

# Nature in the Eastern Ore Mountains / Ost-Erzgebirge / Východní Krušnohoří

## A short introductory guide to the Schellerhau conservation training

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**Diversity** might be among the most obvious traits of the scenery in the eastern part of Erzgebirge/Ore Mountains/Krušnohoří. The variety of landscape is mostly made up by an alternation of forests and open spaces on relatively small scales, and the open spaces interspersed with lots of wooded and non-wooded biotopes. In contrast to other mountain ranges of Central Europe, only about 30 % of the region are compact forests. Very typical - and of great conservation value - are meadows, crossed by stone ridges ("Steinrücken").

This sort of landscape diversity offers room for **biodiversity**, too. The Eastern Ore Mountains are home for nearly 1000 species of vascular plants, about one quarter of plant species in all of Germany. A few of them have their only German occurrence here since the climate conditions resemble more those in central-east European mountain ranges. Because of their natural rarity, but far more because of rapidly changing ecological conditions, about 20 % of the plants got listed in the Red List of Endangered Species. Other groups of organisms show similar numbers: > 1000 species of fungi in the Eastern Ore Mountains (180 species on the Red List), 100 spp. butterflies (60 Red List), 130 spp. birds (40 RL), 60 spp. mammals (20 RL).

To save the endangered plant and animal species requires conservation of the great diversity of habitats - created by geological history as well as human land use history.

### Geology

Standing on a view point and looking around, visitors will mostly miss the high hilltops they would expect in a mountain range. More than mountain peaks, rather deep valleys form the mountainous character of the landscapes. Nowhere in the eastern part of the Ore Mountains, maximum heights of the main range exceed the 1000 m contour line. The tallest peak rises up to 956 m a.s.l. and is called Loučna/Wieselstein.

Wieselstein and almost all of the main mountain range belong to the Czech part of the Eastern Ore mountains, roughly the southern and southeastern quarter. Here the landscape shows its basic geo-morphological outline: while gently rising over dozens of kilometers from the north, a steep escarpment forms the southern edge, down to the Northern Bohemian Basin. The Ore Mountains are regarded as a typical **fault-block range ("Pultschollengebirge")**. It got this shape during the Alpine orogeny, about 20-25 million years ago (mya.).

Nevertheless, most of the rocks are older than that - much older. They date back to the Variscan orogeny, 360-290 mya. High pressure and high temperatures inside the deeper layers of earths crust changed the structure of the (at those times) existing rocks - and produced several varieties of **gneiss, a typical metamorphic rock**. Now, roughly three quarters of the surface of the Eastern Ore Mountains are made up of gneisses.

Especially in the final stages of the Variscan orogeny, great amounts of acidic magma were rising. Some came up to the surface, erupting as lava. It cooled down more or less rapidly and solidified to **porphyry rock**. Usually, that is rather hard and weathering-resistant material. Subsequent eroding forces affected the porphyry less than other rocks, so nowadays it forms more or less visible mountain ranges. All the highest peaks in the Eastern Ore Mountains sit on porphyry (including Mt. Kahleberg, 905 m a.s.l., the highest point in the German part of Eastern Ore Mountains).

Not all of those viscous magmas reached the surface of the Variscan mountains. For some the rising stopped several hundreds or thousands of meters below. It slowly - very slowly - cooled

down and became **granite**, forming so-called plutons (big granite bubbles within encircling other rocks). Since it was generally created by the same sort of magma, the granites are comparable to the porphyries, but of different physical structure. Later on, erosion/denudation exposed some of the granites, like in Schellerhau.

During the slow solidifying of the granitic magma, hot fluid-gases enriched with metals rose to the top layer of those plutons ("bubbles") forming **metal ore**. Some sorts of metal "fluid-gases" intruded into the surrounding gneiss rocks forming ore lodes (such as silver), and quite a lot accumulated within the pluton-tops (here: mainly tin). At some places, the nearly 300 million years of denudation reached exactly this pluton-top and exposed the metal accumulation. This is the case for the place where nowadays the "Altenberger Pinge" (collapse shaft) marks the once-richest tin deposit of Europe.

