

## Adventure Neisse

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## Adventure Neisse Life at the river

#### Preface

Many cities are located along rivers, where we spend our leisure time, agriculture seeks its proximity and they serve to transport goods; rivers are also habitats with a special fauna and flora. The river Neisse, along the German-Polish border, is the focus of two partner exhibitions financed by the European Regional Development Fund (ERDF). They are a sub-project of the Interreg project "Adventure Neisse. V. Stage". In an interdisciplinary project, the Senckenberg Museum of Natural History Görlitz and the Görlitz Collections of History and Culture are creating the travelling exhibition "Adventure Neisse", in which both houses are working on an exhibition part in their field of expertise. "Adventure Neisse Life at the river" shows the Euroregion Neisse, its landscape development, and puts a special focus on the natural history highlights of the region. It deals with the biological diversity in and around the Neisse, in the towns and the surrounding countryside, depicts the life of our homeland and points out often overlooked features. The topics presented in the exhibition are exemplary for river ecosystems and their communities of species in Central Europe. The partner exhibition "Adventure Neisse - Histories at the river" of the Görlitz Collections

of History and Culture deals with the cultural history along the Neisse. In cooperation with our Polish project partners, we can not only show the natural and cultural highlights, but also make them accessible by creating an appropriate infrastructure and thus jointly make the Euroregion Neisse attractive for tourism across borders.

#### Project goal

The touring exhibition **"Adventure Neisse - Life at the river"** of the Senckenberg Museum of Natural History aims to make the natural highlights of the region accessible to a broad public at numerous locations in Poland and Germany in the coming years and to promote the Euroregion Neisse. The partner exhibitions are intended to draw the attention of visitors to natural history and cultural values on both sides of the border.



#### Welcome



Dear Readers,

The ,Neisse Adventure' is the focus of a joint travelling exhibition of the Senckenberg Museum of Natural History Görlitz and the Municipal Collections for History and Culture. Since the summer and until January 2021, the two cultural institutions are exhibiting the immense

diversity of nature and culture through the ages to the people of Görlitz and the city's guests. Afterwards, the exhibitions will be on display elsewhere, promoting the European City and its surroundings.

The Lusatian Neisse River connects both parts of the European City of Görlitz/Zgorzelec. It flows through a region with an exciting natural environment that attracts and unites people, but that has also always been subject to high political, structural, economic and – not least – biological dynamics. Even at the time our town was founded, the first mention of which was in a document in 1071, people were changing their environment. They built their town on the Neisse River and took advantage of the fertile soil and abundance of fish. Fords helped cross the rivers and provided a natural boundary between people on the two banks. Then, as now, the Neisse River is a habitat for animals and plants. The development the Neisse landscape has undergone, the

important role it plays in terms of nature and symbiotic communities, economy, trade and tourism, art and culture, are shown in this four-language exhibition using numerous examples, with models, texts, images, films and virtual reality formats.

The exhibition was funded by the European Regional Development Fund (ERDF) and is part of an interdisciplinary exhibition project with our Polish project partners. The European City and the partners demonstrate that the Euroregion Neisse is an exceptionally attractive place for tourism and has numerous natural and cultural points of interest that are worth a visit. The project ,the Neisse Adventure' created and creates the common infrastructure to make the sights accessible. The exhibitions explain them and encourage visits.

I would like to express my sincere thanks to all those involved – especially the funding bodies, the cooperation partners, the parties responsible for and involved in the two museums, as well as the visitors to this exhibition.

Görlitz, November 2020 Octavian Ursu Lord Mayor City of Görlitz



Dear Ladies and Gentlemen,

The region that we live in is characterised by an impressive wealth of biological species and geological and landscape forms. Charming heath landscapes in the north, the lively Lusatian Neisse, a habitat of aquatic fauna, beech-forested hills and the low mountain ran-

ge, as well as meadows and pastures, rich with different species, are just a few examples of beauty and diversity appreciated by locals and tourists alike.

The wonderful nature and beautiful landscapes are strong aces up the sleeve of our small home region. Unfortunately, they are still not as well known as they deserve to be. The exhibition ,Neisse Adventure – Life on the River', prepared by the staff of the Senckenberg Museum of Natural History in Görlitz, is one of the recommendable ways to popularise knowledge about our region's biological diversity, about how this wealth can be preserved, but also about how humans have shaped and changed this local landscape and how the city of Görlitz, which will celebrate its beautiful 950th anniversary in 2021, has developed over centuries.

And it was exactly the story in the computer animation - ,A virtual flight over the Neisse River through two centuries' – a story about the past, about the changes that have taken place here throughout history and finally about the creation and development of the city, part of which gave birth to a second city many years ago – that impressed me the most. I recommend it to everyone who, like me, is interested in the history of our region. I invite everyone to explore and discover our cities from a completely different perspective, and to the museum staff who developed this exhibition, I offer my sincere congratulations and wish the exhibition every success.

