Enclaves of Life,
Sdružení SPLAV, z.s.

Guidebook through Forest Punk

Advices for creators of diverse forest enclaves

www.enklavyzivota.eu

1. Introduction

1.1. The Enclave of Life Project.

The idea for the Enclave of Life project was born gradually and it took some time to mature into its final form. And as it happens in such situations, in the end it all the important people were together at the right place at the right time, so to speak. It was Bohumír Dragoun, an experimental archaeologist and owner of several forests in the Orlicke Mountains, Adam Kučera, a young owner of a newly purchased forest in the foothills of the Orlicke Mountains, Martin Exner, an Indian with a desire to reforest the land of his childhood, and Sdruzeni SPLAV, association which has been involved in environmentally oriented projects for many years. Parallel to this, Sdruzeni SPLAV cooperated with the Polish Ecological Club from Gliwice and a long-standing partner – local action group from Estonia, Western Harju Partnership.

The theme of the project focused on the environment, with a zoom on forest ecosystems, thus emerged organically, enthusiastically, and out of a need to open similar issues: **Let's talk about the forest. About how such a forest can look like, what we can dream about and what is possible to achieve. About motivation and environmental issues. Let's find people similarly wacky and try to make friends with the experts. Let's keep our eyes open and learn alternative approaches to forest management. Let's forget the classics and be a little punk.**

Why?
In the last few years, there has been significant damage to forest stands in our countries, both in connection with climate change – several very dry years in a row – and with the regular, relentlessly recurring bark beetle calamity. The long-discussed and still unresolved problem of the economic forest with its primary function, namely timber production, is once again emerging. It is clear, and centuries have confirmed it, that the large forest owners are not willing to make a fundamental change for economic reasons. Therefore, if it is desirable and possible to create a forest of biodiversity and social utility with an enhanced secondary function, then it is possible, especially for small owners – enthusiasts.

So let us try to imagine that the secondary function is now shifted to the primary function – that the environmental quality and the climatic, ecological, and social functions are perceived by communities as prior to the economic ones. While the current unsatisfactory form of forest management relies on profits primarily from the quantitative harvesting of tree deserts (forest monocultures), in a biodiversity-valued forest the primary objective is to enhance the natural ecological function of the forest ecosystem. Here, the economic yield is suppressed and efforts to enhance its ecological function prevail.

The 'Enclaves of Life' project thus addresses small landowners or forest owners who would like to create an enclave of uniqueness on their land, something that enriches the living forest. It also approached experts from research, education, and other non-profit organizations with the possibility of using their recommendations and findings on a pilot basis in practice. And it is also reaching out to local communities, especially youth, with the offer to take over the ailing economic forest adjacent to their homes into their collective care and thus participate in a concrete way of improving the future of our landscape. But the aim is also to connect initiators, committed groups, young people, and local communities in the three countries and strengthen their interest and participatory search for ways to sustainable community forestry on a small scale. Through bringing people together, finding questions and obstacles and answers to them, and through discussions at forest workshops, seminars, and conferences, it contributes its part in changing the perception of the forest by local communities and in spreading good practice and exemplary commitment for a better common environment and introducing the topic of community supported forestry.

Using pilot plots (in different geographical areas, vegetation condition or use), it shows how to establish and maintain a forest with an enhanced secondary function on a small area, i.e., an ecosystem that would provide its owners with both benefits (edible forest, coppice forest) and pleasure, while retaining high biodiversity and ecological and landscape significance, or a completely different original intention. Thus, a small area may provide space for slow-growing woody plants, trees providing fruit or drift for insects and small vertebrates, places for songbirds, small meadows for grazing or protective places for the life and peaceful breeding of amphibians. At other times, a place for forest contemplation, a place inviting to visit for flowering trees, lessons, mushrooms, herbs, or therapy.

1.2. Basic idea.

The idea of creating a guide for enthusiastic and ignorant and active owners of forest patches was born from our idea that so many questions would arise that it would be enough to answer them and there would be interesting material in the world. And the notion that we would make do with the diversity of a few dream enclaves of a more vibrant forest to portray all the interesting views of the forest was completely blind.

Yes, in the pages that follow you will read interesting insights from many experts and stories from forest activists - as we participants in meetings and discussions about the different and varied ways we can have a forest. And, some deeper insights into some of the uses of the forest. Rather the less common ones.

The basic idea of the next many pages is not a lesson for the grower and visitor to the forest, it's a guide to inspiration for the person who has itchy hands and would like to have a forest,

sort of, in their own way. And so, we give him or her advice, insight and inspiration, and he or she has to decide for himself/herself.

1.3. Inspiration from local and further forests.

Before we start with our ideas and wisdom, we'll start by giving you a preview of some inspiring examples of landscape and woodland management, which, while not a small forest, certainly show the possibilities. Even cities and state forests can quite commonly try other ways to grow forests. Thus, although there are larger forests and large owners, there is something to note about them.

Uneven-aged Forest management in Klokočná forest

The Klokočná demonstration site is 400 ha of forest managed by the state enterprise Lesy České republiky, Lesní závod Konopiště. Since 1990, the principles of nature-friendly, selective management have been applied here to test the advantages of this ecological approach to forest management in the conditions of fully economically and recreationally exploited forests in the central areas. Klokočná is thus a source of knowledge about the possibilities of uneven-aged, selective management in the natural conditions of most of our forests. The demonstration facility is used for several research works as well as for teaching and training forestry school students.

Forest management in Klokočná is in line with the principles of the Pro Silva movement. Its European headquarters, Pro Silva Europa, has branches in most European and some non-European countries. The Czech branch, operating since 1995 under the name of Pro Silva Bohemica, has 225 members who practice or support the basic idea of the movement - to make the most of natural processes for a better and more sustainable economic result, while maintaining the continuity of all forest functions. https://prosilvabohemica.cz/

The uneven-aged forest, which is harvested for a long time only by selecting individual trees without creating bare areas, is varied at first sight. It is the diversity of the forest that is the basis for its high resilience and the efficiency of its management. The aim is to ensure that the stands, while maintaining their productive capacity, form a richly structured height structure with an optimum species composition and, in the final phase, form a continuous development process that is not disturbed by clear-cutting.

Although 30 years of forest development cannot give a definitive picture of the results of management and the overall transformation of forest stands, the data obtained are of demonstrable value. Not a single clearing had been cut in Klokočná at that time. Logging is carried out by repeated selection of trees throughout the stand. With a few exceptions, afforestation is carried out by natural regeneration, i.e., by seed dispersal from mother trees, which brings economic advantages and better-quality future stands compared with artificial

planting. The new generation of saplings grows up under the mature stand and their development is guided by regulating the access of light penetrating the loose upper stand.

The permanently creative forest "Dauerwald"

The school forest enterprise Masaryk Forest Křtiny is an organizational part of the Mendel University in Brno, a special-purpose facility primarily of its Faculty of Forestry and Wood Technology. MENDEL's forest land covers an area of 10,205 hectares and forms a continuous complex at an altitude of 210 to 574 meters. Currently, deciduous trees predominate with a share of around 62 per cent and their share has been increasing in recent years. The management concept is characterized by the slogan 'Diverse forests for climate change', and 16 management models are implemented on the territory of ŠLP Křtiny according to specific natural conditions. One of them is the Dauerwald: a mixed non-stationary forest with the use of individual and group selection – freestyle cultivation techniques.

The Dauerwald is a model of a mixed forest made up of habitat-appropriate trees, so diverse in thickness, height, and space that age classes can no longer be distinguished, and age cannot be a determining harvesting criterion. What grows is harvested. Trees are harvested using selective principles, i.e., without large clearings. In the Dauerwald, the stand is stable, and the microclimate is balanced throughout the area. Natural regeneration is predominant, but artificial regeneration is not ruled out, for example to diversify the composition or in calamitous groves. The Dauerwald is a concept with a European history of more than a century that has not taken hold in this country. ŠLP Křtiny was one of the first to apply it at the company level and created special management guidelines for this purpose.

An educational video was also produced on the topic, which introduces the most comprehensive management model on a school forestry farm: the "Dauerwald" – a sustainable and creative forest. The aim of the video is to show what such a sustainable forest looks like and what its main ecological and economic advantages are.

https://www.silvarium.cz/lesnictvi/vule-chtit-je-na-zacatku-to-nejdulezitejsi
https://www.slpkrtiny.cz/

New primary forest near Ještěd mountain

The new forest is a unique project in Central Europe. Since 2004, the Liberec-based non-profit organization Čmelák (Bumblebee) – Society of Friends of Nature has been transforming spruce monocultures near Ještěd in northern Bohemia into a full-fledged, colorful, and vibrant forest. Over the years, 35 hectares of dead growth have been bought up, some of the spruces removed and replaced by over 70,000 fir, beech, maple, and other species. Ten owl boxes and 40 bat boxes were placed, and amphibian pools were dug. Public tours and volunteer events are organized annually.

The site is part of the European network of protected areas Natura 2000 and is home to many species of protected plants and animals. The New Forest is one of Bumblebee's most successful projects, having received support from several thousand donors, including large Czech and foreign foundations. Its patron is the Liberec-born actor Pavel Liška. The aim of the project is to transform spruce monocultures into a forest close to nature, which will then be gradually left to nature.

https://www.novyprales.cz/o-projektu.html

Forestdiversity

The Forest Diversity project was developed at the Department of Forest Ecology, Faculty of Forestry and Wood Technology, Czech University of Agriculture in Prague. A team of scientists has been studying, among other things, forest ecosystems that have not been influenced by humans for a long time and if we were to express in one word what characterizes and connects these forests that have not been influenced by humans, it would probably be diversity.

A great deal of biodiversity abounds in so-called habitat trees, which are trees that are distinctive because of their unusual size or age and may even be dead but still standing. Habitat trees are those trees that have at least one tree microhabitat. Tree microhabitats are used by different organisms (but at least one species) at some point in their life cycle for shelter, mating or as a food source. It is these trees in their regeneration phase or already dry torsos that represent a great opportunity for other participants in the forest life cycle. Flowing sap, falling bark, water-filled holes from broken branches, dead wood in the crown or cavities in the trunk, etc., are all used until the tree has completely decayed.

Unfortunately, habitat trees are not a desirable element in everyone's eyes. The importance of habitat trees needs to be communicated. The Forest Diversity Project therefore focuses on mapping habitat trees. The intention is to create an online database of biotope trees (with the help of a mobile app) as important elements supporting biodiversity, based on mapping data, both by nature conservation, forestry, or educational institutions and by the public interested in nature and its conservation. In both cases, the potential for applying the records for scientific purposes is valid.

https://www.facebook.com/Lesodiverzita
https://lesodiverzita.cz/

Zoning in the urban forest around Bratislava

Bratislava Urban Forest has been operating since 1994 as a contributory organization of the City of Bratislava and its task is to manage this 96% forested area with an emphasis on its use by residents. However, for a long time the management strictly followed the forest

management regulations, and although they practiced individual tree selection, the large volumes of harvesting were difficult to reconcile with the forest's recreational function and care for its diversity. It was only through many years of work by local activists and a change in the city's leadership that the city organization was able to take a new direction, applying approaches close to nature.

In recent years, forest management around Bratislava has been changing. It was essential to identify and set aside different types of zones. The area is now divided into the Quiet Zone (54% of the MLB area), where no logging takes place, and the Recreational Zone (42%), where economic interventions are possible, but only in ways close to nature (purposeful selection). In practice, the volume of harvesting is even significantly lower than the regulation stipulates. The established practice of joint marking with conservationists is also continued. Finally, an Intensive Recreation Zone (4%) is set aside, which includes areas where sensitive development is possible (for example, there may be a bike rental or playground). With the help of ornithologists, nesting sites of rare bird species that are purposely avoided by the mining planning staff have also been mapped.

The entire area is now being rejuvenated exclusively naturally without artificial planting, leaving even so-called undesirable trees such as willow, lime, or cherry to grow. There are also small areas of spruce monocultures in the forests, which are slowly breaking down and being replaced by pioneer trees - visitors are invited to these areas to observe this process. The organization has also committed to not using chemical sprays in the area. Bratislava City Forests also places great emphasis on cooperation with conservation associations, on collaboration with scientists, experts, or the Ministry, and on visitor education. For example, fireplaces have been moved away from falcon nesting sites, wetlands are being restored, and ponds are being repaired. The change in management is thus crucial not only for the quality of the visitor experience, but more importantly for biodiversity in the area.

https://zachranmelesy.hnutiduha.cz/cs/clanky/clanky/priklad-dobre-praxe-od-sousedu-zonace-v-mestskem-lese-sprava-lesu-v-okoli-bratislavy

2. Enclave of life.

Do you still remember the colorful flowering meadows, which smelled of daisies, bells, and thyme, and on which you would not even be able to even count the number of butterflies, grasshoppers, bumblebees? Do you have a memory of the hillsides and linear woodlands on the fields with hawthorns, roses, and elderberries, in which pheasants and partridges, hares and countless birds had their homes? Can you think of the beautiful green forests that smell of moss and ferns? In the past, these ecosystems were almost everywhere and were part of every corner, today we must chase them in the landscape protected areas. We have a feeling that such a landscape belongs to the past today. Linear woodlands in the fields are often destroyed to enable faster and easier cultivation and yield of agricultural land, and long, single fields that lack any biodiversity are created. In the last century, beautiful flowering meadows have been largely drained and transformed into more profitable arable land, the original mixed forests, natural for our climate zone, have been harvested and gradually replaced by fast-growing coniferous forests, which are typical in higher altitudes. Today, we all perceive the consequences of this economic approach to nature and the landscape. Catastrophic drought, bark beetle calamities, drastic loss of insects and birds are only a small fraction of the consequences we can see. And all this has a common cause. It is the loss of the natural defences of ecosystems, ecosystems are weakened and therefore easily attacked, especially in times of weather fluctuations.

The aim of this Guidebook is to provide a functional guide on how basically anyone who wants can help our landscape by creating a small or larger enclave of life and thus strengthen the skill of nature to self-sustain itself. In this chapter, let's explain what the enclave of life as such means to us, let's introduce the specific benefits of creating a diverse territory and let´s have closer look to criteria which can influence our decisions when thinking about how a particular future enclave of life might look like and what added function it can bring to me and to the community.

2.1. What is the Enclave of Life?

First, we should define exactly how we will work with the term enclave of life in this publication and what we will refer to by this term. I am sure many of you have heard the term enclave and probably have a subconscious idea of what it means.

If we look in a dictionary of foreign words, we will find that enclave means "a territory within another territory". As such, the word has its origins in the Latin word *inclavare,* which means to enclose. It is used mainly in political science to refer to a territory of a state that is surrounded by another state and that is landlocked. In ethnology, it expresses a nation that

is surrounded by another nation; in civil law, it refers to a piece of land that is inside another piece of land and is not accessible by any public road. So, if we borrow this term and apply it for our purposes, we get a territory, an ecosystem, that is surrounded by some other, completely different ecosystem. Adding life to that, our ecosystem, our enclave, becomes an oasis that is full of life and locked in a place where life is limited.

We understand it would be ideal for living if thriving nature would be part not only of some enclosed area, but also part of our daily lives and environment. Just imagine a flowery meadow with butterflies and lizards instead of a golf course-style city park. We firmly believe that one day such a turnaround will happen - but it certainly won't happen immediately and magically. But every great work is preceded by a first step, and we feel that creating small islands of life wherever possible is a solid start.

By life in this book, we mean mainly life that is colorful, passionate and species diverse, represented by flora and fauna that have an important place in the Czech landscape. Because of the way man has treated and increasingly mistreated the landscape that has been lent to him for management, these key links in the ecosystem chain began to disappear from the Czech landscape, at first gradually and in recent years drastically. We are talking here mainly about the representatives of the insect and animal kingdom that stand at the very beginning of the chain and which we often do not even notice - insects and invertebrates. These serve as a crucial food source for many birds and, alongside chemical pollution, are the main cause of the drastic decline of birds from our landscape. And, of course, not only birds, but also other animals that are directly and indirectly linked to these forms. Currently the Czech Ornithological Society focuses on the decline of so-called field or farm birds, but its annual observations clearly show the decline of other, formerly quite common, bird species such as the house sparrow or blackbird.

