





## The meadows of Šumava



1

WHICH SITES FEATURE  
THE GREATEST SPECIES  
DIVERSITY IN PLANTS?

## The wealth of plants in Šumava

Mlaka in autumn  
Photo Romana Roučková

Non-forest habitats represent a crucial part of the Šumava landscape in terms of species diversity, as three-quarters of the territory's plants are bound to meadows and peat bogs. The history of the dense, dark forest as it is today is relatively short, hence the finite examples of flora and fauna inhabiting it. In contrast, some non-forest vegetation has been present for thousands of years in the landscapes of Central Europe. During that time, a much wider group of species has adapted to life in sunlit, open sites. In the past ten thousand years, a period comprising the current interglacial era of Holocene, the form of the forestless areas has changed considerably several times - the open landscape of the cold eras giving way to forest vegetation, the spread of which was aided through climate warming and moistening. However, the development of human agri-

cultural society significantly affected this natural process. Mankind's actions (grazing, grubbing up and burning woods, etc.) maintained or shaped the non-forest habitats. Using Šumava as an example, it is easy to see how this process positively influenced species diversity in local natural systems. For instance, meadow vegetation of residential enclaves comprises about two-thirds of plant species in the high-altitude areas of Šumava, much more than in the primary forestless areas of cirques and raised bogs. Meadow enclaves have provided habitat not only to mountain species typical of primary forestless areas and those bound to open-canopy types of mountain forest, but also to species that originally occurred at lower altitudes as well as plants introduced by humans and their operations, e.g. field and pasture weeds or ruderal species.

## The meadows of Šumava

2

WHAT ARE THE PRIMARY FORESTLESS AREAS IN ŠUMAVA?

Where no trees grow

A boulder field near the mountain of Obří hrad  
Photo Depository of the NP Administration

Primary forest areas are sites where adverse environmental conditions prevent closed-canopy forest from forming. In Šumava, these are predominately made up of peaty wetlands. However, this book focuses on other sites such as rocks, glacial cirques of lakes or glades beside streams. Rocky habitats lie mainly in the deep-cut river valleys of the Vydra, Otava, Křemelná and Losenice rivers. Sunlit rocky sites are mostly covered with heather (*Calluna vulgaris*) or wavy hair-grass (*Avenella flexuosa*), while stone fields also contain bilberries (*Vaccinium myrtillus*) and cowberries (*Vaccinium vitis-idaea*), although shady and moist rock formations prove most suitable for ferns like the common polypody (*Polypodium vulgare*) and broad buckler-fern (*Dryopteris dilatata*). Cirques of glacial lakes form another site where rocky terrain in combination with accumulation and slide of snow have prevented

the emergence of closed-canopy woodland. The non-forest alpine vegetation frequently encountered above the tree line in the Krkonoše Mountains and the Alps has grown in Šumava throughout the current interglacial period - the Holocene. The most widespread vegetation in lake cirques appears in tall-herb mountain floodplains - e.g. the alpine ladyfern (*Athyrium distentifolium*), and sparse swards with species such as the *Calamagrostis villosa* reed and purple moor-grass (*Molinia caerulea*). A stand of the latter type also supports the Hungarian gentian (*Gentiana pannonica*), as well as short-stemmed and dwarf shrub communities in the walls of the lakes of Černé jezero and Čertovo jezero, where plants such as *Agrostis rupestris* bentgrass, highland rush (*Juncus trifidus*) and parsley fern (*Cryptogramma crispa*) can be found.

### Identify the ferns

Photo David Půbal (A), Romana Roučková (B), Pavla Čížková (C)



## The meadows of Šumava

3

ARE ONLY MONTANE NARDUS  
GRASSLANDS FOUND IN ŠUMAVA?Secondary  
forestless areasThe mountain  
of Pažení as viewed from Houžná  
Photo Romana Roučková

Secondary forestless areas are made up of meadows and pastures created through human colonisation of Šumava. They represent a wide variety of communities, although often comprising wet or dry primarily short-stemmed meadows. Heathlands are also characteristic, with the prevalence of dwarf shrubs, bound to dry spots with shallow soil (e.g. mining tailings, road slopes), or mineralised and drained parts of former peat land. At lower altitudes, mesophilic oat-grass meadows are also present. Agricultural sites regularly fertilised in the past potentially encompass the last remnants of Montane *Trisetum* meadows. A special and a highly important category concerns communities in wet or waterlog-

ged sites. A diverse, locally and spatially specific variety of vegetation ranges across moist meadows, peatland meadows and meadow springs. Such communities often originated in primary forestless areas (massive headwater sites). In fact, the current nature of sites and their species composition has been strongly shaped by man's economic activities (mowing meadows, surface draining via trenches, grazing management, etc.). Furthermore, the range of hygrophilous communities bound to such primary and secondary non-forest habitats is not only typical for Šumava, but Central Europe as well, and can be considered real gems of the countryside.

Try to identify this country's  
most common brushfoot

Photo Depository of the NP Administration



A



B



C

## The meadows of Šumava

4

WHAT ARE TAILINGS AND WHERE ARE THEY FOUND?

# Settlement and secondary forestless areas over the centuries

The Tailings at Horská Kvilda  
Photo: Depository of the NP Administration

As with most mountain regions in this country, Šumava was a dense forest for a long time. Leaving aside the occurrence of Mesolithic cultures (hunters and gatherers) in what is now known as the Lipno Reservoir, any prehistoric agricultural settlement only extended marginally over the region, usually at lower altitudes. In fact, the only forest openings brought about by mankind's activities involved roads and trade routes. However, this began to change in the High Middle Ages (14<sup>th</sup> c.), when settlements were founded along trade routes (e.g. the Gold Trail). In order to serve their economic needs, deforestation commenced nearby to create farmland

and pastures. Medieval gold mining activities also significantly impacted the formation and shape of forestless areas in the highest zones of Šumava. Heaps of panned material (tailings) can still be found today along streams in areas such as Kvilda and Horská Kvilda, which have nurtured heathland communities and a number of rare plant species. Nevertheless, economic and residential use of Šumava reached its height more recently, primarily with the rise of trade in timber and glass. Indeed, anthropogenic deforestation and the appearance of valuable non-forest communities mainly took place from the 18<sup>th</sup> century to the mid-20<sup>th</sup> century.

### Breeds of cattle farmed in former times



Czech fleckvieh cattle



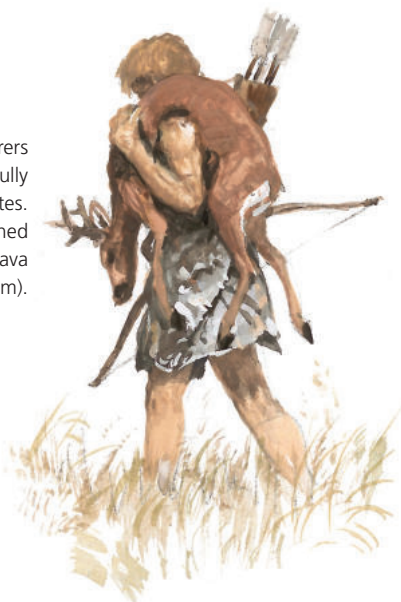
Czech red cattle



**The valley of Luzenské údolí**  
Photo: Štěpán Rosenkranz

# PREHISTORY

Groups of hunters and gatherers (Mesolithic period - 6000 BC) purposefully ranged between several familiar sites. New findings show that they even reached the highest altitudes of Šumava (about 1,100 m).



A network of routes on what was known as the Gold Trail emerged with the rise of trade (10<sup>th</sup> century).

