# ABOUT FORESTS...

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NATURAVITA

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# Natura 2000 ecological network

## NATURA 2000 in the EU

In 2001, the European Union set an ambitious goal of halting the loss of biodiversity in Europe by 2010. The basis of this EU policy are two EU regulations. These are the Birds Directive and the Habitats Directive.

**EU Birds Directive** – adopted in 1979. It aims to protect wild birds and their most important habitats in the entire natural area of their distribution within the EU. It prohibits certain activities (keeping and/or selling native wild birds) and legally regulates other activities (hunting), in order to ensure their sustainability. Furthermore, the Directive requires the protection of more than 190 species of birds and all migratory birds with special emphasis on wetlands of international importance.

**EU Habitats Directive** – adopted in 1992. Measures are similar to those related to bird protection, but extended to another 1000 species (plants, mammals, invertebrates, etc.) and emphasises the protection of certain species of natural and semi-natural habitats, characteristic or unique in Europe (mountain meadows, underwater reefs, or old beech forests, etc.).

Together, the two directives form the basis for the conservation of valuable habitats and species throughout the EU. Thanks to these directives, it is possible to coordinate nature conservation activities regardless of political or administrative boundaries. Taking into account the interests and well-being of people, the whole process of nature conservation is scientifically based and legally established.

Across Europe, protected areas are connected to the ecological network of preserved areas, the NATURA 2000 network. The NATURA 2000 network covers about 30,000 areas in almost 20% of the EU territory. It is also the largest system of preserved areas in the world.

**The name NATURA 2000** is a simplified name for areas from both Directives (Birds Directive and Habitats Directive). The areas listed in the Habitats Directive were originally referred to as Sites of Community Importance (SCIs). The Croatian abbreviation of this directive is POVS - conservation areas important for species and habitat types. 18 habitats, 9 species of animals, and 2 species of plants are important for the EU on the territory of the Republic of Croatia.

The original name of the Birds Directive is Special Protection Areas (SPAs). The Croatian abbreviation for this directive is POP - conservation areas important for birds.



## NATURA 2000 in the Republic of Croatia

Areas and species covered by the Natura 2000 system in the Republic of Croatia were proclaimed by the Government of the Republic of Croatia by the Regulation on Ecological Network on 26 September 2013. Article 1 of this Decree reads:

”This Regulation declares the ecological network of the Republic of Croatia, prescribes the list of species and habitat types whose conservation requires the determination of the ecological network area, prescribes the criteria for determining the ecological network area, target species and habitat types for which the ecological network area is established and determines the cartographic presentation of the ecological network.“

The Regulation transposes into the legal order of the Republic of Croatia the European Union Directive on the conservation of natural habitats and of wild fauna and flora (Directive 92/43/EC) amended by Council Directive 2013/17/EU adapting certain directives in the field of environment, by reason of the accession of the Republic of Croatia (OJ L 158, 10 June 2013) and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version) (OJ L 20, 26 January 2010).

The third article of the Regulation declares the ecological network of the Republic of Croatia as the area of the Natura 2000 ecological network.

In the Republic of Croatia within the Natura 2000 area, 120 species of birds are protected through conservation areas important for birds (POP).

Through conservation areas important for species and habitat types (POVS), in addition to birds, 121 species of other animals are protected (50 species of fish, 6 species of amphibians, 2 species of shellfish, 4 species of cephalopods, 3 species of snails, 26 species of insects, 3 species of crabs, 19 species of mammals and 8 species of reptiles) and 21 species of plants (3 species of moss, 1 species of ferns, 17 species of seed-bearing plants), and 73 habitats are protected from the habitats inhabited by these plants and animals, of which 18 relate to forests.

One of the protected habitats is the flooded meadow of Cnidium silaifolium, through which partly passes the educational - recreational trail “Perunika”.

## Basic terms of forest and forestry

**The forest** is a living community of trees, shrubs, ground plants, and forest animals. It can be said that the forest is a perfect ecological factory, but also an ideal habitat for numerous living creatures. It has a beneficial effect on humans. Forests vary in terms of climate, soil type, and relief. We distinguish **karst forests** (holm oak, pines) in the Mediterranean, i.e. by the sea, **selection forests** in the mountainous part of our country (fir and beech), and **even-aged (regular) forests** in the hilly and plain part of Croatia. The most common tree species in Croatian regular (plain and mountain) forests are: common beech, pedunculate oak, sessile oak, European hornbeam, and narrow-leafed ash. In the floodplain area of our large rivers, the Sava and especially the Drava and Danube besides narrow-leafed ash, white and black poplars and various species of willows occur. Two notions of forest are connected with water and rivers. One is **floodplain forest** - a forest that develops under the influence of floodwater, and the other term is **swamp forest** that is associated with stagnant water. There is no clear boundary between the two forests. Indicators are plant species. With the withdrawal of floodwater into riverbeds, it often happens that water remains in shallow depressions (ponds), and then **swamp vegetation** occurs there.

The branch of the economy that deals with **forest management** is called **forestry**. Forest management is prescribed by the **Forest Act**. Simply said, according to this Act, the forest is considered to be land that is coherently overgrown with forest trees and/or its bush forms, bushes, and ground growth on an area of 0.1 ha (1000 m2 = 0.1 ha) and larger. (The full definition of forest is given in Article 5 of the Forest Act).

Forests are grouped into **stands** by: type of trees, age, purpose, method of origin, management goal. For easier navigation in the field and records, forests (stands) are divided into **units**. The smallest forest unit is called a **subcompartment**, and several subcompartments make up a **compartment**. A larger number of compartments, depending on the terrain and the size of the area, make up the **management unit**. All management units make up the **forest management area**. For each management unit, a f**orest management plan** is adopted, according to which it is **managed for ten years**. After ten years, the management plan is renewed and used for the next ten years.

Based on age, stands are classified into **age classes**. The trees of the first age class are the youngest, and the trees of the last age class are ripe for final cutting and rejuvenation. The **rotation period** is the time from the establishment and growing of the forest to the time when it is cut down and the new rejuvenation cycle is started. The rotation period for pedunculate oak and holm oak is 140 years, while it is shortest for poplars and willows i.e. 40 years. The law stipulates that after cutting the forest must be **reforested (replanted)**. This can be done artificially by **planting seedlings** - poplar, willow, black locust after clearcutting or by imitating nature through the gradual cutting of trees i.e. **shelterwood cutting** which is how we reforest pedunculate oak, sessile oak, and beech forests.

For young newly planted or reforested forest, we say that it is in the **first age class**. This forest in the first age class is characterized by **a large number of individuals per unit area**. If for some reason there is not a sufficient number of young plants, the so-called **filling with seeds or seedlings** is carried out on parts of the surface where young plants are missing. Every naturally rejuvenated forest initially looks like a thicket. In order to select the best individuals that will be the best quality trees in the future (at the end of the rotation period, when the forest is ripe for cutting), it is necessary to help nature. This is done by implementing the so-called **silvicultural works - forest tending**. For the growth of a young plant i.e. seedling, besides **water** that is the source of life and necessary for the life of all living organisms, the plant needs a sufficient amount of **light** to be able to live. At the beginning of the growth, young plants that are the stage of the so-called **seedling stage** and **young growth stage** are weaker, and the so-called **competitive species** (various herbaceous plants and low shrubs) grow faster than young plants - seedlings. By **tending - reducing** undesirable (competitive) species, we bring light to young plants and therefore encourage them to grow faster. We carry out the tending of young forests as needed, i.e. when it is assessed in the field that undesirable species have begun to endanger young plants. In addition to the reduction of undesirable species, forest tending also eliminates trees and young plants and dry trees of the so-called main species, which are seen to be of poor quality and not worth cultivating. This work is done in the so-called **thicket phase and pole stand phase**. As the forest gets older, saplings and later the young trees become taller and thicker, and the forest gradually turns into the so-called **thinnings**. This silvicultural work is the longest phase of forest tending and lasts until the beginning of shelterwood cuttings. Thinnings are performed with certain **intensities and methodology** and are repeated in time intervals (**thinning cycles**). Thinning removes trees that threaten selected trees, and trees that are redundant in the structure of the stand, diseased, irregular, broken, dry trees, but not all. Trees that have holes for birds and other small animals and trees on which are the nests of rare birds are not removed. This contributes to **for-**

**est biodiversity** and achieves **sustainable management**. Thinning further achieves the so-called **intermediate income**. This is the income in money, which is obtained by selling cut wood from thinning, (mostly firewood). The intermediate income is realized as a rule once in every ten years of the forest life. By **shelterwood cutting**, we reach the **final income**, which is called the main income, and it is the crown of forest silvicultural work and the final goal. We manage the forest sustainably on **environmentally acceptable** principles and at the same time, we realize the **material benefit**, i.e. we compensate the spent funds for forest tending. Under the crown of the old forest, young plants i.e. **young growth** sprout from the seeds again. The old forest is ready for felling (the rotation period is over), it gives way to the young forest and the cycle of forest growth and development begins again. This type of management is **sustainable**, or as we foresters call it, **sustainable management**. It is characteristic of this method of management that **a certain forest area is never bare, without vegetation**, rather the vegetation is always at a certain stage of development.