Zgorzelec, November 2020 Rafał Gronicz Mayor City of Zgorzelec LAND

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## **Rivers and their settlements**

Heavy rainfall or the melting of snow in spring leads to regular flooding of the middle and lower reaches of the rivers. When the banks are flooded, nutrients are deposited on them. As a result, fertile soils are formed along the river banks; this is why people have been settling along rivers for a long time.

Even in prehistoric times, the nutrient-rich soils After human settlement, many species found in led to the use of alluvial land by man. European floodplains lost their original habitat. At the same floodplains were also settled very early on. Their time new biotopes were created along the rivers, agricultural use changed this habitat. Arable but also in the cities. For example, falcons, swifts farming secured the food supply of the people and and swallows flourish in human settlements, villages developed. Settlements on inland rivers as they can use towers and tall buildings as a such as London, Cologne or Dresden bear witness substitute for rock walls. to this.

The exchange of goods led to the development of extended trade routes and towns along the fords. Today, names such as Frankfurt or Erfurt still bear witness to the use of these shallow river sections. For most of the year they could be crossed by carts, on foot or on horseback.

#### Floodplains - A country in transition

Floodplains are lowlands along the riverbanks that are regularly flooded during high tide. Such floodplains are natural water retention basins that function to mitigate flood peaks.

In Germany, most major rivers have been straightened and dammed. Former floodplains have been cleared and built over or used for agriculture. Severe flooding and loss of species are the result of this modification.

Floodplains are highly dynamic. They are characterized by their connection to the groundwater and by flooding. Due to their small-scale structure and the constantly fluctuating conditions caused by flooding and drought, floodplains are among the most species-rich habitats in Central Europe.

The alternation between flooding and drought determines the image of the floodplain. Near the river

the plants are exposed to the flood for long periods of time. Shrubs and weakly competing trees such as willow and black alder can be found here. These grow quickly and form soft wood; this is called the softwood meadow. These tree species can tolerate flooding up to 200 days a year. Flooding is less frequent and shorter in higher-lying floodplains, where oaks and elms can be found. These trees grow much more slowly and form hard wood. This type of floodplain is therefore called hardwood floodplain.



#### **Architects of the floodplains**

The beaver is Europe's largest rodent, weighing in at 25 kilograms and a body length of 125 centimeters. Its diet mainly consists of the bark of willows, poplars and other trees, but it also has been known to eat aquatic plants and herbs.

Beavers construct their habitat. They dig earthworks into river embankments. A beaver lodge of branches is only built when the water level rises or the previous underground structure collapses. The entrance to the building is below the waterline. Therefore, beavers prefer waters with a depth of more than 60 centimetres. If the water is too low, it builds a dam. This dam blocks the water and thus regulating the flow of water. Through this, a beaver dam can alleviate the flood peaks.

Monks considered the beaver as a fish because of its scaly tail. For this reason it became a popular fasting food.





For legitimation the Jesuit Father CHARLEVOIX (1754) wrote "Concerning his tail he is all fish, and as such he is judicially declared by the Faculty of Medicine in Paris, and in pursuance of this declaration the Faculty of Theology has decided that the meat may be eaten on days of fasting".



#### The story of a river

People have been influencing the river habitat for a very long time. Historical records of weirs, changes in fish stocks or reports of water pollution and its consequences tell the story of the rivers.

Many centuries ago, people dammed up rivers to drain off water or to power the wheels of mills. Weirs reduced the flow velocity, fine sludge was deposited and the oxygen content in the water sank. At the same time, weirs prevented the migration of certain fish species.

As the population grew, the discharge of household sewage increased. This had negative consequences. The oxygen content decreased due to the decomposition of organic material and this usually led to an impoverishment of the fauna.

Already in early modern times, pollutants were discharged in addition to household sewage, for example from dyeing and tanning factories. This repeatedly led to the death of fish in sections of the river Neisse.

With the expansion of sewage treatment plants and sewage systems since 1994, the water quality of the Neisse has improved so that it can now be used for leisure and sport.



#### **Animals reveal quality**

The chemical composition of the water changes throughout the course of a river. The natural accumulation of organic material, the subsoil, the amount of water, and also discharged wastewater have a particular influence. The water quality of running water can be determined by means of chemical tests. However, it can also be estimated on the basis of the animal species present, as their demands on their habitat are very different.

We know the habitat requirements of many animal species. Some are very specifically adapted to certain conditions, such as the degree of pollution, while others are more tolerant. The indication weight describes the tolerance range of the species and the saprobity value refers to the respective adaptation to a degree of pollution.

Species of oxygen-rich, unpolluted waters, such as stoneflies and many large mayflies, are found in sections of quality class I. Class IV waters are classified as heavily polluted by humans. In these sections, only a few specialised species live here, but they are often found in large numbers; these include rat-tailed maggots, Tubifex worm or lake fly larvae.

The saprobity index is a value that we derive from the occurrence and absence of the animals. It is calculated from the frequencies of the detected species, their saprobity value and indication weight. From this, the saprobity index provides information about the water quality.

Zuckmückenlar

mröhrenwur C Jan Hamrsky

Steinfliegenlarve C lan Hamrsky

Jan Hamrsk

### Not only for fishing

Many fish species living in brooks and rivers prefer certain stretches of water. They can therefore be used to characterise these sections. They are referred to as »indicator species«.

