Agency"

František Pelc. Michal Lodin

One of the significant preconditions for enhancing and improving nature conservation, biodiversity protection respectively in protected areas is ecotourism development, undoubtedly strengthening

In Zambia, there are viable giraffe populations only in the Sioma Ngwezi National Park (the Southern giraffe G. giraffe, in total 200 – 300 individuals, pictured) and in the South Luangwa National Park (the Masai giraffe G. tippelskirchii, 600 – 700 individuals). © František Pelc

Mts. National Park is presented in Table 1.

Looking ahead

The data gathered show the importance of the Šumava/Bohemian Forest Mts. National Park for the public. For the first time, the territory--wide number of visitors to the National Park was quantified, with a figure of 1,840,000 visitors per year, namely from December 2017 to November 2018. In addition, the monitoring scheme provided also data on intensity of using the National Park by tourists and their spatial distribution as well as on their structure. The main motivation for the visit was shown to be having experience of the natural world. The vast majority of visitors were satisfied with their visit as well as with the tourist activities offered. Visitors agreed that nature conservation should take precedence over other uses in the Šumava/Bohemian Forest Mts. National Park. and that restrictions on recreational use for conservation reasons can be accepted.

At the same time, however, the data collected showed that about half of the visitors do not agree that dead wood is an attractive phenomenon for a national park. It was precisely the aim to better understand the attitude of visitors (as well as the local population) toward decaying wood which was behind the questions asked in the other thematic modules of our project. Whether it is a lack of knowledge of the decaying wood functions and roles in natural forests, on which (as we have known from studies) more than a third of the living organisms depend, or

job opportunity/employment and economic prosperity in the countryside and at the same time also local community involvement in nature conservation (Eagles et al. 2002).

Map showing threes selected National Parks (marked by red arrows). Elaborated by Jan Vrba

One of the significant preconditions for enhancing and improving nature conservation, biodiversity protection respectively in protected areas is ecotourism development, undoubtedly strengthening job opportunity/ employment and economic prosperity in the countryside and at the same time also local community involvement in nature conservation (Eagles et al. 2002). Despite a lot of fluctuations, the number of foreign visitors has been increasing in recent decades and in 2018, it has reached for the first time one million. Thus, tourism has become one of the Zambian most rapidly growing economic sectors, providing directly or indirectly jobs to roughly 319,000 people, contributing 6.3% of the GDP, and income from foreign tourism representing 8.3% of Zambia's total exports (ACT 2018).

Nevertheless, a more detailed analysis shows that only about one quarter of foreign visitors to Zambia enjoy ecotourism in protected areas, in addition with sharp differences. More than 140.000 tourists visit the Victoria/Mosi-oa-Tunva Falls and about 23,000 of them enter the adjacent small Mosi oa Tunya National Park. The best-known South Luangwa National Park of the same size as Moravia, one of the historical lands in the Czech Republic, has recently hosted more than 40,000 visitors a year. The giant Kafue National Park covering 22,400 km² is visited by approx. 13,000 tourists per year and the Lower Zambezi National Park is a destination of less than 10,000 visitors throughout the year. The other NPs display attendance in hundreds or a few thousands, sometimes only a few hundred: the latter category also includes the Sioma Ngwezu National Park. For comparison, in the Krkonoše/Giant Mts. National Park, the oldest NP in the Czech Republic, covering less than 400 km², the annual visitor

number is approx. 4 million persons. In the African context, the annual visitor number the famous giant Kruger National Park, being of 90% of the Kafue National Park's size, amounts for more than 1.8 million. The above data and the comparison clearly confirm the enormous potential for changing the current state, namely by sustainable, nature-friendly tourism (cf. UKAid & World Bank 2011).

Briefly on the project's history

The intention to support tourism infrastructure development for nature conservation and enhancing well--being of local communities in Zambia had appeared in the Czech Republic as soon as in 2016 (Pelc I.c.). Based on the outputs of a meeting between the MoTa and the Nature Conservation Agency of the Czech Republic (NCA CR), the Zambian partner officially asked by a letter expressing a strong interest

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Zambia (former Northern Rhodesia) is one of the large countries in southern Africa with an area of more than 752,000 km², thus being almost ten times larger than the Czech Republic. The land-locked country' s population is 18 million inhabitants, population densi ty is 24/km², i.e. six times lower than in the Czech Republic. Due to annual population growth rate reaching almost 3%, the pop ulation is proiected to double in less than 30 years. At present, there are 12 Nationa Parks (NPs) in Zambia with an area ranging from 17 to 22.400 km² and in total covering approx. 8% of the Zambia's territory. About other 22% of the country's territory are allocated for Game Management Areas (GMAs) with really low nature conservation intensity. The nature conservation system guaranteed by the Ministry of Tourism and Arts of the Republic of Zambia (MoTA) is theoretically guite well-thought out, but due to significant lack of funds nature conservation has been insufficient in protected areas, although there are sharp regional differences there (Lindsey et al. 2014, Pelc 2017).

for implementation of the project as a part of the Czech Republic's Official Development Assistance (ODA): the request from the MoTA was also submitted to the Embassy of the Czech Republic in Zambia. The intention was assessed by the Czech ODA. preferring projects supporting agricultural development in the Zambian countryside, as lacking the acceptable parameters, and therefore unsuitable. After further repeated consultations, the Czech Development Agency (CDA) agreed to carry out a feasibility study credibly identifying priority areas and at the

A panoramic view of the site on the confluence of the Kafue and Shishambe rivers (the Kafue National Park) which appeared in the feasibility study the most suitable for building an ecotourism facility.[©] František Pelc

Development in the number of foreign visitors to Zambia (World Bank 2017).

same time setting by expert opinions the investment and operational costs. In 2017, 2018 respectively, the Zambian partner asked both by a letter of the MoTA's Secretary of State to the Embassy of the Czech Republic in Lusaka and consequently by official application asking for the feasibility study assessing three areas of interest for supporting development of a new ecotourism infrastructure in three National Parks, namely Kafue, Sioma Ngwezi and Lower Zambezi. In the middle of 2019, the Zambian initiative resulted in making a contract between the CDA and the NCA CR on implementation of the feasibility study. The study was elaborated by the NCA CR in cooperation with the Faculty of Environmental Sciences, the Czech University of Life Sciences Prague.

The respective feasibility study

The MoTA asked for carrying out the feasibility studv which would determine suitable sites for building ecotourism facilities in the three NPs (see a map) proposed by the Zambian partner including tentative economic costs and based on a comprehensive comparative SWOT analysis also the undisputable priorities for possible implementation of the project.

A brief description of the three areas studied

The Kafue National Park

The Zambia's largest NP is situated in the mostly flat landscape and is covered by miombo woodlands and at some sites, particularly in the northern part, by wetland plateaux. Within the area of the same size as Moravia, in total 20 year-round and some other seasonal ecotourism facilities have been established there. Moreover when taking into account the National Park's size, there has been a much higher potential for further development. Of fauna, from a point of view of both ecotourism and nature conservation attractive populations of the African bush elephant (Loxodonta africana) consisting of 5.000-6.000 individuals. Hippopotamus (Hippopotamus amphibius), African buffalo (Svncerus caffer). Lion (Panthera leo). Leopard (Panthera pardus), Cheetah (Acinonyx jubatus),

Namibian border and is characterized by miombo

extinct and the Giraffe is outside its distribution range there. Almost 400 bird species including the Southern carmine bee-eater (Merops nubicus nubicoides) of which up to 10,000 individuals nest in some colonies within the NP attract birdwatchers. On the NP's territory, seven luxury ecotourism facilities have been stepby-step built, while ten facilities of various quality are located in the adjacent GMA. The National Park and its surroundings are threatened with possible mining. On the opposite river bank in Zimbabwe, there is the unique Mana Pools National Park where also endangered black rhinos have been surviving.

Comparative SWOT analysis and

The aim of a feasibility study is clearly define a project and determine whether it can be implemented. The possibilities for the development are determined by the available opportunities and the unavoidable limits of resources; the market; the environment, the needs and requirements of the local community and political realities. As a part of the study, SWOT analysis was carried out aiming at strengths and opportunities, weaknesses and threats respectively. Strengths and weaknesses are the internal components (patterns) of the proposed project; opportunities and threats are exter-

above three National Parks followed international standards and was conducted independently by each expert. For elaborating the SWOT analysis comparing the individual sites and National Parks. in total 48 parameters were evaluated. Seventeen of them dealt with strengths (e.g. biodiversity, visually attractive landscape or possibilities for ecotourism activities), ten were related to weaknesses. such as seasonality in use. lack of ecotourism facility/equipment, insufficient involvement of local communities in ecotourism, seven were linked with opportunities (possibilities of involvement of local communities into the project, possible synergies with other bodies including NGOs, possible increase in nature conservation and management guality), while twelve represented threats (mining, poaching, negative impacts of ecotourism infrastructure building). Each indicator in the SWOT analysis has a weight of 1, 1.5 or 2 and a rating of 0-5. Each of five experts individually determined the weight and score for all defined parameters and sub-parameters. Weighted score (weight * score) then allowed to compare all the SWOT analysis outputs, using positive values for favourable

other feasibility study aspects

nal factors that may influence the outcome.

The detailed SWOT analysis of six sites in the

The proposal of the most suitable site for building an ecotourism facility in the Kafue National Park central part. Elaborated by Jan Vrba and Vladimír Zdražil

The MoTA's representatives have been for a long time showing an interest in implementing the NCA CR's project. At the head of the table Secretary of State Hon. Amos Mulapanga is sitting and the first person right to him is H.E. Radek Rubeš, the Ambassador of the Czech Republic to Zambia. © Vladimir Zdražil

African wild dog (Lycaon pictus) and of the Spotted hyena (Crocuta crocuta) occur there. Among antelopes, the Kafue NP is inhabited by the Sable Antelope ((Hippotragus niger), Roan antelope (Hippotragus equinus), Common impala (Aepyceros melampus), Puku (Kobus vardonii), Lichtenstein's hartebeest (Alcelaphus lichtensteinii), blue wildebeest (Connochaetes taurinus) and the Lechwe (Kobus leche).

As we have mentioned, the annual visitor number, *i.e.* 10,000–15,000, is relatively low. The details on the really large-size protected area are presented by Mkanda et al. (2018) and Plesník & Pelc (2018).

The Sioma Ngwezi National Park

The Zambia's third largest NP (5,270 km²) is located in south-western part of the country on the Angolan and and acacia woodland and savanna vegetation on Kalahari Desert Sands, at some site also by open grassy and periodically flooded plains. In the past NP's very fauna was almost fully exterminated by poachers two decades ago. At present improved active protection and location on large mammal migration/movement corridors among three countries have allowed at least partial recovery in fauna there. Similarly to the Kafue NP, also the Sioma Ngwezi National Park has become a part of the giant Kavango – Zambezi (KAZA) Transfrontier Conservation Area, covering the area comparable to France (cf. Pelc & Plesník 2016). From a point of view of ecotourism and nature conservation, the occurrence of a Southern giraffe (G. giraffa) autochtonous population has been important since the species does not live somewhere else in Zambia (a giraffe population in the South Luangwa belongs to other species, namely the Masai giraffe, G. tippelskirchii). In the past numerous elephant population was decimated by poachers: therefore, the current population size is of a few hundred. The proportion between elephant carcasses found and living specimens has been dramatically increasing, namely from 3% in 2008 to 85% in 2015. Moreover, the NP offers almost complete portfolio of other African charismatic megafauna including lions, African wild dogs, leopards and possibly cheetahs and some antelopes, but still in extremely low population densities. There is no permanent ecotourism facility in the NP. only along the Zambezi River about 30 km west from the National Park's border, there are five camps and lodges.