Foresters in Croatia have been sustainably managing forests for 250 years. We inherited the forests from our grandfathers, and we will bequeath them to our grandchildren.

Oak forest in the stage of shelterwood cutting (📷 Dalibor Tonc)

The last stage of development, (final cut) Darko Posarić, graduate of Engineering in Forestry, described in his booklet "So that the oak could grow" in which he writes in verses about the development and tending of the oak forest:

"When the young start to grow,
It is time for the old to go!
Lots of sun, clear blue skies:
It's where saplings' future lies.
Older trees give a shade of crown,
So, it's time to cut them down."

„Da bi hrast mogao rast"

## Principles that govern the area of floodplain forest

We can say that the forest is a living community. It lives as members of that living community live, both animals and plants. They, in turn, behave according to the environment around them. Depending on if the ground is rocky or sandy, is there a stream or sea nearby, or is it a lowland or a hill or a mountain. In this regard, it depends on what is the climate like, whether it is Mediterranean or continental or mountainous, and what is the precipitation schedule during the year, how many are rainy, and how many are sunny days. In addition to all these factors (biotic and abiotic) that affect forest life, there is a great and crucial influence of man and his awareness of sustainable forest management and the natural resources associated with it. It can be said that ultimately the forest reacts to man's relationship to it. It endures irresponsible behaviour until its disappearance, and then the consequences of the disappearance of the forest occur, which are reflected on changes of those factors that the forest regulates. The bill for irresponsible behaviour is paid by humans.

Scientists have been researching for years how much impact the forest has on the environment and what are the benefits of the forest. The impact of the forest and the benefits to the environment are called the general beneficial functions of the forest. This does not refer to the benefits of wood production and forest by-products (mushrooms, leaf litter, grazing, forest fruits, medicinal plants…) but the benefits of forests related to major habitat factors. All forests have their own general functions. Some of these functions are more pronounced depending on the spatial position, altitude, exposure to human influence, etc.

Floodplain forests in the Republic of Croatia are located in the valleys of the Sava, Drava, and the Danube, and their tributaries in areas regularly exposed to floods. Depending on the wetting regime over the centuries, different forest ecosystems have emerged that alternate as a mosaic with wetlands and meadows. Floodplain forests are specific in that respect and extremely valuable and their general value exceeds other forests.

Drava estuary (left) to Danube (right) - drone shot, Boris Ljubojević

Principles that govern the area of floodplain forests are associated with beneficial functions (roles) i.e. the well-being of the forest and are divided into three groups.

## GROUP - *ecological functions (roles) of the forest*

- Hydrological role - retention space. This role in the project area is reflected in the fact that the area of the Kopački rit Nature Park makes a specific landscape when the high floodplain waters of the Danube and the Drava spill over the area and in that way prevent i.e. reduce the risk of floods in the downstream part of the river flow.
- Water protection role - filtered and purified floodplain water enters underground streams from a much larger area of the marsh, so chemical contaminants remain on a larger area and in a lower concentration. Monitoring the chemical status of the surface waters of Kopački rit is one of the activities included in the Naturavita project.
- Anti-erosion role - the forest in the lowland floodplain area slows down the flow rate of floodwater and thus the erosion (removal) of the soil. This role of the forest in the project area is manifested in the formation of new islands and deposits of sand and mud which are the basis for the development and growth of willow carrs.
- Climatic role - mitigation of climatic extremes of the highest and lowest soil and air temperatures. Furthermore, the species of trees that grow in floodplain forests belong to the group of hygrophytes. These types of trees (willow, poplar) transpire (release) more moisture into the air and thus the air humidity in the floodplain forest is higher.
- Anti-immission role - purification of polluted air - which depends on the location of the source of pollution, wind direction, and position of the forest and settlement - the consequence of pollution is the drying of forests.

## GROUP - *societal or social functions (roles) of the forest*

- Aesthetic role - the beauty of forests along watercourses, alternating of parts overgrown with trees and swampy vegetation, specific appearance in times of high water levels, the colour palette in autumn is just proof that every landscape has its beauties.
- Health role - manifested in the calming anti-stress effect of the impression of untouched nature, the effect of greenery, physical - walking on the ground, not on concrete, breathing fresh air.
- Recreational role - excursions, various sports, walking, running, cycling, sport fishing, rowing boats.
- Tourist role – it is related to the previous three roles and in a way unites them (ecological - biological diversity of flora and fauna, hunting, and rural tourism).

## GROUP - *socio-ecophysiological functions (role) of the forest*

- Genetic role - preservation of the genetic fund of wild species of trees and shrubs and ground growth of floodplain forests - preservation of the genetic fund of European black poplars and natural forests - EUFORGEN.
- Biodiversity role - floodplain forest is home to various organisms, both plants, and animals, as well as microorganisms. The better preserved it is (the less adverse human influence), the greater the number of different organisms in it.
- Nature protection function (role) of the forest - refers to the origin of floodplain forests. They are of natural composition and are restored naturally, which contributes to the preservation of the original natural floodplain forests. They are managed according to the principle of sustainability (sustainable development).
- Physiological role (carbon sinks) - The process of photosynthesis in the leaves binds carbon from carbon dioxide from the atmosphere and releases oxygen into the atmosphere. This bound carbon is incorporated into the plant and the humus (formed by the decomposition of plants). Carbon binding reduces and mitigates the “atmosphere greenhouse” effect, which has now been proven to cause global warming, i.e. the change of the Earth’s climate. Simply put, the more forests and greenery we have, the cleaner the oxygen-enriched air will be, and the carbon that is the main cause of the greenhouse effect will be bound in plants and soil.

# The main representatives of the plant world

The plant world of the forest is divided into altitude layers, a layer of ground growth, a layer of shrubs, and a layer of trees. Plants, layers of ground growth (usually herbaceous) are characteristic for certain plant communities i.e. forests. There are a large number of them, so they are not described here. The same goes for shrubs (a layer of shrubs) that are in smaller numbers but would also increase the scope of this brochure. We refer the curious reader to the professional literature. The tree species shown here are described by their main characteristics of habitus (external appearance), bark, leaf, and some specifics (fruit) that characterize them. Dendrology (the science of knowing woody plant species) for each species describes all the other characteristics (buds, shoots, flower, etc.) Who wants to know more should look for additional information in the professional literature.

## Basic tree species in Croatia

**EUROPEAN BEECH** ***(Fagus sylvatica* L.)** is a deciduous tree that usually grows up to 40 m in height, although specimens up to 48 m are known. The breast height diameter of such a behemoth (giant) can be up to 2 m. Its bark is ashy and thin and smooth in old trees. In winter, the characteristic, pointed buds of this species are highlighted. In summer it is adorned with light green, up to 12 cm long, and 8 cm wide delicate leaves. The fruit is called a beechnut. Beech grows from lowland to foothill areas of our country. It can rarely be found in the floodplain area, so it is not present in the project area. However, there is one beech forest approximately 140 years old outside the project area, in the forest area Haljevo 27b near Beli Manastir. The form of purple leaves can be found in parks. Beech wood is used in the furniture industry and for firewood.

**European beech**

Zdenko Turniški



**SILVER FIR** ***(Abies alba Mill.* L.)** is an evergreen tree up to 60 m high, sometimes has breast height diameter of over 2 m. In young trees the bark is greyish and smooth, and in old trees, it darkens and cracks longitudinally and transversely. The leaves are up to 30 mm long and needles are up to 3 mm wide, have blunt or incised tip, comb-shaped arranged on the shoot. Three-edged seeds grow on a sitting cone, so when they fall off, only the rachis remains of the cone. Fir grows on deep soils in hilly and mountainous areas. There are no Silver firs in the Naturavita project area. Tolerates shadow. It is one of our most commercially important species. Fir Emperor (Car) in Kosinj is the tallest in Croatia and the largest tree on Velebit! It is 47 m high and has 1.88 m in diameter. In the Forest Park Golubinjak, there is a giant fir Queen of the Forest (Kraljica šume), over 250 years old, 37 m high, and 140 cm in diameter.

**Silver fir**
(left is the back and right is the front of twig with needles)

Zdenko Turniški

**COMMON SPRUCE** ***(Picea abies* (L.)H.Karst)** is an evergreen tree up to 50 m high with a breast height diameter of up to 1 m. Its trunk is usually straight and without a drop in diameter (like a pipe). The root of this species is disc-shaped and shallow, so often after a strong wind in the forest, you can find a few fallen trees. The bark of the spruce is thin and grey-green in youth and cracked in the form of round brownish-red scales in old age. The leaves are pointed at the apex, up to 25 mm long and 1 mm wide needles, spirally arranged on the shoot.