# MIDDLE AGES

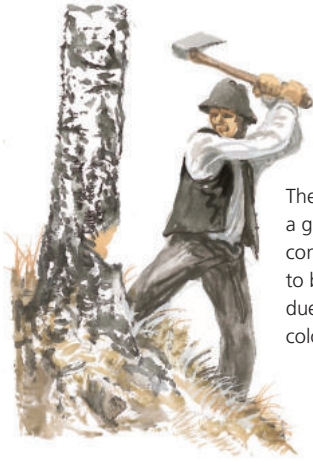
Extracting gold from streams, especially in the area of Kvilda, Horská Kvilda and Zhůří, meant that waste in the form of tailings occurred.



Settlements formed along the Gold Trail. Villages began to appear in the 14<sup>th</sup> century, and farming practices resulted in some deforestation. The landscape became more enriched with plants and animals linked to the inhabitants and their activities.



# MODERN AGE



There has been a growing need for construction materials to build villages due to the ongoing colonisation of Šumava.



The 16<sup>th</sup> and 17<sup>th</sup> centuries witnessed the development of trade in glass, which consumed a large amount of wood. Although some settlements disappeared during the Thirty Years' War, Germans and Austrians later returned to Šumava in the early 18<sup>th</sup> century, hence deforestation continued to serve the glass trade and its logging requirements.



An important milestone in the evolution of the Šumava countryside was the introduction of motorised farming machinery, increasing the quantity of land managed. Events around World War II triggered drastic changes in its utilisation. Several villages became depopulated and were left desolate, so farmers had to abandon their acres.

In the second half of the 20<sup>th</sup> century, the open landscape changed widely due to large-scale agricultural premises being erected.



However, as state-owned farms ceased to exist in the early 1990s, small independent farmers took their place. Certain highly valuable sites that cannot handle agricultural machinery are managed through mowing by hand.



## The meadows of Šumava



5

### WHAT WAS THE IMPORTANCE OF GRAZING IN ŠUMAVA?

**Dolní Cezov**  
Photo Eva Brojířová

## Land management over the years

Farming has played a key role in shaping the landscape of Šumava and its biodiversity. In fact, grazing in woodland has proven vital in transforming the deep forest of Šumava. The influence of pasturage made itself felt initially near old roads, but could extend over several kilometres away from them. Such grazing did not really develop properly until the Middle Ages, in connection with smallholdings being built. Cattle farming was the core of such activities, the pastures hosting the animals from the first snow fall until mid-October. The cattle were led by a local shepherd who shifted them between fields spread out over a variable distance, sometimes to remote summer pastures where the animals would even spend the night. Grazing had a dramatic influence on the land and species diversity. Such areas were left to recover to varying degrees and at different times. Cattle not only ate in deforested spots, but also often in

woods and on peat bogs, while young branches with leaves were cut as feed and wood cleared for building and fuel. The landscape was rather patchy, so the boundaries of the forest and forestless areas could often not be discerned. Since such activities were in direct conflict with the need to grow high-quality wood, later years saw landlords put restrictions upon the inhabitants. However, their activities have resulted in a patchwork of non-forest and open-stand woodlands that is highly valuable in plant and animal diversity. As a consequence, a range of heliophilous species associated with forest clearings have survived that would otherwise have disappeared under a dense canopy of trees. These species have since become the basis of valued non-forest communities in the deforested portions of Šumava. Naturally, the forestless zones have been used to harvest hay and to farm sheep and goats (at smallholdings) in addition to cattle.

### The most common crops to be grown in earlier times



RYE



OAT



FLAX

## The meadows of Šumava

6

HOW WERE THE HEATHLANDS MOST FREQUENTLY USED?

## Montane heaths

Colourful heathland vegetation predominates the high altitudes of Central Šumava. Typically, such patches of heath are bound to medieval mining tailings alongside streams, where gold-panning operations once took place, to the banks beside roads regularly disturbed in the past, or other, extremely nutrient-poor, dry sites. Heathland communities consist of dwarf shrubs, chiefly pertaining to the bog bilberry (*Vaccinium uliginosum*), heather (*Calluna vulgaris*), cowberry (*Vaccinium vitis-idaea*) and bilberry (*Vaccinium myrtillus*). Regarding other notable and rare species, the occurrence of mountain arnica (*Arnica montana*) and Hungarian gentian (*Gentiana pannonica*) is typical of such sites, in addition to

mountain everlasting (*Antennaria dioica*) that tends to be found in rather open stands.

In the past, heathland was used for grazing and might even have been burnt to rejuvenate the overaged woody vegetation. With no disturbance or burning on a periodical basis for a long time, the representation of the species changes: heath vegetation either retreats in favour of bilberry stands, primarily the bog bilberry (*Vaccinium uliginosum*) and the bilberry (*Vaccinium myrtillus*), or becomes overgrown with grasses, particularly the wavy hair-grass (*Avenella flexuosa*) and moor mat-grass (*Nardus stricta*). This process can be observed to varying degrees in most of Šumava's heathlands.

**Hungarian gentian**

**Photo** Depository of the NP Administration

Can you identify species that not only grow on montane heaths?



**Photo** Romana Roučková

## The meadows of Šumava

7

WHAT ARE THE MOST COMMON SHRUBS TO GROW ON DRY PASTURES?

### Montane *Nardus* grasslands

Rejštejn  
Photo: Ester Ekrťová

**Generally inhabiting former pastures or single-cut dry meadows, these plants were supported by soils of low carrying capacity. Such vegetation is most found frequently on dry slopes or the verges of peat meadows. Species-poor stands have evolved on drained peatland.**

Prevailing in such cover are grass species such as the moor mat-grass (*Nardus stricta*), common bent (*Agrostis capillaris*), sweet vernal-grass (*Anthoxanthum odoratum*), heath-grass (*Danthonia decumbens*) and red fescue (*Festuca rubra* agg.). Amidst this vegetation are some small herbs, e.g. the mouse-ear-hawkweed (*Pilosella officinarum*), mountain everlasting (*Antennaria dioica*), large garden (*Thymus pulegioides*), tormentil (*Potentilla erecta*), viper's grass (*Scorzonera humilis*), etc. Rare species include orchids: the long-bract frog orchid (*Coeloglossum viride*) and small-white orchid (*Pseudorchis albida*). Former grazing land can often be recognised by scattered shrubs of common juniper (*Juniperus communis*).

Historically, these swards were grazed or mowed and then manure laid down for fertilisation, but now species diversity and richness is dwindling due to the prolonged absence of such activities. Grasses with minimal demands often dominate the cover. Furthermore, a number of such areas ended up being ploughed and fertilised too much, causing the total destruction of such low-productive communities.

Of course, the decline in an appropriate management approach is a major factor, which has led to once forestless areas becoming overgrown by woody species and the formation of woods, in addition local municipalities have had an impact through gradually increasing pressure for residential development.

Can you identify the common types of dry meadow?



A



B



C

Photo Romana Roučková

## The meadows of Šumava



## Montane *Nardus* grasslands

1. **Stemless carline thistle** (*Carlina acaulis*)
2. **Eyebright** (*Euphrasia officinalis*)
3. **Heath speedwell** (*Veronica officinalis*)
4. **Large garden** (*Thymus pulegioides*)
5. **Viper's grass** (*Scorzonera humilis*)
6. **Mountain everlasting** (*Antennaria dioica*)
7. **Mountain arnica** (*Arnica montana*)
8. **Hungarian gentian** (*Gentiana pannonica*)
9. **Moor mat-grass** (*Nardus stricta*)
10. **Maiden pink** (*Dianthus deltooides*)
11. **Common bent** (*Agrostis capillaris*)

8

11

7

10

9

2

1

4

3

5

6

## The meadows of Šumava



8

WHAT HERBS ARE COMMON TO THESE MEADOWS?