The Lower Zambezi National Park

Also extensive National Park (4.094 km²) is situated along the bordering Zambezi River, reaching width of 0.5–2km. The Zambezi River's stretch in the NP is approx. 120 km long and is surrounded by a floodplain terrace of 2–15 km in width, a chain of hills exceeding 1,000 m a.s.l. and the Great Rift Valley slopes. Many wetlands and pools (in the NP, a part of the floodplain is some months flooded), diverse bush and savannas with landmarks, e.g. baobabs (Adansonia spp.) and the Northern Lala palm (Hyphaene ventricosa) contribute to the dramatic landscape scenery. A broad range of African fauna includes the African elephant (approx. 1,500-1,700 individuals), commonly occurring Hippopotamus, African buffalo, zebras, some antelope species, Lion (a small population of approx. 30-40 individuals), Leopard, Spotted hyena and rarely also the African wild dog, the latter having 3–5 packs there. While the Nile crocodile (Crocodylus niloticus) is common, the Black rhino (Diceros bicornis) was exterminated by poaching, the Cheetah has become

Together with Ms. Mirriam Namushi, Director of the Kafue National Park, North Sector. © Vladimír Zdražil

The Hippopotamus (Hippopotamus amphibius) population on the Zambezi River in the Lower Zambezi National Park accounts for some hundred individuals. © František Pelc

parameters (strengths, possibilities) and negative values for unfavourable parameters. The detailed evaluation was conducted for all six sites selected by the MOTA, National Park Administrations staff respectively. A relatively easy access from the international airports in Lusaca and Livingstone was a primary criterion, namely up to a half-day car ride.

The model structure of an ecotourism facility of medium and lower class was also elaborated.

Outputs of the evaluation

The significantly most suitable parameters for the pilot project were found at the site located within the Kafue National Park on the confluence of the

International Nature Conservation

Kafue and Shishambe rivers. It reached 116 points in strengths, while the other sites 62-102 points, in weaknesses 28 (the other sites 35-37), in opportunities 64 (the other sites 50–55) and in threats 44 (the other sites 44–54). Strengths and opportunities were evaluated guite consistently by all experts, weaknesses for the Sioma Ngwezi site and threats for all sites display higher variability.

By an expert estimation, establishing an eco-camp site would require an investment of CZK 3-4 million (EUR 118,000–158,000). Complementary initial costs (cars, computers, etc.) are estimated at CZK 2-3 million (EUR 78,000-118,000). Annual operational costs were also estimated (approx. CZK 350,000, i.e. EUR 13,800) as well as salaries/wages (CZK 500,000-900,000, i.e. EUR 19,700-36,000) In favour of the best evaluated site in the Kafue National Park, there is its accessibility (along a well--maintained unpaved road from the high-guality Mg asphalt backbone road, location just in the central part of the NP, proximity of the NP's staff settlement), attractive and at the same time practical location on the confluence of two rivers and relatively high numbers of attractive wildlife there.

On the other side of the evaluation, there were sites from the Sioma Ngwezi National Park. The NP provides excellent landscape scenery of wilderness as well as recovering fragments of the native fauna populations. Moreover, their rather difficult accessibility along roads with deeper Kalahari Desert sands and absence of surface water (for water supply. there should be necessary to build water pumpers) at the sites studied decrease ranking and increase possible investment costs. Using lodges close to the adjacent Zambezi River or building new ones as a base for visitors and establishing a simple satellite camp just within the NP used for short-term stavs in wilderness could help to solve the problem there.

A curious cub in a lion pride, the Kafue National Park. © František Pelc

From a broader view, the sites studied in all the targeted Zambian NPs are, although with various intensity, suitable for further ecotourism development and building related necessary facilities (Lodin et al. 2019).

What next?

The study outputs as well as a comprehensive backaround document providing the primary data were submitted to the Ministry of Tourism and Arts of the Republic of Zambia managing protected areas through the Embassy of the Czech Republic in Lusaca and consequently presented at and submitted to the Czech Development Agency. The study identified the priority site, suitable sites respectively for building sustainable ecotourism infrastructure and also provides an expert estimation of costs for building a model ecotourism facility with capacity of up to 30 visitors (in total, approx. CZK 6 million = EUR 237,000) and initial costs of operation (annually about CZK 300,000-400,000, i.e. EUR 11,800-15,800 a year) and salaries/wages (CZK 500,000-900,000, i.e. EUR 19,700–36,000 a year), with services provided by about ten local employees. Management of the ecotourism facility would be step-by-step handed over to the local community, supervised by the investor. All incomes will stay at the site, contrary to standard facilities run by foreign companies. At the same time, a suggested using food from the local products (vegetables, fruits, fish, etc.) should be highlighted as another issue of the development cooperation.

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Where to find financial sources to implement the project? Using the Czech Republic's ODA seems to be the most reasonable. In 2019, according to data available, CZK 20 million (EUR 788,000) were not spent from the Czech Republic's ODA in Zambia so that they had to be redistributed by the

The Busanga Plains in the Kafue National Park harbour large herds of the Lechwe (Kobus leche) attracting predators including lions and cheetahs. 🛇 František Pelc

Ochrana přírody/The Nature Conservation Journal

the audience with the Litunga himself. © Pavel Pešout

United Nations acting in the region. Moreover, the above source could be possibly used after the necessary change in indicators, having been aiming only at agricultural (production) development in the Zambian countryside. Thus, indicators should be complemented by a possibility to support also non-productive aspects in rural development which are of the same importance as the former. The negotiations on this issue are carried out. inter alia. by the Ministry of Agriculture and the Ministry of the Environment of the Czech Republic. When speaking of that, it is necessary to mention that Zambia paradoxically displays overproduction of agricultural products, but due to the extremely low purchasing power of the population, most of them are exported to richer countries.

The African bush elephant (Loxodonta africana) population in the Sioma Ngwezi National Park displays sharp fluctuations in numbers, partially caused by poaching, partially by movement of animals to water source available within the migration corridor among Zambia, Angola, Namibia and Botswana. The herd pictured in the municipality of Nioma, consisting pf approx. 50 individuals, went to drink to the Zambezi River outside the area, © František Pelc

Currently, alternative completion of the project by exchange of students and staff between the Czech University of Life Sciences Prague and the University of Zambia in Lusaca (UNZA) had been under preparation: building a base for these activities in adjacent area to the proposed ecotourism facility has also been suggested. After examining suitability for re-introduction of the selected locally extinct species. e.a. the Black rhino or the Southern Giraffe, such measures could be implemented in cooperation with the Safari Park at Dvůr Králové nad Labem, the greatest breeder of African ungulates across Europe.

If the formal successful modification of the conditions of the Czech Republic's ODA happened. the MOTA would ask, based on the above feasibility study, for support in 2021. The activity should cover a pilot project involving also other local communities in the region where the evaluation of feasibility has been made in 2019 focusing on enhancing the capacities, skills and approaches also in the other sites having been studied. If this is successful, the further Czech Republic's ODA then could target the other two NPs.

The project shows significant multiplication effects of the ODA's outputs: it shall contribute, inter alia, to poverty alleviation, support to local communities, enhance nature conservation and biodiversity protection and also reduce migration of local people to urban areas or possibly to other regions or countries. Including the communication, education and research activities or possible wild animal reintroductions suggests another potential of the project's development.

The project was peer-reviewed by Lídie Stellová (Stella Travel), an expert and a private entrepreneur in ecotourism in sub-Saharan Africa, and leading expert in research on and conservation of sub-Saharan biological diversity David Storch (Faculty of Science, Charles University Prague and Centre for Theoretical Study Prague, a joint research institute of Charles University and the Academy of Sciences of the Czech Republic).

Acknowledament

The authors would like to express their sincere gratitude to the staff of the Embassy of the Czech Republic in Lusaca, particularly H.E. Radek Rubeš, the Ambassador to Zambia, for an excellent preparation of five meetings with key partners at the Ministry of Tourism and Arts of the Republic of Zambia and at the respective National Park Administrations.

On Nature in the Czech Republic

Kučová V.: The Krušnohoří/Erzgebirge Mts. Mining Region as a World Heritage

In July 2019, the selected parts of both the Bohemian and Saxonian Krušnohoří/Erzgebirge Mts. were inscribed on the UNESCO World Heritage List. In a general perception, the region has been for a long time associated with brown coal mining impacts in the foothills of the extensive mountain range. Therefore, the article contributes to explanation of the huge Krušnohoří/Erzge-

birge Mts. cultural and historical values and inspires an increase in inter-sectoral cooperation. The main target of efforts to inscribe the selected parts of the Krušnohoří/ Erzegebirge Mts. on the World Heritage List was to maintain evidences of mining and mineral extraction there forming the character of the mountains for more than eight centuries. Formally, the World Heritage Site consists of 22 components including some solitary monuments. On the Saxonian side, there are 17 World Heritage Site's components, while five components are located in the Czech Republic, but the area of them is similar in both the countries. The Town of Jáchymov Monument Zone, including inter alia a well-known historical mint and the oldest uranium mine called the Svornost/ Concord Shaft, provides a magnificent

BioLog http://biolog.nature.cz

Species recording is a crucial source of data for nature conservation. The recording needs to be effective, precise and comfortable. Recent technologies are suitable environment to do so.

The BioLog Android application by Czech Nature Conservation Agency, serves as an effective way to collect records in the field or just while hiking in nature. BioLog provides an off-line notepad for your observations of animals, plants or fungi in the nature of Central Europe.

The application enables automated localisation (via Google maps) and recording in structured form, which is possible to be imported into Species Occurrence Database of NCA (https://portal.nature.cz/nd) or to be exported. levels.

BioLog could be used as a hint source for species search or species local distribution atlas, from the opposite side. Through filtering of Species Occurrence Database via the Around Me function you can get the records collected near to your position on the screen. Your new records through BioLog can then easily enrich this distribution atlas.

The app is connected to the Species Occurrence Database and therefore collected records could be used in wide spectrum of conservation practice based on species presence: as a ground of administrative issues, for management of the specific areas, for assessments on local and regional

Species Occurrence Database https://portal.nature.cz/nd

Species Occurrence Database is a valuable information resource for experts and all interested in species in Czechia. It is a central species data repository on the national level.

Database encompasses more than 26 million of localised and dated records of 24 thousand species. Three guarters of data are of plants, animals are making a fourth quarter, fungi and lichens do not reach one percent of the data volume. Most of the data are results of expert municipality (if it is in Czechia), just try to search...

research and monitoring, but the involvement of public in the citizen science project shows a growing trend.

Former intention to build a database for expert and official use made the growing public interest and open data policy outdated. The data (except of sensitive records) are today available under the Creative Commons License for any registered user.

Public are grid maps of species distribution

(available at https://portal.nature.cz/kartydruhu), which are generated on a day-to-day basis on the actual state of database, the published knowledge is very recent. The grid maps enable the comparison with published and digitized species distribution atlases. Data are available also in BioLog, the Android app in Around Me function.

Full records are accessible through Filter (at: https://portal.nature.cz/ nd), the main gate to the database: just put the species name or other conditions. If you are interested what species you can find in your home

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example on the Bohemian side. In future, close cooperation between the State Nature Conservancy and National Heritage authorities in implementing management measures there is needed.

Šafář J., Koudelka M. & Polášek V.: The Špraněk National Nature Reserve – Treasures Are not only Underground There

In the Bouzov region (Central Moravia), people have since time immemorial known three remarkable karst phenomena in the foothills of the Sprang Hill, currently called Špraněk Hill, namely the Zátvořice Abyss, the Zkamenělý zámek/Stoned Castle Rock Cliff where a little castle had been located and the Svěcená díra/Sanctified Hole Cave. The latter irritated local people's phantasy: little wonder there are some fables related to Špraněk Hill, mostly dealing with precious stones, gemstones and other treasures hidden underground. Moreover, the real treasure was discovered in the Svěcená díra/Sanctified Hole Cave by Vilém Švec, the local forester, his sons and collaborators – this was the unique Javoříčko Caves. More than 80 years have passed since man visited the by that time unknown underground space on Špraněk Hill for the first time. After discovering the Javoříčko Caves, attention was paid by explorers and researchers mostly to underground. As soon as from the late 19th cen-

tury botanists had been examining huge plant species richness on the surface on Špraněk Hill: later, species rich fauna was also surveyed there. Most surface within the Špraněk National Nature Reserve is covered by forests: thus, a long-term goal in forest management is to leave approx. 90% of the NNR's territory to spontaneous development by natural drivers.

Zajíček P.: A Hundred Years since Discovering the first Parts of a Waterway in the Punkva Caves

The Punkva Caves located in Central Moravia are among the most popular tourist destinations in Europe. The fact is caused not only by rich karst ornamentation in underground spaces or excursions to the Macocha/Stepmother Abyss bottom, but particularly by a cruise on motor boats through a system of greenly shined underground lakes. A hundred years ago, the first parts of the so-called Punkva Caves

waterway had been discovered. In addition, their survey resulted in another unexpected and surprising discovery. In 1921, a short boat trip with an excursion to the Pohádkové jeskyně/Fair-story Caves called the Masaryk Dome began. A dry branch of the Pohádkové jeskyně/Fair-story Caves allowed a discovery of the Skleněné dómy/ Glass Domes continuation towards to the

Summary 2020

Suchý Žleb/Dry Gully. Since 1933, a visitor tour through the Punkva Caves has been going through a dry part to the Macocha/ Stepmother Abyss bottom. From that site, visitors float on motor boats through the Macocha/Stepmother Abyss water domes to the Punkva River spring in the Pustý žleb/Dry Gully with a short stop at the Masaryk Dome.