The seeds are ovoid and fall out of the cones which then fall off the branch. Spruce cones hang, while on a fir tree they sit on a twig, so because of that fir and spruce can be distinguished even from a distance. Spruce grows on loose soils in the mountainous part of our country. It does not grow naturally in the Naturavita project area. There are over 100 cultivars and forms used in horticulture. It is a valued type of wood in industry and construction. A special resonance spruce wood is used to build musical instruments. In the continental part of our country, we usually decorate spruce for Christmas.

Common spruce

Zdenko Turniški

**EUROPEAN BLACK PINE** ***(Pinus nigra,* J.F. Arnold*)*** is a coniferous tree, most often 30 m and sometimes up to 40 m high from a large family of pines (here also belong fir, spruce, larch…). The bark of the trunk is light grey to dark grey-brown in youth, and in old age, it cracks into elongated irregular plates of grey tones, up to 10 cm thick. On the shoots (twigs) there are two dark green, rigid, 8 - 15 cm long and 1.5 - 2 mm thick needles in a 1 cm long sleeve. Cones sit on twigs and are usually 4 - 8 cm long and 2 - 4 cm in diameter. This type of pine occurs naturally up to 1400 m above sea level and in southern Europe. In Croatia, it is found along the Dinarides, and in the coastal part and on the central Dalmatian islands, and on the Pelješac peninsula can be found its subspecies ssp. dalmatica (Dalmatian black pine), which is an endemic and strictly protected species. Since it is very decorative and has low habitat requirements, we find it as an ornamental species in parks and backyards in the continental part of our country. It does not exist in the Naturavita project area. Pine wood is durable, but difficult to process because it contains a lot of resin.

European black pine

Zdenko Turniški

**SESSILE OAK** ***(Quercus petraea* (Matt.) Liebl.)** is a deciduous tree from the oak family usually up to 35 m high, with a breast height diameter of up to 1 m. The bark of old trees is greyish, cracked and up to 2 cm thick. Oak leaves are characteristic and differ in size and shape of the groove. The sessile oak leaf is up to 12 cm long and up to 7 cm wide, on 12-30 mm long stalks. The fruit of the oak is an acorn. The acorn is partially covered by a dome (cap). The characteristic of this species is that acorns sit or are on a very short stalk. The sessile oak grows naturally in the mountainous and hilly part of our homeland. It does not exist in the Naturavita project area. Sessile oak wood is used in the wood industry but is not as prized as pedunculate oak wood.

Sessile oak

Zdenko Turniški

**EUROPEAN HORNBEAM** ***(Carpinus betulus* L.)** is a deciduous tree, up to 25 m high, with a trunk diameter of usually up to 70 cm. In older trees at the edges of forests, the diameter can be even larger. For the trunk of this species, it is characteristic that it is sometimes very twisted and often grooved in the lower part of the stem base. The bark is thin, smooth, light grey, and cracked only in very old trees. Its leaves are usually 5-10 cm long and 2-5 cm wide, with pronounced veins. In autumn they get a golden yellow colour. The fruit of the hornbeam is a 5 - 10 mm long nut. The fruits hang in elongated fruiting groups. Since this species does not tolerate floodplain water and high groundwater levels, in the Naturavita project sites it grows in the peripheral area on the highest terrains that have never been exposed to floods and we find it very rarely.

**European hornbeam**

Zdenko Turniški

**LIME** ***(Tilia spp.)*** Limes are deciduous tree species, usually about 25 m high, and up to 1.5 m in diameter in old specimens (Gubec lime tree). In our homeland, there are three species of lime. The lime trunk is usually straight and has a small drop in diameter. In youth, the bark is smooth and greenish-brown, and in old trees, 2 - 3 cm thick, longitudinally deeply cracked, and depending on the species blackish-grey (small-leaved lime), grey-reddish (large-leaved lime), and dark grey (silver lime). The root system of all three species of lime is well developed and penetrates deep into the soil. The most significant feature that distinguishes these three types of lime is the shape, size, and colour of the leaves. It is characteristic of lime leaves that they are equally long and wide. We distinguish small-leaved lime whose leaves are 4 - 7 cm, large-leaved and silver lime whose leaves are over 8 cm, but silver lime has a silvery-grey back of the lamina (hence its name). The lime flowers are in ball-shaped inflorescences that are attached to the stipule by a stalk. The lime flower smells pleasant, so it is no wonder that one of the months is named after the time of lime flowering (June - lipanj). Flowering occurs throughout the month of June. First, the large-leaved lime (early) blooms, then the small-leaved (late) 14 days later, and only at the end of June and the beginning of July the silver lime. All three species of lime are related in their prevalence to the hornbeam, so they can rarely be seen in the area of the Naturavita project. Lime is a sacred tree of the ancient Slavs. It experiences old age. (Gubec lime tree is about 450 years old).

**Lime**

Zdenko Turniški

# Tree species in the project area

## Domestic tree species

**PEDUNCULATE OAK** ***(Quercus robur* L.)** is our most prized deciduous tree from the oak family. It grows to a height of up to 40 and sometimes 50 m. The breast height diameter reaches up to 2.5 m. The bark on the trunk is smooth in youth, and later, in older trees, it cracks up to 10 cm thick longitudinally. The branched root is characterized by a vein that goes to a depth of several meters. The leaves are up to 20 cm long and up to 10 cm wide, on 2 - 10 mm long stalks. The acorn is up to 5 cm long and 2.7 cm wide, light brown or yellowish with longitudinal stripes. The dome (cap) covers it from 1/2 to 1/3 of its length. It hangs on a stalk usually up to 3 cm long. The pedunculate oak grows naturally in the lowlands and on slightly hilly terrain. Requires deep and moist soil. This type of oak occurs sporadically in the Naturavita project area on elevated terrains (beams). The famous Slavonian oak is valued in the world in the wood industry. In the Prašnik forest near Okučani, there are 2,000 oak trees over 300 years old.

**Pedunculate oak**

Zdenko Turniški

**NARROW-LEAFED ASH** ***(Fraxinus angustifolia* Vahl)** is a deciduous tree that most often grows up to 25 m in height and reaches about 1 m in breast height diameter. Its bark is grey, smooth, and thin in youth, and with age, it thickens and cracks longitudinally. The leaves are alternately pinnate, composed of up to 7 pairs of leaflets up to 10 cm long and up to 3 cm wide. The seed is protected in an elongated oval shell called a samara. This species naturally grows as a species of the Slavonian pedunculate forest. Withstands flooding and high floodplain waters. More recently, it has been attacked by the pathogenic fungus Chalara fraxinea, which causes ash to dry out. If it is found in the same area as the introduced American ash, the narrow-leafed ash will be suppressed and disappear very quickly. One of the reasons for implementing the Naturavita project is precisely to limit the negative impact of non-native ash species on our native species. In the project area, it grows naturally, but it is also artificially introduced by afforestation. Ash wood is of high quality and expensive (especially veneer logs).

Narrow-leafed ash

Zdenko Turniški

**WHITE POPLAR** *(Populus alba* **L.)** is a deciduous tree up to 40 m high with a breast height diameter of up to 2 m. The bark of young trees is smooth and greyish-white along the entire length of the trunk and branches. Later when the tree is older in the lower part of the trunk the bark roughly cracks and becomes dark brown. This is a species that grows on moist deep soils along our large lowland rivers and the root is well developed. When the tree is young the leaves are thin and covered with hairs on the front and back. In older trees, the leaves are leathery, dark green, and smooth on the upper side, and white on the lower side. The fruit of the poplar is a capsule in which there are round seeds up to 2 mm in diameter, wrapped in silky threads that we call pappus. Pappus serves to spread the seeds more easily (by the wind), as this species conquers new terrains. We say that poplar belongs to the pioneer species because it is very adaptable to the quality of the soil. It is important to point out that this species is dioecious, which means that there are separate trees with male flowers and separate trees with female flowers. Its environmental benefit is more important than the commercial benefits of this species.

White poplar

*(left, back of the leaf)*

Zdenko Turniški



**EUROPEAN BLACK POPLAR** *(Populus nigra* **L.)** is a deciduous tree up to 35 m high and with a breast height diameter of 200 to 300 cm. The bark of younger trees is smooth, but in older ones, it is deeply longitudinally cracked and up to 5 cm thick. As with the white poplar, the root is well developed and strong because this species is also found along our large rivers. The leaves are approximately rhomboid in shape, usually 5–7 cm long and 3–6 cm wide, on 3–5 cm long petioles. The fruit is a capsule filled with tiny seeds that are wrapped in silky white pappus. This species is dioecious, which means that they are separate plants with male and separate plants with female flowers. This poplar as well as white poplar is characterized by growing on elevated terrains that are not exposed to constant floodplain water. The most famous variety of black poplar is the Lombardy poplar, whose branches are directed upwards and form a narrow columnar crown. The crossing of European black poplar with North American black poplars resulted in poplar cultivars that we call Euro-American or Canadian poplars.