2.2. Vision of my forest.

According to data from the Institute for Forest Management in 2019, the area of all forests in the Czech Republic is 34.10% of the country. This is the highest share since the end of the 18th century. This puts the Czech Republic below the European Union average of 43%. However, forest cover in the European Union is not uniform. Nordic countries such as Finland and Sweden, with a forest cover of 60%, are increasing the share, while the Netherlands, with a forest cover of only 11%, is decreasing its share.

Statistics tell us that we are at our best forest cover in more than 200 years, but we are still not in a good position, considering that mixed forest is the most natural native ecosystem for our landscape. Another fact that must be considered when assessing the current situation of forests in the Czech Republic is not only the quantity but also the quality of forests. There

are three main types of forests - protective, economic, and special purpose forests. The economic forests have the function of wood production and cover about 75 % of the total forest area. Protective forests are forests in unfavorable locations, for example in drylands or in the mountains. This category of forest has an important ecological function. It protects the landscape from the danger of landslides or avalanches. The non-productive function of this category of forest is an exclusive function. Its share is very low, about 2.1% of the total forest.

The last type of forest is the special one. This forest also has a non-productive function and, according to Act No 289/1995 Coll. of 3 November 1995 on forests, these are forests where the public interest in improving and protecting the environment or other legitimate interest in fulfilling the non-productive functions of the forest is superior to the productive functions. These include, for example, suburban forests, forests in national parks or protected landscape areas, forests near water sources or forests important for the conservation of biodiversity. Their share is around 23% of the total forest area.3

Production forests are mostly monocultures and are the result of a long-term process that began in the 18th century when local firewood and construction timber supplies were gradually depleted. The rapid need for timber led to the planting of fast-growing trees, mainly spruce and pine. This trend has remained essentially unchanged for more than 200 years. And yet it is monocultures that are the poorest ecosystems in terms of diversity. Spruce monocultures are also often called "green deserts" because they look very lively at first glance, but on the other hand not much actually lives there.
This brief introduction to forest categories shows that the most desirable type of forest is the special purpose forest. And, very generally speaking, this is the type of forest we are primarily after.

What is a forest? The most common definition of a forest says that it is land larger than 0.5 hectares, with trees at least 5 meters high (or capable of reaching that height) and a cover of 10%. That is the basic definition. However, our special type of forest (because it is the one, we believe best meets the requirements for diversity and richness of the three categories) can take many forms.

What types of forest can we have in the Czech landscape that meet the idea of an enclave of life? Certain rules need to be followed so that we do not do more harm than good in the landscape. First, it is necessary to choose a varied mix of trees and shrubs to be planted, not to plant them too close together and ideally not to use invasive species. Then, of course, it is also desirable to avoid the use of chemicals in maintenance and excessive interference in the life of the forest. The specific form and purpose of the forest enclave of life is up to its owner (subject to current legislation, of course). The typical type of forest of our ancestors was a forest, where taller stumps were left, from which the trees then grew back better and faster.

Then there is the pastoral forest, where the forest undergrowth was grazed by domesticated animals, creating a landscape with solitary long-lived trees or groups of trees.

There is also more and more popular edible forest, which can provide the owner with a year-round food source, a forest using only native species of trees, shrubs and herbs, a recreational forest that provides the owner with pleasure and aesthetic fulfilment. If the forest is sufficiently species diverse and lighted, it can take many forms depending on the goals and needs of the owner.

Previously we have already sketched the topic of what to look for when selecting the ideal type of forest to meet the above requirements, and now we will develop it a little further. We will outline some of the key questions that a landowner should answer before planting the first trees. To answer the key question of what my forest should look like in 10 or 20 years, we have a few sub-questions as inspiration.

What part of the country is my forest located in? The composition of the forest should respect the local climate otherwise we risk that the trees will not thrive.
What side of the world is the property facing? This will help us to space trees and shrubs appropriately according to their tolerance to shade so that we have the lightest in the forest.
What do I want the forest to give me in the future? Do I want it to make money for me? Do I want it to earn just a little for its maintenance? Do I want it to be an oasis of calm for me to relax in? Do I need a natural windbreak around my house or other property? Do I want to provide available food for the bees? Do I want to provide good grazing and habitat for domestic animals? Am I primarily concerned with nature and ecosystem restoration? Do I want the forest to provide a livelihood for my descendants?

There can be several goals. First, we may want to build an ecosystem whose primary purpose is relaxation and food self-sufficiency as well as ecosystem restoration. In nature, many things can be combined. Realizing what your intent and desire is is important in terms of the overall design and species diversity of the future forest or enclave of life if you will. This is closely related to the question of what trees and shrubs to plant in a future forest.

Ideally, we should plant native species and avoid all invasive plant species1. While it is not directly forbidden to plant these plants as is the case with the "EU list" of prohibited plants in the European Union, we should nevertheless think very carefully about their planting. There are some well-known shrubs and trees on the invasive plant list that have significant economic value but pose a threat to entire ecosystems of native vegetation if they spread into the landscape. These include the Acacia thorn tree, a tree that is highly valued both for its hard wood and, above all, as one of the most valuable honey plants. However, its leaves and seeds contain nitrogen and toxins that leach into the soil when they fall and prevent most other plants from germinating. In this way, acacia has spread uncontrollably and is now

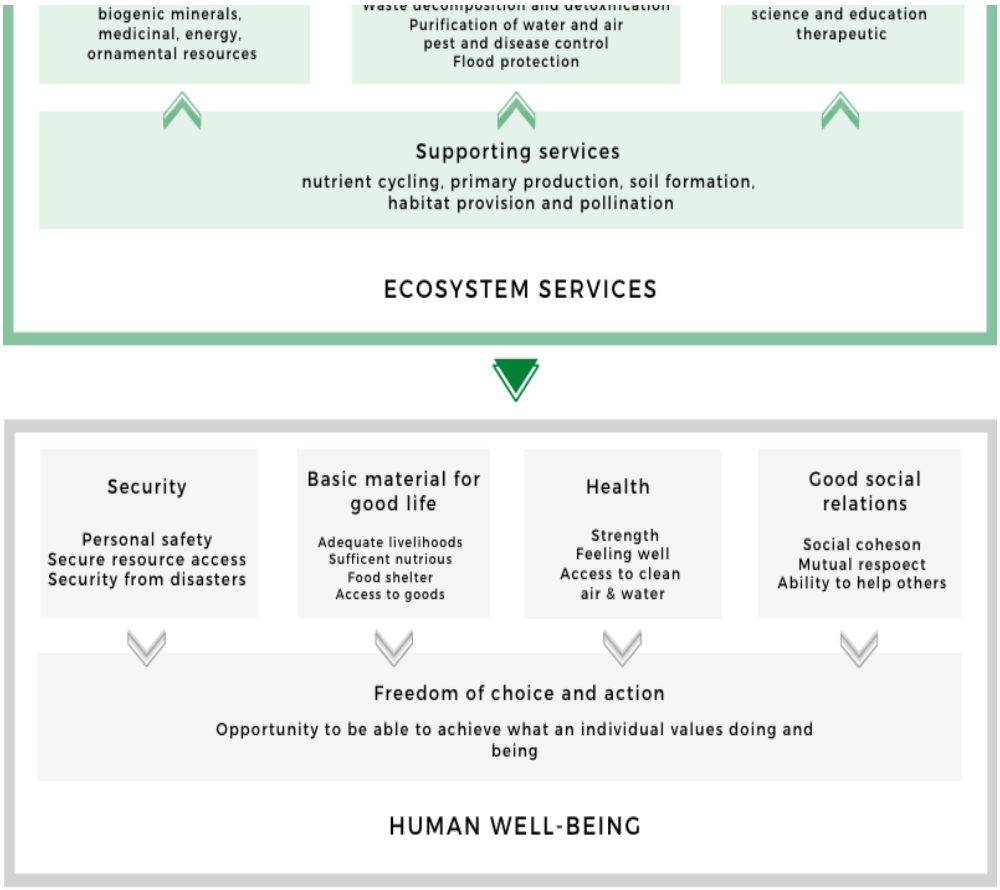
found throughout the Czech Republic. If, for example, we intend to establish a forest that will, among other things, provide grazing for bees, we should choose, for example, the heart linden instead of the acacia, which, although it grows more slowly, is just as loved by bees as the acacia.

2.3. Ecosystem services.

Biodiversity offers ecosystem services to everyone in the World and is a necessity for human life on Earth. An ecosystem is a dynamic complex of plant, animal, and microorganism communities and the non-living environment interacting as a functional unit (World Resources Institute, 2005). Ecosystem services are the benefits people obtain from ecosystems.

The current project is talking about different forest management strategies to provide several ecosystem services. Project shifts the focus from managing forests for timber/money towards managing the forests for all the rest of the ecosystem services.

As biodiversity is presumption for viable forestry, agriculture, and other sectors, any drivers that indirectly affect biodiversity, can lead to changes in drivers directly affecting biodiversity (World Resources Institute, 2005). For example, population growth, technology, or changes in lifestyle, influence the fresh air in the cities or the areas of wooded meadow, needed for bees and butterflies. These result in changes to ecosystems and the services they provide, thereby affecting human well-being (e.g., less lounge diseases, no more honey). Similarly, an international demand for timber may lead to a regional loss of forest cover, which increases flood magnitude along a local stretch of a river. Different strategies and interventions can be applied at many points in this framework to enhance human well-being and conserve ecosystems.



Most resource management decisions are strongly influenced by ecosystem services entering markets (food, timber); as a result, the non-marketed benefits are often lost or degraded. These non-marketed benefits are often high and sometimes more valuable than the marketed ones – think about the clean water supply or clean air. Non-marketed ecosystem services forests are managed with different perspectives, and it makes them the Enclaves of Life.

Enclave is a portion of territory, surrounded by a larger territory whose inhabitants are culturally or ethnically distinct. We target primarily the improvement of non-marketed ecosystem services, connected mainly with forests.

According to MEA (World Resources Institute, 2005), forest systems are lands dominated by trees; they are often used for timber, fuelwood, and non-wood forest products. Forests include temporarily cut-over forests and plantations but exclude orchards and agroforests where the main products are food crops. Forest systems are associated with supporting, regulating, provision and cultural services.

The main aim of the management of enclave of life from ecosystem perspective:

The aim of management	Supporting	Regulating	Provisioning	Cultural
No intervention				
Natural forest/Nature close forest				
Sustainable forest with many species				
Edible forest				
Species rich forest				
Historic forest				
Community forest				
Educational forests				
Therapeutic forests				
Small linear woodland				

On pilot sites (in different geographical areas, in various conditions and levels of maintenance), we aim to create `biodiversity hotspots`, and the management methods we show will be guided by the aims. Small scale forests are established and maintained for creating ecosystems that provide many service groups.

2.4. Supporting ecosystem services.

Variety

Imagine an orchestra with only pianos. The piano is a great instrument, but to make the pieces in the orchestra sound full and deep, pianos alone are not enough. It is no different here in our landscape. The fact that the basis of a healthy enclave of life is diversity has been mentioned here several times and will be mentioned several times more. Diversity is the foundation of a functioning and sustainable ecosystem. Unfortunately, our ecosystems and landscapes are not functioning as they should, and this is largely because of the monotony that has become the prevailing trend in them. A monoculture ecosystem is dominated by one plant species or uses only one variety of a crop, regardless of any 'weeds' that may also be present. Natural monocultures are rarely found in nature. These are, for example, reed stands near water bodies.

Artificial monocultures are now a predominant feature of the landscape. They can be found everywhere except in national parks. These are large areas of woodland, for example spruce or pine, and most fields, but also, for example, 'golf' turf in gardens.

Such an artificially created monoculture community lacking diversity is doomed to either lifelong care by man or slow extinction. It is highly susceptible to pests and diseases that spread rapidly through the stands, it does not form a full underground network of roots, so the soil erodes, and every downpour takes valuable nutrients away. The roots are not deep enough, so they do not capture enough rainfall and the stand is in danger of drying out every time it does not rain for a long time.

The golf lawn mentioned above, which a large part of the population cherishes in their gardens, is a beautiful example of this. It must be supplied with nutrients regularly because it is unable to obtain them from the soil, it must be irrigated regularly because its shallow roots are unable to provide moisture for the grass, and it has to be repaired because it is washed away or killed in places by water in every major downpour. Such a lawn is unlikely to become an enclave of life. Conversely, a lawn or meadow in which many species of plants are present is almost indestructible. The various deep roots of different plants act as a reservoir of water for the rainy season, can reliably draw nutrients from the soil and hold the soil as an armature. The abundance of different host plant species makes it much less likely that the ecosystem will be invaded and fatally damaged by pests or diseases. Such a lawn or meadow opens its arms to a variety of insects that can breed, feed, or find shelter there. Birds, lizards and chickens, bats and other endangered members of the animal kingdom depend directly on insects. And so, we could go on and on.

In the case of fields, the situation is more serious than in the case of lawns and forests, because pests, diseases and weeds are usually systematically and ruthlessly eliminated with aggressive chemical agents that cause long-lasting changes in the soil, making it a holder for the plants that are planted in it and losing its absorptive and nourishing function.

Nature itself can effectively regulate the overpopulation of species we call pests. To do this, nature must be able to house and feed the other animals that eat the pests. Every animal has a role and purpose in nature, and each has a right to its own life and space. When planting new vegetation, we should not forget the needs of other living creatures. Nature can regulate not only animals but also plants. We don't need to feat diversity, there is never enough of it.

Ecology

Ecology as a discipline has existed since the second half of the nineteenth century, but at that time it was concerned with the relationship between organisms and their environment

and between organisms and each other. Over time, the term came to be used more broadly to mean environmental protection.

Ecology is one of the issues that drives the world today. It is being addressed more than ever. While years ago, ecology was underestimated, today only few people question its role. Human society sees its destructive actions towards nature at every turn, and thanks to the Internet, it can see them on the other side of the globe. Today there is a plethora of large and small environmental organizations. This gives people a better opportunity to get involved in all sorts of activities from donating funds to manual or administrative help. Everyone can choose how to support nature.

This is the case as well with our Enclave of Life project. The project is based on the principle that anyone can "adopt" a part of the landscape that is currently monocultural, inhospitable, lifeless and make it a place teeming with life. It can be a large overgrown garden, a piece of field, a clearing in the forest after a forest calamity or a spruce desert where nothing else grows.

The main general goal of ecology and our project is that living organisms should be able to live and thrive in suitable environmental conditions. Ecology is about interrelationships because it believes that everything is interconnected. These relationships, which are often not entirely simple and unambiguous, are damaged or destroyed by human behavior, and this affects the balance of nature almost everywhere we look.

When we remove one link in the chain, we break one connection, it has big consequences. Take, for example, the notorious case of the decline of large ungulates. Over the centuries, large ungulates such as wild horses, bison and prairie dogs have been gradually killed off and replaced by domestic ungulates. The great merit of these native European animals, which have lived here since ancient times, was that they also grazed the meadows and steppes with so-called old grass. This grazing gave a variety of more delicate plants and animals a place to live. In a natural way, they disturbed the soil in the landscape where various insects could lay their eggs, helping to eliminate the more aggressive grass species. This brings us back to diversity, because it was the large ungulates that contributed greatly to the diversity in the landscape. Recently, large ungulates have been introduced "on trial" to some sites in the Czech landscape and the results have been more than impressive. The most famous is the site of the former military complex in Milovice. Within a few years, biodiversity has been restored and highly endangered species of plants, insects and birds have returned to the landscape.

It is clear to us that not everyone will have the capacity and finances to return these large ungulates to their land. However, we can see from this example that restoring relationships in nature brings diversity to it, and diversity brings life to it. To repair the damaged

relationships in our landscape, we do not need to immediately place bison into it, but it may be enough to help nature by planting more diverse trees and shrubs that will provide food for other animals.

Returning to the subject of ecology as a discipline that deals with relationships in nature, we should not forget one important thing. Relationships are not just between insects and plants, or plants and abiotic elements of the landscape. Man is also an integral part of these relationships, and not just in the sense of usurper and destroyer of the planet, as many environmental organizations proclaim. Man is supposed to be a steward who protects nature and ensures that it thrives. At least that is what all the great world religions say. So we all have a responsibility for the nature around us. It is therefore hypocritical to blame the state of the landscape on politicians, legislators, or previous generations. Or to think that if we donate once a year to an environmental organization, our ecological footprint will be cleaned up. It doesn't take much for nature to renew itself. It needs us to support it in the beginning and leave the rest of the work to it.