It was not before 250 million years after the Variscan orogeny that the interior of earth awoke again in this part of the world. As already mentioned, the remaining block of the "proto-ore-mountains" (although without any high mountain tops which had long been washed away) broke apart. While the northern part was uplifted, forming today's Ore Mountains, the southern part began sinking downwards, creating the Northern-Bohemian Basin. That, again, was accompanied by the rising of magma. But this time, the fluid rock material was of very much different chemistry - alkaline rather than acidic, and rich in different minerals. Volcano eruptions formed the České Středohoří / Böhmisches Mittelgebirge ("Central Bohemian Highlands") - by the way: one of Europe's most interesting landscapes! Volcanic activities affected the recently formed Eastern Ore Mountains, too. Hot and fluid basaltic lava outpoured off small rock cracks. Leftovers of that last tectonic active phase of earth's history are the **basalt mountains** sitting on top of the surrounding surface. Mt. Geisingberg (824 m a.s.l.) is the best known of those basalt mountains.

### **Landuse history**

During the 12th century, the dominions on both sides of the Ore Mountains - the kingdom of Bohemia, as well as the "margraviate" (principality) Meissen - had been solidified. Their rulers began to look for further settlement areas within the broad border belt between them, not yet colonized. These policies got great impulses when rich silver ore deposits were discovered in the area of today's Freiberg 1167 - and probably even before that at today's town of Dippoldiswalde.

Castles were built on both sides of the mountains, and farmers from western parts of what is now Germany invited to colonize the Ore Mountains. Within less than a century they turned the **gneiss plateaus to arable land**. Porphyric and granitic soils proved to be much less suitable for agriculture and were left for forests.

The agricultural-oriented villages from that first (and main) settlement show the typical "**Waldhufendorf**"-pattern: along a (rather small) tributary stream - not in the deep main valleys - two rows of farmsteads stretch on both sides of the stream, mostly up to its headwaters. The farmsteads stood/stand roughly 100 m apart, on average. At more or less right angles to the stream (the axis of the village and valley), the new farmers were allowed to cultivate a strip of land: roughly 100 meters wide and up to 2 kilometers long. This long stretch of property got the old German term "Hufe".

Uprooting the trees and first-plowing the land must have been an incredibly cumbersome undertaking! Moreover, lots of rocks had to be removed, the plows brought up new stones. All those stones (Steine) were carried (gerückt) to the edges of the long "Hufe"-strips. Piling up the rocks and stones formed "**Steinrücken**" (*singular: Steinrücke, no proper English translation known, let's call it "stone ridges"*). Steinrücken are a very typical feature in landscapes of Eastern Ore Mountains, about 1.000 kilometers in total.

From the 12th century onward, mining activities were of great economical importance, and they were major drivers of landscape transforming. Besides silver (for wealth and power of the aristocratic rulers), iron was needed for all the tools both in agriculture and in mining itself. Noteworthy iron ore mines were located near Schellerhau (namely in the Pöbel valley). Later, tin began to play a more prominent role. The rich tin discoveries at the Mückenberg/Komáří hůrka near Graupen/Krupka broke the English tin monopoly in Europe in 1241. But it was not until almost two centuries later that the biggest tin deposit was discovered, the so-called "Zwitterstock" one kilometer southwest of mount Geisingberg - where soon after the town of Altenberg was found, and now the big hole of the "**Altenberger Pinge**" is gaping (400 meters wide, 150 meter deep).

Thousands of miners, craftsmen, merchants and fortune seekers followed the "Berggeschrey" (call of the mountains) to the Altenberg region in the 15th/16th centuries. Lack of appropriate roads created immense problems with food supply. The miners and other new inhabitants had to cultivate land on prophyric and granitic soils the first colonizers had left for forests 300 years before. Typically, those miners settlements lack the regular structure and land-use patterns of the Waldhufendörfer. They are comprised of scattered buildings instead (like Zinnwald). The fields are rather small, irregular shaped patches, crisscrossed by stone ridges / Steinrücken (like around Mt. Geisingberg) and dotted with stone heaps. These stone heaps (in German formerly named "Steinhorst") often mark mining heaps or other leftovers from mining activities.