### Mesic *Arrhenatherum* meadows

Houžná  
Photo Romana Roučková

Mesic *Arrhenatherum* meadows can be found in Šumava at lower altitudes, especially on former sites of flower-rich beech forest. Their typical species of grasses tend to be quite tall, such as the downy oat-grass (*Avenula pubescens*), quaking-grass (*Briza media*), false oat-grass (*Arrhenatherum elatius*), orchard grass (*Dactylis glomerata*) and yellow oat-grass (*Trisetum flavescens*). The variety in herbs is striking, e.g. the ox-eye daisy (*Leucanthemum vulgare* agg.), spreading bellflower (*Campula patula*), rough hawkbit (*Leontodon hispidus*), yarrow (*Achillea millefolium*), white bedstraw (*Galium album*), hogweed (*Heracleum sphondylium*), etc. Rare orchids can be infrequently encountered

as well - examples include the burnt orchid (*Orchis ustulata*) and fragrant orchid (*Gymnadenia conopsea*). These meadows are mown for hay twice a year and occasional grazing is possible. Flowery and species-rich mesic *Arrhenatherum* meadows are unusual today, as such communities were often destroyed in the past by intense agricultural production (over-ploughing, introducing cultivated mixtures of grasses, over-fertilisation). Conversely, though, such vegetation is highly susceptible to becoming overgrown by woody species (leading towards reforestation) if there is a lack of regular mowing, resulting in their total disappearance.

Can you identify these common species?



A



B



C

Photo Romana Roučková

## The meadows of Šumava





## Mesic *Arrhenatherum* meadows

1. **Downy oat-grass** (*Avenula pubescens*)
2. **Common bent** (*Agrostis capillaris*)
3. **Sweet vernal-grass** (*Anthoxanthum odoratum*)
4. **Red fescue** (*Festuca rubra*)
5. **Yorkshire-fog** (*Holcus lanatus*)
6. **Spreading bellflower** (*Campanula patula*)
7. **Field scabious** (*Knautia arvensis*)
8. **Red clover** (*Trifolium pratense*)
9. **Ox-eye daisy** (*Leucathemum vulgare* agg.)
10. **Germander speedwell** (*Veronica chamaedrys*)
11. **Meadow vetchling** (*Lathyrus pratensis*)
12. **Ribwort plantain** (*Plantago lanceolata*)
13. **Common bird's-foot-trefoil** (*Lotus corniculatus*)
14. **Hogweed** (*Heracleum sphondylium*)
15. **Rough hawkbit** (*Leontodon hispidus*)

1

14

2

5

9

7

6

4

3

11

8

15

10

12

13

## The meadows of Šumava

9

WHERE DO THESE MEADOWS LIE?

### Montane *Trisetum* meadows

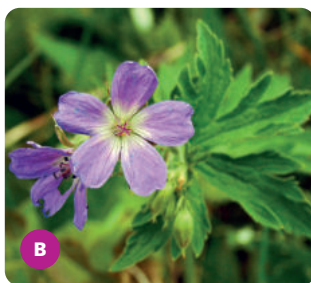
Filipova Hut  
Photo Ester Ekrťová

Montane *Trisetum* meadows are not quite so well developed in Šumava as in the Krkonoše Mountains. However, they lie in some sections of nutrient-rich, damp habitats, typically near settlements. Essentially, they are swards comprising species small in size, such as the red fescue (*Festuca rubra*), common bent (*Agrostis capillaris*) and yellow oat-grass (*Trisetum flavescens*), alongside typical wide-leaved herbs such as spotted St. John's-wort (*Hypericum maculatum*), red campion (*Silene dioica*) and wood crane's-bill (*Geranium sylvaticum*) as well as some mountain species - rockcress *Arabidopsis halleri* and the

black rampion (*Phyteuma nigrum*). This kind of vegetation is tightly bound to traditional farming methods; more specifically, meadow stands found close by settlements that used to be regularly fertilised to provide forage of good-quality. The meadows were cut once or twice, and occasionally grazed. With such habits ending, they are changing into montane *Nardus* grasslands of better carrying capacity (due to depletion of nutrients), or contrarily they become overgrown with ruderal vegetation (absence of regular mowing), hence the occurrence of these communities is dissipating.

Can you identify these common species?

Photo Romana Roučková



# The meadows of Šumava



## Montane *Trisetum* meadows

8

14

4

10

2

1. **Common lady's-mantle** (*Alchemilla monticola*)
2. **Common bent** (*Agrostis capillaris*)
3. **Northern hawk's-beard** (*Crepis mollis* subsp. *succisifolia*)
4. **Red fescue** (*Festuca rubra*)
5. **Wood crane's-bill** (*Geranium sylvaticum*)
6. **Black rampion** (*Phyteuma nigrum*)
7. **Meadow buttercup** (*Ranunculus acris*)
8. **Garden sorrel** (*Rumex acetosa*)
9. **Red clover** (*Trifolium pratense*)
10. **Yellow oat-grass** (*Trisetum flavescens*)
11. **Germander speedwell** (*Veronica chamaedrys*)
12. **A Rockcress** (*Arabidopsis halleri*)
13. **Spotted St. John's-wort** (*Hypericum maculatum*)
14. **Melancholy thistle** (*Cirsium heterophyllum*)
15. **Aconite-leaved buttercup** (*Ranunculus aconitifolius*)
16. **Wild pansy** (*Viola tricolor* subsp. *polychroma*)
17. **Red campion** (*Silene dioica*)
18. **Bladder campion** (*Silene vulgaris*)
19. **Sweet vernal-grass** (*Anthoxanthum odoratum*)

3

5

6

13

15

17

18

11

7

19

9

12

16

1



## The meadows of Šumava

10

WHAT IS THE COLOURING OF PURPLE MOOR-GRASS IN AUTUMN?

### Intermittently wet *Molinia* meadows

Želňava  
Photo Ester Ekrťová

Such intermittently wet meadow communities are typically associated with lower altitudes of Šumava and its foothills, especially the southern portion of the territory. They comprise meadow vegetation at sites with significantly fluctuating humidity throughout the year, such as on the perimeters of peat bogs and fens or elevated terraces in the floodplains of streams and rivers. Consisting of swards, there is a significant proportion of purple moor-grass (*Molinia caerulea*) - a striking tuft-forming grass species, the leaves of which turn orange as autumn nears. The attractiveness of the meadows is heightened by the mass of many rare and endangered plant species. Examples are the Siberian iris (*Iris sibirica*), large pink (*Dianthus superbus*) and marsh gentian (*Gentiana pneumonanthe*). Where bordering the territory of Předšumaví, i.e. foothills, even dyer's plumelless sawwort (*Serratula tinctoria*) can make a rare appearance. The swards take on a significant summer aspect with the blue-flowering devil's-bit scabious (*Succisa pratensis*) and betony (*Betonica officinalis*). Traditionally, these were meadows mown once a year, often resulting from sur-

face draining the peripheries of peat-land via networks of small canals, thereby permitting mowing and the harvesting of hay. Partial drainage led to once permanently waterlogged areas of peat vegetation drying up in the summertime, encouraging species favouring such a water regime. Today, a reverse process can be observed in a number of areas, where the community is gradually returning to the vegetation of peat meadows - even high water-bearing sedge grasses - as surface drainage has been discontinued. Traditional management methods brought about a very rich mosaic of sites supporting a myriad of species - from wetland plants bound to sites of springs and drainage channels, through to a proportion of xerophilic species that can only tolerate temporary waterlogging in spring or autumn. A very negative impact is visible at most sites that have experienced a long absence of mowing, where only purple moor-grass prevails in the unmown stands while the original species diversity has been lost, along with the occurrence of many rare plant species.

Can you identify these species?