Providing living spaces for plants or animals and maintaining a diversity of plants and animals, are supporting services and the basis of all ecosystems and their services.

Within the project, the main ways we create supporting ecosystem services are through the idea and concept of:

- No intervention
- Natural forest/Nature close forest
- Species rich forest
- Small linear woodland

Habitat for species

As forests provide living spaces for plants and animals; they also maintain a diversity of complex processes that underpin the other ecosystem services. Some habitats have an exceptionally high number of species which makes them more genetically diverse than others; these are known as ‘biodiversity hotspots' or in our case: Enclave of life.

Forests offer very diverse habitats for plants, animals, and microorganisms. Semi natural grasslands can be among the habitats with highest biodiversity levels. They host a unique pool of species, specifically adapted to these open habitats. Genetic diversity (the variety of genes between, and within, species populations) distinguishes different breeds or races from each other, providing the basis for locally well-adapted cultivars and a gene pool for developing commercial crops and livestock.

For constantly managed and high population Europe, one of the challenges is to find possibilities for ecological succession during the times of climate change. Climax forestry

composition (old broadleaves, deadwood, insects, birds), needing app 100y, supports both habitat and genetic diversity. At the same time - climate changes creating the need for different species compositions in some areas (e.g., Estonian seaside, Czech and Poland mountain areas), that are more influenced by warming climate.

Maintenance of genetic diversity

Conserving and using genetic diversity can provide the options needed for coping with stress. The capacity of agro-ecosystems to maintain and increase their productivity, and to adapt to changing circumstances, remains vital to the food security of the world's population. Promoting the ecosystem approach contributes to the conservation and sustainable use of genetic resources for food and agriculture. Natural ecosystems hold important genetic resources which are of major significance through their potential to contribute beneficial traits to production systems, such as pest or disease resistance, yield improvement or stability. Thus, genetic diversity provides society with a greater range of options to meet future challenges.

Since the 1900s, some 75 percent of plant genetic diversity has been lost as farmers worldwide have left their multiple local varieties and landraces for genetically uniform, high-yielding varieties. Of the 4 percent of the 250 000 to 300 000 known edible plant species, only 150 to 200 are used by humans. Only three - rice, maize, and wheat - contribute nearly 60 percent of calories and proteins obtained by humans from plants. It is key to keep plant diversity to be better prepared to adapt to changing conditions and resist external attacks (extreme weather, diseases).
Forests are among the most important repositories of terrestrial biological diversity.

2.5. Provisioning ecosystem services.

Water, food, wood, and other goods are some of the material benefits people obtain from ecosystems called ´provisioning services´. Many provisioning services are traded in markets. However, in many regions, rural households also directly depend on provisioning services for their livelihoods. In this case, the service's value may be much more important than is reflected in the prices they fetch on local markets.

Agriculture, forestry, and fisheries are influenced and influence all types of ecosystem services. Below, we are looking at the interaction between the different production systems and the types of ecosystem services according to the typology of The Economics of Ecosystems and Biodiversity (TEEB).

Food

Virtually all ecosystems provide the conditions for growing, collecting, hunting, or harvesting food. The Non-Timber Forest products also contribute to a large part of the nutrition in developing countries. Food from forests covers in different ways fruits, nuts, mushrooms, honey, or spices.

Raw materials

Ecosystems provide a great diversity of materials including wood, biofuels, and fibers from wild or cultivated plant and animal species. From forests: wood and fibers.

Freshwater

No water, no life. Ecosystems play a vital role in providing the flow and storage of fresh water. Forests help maintain healthy aquatic ecosystems and provide reliable supplies of clean freshwater. Forests do not only filter and clean water, but they also help prevent soil erosion, reduce sedimentation in reservoirs and mitigate the risks of landslides, mudflows and floods, all problems that can threaten downstream water supplies. And while forests themselves consume water, they also improve infiltration rates, thereby helping recharge underground aquifers. Loss of forest cover can adversely affect freshwater supplies.

Medicinal resources

Natural ecosystems provide a variety of plants and mushrooms which offer effective cures for many kinds of health problems. They are used in popular and traditional medicine, and for developing pharmaceuticals. Key medicines such as Quinine, which effectively fights malaria, come from trees. Traditional knowledge can teach us a lot about other possible natural remedies if the fragile balance of the forest ecosystems is kept.

2.6. Regulating and maintenance services.

Maintaining the quality of air and soil, providing flood and disease control, or pollinating crops are some of the ‘regulating services' provided by ecosystems. They are often invisible and therefore mostly taken for granted. When they are damaged, the resulting losses can be substantial and difficult to restore.

Agriculture, forestry, and fisheries are influenced and influence all types of ecosystem services. Below, we are looking at the interaction between the different production systems

and the types of ecosystem services according to the typology of The Economics of Ecosystems and Biodiversity (TEEB).

Local Climate Air Quality

Ecosystems influence the local climate and air quality. For example, trees provide shade whilst forests influence rainfall and water availability both locally and regionally. Trees or other plants also play an important role in regulating air quality by removing pollutants from the atmosphere.

Urban trees can affect air quality in the following ways: (i) converting carbon dioxide to oxygen through photosynthesis;(ii) intercepting particulate pollutants (dust, ash, pollen and smoke) and absorbing toxic gases such as ozone, sulfur dioxide, and nitrogen dioxide, (iii) emitting various volatile organic compounds contributing to ozone formation in cities (iv) lowering local air temperatures (v) reducing building temperature extremes in both summer and winter and consequently reduce pollution emissions from power-generating facilities.

Carbon sequestration and storage

Ecosystems regulate the global climate by storing greenhouse gases. For example, as trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues.

Urban trees can affect air quality in the following ways: (i) converting carbon dioxide to oxygen through photosynthesis;(ii) intercepting particulate pollutants (dust, ash, pollen and smoke) and absorbing toxic gases such as ozone, sulfur dioxide, and nitrogen dioxide, (iii) emitting various volatile organic compounds contributing to ozone formation in cities (iv) lowering local air temperatures (v) reducing building temperature extremes in both summer and winter and consequently reduce pollution emissions from power-generating facilities.

Moderation of extreme events

Ecosystems and living organisms create buffers against natural disasters. They reduce damage from floods, storms, tsunamis, avalanches, landslides, and droughts.

Extreme weather events and natural disasters are posing an increasing threat to the world's forests. The condition of forests themselves can have an influence on extreme events. For example, deforestation or poor management can increase flooding and landslides during cyclones. However, the extent of large-scale flooding in the lower parts of major river basins does not seem to be linked to the degree of forest cover and the management practices in

the catchment area. Similarly, forests cannot prevent large scale landslides and mass movements which are triggered by tectonic or extraordinary rainfall events.

Waste-water treatment

Ecosystems such as wetlands filter effluents, decompose waste through the biological activity of microorganisms, and eliminate harmful pathogens. Trees contribute heavily to waste-water treatment through their root system and their role in nutrient cycling.

Erosion prevention and maintenance of soil fertility

Vegetation cover prevents soil erosion and ensures soil fertility through natural biological processes such as nitrogen fixation. Soil erosion is a key factor in the process of land degradation, loss of soil fertility and desertification, and contributes to decreased productivity of downstream fisheries.

Studies have shown that the more closely an agricultural system resembles a natural forest in its canopy structure, tree spacing and ground cover, the less chance there is of soil erosion. Traditional agroforestry techniques, which provide natural cover, have been used for centuries to produce food without causing long-term damage to the environment.

Pollination control

Insects and wind pollinate plants and trees, which is essential for the development of fruits, vegetables, and seeds. Animal pollination is an ecosystem service mainly provided by insects but also by some birds and bats. In agro-ecosystems, pollinators are essential for orchard, horticultural and forage production, as well as the production of seed for many root and fiber crops. Pollinators such as bees, birds and bats affect 35 percent of the world's crop production, increasing outputs of around 75% of the leading food crops worldwide.

Natural forests are important habitats for pollinators, providing refuge and food. Given the choice, wild honeybees chose nesting places in trees rather than in an open landscape. When enough bees are present in a forest, they provide better pollination that leads to improved regeneration of trees and conservation of the forest's biodiversity.

Biological control

In forest, when needed, the biological control of pests is often the chosen methodology since the relatively stable environment of a forest guarantees freedom from such adverse effects as interference by pesticides or disturbing agricultural practices. Natural or sustainably managed forests are also great reservoir of natural pest eradicators.

Regulation of water flow

Forests influence the amount of water available and the timing of water delivery. Stream-flow regulation by forests is the result of processes in the forest canopy, on the surface and below the ground – a combination of interception, transpiration, evaporation, evapotranspiration, and infiltration. Accordingly, sustainable forest management is key to the regulation of water flows.

2.7. Cultural services (Beauty and aesthetics, Emotion, Quality of life and mental well-being).

Beauty and aesthetics

Since ancient times, man has not only lived from nature, but admired it as well. Ancient philosophers such as Virgil, Ovid and Theocritus composed poetic poems on the landscape and its beauty and utility. But it was mainly a celebration of the utilitarian landscape that gave people their livelihood. It was not until the eighteenth century that a turn was evident in Europe, and the celebration of the beauty of nature began to include the free, wild landscape, the one that people had previously either feared or ignored. In the non-European world, of course, this trend may have been different, but there is no reliable evidence for it.

The English philosopher Lord of Shaftesbury made a major contribution to the aestheticization of wild nature with his work The Moralists, a Philosophical Rhapsody. The free, wild nature has come from the hands of God, and the hands of man have only corrupted it. He saw such nature as the opposite of the French geometric parks, which he considered artificial and ugly. He was also one of the first to articulate the idea of the English landscape park. He was followed by other thinkers who found more pleasure in pristine nature than in man-made parks and gardens.

A major milestone in the approach to the wild nature is the Romantic period. The Romantics were one of the first to focus not only on the harmony of the outdoors, but also on its shadowy aspects, seeing them as an integral part of nature's beauty. Closely linked to the influence of Romanticism was the establishment of the first protected areas, which were created mainly in countries influenced by German thought and Romanticism, Germany, Finland, and Bohemia. Perhaps for the first time, we can also see attempts by individuals to actively protect wildlife (for example, buying up trees to be cut down, etc.).

The aestheticization of nature was followed in later years by realism, impressionism and symbolism, movements that linked the sense of beauty and wild nature. However, at the end of the 19th century, according to Associate Professor Stibral, a kind of 'fatigue' with

natural beauty emerged, and it was mainly the decadents who wrote about their weariness with the beauty of the landscape, or outright contempt for nature and naturalness, and began to embrace artificial refinement. They are followed in this respect by the avant-garde and futurism, who put human society and its progress, most often in the form of technology, at the center of their concerns. The trend of reduced interest, even disinterest, in nature stretched into the 1960s. Even at that time, various beautification societies were formed, but nature, interest, and care for it were certainly placed outside the mainstream of human society. After the Industrial Revolution, two world wars and economic crises, the protection of the landscape and nature went by the wayside. With very few exceptions, there was no aestheticization of nature. The beauty of factory chimneys and dams was highlighted.

It was not until the second half of the twentieth century that a turnaround took place. People are becoming aware of the effects and darker sides of technological progress, and a generation of people is growing up who do not want to follow a consumerist lifestyle.

But it is clear from what is written above that this was not always the case. People have often feared, despised, or ignored wildlife as something inappropriate but tolerated. The aestheticization of nature is not an evident point of view. Today, it is undeniable that people in developed countries see nature as a beautiful part of life from which they draw peace, relaxation, mental and physical relaxation. This attitude makes it much easier to protect and nurture its magic, as the modern romantics would say.

Nature is beautiful as it is. Its charm lies in the many colors and shapes it has, in its wildness and, above all, in the fact that it has life. The more varied the life found in it, the more nature is nature.

Emotions

While nature was a resource for survival for our ancient ancestors, but also a danger they feared, thanks to the way we have conquered the landscape, today there can be no question of fear. Our ancestors had to hide in the European landscape not only from predators but also from the natural elements.

A major turning point came with the existence of the first big cities, when people became aware of the positive effects of nature on emotions and health. Gardens in Babylon Mesopotamia were maintained so that the city dwellers of the time could maintain contact with nature. The importance of nature for psychological well-being was reflected in religious complexes such as monasteries, where each had its own Marian Garden where its inhabitants could go to contemplate. And not only that. Even the hospitals that were being built had as an integral part of them a garden or park where the sick could look out or go for walks. Mansions had their parks, as did universities. Nature was considered a healer.

As was the case with its aestheticization, the Industrial Revolution and the twentieth century, when mankind was literally intoxicated by technological advances, brought a great change in this attitude. Nature was no longer given the same healing power as in the periods before and after.

Today, the positive and healing influence of nature on human physical and mental health is undeniable. Nature awakens positive emotions in us, we go to nature for health walks, running, cycling, praying, relaxing, meditating, resting. Philosophers cannot agree on the origin of the positive emotions that a walk in the woods or watching a documentary about the forest awakens in us. There are evolutionary theories that simplistically build on the assumption that we feel good in nature because we have lived in it for most of our evolution as a species. Then there are cultural theories, which are built on the notion that our relationship to nature is culturally learned by being raised to love nature and hate cities. The last theory is the emotional theory, which says that the positive emotions we have in nature can occur in any other place that will have the same positive qualities.

While all these theories are philosophically interesting, none of them is easily scientifically provable and therefore cannot be verified. They do, however, tell us much about the role of nature in human emotions. The very fact that several thinkers have devoted a great deal of their time (sometimes half their lives) to the question of where positive emotions come from in relation to nature shows that it was not only these people who considered this issue to be very fundamental and important in relation to human health.

A very important aspect of why we feel good in nature, why nature soothes us, is the green color it contains. The color of animals and all other objects is determined by reflected light, the wavelengths that are left over after reflection and are reflected and perceived by our eyes. In trees, this is green. In the leaves, light is transformed by the action of chlorophyll, and if the leaves did not use it completely, there would hardly be anything left – in which case the forest would be as black in the daytime as it is in the dead of night. Chlorophyll cannot work with this part of the color spectrum and so reflects it back untouched. Thanks to this imperfection, we can see the remnants of photosynthesis. This is why almost the entire plant kingdom presents itself to us in lush green, which is a waste of light that trees cannot need. It is beautiful to us, but worthless to the forest.

Green is the predominant color of forests. But what does the green color mean according to color psychology? The traditional idea is that green signifies harmony, growth, renewal. It focuses people inward and calms them down. Respondents to Veronika Versova’s research for her bachelor's thesis associate green with the following emotions: movement, joy, zest for life, hope, life, energy, calm, balance, renewal, revival, growth. In my search for available resources, I did not find a single mention of the negative effects of green.

Whether we love nature because it is ingrained in us by evolution or by culture, it is an undeniable fact that the green color of nature, i.e., forests, trees, bushes, and herbs, calms us and therefore has a healing effect on our psyche and emotions.

The non-material benefits people obtain from ecosystems are called '**cultural services**´. They include aesthetic inspiration, cultural identity, sense of home, and spiritual experience related to the natural environment. Typically, opportunities for tourism and for recreation are also considered within the group. Cultural services are deeply interconnected with each other and often connected to provisioning and regulating services: small scale fishing is not only about food and income, but also about fishers' way of life. In many situations, cultural services are among the most important values people associate with Nature – it is therefore critical to understand them.

Recreation and mental and physical health
Nature-based opportunities for recreation play an important role in maintaining mental and physical health, e.g., walking and playing sports in parks and urban green spaces. Forests can host a wide range of sportive activities such as mountain biking.

Tourism
Enjoyment of nature attracts millions of travelers worldwide. This cultural ecosystem service includes both benefits to visitors and income opportunities for nature tourism service providers.

Tourism in forests is now an important aspect to take into consideration when planning forest management. Tourism revenues can often bring an incentive for sustainable forest management.