Every river begins at a spring. Since the spring water is low in oxygen and contains a lot of carbon dioxide, hardly any fish live there. Only a few species of caddis flies, snails and freshwater shrimps have adapted to these living conditions. The approximately 3–4 mm large spring snails and the amphipod Gammarus fossarum live in the spring region and the streams that immediately follow.



Following the spring is the brook zone. In its upper area the water flows quickly. The stream bed here is often stony and gravelly. As a result, the water is stirred up and the oxygen content is high and the temperatures low. The river trout is the main species in this section of the stream, the "trout zone". The trout shares this ecosystem with many other animals such as freshwater shrimps, mayflies, stoneflies and caddisflies.

Further down the river system the stream bed is often sandier and aquatic plants can colonize this area. Graylings have specifically adapted to these conditions. This section is therefore referred to as the 'grayling zone'.

> Bachforelle © Jiří Bohda

Fish species have also adapted to the special living conditions in the middle and lower reaches of rivers and in the estuary areas.

When the brook transforms into a river, the bed becomes wider, causing the flow velocity to decrease. Here the oxygen content drops and the water temperature rises, often to over 20°C in the summertime. Many fish species live here, particularly the barbel.

Other fish in this region like the grayling and common nase, which were formerly frequent in the Neiße near Görlitz, became rare due to the water quality levels becoming insufficient. Most of the 35 species currently found here are considered to have low ecological requirements, such as chub, roach, loach, bleak and gudgeon. Additionally, introduced fish species such as bighead carp and rainbow trout live in the Neiße.

Further downstream, in the middle reaches of the river, the subsoil is muddy and larger aquatic plants are common, especially along the banks. The water is usually deep and turbid and the bottom can be oxygen deficient. The most common fish in this region is the bream. If the banks of the rivers remain intact, the barbel and bream zones often have alluvial forests.

Brackish water often marks the transition to estuaries. Species that have the ability to tolerate salt water characterise the fish fauna. It is therefore called the 'ruffe-flounder' zone, named after the two frequent representatives.

Brachse (Blei) © Andreas Vilcinskas

#### The Noble and the Plague

The European noble crayfish has long been the most important edible crayfish in Europe. In the 19th century it still played an important role in inland fishing and was exported in large quantities. At that time, however, alien species were introduced and with them a fungus that was deadly for the European crayfish. This almost led to the extinction of the European cravfish.



The European crayfish inhabits both flowing and standing natural waters with rich riparian vegetation and sufficient hiding places. It likes to dig its burrows into steep embankments. The crayfish do not require any specific levels of water quality. Therefore, they also occur in more nutrient-rich waters. However, they react sensitively to environmental toxins, especially to insect of pollutants and breeding programmes are intended to repellents.

The main cause of the sharp decline in the European crayfish is due to a fungus that nearly wiped out the

entire population within a short period of time. The imported species are resistant to the crayfish plague fungus but spread its spores. They also compete with the European crayfish for food and habitat. Only a few isolated populations of the European crayfish have survived in the Lausitz. Filtering strips to reduce the input help preserve the species.

#### Live for a day?

The life span of mayflies varies according to species. Some only live a few months, others several years. All mayflies spend most of their lives as larvae in water. As adults, mayflies live for only a few hours to days.

Mayflies can only eat as larvae. This is because only these stages have well developed mouth parts with which they can crush plants or dead plant parts. Some species are predators and catch other insects like mosquito larvae. Adult mayflies do not retain the ability to eat food. Their mouth parts and intestines are atrophied.

Mayflies shed their skin several times as larvae and look more similar to the adult animal after each shed. A special feature of mayflies is that a winged, but not yet sexually mature animal hatches from the larva and moults again shortly afterwards. After this last moult, the mayfly is sexually mature. As the larvae are driven downstream by the current in the course of their development, the females fly upstream before they lay their eggs in order to ensure the best possible living conditions for their offspring.

Große Eintagsfliege © Allan Hopkins

#### **Home builders**

The larvae of caddis flies develop in water. Many build a protective quiver to shield them from predators. This is what inspired their German name - »quiver fly«. Adult caddis flies usually live in the vegetation of the banks and are active at dusk or at night.

The larvae of many caddis flies develop in streams and rivers; others prefer stagnant waters. They feed on plants or prey on small animals. Some catch their prey as roaming predators, while others weave nets to catch them. Not all larvae build themselves a quiver; many predatory species go without this protective but unwieldy tube.

The quiver is made of small stones, plant parts, pieces of wood, or sometimes empty snail shells. Using a secretion from their salivary glands, the larvae glue the components together. When they grow, they attach more material, always at the front end of their bodies. Adult caddis flies often live for only a few days before they completely stop eating food. Species that live longer feed on nectar. They have a short proboscis that they use to lick up the nectar.

Köcherfliege © Nikolai Vladimirov



## Of bugs, midges and amphipods

Some animals spend their whole life in the water, others live there temporarily and leave the water only to reproduce or to colonize new areas. Amphipods and numerous water bugs belong to the first group. Mosquitoes, caddisflies and dragonflies only stay in the water during their larval period.