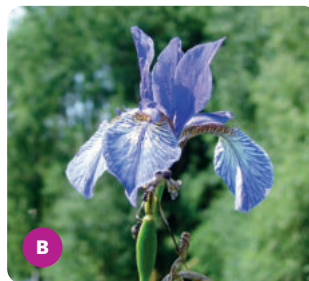


Photo Romana Roučková

## The meadows of Šumava



## Intermittently wet *Molinia* meadows

1. **Purple moor-grass** (*Molinia caerulea*)
2. **Siberian iris** (*Iris sibirica*)
3. **Large pink** (*Dianthus superbus*)
4. **Marsh gentian** (*Gentiana pneumonanthe*)
5. **Devil's-bit scabious** (*Succisa pratensis*)
6. **Betony** (*Betonica officinalis*)
7. **Carnation sedge** (*Carex panicea*)
8. **Carex umbrosa** (a sedge)
9. **Northern bedstraw** (*Galium boreale*)
10. **Viper's grass** (*Scorzonera humilis*)
11. **Dyer's plumeless saw-wort** (*Serratula tinctoria*)
12. **Tufted hair-grass** (*Deschampsia cespitosa*)
13. **Ragged-robin** (*Lychnis flos-cuculi*)

12

1

11

2

5

13

6

4

7

3

9

10

8



**Irises in Skelná**  
Photo Marek Drha









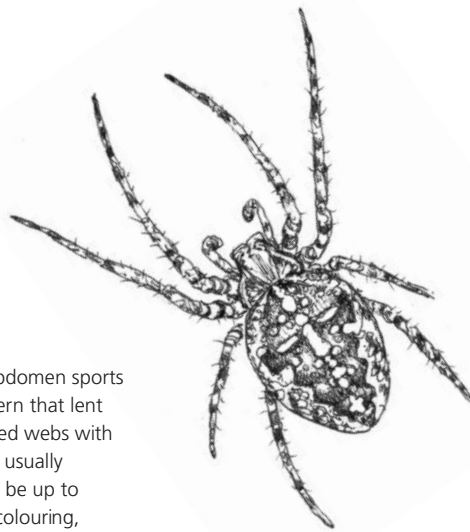






***Coelotes terrestris***, a member of the funnel-web spider genus, lives in a tangled structure resembling a stocking that lines its underground nest. The insect is about 10 cm long with a diameter of 1 cm. Signal fibres extend from the aforementioned structure to inform the spider of any prey, which it then traps with sticky droplets, allowing the spider to subsequently kill it.

**Size:** 8-10 mm



The **cross spider** is commonplace. Its abdomen sports the distinctive, white, cross-shaped pattern that lent it its name. This spider weaves orb-shaped webs with a diameter of well over 50 cm. They are usually mounted as if in a frame. The fibres can be up to eight metres long. The species varies in colouring, a brown shade being the most frequent, but there are also grey, black-and-white, yellowish and red alternatives.

**Size:** males 5-10 mm, females 12-17 mm.



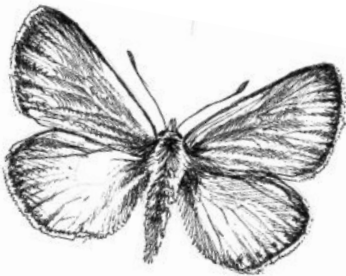
### **Myathropa florea**

A relatively large hoverfly, the hairs on the thorax of this insect form an image, something like a death's-head. The clarity of this on some individuals is perfectly clear although for others it might only be faint. From spring to autumn, the creature searches for flowers in meadows, hedges or the verges of forest.

**Size:** 12-15 mm

**The violet ground beetle** is an elongated beetle with long limbs. Its colouration is matt black, while the edges of the wing cases and the clypeus are golden with a violet or teal blue tint. The beetles hide during the day under stones, in tree litter, under pieces of wood, in the remains of trees, or inside or outside woodland, and range from low lying areas to mountains. They hunt insects and snails at dusk and night and are flightless creatures.

**Size:** 2-3 mm



**The Amanda's Blue butterfly** is visible from June to early August, and produces a single generation of offspring that hibernates through the winter as a caterpillar. It prefers damp meadows, ones left relatively unattended, and upper altitudes. The caterpillars search for tufted vetch (*Vicia cracca*). Not mowing the entire meadow at once proves very helpful to the creature. While the male is blue, the female is of brown colour, but the outer side of the wings is almost identical in both.

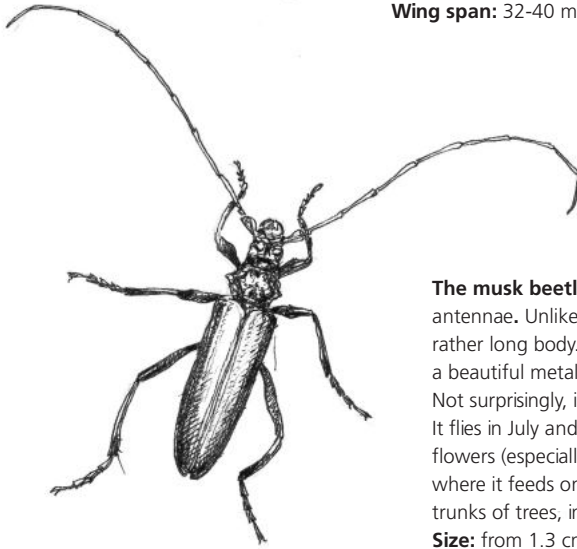
**Forewing length:** 16-19 mm



**The lesser marbled fritillary** flies in June and July, preferring moist and cool places.

As a caterpillar, it feeds mainly on the meadowsweet (*Filipendula ulmaria*) and the great burnet (*Sanguisorba officinalis*). Overgrown meadows make for sites to see numerous such butterflies basking in the sun. Not endangered, extensively mowing meadows is not greatly favourable for the insect. The inner side of the wing is identical in colour for males and females. The outer side is darker in the female, while the male has a generally longer and narrower abdomen.

**Wing span:** 32-40 mm.



**The musk beetle** is characterised by its long antennae. Unlike the female, the male has a rather long body. This beetle is usually a beautiful metallic green or bluish colour.

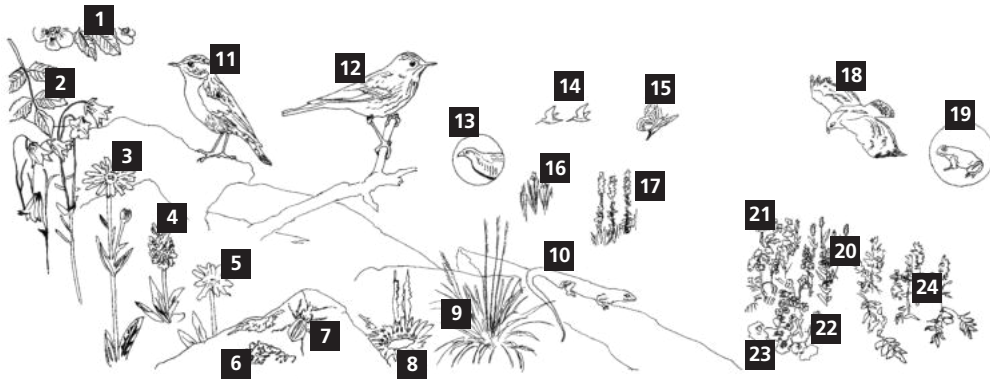
Not surprisingly, its smell resembles musk. It flies in July and August and favours various flowers (especially on umbelliferous plants), where it feeds on pollen, or directly on the trunks of trees, in which its larvae develop.