Zajíček P.: The Na Pomezí Cave: 70 Years since Becoming a Show Cave

Karst areas in North Moravia and Silesia have passed a long geological development and rocks consisting them have undergone complex metamorphosis from original organogenic limestones of the Devonian Period to crystalline ones, i.e marbles. The Na Pomezí/On the Border – Liščí díra/Fox Hole underground cave system reaching almost 2 kilometres in length is the most extensive cave system created in marbles in the Czech Republic. Seventy years ago, the unique underground space became a show cave. Nowadays, a visitor path is 450 meters long and the cave is visited by approx. 50,000 persons annually. Some patterns in the Na Pomezí Cave illustrate remarkable geological development in the area. Complexity and extension of underground space shows that relatively small karst bodies can also hide underaround holes of surprising volume. A rich karst ornamentation attracts tourists on the visitor path accessible to the public. Pursuant the Czech Act on Nature Conservation and Landscape Protection, as amended lat-

er, the Na Pomezí Cave has been declared, together with adjacent karst phenomena, a National Nature Monument.

Hlaváč V.: Fifty Years of the Žďárské vrchy Hills Protected Landscape Area. Looking at the Past and Brief Thoughts on the Future Direction

In 2020, the Žďárské vrchy Hills Protected Landscape Area (PLA) has been celebrating 50 years since its establishment. On the border between Bohemia and Moravia, primary, mostly beech-fir forests had begun to change as early as during the first

continuous settlement in the 13th century. Ore-mining, glass-making and particularly agriculture on sloping lands in harsh natural conditions shaped for centuries the landscape into a unique picturesque mosaic there. It also included rural settlement with typical buildings of local folk architecture. adjacent sloping small fields separated from each other by small strips made from for centuries gathered stones, wet peat meadows with extraordinary species richness, but also fishponds, forests or mysterious peat-bogs. The region with highly original spirit inspiring painters, music composers and writers has been maintaining its charm at some sites. The PLA's current priorities include water retention within the landscape, forest restoration after European spruce bark beetle (Ips typographus) plagues, consistent persecution of illegal afforestation and supporting biological diversity across the farmland.

Ochrana přírody/The Nature Conservation Journal

Juřičková K. & Mückstein P.: The Svratka River Meanders Nature Reserve near the Village of Milovy – A Mountain Valley Floodplain right in the very Heart of the Žďárské vrchy Hills

Within the Milovy Basin in the middle of the Žďárské vrchy Hills, the Svratka River flows through an extraordinarily well-preserved broad mountain valley floodplain.

There have been only a few sites where nature has not been heavily appropriated by humans and has been left to spontaneous development. The meandering Svratka River on the border between Bohemia and Moravia in the Žďárské vrchv Hills Protected Landscape Area is among such magic corners where adjacent meadows are flooded during the spring melting: later in summer, they show a brightly coloured palette of flowering plants and on cold autumn days, they are covered by a mysterious misty veil. The valley floodplain phenomenon with the climate of higher inverse elevation, displaying higher humidity, lower temperatures and frequent mists and fogs, all these patterns have allowed survival of many remarkable wild plant and animal species including glacial relicts (cold-adapted species that has been left behind as the range of the species changed after an ice age ended). The State Nature Conservancy is challenged by a project for restoring extensive growths, particularly by those nowadays covered by canary-grass (Phalaris spp.) in the most degraded part of the regularly flooded floodplain.

Ochrana přírody/The Nature Conservation Journal

Härtel H.: European Transboundary Protected Areas: Bohemian-Saxon Switzerland

The article opens a series on European transboundary protected areas certified within the EUROPARC Federation's Transboundary Parks Programme. The activity follows initiatives initiated by the IUCN, inter alia, as a part of launching the Parks for Life Programme (1994, priority project

No. 22) and which in Central and East Europe had started soon after the Fall of the Iron Curtain. Due to the fact that Europe consists of many mostly small countries. transboundary cooperation has been not only a welcomed benefit but often a necessary precondition for well-functioning of many protected areas. In addition, the transboundary cooperation in Bohemian--Saxon Switzerland certified within the Transboundary Parks Programme is implemented not only by both the national parks, but also by two Protected Landscape Areas. Among the Czech representatives, Dr. Jan Čeřovský, co-founder of modern nature conservation in former Czechoslovakia, the Czech Republic respectively, was significantly involved in these activities. In 1996, the IUCN issued a proceeding of the international conference entitled Biodiversity conservation in Transboundary protected areas in Europe (Čeřovský 1996). Experience from Bohemian-Saxon cooperation as well as conclusions made from it presented

in the proceeding (Hentschel & Stein 1996)

has been fully relevant also at present.

Hromas J. & Komaško A.: 70 Years since **Discovering the Koneprusy Caves**

Zlatý Kůň/Golden Horse (Central Bohemia) is a hill that should not exist anymore. By chance, it is National Nature Monument today. In 1972, the protected area was declared there "to protect the Koneprusy Drip-

stone Caves and other karst phenomena as one of the geologically oldest in Europe, with fossil findings of animal and humans remains from the Upper Pleistocenne and with archaeological and historical findings". The cave system is the longest in Bohemia reaching 2.050 meters in length and more than 70 meters in depth. The part open for the public is attended by almost 100,000 visitors from around the world annually.

Hruška J., Oulehle F. & Lamačová A.: Is the Hvdrological Balance in Forest Catchment Areas Influenced More by Climatic or Vegetation Drivers?

In 2014-2019, Central Europe suffered from extraordinary droughts and heat waves. The events, although not friendly both to humans and ecosystems helped to answer some questions related to the hydrological balance in the Czech Republic's landscape and together with climatic models to outline the expected future. Particularly collapses in Norway spruce commercially managed forests naturally resulted in low ability of monoculture/plantation forest management to react to rapidly changing environmental conditions, e.g. increase in the temperatu-

re and in variability in the precipitation total and rainfall distribution. Forest production has been reaching its limits namely in areas where requirements on vapour are almost the same as the precipitation total: these are particularly located between 450 and 600 m a.s.l. The landscape and water balance would strongly benefit from restoring water courses and their floodplains as well as from restoring wetlands and creating new ones.

Rešl D.: Fifty Years of the Orlické hory/Eagle Mts. Protected Landscape Area

The Orlické hory/Eagle Mts. landscape (eastern Bohemia) celebrates 50 years of legal protection under the label of Protected Landscape Area (PLA). Small area hidden along the borders is sometimes overshadowed by the adjacent Krkonoše/Giant Mts. and Jeseníky Mts. Moreover, the Orlické hory/Eagle Mts. are picturesque and

in many ways unique. Before declaring the PLA, the landscape had sharply been modified there. In the first half of the 20th century the area was relatively densely populated by humans. Except the tops, mountain slopes had been deforested and land was used by agriculture. Since the 1950s the landscape has been reforested: thus, forests currently cover 70% of the PLA's territory. When forest communities on the mountain tops had begun to recover after heavy air pollution, being intensive particularly in the 1980s, new disasters, namely droughts, winds and the European spruce bark beetle (Ips typographus) plague appeared. Nevertheless, during the last decade, spontaneous comeback of the European beech, also known as the Common beech (Fagus sylvatica) and the Rowan (Sorbus aucuparia) can be observed there. Restoration measures have brought back the natural flowing on the Zelenka Brook, Záhořský potok Brook at the village of Orlické Záhoří and the Souvlastní watercourse at the human settlement of the same name and other measures have step-by-step been implemented or being under preparation.

Nature & Landscape Management

Lysák F.: Difficulties in Organic Substrate Mineralization during Ecosystem Restoration

Organic sediments and soils with high organic matter proportion are typically found on floodplains, spring areas, peat-bogs and generally wetlands of all types. Forming

layers with high organic matter proportion is a long-term process lasting centuries and millennia, where mostly plant remnants are step-by-step slowly accumulated under anaerobic conditions. Thus, in constantly water-logged layers the organic matter captures a lot of nutrients as well as of carbon. As soon as anthropogenic changes in water regime, namely decrease or fluctuations in by that time more or less stable groundwater level occur, both aeration of substrates and accelerated mineralization begin and nutrients and carbon dioxide are released. The article presents author's lessons learnt in wetland restoration and advices on measures to be applied in the field.

Poltýn F. & Dedek P.: The Mikulov Alley -A Good Practice Example

Alleys, avenues and lanes have been following humans on their roads since time

immemorial. The first ones had been established as early as in the Middle Ages, their popularity peaked in the Baroque period and they have become an integral part of the so-called composed landscape. Their role was not only aesthetic, displaying also landscape management, strategic (orientation and mobility in the field, a cover for moving of troops) as well as production (fruit tree alleys fed those troops) functions. The above multifunctionality was so important that changes in legislation were needed, e.g. duty to plant alleys along newly built roads introduced by Maria Theresa, the Holy Roman Empress in 1752. The article aims at highlighting a new historic role of alleys and presenting the necessity to accept it during management and restoration of these landscape elements. Using the

Ochrana přírody/The Nature Conservation Journal

Mikulov Alley as an example the authors show that although alleys provide saproxylic insects with substitute habitats, their species richness there is sometimes fully comparable with that of more extensive protected areas.

Ekrtová E., Křivan V., Jelínek A., Poledníková K. & Poledník L.: The European Ground Squirrel (Spermophilus citellus) - An Umbrella Species for High Biodiversity Farmland

In the Czech Republic, a sharp decline in biodiversity in the agricultural landscape has recently become very urgent. The topic even jumps from scientific journals and enters into

mass media, thus confirming its weight and severity. Consequently, a part of the general public has been interested in the issue. Moreover, only negative examples are almost always given, while a positive example of diversified high biodiversity farmland only minimally appears there. Using recovery in the European ground squirrel (Spermophilus citellus), also known as the European souslik, as an example, the article presents a complex of vineyards, orchards, fields and steppes on the periphery of the town of Velké Pavlovice (South Moravia). The heterogeneous landscape can inspire not only ecological restoration towards rich and diverse farmland but also for a strong appeal for its conservation, preservation and maintenance.

Ochrana přírody/The Nature Conservation Journal

Dolejský V.: The Grey Wolf Management Programme for the Czech Republic – An **Introductory Presentation**

Before the mid-18th century, Grey wolf (*Canis* lupus) numbers had dramatically declined and during the reign of Maria Theresa of Austria, Holy Roman Empress and Queen of Bohemia (1740 – 1780), wolves were rare. In Bohemia, wolves survived for the longest time in the Dominion of Krumlov, namely by 1795. In Moravia,

the Grey wolf occurred more frequently and the last historical records of hunted individuals are known from the Kouty Forest District in the Jeseníky Mts. (1907), close to the Town of Zábřeh (1908) and finally from Červený Grúň near Jablunkov from 2014. Wolf's comeback had begun by its first occurrence after the World War II which happened near the town of Staré Město pod Sněžníkem. North Moravia. dated 1947. Other evidences reported in 1960. 1965 respectively are located at the village of Štáblovice, Opava Region and of Kunčice in the Králický Sněžník Mts., both again in North Moravia. There were step-by-step more sites of the wild canid's occurrence and migration from the Grey Wolf's Carpathian population living in Slovakia and Poland has resulted in regular presence of a wolf pack in the northeastern Moravia since 1995 giving a chance to establish a viable sub-population of the large carnivore there. In the last two years, Grey wolf's recovery fed mostly by dispersal from the Central European Lowland population in Germany and Poland has been causing a lot of uncertainties and conflicts across the coun-

try. The Grey Wolf Management Programme

Krejčí L.: Close-to-nature Management of the Černá Ostravice River in the Beskydy/ Moravian-Silesian Beskids Mts. Protected Landscape Area

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for the Czech Republic having recently been approved by the Czech Republic's Government responds to these issues: the policy document also includes an effective system to prevent and compensate damages caused by wolves.