An exception from those irregular villages of the 16th century is **Schellerhau**. Hans Schelle, a rich entrepreneur, got the permission to establish a village with structures similar to traditional "Waldhufendörfern". The inhabitants should provide the mines of Altenberg with wood, and the miners with food. However, the available place was limited, and the soil conditions far from adequate. Schellerhau remained a very poor village for centuries.

Mining technologies of those times needed a lot of wood both in the form of timber, firewood (in many places, the rock was heated to make it workable to the hand tools) as well as char coal (for the smelters). Almost no sustainable-use policies were applied to the forest use before the end of 18th century - until almost no suitable wood remained in the Eastern Ore Mountains (and many other areas, too).

In 1811, the forest academy of Tharandt was found (the second oldest in the world, after St. Petersburg). A radical shift of forest policy and huge economic efforts led to **large-scale reforestation programs**. The overused forests - with almost no big trees left, but probably still of semi-natural species composition - were replaced by spruce plantations. These spruce (*Picea abies*) forests are still the dominating forest type in most parts of the Ore Mountains, besides all the efforts of the Saxon forest service to return to more nature-like structures with beech (*Fagus sylvatica*) and other hardwoods, as well as White Fir (*Abies alba*) nowadays. Nevertheless, the steep valley slopes of the streams at the eastern flank of the Ore Mountains safeguarded some important semi-natural forests from "sprucification".

During the 18th/19th centuries, agriculture changed as well. Long fallow times (after a couple of harvests land had to remain without plowing for up to 10 years to regain fertility) were much shortened by the introduction of potatoes, around 1770. Potatoes and other new fruits helped to reduce famines considerably, nevertheless villages like Schellerhau remained poor and barely able to feed the population of Altenberg and surroundings.

Then roads were constructed in the first half of the 19th century. Most of today's road network can be traced back to that time. That improved the accessibility of the mountainous area, new transport possibilities abolished the limitations to bring grain from the lowlands (with its much more agro-friendly conditions) to the Ore Mountains. In the same way, the roads offered unprecedented market possibilities: the horse-drawn economies in Dresden - and the other cities north and south of the Ore Mountains - were happy to consume **hay from**

**mountain meadows!** So more and more land which had proved itself unsuitable for agriculture with plows was turned to meadows used with scythes.

Every springtime landscapes got colorful carpets since the mountain meadows were very rich in flowering species. That caught the eyes of the **first tourists** ("Sommerfrischler"), mostly well-off city dwellers eager to escape the unhealthy environmental conditions of the urban areas. More and more visitors came, renting rooms and whole houses in the mountain villages. This new source of income changed the life in places like Schellerhau to become holiday destinations.

The second half of the 20th century brought new far-reaching changes to life and land use. Communist agro-policy forced all farmers to join "**Agricultural Production Cooperatives**" (Landwirtschaftliche Produktionsgenossenschaften - LPG) conducted by governmental planning. Fields and grassland parcels were merged into much bigger complexes. Specialization among the LPGs separated pasture and meadow zones in the mountains from cropland in the plains. Grassland began dominating the upper Eastern Ore Mountains more than ever. But in the same time the **meadows were rapidly losing their biodiversity** due to overdoses of chemical fertilizers and pesticides, gargantuan amounts of liquid manure from large cattle factories, and big tractors. Lynchets and field paths were removed, wetlands were drained. Just a few places with ecological conditions too difficult to overcome with big machinery and chemistry resisted the "agricultural intensification" - in some cases those places were not used anymore at all. One example are the wetland meadows between the village of Schellerhau and the stream Rote Weißeritz, now the nature reserve (Naturschutzgebiet, NSG) "Schellerhauer Weißeritzwiesen".