European black poplar

Zdenko Turniški

**WHITE WILLOW** *(Salix alba* **L.)** is a deciduous tree up to 30 m high, breast height diameter up to 1.5 m, often with a crooked and irregularly developed trunk. The bark of the trunk in youth is smooth reddish-grey or greenish, and later in old age, it becomes grey-brown and deeply obliquely cracked. The green smooth shoots (twigs) alternately have leaves up to 10 cm long and 1.5 cm wide. In early spring, before leafing, willow twigs are adorned with bushy greyish-white female flowers (catkins), which often end up as a decoration in vases. The fruit of the willow is a capsule containing numerous small, up to 1.5 mm long seeds, wrapped in silky pappus. Willows are dioecious pioneer species that can live to be up to 100 years old. Significant for their spread is the method of propagation, which can be vegetative (cuttings, from roots, layering), which is most often used in forestry, and generative (by seed) as carrs are formed. As the terrain in the Naturavita project area is connected with the floodplain and groundwater regime, great importance for the expansion and survival of forest communities have willows that are the main so-called pioneer species. White willow is one of several species of willow that can be found in this area and it forms coherently overgrown stands (forests).

White willow

Zdenko Turniški

**FIELD MAPLE** ***(Acer campestre* L.)** is a deciduous tree up to 20 m high, usually up to 60 cm in diameter. Its trunk is sometimes as distinctly twisted wire. The bark is grey and finely meshly cracked, thin, up to 1 cm thick. The root is well developed and penetrates deep into the soil. The leaves of the field maple are usually 4 - 7 cm long on a reddish stalk up to 10 cm long. The fruit is a samara consisting of two winged fused seeds that separate when ripe. Seeds carried by the wind in a spiral fall to the ground (anemochory - the spread of plant seeds by the wind). This species is related to narrow-leafed ash and pedunculate oak, so it can be found as an accompanying species on elevated terrains in the Naturavita project area.

Field maple

Zdenko Turniški

**FIELD ELM** ***(Ulmus minor* Mill. L. syn. *Ulmus campestris* L.)** is a deciduous tree up to 40 m high, with a flat trunk covered with up to 3 cm thick, deeply longitudinally cracked bark. Its root is well developed. The leaves have an asymmetrical base and are usually 5-10 cm long on a 6-15 mm long stalk. The veins are pronounced on the lamina where 8-12 lateral veins separate from the central vessel. The elm fruit is a winged single-seeded nut that is located eccentrically in a wing up to 2.5 cm long and up to 2 cm wide. This species grows together with field narrow-leafed ash, field maple, and European white elm on alluvial soils such as in the Naturavita project area. In the past, there were more of them, but with the appearance of the so-called "Dutch elm disease" caused by the fungus Ophistoma ulmi (Buism.) drying of this species occurred. Elm is now found in separate groups or as an individual tree. Elm wood is just behind oak in quality, so it was appreciated while it was in abundance. Attempts are now being made to keep specimens of this species alive and to exclude them from regular management. (Unfortunately, the famous Old Elm (Stari brijest) in the area of the Kopački rit Nature Park dried up a few years ago).

Field elm

Zdenko Turniški

**EUROPEAN WHITE ELM** ***(Ulmus laevis* Pall.)** is a deciduous tree usually about 20 m high but in favourable habitat conditions it can grow up to 30 m in height, and up to 1.5 m in diameter. The trunk is usually straight but can be twisted. The bark is brownish dark, about 2 cm thick, and is suitable for bounding (name - Vez). Peels in thin long strips. The elm leaves have a distinctly asymmetrical base. The leaf is usually 5 - 15 cm long and 3 - 9 cm wide. Has pronounced veins. The fruit is a hanging winged nut on a 3-4 cm long stalk. The samara is ovoid round and 1 - 1.4 cm long. This species grows on alluvial soils such as in the Naturavita project area. In the admixture of the main species, it is found on moist, periodically flooded terrains.

**European white elm**

Zdenko Turniški

**WHITE MULBERRY** ***(Morus alba* L.)** is a deciduous tree up to 20 m high, round crowns in youth are yellowish-grey, and later grey-brown with deeply cracked bark. The leaves are arranged alternately on the shoot. They are ovoid and usually 6-14 cm long and 4-10 cm wide. They are usually simple, and sometimes with 2-3 incompletely expressed sepals. The lamina is light green on the upper side and greenish-grey on the lower side. After fertilization, the female flower turns into a complex edible fruit called mulberry. This species of tree originates from central and east Asia (China, Japan) and was brought to Europe in the XII. century for the production of silk. Namely, the larva of the mulberry silkworm feeds on the leaves of the white mulberry. As mulberries are very sweet fruits, they are food for birds, which then spread them. This species was initially found in tree-lined avenues and hedges around houses, and birds also spread it in forests. Mulberries are food for a variety of large and small games. In the Naturavita project area, this species is widespread in white willow and European black poplar forests as a larger shrub or lower tree.

**White mulberry**

Zdenko Turniški

## NON-NATIVE DOMESTICATED TREE SPECIES

**EUROAMERICAN POPLAR** – by this name we refer to all clones created by the crossing of American black poplar and European black poplar. Poplar hybrids are characterized by quality wood, large growth, and easy propagation. American black poplar trees are more regular than European black poplars, they have larger and bigger leaves. As a result of crossing these two species, Euro-American hybrids (P. × canadensis Moench.) were formed, which have better technical properties than their parents. They are most often propagated by cuttings. Individuals and offspring together form a cultivar (variety), and a cultivar obtained by targeted breeding (vegetative propagation) is called a clone.

**Euroamerican poplar**

Zdenko Turniški

**BLACK LOCUST** ***(Robinia pseudoacacia* L.)** is a deciduous tree species that usually reaches a height of 30 m and about 50 cm in breast height diameter. It was introduced to Europe from North America in the 17th century, and at the end of the 19th century in Croatia. The bark of young trees is smooth and brown, and with age, it becomes deeply longitudinally furrowed. Black locust has a shallow root, so it is prone to windthrows. The leaves are 15 - 30 cm long and composed of an odd number (9 - 25) of ovate leaflets. It is characteristic for this species that it blooms in May, 10-14 days before leafing. The flowers are fragrant, in 15 - 20 cm long white hanging clusters. Black locust is a prized honey plant. The fruit of the black locust is a hanging pod in which there are 5 - 10 small kidney seeds. As a pioneer species (a species suitable for afforestation in new unforested terrain), it is characterized by high burst power, and once planted on some soil, it is difficult to control and can become invasive. In the Naturavita project area, it is found in separate black locust stands, and as individual trees on dry terrain.

Black locust

Zdenko Turniški

**BLACK WALNUT** ***(Juglans nigra* L.)** is most often about 30 m high tree with a breast height diameter of about 2 (3) m. Its trunk is high and straight. The bark is smooth in youth, greyish-green to greyish brown. In old trees, it is deeply longitudinally furrowed and dark brown to greyish-black in colour, about 2 cm thick. The leaves are 30 - 60 cm long and oddly pinnately composed of 11 - 23 laminas, usually 6 - 12 cm long and 2 - 5 cm wide. Often the apical lamina is missing. The leaves are distinctly yellow in autumn. The fruit is a walnut of 3.5 - 6 cm in diameter, one or two on a common stem. It is wrapped in a fleshy part that does not crack. In autumn, the fruits turn black and fall off. Walnuts are hard. The core is edible. Black walnut lives about 150 years. It grows best on deep rich fresh soils along river valleys. Its wood is of high quality and appreciated especially in the production of veneer. In the Naturavita project area, there are several separate stands (crops) of good quality.

Black walnut

Zdenko Turniški



## NON-NATIVE INVASIVE SPECIES OF TREES AND SHRUBS

**BOXELDER MAPLE** ***(Acer negundo* L.)** is a deciduous tree that grows on quality soils up to 25 m high with a breast height diameter of about 40 cm. On poorer, soils with fewer nutrients, it grows like a tall bush. Its crown is wide and branched, and the trunk is relatively short. The trunk is covered with a thin brown-green bark that is smooth in its youth. In older trees, the bark becomes longitudinally cracked and grey. The leaves are composed of 3 - 7 ovate laminas. The length of the leaves is usually 8 - 12 cm and the width 2 - 4 cm. This is a dioecious plant which means that it has separate individuals that bear male flowers, and separate individuals that bear female flowers. The fruit is a nut that hangs on a stalk in pairs, winged by samaras joined at an acute angle. When they mature, they fall off and spread by the wind. Boxelder maple reproduces quickly and easily and suppresses indigenous vegetation. Habitat requirements are minimal, but it reaches its greatest dimensions on deep, moist soils. It grows abundantly in the Naturavita project area and preventing its spread is one of the reasons for launching the project.