Most water bugs have a predatory diet. They are not selective regarding their prey. They grasp on to them and suck them with their stinging proboscis. To do this, the water scorpion has transformed its first pair of legs into raptorial appendages, used to trap prey. Some water bugs carry their air supply in a bubble on their underside. Others, like the water scorpion, breathe through a long snorkel at the end of their abdomen.

There are very different varieties of midges. Mosquitoes live in stagnant waters, from lakes to rainwater barrels. Black flies, on the other hand, develop exclusively in flowing waters and are much smaller than mosquitoes. Black flies do not have a mosquito's proboscis, but rather bite the skin and drink the confluent blood from the wound.

Amphipods belong to the crustaceans and are closely related to woodlice. Their bodies are laterally flattened. Mole crabs feed mainly on fallen leaves, rarely on carrion. They breathe through gills, which are constantly supplied with fresh water by the movement of their legs.



Stechmückenlarve © Jan Hamrsky

Wasserskorpion © Jan Hamrsky

### **Flyers by the river**

Almost everybody knows of dragonflies. They fly and hunt at the edge of water bodies, defend their territories, mate and lay eggs. There are about 80 species of these dazzling jewels among the aquatic animals in Germany and Poland. Their life as aquatic larvae is unknown to most. The different stages of the dragonflies have different requirements of their habitat depending on the species.

All dragonfly larvae are predators. They feed mainly on insect larvae, worms and small crabs.

The larvae of the green snaketail usually develop in clean, semi-natural flowing waters, especially in streams and rivers with sandy bottoms. They particularly avoid muddy waters. Their larval development takes three to four years. This species has increased in population on the Neisse River in recent years.

The larvae of the banded demoiselle and the beautiful demoiselle also live in flowing waters. They hide within water plants and roots waiting for prey. The beautiful demoiselle is more sensitive to lower oxygen concentrations. The larval period of the dragonfly can last one to two years depending on the water temperature.







Gebänderte Prachtlibelle © Gabriele Harig

#### **Temporary accommodation**

The living conditions of the slip and baffle banks are noticeably different. Gravel and sand on the slip-off bank allow the settlement of land animals that tolerate flooding or have strategies to escape it. Animals that breed or raise their young in caves, on the other hand, inhabit the embankments of the bulwark.

The highly endangered spider *Arctosa cinerea* inhabits the sandy to gravelly banks of the sliding slope. It is well camouflaged and up to 17 mm in length. The spider spends the summer in tube borrows that it leaves nightly for feeding. It feeds on beetles, spiders, grasshoppers and insect larvae, which it captures on land. During high water levels it closes its tube and can survive in an air bubble inside.

Kingfishers construct their breeding burrows in the steep embankments, which can be commonly found on these slopes. Whilst hunting, they wait patiently for fish to pass within range and lunge at their unsuspecting prey. The fish are stunned and eaten headfirst.

Otters build their burrows in the river embankments. The entrance is, similar to the beaver, always under water. The living chamber lies above the water line and is connected to the surface via a ventilation shaft.



Otter liří Bohdal

Eisvogei © Jiří Bohdal

# When the river becomes a snake

If streams and rivers are not straightened, they can find their way freely and meander through the landscape. The opposite banks in the water loops are usually very different.

The current carries away earth, sand, gravel and debris to the outside of a stream or river loop. There a steep slope forms, the bulging bank. If this bank is overgrown with trees, it can be washed away. The roots of the trees then hang freely above the water. Under these roots the bank is hardly visible. Such places are protected from predators and offer a safe shelter for many animals. Opposite, on the inside of the river loop, the current is less strong. Here material is deposited and flatter banks with sand and gravel banks are formed. This is known as the sliding bank.



#### Where the river acts like a saw

When a mountain disturbs the course of a river, the river looks for a new path. Over hundreds of thousands of years it digs its way through the subsoil along weak points in the rock and a valley is created.

If the river makes its way through an entire mountain range, a long, narrow valley is created. Such breakthrough valleys are not only formed by large rivers, but also by small ones like the Neisse. They are called "Skala" in Upper Lusatia. The breakthrough valleys along the Rhine are known throughout Germany, such as the Rhenish Slate Mountains.

Because the river cuts through the mountains, phases or peculiarities of mountain formation are often recognizable in breakthrough valleys. For example, the valley of the Lusatian Neisse, between St. Marienthal Monastery and Hirschfelde, the Rumburg granite is clearly visible.

In its lower reaches, the Lusatian Neisse flows through wide glacial valleys and cuts through moraine heights and ranges. Its path through the Muskauer Faltenbogen, the most beautiful push moraine in Europe, is truly spectacular



# How flooding occurs

When it rains, the ground absorbs water. Depending on the type of soil, the speed at which the water flows off and the amount of water the soil absorbs can differ. When the soil is saturated, the water flows downhill and accumulates in small streams.