Aesthetic appreciation and inspiration for culture, art, and design
Animals, plants, and ecosystems have been the source of inspiration for much of our arts, culture, and design; they increasingly inspire science as well. Forests have inspired the development of many technologies such as the one to help capture rainwater in cities.

Spiritual experience and sense of place
Nature is a common element in most major religions. Natural heritage, spiritual sense of belonging, traditional knowledge, and associated customs are important for creating a sense of belonging.

Nature and wildlife have always had a part in ancient cultures hosting good and bad spirits. And connected to forests and nature, there is Estonian Indigenous Religion; literally: faith of Earth, faith of the Land, where people worship at sacred groves.

Regulating services | Ecosystem Services & Biodiversity (ESB) | Food and Agriculture Organization of the United Nations (fao.org)

2.8. Architecture of the forest and its space.

Architecture of the forest and its spaces

Nature itself is the best architect we can hire. The main process it works with is the so-called succession. This is a development that follows the laws of nature for the conditions and allows bare ground (which is unnatural in the landscape with few exceptions) to gradually transform into a nourishing long-lived forest. Different strategies of natural succession exist for different places. In our temperate climate, succession is typically carried out in the following steps: the bare soil is covered with annual plants, which protect it from drying out and enrich it with nutrients as it decomposes. It also creates a suitable environment for the first undemanding insects and other little animals which settle in the soul. When the soil has healed, natural succession sends perennial herbs and grasses into place, which will further strengthen the soil with their roots and cover it completely. At this stage, the more delicate insect species also return and further fertilize the soil. The next step in succession is when the soil is rich enough to support shrubs and seedlings of easily germinated trees brought in by the wind or by birds. Then we have a short-rotation forest of fast-growing trees such as birches. And the final stage is the long-lived forest where the forest humus is so fertile and suitable that even hardy and resistant trees such as oaks and beeches grow and thrive. The different stages of succession are intertwined and last for different lengths of time. However, we can say that without human intervention, it can take many decades or even hundreds of years to go from bare fields to long-lived forest. And none of us have that kind of time. So, nature really is the best architect, knowing what it is doing, but it is very expensive. It is paid by time.

Basic spatial relationships in the forest:

- Vertical structure. Forests typically have a vertical structure with different vegetation levels such as tree level, shrub level, herb level and undergrowth level. Each tier plays a specific role in the ecosystem, and interactions between the tiers affect species distribution, lighting, and nutrient supply.
- Horizontal structure. Horizontal structure involves the arrangement of different habitat types in a forest. These may include wetlands, meadows, vernal pools, slopes, hillsides, and others. Different habitats provide different conditions for plants and animals.
- Corridors and mobility. Natural corridors, such as rivers, streams, and roads, serve as links between different parts of the forest. This can allow for animal movement, seed dispersal, and genetic exchange between populations.
- Zones of stability and change. Forests can also contain different zones of stability and change. Stable zones, such as old-growth forests, serve as refugia for many species.

Zones of change, such as logging or natural disturbance, in turn create new habitats and promote regeneration.

Within the forest architecture, we can identify different zones with different ecological functions, such as zones for bird nesting, zones for pollinators, zones for regeneration, etc.

Forest architecture is not just about the arrangement of physical elements, but about the creation of experiences. It is a balanced and respectful approach to creating a space that preserves the beauty of the natural world while serving our needs. Forest architecture connects nature and people.

To live to see our dream forest at least in a few units of years or decades, we need to learn as much as possible from nature and make her job easier. We need to work with the space so that ideally, we skip or shorten the stages of succession. And certainly not sabotaging the process by disregarding the basic laws of nature (such as planting wetland trees in a dry landscape.

So, to immerse oneself in the role of an architect and help nature a little, one must first sit down, look at a site plan and piece it together into a functional architectural design. We need to consider our vision and what we think the land should look like. We have already discussed this in earlier chapters.

Once we have our central vision, we should choose the specific trees, shrubs, and herbs that we will plant. It is a good idea to choose native European species and, if possible, avoid invasive species that may do more harm than good in the future. We should then know which of our favorites are suitable for which habitats. Whether they need sun or rather shade, whether they need drier soils or moist soils, the pH of the soil, how tall they will eventually be and how deep their roots will be. For herbs and grasses, we recommend considering the natural composition of the meadows in the area and the presence of animals that you will encourage to live there. You can also incorporate various other important landscape features such as pools into your woodland.

Depending on the species you choose, make sure that you also plant trees and shrubs far enough apart so that they get plenty of sun. This also involves respecting the position of the plot according to its cardinal points.

If we follow these basic principles (which we will elaborate on later), we can create a breathtaking and lively space. Landscape architecture will help us and save us a lot of time when we would have to wait for natural regeneration through natural succession.

2.9. Values.

In the previous section, we discussed the goals that drive owners to establish an enclave of life. These are the individual goals of a given landowner; in simplified terms we can say the importance to the person. We will now look more closely at what values and particular aspects our enclave of life should encompass and reflect in terms of nature itself.

Our vision is not to create an enclave of life just according to what we personally think would be best, but according to the environment, the local community and other factors that are also worth reflecting on. This will allow us to create a functional ecosystem that is supported by the people of the area, meets the demands of diversity and ecology, has a high aesthetic value that evokes positive emotions and perfectly complements the space around it.

But nature is a value itself. "Nature existed without the human element, but it was not humanized nature. Man entering this world with human needs transforms this real world into a world of human values. Man, with his needs, begins to transform nature, but after or during the transformation process, not only another reality comes into being. Man tries to create, by his active activity, a qualitatively new reality that has value for him in terms of human needs. It is, in fact, a reality with which man is connected by his value attitudes. Man is therefore the agent who transforms reality into one that is meaningful to him. A dehumanized nature is very difficult to create, and it is not our vision either.

Let us look at the values nature has in and of itself. We can reflect on them and see that they are equally important for us humans.

2.10. Community.

In Central Europe, which has a high population density, it is very difficult to privately own a piece of land that is completely isolated and there are no neighbors for miles around. You won't find such a landscape in the Czech Republic; you would have to look in sparsely populated northern Canada or Siberia. Our forest, our enclave of life, will therefore always influence the community of local people who live in the area.

We dare say (in accordance with our own and many other people's experience) that the creation of enclaves of life is always welcomed by society. People are glad that their environment is being improved and that they have such a nice view of a green pastoral forest rather than endless arid fields.

Yet aesthetic value is far from the only or even the most important thing that local communities appreciate about the creation of enclaves of life. Many people value trees as

protection from the wind and from the heat of summer. Czech society is also becoming increasingly aware of the negative consequences of the use of chemicals in agriculture on our health and is therefore glad for every place where they are being phased out. By planting trees on your property, you can protect your neighbors from flooding or, in turn, return water to their wells over time. People don't like the monoculture landscape that dominates the country. They like to go to green forests and wander through healthy, diverse nature, not green deserts.

If you decide to create an enclave of life on your land and improve a piece of the landscape, you can be sure that the local people will support you. If you present your idea to the people around you and explain what it is and how your enclave will benefit everyone around you, they will certainly offer to help you. So, you don't have to be alone in your project if you don't want to. In the initial stages of establishing a healthy forest, an extra pair of hands is a big help.

Community involvement is therefore beneficial for all parties. As can be seen from the growing popularity of various neighborhood or community facilities around the world and in the Czech Republic, this type of management is becoming very popular and functional. We can name community gardens on housing estates, composting plants where people take their bio-waste and in return can get fresh, nutritious soil for flowers on their balconies, or community parks with relaxation zones.

2.11. Conclusions.

In this chapter, we have presented the basic characteristics of the enclave of life we want to create. We have shown what it could look like, how to get started, and what to keep in mind when setting it up. A large part of this chapter was also devoted to the values that an enclave of life represents. It is our values and our goals that allow us to carry out such a project as transforming a piece of inhospitable landscape into an enclave of life.

It is clear from what was written above that a precise and unambiguous guide to creating a biodiverse part of nature is very difficult to produce. This is because each such part may be created for a different purpose and with a different owner's intention. And that is the magic of working with nature. However, we can precisely describe the rules and principles that we should follow if we want to approach this subject according to the laws, not only of man, but especially of nature.

In the following chapters we will therefore look specifically at the essential aspects and steps in creating **AN ENCLAVE OF LIFE.**

3. Two ways to think about the forest.

After all the thinking and discussion about living in forest enclaves, we have two starting points, sometimes both at once – the forest or the dream of the forest. We borrow the idea of a labyrinth, in the centre of which we await understanding and solutions, in short, a treasure.

Often, after all, we stand at one gate of the labyrinth, and somewhere inside is hidden the mystery of what it might look like as an enclave of life, as something more alive in a poor, or just a farm forest, or even among fields and meadows. We have a forest, a piece of land, and that's why we got into thinking about the forest in the first place, but which way?

3.1. How to approach my land.

The first situation, as the stories in Chapter 7 suggest, is that somehow, we happen to oversee this piece of forest or other land and suddenly we stop and think that we don't actually want just any ordinary forest. And we look for possibilities. Not just technical ones, but ideas of what to work towards. We gather insights, experiences, stories. We're looking for information, rules, laws. We think about whether to let something grow or to interfere, we talk to people - foresters, neighbours, experts, and the paths through the labyrinth become more and more winding. We look for inspiration and formulate our expectations of what we want the forest to look like.

3.2. How to make my dream come true.

From the second gate of the imaginary labyrinth, on the other hand, we can clearly see our dream of a forest, a piece of the world that we know what it should look like, but we are still looking for that place, or we have already found it, and that is why we are leafing through

this guidebook, but we do not know which way to go to reach our dream enclave, or to what extent we have to adapt it to the very piece of land that we have chosen to materialize our dream and idea of an enclave of living or other forest.

3.3. What can I do with what I have.

Whichever gate you stand at, finding your way to the center is possible. We have prepared a living diagram in orgpad (https://orgpad.com/s/RA52Xgcp9rq) to help you do so.

4. Forest and Law.

4.1. What is forest – definition and terminology.

Every forest owner, or a person who is considering buying a forest, should know the basic legislative rules related to forest management, which are listed in the Forest Act (Act No. 289/1995 Coll. on Forests and amendments and additions to certain acts). This Act was issued to determine the prerequisites for the preservation, care and restoration of forests as a national heritage, which constitute an irreplaceable component of the environment, for the fulfilment of all their functions and for the promotion of sustainable forest management.

The word 'forest' can have several meanings, depending on whether its definition is explained to us by a geography teacher, a forester or an official of a state forestry authority. In the Forestry Act, forest is understood as a collection of forest stands, including their environment and the land on which the forest is located - we call it land designated for forest functions (PUPFL). The term forest functions refer to all the benefits provided by the forest, both productive and non-productive (e.g., water management, soil protection, ecological stabilization, recreation, etc.).

Most forest owners manage their forests according to a forest management plan (FMP) or a forest management outline (FMO), depending on the area of the forest property. Forest management joins activities that ensure the fulfilment of forest functions - the forest must be restored after logging, i.e., a new forest stand must be established. The new forest stand can be created by artificial regeneration, where the clearing is reforested by hand planting, or we can work with natural regeneration, where the new stand is created from the seeds of standing trees from surrounding stands. The afforestation phase is followed by the forest protection phase, in which the forest owner tries to minimize the impact of harmful factors such as drought, wind, frost, fires, insect pests, immissions, etc. Animals have always been and will always be an integral part of forest ecosystems and they also cause damage to forest crops, either by eating young trees or by biting, peeling, and stripping bark. Forest

stands need to be nurtured during their early stages of growth, maturation, and ageing, i.e., the number of trees per hectare needs to be reduced so that the tree individuals have sufficient canopy space, sufficient light and sufficient nutrients in the soil, which are more quickly depleted when more individuals per hectare compete.

The Forest Act operates with the concepts of Afforestation and Securing of forest stands. The concept of afforestation has already been explained in the previous text. Unless otherwise specified, the stand must be afforested within two years of the creation of the clearing. Securing of a forest stand is defined as achieving a stand condition where intensive protection against biotic and abiotic factors (e.g., protection of trees against wildlife) is not needed, while the number of individuals and their distribution and the species composition of the trees in the stand provide the conditions for the establishment of a habitat-suitable forest.

In the forest, we distinguish between pre-clearance and clearance logging. Both can be differentiated into intentional and accidental logging. Pre-clearance intentional logging is implemented for the purpose of stand development, where the objective of the logging intervention is to remove a certain percentage or number of individuals in the stand. Intentional clearance logging is performed for the purpose of renewing the stand. After the implementation of intentional clearance logging, a clearing or so-called thinning is created, where most of the clearing trees have already been harvested, or the stand has been reduced.

Due to the influence of damaging agents, the forest may be subject to felling, tree damage by insects, snow, or frost. In such cases, we are unable to grow our forest to the target clearing age, or clearing dimensions and we must harvest these trees to prevent the spread of pathogens. In forests, we may also see exceptional logging. It is mandated by the state forestry authority, it is conditioned by a permit or order, and it is usually in case when a road or highway is to be built in our forest; or if our forest threatens the safety and health of neighboring landowners. In the event of a widespread fire risk, the state forestry authority may also order us to clear-cut firebreaks to reduce the risk of fire starting and spreading.

Each piece of forest can be classified into several spatial units so that our forest can be accurately identified on the ground. The basic unit of forest spatial organization is the stand or stand group, which is defined by one or more stages (tree layers). These are merged into divisions; divisions are merged into compartments. For example, our forest plot may be labelled as follows: 250Ca10. The number 250 is the designation for the compartment, the capital letter 'C' indicates the division, the lower-case letter 'a' indicates the stand, and finally '10' is the designation for the stand group. The number 10 at the end of this forest spatial unit (JPRL) indicates that our forest is between 90 and 100 years old.

The superstructure unit, over the JPRL, is the Natural Forest Area (PLO), which defines continuous areas with similar growing conditions for the forest, due to similar annual rainfall, similar annual temperatures, but also similar subsoil, similar prevailing bedrock, and landscape relief. There are 41 natural forest areas in the Czech Republic. For comparison, Krkonoše PLO occurs on acidic rocks at the highest altitudes in the Czech Republic, with spruce, fir, and cranes as the dominant tree species; annual precipitation and total snow cover are the highest in the Czech Republic. On the other hand, the České středohoří PLO is characterized by basalt piles with steep slopes on fertile habitats, where the most serious factor and threat to forest cultivation is the undesirable ground vegetation component, and on the southern slopes the threat of drought.

Have you ever heard of the term management unit? This term refers to units of differentiation in forest management that are related to natural forest areas and are characterized by their functional focus, natural conditions, and the condition of the forest stands. To put this into perspective: the target management unit is a combination of two numbers, where the first digit gives us an approximate range of elevations or forest vegetation stages, and the second digit gives us trophicity (habitat viability). Thus, the first digit is defined for lower, middle, higher or mountain positions. The second digit may indicate habitats that are exposed, acidic, fertile, charred (temporarily affected by water) or waterlogged (permanently affected by water). For example, CHS 25 denotes nutrient habitats of lower elevations. CHS 73 refers to acidic habitats of high altitudes and so on.

Even a forest landowner without a forestry background can deduce how to manage a forest by consulting the management guidelines for the various management units.

PUPFL. Land intended for forest functions – in Czech language known under the abbreviation PUPFL - is defined in the Forest Act for: Land with forest stands, land that has been cleared for logging and is awaiting reforestation, as well as forest clearings and unpaved forest paths up to 4 meters wide, and all land that used to be forest but has been temporarily removed due to a decision of the state forest administration.

´Paved forest paths, small water areas and other areas, land above the upper limit of tree vegetation, excluding built-up land and its access roads, forest pastures and game fields, if they are not part of the agricultural land fund and if they are related to the forest or serve forest management (hereinafter referred to as 'other land'). The state forest administration authority may order that these lands be designated as land intended for the performance of forest functions. ´

However, nurseries and plantations of forest trees are not included in land intended for forest functions, unless they are established on PUPFL land. This is a matter for the state forestry authority to decide and the inclusion of such land in PUPFL is not automatic. The

state forest administration authority also decides on other disputable cases at the request of the forest owner or of its own free will.

4.2. Categories of land and ownership.

4.2.1. Basic differentiation in Czech Republic

Forests are divided into three categories according to their predominant functions:

- Protective forests
- Special purpose forests
- Commercial forests.