Boxelder maple

Zdenko Turniški

**CHINESE SUMACH** ***(Ailanthus altissima* Mill. Swingle),** (Tree of heaven, nutgall tree) is a fast-growing deciduous tree native to China, up to 35 m tall and up to 50 cm in diameter. In young trees, the bark is light grey and smooth and later it becomes slightly brownish, longitudinally furrowed with white shallow stripes. The leaves are alternately arranged on a shoot. They are up to 80 cm long, composed of an odd number up to 39 laminas up to 12 cm long and 4 cm wide. The laminas are on a short stalk. The shape of the leaf is characterized by a pointed tip and two blunt teeth at the base of the leaf with an otherwise straight edge. This type of tree is dioecious, so we distinguish male and female individuals. The fruits are double-winged nuts with a single seed. Maximum adaptability to the conditions of the environment in which it grows makes it a species

that is widespread on all continents except Antarctica. It was introduced to Europe as an ornamental plant in 1740. In Croatia, due to its rapid growth and branched root system, in the 60s and 70s of the last century, it was planted in some places as a species that repairs landslides. With its aggressiveness, it gradually disrupts the stability of the ecosystem and inflicts repairable damage for now. Control of Chinese sumach is very demanding and a combination of mechanical and chemical methods is required for success. As the use of chemical methods is prohibited in the Naturavita project area, long and expensive mechanical methods of cutting and clearing remain.

**Chinese sumach**

Zdenko Turniški

**WHITE ASH** ***(Fraxinus americana* L.)** and **GREEN ASH** ***(Fraxinus pennsylvanica* Marshall)** are deciduous trees from the olive family (Oleaceae), genus ash. They were introduced to Croatia in the 19th century as ornamental species, and for afforestation of lowland habitats. Due to similar morphological characteristics, these two species are generally known in Croatian forestry practice under the common name "American ash". Today, the "American ash" is one of the most widespread exotics of our lowland forests, especially in the area along the Danube and Drava, where as a pioneer species inhabits river islands and marshes. Although no "inventory" has ever been made of how many "American ash" species there are in our area, according to the habitat requirements and terrains where these ash species thrive, it can be concluded that green ash dominates. Namely, it grows on wet habitats whose stability is disturbed, and such habitats are mainly in this area. **Green ash** is a deciduous tree that grows in our habitat conditions up to 20 m in height and with a breast height diameter of up to 50 cm. In young trees, the bark is smooth, ashy-grey, while in older trees it is dark grey or grey-brown, multilaterally cracked and corky. It is characteristic that its bark is reddish on the inside. It develops a shallow root system. The leaves are up to 30 cm long, with 5 - 7 (sometimes 9) laminas. The laminas are 8 - 17 cm long, 2 - 8 cm wide, pointed or wedge-shaped base, pointed tip on short, 0 - 8 (–12) mm long, usually hairy petioles. Green ash is a dioecious plant. The fruit is a 2.2 - 6 cm long, 0.3 - 1.0 cm wide samara, yellowish or light brown. The wings have a rounded, pointed, or slightly incised tip.



The seed is spindle-shaped, up to 2.8 cm long and up to 0.25 cm in diameter. It usually grows in low floodplains near rivers and other bodies of water, often with roots in the water, so we say it tolerates swamping.

**Green ash (American)**

Zdenko Turniški

**FALSE INDIGO** ***(Baptisia, Indigobush) (Amorpha fruticosa* L.)** is a deciduous shrub usually 2-3 m high. There is no stem, and the shrubby shoots are mostly 2-3 cm in diameter. The leaves are up to 20 cm long and consist of 11 - 25 ovate or elliptical laminas 1.5 - 4 cm long. They resemble black locusts, hence the similar name (bagremac). It blooms in the summer. The inflorescence is 10 - 15 cm long and has up to 300 purple flowers. This plant is native to North America and was brought to Europe in the early 18th century as an ornamental plant, but also to stabilize railway embankments. Due to its easy adaptability to habitat conditions and way of spreading, this plant quickly became invasive. Since it tolerates shade and grows in groups on the floor of shrubs in oak forests, it obscures the light of oak seedlings and young growth, thus making it difficult to rejuvenate oak stands. In the same way, it has an adverse effect on other plants from the ground floor and thus reduces biodiversity. This plant is extremely honey-bearing, so it is a favourite of beekeepers.

**False indigo (Indigobush)**

Zdenko Turniški

# Representatives of the animal world

Since the area covered by the Naturavita project also includes the Kopački rit Special Zoological Reserve, the fauna of other parts covered by the Naturavita project area is similar with the exception of wetland birds. Of course, there are more of them in the area of the Kopački rit Nature Park. The area covered by the Naturavita project is rich in wildlife from the classes of phytoplankton and zooplankton through the most numerous class of insects to the subphylum of vertebrates with their classes (fish, amphibians, reptiles, birds, and mammals).

The presence of 895 species of insects from 8 orders was recorded in this area. The most numerous species are butterflies (Lepidoptera), beetles (Coleoptera), diptera (Diptera), and hymenoptera (Hymenoptera) and they make up 86% of the entomofauna of Kopački rit. For the wetland habitat as the species that is most noticed, especially in the summer months, diptera are a significant group (Diptera) with its family mosquitoes (Culicidae). For humans, because in addition to being molestants, this group is also important as a vector of disease (malaria, dengue fever, yellow fever, and various types of encephalitis). Of the 50 species of mosquitoes in Croatia and of 32 species recorded in Slavonia and Baranja, 20 species are found in Kopački rit. Wetland conditions in Kopački rit as well as in the rest of the wetland included in the Naturavita project favour the development of large populations of floodwater mosquitoes.

## MOSQUITO (Culicidae)

According to data diligently collected by students and scientists from the Department of Biology at the Josip Juraj Strossmayer University of Osijek in one of the research, out of almost 210,000 individuals counted, there were twenty species of mosquitoes. Such diversity and abundance of species were made possible by specific habitat conditions along the Drava and Danube, and of course Kopački rit, where there is an abundance of these molestants. However, no matter how "bloodthirsty" and unnecessary these tiny gentle insects are to us humans, they are necessary for the biological ecological balance of the swamp and water-dependent ecosystems. They (eggs, larvae, and pupae) are a source of food for fish and amphibians and represent the beginning of the food chain. Adult mosquitoes feed on sweet plant juices of nectar or withered fruit. Females, in which the proboscis for stinging and sucking is fully developed, in order to obtain the proteins necessary for the development of eggs, additionally feed on animal and human blood. The development of mosquitoes, in ideal conditions, takes about seven days. Life expectancy depends on gender. Males live about seven days, and females usually 2 to 3 weeks depending on the species. During its life, the female lays 150 to 400 eggs up to five times a year in water, on leaves, soil, moss, and all other places where water can be expected. The life cycle of mosquitoes takes place in four stages: egg, larva (4 developmental stages), pupae, and adult mosquito. (QR code - Life cycle of a mosquito).



**QR kod - Life cycle of a mosquito**

**ASIAN TIGER MOSQUITO** ***(Aedes (Stegomyia) albopictus,*** Skuse, 1894.*)* is an invasive, non-native species that, unlike other species, is active during the day. In direct combat, it overruns native mosquito species and can cause their extinction in areas where it has spread.

**Asian tiger mosquito**

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## STAG BEETLE *(Lucanus cervus Linnaeus,* 1758.*)*

If you walk through an oak forest or a forest with rotten stumps and rotten fallen trees, on the trunk you can come across one of the largest insects in Europe. It is a beetle whose male body is up to 6 cm long. Its head is adorned with two growths of the upper jaw up to 2 cm long. They look like stag antlers, hence the name stag beetle. Unlike the male, the female is much smaller and has smaller, almost invisible upper jaws (horns). The male's "horns" serve when fighting for the female with other males during courtship. The grip of the tongs (horns) of the male, although they look scary, unlike the grip of the female is not painful for humans. The life cycle of this large insect is 6 years. The female lays eggs in a rotten stump or roots from which the larvae hatch. The larvae feed on rotten wood for five long years and thus help the process of decomposing the wood material. In the fifth year, at the end of the summer, they form cocoons, and in the autumn, the adult individuals hatch and stay in the ground until the end of the spring of next year, when they slowly, clumsily fly to the surrounding trees. Adults feed by licking plant sap and resin-damaged trees. When it was realized that the survival of this rare insect depends on the amount of rotten and rotting trees in the forest, the removal of

all rotten fallen trees was stopped. Therefore, when walking through the woods you see a fallen tree or a rotten stump, you should know that it probably hides the eggs and larvae of this beautiful insect. The stag beetle is a protected wild animal species in the Republic of Croatia and as such is on the list of interests for the European Union.