Very dramatic development happened to the forests, too, between the 1960s and the end of 1990s. Both in East Germany and in Czechoslovakia, **brown coal/lignite** was extracted from huge open pit mines (and they still do it!) to burn it in big power stations, without appropriate filter equipment. So the smokestacks not only emitted carbon dioxide (what they still do, with enormous impact to the greenhouse gas balances of Saxony as well as Czech Republic). Especially the lignite from Northern Bohemia is very rich in sulfur - leading to concentrations of sulfur dioxide far beyond the tolerance capacities of both human health and vegetation. Especially the spruces which have made up to three quarters of all forests in the Eastern Ore Mountains have proved to be very susceptible to sulfur dioxide and the resulting acidification by sulfuric acid. At least 10.000 hectares (100 square kilometers!) of **spruce forests died** on both sides of the German-Czech border. Foresters tried to replace them by exotic and less susceptible species like larches (*Larix spec.*) and blue spruce (*Picea pungens*). It was not until the final years of the 20th century that the governments really addressed the roots of the dying of forests ("**Waldsterben**"), and only after powerful citizen's resistance. The NGO Grüne Liga Osterzgebirge (Green League of Eastern Ore Mountains) was the main force behind the citizens' initiative organizing the protests.

The susceptibility of spruce monocultures to environmental impacts clearly shown by the "Waldsterben" as well as several damaging storms led to change of governmental forest policies, back to more "nature-oriented" tree-composition and forest structures. Since the 1990s a large-scale forest conversion has been underway, with broad-leaf trees and white firs planted to replace and complement the spruce forests.

In agriculture, the political changes of 1989/1990 entailed a lot of uncertainties among the farm enterprises. For some years agricultural use of not-so-optimal locations seemed not worthwhile at all. Large areas of grasslands went fallow (especially on the Czech side of the border) or were just "mulched" to prevent bushes and trees from encroaching. With the current agricultural funding policy of the European Union and the application of those subsidies by the Saxon and the Czech governments the pendulum has swung back to the

encouragement of **semi-industrial methods in agriculture**. Agrobiodiversity is rapidly declining, again.

Anyway, a lot of efforts have been undertaken since 1990 to preserve and enhance biodiversity in places less affected by semi-industrial agriculture and forestry. New nature reserves were declared (i.e. NSG "Am Galgenteich") and existing ones considerably enlarged (NSG "Geisingberg"). A lot of habitats and biotopes have got appropriate (more or less) management and maintenance, thanks to governmental subsidies. From 1999 to 2018 a so-called "**Naturschutz-Großprojekt**" (large scale conservation project) with the title "Mountain Meadows in Eastern Ore Mountains" has been financed by the Federal Ministry of Environment of Germany.

Most noteworthy, however, is the invaluable commitment of many people for nature in Eastern Ore Mountains, especially in practical ways. Among them are several hundreds of student volunteers who have participated in the Schellerhau conservation training since 1996!

### **Biotopes and habitats:**

Although spruce-dominated monocultures are still the typical feature of most forests the Eastern Ore Mountains still harbor a variety of **semi-natural forest types**. According to the concept of "potential natural vegetation" **European beech** (*Fagus sylvatica*) would dominate most places where it is not too wet, not too dry and not too steep. The main companions in the colline and sub-montane foothills are oaks (*Quercus petraea*, *Q. robur*) which were favoured by coppicing usage in former times. Above contour lines of 400 to 500 meters, beech-dominated forests would rather be mixed with spruce (*Picea abies*) and white fir (*Abies alba*). As already shown spruces are much more common now than nature would determine whereas firs are an endangered species nowadays in Saxony. A few centuries ago it was said that one quarter of all trees in the Ore Mountains were **white firs**. But this magnificent tree was not able to adapt to silvicultural methods of the 19th and 20th centuries (clear-cutting with huge open spaces), and it was most susceptible to sulfur dioxide forest damages. A few hundred specimen have survived in the Eastern Ore Mountains (out of 2000 in the whole of Saxony), with the best preserved white-fir-stand in the Pöbeltal-valley south of Schmiedeberg. Most of the seminatural mixed beech forests have been preserved in a system of nature reserves, like the NSG "Hofehübel" at Bärenfels.