Limrová A.: Priority Area/Axis No. 4 on the Home Stretch of the 2014 – 2020 Operational Programme Environment Implementation Period

According to the title of the 2014 - 2020 Operational Programme Environment it may look like the year 2020 is the last for the above implementation period in the Czech

Republic. In the fact, we have reached about two thirds of its lifespan. The article presents an overview of projects finished or having been implementing since 2014. Financially. the programme has already spurting by finalizing, but many projects are only crouching down; their completion and thus, the overall assessment of the 2014 - 2020 implementation period have still been waiting for us. In 2020, the last calls will probably be launched for most of the specific targets, but this shall not be the end. Implementing hundreds of projects will be continuing in the coming years and the Nature Conservation Agency of the Czech Republic will watch with expectations their outcomes.

The study mentioned in the article determines the way of measures based on a proper analysis of the Černá Ostravice River fluvial system. There are three alter-

natives of measures suggested. Each one of them can offer certain benefits and it only depends on a discussion among the authorities involved, which one of them should be preferred. The final set of measures can eventually use the various effective parts of all the alternatives proposed, applied in an advantageous combination. In general there are suggested some measures convenient to the proper fluvial function and to the good river ecological state including all components. The study presented should be perceived as a concept supposed to be further developed and designed more specifically during ongoing discussions. Everybody has to realize that all the implemented measures represent certain initial state which can be either leave to its own further development, or can be also regulated in the case of need.

Kubín M., Závorka L., Rulík M., Galia T., Škarpich V., Mikl L., Šmejkal M. & Jaskula F.: He Who Flouts Might Survive. Heavy Machinery Effects on Life in Rivers

The goal of the study conducted in the Odra/Oder River Basin within the Beskydy/ Moravian-Silesian Beskids Mts. Protected Landscape Area in 2016 – 2019 was to evaluate mortality in the Alpine bullhead (Cottus poecilopus) and Brown trout (Salmo trutta) during in-channel interventions

by heavy machinery and to obtain information about their movement. Moreover, the effect of interventions on zoobenthic populations and channel morphology was assessed. The mean mortality of fish species (31%) and zoobenthos (95%) was found during the interventions. The probability of bullhead mortality decreased by increasing size of a fish body during heavy machinery operations, but no such trend was observed for the trout. Mean distance of fish movement (at variable directions) was 10 m in both assessed fish species. There were no differences between the movement before and after intervention for both fish species except the high-flow period. Distances of movements of the bullhead were longer during high flows (up to 566 m upstream) than during low water stages (only a few meters). By contrast, there were no differences in recorded distances for trout movement between high-flow and lowflow periods. The intervention of heavy machinery led to decrease in longitudinal and cross-sectional channel heterogeneity and the management reduced diversity in zoobenthic species (59%). 2D hydrodynamic simulation (Iber software) calculated up to 75% volume of deposited fine material in 40-m long channel section during low flows.

John V., Beneš J., Číp D., Andres M. & Konvička M.: Butterfly Conservation in the Era of Climate

During the last decades, Central Europe has significantly become warmer which is, inter alia, reflected in insect fauna. The

most recognizable example is an expanding distribution range of the European mantis (Mantis religiosa) which occupied whole Moravia in the 1990s and has reached Bohemia and it at present occurs also in the foothills of the Krkonoše/Giant Mts. or in the Bohemian-Moravian Highlands. According to the authors, butterflies expanding their distribution range into new areas include the Large copper (Lycaena dispar), Great banded grayling (Brinthesia circe) and the Scarce swallowtail (Iphiclides podalirius). In the Czech Republic, there are about 20 (diurnal) butterfly species with recent expansion, among nocturnal species (moths) the migratory African death's-head hawkmoth (Acherontia atropos) and the Oleander hawk-moth, also known as the Army green moth (Daphnis nerii) have been expanding their distribution. Research outputs show that in the Czech Republic generalist species expand, species with more specific requirements are not expanding and many species has been becoming extinct there. The article highlights species which need active measurements for their survival: steppe species of such type include namely the Hermit (Chazara briseis) and the *Damon* blue (*Polyommatus damon*) while among forest species, the Scarce fritillary (Euphydryas maturna) and the Rock grayling (Hipparchia alcyone) should be mentioned. Management imitating the prehistorical landscape grazed by large herbivores is particularly effective and due to rapid climate change, translocations have been putting at the front although they were refused until recently by the authors.

Baranovská E. & Moravec P.: Conservation and Reintroduction of the Hermit (Chazara briseis) in the Louny part of the České středohoří/Bohemian Uplands Protected Landscape Area

The Hermit (Chazara briseis) is one of the most threatened butterfly species in the Czech Republic. As late as in 2006, 1,323 individuals of the species were found on some hills in the

České středohoří/Bohemian Uplands Protected Landscape Area, mostly on Raná, Oblík and Srdov hills. Since that time, hermit populations on Oblík and Srdov hills have become extinct and the numbers have dramatically declined also on Raná Hill. In 2016, the extensive autecological study revealed that long-term survival of the Hermit needs to maintain metapopulation dynamics and to recovery populations at the original sites. Therefore, measurements to create suitable habitats for the above butterfly species have been carried out on Raná Hill and other adjacent hills: they include mowing, old unwanted grass removal and grazing in the suitable periods and with appropriate intensity. In addition, it was necessary to reintroduce hermits at the original sites. Based on outputs provided by monitoring in 2018 -2019, efforts to reintroduce hermits on Dlouhá hora/Long Hill and Číčov Hill can be considered successful.

Kaděra M.: Forest Dimness versus Heliophilous Fauna

Light and water are among basic drivers of successful life's development in all for-

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est ecosystems, notably in those inhabit-

ed by rare organisms displaying specific requirements for food quality. This is particularly the case of floodplain forests, especially unique South Moravian ones. Because both the above factors have been for a long time very negatively affecting biota there, the article aims at supporting a certain redress there. The author chiefly highlights bothers caused to heliophilous forest fauna by absence of sunny habitats: he suggests that roots of the troubles have been in the presence of other forest formations than in the past as well as in reluctance of foresters to accept non-productive forest functions. Therefore, he proposes, inter alia, artificial pruning of habitats which old trees would benefit from. In addition, the author describes measurements to be applied in practice in this way. For the State Nature Conservancy, despite various obstacles, to locally promote other forest management approaches saving faunistically remarkable forest heliophilous species as much as

Lukavský J.: Is Our Yellow-rattle Functioning Properly? Experience from the Field in a Region

possible from extinction is a difficult task.

After abandoning traditional agricultural practices in the landscape and due to increasing eutrophication, grassland species richness has been declining also due to grass expansion. The effect has also been expressed in Specially Protected Areas (SPAs) where the Wood small-reed or

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Bushgrass (Calamagrostis epigejos) spread massively across. Increased frequency in mowing has been applied not only because of lack of funds but also as a support to specially protected and threatened wild plant and animal species. Thus, the measures to support threatened species often paradoxically resulted in SPAs' degradation. The trend can be reversed by using the European yellow-rattle (Rhinanthus alectorolophus) in managing forestless areas. By its experimental sowing, positive effects of the plant on species composition, richness and diversity were confirmed. Using

the European vellow-rattle both to suppress the Wood small-reed and to enrich the grassland growth surpasses expectations and the forestless area management measure is a suitable compromise between botanical and zoological interests where enhancing threatened plant species, sustainable development of plant communities and long-term support to invertebrates are fully merged. It can be concluded that the European yellow-rattle would be used more both in SPAs and in the non-reserved landscape.

Pilous V.: Threatening Tufa Waterfalls in the Bohemian Massif in Relation to Climate Change

Occurrence of tufa fresh water carbonates in the Bohemian Massif is sparse due to the geological and climatological conditions. However, they are important research features and somewhere they are

attractive for tourists as well. The recent tufa waterfalls are of very special importance, as a huge range of micro-landforms originates on their surface and they also host a huge variety of biotic features. Beside the Český kras/Bohemian Karst, the Český ráj/Bohemian Paradise Protected Landscape Area is an area with the highest number of tufa waterfalls in the Czech Republic. They belong mainly to a type of false-tufa waterfalls, i.e. they are not developed in carbonate rocks, but in Cretaceous sandstones. Some of them build cascades or are developed on gentle slopes. All the important sites are located in deciduous broad-leaved forests and thus the tufa-forming process is endangered by the fall of leafs and branches. These organogenic sediments were usually periodically removed by increased water flow in the past. Due to climate change, the snow cover was very poor or almost completely absenting during last winter seasons. Thus, the gently-inclined slope parts of the waterfalls still remain covered with organogenic sediments. As a result, forming of tufa is interrupted and moreover, the tufa is beginning to be degraded and disintegrated by regelation-induced gelivation process and the root pressure of the natural rejuvenation saplings. In order to protect the extremely important and valuable natural features, it is necessary to initiate periodical monitoring of their development and take special management, particularly removing the organogenic sediments covering the tufa surface and reducing the rejuvenation saplings.

Vébrová D.: The Twenty-Year Way from **Cultural Forests to Natural Processes**

The Bohemian Switzerland landscape (northern Bohemia) is well-known for its romantic beauty of rock massifs, gorges, glens and narrow passes in a mosaic with some basaltic peaks. The reason why the Bohemian Switzerland National Park (NP) had been established was unique morphology and related specific habitat conditions but not conviction that extraordinarily well--preserved ecosystems dominate there. Moreover, forest size and continuity not disturbed by human settlements had also been appreciated. After approx. one year efforts carried out by the NP Administration to stop or at least to slow down European spruce bark beetle (Ips typographus) spreading, there have been extensive deforested areas in the NP's climatically warmer and drier western part. Therefore, the NP Administration limited its measurements to a buffer zone along the NP's border where forests of other owners are located: thus, natural processes have been dominating within the

NP itself. On more than a half of the NP's territory, all bark beetle wood has been left to decay just at the site. Mental and practical shift in forest ecosystem management there can be defined as redirection from details and from efforts to reach "naturalness" to preferring natural processes on the compact area of sufficient size.

Stejskal R.: Targeted Application Methods or a New/Old Tool for Controlling Invasive

Alien Woody Plants: The first Experience from the Podyjí/Thaya River Basin

Invasive alien woody plants have for a long time been causing serious problems for protected parts of nature. Although we have been trying to control invasive alien woody plants, e.g. the most common Black

locust (Robinia pseudoacacia), in many Specially Protected Areas in the Czech Republic, an effective management tool has been missing yet. In practice, there are various approaches differing in their philosophy and effectiveness and very often repeating mistakes, thus making sometimes the state of the art even worse instead effectively solving the problem. The article presents the first experience from applying new measures in controlling the Black locust and other invasive alien woody plants in the Podvií/Thava River Basin National Park (South Moravia). In fact, these are various modifications of the herbicide injection targeted at invasive alien woody plant trunk having been known for decades and included into the document Eradication of the selected invasive alien plant species (Pergl et al. 2016). In the Podyjí/Thaya River Basin National Park, the Black locust often occurs in valuable habitats of heathland, rock steppe or species-rich dry grassland outside forests as well as on forest clearings - directly among Greater pasque flower (Pulsatilla grandis) clusters, Burning bush (Dictamnus albus) growths or at orchid sites. Due to the targeted application it was possible to treat also black locusts growing just among rare and threatened plants. The first experience from applying the methods in the Podyjí/Thaya River Basin National Park provided promising outputs.

Karnecki J.: Water Retention in Urban Agalomerations

When mentioning the water retention, it mostly is related to water management in the open landscape. Nevertheless, the programme entitled as Brooks for Life having been implemented across the whole City of Prague's territory aims at brook restoration in the capital of the Czech Republic. It has

also been helping to raise awareness of watercourse restoration among the general public there. In addition, Prague citizens can enjoy themselves the benefits provided by the restoration. In other words, they can physically touch the water. In Prague, some hundreds of meters of watercourse beds are restored each year and new projects have been becoming more and more ambitious. Inter alia, extensive restoration of the Rokytka and Běchovice brooks as well as connecting the Berounka River and the Krňák cut-off meander at the Lipence city quarter have been under preparation.