Protective forests include:

- Forests located in extremely unfavorable habitats, such as debris, rocky seas, steep slopes, ravines, unstable alluvial deposits and sands, dumps and other habitats which, by their nature, do not allow the growth of quality forests.
- High altitude forests below the tree line, protecting lower elevation forests and forests on exposed ridges. In these areas, we will always have problems with snow, ice and wind damage, short growing seasons, and lack of nutrients.
- Forests in the dwarf forest vegetation stage.

As in other cases, the state forestry authority decides whether to classify forests in this category at the request of the owner or on its own initiative.

Special purpose forests are defined for forests that are:

- in the sanitary protection zones of water sources of the first degree,
- in the protection zones of sources of natural medicinal and table mineral waters,
- on the territory of national parks and national nature reserves.

The above subcategories of special purpose forests are defined "by law". As in other cases, the state forest administration authority may, on its own initiative or at the request of the forest owner, classify forests into the following subcategories:

- in the first zones of protected landscape areas and forests in nature reserves, national nature monuments and natural monuments,
- spa forests,
- suburban and other forests with increased recreational function,
- forests used for forestry research and forestry education,
- forests with an enhanced soil-protective, water-protective, climatic or landscape function,
- forests necessary for the conservation of biodiversity,

- forests in recognized game fields and independent pheasant farms,
- where other important public interests require a different management approach.

Commercial forests are forests which are not included in the above categories or subcategories.

Forests under the influence of immissions

Forests under the influence of immissions are classified into four risk zones. The risk zones are regulated by the Ministry of Agriculture by law. If your forest is under the lowest immission load, then it is in Risk Zone D. As the intensity of immission increases, or as the damage leading to stand decay increases, the zones are arranged in ascending order in zones D, C, B, A. The highest parts of the ridges of the Krušné and Jizerské hory mountains, where the forests were synergistically damaged by the action of power plants (non sulphur free) in combination with acid rain, leading to the disintegration of these forests, were for long time ranked immition Risk Zone A. These stands have been replaced by substitute tree stands which were more tolerant to the effects of the immisions. Fortunately, after several decades the immission situation in Czech Republic has improved and therefore most of the forests in the Czech Republic are classified in the lowest danger zone – zone D.

4.2.2. Who owns the forests in Czech Republic?

According to the latest Green Report (Report on the State of the Forest and Forest Management of the Czech Republic in 2021), the ownership structure of forests in the Czech Republic is following:

Vlastnické vztahy v lesích ČR (ha, %)

Vlastnictví		Porostní plocha	
		(ha)	%
Státní lesy		1 406 841	53,79
z toho	LČR	1 161 335	44,40
	VLS	123 024	4,70
	lesy MŽP (NP)	95 484	3,65
	krajské lesy (střední školy aj.)	2 370	0,09
	ostatní	23 055	0,88
	lesy MŽP (AOPK)	1 572	0,06
Právnické osoby		88 969	3,40
Obecní a městské lesy		449 193	17,18
Lesy církevní a náboženských společností		139 001	5,31
Lesní družstva a společnosti		31 103	1,19
Lesy ve vlastnictví fyzických osob		500 110	19,12
Ostatní (nezařazené) lesy		162	0,01
Celkem		2 615 378	100,00

Poznámka: *Údaje uváděné v tabulce vychází z dat lesních hospodářských plánů dostupných v informačním a datovém centru ÚHÚL k 31. 12. 2021.*
Pramen: *ÚHÚL*

4.2.3. Regulations for afforestation and forest planning.

Regional forest development plans (OPRLs in Czech) are a methodological instrument of state forestry policy, aimed at recommending principles of forest management. The elaboration of regional forest development plans is commissioned, and draft regional forest development plans are approved by the Ministry. OPRLs are prepared for individual natural forest areas. The OPRLs are prepared by the individual branches of the Institute for Forest Management (UHUL in Czech) in whose jurisdiction the natural forest area is located. The costs of preparing the OPRL are covered by the State. All details of the contracting or approval of these plans are governed by binding regulations published by the relevant ministry. (Forest Law)

4.2.4. Forest management.

Forest management plans (FMPs, LHPs in Czech)

The Forest Management Plan (FMP, LMP in Czech) is the forest owner's instrument according to which the owner manages the forest. LHPs are normally drawn up for a period of 10 years for forests of no more than 20 000 ha (= the area of one Forest Management Unit). If the LHP has been approved for a legal or natural person, then it is the responsibility of that person to comply with its binding provisions, i.e., the maximum total amount of harvesting and the minimum proportion of ameliorative and reinforcing trees in reforestation. In the case of state-owned forests, it is also necessary to comply with the minimum area of maintenance logging in stands up to 50 years of age. In addition to the mandatory requirements, the LHP also contains recommendatory measures for the owner's consideration. As the planting of amelioration and strengthening trees is a relatively costly affair, the State contributes to the partial payment of these costs. LHPs are usually prepared for forest estates of 50 hectares. The LHP includes a text section, a management book and forestry maps. The cost of the LHP is borne by the forest owner with the condition that if the forest owner agrees to register all the information resulting from his LHP for the purposes of registration and control of the SSL, then he may be granted a subsidy from the state of approximately CZK 400/ha. LHPs are prepared by private offices that are licensed to prepare LHPs and LHOs. The license is granted only to individuals and legal entities that graduated in Forest Engineering and have 10 years of experience in forest management.

Forest management guidelines (FMGs, LHOs in Czech)

The state forest management authority commissions forest management guidelines for forest owners with an area of up to 50 hectares. LHOs are prepared for a period of 10 years for the so-called establishment districts (in the case of LHPs, forest management units).

Individuals and legal entities and forest owners up to 50 hectares could comment on the preparation of LHOs within the time limit that is published with the intention to prepare LHOs by the state forest administration. The costs of the LHO are covered by the state. Unlike the LHP, the LHO is an instrument of state forestry policy, not an instrument of the forest owner. LHOs are also prepared by specialized offices. For a forest owner of up to 3 hectares who takes over the LHO by protocol, the maximum total amount of harvesting becomes a mandatory clause of the LHO. For a forest owner over 3 hectares who takes it over by protocol, the minimum proportion of ameliorative and reinforcing trees in the regeneration of the stand becomes a mandatory clause of the LHO in addition to the maximum total amount of harvesting.

If anyone wishes to comment on the content of the LHP or LHO, they may do so before it is approved. This applies both to forest owners and to natural and legal persons whose interests or obligations could be restricted or impaired by the LHP or LHO. Comments on LHPs and LHOs may always be submitted no later than the deadline set by the approving authority of the state forest administration.

4.2.5. Restoration and improvement of forest stands.

Forest ownership implies many obligations that the forest owner must unconditionally respect.

The forest owner must consider the possible combinations of transfer of planting material between different provenance areas, between different natural forest areas and between forest vegetation stages. It is therefore not possible to use planting material of pine from the Polabí region and use it for afforestation of high mountain areas in the Moravian-Silesian Beskydy. Neither the vertical nor the horizontal transfer rule would be respected. This planting material would probably not have survived the first winter on the peaks of the Beskydy Mountains, and if it had, it would most likely have been destroyed by frost or snow sooner or later. The forest owner must therefore use site-appropriate tree species, mixtures of tree species, use planting material of ideally the best phenotypic classification, and always document the accompanying certificates of origin of the planting material. The general objective of the forest owner and of society, which considers forests a national treasure, is to increase resilience and improve the performance of forest functions.

The size of the clearing in case of intentional clearance logging shall not exceed 1 ha and its width shall not reach twice the height of the stand, or even 1 stand height in the case of stands on exposed management files. If the forest owner needs to clear the residue up to 1 ha, then the width of the cut is not limited. The forest owner can apply to the state forestry authority for an exemption from the maximum size and width of the clearing, namely on

target management unit 13 (= natural pine habitats – pine is a sunny tree and needs sufficient sunlight for proper growth and development) and on inaccessible mountain slopes (here there is an economic justification, when it takes two days to build a forest cableway and no one will build it there for just a few raw logs - however, these must not be exposed management units). In both cases, an exemption can be granted for a clearing size of up to 2 hectares.

A total clearing management must not be implemented in extremely unfavorable habitats and in protection forests - here, screening, and selected felling are preferred.

In forestry terminology, we encounter the term 'stunting' - this is the proportion of the actual and the charted stock of the stand, or the proportion of the actual and the charted circular stock. The circular count base is calculated as the sum of the circular count bases of the individual trees in the stand - we can think of it as the sum of the perpendicular projections of the areas of the circles, which are drawn at a height of 1.3 meters above the ground for each tree. Stunting is a dimensionless unit usually taking a value between 0 and 10, this number can also take a value above 10 in dense stands. At a value of 10, we speak of full stunting. The stunting value must not fall below 7 in the case of pre-clearance intentional logging, unless it is a clearing operation to promote natural regeneration, or in the case of stand fortification.

A total clearing shall not be assigned to immediately surrounding young stands, irrespective of forest ownership, if the total size exceeds 1 or up to 2 hectares (see above).

What land should be afforested according to the regulations?
All clearings within two years of creation. Stands on these clearings should be planted within 7 years of the creation of the clearing.

When is agricultural land available? Establishing of a forest stand on an agriculture land.
When establishing a forest stand on agricultural land using the financial contribution, it is recommended to follow the Methodological Recommendation for applicants for subsidies from Rural Development Program – Afforestation of agricultural land, which is available on the website www.uhul.cz/poradenstvi/Evropskedotace. The actual afforestation project is in cooperation with a professional forester. Further steps follow, from the comments of the public authorities concerned to the issuance of a decision on the change of land use by the Construction Authority. The procedure involves many steps, which the local authority or the branch of the UHÚL can help with. When establishing a forest plantation on agricultural land without using the financial contribution, it is advisable to first consult the local authority, as only if your project is in line with the municipality's land-use plan can points 4 and 8-15 of

the above-mentioned Methodology be dealt with. Once your land has been declared PUPFL by the SSL (chap. 1), the obligations relating to reforestation and rearing will apply.

Can an old orchard be turned into a forest?

You need to apply to the cadastral office or the state forestry authority for a change of functional use of the land.

Changes to entries in the Land Registry in connection with afforestation

If agricultural land is declared by the state forest administration authority to be land intended for forest functions, the land type will also be changed in the land register, which is processed by the locally competent cadastral office.

4.2.6. Support of afforestation

The state supports forest management, either through financial support to forest owners or through the providing of services.

Indirect support

Not subject to tax:

- Forest land on which protection forests and special purpose forests are located.

Exemptions:

- land intended for the performance of forest functions on which there are economic forests subject to immission, classified in the two highest risk zones,

Direct entitled (from the national budget)

- The right to compensation for damage resulting from restrictions on forest management against the state administration authority that decided on such restrictions.
- Compensation for forest damage.
- Regional forest development plans (ÚHÚL).
- Partial reimbursement of the increased costs of planting ameliorative and reinforcing trees.
- Forest management guidelines.
- Amelioration and damming of streams – public interest.
- Refund of increased costs of management in protection forests and special purpose forests.
- Expert forestry manager.

Direct non-entitled

A) from the national budget

Subsidies for forest management for:

a) ecological and nature-friendly technologies in forest management (horse, iron cableway),
b) restoration, securing and cultivation of forest stands up to 40 years of age,
c) increasing the proportion of ameliorative and reinforcing trees,
d) measures to restore forests damaged by immissions and forests declining due to anthropogenic influences,
e) measures to restore stands with inappropriate or alternative tree composition (reconstruction or conversion of stands),
f) afforestation measures in mountain areas,
g) forest protection (rehabilitation),
h) measures to ensure the non-productive functions of the forest,
i) measures to ensure against forest insect pests and measures in the event of other exceptional circumstances and unforeseeable damage threatening the state of the forest beyond the forest owner's capabilities,
j) support for forest owners' associations and support for the management of small-scale owners' associated forests,
k) drawing up plans (LHP) on condition that the plan data is provided in digital form for the needs of the state forest administration (max CZK 300/ha),
l) managing the consequences of exceptional circumstances and unforeseen damage to forests.

Services provided to forest owners:

- large-scale protection of forests against insect pests,
- large-scale chemical amelioration and fertilisation of forests,
- forest fire prevention and protection,
- control of mosquitoes on land intended for forest functions in places where the sanitary service authorities confirm their imminent calamity occurrence,
- monitoring and forecasting the occurrence and development of harmful agents,
- advisory activities and raising the professional level of forest owners and professional forest managers.

Subsidies for selected game management activities.
Subsidies to mitigate the effects of the bark beetle calamity.
Subsidies for the protection and reproduction of the forest tree gene pool.
Green diesel = entitlement to refund of part of the excise duty on mineral oils demonstrably consumed for primary agricultural production.
Support Guarantee Fund for Agriculture and Forestry (PGRLF).

B) from the state budget - Ministry of the Environment
State Environmental Fund (SFŽP in Czech)
Landscape Care Program
Program to support the restoration of the natural functions of the landscape

C) Financial support from local government budgets (regions, municipalities)

D) Support from EU funds
Rural Development Program of the Czech Republic
Operational Program for the Environment

4.3. Where can I find the basic rules for managing a private forest.

Czech legislation regulating forestry is, according to some opinions, the strictest in Europe or even in the world, especially towards owners. We will not, however, elaborate here on how to navigate the maze of detailed regulations. This has already been done by specialists from the **Institute for Forest Management** (see: https://www.uhul.cz/portfolio/radce-vlastnika-lesa-a-metodicka-doporuceni/); moreover, they keep the materials up-to-date at the link provided, which is a major advantage over any one-off analysis. For answers to more complicated or detailed questions, links to other organizations and authorities dealing with the subject can be found at: https://www.uhul.cz/portfolio/odkazy/.

4.4. Supervisory authorities or who is watching us and who can help us.

Those who don't want to go through the laws and ordinances or the previous references (and those who do) should at least get to know two key people. There is an official at each **municipality with extended jurisdiction**, called an ORP (a list of ORPs with contacts is here: https://www.epusa.cz/index.php?zkratka=orp; a map is here: https://mapy.cz/turisticka?q=obvod%20obce%20s%20roz%C5%A1%C3%AD%C5%99enou%20p%C5%AFsobnost%C3%AD&x=15.6252330&y=49.8022514&z=8&base=ophoto)
who oversees the state's forest management agenda. From him/her you can get the forest management guidelines (description of the individual stands owned and basic instructions on what to do with them) and find out the contacts of **professional forest managers** working in the area. The most common forest managers are the Forestry Inspectors of the Czech Republic. You can find out which one is responsible for your forest here: https://lesycr.cz/mapa-lesnich-pozemku-a-vodnich-toku/. You can also choose your own professional forester. The only condition is that they must be certified; however, if you choose one of your own, you will have to pay for the costs of their work yourself.

We strongly recommend that you get to know both the "state forest authority" and the professional forester as soon as possible. You will not be able to avoid them in the future anyway, and by consulting them early you can avoid many inconveniences, especially if you are planning non-standard forest uses (which are the majority in this manual). Both should know the answers to the most common questions and be able to find out the answers to the less common ones. Fundamentally, they can help you in the field of legislation: they should know what your rights, options and obligations are, whether your forest is subject to any of the special regimes (nature conservation, military, hunting, extremely unfavorable habitats, various protection zones, etc.), what these regimes specifically mean, whether your plans are compatible with the particular land, whether they will require any exemptions, how to achieve them, etc.

4.5. Categories of forest from a different perspective.

Often, we look at the forest beyond the scale of laws and regulations and then we are looking at a scale between something native, untouched, and on the other hand something very human, serving. But even here it is not a simple line. We are just reconstructing the original forests, and in today's climate they would still look different. Forests close to settlements and systematically used looked different in prehistoric and medieval times than they do today, mountain forests are far from being pristine but have mostly been restored after being destroyed in the Middle Ages, large stands are on previously deforested parts of the landscape. Who is to know? Let us rather look for the story of the place we are interested in.