**Stag beetle**

Zdenko Turniški

## COMMON EUROPEAN TICK *(Ixodes ricinus Linnaeus,* 1758.*)*

Sometimes the enjoyment and impressions of walking in nature may be spoiled by the moment when we realize that a tick has stuck somewhere along the way and that the sudden itching is caused by the bite of that small insect from the order of mites. As they need blood for their development and reproduction, they are most often found on the skin of animals (birds and mammals), but also on humans when they move through their natural environment. It can be said that ticks are more attached to the "victim" than to their environment. This way of life is connected with the life cycle of this small parasite. The life cycle takes place through four stages: egg, larva, nymph, and adult tick. Between each of these stages, in order to survive, a tick must have a meal of blood. Most fail to do so, so they die. Interestingly, the second part of the Latin name "ricinus" is related to the shape and colour of the body of an adult female, which when it drinks blood resembles a grain of ricinus seed. The ticks are blind, baggy-bodied, with a brown chitinous plate on the back and greyish buttocks. Adult males are smaller than females, and only females feed on blood. Ticks live on the leaves and branches of low vegetation and shrubs in the ground layers of the forest, so it is best to go into the forest in long pants and closed shoes. **Upon arrival home, be sure to inspect clothing and body.**

**IMPORTANT!**

Ticks can be carriers of various diseases. They are most often infected by feeding on forest animals (rodents). The most common diseases they transmit are Lyme borreliosis and tick-borne meningoencephalitis. Fortunately, these diseases are endemically widespread and uncommon. Lyme disease is treated with antibiotics and meningoencephalitis is prevented by preventive vaccination that is given to people whose work is related to the forest. Both of these diseases are very rare in the Naturavita project area. You can find out more about ticks on the website *https://krpelji.info* prepared by the Faculty of Forestry, University of Zagreb.

**www.krpelji.info**

**Common european tick**

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From the class of **fish** in the Drava and Danube that belong to the Black Sea basin, 78 species were recorded. In the area of Kopački rit and the lower course of the river Drava, (project area) which serves as areas for spawning and food, according to long-term monitoring, there are 46 species of fish. 21 species are protected by international regulations. 9 species of fish are of interest to the European Union (Natura 2000). Of the seven endemics of the Danube basin, 3 species come in Kopački rit, and 4 species along Kopački rit. The project area is inhabited by 35 indigenous fish species.

**FISHERMEN AND FISH**

Walking along the banks of the Drava you can often come across some of the great lovers of nature and the river. These are fishermen or as we in Osijek and the surrounding area call them “pecaroši”. Each of them is full of stories about the catches of big fish, but also about those that fell off the hook at the last minute and saved themselves in the murky waters of the Drava and its tributaries. On our educational-recreational trail “Biljsko jezero” you will get acquainted with the rich fish stocks of the rivers Drava and Danube and the largest wetland in this part of Europe, the Kopački rit Nature Park.

**Amphibians** are represented by 11 species, which is 55% of the total of 20 species of amphibians in the Republic of Croatia.

In the Kopački rit Nature Park, as well as in the project area, 10 species of **reptiles** have been identified, of which the most common are the European pond turtle (*Emys orbicularis Linnaeus*, 1758)

**European pond turtle**

Zdenko Turniški

and two species of snakes, the grass snake (*Natrix natrix Linnaeus*, 1758) and dice snake (*Natrix tessellata Laurenti*, 1768).

**Grass snake**

Zdenko Turniški

**Dice snake**
trying to swallow a fish. (The fish managed to escape!)

Dalibor Tonc

Specifically in the area of Kopački rit, and also in the area of the Naturavita project, 297 species of **birds** were seen, which makes 74.4% of the total ornithofauna of the Republic of Croatia (399 species). Furthermore, about 140 species of birds nest regularly or occasionally.

**Black stork**
and birds in the nest

Željko Gubijan

During the spring and autumn migrations, 65 species live in this area, while 22 are winter visitors. From the list of birds of interest to the European Union (Natura 2000), there are 12 bird species in the project area. Among other migratory birds, there is the purple heron (*Ardea purpurea Linnaeus*, 1766). This species of heron is stylized on the emblem of the Naturavita project.

**Purple heron**

JUPP →
"Kopački rit"

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↓

Fish-feeding birds (ichthyophages) such as the great cormorant (*Phalacrocorax carbo Linnaeus*, 1758) and the white-tailed eagle, sea eagle, erne (*Haliaeetus albicilla Linnaeus*, 1758) are important for the food chain of this area.

**White-tailed eagle (sea eagle, erne)** has a white tail when it is sexually mature

← Zdenko Turniški

**White-tailed eagle (sea eagle, erne)** with an eaglet

Željko Gubijan
↓

There are 54 species from the class of **mammals** in the project area, which is approximately half of the total number of known mammals in the Republic of Croatia. On the list of mammal species important for the EU (Natura 2000), among the species inhabiting the project area, are Eurasian otter (*Lutra lutra Linnaeus*, 1758) and European beaver (*Castor fiber Linnaeus*, 1758), which became domesticated after being successfully reintroduced in the area of the Drava.

See more about the beaver on the educational-recreational trail “Veliko polje“!

**Beaver**

Marijan Grubešić

## WILDCAT *(Felis silvestris* Schreber, 1775.*)*

Sometimes, but very rarely, a wild relative of our tame domestic cat can be seen peeking out of the thickets of the forest and carefully crossing the forest corridors or embankment. It is larger than a domestic cat (height of the spine 35-40 cm), stockier, with a larger head. It has a characteristic thick, short tail with usually nine broad black rings of fur. The tip of the tail always ends in a black ring. If there is any doubt as to whether or not what we see in the distance is a wild cat, when we see its tail ending in a black belt, we can be sure that it is her. The fur of the male is pale grey to black-grey, while in the female it is yellowish-grey interspersed with darker ring spots. Its belly is lighter. This solitary hunter climbs trees well, and its prey (mice, voles, dormice, rabbits, birds, bird eggs, and sometimes very rarely fawns) either hunts or lurks at dusk or at night. It makes its lair in hollows and abandoned fox dens, where after mating in February or March it gives birth to 2 - 5 blind hairy kittens in May.

**Wildcat**

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## NORTHERN WHITE-BREASTED HEDGEHOG *(Erinaceus roumianicus* Barrett-Hamilton, 1900.*)*

In a sparse deciduous forest with an abundance of shrubs, on the edges of forests and near settlements in parks and gardens, this lone hunter can often be met at dusk or night. It is characterized by a stocky body, short legs, elongated pointed muzzle, small ears, and eyes. Its back, hips, and head are covered with dark brown thorns, while its belly is covered with hair. The chest of this hedgehog is lighter (greyish) and they are a way to distinguish it from the southern white-breasted hedgehog (***Erinaceus concolor***) whose chest is extremely light (white). In dense bushes, in holes, from moss, grass, and leaves it builds a large flat nest. In danger, it bends into a ball. We can often hear our little prickly friend rustling the leaves, in the twilight or in the dark on summer evenings, in some hidden corner of the garden or park as it crawls through the bushes, chirps, roars, or whistles. After mating in April or August, 1-2 times a year during May or September the hedgehog gives birth to 3 - 7 young hedgehogs with soft spines. When it is not sleeping, it feeds on earthworms, snails, insects, young mice, frogs, and snakes, and sometimes it snacks on various juicy forest fruits.

**Northern white-breasted hedgehog**

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## WILD BOAR *(Sus scrofa* Linnaeus, 1758.*)*

In quieter, more remote parts of the forest, it is not uncommon to come across a herd of wild boars running in a line on crossings or forest paths, one by one. The wild boar is the only cloven-hoofed, non-ruminant, omnivore that lives in floodplain forests. They are the optimal habitat for the wild boar given their water, bilge, and peace requirements and in this regard the space for reproduction. The wild boar has a spine height of 70-90 cm. Compared to the domestic pig, it has a shorter, narrower body and long legs, and long dark brown to black bristle fur. On the short and thick neck, it has a large, elongated head, which ends with a movable flat tip of the snout. Males are characterized by having developed large, long canines (tusks) that protrude beyond the muzzle. Older males are solitary while younger ones keep together, but away from the pack led by the oldest female. It is a social animal that likes to roll (bilge) in the mud. A persistent runner who crosses long distances at night, as well as a swimmer who has no problem crossing a larger river. It makes a den in hollows that it covers with grass in the middle of a thick bush. After mating from September to January, it farrows 4 - 11 piglets during March and April. The piglets are hidden in a den for the first 14 days, and then follow the sow and set out to explore the world. The piglets are playful and lovely with their lighter stripes on the brown fur. This forest inhabitant is active both day and night and is always on the lookout for food. It feeds on herbaceous plants, roots, tubers, forest fruits, acorns, and field fruits (potatoes, corn). Sometimes it can eat earthworms, insects, snails and snakes, mice, voles, and moles.

**IMPORTANT!**

We must not try to catch a wild boar piglet because its mother is nearby and can be very angry and dangerous when its “children” are touched!

**Wild boar,**
sow with piglets

Robert Gros

## RED FOX *(Vulpes vulpes* Linnaeus, 1758.*)*

Walking through the woods at dusk, we may find a fox as it stops for a moment on the forest trail and sniffs if the air is “clean” and continues its way. Maybe to some settlement which it is known to visit when it is pressed by hunger during the cold winter months. This 55-85 cm long and 35-40 cm tall beast from the dog family has short legs, an elongated snout, and pointed ears. Its fur is brownish-red on the back, and its belly, like the tip of its long ornate tail, is white. It lives individually, is a timid animal, and afraid of people. It makes a den in the bushes in holes it digs under the roots of trees, but it is known to often use abandoned badger dens. In its lair, it gives birth to up to three hairy grey cubs (foxes) in the spring, in the upbringing of which the male also participates. It feeds on small rodents, young rabbits, birds, and when hunger forces it, it also feeds on insects, berries, and forest fruits.