Naturally, a variety of other tree species find niches in the forests like maples (*Acer pseudoplatanus*, *A. platanoides*), ash (*Fraxinus excelsior*) and witch-elm (*Ulmus glabra*) - the latter being sharply reduced by the so-called "Dutch elm disease". Those species ("Edellaubhölzer") get a greater share on steep slopes and in ravines ("**Schlucht- und Hangwälder**") where beech roots are often damaged by moving soils and rocks.

The ecological fitness of beeches (and firs) comes to the limits at the highest parts of the Ore Mountains. Spruces take over as the dominant species, but without completely pushing beeches aside except for the harshest places. Rowan trees / **mountain ashes** (*Sorbus aucuparia*) show a great ability to stand rough climate and poor soils - but obviously not the human made immission of nitrogen gases and the resulting high concentrations of ozone.

Open spaces within the *Sorbus-Picea*-forests are of great importance for species conservation in the Ore Mountains. **Black grouse** (*Tetrao tetrix*) has one of very few remaining central-European populations here. The mating season of red deer (*Cerphus elaphus*) involves a lot of loud bellowing ("röhren") and fights between male deer. On every second hunting pulpit a hunter will sit in that time of the year observing the clearing in front of him.

Probably, such open spaces used to be quite common on the mountain ridge plateau when it was covered by **peat bogs** and other biotopes unsuitable for dense forests. But intense human cultivation has deeply affected those areas for many centuries. Old mining technologies

needed a lot of water to run the equipment. Therefore long water channels ("Kunstgräben") were dug. The so-called "Revierwasserlaufanstalt" south of the historical mining city Freiberg includes 54 kilometers of ditches and 24 km of water tunnels ("Röschen") as well as 10 ponds and reservoirs - comprising an important technology monument. A similar but smaller system provided the tin mines of Altenberg with water collected by two channels from the raised bogs in the border region near Zinnwald. Of those bogs, not much is left today besides the (mostly inaccessible) Seeheide/U jezera north of Pramenáč/Bornhau (909 m, the second highest mountain of the region), and the nature reserve **NSG "Georgenfelder Hochmoor"**. Here visitors can still find typical peat bog plants like sundew (*Drosera rotundifolia*), European cranberry (*Vaccinium oxycoccus*) and tussock cottongrass (*Eriophorum vaginatum*) - amidst a more or less dense cover of dwarf mountainpine (*Pinus mugo*). Drying-out is still a big concern for the bogs in the Eastern Ore Mountains. To counter that, conservation projects have been focused on closing the ditches which have been collecting the bog-water for centuries.

Once upon a time, another big bog area was immediately west of Altenberg, named "Seifenmoor". By nature, it was the headwaters of Rote Weißeritz. Already in the 16th century, the mining enterprises began with the construction of two ponds as water reservoir, the "Galgenteiche" in this ground depression. Later, the ponds got several enlargements, and 1987-1993 a third Galgenteich was added - destroying the last remaining part of the "Seifenmoor".

Before humans colonized the Ore Mountains, natural standing bodies of water were very rare, probably almost non-existing. Nowadays **ponds, big and small, play an important role** for biodiversity. Amphibians like the common frog (*Rana temporaria*) form a big part of food supply for rare birds like black stork (*Ciconia nigra*).

Further downhill **mountain streams** like Wilde Weißeritz, Rote Weißeritz and Müglitz collect the water with their tributaries. The amount of water can vary very widely - from almost nothing like in the dry summer of 2018 to more than 400 cubic-meter per second in the Rote Weißeritz near Schellerhau during the flood of august 2002. Normally, these rivers and rivulets are fundamental lifelines for ecological networks. The larvae and adults of a great variety of insects form the basis for many food chains - like mayflies (*Ephemeroptera*), caddisflies (*Trichoptera*) and dragonflies (*Odonata*). Fishes like brown trout (*Salmo trutta*) and European bullhead (*Cottus gobio*) live in the streams, as well as birds like white-throated dipper (*Cinclus cinclus*).