**Size:** from 1.3 cm to almost 4 cm

**The black-and-red froghopper** is a leafhopper, strictly terrestrial animals which feed on the plant juices they suck; they are related to the true bugs. About one centimetre long, it has distinctive black and red colouring. It ranges mainly in rather high altitudes and is found in grassy clearings and on the verges of forest. The larvae grow in a protective foam wrapping, which can easily be overlooked, unlike other froghoppers. They tend to occur in the lower parts of plants and on the roots. **Size:** body length is 1 cm







1. **DOG-ROSE** (*ROSA CANINA*)
2. **SPREADING BELLFLOWER** (*CAMPANULA PATULA*)
3. **MOUNTAIN ARNICA** (*ARNICA MONTANA*)
4. **ELDER-FLOWERED ORCHID** (*DACTYLORHIZA SAMBUCINA*)
5. **VIPER'S GRASS** (*SCORZONERA HUMILIS*)
6. **WORLD MAP LICHEN** (*RHIZOCARPON GEOGRAPHICUM*)
7. **CARABUS ARCENSIS** (A GROUND BEETLE)
8. **STEMLESS CARLINE THISTLE** (*CARLINA ACAULIS*)
9. **MOOR MAT-GRASS** (*NARDUS STRICTA*)
10. **COMMON LIZARD** (*ZOOTOCA VIVIPARA*)
11. **WHINCHAT** (*SAXICOLA RUBETRA*)
12. **TITLARK** (*ANTHUS PRATENSIS*)
13. **CORNCRAKE** (*CREX CREX*)
14. **COMMON SNIPE** (*GALLINAGO GALLINAGO*)
15. **LARGE RINGLET** (*EREBIA EURYALE*)
16. **SIBERIAN IRIS** (*IRIS SIBIRICA*)
17. **GARDEN MONKSHOOD** (*ACONITUM PLICATUM*)
18. **BUZZARD** (*BUTEO BUTEO*)
19. **COMMON TOAD** (*BUFO BUFO*)
20. **COMMON BISTORT** (*BISTORTA MAJOR*)
21. **COMMON VALERIAN** (*VALERIANA OFFICINALIS*)
22. **YELLOW LOOSESTRIFE** (*LYSIMACHIA VULGARIS*)
23. **MARSH-MARIGOLD** (*CALTHA PALUSTRIS*)
24. **MEADOWSWEET** (*FILIPENDULA ULMARIA*)

## The meadows of Šumava

11

WHAT WERE THESE MEADOWS ONCE USED FOR?

### Wet *Cirsium* meadows

Strážný - a floodplain of the stream of Kořenský potok  
Photo Ester Ekrťová

Wet *Cirsium* meadows usually lie in valleys with streams or small rivers and areas of natural springs. Often there is a linear transition between this type of habitat and peat bog vegetation. Wet *Cirsium* meadows are flowery, often species-rich communities, such vegetation replacing woodlands of alder and willow.

The predominant species of such stands include the wild angelica (*Angelica sylvestris*), common bistort (*Bistorta officinalis*), marsh marigold (*Caltha palustris*), wood club-rush (*Scirpus sylvaticus*), common sedge (*Carex nigra*), carnation sedge (*Carex panicea*), meadowweet (*Filipendula ulmaria*), soft-rush (*Juncus effusus*), etc. Rarer species encompass the white-blooming marsh valerian (*Valeriana dioica*) in springtime, a tiny plant, or the stately *Tephrosia crispa* groundsel of yellow colour. An abundance of the broad-leaved marsh orchid (*Dactylorhiza majalis*) is typical of thistle wet meadows as well. Meadows of this type were used as a source of hay

and bedding, and were mowed once or twice a year depending on the specific situation (weather events, etc.) and the carrying capacity of the meadow. If not mowed, they reduce their species diversity to form stands with a single prominent feature, normally meadowsweet (*Filipendula ulmaria*) or wood club-rush (*Scirpus sylvaticus*). Typically, there is a strong expansion of the sedge *Carex bryzoides* in long uncultivated areas of such meadows in Šumava. Traditional farming (similarly as with peat meadows) once necessitated drainage using a system of shallow trenches with possible temporary damming in case of severe drought. Remnants of such streamlets are still visible in many places today. If the system is not maintained and there is significant waterlogging, the thistle vegetation transforms into tall-stemmed sedge communities, where herb meadow species disappear and wet-land species dominate, such as the bottle sedge (*Carex rostrata*).

Can you identify any hygrophilous species?

Photo Romana Roučková



## The meadows of Šumava



## Wet *Cirsium* meadows

8

1. **Marsh-marigold** (*Caltha palustris*)
2. **Marsh hawk's-beard** (*Crepis paludosa*)
3. **Marsh valerian** (*Valeriana dioica*)
4. **Tephroseris crispa** (a groundsel)
5. **Wild angelica** (*Angelica sylvestris*)
6. **Common bistort** (*Bistorta officinalis*)
7. **Velvet bent** (*Agrostis canina*)
8. **24) Meadowsweet** (*Filipendula ulmaria*)
9. **Yorkshire-fog** (*Holcus lanatus*)
10. **Wood club-rush** (*Scirpus sylvaticus*)
11. **Ragged-robin** (*Lychnis flos-cuculi*)
12. **Marsh willowherb** (*Epilobium palustre*)
13. **Common sedge** (*Carex nigra*)
14. **Broad-leaved marsh orchid** (*Dactylorhiza majalis*)
15. **Brachythecium moss** (*Brachythecium rivulare*)

5

11

4

7

6

9

10

14

2

12

3

1

13

15

## The meadows of Šumava

12

WHAT IS THE RARE PLANT CALLED THAT IS TYPICAL OF MEADOW SPRING AREAS?

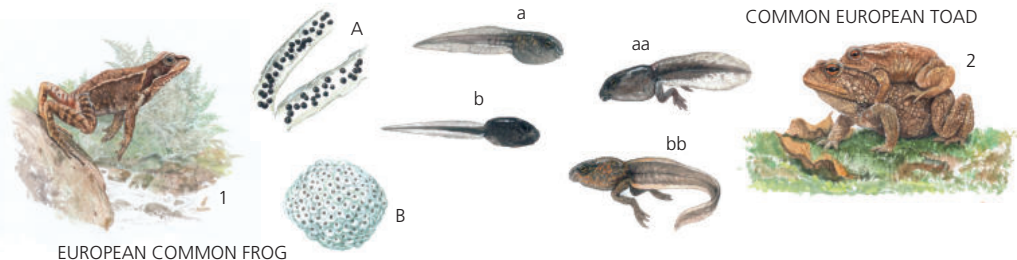
### Meadow springs

Strážný - a floodplain of the stream of Kofenský potok  
Photo Ester Ekrťová

The presence of wells is not limited to woods, as a Czech poet once mused. They exist in meadows as well, although they may be less noticeable today. The types of meadow spring sites discussed here only host specific flora typical to open sunlit spring areas with rising water. These are such places where there is permanent increase in water levels, creating a low-lying water surface that seeps away. The very rare water blinks (*Montia fontana* subsp. *amporitana*) is a characteristic companion. It forms rich vegetation in spring areas and is accompanied by other species, such as the short-fruited willowherb (*Epilobium obscurum*), bog chickweed (*Stellaria alsine*) or, very rarely, the hairy stonecrop (*Sedum villosum*). Botanically speaking, this is highly important ve-

getation, albeit often limited in terms of species, but this traditional element of this country's landscape is vanishing and essential for some species. In the past, meadow springs were common and provided drinking water for passers-by. Shallow canals were set up to drain such places with possible damming in dry periods. Spring area vegetation often overgrew entire stretches of canals, spreading across dozens of metres. Without regular maintenance of the canals and periodical mowing or grazing of the meadows, this type of spring area vegetation ceases to exist, becoming standard wetland vegetation bound to permanently saturated places, remaining merely where rising springs are strong enough to encourage such vegetation.

### Label the toad and frog developmental stages



## The meadows of Šumava



13

WHAT IS THE NAME OF THE CATTLE THAT WAS FIRST WIDELY FARMED IN ŠUMAVA?