Primary forest

A native forest is a forest complex that has never been directly or indirectly (e.g., through emissions) affected by humans. These forests are more than a thousand years old. Such forests are only partially preserved in the equatorial zones of Africa or in the Siberian taiga. At present, only 'rainforests' are referred to, ignoring indirect human influence. Such forests can be found, for example, in the Bialowieza Forest, in the strict reserves of the Babi Mountains, or in the Bieszczady and high mountain forests of the Tatra Mountains in Poland. Primary, pristine, untouched by man forest, evolving to this day without the influence of human hand and reason in Central Europe, can therefore not be found, perhaps hidden fragments in very inaccessible places, but eventually even there the influence of man through hunting, grazing or other uses has reached. It is possible that small fragments of primary forest further developed without human influence will be found in the preserved forest complexes of central Europe or in mountain areas, but since even in the Belovezhskaya Forest hunting and mining have been going on since the Middle Ages, since

even in the Alps the forest boundary has been reduced by grazing since antiquity in most areas, virgin forest is simply not a direct inspiration for the consideration of a forest enclave of another more lively forest in our landscape. But by understanding the processes we can come close.

Natural forest

Climax, natural = the final stage of successional forest (in which structure and flows become established) with a composition of woody and companion plant and animal species appropriate to the climatic and soil conditions of the site (in each area it represents the last link in phylogenetic development). It is also referred to as primary forest; in the Czech Republic only remnants in reserves (Boubínský prforest). Source: https://rumex.mendelu.cz/oryx/les_jako_ekosystem/

Natural forest = phytocenologically like the original climax forest in each habitat, with a changed structure. Most of our natural forests are close to the climax forest, but do not reach it due to logging. Source: https://rumex.mendelu.cz/oryx/les_jako_ekosystem/

Managed forest

A managed forest is a forest complex in which humans support natural processes and thus gain several benefits. Man uses, protects, and restores such forests. Forest ecosystems have a major impact on soil, climate, and water. If any of these aspects are more important and provide more benefits than the production of raw timber, such forests are called conservation forests. This is most forests in our territory, and even in them we can look for enclaves that honor natural processes, and these are also an inspiration, e.g., forest stands in university research projects (Křtiny, Klokočná and other sites).

Protected forest

Thanks to society's growing awareness of the value of forests, their protective role has become particularly evident in recent years. The protective function of forests is primarily concerned with their stability as ecosystems, which enables them to fulfil these functions at the highest level. As a group of plants, forests protect the soil from erosion, regulate water conditions, benefit air quality and are also a place for recreation. All these factors make a protective forest much more important to humans, sometimes even exceeding the material values resulting from the productive use of the forest. Protected forests are often multi-species and similar in structure to natural forests. As a result, they also have a high landscape value. In such complexes, economic management is modified by limiting cutting, increasing the age of felling or implementing recreational management. Despite the equal importance of the different functions of the forest, the leading function is the

production function, which enables the other functions to function properly through financing.

5. Natural and historical framework.

The natural conditions have been joined everywhere by variously distinct traces of earlier human activity. Every single place and the whole landscape are thus woven from these two sources: natural conditions and human activity. Both determine the limits of what is possible and the degree of effort that will be required if a place or land is to be modified and changed in any way. While we can learn a great deal about the broader context of the landscape and its surroundings from a variety of sources, in relation to a particular place we will usually be referred to observational talent and experience; whether our own or someone else's. One visit is never enough; we need to keep going back and noticing. Even so, a place is different every time, but there are features that do not change. Where does the snow melt earliest and latest? Where does the sunshine often and where hardly ever? Where do we keep our boots mud-free even though it hasn't rained in a week? Where does the grass stay green even in the driest summer? Where do nettles and sorrel grow, where blood-rush, where reeds, where ferns? Which trees seem to thrive here, and which don't? All this and much more will give us clues. Nevertheless, the search for a solution that harmonizes with the place, respects it and
makes use of its givenness is always more of an intuitive art than a mathematical equation.

5.1. Natural conditions.

Just like us, plants have life needs, even a plethora of them. It makes sense: plants are inherently much more connected to their environment than we are. Not only do they interact with each other, they literally interact with it and cannot go elsewhere. Moreover, the more "hardy" a plant is, or the longer it lives, the more important it is for it to withstand all the extremes it may encounter in each location, be it lack or excess of light, heat, water (including snow and ice), nutrients, wind speed, and finally, competition from other plants and the frequency of pests. Trees that can grow on a site over the long term can serve as one of the most accessible and best indicators of long-term site conditions.

As already mentioned, the conditions affecting plants are numerous. In order to simplify things, we will focus on more detail only on their needs, which change significantly over time and place.

It is these that determine what is possible in a particular place and how much effort it will take. So first we will try to look in more detail at the main needs of plants. This is no longer a simple task because they are all essentially interrelated. Each of the following subsections briefly outline the topic in the first paragraphs. In the last paragraph of each subchapter, you will find a signpost where you can find out more, either on the topic as such or in relation to a specific place.

5.1.1. Water.

Plants, animals, and us are cleverly assembled dust glued together by water. Water is usually quite available on Earth, which is why it makes up most of our bodies. It has several obscure properties that make it flow, usually downhill, and seem so soft that it seems to swallow anything that falls into it. But if we give it enough time, it can smooth or even grind even the toughest materials. In addition, it occasionally solidifies (from above!) and increases in volume so that it can tear rocks. It can dissolve and transport anything, not only salt or branches, but also large amounts of energy. Plants don't think much about any of this. What is more important to them is whether they have just the right amount of water for the moment and whether it contains everything they need in the right quantity (see section 5.1.3 for more on this). If we assume the conditions of the Czech Republic, we are basically fully dependent on rain. We are the watershed of Europe; no water comes to us, on the contrary, it all flows away. How much water runs off, how fast, and how much it takes with it is an interesting and important question, but we will not deal with it here. What matters for plants is both the usual availability of water in the soil and the extremes (dry or wet episodes and their duration). All these can be measured and classified in different ways. But basically, the point is that in most of our area, the annual rainfall totals and distribution are (at least for now) sufficient, and water is not something that determines the existence or non-existence of the usual tree species. In addition to this, most of the areas are places where water is difficult to obtain or, conversely, affected by its easy availability or surplus.

Accessing soil water has become much more common in the last 10 years than before. The main reasons are twofold: the gradual rise in temperatures (and higher evaporation) and the lower regularity of rainfall or the length of the rainfall-free period. This phenomenon must be considered in the future, given climate change forecasts. However, in the long term, soil water has been difficult to obtain in the Czech Republic in basically two types of habitats: either where it rains least (e.g., Hodonín, Žatecko), or where water soaks in or runs off quickly due to the geomorphology (shape and permeability) of the terrain (e.g., rock towns, table mountains, areas on sands or limestones). Trees indicative of these conditions are twisted pines and oaks, and possibly acacia trees. Readily available water may be in the soil intermittently (typically during spring thaw or heavy or prolonged rainfall) or for long periods of time. A sudden increase in water can be dangerous for plants because it reduces the availability of soil air, in which case the roots can drown in a very real sense. These events are rare, but they do happen. Long-term, readily available water is then again available where there is a geomorphological justification, such as impermeable subsoil preventing runoff or water rising naturally into the surroundings from reservoirs or watercourses. Typical trees for these conditions are willows, alders, poplars, or ash trees.

Easily available water can be in the soil either intermittently (typically during spring thaws or heavy or prolonged rainfall) or over a long period of time. A sudden increase in water can be dangerous for plants because it reduces the availability of soil air, and the roots can drown in a very real sense. These events are rare, but they do happen. Long-term, readily available water is then again available where there is a geomorphological justification, such as impermeable subsoil preventing runoff or water rising naturally into the surroundings from reservoirs or watercourses. Typical trees for these conditions are willows, alders, poplars, or ash trees. Specific environments dependent on sufficient water are peat bogs or periodically flooded floodplain forests. Water particularly shapes the root system of plants; where it is scarce, it tends to be strongly developed laterally and deeply. Where there is an 'excess' of water, it also affects the roots: roots do not usually penetrate groundwater, so plants root only shallowly, which can easily result in uprooting in woody plants. It seems that in the future, humidity may play a major role in addition to the availability of water in the soil. The Czech Hydrometeorological Institute (www.chmi.cz) monitors rainfall patterns. The soil water content or the current drought is monitored, for example, by CzechGlobe (www.intersucho.cz). The Research Institute of Water Management (https://heis.vuv.cz/) provides up-to-date information on watercourses, including their projection on maps. Each watercourse in the Czech Republic has its own manager, with whom it is advisable to consult.

5.1.2. Temperature.

Temperature is what both wakes and puts plants into hibernation; it also determines whether and how they will be able to make use of other environmental factors. This is because temperature is crucial for the rate of most chemical processes, including physiological reactions such as photosynthesis. Different plant species differ in their requirements for minimum and optimum temperatures for photosynthesis. The temperatures that we normally experience (say, between -20 °C and 35 °C) do not in themselves pose an existential threat to most of our plants (and trees in particular). However, this is true under two conditions: the temperature must vary continuously, and the plants must have sufficient access to water. That every plant has a range of temperatures in which it thrives and that sudden changes in temperature, such as late or early frosts, are not good for plants, is something we probably all know intuitively. Less well known is that even a pleasant 15 °C can be fatal for plants. This can happen, for example, if it is warm but the soil and water in it are still frozen; the needles or leaves are already transpiring (evaporating water), but the roots have no access to water to replace these losses. This often causes damage, especially to seedlings and saplings that do not root deeply enough. The difference in optimum temperatures for photosynthesis and the growth of different plant species, together with water availability, are the main reasons for the formation of vegetation belts. Both on Earth in the form of biomes (e.g., tropical rainforests, deserts, etc.) and on a smaller scale in the form of so-called vegetation stages. There are several subdivisions of vegetation stages in the Czech Republic; however, the most important features are summarized by the predominant "stand-forming tree species", i.e., the tree species that would dominate in a natural forest at a given location. And there are only three of these in our climate: oak, beech, and spruce. In this order, they also alternate from the lowlands to the mountains. In addition to the altitude itself, exposure, i.e., the availability of space for direct sunlight, also applies. This means a simple thing: the southern slopes warm up earlier and faster than all the others. As a matter of interest, the degree of south slope 'moves' the site one degree of latitude closer to the equator. The Czech Hydrometeorological Institute (www.chmi.cz) monitors temperatures in our country. As one of the most important characteristics of the environment, the long-term course of temperatures is an essential aspect (albeit indirect) for assigning a particular place to one of the classifications (forest typology for forest land: http://www.uhul.cz/nase-cinnost/lesnicka-typologie; classification of agricultural soils: https://bpej.vumop.cz/; climate classification according to Quitt (see the conclusion of Chapter 5.1.1).

5.1.3. Nutrition.

From nothing will come nothing again. Even plants need more than "just" water and air to grow. But unlike us, they can't go in search of nutrients, so they depend on what is available in the place where they find themselves. Plants differ in their need for different nutrients. Plant communities can therefore also tell us a lot about the substrate or history of the place

where they grow. Indeed, there are two ways in which nutrients enter the soil: either they are released by weathering of the bedrock or parent rock, or, less often, they reach the site by other means (by water washing in, wind drift, rainfall, or specific uses such as long-term animal housing, artificial fertilization, etc.). The parent rock and the age of the soil have a major influence on the physical and chemical properties of the resulting soil type and the availability of nutrients. Of the physical properties, the structure is crucial, i.e., the representation of particles (called fractions) of different sizes. Soil can be sandy (with a high proportion of sand grain-sized particles), clay (with a high proportion of microscopic particles), or loamy (something between sandy and loamy). Among the chemical properties, the availability of the main nutrients is important for plants. These are the ones that almost every fertilizer contains: nitrogen (N), phosphorus (P), and potassium (K). The other nutrients are either needed very little or are present in the environment in sufficient quantities. In our conditions, the scarcest nutrients are usually the basic elements, which are easily "washed out", i.e., carried away by water (in addition to potassium, calcium, and magnesium). Acidic quartz, on the other hand, is rarely absent, and even nitrogen and phosphorus are now much more available in the environment than ever before. This is due to the long-term intensive fertilization of these elements in agriculture and, in the case of nitrogen, to the development of transport and oil combustion. The richest (and most fertile) nutrient-rich soils in the Czech Republic are either in river basins, around the youngest mountains, or on sprays (material deposited from glacial moraines: South Moravia). These soils have usually been farmed for millennia because of their characteristics. Soils formed on sedimentary rocks (limestone, siltstones - most of Bohemia) have a medium nutrient content. The most nutrient-poor soils are those formed on the acidic bedrock of granite and similar rocks (rula, cobble, phyllite, siltstones - these form the bulk of the border mountains). Most of our native trees are more influenced by other factors than nutrient availability. However, they themselves can influence the amount, and especially the ratio, of nutrients in the soil over the long term. Where the influence of nutrients can make a major impact is in the character of the undergrowth. Specific plant communities are mainly associated with sites strongly influenced by calcium (i.e., karst areas and sites on limestone) and nitrogen (around arable land or pasture). In other cases, the influence of nutrients and substrates is much less obvious and often ambiguous. Soil and subsoil mapping is carried out by the Czech Geological Service (https://mapy.geology.cz/geo/), The Czech Geological Service (https://mapy.geology.cz/geo/) deals with soil and geological subsoil mapping, the basic crossroad is also available on the website of the Ministry of the Environment (https://www.mzp.cz/cz/pudni_mapy) , the aspect of the subsoil is also influenced by the aforementioned field classifications (forestry typologies - for forest land: http://www.uhul.cz/nase-cinnost/lesnicka-typologie; agricultural land classification for agricultural land: https://bpej.vumop. cz/). It is even more true for soils than for other factors that even directly adjacent places can differ significantly from each other. It will therefore be better to check the basic properties of the soil directly on the spot. This can be done by making a roll out of the soil and letting it dry. There are three main possibilities: the soil almost does not

stain the fingers, the roll cannot be formed, or it completely crumbles after drying. Then it is sandy soil, which tends to be poor in nutrients and dries out quickly. The soil stains with fingers, it is possible to create a roll, but it is not possible to shape it much further. It will crack after drying, but the parts will still hold together. It is clay soil; it usually has the best properties from a gardener's or farmer's point of view: it binds nutrients well and has optimal permeability for water and air. The soil strongly stains the fingers, the roll hardens as it dries, and holds together more or less completely. This is a clayey soil that dries out slowly and allows water to pass through only with difficulty and slowly.

5.1.4. Light.

So far, we have been talking about factors that are not changing so much in the long term, but the availability of light changes dynamically over time. This is both in relation to heat, i.e., the periodic change of day and night and the seasons, and to the evolution (so-called succession) of the site. Light and heat are indeed closely related; it is usually the case that light is followed by heat, or that the more intense light warms the soil surface, from which the air is then warmed (hence, for example, the hottest part of the year follows the summer solstice). But plants also need light directly; they literally feed on it. They need it for photosynthesis. In addition to temperature, light also helps control the internal clock of plants; by the length of illumination, the wavelength (i.e., color), and intensity of light, plants can distinguish not only morning from evening but also the seasons and prepare for the coming season. The periodic changes in light availability are a matter of being or not being for the herbaceous floor of forests, especially deciduous forests, in our conditions. Before the trees leaf out, there is a brief moment of full light enjoyment for ground plants called the spring aspect. It is in this window of time that they must have time to emerge and flower (e.g., spring bluebells, bear garlic, chokecherry, etc.). Later, they would not find enough light, so they make way for shade-tolerant summer aspect species. Most conifers do not drop their leaves, and therefore the undergrowth of coniferous forests is noticeably poorer. Even under solitary trees, there is less undergrowth than in a fully shaded area in the neighborhood. The development of a site is usually considered 'bare ground' for ease of reference. Whatever way it is created (by ploughing, forest harvesting, fire, bark beetle, etc.), again a short window of time opens, in this case of a few years at most. Light is now plentiful; on the other hand, other extreme conditions must be survived: extreme fluctuations in temperature and water availability. It is at this point that seeds already in the soil (from the so-called seed bank), seeds that have arrived, and even seedlings that we have brought in can be used. Anytime later, the competition is much higher, and it is much harder to get a foothold. In natural development, therefore, "accidents" play a major role (e.g., the course of rainfall and wind direction in a particular year, the distance of the site from fruiting plants of a suitable species, the mobility of seeds, the fact that large tree crops occur only once every few years, etc.). The fate of artificial plantings is determined by the intensity and

timing of human care. Light availability is generally determined by the costliness of the sun. The specific location is then influenced by exposure (southern slopes trap light more) or by shade-creating obstacles.