As already mentioned, **stone ridges** ("Steinrücken") are a very typical feature of landscapes in Eastern Ore Mountains, offering habitats for a wide variety of plants and animals. Depending on the character of the underlying stones (acidic porphyry - more neutral gneiss - alkaline basalt), the local climate and the land-use history those stone ridges can be dominated by maple, ash, wild cherry (*Prunus avium*) and others, or it can just nourish undemanding mountain ash. In the past, the trees were used in a coppicing way for firewood, offering enough space for a diverse flora of light-loving (photophilic) shrubs and herbs. Despite the fact that most stone ridges have fundamentally altered their appearance in the last decades (with less demand for firewood), they still can harbor some (nowadays) rather rare species, like february daphne (*Daphne mezereum*), fire lily (*Lilium bulbiferum*), "Sequier's Pink" (*Dianthus seguieri*, Busch-Nelke), purple orpine (*Sedum telephium*, Purpur-Fetthenne), common viper (*Vipera berus*), red-backed shrike (*Lanius collurio*), among many others. An especially noteworthy tree is the **European crab apple (*Malus sylvestris*)**, locally known as "Hulzäbbl" (= "Holzapfel"). In many parts of Central Europe *Malus sylvestris* has become quite rare because of loss of habitats (light-favored forest edges and groves among fields), and it has been losing its genetic identity by hybridization with cultivated apples (*Malus domestica*). In the Eastern Ore Mountains, *Malus domestica* hadn't been planted outside the

villages before the end of 19th century. So the stone ridges gave a perfect refuge for this species. "Hulzäbbl"-fruits have always be known among the locals for their remarkable medical properties. The Green League of the Eastern Ore Mountains focuses a lot of conservation efforts on *Malus sylvestris*.

Most conservation priority in this region is given to meadows. A typical **mountain meadow** - mown once or twice a year to make hay, ideally in combination with sheep grazing - might contain three or for dozens of plant species within a few square meters. Arguably no other type of biotope can harbor more biodiversity on such a small patch of land! Characteristic plants of mountain meadows are spignel (*Meum athamanticum*, Bärwurz), centaury (*Centaurea pseudophrygia*, Perücken-Flockenblume), hawksbeard (*Crepis mollis*, Weicher Pippau), melancholy thistle (*Cirsium heterophyllum*, Alant-Distel), among many others. To todays rarities belong globe flower (*Trollius europaeus*, Trollblume) and early-purple orchid (*Orchis mascula*, Stattliches Knabenkraut).

Most important and of greatest concern for conservation are the nutrient-poor type of mountain meadows, regarded as matgrass heath ("**Borstgrasrasen**"). Before an oversupply of nitrogen from chemical fertilizers as well as nitrogen oxide gases led to eutrophication of almost all landscapes, matgrass meadows were very common including species like mountain arnica (*Arnica montana*), viper's grass (*Scorzonera humilis*, Niedrige Schwarzwurzel), milkwort (*Polygala vulgaris*, Kreuzblümchen), and lousewort (*Pedicularis sylvatica*, Wald-Läusekraut).

As the name implies, **wetland meadows** are found on soils with more moisture. Unfortunately, very often not only water accumulates in ground depressions but also the abovementioned excessive supply of nitrogen compounds. Nutrient-poor, swampy or even boggy biotopes have become very rare, as well as species like butterwort (*Pinguicula vulgaris*, Fettkraut), bogbean (*Menyanthes trifoliata*, Fieberklee), and marsh orchids (*Dactylorhiza maculata*, *D. majalis*, Gefleckte und Breitblättrige Kuckucksblume).

Well-preserved complexes of mountain meadows, matgrass biotopes and wetlands, dotted with bushes and crisscrossed by stone ridges, can be found at the nature reserves "Geisingberg" and "Schellerhauer Weißeritzwiesen". Their future depends on sensible management work - like it has been exercised by motivated student volunteers at the Schellerhau conservation training since 1996.