### Pastures

Kepelské Zhůří  
Photo Eva Brojířová

After World War II, as people drifted away from the extensive forestless areas they had been cultivating, a process of gradual overgrowing started in such places, which still continues, even though the sites might have been known to agricultural cooperatives formed after 1948. Such cooperatives introduced large-scale cattle farming with commercial milk production, which demanded a relatively stable method of management. A large quantity of solid and liquid manure was used to fertilise neighbouring meadows. In the foothills, a number of meadows were also ploughed up for growing crops. In the mountainous areas of Šumava, including the border zone, a gradually switch to breeding cattle commenced for meat production, bringing in herds of Hereford beef

cattle in the 1980s. The early 1990s saw the collapse of state-run cooperatives, with private farms forming afterwards. In 1991, part of the Protected Landscape Area of Šumava was designated a national park. In order to look after the non-forest areas, Šumava NP & PLA Administration primarily assigns local farmers to carry out such maintenance. In the mountainous part of Šumava, as was the case in the past, pastures dominate over mown meadows and extensive grazing of beef cattle significantly exceeds that of sheep, goats or horses. Protecting species and valuable natural habitats has required Šumava NP & PLA Administration to impose restrictions on grazing, this by defining the area and numbers of cattle permitted, or by stipulating a preferred grazing period.

### Livestock kept most frequently

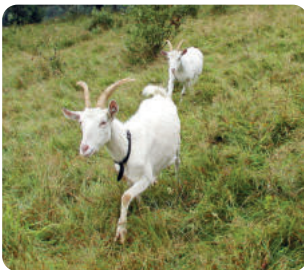


Photo Romana Roučková

## The meadows of Šumava

14

WHAT DOES  
SUCCESSION MEAN?

# Succession – the return of the forest

Zvonková  
Photo Romana Roučková

Šumava permits an insight into succession and its consequences, as it is happening now for all to see. The use of the countryside dramatically altered following the end of World War II when the German population had to leave, as well as the social upheavals of 1948. The management of economically unprofitable land ceased, and large expanses of non-forest enclaves of such former communities were closed off or used as military training grounds. Hardy species of grasses and herbs started to take over the abandoned meadows and pastures. However, small and often rare plant species dependant on periodical disturbance by grazing and the mowing of meadows cannot endure in a closed stand. A characteristic phenomenon is the subsequent onset of woody species, which creep into such unmaintained areas to varying degrees. Where

aerial images from the 1950s show pastures with scattered, small spruce trees, now fully grown forest stands. Hundreds of hectares of valuable non-forest habitats have disappeared under self-propagated stands of birch, spruce or willow, as well as becoming sites of fields and former buildings. While this could sometimes be perceived as positive, especially as regards anthropogenic habitats, such as fields, dump piles, sand pits, quarries or unmanageable surfaces worthless in terms of natural history, the loss of Šumava's forestless areas means that the diversity of species and vegetation is significantly reduced across the territory. It is important to retain patches of early successional stages that are considered the most valuable and essential to natural history for a variety of animals, this applying to both natural and typical anthropogenic habitats.

### The most common successional woody species



ROWAN



SILVER BIRCH



NORWAY SPRUCE



GOAT WILLOW

15

WHERE DO GENTIANAS  
GROW IN ŠUMAVA  
LIKE IN THE ALPS?

## Hungarian gentian – a symbol of Šumava meadows as seen in the Alps

Hungarian gentian  
Photo Pavel Huběný

Hungarian gentian is a stately plant of long life with thick underground rhizomes, traditionally used as a basis for bitter liqueurs. Although the main home of this attractive plant is subalpine and alpine zones of the Eastern Alps, the plant occurs northerly in Šumava and in the mountain ranges of the Sudeten region (Krkonose and Jeseníky), from whence this gentian was considered to originate. However, current knowledge indicates that it originally could have extended as far as the Krkonose Mountains. The Hungarian gentian is an example of a "glacial relic", i.e. a heliophilous species bound to open non-forest landscape that was typical for the cold period of the Quaternary. At altitudes below the upper tree line, such as in Šumava, the gentian grows where the habitat prevents close-canopy forest from forming - referred to as primary forestless areas. Examples of

such sites that prove favourable for the gentian to thrive are cirque walls at the lakes of Černé jezero and Plešné jezero as well as banks of streams in the central part of Šumava. Nonetheless, this plant also appears on mountain meadows near the residential enclaves of Kvilda, Horská Kvilda, Filipova Huť and Modrava, as well as at Březník and in the valley of Luzenské údolí. Mountain meadows represent forestless areas formed by the actions of mankind since the Middle Ages ("secondary forestless areas"), which became a new refuge for the species, enabling its broad spread. In the past recent fifty years, however, the reverse trend has been observed, as forest has reclaimed ground on secondary forestless areas due to a long absence of traditional farming, hence the richly flowering groups of the Hungarian gentian are somewhat threatened.

### Hungarian gentian

FLOWERING STALK



CAPSULE



SEED



ROSETTE





## The meadows of Šumava

16

WHAT IS THE INSECT THAT LOOKS LIKE BEES OR WASPS IN ITS COLOURING?

### Insects

Seven-spotted lady beetle  
Photo Pavel Krásenský

Roughly a third of Šumava's territory was eventually given over to farming animals for their sustenance during the colonisation process, thereby fundamentally shaping the secondary forestless areas through grazing (cattle, sheep, goats, horses) and for the provision of fodder. How is it related to the occurrence of insects? Directly is the answer, as it is the forestless area and its successional changes or disturbances, i.e. either overgrowing or re-opening of the landscape, to which a vast swathe of insect biodiversity is bound. Changes occur anywhere humans abandon land to which they eventually return. Numerous sights await - whether it is the beautiful colourful wings of butterflies, beetles flying along roads and paths (e.g. jewel beetles or tiger beetles) or feasting on flowers, the abundance of foam

nests of froghoppers on grasses, the rustling and rattling of ground beetles at night, or caddis flies, hawkers and dragonflies fluttering above streams or small peat ponds. Caddis fly larvae are obvious to the eye if boating the River Vltava on stones in water, as the cases protecting them comprise narrow tubes composed of stuff like pebbles, etc. There are also hoverflies - the insects that mimick bees and wasps and love flowers. Last but not least, dipteran insects such as flies and mosquitoes can be encountered, or blackflies and march flies that prefer damp sites, which are believed to be special to Šumava. The list of examples goes on and on. It is essential to know that the insect species found locally in the forestless areas account for over 70% of total biodiversity in Šumava.

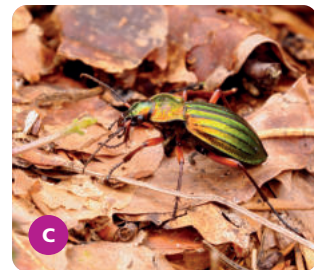
Try to identify these insect species



A



B



C

Photo Pavel Krásenský

## The meadows of Šumava

17

WHICH BUTTERFLY  
LIKES THE YELLOW  
FLOWERS OF GROUNDSEL?

## Butterflies as signifiers

**Purple-edged copper**  
Photo Romana Roučková

The butterflies in Šumava demonstrate well the reliance on sites and the richness of the Šumava countryside. Butterflies are actually a good indicator of the quality of a habitat. Sometimes they are referred to as "umbrella species", because they visibly connote the occurrence of other entire groups of species difficult to see with the naked eye. Vital habitats for butterflies in Šumava comprise peat meadows and other peat-associated communities. Examples of typical umbrella species include the cranberry blue (*Vacciniina optilete*), a butterfly feeding on bog bilberries, and the moorland clouded yellow (*Colias palaeno*). The small cranberry on the open peat bogs and raised bogs host the cranberry fritillary (*Boloria aquilonaris*). The bog fritillary (*Boloria eunomia*) is a unique species bound to the common bistort. At

dusk, the rosy marsh moth (*Coenophila subrosea*) is seen on flowers inside the peat bogs, a nocturnal moth whose caterpillars feed on the black crowberry. Cotton-grass peat meadows host the very rare large heath (*Coenonympha tullia*), while mountain meadows and pastures in Šumava feature the presence of satyrs and wood nymphs as well as other species of fritillaries. Every other year (even-numbered) a large amount of large ringlets (*Erebia euryale*) are noticeable on groundsel plants along the paths and verges of meadows, while the dark green fritillary (*Argynnis aglaja*) flutters around thistles, plus there is the Amanda's blue (*Polyommatus amanda*), whose caterpillars feast on the tufted vetch. Large quantities of butterflies are visible over moist, open soils on hot summer days.