During particularly heavy rainfall or when the snow melts in spring, streams and rivers can no longer absorb the water. This leads to flooding. Nature provides a solution for these events. Floodplains and tributaries are natural catchment basins for large quantities of water. In addition, river loops and oxbows slow down the flow of water.

By straightening the rivers, they become shorter. Dikes prevent the flood plains from being flooded. During continuous or heavy rainfall, the water masses reach the cities faster. There, the sealed or covered soil cannot absorb water. Draining water is channeled through the sewage system into the already overflowing rivers. This leads to flooding of

Hotwasser and er Neiße 2010 () an Noak the cities. On the 6<sup>th</sup> to 7<sup>th</sup> of August 2010, it rained for 30-36 hours in Lusatia; this caused the river Neisse to swell. When the Witka dam broke, the water level rose within two hours and flooded Görlitz and the surrounding area.



Juli 1981

Juli 1958

Hochwasser 28.09.2010

Hochwasser August 2013 Hochwasser August 2002

Hochwassermarken © Jana Bingemer

#### Soils in the river valley

Unique soils develop in the river valleys. They are mainly composed of the sediments deposited by the river. The closer they are to the river, the more they are affected by soil moisture and groundwater.

Floodplains are often flooded and covered with sediment carried by the river. Here you will find typical floodplain soils. They consist of sandy and muddy layers and contain significant amounts of organic material, making them highly fertile. However, these plains cannot be used for agriculture. This is because the fluctuating groundwater level does not allow the cultivation of many crops and floods often cause harvest losses. Near the river there are humid riparian forests. Alders, willows, ashes and oaks can be found growing here, and occasionally poplars and elms. Through river regulation and development, as well as deforestation and conversion into grassland, riparian forests on the Lusatian Neisse have become rare.

At higher altitudes, which are no longer flooded, different soils develop depending on the subsoil. Fertile brown soils are mostly used as arable land. Forests have been preserved on the sandy soils. On the steep valley

slopes there are often strips of trees. They separate the floodplains from the higher terraces and sometimes run for kilometres along the river.





### **Stairs in the river valley**

The slopes of river valleys often form steps. These steps are often narrow but can also be wide. They are called fluvial terraces and display the previous placement of the riverbed and valley floor. Sometimes the terraces along a river valley form different levels. If the river runs through a mountain range, these terraces can be a few dozen, sometimes even several hundred metres above the present day river.





In earlier times, however, the rivers did not flow at the level of the river terraces. Rather, the terraces were raised through mountain formation as a result of earth crust movements, while at the same time the rivers dug deeper into the valleys. In the Central European lowlands, the formation of such high terraces is closely linked to repeated glaciation during the ice ages.

Near Rothenburg, the high terrace on the Neisse River forms a plain up to 10 kilometres wide. Steep, 10 to 15-metre-high edges separate the terraces from the lower-lying floodplains. During high water levels, the floodplains are flooded. The settlements were therefore built on the upper terrace, where they were safe.



#### Life on the wet meadow

Until the beginning of the 19<sup>th</sup> century, wet meadows nearby river banks were only mowed once a year, in September. In winter, the mowed material was used as bedding in horse and cattle stables. Today these meadows are threated by frequent mowing, drainage and fertilization.

riverbanks is particularly dramatic. This is caused by modern forms of cultivation. Fertilization and a higher frequency of mowing have made many plants fertilizer and has therefore become rare. species rare.

One example of this decline can be seen in great burnet. It is a typical plant found in "pipe grass litter meadows", a special type of meadow. Because these meadows are very species-rich, they are particularly protected. Butterflies such as the dusky large blue and the scarce large blue live here. The caterpillars of these butterflies depend on the flowers found in the meadow for sustenance. They eat these flowers from the inside and then drop to the ground. There they wait for a special type of ants to carry them into their burrow. The caterpillars feed there on the ant brood. In the early summer the butterflies hatch and are active into August.

The decline of species numbers in the meadows along A variety of other animals also live in wet meadows, such as the marsh fritillary, the large copper and the narrowmouthed whorl snail. This snail is highly sensitive to



### The big scramble

There are many different types of meadows, but their structure is always similar. On the respective »floors« of the meadows, the different inhabitants look for food, places to lay eggs and a home.

In the soil between the roots, rabbits and mice dig their burrows. Woodlice and earthworms decompose plant remains and enrich the soil with nutrients. Many beetle larvae can live here for several years.



A litter layer of plant debris forms directly on the ground. Snails and millipedes are at home in this habitat, because they like the high humidity. The trails of ground beetles and ants run across the ground.

Herbivores such as cicadas, butterfly caterpillars and grasshoppers live between the stems and leaves. Spiders wait patiently until some of them get caught in their web. Aphids pierce plants and feed on their sap. They excrete honeydew, a sugary liquid that ants like to drink. Bumblebees, hoverflies and butterflies fly between the flowers and collect pollen and nectar. Many insects need specific plants as food for the development of their offspring. If these are unavailable, these animals cannot live there.



### Where have all the birds gone

Die Landwirtschaft hat sich im letzten Jahrhundert stark verändert. Das hatte Auswirkungen auf die Lebensräume von Tieren und Pflanzen, die unsere Kulturlandschaft prägen. Viele Kräuter und Tiere verschwanden.