Koutný J. & Servus M.: A Gift for the Thirty Years of the Litovelské Pomoraví/Litovel Morava River Basin Protected Landscape Area

In 2020, the Litovelské Pomoraví/Litovel Morava River Basin Protected Landscape

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Area (PLA) celebrates 30 years since its establishment. One of the youngest PLAs in

the Czech Republic includes in each season the extraordinarily picturesque floodplain landscape sometimes called the Moravian Amazonia where both the floodplain forest and the river live in symbiosis. For centuries, floods overflew and spilled into the forest along the river and brought water and soil enriched with nutrients. The ecosystem of the periodically flooded forest has fully been dependent on dynamically flow and sediment runoff river regime. Therefore, restoration projects have been implemented there and the action entitled Support to the spontaneous Morava River restoration near the town of Štěpánov won the Olomouc Region Award for significant contribution to environmental protection in 2020.

Just T.: River Strips Restoration and News from Bavaria: Riparian Strip Protection by **Agriculture Use Prohibition**

A river (as well as a brook) strip is an area dominantly formed by a watercourse and used for its functions and development. It used to be naturally waterlogged and often spilled by floods and it harbours specific wild plant and animal communities/assemblages. Therefore, it is normal not to built-up and plough it. If there is a floodplain along the watercourse, a river strip covers most of it or the floodplain as a whole. Restoring a river strip is significantly more beneficial than renaturalization of the river bed. In Bavaria, water ecosystem restoration profits from

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the close relation to flood prevention, control and mitigation. Based on the plebiscite, they approved prohibition of agricultural production 5 meters from the watercourse edge there. In the Czech Republic we would follow the Bavarian approach.

Pešout P. & Knížátková E.: Adaptive Management in Specially Protected Areas Implemented by the Nature Conservation Agency of the Czech Republic

Protected area management is one of the most important tasks of the State Nature Conservancy. Due to improving the knowledge of species and natural habitat distribution and their development as well as increasing uncertainty caused by incomplete knowledge of impacts resulted from extensive anthropogenic land-use changes and current and predicted climate change. a traditional long-term planned blueprint

management has been untenable. Therefore, the Nature Conservation Agency of the Czech Republic decided to apply in practice adaptive management (AM) and to introduce necessary information and economic tools for its implementation. The AM is a never-ending cycle or a helix in the respective Specially Protected Area (SPAs) management: it substantially is based on an iterative decision-making, *i.e.* evaluating results and outputs of the given protected area management including measurements having been applied in the field and adjusting actions on the basis of what has been learned. Particularly when responding to climate change impacts and permanent changes in land-use caused by humans it shall be necessary to allow to implement to a very large extent and a lot more than now alternative and experimental measures in the SPA management. Thus, taking into account lessons learnt from the SPA management shall not be related to the cycle of updating and amending management plans for these SPAs, but it should be established as a continuous and permanent process. The process shall be, of course, managed because it places higher demands on expert/technical knowledge during the decision-making procedure.

Vait J., Just T. & Vogl Z.: The Lower Berounka River – A Chance for Nature

In the city of Plzeň/Pilsen, the Berounka River is formed by the confluence of rivers draining a large fan-shaped flabellate basin, thus determining its flooding activity. Between the city of Plzeň/Pilsen and the town of Beroun, the river has maintained a relatively natural character, particularly in from a point of view of nature and the landscape excellent valley above the village of Křivoklát. Below that point, the valley becomes wider, it is crossed by a railroad, there are more built-up areas, the river is fragmented by weirs and some river's parts were variously modified in the past. In past years, continuous technological changes were made also to the river bed there, including the naturally valuable Český kras/ Bohemian Karst, and making the Berounka River navigable was planned, too. Finally, climbdowning the latter idea has open pos-

sibilities to implement measures improving ecological status of the river. They include a lot of fish ladders/passes, restoring the

whole river's stretches and measures to introduce nature-based solutions in flood prevention, control and mitigation.

Nature Conservation Legislation

Jelínková J.: Small Water Reservoirs and Landscaping to Retain Water in the Landscape-What Means that "a Binding Opinion of the State Nature Conservancy Authoritv Is Not Required"

On February 1, 2020 Act No. 312/2019 Gazette which changes the Building Act and the Water Act to support building of small water reservoirs and landscaping serving to retain water in the landscape entered in force. Despite a meritorious intention. adopting the legislative proposed by Members of Parliament causes at least a tough nut to crack to interpret it, as regards its relation to the Nature Conservation Act and to scope of the State Nature Conservancy authorities. Considering the above, the author thinks it is necessary the Ministry of the Environment and the Ministry of Agriculture methodologically direct the State Nature Conservancy authorities, water manage ment authorities respectively, so that both the authorities in mutual cooperation are able to prevent any harmful interventions in the interests protected by Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later.

Mana V.: A Speech of Facts and Proposing Laws

In light of developing the Building Act recodification in the Czech Republic, the author thinks about the process of making the act itself and concludes that people do make their decisions neither on numbers nor on verified information, but on stories creating a great deal of emotion. The simpler story, the stronger affect, because it can be understood by most of the society. At the same time it has been known that thinking hurts. Probably because of the above patterns people may not to naturally tend to seek the truth and are satisfied with the confidence in newspaper headlines. Experts in political marketing know very well that really effective propaganda should be limited to a few simple slogans which are often and again and again repeated until they are believed by the whole society. Moreover, the aim of a legislator should always be a high-quality piece of legislation which will serve the society as long and as good as possible. Such a law cannot be developed without detailed and thorough analytic background documents describing the roots of the problems to be solved by the new piece of legislation.

Svoboda P.: The New Building Act - How to Castrate Nature Conservation in the Czech Republic

The author highly critically assess a proposal on the Building Act recodification in

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the Czech Republic. It was made within the sphere of legislative clientelism, favouritism and a serious conflict of public and private interests. The proposal was developed by the interest entrepreneur association bringing together building corporations. Therefore, in legal relations regulated by

the Building Act it represents interests of the only one, single group of stakeholders, namely entrepreneurs in building industry, indeed developers and builders. The new Building Act proposal is an unprecedented degradation of legislation on nature conservation and environmental protection in building law procedures, clearly resulting from clientelism in background of its elaboration which has had no equivalent in the democratic development of the Czech Republic since 1989. The act's proposal is conceptually objectionable and corrupt in its fundamentals themselves and cannot be improved in the further legislation procedure. Thus, the only reasonable step can be taken in this respect: do not adopt it and send it back to the Ministry of Regional Development of the Czech Republic to be rewritten.

Dědek V.: Public Participation in Building Administrative Procedure after Reforming the Building Law

As described by the authors of the article The Truth on Participation of the Public in Administrative Procedures (Ochrana přírody, 74, 3, 17-19, 2019), there has been a trend to reduce rights of civil society asso-

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ciations to participate in administrative procedures dealing with nature conservation, landscape protection or with environmental protection in the Czech Republic. The reason is an effort to accelerate building huge infrastructure across the country. The acceleration of building and development is also the main declared goal of the Building Act recodification having been under preparation. The article highlights the proposed changes in public participation in nature conservation and landscape protection and concludes that most of them cannot be considered as unambiguously positive and that it is difficult to image how the precondition that state administration authorities should be unsuggestible will be anchored and how systematic impartiality of the respective civil servants will be provided.

Jelínková J.: Eliminating Consequences of Unauthorized Interventions Pursuant to Article 86 of the Nature Conservation and Landscape Protection Act - Questions from Practice

Explanatory memorandum on Article 86 of Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, says that "provisions on elimination of consequences of unauthorized interventions are practically key tools of the Act because they allow to remedy/ compensate an ecological damage caused to nature and the landscape". In the fact, applying Article 86 of the Act is not common in the practice. This is not only because some damages simply cannot be

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compensated in the practice, but also a wrongly understood possibility for administrative discretion ("may impose to carry out measures in order to achieve remedy") and reluctance to deal with legal and factual issues related to decision-making on possibility and purposefulness of restoring the respective parts of nature and the landscape to their original conditions and particularly by imposing on the liable person to carry out adequate compensatory measures in order to achieve remedy. The article summarises how these contentious issues are reflected by the case-law of administrative courts.

Zdráhalová L.: Various Approaches to Damages caused by the Grey Wolf

The Grey wolf (Canis lupus) originally inhabited almost the whole Europe, but due to persecution in the past its distribution range has significantly declined. In addition, wolf population size is affected by suitable habitat degradation and loss. At present, the carnivore occurs particularly in the Russian Federation, Poland, Ukraine and it also inhabits Scandinavia, the Balkan Peninsula, the Carpathians and the Italian/Apennine and Iberian Peninsulas. In total, there are about 60.000 wolves in Europe and due to measurements taken, the numbers have been increasing there. Thus, there can be more conflicts with human interests and damages to livestock. The article compares how the conflicts and damages arise and how the selected European countries including the Czech Republic handle them.

The author concludes that there are visible efforts to support *ex-ante* measures as much as possible because they can relatively effectively prevent the damages.

Svobodová O.: Releasing Specially Protected Animals Reared in Captivity into the Wild by Bureaucratic Treadmill: Are there Any Legal Pitfalls?

In June 2020, the Regional Authority of the South Moravian Region was asked by the Nature Conservation Agency of the Czech Republic pursuant to Article 54, paragraph 3 of Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, to issue a permit on releasing the European ground squirrel (Spermophilus citellus) specimens reared in captivity at the site of Břeclav-Ladná as a part of the species' national action plan/recovery programme. The required

permit was issued as soon as possible, but not many were missing and proverbial bureaucratic treadmill did not allow releasing the respective animals at the site this year which would result in extinction of the European ground squirrel population there. With respect to the complexity of the procedure the author dealt with question whether it really was necessary to carry out all respective discussions on the intention and by an advanced interpretation, she concluded that in the case of releasing specially protected animals in the framework of action plans/recovery programmes which has been discussed and approved

by the Ministry of the Environment of the Czech Republic the partial permits of regional authorities are not needed.

Svoboda P.: Amendment to the "Accelerating" Act: Further Deregulation of Building and Construction at the Expense of Nature Conservation

As climate change has been progressing in the Czech Republic, opposite legislation trend under the slogan of accelerating building and construction further weakening key tools in legal nature conservation, has been continuing. The most recent legal step in this direction is Act No. 403/2020 Gazette amending the Act on Accelerating Infrastructure Building and Construction (under the new title Linear Building Act) and other Related Laws, inter alia, the Building Act (No. 183/2006 Gazette), the Nature Conservation and Landscape Protection Act (No. 114/1992Gazette) and the Administrative Procedure Code. The first substantial change is an introduction of the single binding opinion on interventions into nature, but the new statutory regulation suggests substantial reduction in the respective public participation in decision-making on nature and the landscape. The other substantial change is an introduction of general legal fiction of affirmative binding opinion of the respective State/Public Administration authority, if the deadline for issuing the decision has expired. Thus, the lawmaker introduced the extraordinary legal concept as a general standard for permitting all constructions including those for which the re-

spective authority should - pursuant to the respective special act - otherwise express its disagreement. Therefore, such cases would include plans seriously threatening public interests.

Jelínková J.: Is Permitting Felling Woody Plants for Building Purposes a Fiction?

The article deals with the question whether the newly introduced general fiction of an affirmative binding opinion of the respective authority, if it has not been issued within the deadline, covers also the binding opinion of the State Nature Conservancy Authorities for building purposes. The author concludes that if the State Nature Conservancy authority does not issue from various purposes the binding opinion pursuant to Article 8, paragraph 6 of Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, within the deadline set for its issuing, the Building Office cannot decide on a location of the building structure, if the building purpose requires falling woody plants pursuant the above Act. Moreover, if the Building Office issues the decision, such falling woody plants should not be considered as permitted. Therefore, possible felling should be terminated and legal recourse should be an offence for felling woody plants without permission.

Marek P. & Musil J.: Small Hydropower Plants and their Environmental Bonus. Greening

Small hydropower plants (SHPs) are significant negative anthropogenic man-made elements on watercourses. Their most important impacts include loss of watercourse continuity, particularly changes in hydromorphological conditions on the whole watercourse, and impacts on biological recovery in the watercourse. Watercourse fragmentation often results in non-viable fragmented populations of freshwater organisms and during SHP operations, individuals can be directly injured, destroyed or killed, although measures to minimize and mitigate the negative effects have been known. Moreover, they are typically not implemented or fully applied during SHP

operations, e.g. effective operations of the SHP's protective downstream elements. Inspections and enforcement by the respective Public/State Administration authorities is so demanding and ineffective that the authorities often resign to carry out them. Continuation of such a setting has been unacceptable, also in relation to spending public money e.g. for providing watercourses with permeability for fish migration and other movement in the Czech Republic. Thus, it is necessary to change the principles of support to energy production and its conditions by hydroenergetics or to incorporate the particular negative effects of the energy production into direct costs of the individual facilities.