5.1.5. Biodiversity.

We know that biodiversity is essential for the functioning of the world, but we do not know why. It is generally stated that higher biodiversity means higher productivity or higher stability for the whole ecosystem. While this is often the case, sometimes it is not; it is certainly not a universal rule. So, rather than rational reasons, it is simply that we like it. On the subject, I think of the almost-classic "I'll be whatever you want" lyric: something like this is biodiversity for us humans. In some places, we consistently suppress it; in others, it takes on the role of a deity. The first approach is very familiar to most gardeners and farmers. Every "non-target entity" in the field, forest, or flower bed is an enemy, or at least a potential competitor, taking up space. On the other hand, sometimes in the name of biodiversity, places are left to develop spontaneously, where after decades or centuries of farming, it will be more likely that they will decay spontaneously and then almost be restored to their previous non-native state, only perhaps on a smaller area. Yet biodiversity is also of real importance to plants and to us, especially the almost invisible biodiversity. We are talking about molds, fungi, nematodes, bacteria, fungi, fungus gnats, ringworms, and similar, not very attractive vermin that healthy soil should contain. It is a world we are only just beginning to explore. I would be careful to see it only as harmonious, in solidarity, and cooperative. Rather, it will work a bit like our politics: even plants enter all sorts of coalitions with each other and with various microbes, especially fungi, in which it is usually a win-win deal, for example, by exchanging water and some elements (fungi) for sugars (plants). In any case, however, a properly revived soil with plenty of organic matter has a much better chance of supporting a plant than a sterile, i.e., dead, soil. Biodiversity, in the sense of diversity of plant and animal species, can be seen in a similar way. Here, too, there can be solidarity and cooperation (sharing water and nutrients by root growths between neighbors or "parent and child"), but we can also encounter pure killing struggles (e.g., It is more a question of what part of reality we want to see. In the matter of biodiversity, we need to start from the end, i.e., from setting targets, perhaps more than ever before. What do I want? If the goal is maximum production of some mass per unit time per unit area, logically there is not much room for biodiversity. If, on the other hand, biodiversity is the goal, it is good to ask further: of what and how much? The answer to this question is up to everyone. Progress toward more specific targets is elaborated in chapters 5.3.13 and 6.2.

For a better understanding of biodiversity, whether species, biotopes, or a specific site and its surroundings, it may be useful to consult the databases of the Agency for Nature Conservation and Landscape Protection of the Czech Republic (https://portal.nature.cz/),

use one of the mobile recognition or mapping applications (https://biolog.nature.cz/biolog/cz), or use one of the atlases dedicated to different taxonomic groups (mammals, plants, butterflies, beetles, etc.).

5.1.6. Typological classification of forest habitats

Forest typology is a scientific discipline that deals with the classification of permanent ecological conditions. For the forest owner, typology is not just a marginal issue - the average forester carries a typology map with him, good foresters can identify forest types based on natural conditions themselves. Forests can be divided into forest segments with similar growing conditions such as light, temperature, water regime, soil structure and chemistry, and elevation. A typological survey is also carried out regarding the herbaceous and shrub layer. Each forest herb or herb assemblage determines the characteristic features of a given habitat, from which the natural species composition and productivity of the habitat can be derived. For example, marsh marsh is characteristic of waterlogged soils, and juniper is an identifier of poor acidic habitat. Bramble and raspberry suggest that the habitat is fertile.

In the Czech Republic, the forest classification system has been in place for a long time. It is currently enshrined in Sections 5 and 6 of Decree 289/2018 Coll. on the preparation of forest management plans and the definition of management files. The Institute for Forest Management is involved in the survey of forest types, their refinement and updating. On the web portal of this organization (www.uhul.cz) it is possible to click on the typological map of the Czech Republic and find the specific position on the map that interests us.

How to learn how to read forest types, and by what are they distinguished?

The website https://www.uhul.cz/wp-content/uploads/tabulka-LT_2023_web_FIN.pdf shows an overview of all forest types (LT) and sets of forest types (SLT) found in the Czech Republic. A forest type group is a designation for a basic zonal unit, which is formed by merging vegetation stage and edaphic category. It is written with a two-digit code, where the first digit is 1 (0) to 10, which indicates the forest vegetation stage. The second position is indicated by the letter of the edaphic category. For example, the abbreviation 8K stands for acid spruce (8 = eighth forest vegetation stage = spruce, K = edaphic category acid). The forest type is a basic mapping unit expressing, in addition to the vegetation level and the edaphic category, the most common synosis of trees and phytocenoses. The forest type is indicated by a three-digit code. The last place of this code is normally occupied by the digits 0 to 7. The meaning of these numbers represents the following environments: 0 - anthropogenic, 1 - modal (typical), 2 - poorer, 3 - richer, 4 - drier, 5 - wetter, 6 - loamier, 7 - skeletal. For example, forest type 6M7 is called Acidic Spruce Beech Skeletal.

There are ten forest vegetation stages in the Czech Republic.
1. Oak
2. Beech
3. Oak
4. Beech
5. Hemlock
6. Spruce-Beech
7. Beech-Spruce
8. Spruce
9. Maple
10. Alpine

Individual forest vegetation stages differ from each other in the length of the growing season, annual rainfall, average annual temperature, altitude, and natural species composition. The dominant tree species in each forest vegetation stage is already embedded in the name of the vegetation stages. For the abbreviations SLT and LT, the first digit of the two- or three-digit code may be 0. This is the designation of pine communities and communities with a naturally high proportion of pine. Pine is therefore an azonal tree species - it has no fixed anchorage in any forest vegetation stage and can occur naturally in all forest vegetation stages in various forms.

The forest-typological system works with the following edaphic categories (EC), which are merged into ecological series (ES):

The ecological extreme series brings together the following edaphic categories:
X - basal dwarf
Z - dwarf
Y - skeletal

The ecological series acidic brings together the following edaphic categories:
M - lean
K - acidic
N - acidic stony
I - acid clay

The ecological series Nutritious brings together the following edaphic categories:
S - fresh
F - fresh stony
C - arid
B - rich
W - limestone

H - loamy

The humus-enriched ecological series brings together the following edaphic categories:
D - enriched
A - enriched stony
J - enriched skeletal

The water-enriched ecological series groups the following edaphic categories:
L - floodplain
U - alluvial
V - wet

The ecological series charred brings together the following edaphic categories:
O - oily fresh
P - charred acidic
Q - lean charred
The ecological series gloopy brings together the following edaphic categories:
G - gloopy
T - lean gley

The ecological series peat brings together the following edaphic categories:
R – peat

Why is forest typology important to us?

Forestry typology (LT) is an integral part of forest management plans and curricula. Forest owners manage according to it, define realistic operational and production objectives, and use a recommended tree species composition that reflects the conditions of the environment. The LT also serves as a support tool for forest valuation. If forest land is temporarily or permanently withdrawn by the State Forestry Administration, the forest owner is entitled to compensation (financial compensation), which is calculated based on the LT. The forest owner whose forest is to be withdrawn from the best habitat will receive higher financial compensation. For example, in the 2nd forest vegetation stage, according to Decree 441/2013 Coll. in Annex 6, the set of forest types 2D (edaphic category clay) is valued at a basic price of 7.33 CZK/m3, whereas in the dwarf edaphic category (2Z) the basic price is only 1.35 CZK/m3. Simply put, the 2S forest type set should have the best volume production of all forest type sets in the second forest vegetation stage. The LT also serves as a basis for the provision of forestry subsidies - whether for the approach of timber with the use of a cable car in steep ravines on unstable soils, or for the protection of crops on nutritious habitats, or for the promotion of ameliorative trees in areas with unfavorable soil chemistry. LT is also used in the assessment of forest ecosystems, their functions and in

research. LT is used as an essential criterion in determining the optimal species composition when establishing new stands. Finally, LT is used as a basis for management measures in areas with different levels of nature protection.

Forestry typology has a similar purpose in all European countries. It may differ due to the differentiation of climatic, soil and vegetation conditions, which are set differently in each country. Different conditions will be found in countries with a maritime climate, different conditions in countries with a continental climate.

There is also a unique large-scale global typological system describing 108 major ecosystem types. This typology should help to identify which ecosystem type is most important for the protection of nature and the environment, while also supporting those ecosystem services that are teetering on the brink of extinction. This system is known in Europe as the "IUCN Global Ecosystem Typology 2.0" In contrast to the forest-typological classification system, this system details non-forest, aquatic and arid ecosystems in addition to forest ecosystems.

5.1.7. Ecological classification of forests

When deciding on our forest and looking at it in terms of what to plant in our forest/non-forest, we can base our decisions on forest typology, i.e., on an assessment of what is best to grow in each place with respect to natural conditions and forest management. Or we can look at our site as an area for nature and focus on what would grow naturally without human intervention (potentially natural vegetation) or look at the distribution of communities in our forest according to the corresponding ecological conditions (biogeographical zonation).

Forestry typology

Forest typology is the basic discipline of forest management that deals with the classification of permanent ecological conditions. It divides forests into segments with similar growth conditions, evaluates these conditions and draws conclusions for appropriate forest management. Forest-typological mapping is enshrined in Sections 5 and 6 of Decree No 298/2018 Coll., on the preparation of forest management plans and the definition of management files. Forest-typological mapping involves assessing permanent environmental features (light, heat, water regime and soil chemistry) and reconstructing the natural composition of the plant community. The main output of forest typology is the forest typology map: https://geoportal.uhul.cz/mapy/MapyOprl.html

The forest typology serves as a basis for setting forest management measures, operational and production objectives through forest management plans and curricula. It has become even more important as it has also become the basis for the assessment of forest ecosystem

functions, forest valuation or the development of management plans for specially protected areas.

The forest-typological classification system is a complex table, which can be found one chapter above. Forest type (LT) = the lowest unit of differentiation of habitat growth conditions. Always a three-digit designation. Example designation for LT 2 (forest vegetation stage) S (edaphic category) 2 (according to permanent environmental features).

Details on forestry typology can be found in chapter 5.1.6.

Potentially natural vegetation

Potentially natural vegetation is an ecological concept that describes the state of vegetation in nature (landscape) that would be created if all human activity ceased (without subsequent human influence). The concept is based on current environmental conditions and respects all irreversible changes to the environment created by humans such as artificial water reservoirs, artificially exposed rock substrates, drained swamps, and alluvium.

The map of potential natural vegetation of the Czech Republic (Neuhäuslová et al. 1997, 1998, 2001) at a scale of 1 : 500 000 shows the types of vegetation that would exist in a particular place and natural or man-made habitat if man did not influence the vegetation. In most of the Czech Republic, forests are potential natural vegetation. The map of potential natural vegetation is a synthesis of all phytocenological, synecological and vegetation cartographic data on our vegetation, supplemented by long-term field revision. It contains 51 mapping units, mostly associations.

There are still possibilities to look at the land from the point of view of a reconstruction map of natural vegetation, which tells us what it looked like before human intervention, but then we have to realize that such conditions no longer prevail - we have changed a lot as humans, and the climate and the movement of organisms have also changed. Yes, somewhere it can go towards that, we are then in some types of strictly protected areas like peat bogs, rock steppes, river floodplains around natural riverbeds... but even there, there are so many other influences that it just doesn't fit. So the history is roughly known and the science is still working.

The map distinguishes the following mapping units:
https://www.pladias.cz/download/vegetation

Biogeographical classification

The biogeographical classification of the Czech Republic or also the biogeographical differentiation of the Czech Republic is the division of the territory of the Czech Republic in terms of biogeography, i.e., in terms of the spatial distribution of communities depending on the corresponding ecological conditions. The biogeographical division defines the spaces whose mission is to ensure the development of ecologically stable natural and natural communities. It is also an important basis for the maintenance and restoration of biodiversity. These spatial frameworks of biogeographical zonation are biogeographical units, arranged in an efficient hierarchy.

To show the richness and diversity of biota at different levels, two systems of biogeographical subdivisions have been defined in the territory of the Czech Republic: individual and typological subdivisions. To ensure that all representative and unique biocenoses are represented in the network of areas representing the biodiversity of the territory, it is necessary to use both types of biogeographical subdivisions as a basis.

Typological zoning

The aim is to define types, spatially disconnected segments of the landscape that are repeated in the landscape and have similar ecological conditions. Typological zonation highlights the repeatability and similarity in the landscape.

Individual zoning

The aim is to capture continuous and relatively homogeneous units that differ to varying degrees in biota composition. Individual zonation highlights the unique, non-repeatable characteristics of an area.

5.2. The influence of man.

5.2.1. Historical and legal development of forest protection.

5.2.1.1. The beginnings of systematic forest management.

The protection of forests and woodlands has been documented since the 14th century, when the Emperor and King Charles IV. In his unpromulgated provincial code Maiestas Carolina (1348) he attempted to codify forest protection. However, even before that, information about coppice forests and forest grazing emerges from the sources, especially in the case of ecclesiastical institutions, but also in the case of towns (e.g. the Cheb Order of 1379). In the 16th century, we can see the nobility's attempt to intensify forest management for the needs of the developing industry. These were mainly glassworks and hammers, with the owner of the estate defining the rules for the use of wood. He protects his woodland

and ensures that it is used properly. However, the value of timber is increasing rapidly with the need for the Kutná Hora district. Silver mining and the minting of the Prague groschen was an economic priority for the Czech rulers. Let us look at the situation in the Orlické Mountains as an example.

When the deposits around Kutná Hora were exhausted, logging moved to the Polabí region and later to the core of the Krkonoše Mountains. Here, however, logging was very intensive and after 1600 the Kutná Hora district was threatened by a shortage of wood for charcoal and firewood. Therefore, in 1609, the Kutná Hora Mines Commission, together with the local forestry staff, recommended looking for new sources.

The woodcutters also looked at the so-called Rychnov Mountains - that is, the area of the rivers Zdobnice and Říčky in the Orlické Mountains. Here there was not only timber, but also properly directed flows allowing for rafting. Another important prerequisite was property. This was already fulfilled in 1560. After the death of Jaroslav of Pernštejn, who was without heirs, in 1560 the Rychnov estate passed to Emperor Rudolf II as an inheritance. Timber had been harvested here before and, as the intensity of logging increased from 1570 onwards, this necessitated the surveying of the local forests in 1573, the establishment of the office of chief forester in 1574 and the issuing of forest regulations. To organise these activities, the office of chief forester was established, which was held by Leonhard Veldhammer von Aussee zum Quass. In 1575 (1577), the Imperial Chamber sold the estate to Burian Trček of Lipa, but the monarch stipulated in the purchase contract that the local forests would remain as "reserve forests"- that is, forests on the Zdobnice and Divoká (High) Orlice for the needs of the Royal Mint in Kutná Hora. This exception made in connection with the sale of the estate is mentioned in the mandate of Rudolf II of 1608 and again on 12 March 1610, where it is stated that the sale does not concern forests that remain at the disposal of the Emperor "*except for the woods and timber that stand and grow on that hill, which lies between the rivers Zdobnice and Orlice, and will continue to grow for ages to come". The patent also calls for the rafting of the rivers '...a new navigation, namely along the Vorlice, the Hřitška and Zdobnica rivers up to the Elbe River, and to make them navigable, along which rivers and rivers, so that the wood for burning coal and for other upper needs from the mountains of our forests in Rychnov, ...the timber announced down to the same Kutné Mountains in logs could be floated*...".

In 1609, several commissions were held and from 1610 mining was transferred to the Orlické Mountains to the navigable Říčka and Zdobnice rivers (Lokvenc 1978). The very rafting of the Zdobnice and its small tributaries required interventions in the centuries-old riverbed - in places, the banks were strengthened, the riverbed was cleaned and straightened. Subsequently, sluices (Říčka - historically Klauza) and culverts were built. All these interventions had to be reflected in the acceleration of the flow.