**Red fox**

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## GOLDEN JACKAL *(Canis aureus* Linnaeus, 1758.*)*

When at dawn or in the evening, but also in the afternoon, you see an animal that looks like a dog but resembles a larger fox, has a snout like a wolf but is much smaller, so it is not a wolf, you saw a jackal. In recent times (after the Homeland War) in our area began to appear more frequently, and those who spend more time in nature have probably seen it. This largest beast from the family of dogs that stays in our region and in the project area has a back of up to 50 cm in height and a total length with a tail up to 120 cm. One-quarter of the length is its ornate tail. Its snout is pointed and resembles a wolf's muzzle in arrangement and number of teeth. Its back is grey-yellow, and its belly is whitish to light grey. It is a monogamous beast that defends and marks its territory and is always on the move. It rarely groups into smaller packs. This timid hunter feeds on what it can catch (mice, game cubs, poultry), but also sometimes eats fruit, grapes, or wild berries. Although as a beast it is at the end of the food chain and contributes to the biological balance, too many individuals in the hunting ground do great damage by attacking and feeding on roe deer. At the end of the year, the female gives birth to 4 - 8 young.

**Golden jackal**

Zdenko Turniški

## EUROPEAN BADGER *(Meles meles* Linnaeus, 1758.*)*

If you turn off the beaten hiking trail a little deeper into the forest, on elevated terrain, often on the sides of deep canals where there are mounds of excavated earth i.e., everywhere out of reach of floodwater, you will come across a hole that is the beginning of one of the long corridors leading to the den of European badger. Even when you see it for the first time, you will easily recognize it by the head with black and white stripes, and white ends on the ears. Its body is compact, up to 30 cm high, with short legs and a short ornate tail. Its hair is thick and long, grey on its back and black on its belly and legs. Considering its way of life below the surface of the earth, one might think that the name "smudger" is more appropriate because it would be expected to be dirty, but this is a very neat beast that, in addition to all its long corridors, has manure pits and maintains its den clean. Badgers are social animals that live in small groups that mark and defend their maze of underground corridors. In the spring, the female badger gives birth to 3-5 blind cubs. Badgers feed on anything they come across and are not picky. Although it is basically a carnivore whose menu includes earthworms, frogs, snakes, mice, and small birds, it also eats wild berries and fruits, as well as acorns and field fruits. It does not sleep all winter, so it can be seen in winter when it comes out of the den for a short time. It has no natural enemies and lives to be 12-15 years old. Its only enemies are cars, which unfortunately often kill it in its attempt to cross the road at dusk and at night when it is active.

**European badger**

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## ROE DEER *(Capreolus capreolus* Linnaeus, 1758.*)*

Traveling in the morning or early evening, you have probably seen some animals grazing along a roadside road in the distance in a field or meadow. These are most often roe deer. If the eyes serve you and the roe deer turn their backs on you, you will see a cluster of white oval-shaped hairs on their buttocks. This "mirror", as we call it, is a sure sign that you have seen roe deer. Often walking through the forest, we can see them on the forest trail walking lightly or in the forest clearing carefreely enjoying the abundance of fresh grass. If we notice them before they smell and hear us, and in doing so we stay still, we will be able to enjoy watching these timid forest dwellers. Namely, the roe deer eyes have no possibility of creating a sharp and deep image, which makes it difficult to distinguish static objects. We use the name roe deer collectively for males (roebuck or roe buck) and females (roe deer) and cubs (fawn). The roebuck is expectedly larger than the female and is 130-140 cm long from the tail to the tip of the muzzle, and in the area above the front legs, which we call the ridge, it is about 75 cm high. Their hair is reddish-brown in summer and short, and in winter it is longer brownish-grey or grey-brown, with the previously mentioned white "mirror" on the buttocks under the tail. The roe deer is a good jumper and runner as a result of the strongly developed back and slender front legs. The short antlers, which only a roebuck has, do not hinder its

passage through the bushes and young forests in which it lives during the day. Every year in late autumn (October, November) the roebuck loses its antlers and immediately begins to grow new ones, so in the spring, scratching the bushes, it cleans the newly grown antlers from the velvet. (You can learn more about the development of roe deer antlers on the educational-recreational trail “Perunika”.) It marks its territory with a fragrant gland on its forehead bone when it rubs its antlers against the bushes, and by making noises that sound like barking (grunting). When the roe deer is ready to mate it attracts the roebuck by the whistling and her olfactory gland on the buttocks. At the end of spring and the beginning of summer, the roe deer usually lays two spotty (white spots) fawns, which it takes care of on its own until the beginning of autumn. Then the roe deer form a herd out of a sense of security. Herds disintegrate in the spring because roe deer live individually or in small groups for most of the year. Roe deer carefully choose their food, so their menu includes soft leaves and young shoots and buds of forest woody plants, and they like to sometimes eat forest fruits (wild apples, blueberries, strawberries, and other berries). During the winter, they dig in the snow in search of the remaining tufts of green grass, but the hunters who bring salt, hay, and corn to their feeding grounds contribute the most to keeping roe deer in a certain territory.

**Roebuck** (roe buck)

Dražen Degmečić

## **RED DEER** *(Cervus elaphus* Linnaeus, 1758.*)*

Whoever once heard and saw a deer roaring in the swamp forests, in late August and early September, will never forget that experience. When that king of swamp and lowland forests lets out its hoarse voice the whole forest echoes. By roaring, before mating, the antlers sometimes decorated with leftover sedges, on the roaring places next to the harem of its hinds, it informs other newcomers of its kind, with whom it often clashes, that it rules this territory. The deer is our largest land animal. From the tip of the snout to the 20-25 cm long tail, an adult male (stag) can be 225-275 cm long, 120-150 cm high at the ridge and weighing up to 300 kg. Females (hinds) are slightly smaller and therefore weigh less - 70 - 130 kg. This body mass was produced by the strong structure of the muscles and tendons on its legs, which allows it to run quickly in danger and jump up to 3.5 m in height and 12 m in length. Deer change their coat colour depending on the season. In spring and summer, it is rusty red, and in autumn and winter, the longer thicker hair is dark brown to brownish-grey. The deer, like the hind, has a “mirror” on its buttocks, but it is yellowish-white to yellow-red. Unlike the hind, the deer has horns on its head and a mane on its neck. Only males have antlers, and they fall off in late February and early March. You will learn about the development of deer antlers on the educational-recreational trail “Perunika”. In late spring (May - June), the hind usually gives birth to a cub called a kid or fawn in solitude. When the fawn gets a little stronger, the herd returns with it to the other individuals. Deer game feeds on grasses and herbaceous plants, various fruits and leaves, and saplings of trees which can do damage to seedlings of forest trees. To prevent deer from browsing the saplings and leaves of young plants they have planted, foresters build high protective fences around the areas where the young plants have been planted. But even those high fences are sometimes not a problem for deer, and they jump over them easily when pressed by hunger. In order for deer game to have enough food even in the cold winter months, hunters take care of them by bringing hay, corn, beets, carrots, and sometimes apples to their feeding grounds. For the life and health of deer, in addition to water and food, salt is also necessary, which hunters bring to the salt pans.

**Red deer**

Dražen Degmečić

# The importance of preserving natural balance, biodiversity, and sustainable management

There are various definitions of nature that differ insignificantly from country to country, but they all have in common that nature represents an overall biological and landscape diversity without human intervention. It is this human intervention that can most often disturb, and it does disturb the natural balance. Natural balance is closely related to the number of individuals and food chains and their members. In a landscape, depending on its diversity, different food chains appear. We are talking about a landscape dominated by water, forest, (grass) meadow, stone. Each landscape has its own laws and its own balance of the food chain network and the members of the food chains that inhabit it. There are always some producers (plants) that are a source of energy for consumers of the first order (herbivores), and which are then each other's source of energy for consumers of the second (carnivores and omnivores) and the third and fourth order (carnivores). All these members at one point (death) if they did not serve as food for higher order consumers become a source of energy for decomposers. Due to its biodiversity, i.e. the diversity of the food chain network, nature regulates its balance if it is disturbed naturally (natural disasters - winds, floods, landslides, low or high temperatures). Depending on the duration of the disaster, it takes a longer or shorter time for the balance to be established. It either goes in the direction of establishing the existing balance before the disaster or in a completely new direction if the habitat or landscape conditions have changed permanently. We have such examples in the project area itself in parts of the forest, but also the wetlands. Periodic flooding of part of the wetlands and forests as a consequence after the withdrawal of high waters always leaves behind a part of the sedimentary material that the water brought by flooding. By the deposition of this material, the microrelief gradually changes. Every year after each flood, nature restores the disturbed balance. On the surface that was flooded, plants that are a source of food for herbivores flourish again. On the other hand, during the flood, fish spawning in such waters reached the backwaters and ponds through the canals, followed by consumers of the second, third and fourth order in the chain. In this relatively short time, a new natural balance is established in this case of fish and fish-eating birds. With the withdrawal of floodwater, fish species also withdraw, and with their disappearance, fish-eating birds also withdraw i.e. move to their permanent habitats. When at some point the microrelief changes so much by the deposition of materials brought by floodwater that, for example, the pond can no longer be filled with sufficient water or its inflow is prevented, the appearance of swamp vegetation in which fish spawned will be absent. The succession of the development of the plant community takes place in the direction of the development of the wetland meadow. Other plant and animal species (e.g. voles) come to this meadow, which are then a source of food for consumers of a higher order (foxes, jackals), or some other food chain. In this case, a new natural balance adapted to the new habitat conditions is established.