Research, Surveys and Data Management

Geršl M.: Mineral Water in the Hranice Karst - Assessment of Historic Descriptions of the Teplice Acidulous Mineral Water Headsprings as Seen by Current Research

The first description of the Teplice mineral water headsprings in the Moravský kras/Moravian Karst (Central Bohemia) was made by Thomas Jordanus von Klausenburg (1539 -1586), Chief Physician in the Margraviate of Moravia who also examined healing springs in the adjacent spa. He published his observations in Olomouc in 1580 in Czech and later in 1586 in Frankfurt in Latin entitled De aquis medicatis Moraviae commentariolus.

Assessing the information gathered since 1580 concluded that the Hranice Karst, i.e.

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the Teplice Acidulous Mineral Water, is due to hydraulic regime closely linked to the Bečva River patterns: the Bečva River water surface is related to underground mineral waters. Increase in water level in the river causes increase in hydrostatic pressure affecting underground mineral waters. The mineral water source area is also located in the Bečva River near the village of Kamenec, the Na Kučách area respectively.

Krása J., Dostál T. & Bauer M.: Assessing Clogging the Dobroměřice Fishpond by Sediments

Particularly in farmland, there are consequences of erosion and soil transport to wa-

tercourses and further to fishponds and water reservoirs. How to correctly assess the current state of a river basin and of a reservoir and to identify sources of contamina-

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tion? Therefore, for proposing appropriate conservation measures in the landscape and directly on watercourses, mathematical modelling can be successfully complemented by Geographic Information Systems, remote sensing and photogrammetry. When surveying a site, archive aerial photographs can be used. In addition, Unmanned Aerial Vehicles (UAVs) or drones are useful, both for making overall survey photos and photogrammetric processing of an ortophotomap, or of a detailed surface model. Using the Dobroměřice Fishpond (District of Louny, the Ústí Region) as an example, the article illustratively presents the possible methods. The results show that erosion processes have strongly been developed within the study area, average loss of soil on arable land in the river basin reaching 7.5 tonnes per hectare per year. Moreover, the substantial part of erosion load is captured directly within the river basin and does not enter the watercourses.

Krause D. & Pilous V.: The Krkonoše/Giant Mts. National Park Geomorphology Put under a Microscope

Georelief is a base of natural richness of the highest mountains in the Czech Republic, *i.e.* the Krkonoše/Giant Mts. since some georelief's forms are unique not only on the Central European level. Although when comparing with living nature, abiotic environment can be at first glance seen less vulnerable, up-to-date experience and increasing pressure caused by humans suggest that geomorphological phenomena should also be effectively protected and conserved within the National Park's territory. Even more so because damages caused to them are mostly irreversible and measures analogical to restocking or reintroduction applied in wild plant and animal protection, conservation and management are not, of course, eligible and cannot be used in this case. In the Krkonoše/Giant Mts. National Park and its buffer zone, a project aiming at surveying in detail all geomorphological phenomena and thus supporting their protection in future there has been launched. The project is funded by the Operational Programme Environment and its main activity includes field mapping by a digital terrain model with spa-

tial resolution of 50 cm and height precision in cm. Combining the field survey and the high-quality data gathered by a laser aerial scanning allows the precision in detection and accurate delineation of relief forms which could not be reached in the past.

Zajíček P.: The Latest Epigraphic Research Has Shifted back the Age of the Oldest **Cave Drawing Traces in the Czech Republic**

Since 2016, epigraphic research has been carried out by the Cave Administration of the

Czech Republic, Palacký University Olomouc and the Nuclear Physic Institute of the Czech Academy of Sciences Prague in the Moravský kras/Moravian Karst (South Moravia). In 2019, surprising results of radiocarbon dating of some black charcoal drawing traces in the Kateřina Cave had showed that they are approx. 6,300 years (for more details,

see Ochrana přírody, 74, 5, 39-41, 2019). During detailed documenting the above objects other interesting clusters of lines and patterns were discovered there. Analysis of one of them revealed that they are even older, namely more than 7,000 years. The question is whether these are random wear traces from torches or whether the line or primitive drawings were created by prehistoric humans intentionally. Archaeologists suggest the latter. Humans could mark by this way sites used e.g. for underground ritual ceremonials. Therefore, research and surveys have been continuing there.

Černý K., Tsykun T., Strnadová V., Mrázková M. & Hrabětová M.: The Apple Collar Rot (Phytophthora cactorum) – A Dangerous Invasive Pathogen of the European Beech Has Domesticated in the Czech Republic

Non-native pathogens of forest woody plant species have been more and more affecting nature and the landscape in the Czech Republic. The most important invasive species with significant impact on composition, functioning and biodiversity of invaded forest growths in the Czech Republic which have recently colonised the Czech Republic's territory include e.g. the Ash dieback (Hymenoscyphus fraxineus) and the Root disease of alder (Phytophthora alni). Rots (the genus Phytophthora) are among the most danger-

ous invasive alien species at all. In their life cycle they are related to water so that they should primarily threaten habitats with water enough. Moreover, recent research revealed

that mesophilous forest communities are also vulnerable, being susceptible to rots. The fact can be evidenced by another species of the genus Phytophthora – the Apple collar rot (Phytophthora cactorum) having been spreading across beech habitats and potentially seriously threatening them. For reducing its spreading, applying suitable preventive measures aiming at terminating its introduction into the beech growths has currently been of utmost importance. During restoring the growths, natural succession should be preferred and in the course of artificial man-made restoration, nowadays massively applied in restoring Norway spruce growths, healthy planting material should be used. Nevertheless, despite the urgency research on the measures has not begun yet in the Czech Republic, hoping that it will be launched as soon as possible.

Vařilová Z. & Šafránek J.: Managing Rocks in the Bohemian Switzerland National Park

When the term "Bohemian-Saxon Switzerland" is mentioned, everybody recalls the Pravčice/Prebischtor Sandstone Gate, the town of Hřensko or the Kamenice River canyons & gorges. People perceive and enjoy romantic beauty of the sandstone landscape there. Moreover, there are two sides to every story. As a consequence of step-by-step erosion, weathering and disintegration in sandstone rocks, rock-falls occur in the Labe/Elbe River Canvon displaying sharp regularity. During the past 100 years only, some really dangerous events happened, particularly due to heavy traffic

in the valley: an important railway and international road Děčín-Schmilka (No. I/62) crosscut it and there also is relatively high ship traffic. To avoid risks related to rock--falls, the special department operates at the Bohemian Switzerland National Park (NP) Administration. The rock squad aims at monitoring rock entities on the NP's territory and assessing and analysing data gathered in the field. In total, in establishing and running continuous monitoring, preparing and implementing treatments of dangerous rock formations and implementing protective measures, more than CZK 20 million (EUR 7.3 million) have been spent there.

Augst U. & Benda P.: Peregrine (Falco peregrinus) Population Dynamics in Bohemian-Saxon Switzerland

The Peregrine (Falco peregrinus) and Bohemian-Saxon Switzerland have ever been belonging together. The Peregrine is a region's

symbol and it would be difficult to find better flagship species for that forest-rock landscape. The species' eventful history is also symbolical. The Peregrine has since a long time ago breeding there, but it had became extinct due to humans and consequently, it was reintroduced by humans again there: the activity required huge efforts. As late as in the turn of the 19th and 20th century, there were approx. 12 breeding pairs on the Saxon side and approx. 8 ones in the Bohemian part. Even in 1950, approx. 15 pairs nested in the region. Moreover, similarly to many European countries, the Peregrine became extinct in Bohe-

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mian-Saxon Switzerland in 1972. The current population was established by 76 young birds reintroduced there in 1989-1996. Breeding most often fails due to predation by the Eagle owl (Bubo bubo) as well by the Stone or Beech marten (Martes foina) and the Raven (Corvus corax). Some failures in Peregrine breeding was also caused by unfriendly human activities.

Plesník J.: Climate Change Has Significantly Been Already Influencing Biological Diversity

Climate change is currently considered as the third most important driver of loss of biodiversity on its all main levels (i.e genes, species, ecosystems) on a global scale, posing a growing risk owing to the accelerated pace of change and interactions with other direct drivers. Shifts in species distribution, changes in phenology, altered population dynamics and changes in the composition of species

assemblage/community, or the structure and function of ecosystems, are evident. Almost half of threatened terrestrial mammals, excluding bats, and one guarter of threatened birds may have already been negatively affected by climate change in at least part of their distribution range. Ecosystems such as tundra and taiga, previously little affected by people directly, are increasingly experiencing impacts of climate change. Large reductions and local extinctions of populations are widespread: this indicates that many species are unable to cope locally with the rapid pace of climate change, through either evolution-

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ary or behavioral processes, and that their continued existence will also depend on the extent to which they are able to disperse, to track suitable climatic conditions, and to preserve their capacity to evolve. According to observational evidence, the effects are accelerating in marine, terrestrial and freshwater ecosystems and are already impacting agriculture, aquaculture, fisheries and more generally, ecosystem services. Furthermore, the future impacts of climate change are projected to become more pronounced in the next decades. The article briefly summarizes key current knowledge on the relationship between climate change and biological diversity.

Kujanová K.: How We Do (not) Implement the Water Framework Directive in Improving the Morphological Status of Watercourses?

By joining the European Union, the Czech Republic committed itself to implement the Water Framework Directive (WFD). The WFD's main aim is to avoid further deterioration of water ecosystems, to protect and conserve them and to enhance their status by appropriate measures. In the Czech Republic, 28.4% of the total watercourse length, *i.e.* tens of thousands of kilometres of the watercourse network, were unfavourably modified. According to the EU Biodiversity Strategy for 2030, at least 300 kilometres of watercourses should be restored in 2016-2025. Thus, with respect to morphology, the state of watercourses and their floodplains has not significantly been improving yet since the 1990s. Compared to their biological and

physical-chemical components, improving the morphological status of watercourses plays, in addition to aesthetic point of view, a crucial role in retaining water in the landscape, in flood prevention, control and mitigation and in combating drought. Therefore, the topic is a timely issue across the whole society. Thus, the author appeals to all the respective bodies to implement the idea of systematic watercourse management and of improving their state also from a point of view hydromorphology.

Marek P. & Musil J.: Biological Assessment of Fish Ladder Effectiveness – A Methodology Developed by the Nature Conservation Agency of the Czech Republic

In the Czech Republic, providing watercourses with permeability for fish migration and other movement has most often been carried out by building fish ladder/fish pass-

es. Assessing effectiveness of such measures is a basic necessary feedback and indication whether the targets have been met. From past simple number of fish ladders built or number of kilometres of watercourse to be permeable for fish migration, both using purely technically the data available, there has been a step-by-step shift to biological assessment of fish ladders. It deals with possibility to set the real proportion from possibly migrating fish communities/assemblages or the percentages of effectiveness of really migrating fish. The Nature Conservation Agency of the Czech Republic has issued a methodology on bio-

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logical assessment of fish ladder effectiveness, thus providing an information source as well as the framework and setting the conditions for implementing monitoring and for interpreting the gathered and obtained results within the standardized assessment.

Opinions, Polemic and Disputation

Hofmeister J.: Dynamics in Forest Dynamics and in Approaches to its Protection: Is there Time to Make Further Steps?

Forest development dynamics which also includes natural disturbances is among generally respected principles in nature conservation: in the Czech Republic, protection and conservation of the substantial proportion of forest ecosystems in Specially Protected Areas (SPAs) are based on it. Moreover, when managing the particular SPAs, implementing the principle is not sufficient, sometimes bordering denial of it. The fact has to a large extent resulted from animosity of some nature conservationists towards spontaneous forest dynamics, but it also reflects some inconsistency in nature conservation to integrate the forest dynamics principles into tools and measures aiming at the management of the SPAs concerned. The article highlights the above facts and it calls on consistent and

rigorous promotion of natural forest dynamics protection and conservation so that forest protection and conservation in SPAs is more in line with theoretical principles which is based on.