Along with agriculture came the field weeds, which grow between the field plants. However, due to constantly improved cultivation methods such as seed cleaning, the use of herbicides or increased use of fertilisers. their occurrence has greatly decreased. In comparison to 1950, today there are often only half of the plant species that used to be widespread inside a field and 70% at the field's edge. As a result, the habitat of numerous insects that depend on wild herbs for food is disappearing. This in turn threatens insectivorous birds such as skylarks. Their population is currently declining rapidly, which is why the skylark was bird of the year in 2019. For the skylarks, it is not only the lack of insects that is a problem. They breed between April and August in meadows or fields with open vegetation. The heavily fertilised meadows and fields are too densely overgrown and are often mowed too early in the year, before the young animals have left the nest. Skylarks therefore rarely find suitable places to breed.



### **Transition of riverside vegetation**

Plants strengthen the structure of the banks, filter pollutants from the water and provide nourishment and shelter for animals. The distribution and frequency of plants depends on their special needs, such as humidity and flooding frequency.

Documentation and herbarium records in the Senckenberg Museum in Görlitz reveal a species-rich flora that inhabited the Neiße of the past. However, in recent decades, the riverbank vegetation has changed considerably as forest and agricultural areas often extend to the rivers edge. Cultivated plants and introduced or wild species, so-called neophytes, are displacing the species-rich, natural vegetation. For example, the banks are overgrown with glandular balsam, giant hogweed and various species of Asian knotweed. Native shore plants such as purple loosestrife, butterbur, flowering rush or great manna grass disappear. Even the longleaved speedwell, once frequent on the Neiße, can hardly be found today.

Cross-border research initiatives are developing methods to combat invasive plants on the banks of the Neisse.





## Black poplar – a threatened habitat

In the alluvial forest the black poplar was previously widespread and of significant ecological importance. Land use of the floodplains, through agriculture and construction, led to the decline of black poplar. In Saxony, it is now classified as threatened with extinction.

Black poplar trees demand large amounts of light, water and nutrients in order to germinate. It is not a strong competitor compared to other tree species making it difficult to attain the required resources. The black poplar can live 100 to 150 years and reach a height of 35 metres. In the Neisse region its population is relatively old. Many animals use the black poplar as a food-source or living space. The black poplar is used by many birds for nesting and bats use it as a place for sleeping and raising young. Therefore, it is an important habitat element in the alluvial forest.

In Saxony over 400 beetle and 80 butterfly species can be found on or in black poplars. Some species, like the beetle Dorytomus ictor, exclusively lives on black poplars. The leaf beetle Chrysomela populi, or the caterpillars of the poplar hawk-moth eat the leaves of the poplar, whereas the 'poplar leaf—rolling weevils' use the leaves by rolling its eggs into them, thus protecting them from potential predators.

In Saxony, nature conservation programs are trying to preserve the black poplar through protection and planting efforts.



# Hermits and hollow dwellers

When the protective bark of trees is damaged, fungi and bacteria can penetrate the wood. They start to decompose it and a hole develops inside the trunk. Many insects, birds and mammals use such tree hollows as their habitat.

Birds, wildcats, bats and edible dormice raise their young in tree holes. Over time, a crumbly layer forms on the floor of the hollow. This is called a detritus layer. It consists of wood debris, bacteria, fungi and excrements of the animal inhabitants. Detritus is rich in nutrients and stores moisture.

Typical inhabitants of detritus hollows are beetles. One of these beetles spends its life in a single hollow, thus it is called a "hermit". These beetles grow up to 4 cm long and spend 2–3 years in a larval stage; during this time it feeds on the fungi on the inner wall of the hollow. The adult beetles live only a few weeks: between May and August they mate and the females lay their eggs in the detritus. The hermit beetle is a strictly protected species and can be found along the river Neisse in old, tall trees.









#### **Builders of the hazel bush**

Whether in flowers, fruits or branches - hazel bushes provide food and habitats for many animals. Some decide to build a new home; others take advantage of abandoned sleeping and breeding spaces. Some groups of animals even leave the work to the shrub itself.

The hazel dormouse builds itself small spherical nests in hedges and bushes from branches, grass and leaves. It also likes to use tree holes or nesting boxes for shelter. When looking for a home, it must do so quickly. This is because the spaces are also popular with cave breeders, edible dormice and yellow-necked mice.

holes in young hazelnuts and lays her eggs in them. A larva later hatches from the egg and devours the nut as

it grows. Finally, it emerges through the hole from the empty shell. The 'dead nut' an then be reused. For ants of the genus Temnothorax, the hollow hazelnuts are perfectly sized to build a nest in.

The hazel-catkin gall midge lays its eggs in the hazel's catkins. The insect injects plant hormones that stimulate The female of the nut weevil, a beetle species, drills the catkin to thicken. The larvae develop in this plant gall until winter; then they leave the gall and spend the winter in the soil.