Can you discover what butterflies  
transform from the caterpillars shown here?

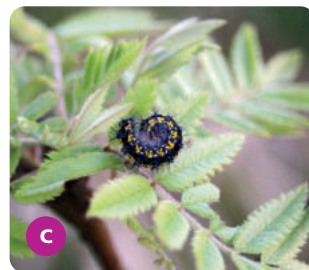


Photo Alois Pavlíčko

## The meadows of Šumava

**Red-backed shrike**  
Photo Ivan Dudáček

18

WHICH BIRD HANGS  
ITS PREY ON TWIGS?

## Birdsong on the hillsides

To prove the territory's extraordinary ornithological importance, Šumava was declared a special protection area as part of Natura 2000, one that supports a total of 140 species of birds. Avian communities of the highest diversity are bound to its mosaic landscape, where mown areas are interspersed with fallow spaces, as well as wetlands and peat bogs. Examples of such variety include the floodplain of the River Vltava - Vltavský luh, which makes up about 1% of Šumava (NP & PLA), creating conditions for about 80% of all bird species nesting in Šumava. In addition, the diverse mosaic of forestless enclaves at varied levels of succession, often associated with wetlands, create favourable settings for other protected species. Examples include the

common rosefinch (*Carpodacus erythrinus*), whinchat (*Saxicola rubetra*), red-backed shrike (*Lanius collurio*), great grey shrike (*Lanius excubitor*), corn bunting (*Miliaria calandra*), and woodlark (*Lullula arborea*); as well as the titlark (*Anthus pratensis*), grasshopper warbler (*Locustella naevia*) and marsh warbler (*Acrocephalus palustris*). Agricultural spaces are home to a number of other steppe and forest-steppe species, e.g. the common quail (*Coturnix coturnix*), grey partridge (*Perdix perdix*), skylark (*Alauda arvensis*) and yellowhammer (*Emberiza citrinella*). There are species that nest in the woods or along their verges, which search for food in the surrounding open countryside, such as some birds of prey and owls.

Try to identify  
these songbirds

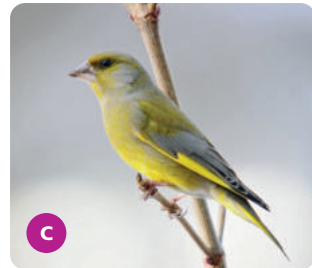


Photo Ivan Dudáček

## Bird species bound to secondary forestless areas

19

WHICH LOCAL BIRDS ARE UNDER THREAT?



The **black grouse (*Tetrao tetrix*)** is bound to peat bogs, waterlogged/peat meadows, peat bog birch woodland and even various successional sites of secondary forestless areas, which either lie fallow or are partially used as meadows or pastures. It seeks out open habitats with scattered vegetation. The Šumava's last remaining stable population ranges in the floodplain of Vltavský luh, where there are the majority of mating sites.



The **common snipe (*Gallinago gallinago*)** nests on peat and waterlogged meadows. During breeding season the male gives a bleating sound, made by vibrating the outer rectrices (larger feathers in the tail) as the bird flies headlong. Since the 1980s, there has been a nationwide decline in numbers by more than 80% due to extensive drainage of meadows. Although Šumava has not experienced such a drastic drop, snipes are increasingly under threat as suitable sites become overgrown.



Šumava boasts the largest numbers of **hazel grouse (*Bonasa bonasia*)** in Central Europe or the Alps. Although considered a typical forest fowl, the greatest density is seen in areas with rugged terrain where forest blends with forestless areas that lack any long-term management; in ecotones where mixed stands and overgrown meadows and pastures meet, often in direct contact with bank vegetation along small streams.

Photo Ivan Dudáček

Photo Ivan Dudáček (A, B), Martin Mecnarovský (C)



## The meadows of Šumava

20

WHAT DO  
CORNCRAKES EAT?



### Corncrake

Corncrake  
Photo Ivan Dudáček

One of the most interesting bird species of forestless areas, the corncrake (*Crex crex*) resembles a slender partridge – the body is flattened, the limbs are strong and long. The bird tramples down paths in vegetation that permit rapid and quiet movement through dense meadow cover. Catching a glimpse of the creature is difficult, but the male's distinctive call is hard to miss. It sounds like its scientific name ('*crex crex*') and can be often heard in May to July, especially at night. Corncrakes are omnivores, but animals are uppermost in young birds' diets, mostly insects and small invertebrates, whereas parts of grasses and weeds make up the plant component. The nest is hid-

den on the ground in a tangle of plants and can contain 8-12 eggs, with the female sitting on the clutch for 21 days. Offspring are guided away from the nest by the female immediately after hatching. A migratory species, during August and September it departs for South Africa, from whence it returns in April or in May. The corncrake was once plentiful, but drainage of meadows and large-scale farming means it has nearly disappeared. The bird ranks amongst Europe's endangered species that are protected additionally under Natura 2000. Conservation is supported by subsidies to farmers if they carry out mowing or grazing of meadows under certain rules.

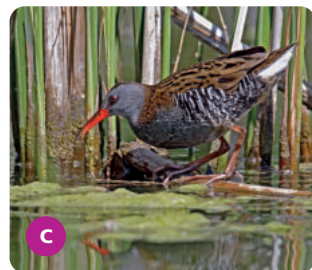
What are the names  
of these crakes?



A



B



C

Photo Ivan Dudáček

## The meadows of Šumava

Eurasian  
harvest mouse  
Photo Hlásek.com

21

WHICH RODENTS  
DWELL IN ŠUMAVA'S  
MEADOWS?

## Life on the meadow

Šumava and its foothills is home to 67 species of mammals. Although mammal communities in meadows and pastures are rather poor, the diversity increases when at least where water flows. Of small mammals, dry meadow communities are characterised by a predominance of the insectivore common shrew (*Sorex araneus*) or rodent field vole (*Microtus agrestis*). Overgrown wetlands, wetland meadows and spring areas are preferred by the Miller's water shrew (*Neomys anomalus*). The well-known European mole (*Talpa europea*) is another species common to these habitats. Mown meadows as well as pastures are the usual refuge for

the common vole (*Microtus arvalis*). Very modest and adaptable rodents include the European pine vole (*Microtus subterraneus*). The Eurasian harvest mouse (*Micromys minutus*) occurs most frequently in the agricultural landscape of Šumava's foothills. The northern birch mouse (*Sicista betulina*) is often encountered on damp meadows and peat bogs or along minor streams. Rugged countryside with piles of stones, dry stone walling and ruins of buildings is sought out by the garden dormouse (*Eliomys quercimus*). Mammals ranging up to the highest altitudes of Šumava include the European hare (*Lepus europaeus*).

Can you recognise this  
country's dormice?

Photo Hlásek.com



## The meadows of Šumava



22

WHAT IS THE MOST COMMON BAT IN ŠUMAVA'S FORESTLESS HABITATS?

### Other creatures found locally

Wild boar  
Photo Vladislav Vogeltanz

Meadows and pastures are sites where disturbed meadow turf may be seen, a sign of a large mammal – the Central European wild boar (*Sus scrofa*). Typical omnivores, they may present a danger to the eggs of birds that nest on the ground (e.g. the black grouse). Other large mammals can be witnessed locally as well - particularly in the evening or in early morning as they graze. Examples include herbivores such as the red deer (*Cervus elaphus*), which favours forest, or the European roe deer (*Capreolus capreolus*), which is particularly abundant at lower altitudes.