And where are humans in this story? Nature to some extent endures the interference of humans. Sometimes human interference is crucial to maintain some natural phenomenon, but it must be done with measure. One of the positive examples is the maintenance of the passability of the canals through which the flood water enters the wetlands. Furthermore, any human interference in natural processes must be supported by scientific knowledge, precisely so that the natural balance is not disturbed in the future. Therefore, various research and observations are carried out (e.g. mosquito monitoring). One of the good examples of human interference in natural processes is the reintroduction of the European beaver to the area of our large lowland rivers (Sava and Drava) and their tributaries. Excessive hunting (expensive fur) in the past and the destruction of natural habitats by uncontrolled canalization of rivers led to the disappearance of beavers from Croatia by the end of the 19th century. Within the project "Beaver in Croatia" by repopulating natural habitats in the area around Ivanić Grad (Žutica forest) and, significant for this area, on the river Drava, in the area of Legrad in the period 1996-1998, 85 individuals were successfully introduced and also spread to the Naturavita project area. The beaver population has multiplied since then. According to the observations of the guards from the Kopački rit Nature Park, one or more families live in the area of the Park (monitoring of otters and beavers is one of the tasks of the Naturavita project). Since they have no natural enemy, (before a wolf) today for young beavers, fox or eagle, and stray dogs near the settlement, their number has increased so that now beavers do damage to agricultural crops, orchards, young trees, and block smaller watercourses. Now again, humans must intervene in the story and based on research, bring the so-called sustainable beaver management plan. This plan must be such that it also protects the beaver from extinction, but also prevents or reduces the damage caused by the beaver. Thus, a new biological balance must be established, which is now disturbed by reintroduction.

The basis for the so-called sustainable management of area i.e. nature are scientific knowledge. Based on many years of observations and research, foresters have realized that if they do not intervene in the project area, non-native invasive tree species will prevail, changing habitat conditions and disturbing the natural balance of floodplain forests. Therefore, after demining of areas that were inaccessible, there was a gradual replacement of allochthonous invasive tree species (Euroamerican poplar, American (green) ash) with native species (pedunculate ash, narrow-leafed ash, European black poplar, and white poplar, and willow) depending on existing habitat conditions.

One sometimes wonders what it can do as an individual and how to contribute to the sustainable management of nature and natural resources. To know this, we need to know what the term sustainable development means in general. The best definition was given by the Chairwoman of the UN Environment and Development Commission

(1987) Gro Harlem Brundtland, who introduced the concept of sustainable development. She says that it is “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development is a process of change in which the use of resources, direction of investment, the orientation of technological development, and institutional changes are in harmony with each other and enable meeting the needs and expectations of present and future generations.” (Report “Our common future”) Based on the 2030 Agenda for Sustainable Development, the EU has adopted its own sustainable development strategy. It states: “Sustainable development is based on a pattern of production and consumption that does not degrade natural resources, protects the environment, promotes the equal distribution of goods to all, and reduces poverty.“

Of course, depending on the level of decision making and the place in the society in which one finds oneself and also its age,  one can do a lot. Let’s put it this way, “living nature rationally” should become a way of life. When we are young and school-age, by separate waste collection we contribute to less use of natural non-renewable, and renewable resources. Namely, it is important to know that, for example, by collecting and separating old paper, we reduce the need to process a certain amount of wood needed for paper production. For the production of recycled paper, a certain smaller amount of “new” wood must be sacrificed due to the technological process. But most of it is already used paper. Furthermore, by turning off the tap water while brushing your teeth, you can save several liters of drinking water per day. When we multiply this number, for example, 2 liters, by the number of days in the year (365 x 2), we come to the number of 730 liters for each student per year. By closing the faucet, approximately 3,500 students save as much water as can fit in one Olympic-sized pool in a year (the Olympic pool has approximately 2,500 m3). By unnecessarily illuminating the space, we irreversibly lose the current (energy) needed for lighting. By choosing electrical appliances and lighting fixtures of a higher energy class, we save energy. There are many examples of how as individuals we can participate in the sustainability of nature management. It is important to understand that we need to spend all the resources available to us rationally. Therefore, we have to spend them, but carefully so as not to disturb or minimally disturb the natural balance and to keep those resources for generations to come. So, we humans must benefit, but to the least detriment of nature.



## Forest biodiversity in the project area

In the area covered by the Naturavita project, we find several forest communities. The development of these communities is closely related to the presence of both groundwater and surface water, i.e. the terrain flooding regime.

We can say that the forest communities in the floodplain area are distributed zonally. At the lowest part of the terrain along the watercourses on the border with the wetland plant communities (reeds), there is a thicket of purple osier. It develops in the form of shrubs. It is continued by forests of almond willow that develop on parts of the Danube and Drava banks and marshes from which water is withdrawn at the latest. On the edges of the island, it creates narrow belts of young willow forest in the carr stage (seedling and young growth stage). This forest community is short-lived (10 years), up to 3 m high, and has no economic value. Its importance is emphasized by common beneficial values, because its dense overgrowth stops floodwater, which therefore deposits sediment, raises the soil, and provides conditions for the development of better species (white willow and European black poplar forest development). The survival of these two forest communities depends directly on water levels. If the water level is constantly high, the resulting carrs of purple osier and almond willows decay and emerge again when the water level drops.

Carr ( Dalibor Tonc)

The characteristic plants that occur in these carrs are yellow iris and European dewberry. In the interior of the wetlands, along the ponds and large bodies of water, there are forests of white willow. They are recognizable by white willow trees that are distorted by the ac-

tion of ice in the winter period when the ice crust presses on the trunks. These forests are zonally located between the forests of almond willow or reed and marsh vegetation on the lower terrains and the forests of white willow and black poplar on the higher terrains. The layer of shrubs is poorly developed and in addition to white poplar, European dewberry also appears in it. For the survival of this forest are important floods that are frequent and last 3 - 5 months with the most common water heights of 2 - 4 meters. In the past, large areas of these forest communities were reclaimed, and hybrid (Euroamerican) poplar crops were planted on them. Forest of white willow and black poplar are the most widespread forests in the central positions of the Danube islands and the coastal part of the Danube part and the Drava part of the project area. Floods are rarer here and of shorter duration than in white willow forests. This forest community represents the optimal phytocenosis of the marsh forests of the Danube region. The layer of shrubs in these forests is abundantly developed and in addition to white willow and black poplar, it contains hawthorn, guelder roes and, less frequently, mulberry. The layer of ground growth is abundantly developed, and in addition to hydrophytes, plants with less moist habitats also grow. White and black poplar forests grow on the higher positions of the coast and the Danube islands, and on the high positions of the Drava terraces. Floods in these areas are rare and short-lived. The soil is rich in nutrients and high fertility, which is manifested in the growth of other tree species. Along with the white and black poplars that dominate, there are narrow-leafed ash, white willow and European white elm, and some pedunculate oak. Under the human influence in these forests are significantly present the so-called neophyte species (introduced species of recent times) boxelder maple (box elder), American ash, and black locust. Layers of shrubs and ground growth are abundantly developed. This forest community overgrows the best habitats along the Danube and the Drava and has great economic significance in terms of forest management. At the highest positions of floodplains that are exposed to periodic floods, going from the water the forest of European white elm and narrow-leaved ash connects directly to the poplar forests. It develops on the banks of rivers (“living water”), but not in the marshes along the backwaters. The layer of trees is dominated by pedunculate oak, narrow-leaved ash, field elm, European white elm, and pioneer species appear (purple osier and almond willows). Unlike the layer of trees that is always dense, the layer of bushes is only dense in places. It is characterized by species of common dogwood and Tatar maple, and in the area of the Naturavita project by neophytes, American ash, and boxelder maple (box elder). Due to the aggressiveness of the species, with the spread of the latter two (American ash and boxelder maple), natural species (Narrow-leaved ash and European white elm) disappear from the composition of the plant community. Among other species, European dewberry and remote sedge and stinging nettle develop in the locally abundant layer of ground growth in places. This community is the final stage in the development of forest vegetation of floodplains. The area under this forest community is gradually increasing because its development is favored by drought conditions and less frequent and shorter floods. This forest community is not of significant economic importance, but it is valuable in terms of biodiversity and is subject to Natura 2000 habitat protection. (Natura code 91FO).

NATURAVITA

https://naturavita-project.eu/

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