#### **Wandering frustration**

Through human activity, we have fractured our landscape into fragments. Humans intersect the habitats and migration routes of wild animals, especially through the construction of roads. These roads isolate some animals from their conspecifics and prevent the necessary genetic exchange.

In healthy populations, a balance of local extinction, reproduction and migration of animals from other areas is maintained. When animals can no longer migrate and colonise new areas, the risk genetic isolation and inbreeding increases. As a result, hereditary diseases and malformations increase, the population is then weakened and may even become extinct.

In order to counteract isolation, biotopes are reconnected. In the case of flying species, this is possible via step-stone biotopes. In this process, biotope islands are created, which can be set at different distances

depending on the species. For many species, however, this is not sufficient. They are dependent on biotope corridors. For this purpose, continuous strips of the corresponding biotope are created, for example hedges, forest meadows or meadows. Roadsides are connected by wildlife overpasses.







Luftbild auf Grünes Band © Klaus Leidorf/BUND

#### **Radical haircuts**

Many landscape characteristics are the result human use. Often we are no longer aware of this, as the professions associated with it have disappeared. An example of this can be found along running waters. There are numerous willows that are low in growth and have a thickened trunk. These are known as pollarded willows.

A pollarded willow is not a tree species, but rather result of its use. In young willows, the tip is cut off when the height of growth reaches 1–2 metres. The trunk then does not grow any higher. Numerous new, flexible branches sprout from the cut surface. These branches were historically used to weave baskets, furniture and fences.



Due to the repeated cutting, the uppermost section of the trunk thickens. A pollarded willow must be cut back again and again. Since willow rods are hardly used today, many pollarded willows are no longer maintained. After a few years they break down under the weight of the numerous thick willow rods.

Pollarded willows are nesting and feeding places for many animals and therefore important for the preservation of natural diversity. More than 400 insect species have been identified on old, thick-stemmed willows. These include many endangered beetle species that live in the rotten softwood, such as the musk beetle and other longhorn beetles.



#### Air mail and sea transport

Small soil animals such as mites and springtails contribute significantly to the fertility of the soil they inhabit. Fertility depends on the subsoil, but also on the development time of the soil. Raw soils, such as those exposed after landslides, contain hardly any nutrients. The decomposition of rock and plant remains by bacteria, fungi and soil animals creates fertile soil. To do this, microorganisms must first reach the newly exposed sites.

When rivers become torrential streams, embankments sometimes break off or the top layer of soil is removed. Soil, sand and gravel are deposited as islands or on the banks. After such natural disasters, as well as after forest fires or landslides, the newly formed soil must be repopulated to ensure fertility.

Since the small mites and springtails are wingless and cannot travel significant distances to colonise new habitats, they need outside help. They can be carried by other animals or use the wind to spread. Some species of mites and springtails that live near the water use the river for transport.



#### **Green cities**

Since the middle of the 18th century, parks have been constructed in cities. Around 1904, the city of Görlitz was one of the German cities with the highest per capita proportion of public parks, earning Görlitz the name ,Garden City of the East'.

Originally, parks were intended to offer the inhabitants of the increasingly growing cities access to nature and recreational spaces. Particular emphasis was put on curating sophisticated garden architecture and many non-native species were planted as attractions. Today, the parks are designed to be closer to nature and since they are no longer intensively managed, many valuable habitats have been created.

Green spaces act as 'green lungs', improving the urban climate. Compared to the surrounding area, the urban climate is warmer and drier. Plants and most importantly, trees, provide cooling on the hottest days. Studies have shown that a ten percent increase in green spaces can reduce the temperature in cities by up to three degrees. Trees and shrubs also reduce noise, cleanse the air of fine dust and bind carbon.



#### **Every gap is used**

In the gaps between cobblestones there are narrow strips containing soil. These small joints provide habitats for organisms. However, the conditions are far more difficult to live in these spaces.

Every day many people walk over the cobbles and thus the gaps between the stones. The knotted pearlwort, the common knotgrass and the silvergreen bryum moss grow so flat that they hardly protrude over the pavement cracks. This allows them to tolerate the high foot traffic. There is also little water in the soil under the pavement. Some plants such as wild chamomile and common knotgrass can store water in their leaves to compensate for this lack of moisture. Other species form long taproots to reach the water deeper within the soil.

Animals also use the gaps between the stones. Some wild bees dig tunnels into the sandy gaps. In these



tunnels they lay several eggs, one after the other. Ants such as the black garden ant build large nests with complex paths. It is also warmer under the stone pavement than in the open ground. As a result, the offspring develops faster and the animals can remain active for longer in autumn.



#### **Rural exodus**

Many animals in the city are hemerophiles. This means that they profit from man-made changes in the environment and therefore follow us into the settlements. Only 150 years ago blackbirds were very withdrawn forest birds. Over time, little by little they followed people into the city.

The city offers the blackbirds several advantages for survival. Due to the milder climate in the city, blackbirds find plenty of food almost all year round. Often even more than in the countryside, where insects and molluscs are becoming less and less available. The combination of favourable living conditions and fewer predators means that they reproduce in large numbers. In the forest, a higher density of birds of prey and other predators regulates the animal population.