The Nature Conservation history

Cílek V.: Thirty Years with Vojen Ložek (1925 - 2020)

In August 2020, Vojen Ložek, one of the greatest Czech and Slovak natural scientists of the 20th century passed away at the age of 95 years. He has been a real legend since dozens of years and today he should be considered a man who has not been born anymore. Nowadays it is difficult to say anything new on him because his life and achievements were remembered every five years after his 50th birthday. Ložek became famous by two

books. In Czechoslovakia, it was the book entitled Nature in the Quaternary period (Academia Press Prague, 1973) which was read as the first one in their branch of study by probably all Quaternary geologists of the middle-aged and older generations. Moreover, European malacologists were deeply impressed by his monography Quarter Mollusken der Tschechoslowakei (1964): through that publication he had become a Honorary Member of Philosophical Society of Cambridge (1968) and was later awarded by the Albrecht-Penck-Medaille (1989). To malacology, Ložek was introduced by Jaroslav Petrbok, but as scientist he was probably formed by meeting archaeologist František Prošek and geologist Jiří Kukla. Up to the early 1990s, all naturalists were above all enhanced by joint excursion and fieldwork. In the evening, people came together and were talking for hours on nature as well as on their teachers and colleagues. In Vojens's storytelling, a wide range of naturalists from the former Czechoslovakia in 1918 – 1938 came alive in addition to recent stories.

Patzelt Z.: On the 20th Anniversary of the Bohemian Switzerland National Park Administration

in 2020, not only the Bohemian Switzerland National Park itself, but also its Administration and staff celebrate its 20th anniversary. Es-

tablishment of the National Park in the Labe/ Elbe River Sandstones became a long-awaited milestone not only in nature conservation and landscape protection but also in the life of many people for them the National Park became a workplace. It is gratifying that many of them have been working for all the two decades there and they are going to continue doing so. The 20th anniversary provides an opportunity to at least briefly remember the beginnings of the National Park Administration, but also to think of the future. The current European spruce bark beetle (Ips typograhus) plague as well the COVID-19 pandemic strongly call for a long-term vision preferring forest ecosystem functions/services not only in protected areas. New large-size Specially Protected Areas should also appear in the Czech Republic soon.

Petr Zajíček: Karel Absolon

In history of the Czech Republic, many personalities significantly contributed to research and documentation in various branches of science. Karel Absolon was one of the most important and most successful poly-

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maths in the country. His became famous particularly due to discoveries of caves and making them accessible in the Moravský kras/Moravian Karst as well as archaeological field surveys in Moravia crowned by the great success in the Venus of Dolní Věstonice's discovery. Nevertheless, he was also successful as zoologist studying fauna occurring in dark habitats. In addition to providing evidence for the occurrence of known taxa, he described hundreds of new troglophilous and troglobiontic invertebrates. He

was an extremely successful manager, but also a pushy sharp-elbowed man who did not hesitate to play hardball on his pathway to glory. In 2020 60 years have passed since the death of the remarkable researcher as well as 50 years since publishing his well--known two-volume monography on the Moravský kras/Moravian Karst.

Zajíček P.: A Visit to the Svěcená díra/ Sanctified Hole near the Village of Javoříčko in 1873

The Javoříčko Karst is among the most important limestone areas in Central Moravia. On the area of 6 sq. kilometres 52 caves as well as other karst phenomena have been registered. The Javoříčko Karst limestones are of the same origin as most of the carbonate rocks in Moravia: they were created during sedimentation of marine animal calcareous shells in the Early and Late Devonian. Nowadays, the Svěcená díra/Sanctified Hole harbours the highest number of wintering bats, particularly of the critically

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endangered Lesser horseshoe bat (Rhinolophus hipposideros) within the Javoříčko Karst. Moreover, increasing numbers of the hibernating mammals have recently been found also in other parts of the cave system. In the course of unregulated visits to the cave, most of the Svěcená díra/ Sanctified Hole rich dripstone decoration has been destroyed. Nevertheless, visitors can enjoy such a natural beauty in the main parts of the later discovered Javoříčko Caves which are among the most beautiful caves in the Czech Republic.

Focusing on the Public

Plesník J.: A Sudoku Puzzle Has Not Been Solved Yet: How Many Species Are Currently There on Earth?

The diversity of life is one of the most striking aspects of our planet; hence knowing how

many species inhabit Earth is among the most fundamental questions in science. It has been increasingly recognised that knowledge on how many species are alive on Earth today, and about how many of them are known to humans is important for full understanding of the ecological and evolutionary processes which created the global biological diversity. Yet the answer to this question remains enigmatic, as efforts to sample the world's biodiversity to date have been limited and thus have precluded direct quantification of global species richness. Moreover, in the last decade, new methods of estimating global species richness have been developed and existing ones improved through the use of more appropriate statistical tools and new data. Taking the mean of most of these new estimates indicates that globally there are approximately 5 – 10 million eukaryotic species on Earth (the IPBES Global Assessment Report on Biodiversity and Ecosystem Services released in May 2019 used the estimation of 8 million plant and animal species, *i.e.* not all eukaryotic species, living at present on our planet). Based on the best data available, 1.9 million species have been identified, described and catalogued by scientists.

Bečka P., Starý M., Štemberk J. & Kučeravá B.: Introducing a Transboundary Socio-economic Monitoring Scheme in the Šumava/ Bohemian Forest Mts. and Baverischer Wald/Bavarian Forest Mts. National Parks

Administrations of the Šumava/Bohemian Forest Mts. and Baverischer Wald/Bavarian Forest Mts. National Parks need to carry out a long-term monitoring of fulfilling both their nature conservation goals and missions. A transboundary project carried out by both the administrations aimed at the latter. The data gathered highlight the importance of the Šumava/Bohemian Forest Mts National Park for the general public. For the first time, they accurately quantify number of visitors to the National Park at 1.84 million per year, namely from December 2017 to November 2018. In addition, the monitoring scheme provided also data on intensity of using the NP by tourists and their spatial distribution as well as on their structure. It was found that the main motivation to visit the National Park is an experience

in nature. Most tourists were satisfied with their visit as well as with the leisure time use offer. Visitors agreed that within the National Park nature conservation should be preferred to other ways of its use and that restrictions in its recreation use due to

nature conservation can be accepted. The visitor interviewing and monitoring in both the neighbouring national parks will further be maintained, elaborated and developed.

Řezníčková A.: Contemporary Cock-and-Bull Stories on Wolves Are Coming Alive through Social Media

Documenting grey wolves (Canis lupus) in the wild has been easier than in the past. Almost everybody who gets a camera trap and is successful in installing it at sites of wolf's regular occurrence, can take photo of these large carnivores. Records also result from random watching wolves and sporadic close encounters with them. Thus, there are a lot of Grey wolf's snaps on internet available. Nevertheless, it origin is not sometimes clear as well as whether they really display wolves. Out of context, shots can help to present mistaken or deceptive information on wolf's behaviour or hoaxes. The same video records or photos are often distributed among the public, always mentioning various sources/ authors, locations or dates of making them. In some cases, it can be a spontaneous response, but in others all of this suggests that they are not by chance. Using the selected examples, the article shows efforts to intendedly and calculatedly manipulate the general

public to shift the public opinion against the existence of wolves.

Záliš Z.: The Žďárské Vrchy Hills House of Nature – Twelve Years from an Idea to Finished Work

On the occasion of the 50th anniversary, the Žďárské vrchy Hills gave itself a gift – the House of Nature. Having been the 9th visitor centre of this type in the Czech Republic, it was built from two historical buildings from the mid-18th century in the village of Krátká u Sněžného (District of Žďár nad Sázavou). It presents the landscape there before arrival

of humans and its step-by-step settlement up to the Ždárské vrchy Hills current face. Establishing the House of Nature in the Krátká Rural Conservation Area was also by a coincidence when the Nature Conservation Agency of the Czech Republic got both

vernmental bodies. Attendance in the Žďárské vrchy Hills has been rather evenly dispersed and although the village of Krátká and adjacent villages of Samotín and Blatiny located under the Drátenická skála/Tinker's Rock are very attractive and often visited, the House of Nature has not been seeking for the highest visit rate. Significant attendance at the House of Nature by school groups is suggested.

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Havlíček J., Chobot K. & Vrba J.: Biodiversity White Spots in the Czech Republic -A Year since Launching the Campaign

Due to almost 27 million data, the Nature **Conservancy Species Occurrence Finding** Data Database operated by the Nature Conservation Agency of the Czech Republic (NCA CR) is the most comprehensive database on organisms' occurrence findings in the Czech Republic, and by this data volume, it can boldly compete with similar databases from abroad. By simple calculation of the total number of records per the Czech Republic's territory it can be found that there are as average 340 records/km². When examining the data set in detail, there are huge differences in data spatial distribution. In addition to sites with thousands of records there also are "White spots" where data have been missing from. The project entitled Biodiversity White Spots in the Czech Republic launched by the NCA CR in 2019 has been aiming at examining such spots. The article presents the first analysis of the data gathered since

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launching the project. Almost 600 authors of records and many others which acted as co-authors of records have participated in the mapping the white spots. The best of them have even contributed by more than 600 records and 26 authors provided more than a hundred of records. As for wild plant and animal species, more than 100 taxa were recorded by 10 participants, the record having been 555 taxa reported. Among 2,029 species recorded in total, the most numerous were birds, but vascular plants, mammals, butterflies and beetles have relatively often been found, too. In general, there were 2,351 records on species listed in Red Lists of Threatened Species of the Czech Republic and 2,516 records dealt with Specially Protected Species. Therefore, the Biodiversity White Spots in the Czech Republic project shall be continuing in future.

Peckert T. & Hruška P.: A Joint Direction of Nature Conservation and Tourism – A Reality or a Utopia?

Both nature conservation and support to tourism development were among drivers in declaring the Český les Mts. Protected Landscape Area. For long-term coexistence of both the interests, a strategical document setting limits, possibilities and rules is necessary. A transboundary extent of the policy background document is important due to joint geography, history and support to tourism. In addition to valuable natural habitats, the area's important values include particularly the unique cultur-

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al/historical landscape, harbouring a lot of remnants of the pre-WWII settlement. A guiet environment is considered as a value which should be used in a sustainable manner. Based on intensive communication with tourism stakeholders including visitors and with regard to the nature conservation defined interests, ways, means and possible interpretation of attractions and making them available for the public in the core area were set: the area is a space for slowed movement of tourists.

Nagel R.: We Count, Monitor, Assess or What Has 15 Years of Monitoring Visitors Revealed in the Bohemian Switzerland National Park?

When the Bohemian Switzerland National Park (NP) was declared twenty years ago,

it was differently accepted by various interest groups and people. Those who had welcomed its establishing or even had personally been involved in that process were of course fully satisfied and excited. Many considered the NP as an opportunity how to attract more visitors through the National Park trademark to the otherwise overlooked, unheeded and neglected region who can contribute to the region's economic development. On the other hand, opponents were afraid of that there will be a lot of restrictions both for visitors and local people: thus, there shall be less tourists arriving there and the region will in total lose out on the NP. Thus, the NP Administration soon recognized that special attention should be paid to the NP's attendance by visitors. Due to the long-term monitoring scheme it can be declared that fears of the sceptics were not fulfilled.

Zemanová K.: The House of Water: Discover the Švihov Water Reservoir, the Adjacent Landscape and Water in Many Forms

The House of Water Visitor Centre is an advanced exhibition communicating to the general public the importance of water for nature and humans through the Želivka Water Reservoir Site of European Importance (SEI, pursuant to Act No. 114/1992 Gazette on Nature Conservation and Landscape Protection, as amended later, the term for Site of Community Importance, SCI under the European Union's Habitats Directive) in Central Bohemia by an entertaining way. The House of Water was built by the Czech Union for Nature Conservation Vlašim which also operates the facility year-round. The interactive exhibition attracts children, adults and seniors. In addition to the indoor exhibition, there also is an outdoor educational trail dealing particularly with various displays of water in the landscape. In an atrium, there is a wet refreshment to visitors by water playing tools. The Želivka SEI is presented not only by the House of Water exhibition itself, but also by commented excursions to the Švihov Water Reservoir dam which is normally not open to the public, having been the Czech Republic's critical infrastructure. Educational programmes for schoolchildren of all ages and communication, education and public awareness

events is another key part of the House of Water's activities.