Listing mammals in forestless areas would not be complete without bats. Of these, the brown big-eared bat (*Plecotus auritus*) is probably the most adaptive species and traverses farmland to mountain forests on Šumava's ridges. Bats ranging over housing include the grey big-eared bat (*Plecotus austriacus*); colonies in the summer are even created by females in the lofts of buildings. The serotine bat (*Eptesicus serotinus*) does not avoid humans either, and is found in non-forest uplands up to the altitude of 900 m.

Which of these mammals is not native to Šumava?

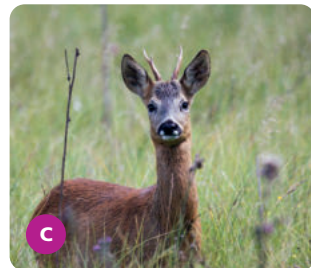


Photo Eduard Levý (A), Marek Drha (B,C)

## The meadows of Šumava



## Elk

23

HOW MUCH CAN  
AN ELK EAT EACH DAY?

The elk (*Alces alces*) is the largest animal in Šumava, although sightings are rare. Distribution here is related to an increase in its population in Poland. Migrant individuals have gradually settled all the suitable territories, which in this country concerns two areas where elks range permanently and even breed. These are the Třeboň region and the right-hand bank of the Lipno reservoir. Šumava's population is currently estimated at 15 animals. Elks weigh 500 to 600 kg and feed on young annual shoots of deciduous woody species and herbs, while in winter they consume twigs and the bark of deciduous trees and conifers. As an elk can consume up to 50 kg of food daily, it needs to range where it finds enough to eat and discover quiet spots for feeding, resting and breeding. Abandoned fore-

stless areas that are becoming overgrown through natural succession, featuring wetlands or bodies of water, form the best sites for this animal; plus minimal human activity is necessary. Elks stay in wetlands with stands of shrubs and rich wetland vegetation, particularly in summer; in winter, they move on to relatively dry forest vegetation, preferably with clearings with self-sown deciduous woody species. As Central Europe is densely populated, the elk is destined to remain a critically endangered species due to its habitation demands, without the possibility of nurturing a larger, more stable population. If it is to remain in the Czech countryside, it is necessary to ensure untouched and large sections of landscape remain free from outside economic pressures.

## Elk







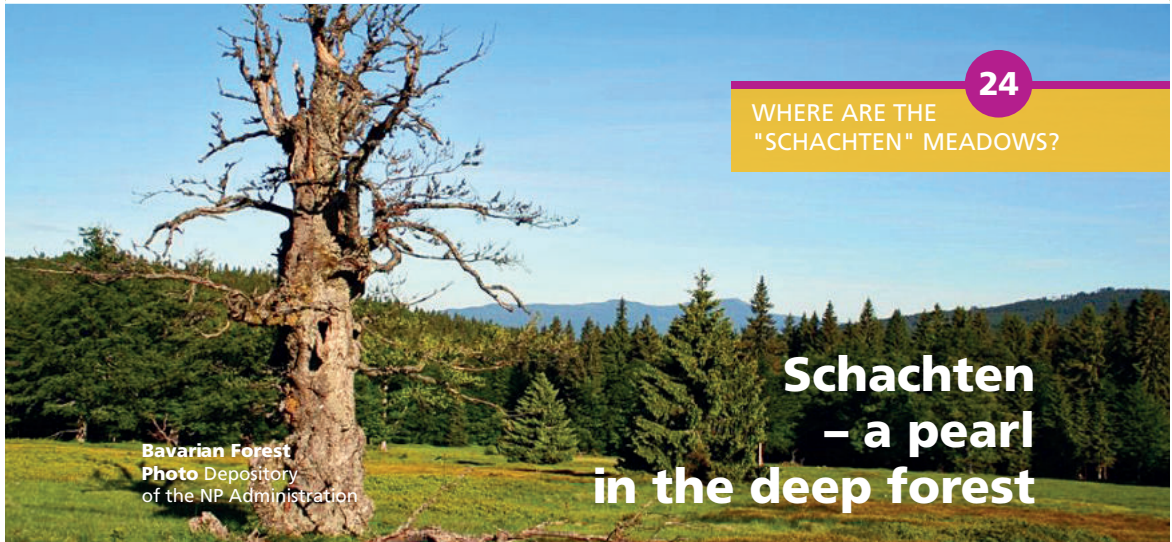
**Cultural meadows**  
Photo: Haňa Rosenkranzová



## The meadows of Šumava

24

WHERE ARE THE  
"SCHACHTEN" MEADOWS?



**Bavarian Forest**  
Photo Depository  
of the NP Administration

## Schachten – a pearl in the deep forest

The German word "schachten" refers to pastures in the wooded belt of the Bavarian Forest along the state border. Once abandoned, they are managed to some extent today. Set up in connection with forest grazing, they chiefly served as places to overnight cattle (especially oxen and young animals). They typically contained a shepherd's shelter while the animals slept in the open. In the daytime, the shepherd would herd the cattle through the surrounding woods. Such remaining spots are mostly located above 1,100 m - between the peaks of Grosser Falkenstein and Rachel. Featuring aged solitary trees (mainly beech and maple), the impression is created of a park amidst deep forest; they are highly sought-

out destinations by hikers. The oldest one to have been cleared dates from 1613 and is named "Ruckowitzschachten". Schachten thrived in the second half of the 18<sup>th</sup> century, with pastures stretching out between Grosser Falkenstein and Rachel over 218 ha (now 85 ha). By the beginning of the 19<sup>th</sup> century, the use of schachten was dwindling, as forest grazing was abandoned due to damage being caused by browsing and trampling, leading to slower natural regeneration. While some of the sites became overgrown by woody species very quickly, some were artificially reforested, triggering large protests; thus the practice was stopped.

Try to identify  
these reptiles



A



B



C

Photo Jiří Bohdal (A,C), Dana Hošková (B)

## Hungarian gentian





SWEET VERNAL GRASS  
(*ANTHOXANTHUM ODORATUM*)



HEATH GRASS  
(*DANTHONIA DECUMBENS*)



TUFTED HAIR-GRASS  
(*DESCHAMPSIA CAESPITOSA*)



COMMON BENT  
(*AGROSTIS CAPILLARIS*)



RED FESCUE  
(*FESTUCA RUBRA* AGG.)

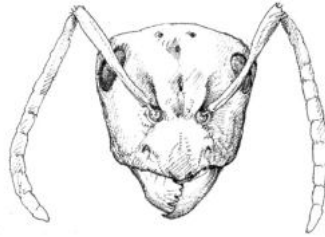


MOOR MAT-GRASS  
(*NARDUS STRICTA*)

## Different forms of head adaptation in insects



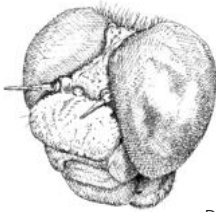
NICROPHORUS  
VESPILLOIDES



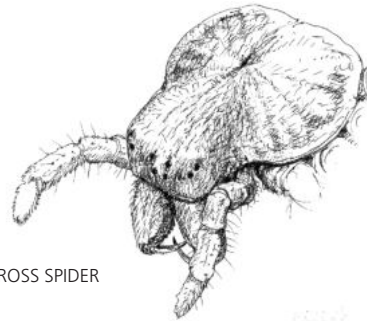
RED WOOD ANT



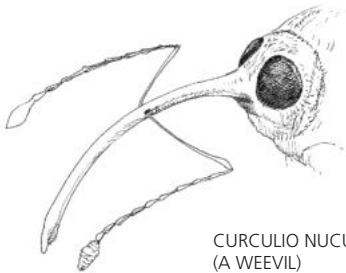
YELLOW (BUTTERFLY)



DRAGONFLY



CROSS SPIDER



CURCULIO NUCUM  
(A WEEVIL)



ISOPHYA PYRENEA  
(A KATYDID CRICKET)