The blackbirds have adapted their behaviour to the new environment. To drown out the noise, they sing louder and at a higher pitch. Their escape instinct is less pronounced. Due of the artificial light they are active longer, sleep less and are generally more restless. Also, their genes contain evidence that they are ageing more rapidly. Stress caused by polluted air, noise and artificial light at night probably causes blackbirds similar stress as is seen in humans.



#### **Masked Robbers**

The original distribution area of the raccoon is in North America. It was brought to Europe for its fur and today it has grown to have a large distribution across Europe.

In 1934 four raccoons were released into the wild in Hesse; others came from fur farms or were released for hunting purposes. The animals first settled in the woods and then followed the humans into the cities.

During the day they sleep in trees, sheds or attics. In the evening they become active and search for food. As omnivores, they feed on small fish, birds' eggs, fruits and nuts, among other things. They also like to dig for leftovers in garbage cans or plunder the feeding bowls of cats and dogs.

Raccoons have no natural enemies in Germany, which is why they multiply so quickly. As predatory mammals they decimate the populations of endangered songbirds and amphibians. An animal species that spreads so effectively and has negative effects on the native ecosystems is referred to as an 'invasive species'.

Waschbär © Catrin Hammer

## The night is getting brighter,

More and more roads and buildings are illuminated in the dark. As a result, the nights become brighter. The light of a medium-sized city beams 25 km into the surrounding area. This artificial light has negative effects on many living beings. This is why it is called »light pollution«.

Many butterflies are active at night and collect nectar and play a major role in the pollination of plants. These moths orient themselves based on the brightness of the moon. They are drawn towards bright light sources, such as street lamps, and circle around them. In this process the moths lose a lot of energy. They sometimes die as a result of the loss of energy or burn up in the lamps. For nocturnal hunters such as bats that tolerate the light (e.g. the common pipistrelle), the lamps are a richly laid table. Light-sensitive bats such as the greater mouse-eared bat avoid the lamps; they only find food in the darker areas

of the city. Night lighting also has an effect on diurnal animals. Because of the artificial light, blackbirds are active longer in cities during the days. They have shorter rest periods and sleep less and more restlessly.

> Zwergfledermaus © Dietmar Nill

Licht der Gewächshäuser bei Turów © Scultetus-Sternwarte Görlitz

### Trees do not have it easy!

Not only do large green spaces have a positive effect on the urban climate, individual trees do as well. Trees produce oxygen, bind dust and pollutants, increase air humidity and reduce the temperature of the surroundings.

A city tree has to withstand a lot. Many trees only have a small area of open ground surrounding them. The trees can only receive their water needs from these small areas. However, these "tree rings" are often compacted, so the soil is very firm. Rainwater then runs off quickly without seeping into the subsurface. These trees therefore suffer from a lack of water, especially in hot summers.

Because of the compacted soil, less oxygen reaches the roots and also the fungi and bacteria found in the soil. These microorganisms need oxygen to release nutrients such as phosphorus and nitrogen that are vital for the trees. In addition, soils are contaminated by dog excrement and urine as well as road salt, which also affects the trees. Parking vehicles or bicycles damage the bark of the trees. This makes it easy for bacteria and fungi to infest the trees. This weakens them and eventually results in their death.







#### **Towers and walls**

The walls of buildings often offer animals and plants similar conditions to natural rocky slopes. Some animals and plants have therefore followed humans into the cities and made buildings their habitats.

The peregrine falcon builds its nest high up on steep rock Plants also migrated from the mountains to the cities. faces. It is thus well protected from enemies. In cities the birds find comparable nesting places on high buildings and church towers. The peregrine falcon was almost extinct in Germany. The pesticide DDT made the shells of the eggs so thin that they often broke. In addition, eggs were taken from nests to sell the young.

The ivy-leaved toadflax originally comes from the Alps in northern Italy. It was brought to northern Europe in the 16th century as an ornamental and medicinal plant. It has since escaped from the gardens. Today it grows almost all over Germany in the cracks in walls and on other rocky surfaces.



#### Secret subtenants

Houses offer many comfortable habitats for animals. Whether dry attics, warm living spaces or cool, damp cellars: animal roommates make themselves comfortable everywhere. Some are permanent tenants, others move during the year.

Beech martens like to sleep in attics during the day. At night they become active. Kits playing throughout the night are real "poltergeists". Bats are perfectly adapted to man-made structures. They can use almost all crevices and hollow spaces as sleeping places. They spend the winter in cool but frost-proof places such as underground cellars or vaults with a specific humidity. In summer, female bats often live with their young in large groups, the maternity colonies, in attics.

We also have many invisible roommates living with us in our apartments. Silverfish are shy and disappear into cracks as soon as the light comes on. They are not harmful, on the contrary: they like to eat allergy-causing dust mites, skin flakes and moulds.

Many insects seek shelter in our homes before the freezing temperatures come in late autumn. Of about 180 native butterfly species, six live throughout the winter as butterflies, often in cellars. These include the peacock butterfly, the small tortoiseshell and the common brimstone.











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