International Nature Conservation

Pešout P.: Olympic, Three National Parks in One

The Olympic National Park inscribed on the UNESCO World Heritage List covers a significant part of the Olympic Peninsula in the State of Washington in the United States. The English explorer, Captain John Meares who had seen the region during his expedi-

tion in June 1788, named it Mount Olympus - it seemed to him a veritable home of the gods. At present, wilderness covers 95% of the NP's territory. On 3.766 km² of its size the National Park protects the glaciated alpine Olympic Mountains, one of the most extensive North American temperate rain forests and one hundred kilometre coast line with little human intervention. Therefore, it is one of the largest compacted areas of terrestrial wilderness in the contiguous United States. In addition, it has step-by-step been extended by significant stretches of the Pacific coast. Although only a small part of the NP is open for the public, the magnificent area is annually visited by approx. 2.8 to 3.2 million tourists. The most remarkable achievements carried out by the National Park administration include Elwha River continuum restoration by removing dams and developing cooperation with Native American tribes in conservation and traditional sustainable use of natural resources.

Ouhrabka V. Will the Arsen Okrojanashvili **Cave Become Next Show Cave in Western** Georgia?

In autumn 2019, experts from the Cave Administration of the Czech Republic finished another part of their activities in Georgia, having been implemented within the Czech Development Agency projects since 2012. A partner organisation, Georgian Agency of Protected Areas asked for a support from Czech experts in assessing possibilities to make the Arsen Okrojanashvili Cave (Toba 2) located in the West Georgian province of Samegrelo a show cave. The Cave Administration of the Czech Republic staff members proposed a hydrological monitoring lasting minimally two years there. By that time, the cave should be open only by simple adventure way, movement of tourists through a waterfall cascade should be safeguarded by an assured route possibly equipped with ladders and ropes, for passing lakes rafts and wet suits should be used, etc. Access

to the cave should be allowed only with a person in charge of guiding, in addition only in the period of low risk from rainfall.

Pelc F. & Lodin M.: A Feasibility Study on Improvement of Local Economic Prosperity and of Nature Conservation in Zambia supported by the Czech Development Agency

Environmentally-friendly nature-based tourism is globally among the most quickly developing activities; in Africa, it is an important regular financial source for many

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countries. On the request of the Ministry of Tourism and Arts of the Republic of Zambia, experts from the Nature Conservation Agency of the Czech Republic Prague and the Faculty of Environmental Sciences, Czech University of Life Sciences Prague have assessed possibilities to establish an ecotourism facility in one of three selected Zambian national parks. The project was a part of the Czech Republic's development aid funded by the Czech Development Agency. An analysis of strengths, weaknesses, opportunities, and threats (SWOT analysis) evaluating in total 48 features and a detailed multi-criterial feasibility study confirmed that all the three studied National Parks (Kafue, Sioma Nawezi and Lower Zambezi NPs) are suitable for further ecotourism development. The significantly most suitable parameters for the pilot proiect were found at the site located within the Kafue National Park on the confluence of the Kafue and Shishambe rivers. The study outputs as well as a comprehensive background document providing the primary data have be passed on the Zambian partners. The further step will be a fundraising for building the facility in Zambia, aiming at enhancing local economic prosperity, poverty alleviation and strengthening nature conservation under climate change.

Plesník J. & Pelc F.: A Decline in African Large Animals Have Been Continuing

According to the recent IUCN Red List of Endangered Species, African mammalian species which had been for a long time

considered as very common, e.g. the African elephant (Loxodonta africana), Lion (Panthera leo), Commom hippopotamus (Hippopotamus amphibius), Chimpanzee (Pan troglodytes) or the Giraffe (Giraffa cameleopardalis), the latter consisting accor-

ding to ther current opinion of four species, should be classified to be globally threatened. The decline in many of them is both in numbers as well as in distribution range size. Research indicates that African protected areas (PAs) have generally failed to mitigate human-induced threats to African mammal populations, but they also show

some successes. Although some iconic PAs

across Sub-Saharan Africa strongly benefit from nature-based, wildlife tourism, most of PAs are for a long time deeply underfinanced there. In addition to natural and semi-natural habitat fragmentation, degradation and loss and wars and other armed conflicts, overexploitation is a major driver of defaunation in African megafauna. Poaching is rising, given increasing demands for bushmeat, traditional medicine, souvenirs, pets and luxury goods and pushing species (e.g., rhinos, great apes) toward extinction despite considerable international efforts. But even when policy instruments officially are in place and their implementation is in fact being actively attempted, the lucrative financial gains for poaching driven by the high demand for animal parts and live animals have pushed poachers to discovers innovative means of evasion. The recent COVID-19 pandemic would make the state of the art and outlook of African

megafauna even worse. Therefore, further viable existence of African megafauna requires deep economic, social, environmental change ad change in governance across the whole continent.

Drbal K., Hromas J. & Ouhrabka V.: Official Development Aid to Georgia and Moldova provided by the Cave Administration of the Czech Republic

In 2019, the Cave Administration of the Czech Republic continued through the Czech Development Agency with projects of the Czech Republic's official development aid (ODA) to the selected countries. In Georgia, the support was asked to carry out hydrological monitoring in the Arsen Okrojanashvili Cave and to select the most important karst phenomena in the Racha region as a background for declaring a large-size protected area there. After gathering background data in Moldova, a feasibility study for making the Emile Racovita – Zolushka Cave a show cave was elaborated in the Czech Republic. The expert assessment concluded that making the selected part of the cave system accessible for visitors is feasible and it will allow to

present to the general public a unique natural phenomenon of the global importance. Moreover, some problems should be solved there, particularly an entry into the border area, issue of a stone quarry, selection of the cave's parts to become a show cave, water and microclimate regime protection and building a visitor infrastructure.

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Pešout P.: Bringing Nature back into Our Lives – the EU Biodiversity Strategy for 2030

Despite long-term pan-European efforts, a rapid decline in biological diversity has not been slowed down. Therefore, on May 20, 2020 the European Commission issued a new strategy for the forthcoming decade under the motto Bringing nature back into our lives. In addition, the EU Biodiversity Strategy should be one of the pillars of the new EU policy called The European Green Deal. The main of the ambitious plan is to be climate-neutral in 2030 and to provide long-term sustainability of the EU's economy, inter alia, through protecting, conserving, managing and restoring nature. Investing in nature protection and restoration will also be critical for EU's economic recovery from the COVID-19 crisis: thus, the Strategy is also a core element of that recovery. The author debates challenges to reach the Strategy's ambitious targets by the Czech Republic. The government of the Czech Republic has approved the National Biodiversity Strategy of the Czech Republic (NBS CZ) for 2016-2025. In 2020, following the NBS CZ, the State Nature Conservation and Landscape Protection Programme of the Czech Republic has been amended for 2020 - 2025. The current Programme

should be one of key tools to implement the EU Biodiversity Strategy targets. Moreover, it has been clear that the next Programme's amendment should be much more ambitious.

Flousek J.: Svalbard – Nature Conservation in the Far North

On Svalbard, man who has spent a part of his life in the Krkonoše/Giant Mts. tundra feels himself with some exaggeration like home. Similar frozen soil types, familiar species or at least genera of plants, a bird species which time to time visits also the Krkonoše/Giant Mts. ... almost all on an incomparably bigger scale, only minimally disturbed by humans and particularly without crowds of tourists everywhere. The future of nature on Svalbard has not been clear yet, although the current negative trend has been more and more visible. Further development depends on global approach to solving climate change and treatment of plastics. It is expected if this has not been happening that global warming in Artic shall influence weather and climatic condition also in the rest of the Northern Hemisphere

including the Czech Republic. One of the key nature conservation principle on Svalbard is enviable, saying: On Svalbard nature and their native inhabitants are at home and humans are only guests on their territory!

Kuklík M. & Zelený V.: Nature on Cape Verde Islands and Possibilities of its Conservation

The archipelago of Cape Verde consists particularly of seven larger islands and together with the Canary Islands, Madeira and the Azores is a part of Macaronesia. Natural vegetation on the islands depends mainly on the available water brought largely by northeastern winds with rainfall. According to the current knowledge, the Cape Verde flora is relatively young and has possibly been formed during the last hundreds of thousands of years, most probably by transport of seeds and spores by air currents away from West and Northwest Africa. The occurrence of endemics is strictly limited by the humidity together with the altitude. The first Red Book of Cape Verde published in 1996 showed that more than 26% of vascular plant species, more than 47% of bird species and more than 25% of reptile species should be considered threatened by extinction. The Republic of Cabo Verde signed the Convention on

Biological Diversity just at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in June 1992 immediately after the multilateral treaty had been open to signature by independent countries. Due to relatively well-functioning public/state administration Cape Verde receives one of the highest per capita Official Development Assistance (ODA) in the world.

Plesník J., Pelc F., Ucová S. & Plesníková M.: The COVID-19 Pandemic and What Implies from it for Nature Conservation and Landscape Protection

In 2020, the global public was abruptly reminded by the COVID-19 disease caused by SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) that pandemics can pose a very serious threat to public health and economies on worldwide scales. The majority (70%) of emerging diseases, and almost all known pandemics are zoonoses – *i.e.* are caused by pathogens of animal origin spilling over due to contact among wildlife, livestock, and people. The risk of pandemics has been increasing rapidly, with more than five new diseases emerging in people every year, any one of which has the potential to spread and become pandemic. The risk of a pandemic is driven by exponentially increasing anthropogenic changes. Unsustainable exploitation of the environment due to land-use change, agricultural expansion and intensification, wildlife trade and consumption, and other drivers, disrupts natural

interactions among wildlife and their microorganisms, increases contact among wildlife, livestock, people, and their pathogens and has also led the COVID-19 pandemic. On the other hand, healthy ecosystems can mitigate risk of future disease spillover. Both the immediate pressures of biodiversity loss and ecosystem degradation as well as the underlying drivers must be addressed through an integrated approach that works across disciplines, sectors, value chains and spatial scales (an inclusive One Health approach). Thus, the risk of future pandemics can be reduced by investing to effort to curb deforestation and to control wildlife trade including wet markets as well as in efforts to monitor, prevent and control new virus outbreaks from wildlife and livestock. At the same time, it is becoming increasingly clear that the path ahead represents a once-in-a-life opportunity to shift the global development paradigms towards greater sustainability and a greener, more inclusive economy.

NATURE IS OUR HERITAGE AND THE FUTURE

The Nature Conservation Agency of the Czech Republic (NCA CR) is a governmental body established in 1995. The NCA CR 's main aim is to protect, conserve and manage nature and the landscape on the whole territory of the Czech Republic. The NCA CR directly manages 24 Protected Landscape Areas (PLAs, IUCN Category V) and 132 National Nature Reserves and National Nature Monuments (small-size Specially Protected Areas of at least national importance) outside National Parks and PLAs (IUCN categories Ia, III, IV) across the country.

The NCA CR's range of activities includes inter alia:

- Performing State/Public Administration in nature conservation and landscape protection in the particular areas, namely the Protected Landscape Areas, as the Public Authority;
- Monitoring the status of, changes and trends in the selected natural habitats and their types and populations of specially protected wild plant and animal species;
- Technical and expert support to other State/ Public Administration authorities including methodological and expert activities;
- Carrying out inventories, surveys, monitoring and research for nature conservation and landscape protection;
- Running the Nature Conservancy Central Register and the central governmental documentation on nature conservation and landscape protection;

- Managing the Nature Conservancy Species Occurrence Database (in May 2021, there are more than 28 million records, thus being the most comprehensive database on species occurrence in the country);
- Implementation of practical conservation measures in the field to conserve nature and to protect landscape in the 24 Protected Landscape Areas and 132 National Nature Reserves and National Nature Monuments on the whole Czech Republic's territory;
- Developing & implementing specially protected species action plans & recovery programmes;
- Administration of national subvention programmes/subsidy schemes as well as of some European Union funds serving to conserve nature, protect the landscape and to mitigate climate change or to adapt to it;

- Payment of financial compensations for loss of property in agriculture, forestry and fishpond management;
- State property management in the Czech Republic's Specially Protected Areas including purchasing and exchanging new land;
- Communication with, education of and public awareness among the general public and the target groups;
- International cooperation in nature conservation and landscape protection: the NCA CR is the Czech Republic CITES Scientific Authority, European Topic Centre on Biological Diversity (ETC/BD) partner, IUCN, EUROPARC Federation and ENCA member and National Focal Point of the CBD SBSTTA and Clearing-House Mechanism (CHM) and of the IPBES.

The NCA CR consists of Headquarters based in Prague and of 14 Regional Branches. As of May 1, 2021, it has 668 staff members, of them 555 with university degree and 46 with Ph.D. degree.

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