Logs were floated, logs were also floated in favorable conditions, and perhaps even logs were carted away when water was scarce. The rafts were then tied below Vamberk and in Doudleby. We have data on the amount of timber harvested for the period from December 1616 to September 1625. At that time, 47 179 fathoms of timber (75 000 m3) were harvested. However, this business did not meet expectations and was gradually reduced, although attempts to exploit the timber reserves were still made in 1628, 1654 and 1753. However, the greatest activity must have been assumed by 1625.

If we imagine such extensive interventions into the vegetation in the immediate vicinity of the rivers and their tributaries, then the local ecosystems (slopes, banks, and the beforementioned acceleration of the water flow...) must have been disturbed, and then it is obvious that during the larger rains and spring thaws, floods must have occurred with the transport of a lot of soil, branches, and roots.

The deteriorating state of the forests in the 17th century necessitated several measures, especially on the noble estates. Perhaps the most important was the provision of expert forestry staff. However, the general deterioration in the quality of forests made it necessary to adopt appropriate legislation. The publication of the Forest Regulations of Maria Theresa (1754, 1756) was essentially state supervision of forests.

The forest regulations imposed several obligations and restrictions on the owners to preserve the forest and ensure its sustainable yield. The owner was obliged to take care of the reforestation of cleared areas and to secure the forest for the future. Felling was allowed from the beginning of November to the end of February and the felled timber had to be processed and transported as soon as possible. Special provisions on timber saving were applied in communal and peasant forests. It was forbidden to sell timber without the permission of the higher authorities and management supervision was established. Freemen and royal subjects also had to seek permission from the regional authority to cut down trees. The patronage of the patronage authorities was established over the backwoods and foundation forests. The export of timber abroad was forbidden by the Forest Orders, except where transport to the interior was not possible. The use of construction or other utility timber for fuel purposes was prohibited.

The forest schedules set out access to different ownership categories of forests. Peasant, municipal and town forests were to be supervised by the authorities of the landed gentry, while other forests were to be supervised by the regional or patronage authorities.

5.2.1.2. Imperial Patent No. 250/1852 Coll.

A major step forward in raising the professional level of forest estate management was the issue of Imperial Patent No. 250 in 1852. Even before its issue, in 1850 the Minister of Agriculture and Mining issued a regulation on state examinations for forest managers, entitling them to independent forest management, as well as on state examinations for forest protection staff and auxiliary technical staff.

Section 22 of the Act on the obligation of a qualified forest manager, at a time when forestry vocational training was far from adequate in scope and level, was implemented in the individual states of the monarchy according to a model regulation issued for Tirol and Vorarlberg: In Moravia, by a law of 1873, according to which estates with an area of over 575 ha had to have a qualified forester; in Bohemia, the obligation to have a qualified forester was enacted in 1873 only for municipal forests, and for other forests only from 1907; in Silesia, this obligation was imposed by a decree of the regional president in 1907 for forests with an area of over 500 ha. In Bohemia, pursuant to Section 16 of Act No 11/1893 Coll., the function of 'district technical forest experts' was established to provide expert assistance, forest management and registration in municipal forests.

In 1889, the Ministry of Ploughing issued new regulations on state examinations for foresters and for auxiliary and technical staff. Graduates of the forestry department at the Vienna School of Agriculture, forestry schools in Bělá pod Bezdězem and Sovinec, as well as grammar schools and secondary schools with prescribed forestry experience were admitted to the forestry examination. The test subjects were forest cultivation, forestry technology, transport, forest measurement and management and hunting. The examinations were held at the regional authorities.

The forestry staff of the political administration were tasked with:

- *To support the political authorities in the exercise of state supervision over forests and to ensure compliance with all forest regulations by expert advice, constant monitoring of forest conditions and reporting of any illegality detected,*
- *improve forest cultivation by instructing forest owners and suggesting measures to improve the productive capacity of forests,*
- *Lead or manage the administration of forests entrusted to them by the Ministry of Ploughing (e.g., municipal or some state enclaves),*
- *to carry out any tasks assigned to forestry by special regulations (hunting, fishing, etc.),*
- *independently conduct local inquiries on matters of professional competence on behalf of the political authority,*
- *to provide services to the forestry departments for the damming of riparian areas if they have been entrusted with this by the Ministry of Ploughing.*

Imperial Patent No. 250/1852, supplemented by other regulations and modifications in response to developments in the individual countries of the monarchy, was the decisive legal

norm determining legal relations in forestry in the territory of the present-day Czech Republic until the Forestry Act No. 166/1960 was issued.

5.2.1.3. Laws.

The first comprehensive forest law for our territory was in force from 1852 until 1960. The current forest law in force dates from 1995. Between 1961 and 1995, two different versions of forest legislation were in force, which separated forest owners from forest use and introduced some other socialist-planning institutes. In other respects, however, they maintained the essence of forest law from the past.

Several implementing decrees have been issued for the Forest Law, 11 of which were issued in 1996 following the new Forest Law. They lay down details on the protection of land intended for the fulfilment of forest functions, the establishment of imminent danger zones for forests, rules on subsidies for reclamation planting, the method of calculating damage to the productive functions of the forest, genetic classification and details on forest regeneration, afforestation and record-keeping in the handling of seeds and seedlings of forest trees, the preparation of regional forest development plans and the delimitation of management files, forest management planning, details on the granting of forestry licenses, details on forest protection measures. Later, some of these decrees were replaced by new decrees, the new ones being the Decree on marking, measuring and classification of timber and the Government Decree on establishing binding rules for the provision of financial contributions for forest management and selected hunting activities. Government decrees announcing the implementation of forest inventories between 2001 and 2004 and between 2011 and 2015 were of one-off validity.

Since 1992, the Act on Nature and Landscape Protection has included all forests in the territory of the Czech Republic in the category of 'important landscape features' (ILEs), as defined in Section 3 of the Act on Nature Protection. This gave forests increased protection and a specific protection regime within the framework of general nature protection.

The question is whether all forests can serve as significant landscape features as the Act on Nature and Landscape Protection intends them to. As ecologically or aesthetically valuable parts of the landscape that are intended to contribute to maintaining its ecological stability.

Forest management - i.e., "forest management plans" and since 1995 also "forest management plans" - is one of the most traditional instruments of forest law. It is intended to significantly influence the economic intentions and practices of forest owners - forest regeneration, species composition, the extent of intentional harvesting, and possibly some other management indicators.

'Forest planning' is a collective term for the setting of objectives and the procedures leading to their achievement within a certain timeframe for the forestry sector. At the heart of this field is the science of forest management, which deals, among other things, with the ways in which forest management measures can be planned objectively towards the objectives based on a detailed analysis of the state of the forest and the needs of the forest manager or society.

The main works of forestry planning are the forest management plan (FMP) as a medium-term plan, usually valid for 10 years, and the regional forest development plan (RDP) as a long-term plan valid for 20 years.

According to Act No. 289/1995 Coll., FMPs are an instrument of the forest owner and legal and natural persons for whom they have been approved are obliged to comply with their binding provisions. Only legal or natural persons licensed to do so may process FMPs, and the costs of their processing are borne by the forest owner. OPRL - are a methodological tool of the state forestry policy and recommend principles of forest management. The preparation of regional forest development plans is commissioned, and the draft regional forest development plans are approved by the Ministry. OPRLs are prepared by the Institute for Forest Management and the costs incurred for their preparation are covered by the State."
The Nature and Landscape Protection Act of 1992 also brought about quite fundamental changes concerning the exercise of ownership and management rights in forests within the territory of national parks and some other protected areas.

The most significant change is the exercise of the right to manage state forests in national parks, which was transferred from the state enterprise Forest CZ to the respective national park administrations.

5.2.2. History of the site and the impact of the past.

If we want to find out the history of our forest, or the place we want to transform into a forest, then map documentation is sufficient for basic orientation. These have now been digitized and then we just need to sit down at the computer and arm ourselves with patience. Archive: cuzk.cz

The oldest map you can find here is Müller's map of Bohemia. It dates from 1720 and shows Bohemia at a scale of 1:132 000. It is the largest old map of Bohemia - it has a total of 25

sections (each 557 × 473 mm), which when folded form a rectangle measuring 2822 × 2403 mm. Müller began mapping in 1712 in the Bechyně region and completed it in 1717. The relief is depicted using the hill method with shading, and great attention is paid to the river network, but the map's greatest asset is the detailed delineation of settlements and economic activities. The scale of the map does not make it very suitable for finding a small area – a forest.

The Original Maps of the Stable Cadaster (Indication Sketch) can help us more. The Indication Sketch, also called Indication Sketch, also referred to as the Handheld Map, or Indikationsskizze in German, is one of the products of the mapping of the Stable Cadaster. It is a cursory copy of the original map.[3][4] Indication sketches were created simultaneously with the detailed surveys that took place in Bohemia in 1826-1830 and 1837-1843, and in Moravia and Silesia in 1824-1830 and 1833-1836. From the point of view of the semi-map, the indicative sketches include boundaries (municipal, tenure, cultural boundaries, etc.), building objects, roads, watercourses and areas, fixed points, boundary landmarks and other objects. The indicative sketch included the types of cultures - hence the forest. Here you will find the name of the holder, the house number, the legal property of the land (D - dominical, Ueb = Ueberlandgrund - overland), for forests the abbreviation St.R. (Stockrecht) and R.R. could be added. (Raumrecht), the name of the track (track = a larger number of parcels together, tracks were also referred to as hills, parts, floodplains etc. Colors were chosen so that the maps were easy to understand, thus corresponding to the actual color of the objects depicted. Watersheds are shown in blue, forests in dark grey, gardens, meadows, and pastures in various shades of green, vineyards in purple, etc.

You can also help yourself to the so-called Imperial compulsory impressions of the stable cadaster 1:2 880 - Bohemia. These are color raster copies of the so-called imperial obligatory impressions of the stable cadaster maps of Bohemia. These are maps from the years 1826-1843, originally intended for archiving in the Central Archive of the Land Cadaster in Vienna, from where they were transferred to Prague after the establishment of the Czechoslovak Republic as part of the archival separation. In contrast to the so-called original stable cadaster maps, they show the original state of the landscape without the addition of later changes. Approximately 8400 cadastral maps on about 31 thousand map sheets are archived for the territory of Bohemia. In cadastral areas for which these maps have not been preserved, they are gradually being replaced by original stable cadaster maps.

The land cadaster map is at a scale of 1:5000. It is a continuation of two previous mappings. And there is a lot to read from it.

Historical maps give us a basic overview of land use over the last nearly two centuries. The forest returned to the landscape in many places after World War II. Old photographs and

postcards can give us an idea of what kind of forest it was. These show the face of the landscape over the last hundred years.

If we were interested in landowners, the Land Registry will provide us with this information after the mid-19th century without much archival study. This is based in each county town and if you know the parcel number (and we can find that on a map) then they will locate the holder for us.

We would then have to look in the land registers for information on holders before the mid-19th century.

What good is it to know if the site of "our wood" was there in the past? We can then use the findings to make better predictions about which trees will thrive on a given site. A site with a disused pond will be suitable for alders, birches, and willows. A site that has been arable land for centuries will not be suitable for spruce but will do well for hazel.

5.2.3. History of forest crafts and associated forest production today

The forest, as a complex of a vast ecosystem on our planet, has been a great source of all raw materials necessary for the survival of the human species since prehistoric times. Prehistoric people were aware of this natural, renewable wealth and approached nature and its gifts with humility. It was not just a source of wood; it was primarily a source of sustenance for both plant and animal products.

Then came the Neolithic Revolution, the discovery of agriculture and the domestication of the first animals, which made the whole endeavor of making a living more efficient, and man was able to grow a year's supply. Similarly in forestry, however, people understood that they could not just take from nature but give to nature properly. This led to the first introduction of various rules and the first forestry laws.

We know that the forest is a renewable resource, but the current hectic times call for very efficient and accelerated harvesting, which often leads to the degradation of the entire ecosystem. Today's trend is to go back to the past and be inspired by nature-friendly management. However, this is not an easy task, as many foresters are bravely dealing with many of today's challenges, which are very time-consuming and physically demanding, leaving no time to implement new methods. These methods and conversions are often financially unfeasible on large forest sections. It is therefore necessary to start with small, small forest owners.

Each of us can think about how to help nature, and each of us can take just one right step to improve the situation. For example, guiding pre-school children to think about what is good for nature and what is not. Forest education is thus the first step we can take to instill in children a respect and humility for the nature we live in.

4.2.3.1. History of forestry.

As mentioned in the introduction, the forest has been used by man for his survival since ancient times. Subsequently, forests have been used more and more as man's skills have become more efficient. The natural forest cover in our countryside before the more numerous colorizations of the human species was up to 100 %, and in the 10th century historical sources indicate a forest cover of approximately 70 %. The cause of the decline in natural forest cover lies in the development of agriculture and the clearing of forests for growing crops and grazing livestock. At that time, the forest was seen as an inexhaustible resource and people did not care for it. When the land was depleted, people went ahead and established new fields, and the old one naturally grew back with pioneer trees. However, forest grazing by livestock often prevented natural regeneration.

Subsequent times led to the development of industry, in which the forest played an essential role. We are talking about the extraction of minerals, metals, the development of coal mining, glassmaking and other industries. The deforested areas did not reforest themselves at this rate, and so forest cover continued to decline. The population continued to grow, increasing the demands on subsistence. Only the discovery of hard coal for industrial use slowed this down. People needed the wood raw material for both their own use and as a source of employment. This led to reflection and finding a balance between the production and consumption of wood raw material. Therefore, the predecessors started to introduce activities and rules to improve the situation. These included, for example, the protection of the forest, the creation of forest nurseries and the damming of the ravines. The introduction of forestry disciplines led to the improvement of knowledge in the natural sciences, and at the same time the demand for non-productive useful functions of the forest increased.

The first surviving document dealing with forest protection and some rules of forest management was the first "code" of Charles IV around 1350. This never came into force, but it became an inspiration for many forest owners of the time, especially towns. To ensure systematic forest management in our territory, the so-called 'provincial forestry regulations' were issued around 1750, but the problem was a lack of qualified personnel, which was not solved until 1850 by the regulation on state forestry examinations. Forestry education also began to develop at this time. The most important milestone, however, was the Austro-Hungarian Law, which anchored the economic processes in forestry and gave substance to the so-called sustainable economy. It remained in force until 1960.

In the 19th century, monoculture management and the development of clear-cutting became widespread. Spruce and pine became the most profitable timber species.

In 1960, a new law introduced a basic undergrowth management system and bare coppice was not allowed to exceed the height of the harvested stand. However, this did not suit the regime at the time, and a new law was passed with larger permitted cuts. In the 1970s and 1980s, our mountain forests were hit hard by industrial emissions, which led to the collapse of entire mountain forest ecosystems, especially in the Ore, Jizera, Giant and Orlické Mountains.

This is a very brief description of the development of forestry in our area. Despite all the ills and calamities in forestry, the situation is improving year by year and forest cover in the Czech Republic is slowly moving upwards.

4.2.3.2. History of forest crafts.

The use of forest products was freely available until the ownership structure began to emerge. Various restrictions began to be imposed and entry into the forest could be forbidden.

The first references to beekeeping date back to 1057, with the greatest flowering of beekeeping in the 16th century, when trees providing food for bees were to be protected. The turn of the 14th and 15th centuries was marked by ash burning, charcoal production, forest grazing and resin extraction. With charcoal production booming in the 16th and 17th centuries for mines and smelters, the forest situation began to deteriorate, and the supply of woody biomass dwindled. Natural regeneration was made almost impossible by cattle grazing in the forests. Consequently, pressure to restrict this increased in the 18th century. Therefore, in 1754, the Imperial Patent was issued, which laid down rules for grazing cattle, burning ash, and producing charcoal. The extraction of resin from living trees and the extraction of willow and hazel rods were prohibited.

In the 1970s, attention was paid to fishing, agricultural production, and beekeeping. Horse breeding for use in forestry was also newly included in associated forestry production.

4.2.3.3. Forgotten crafts.

Beekeeping, or forest beekeeping.

An almost forgotten medieval craft that has lost its purpose in modern times. Today, beekeeping is carried out in a modern, intensive way. Medieval beehives can be seen, for example, in open-air museums (Rožnov pod Radhoštěm).

The idea was to search for nests of forest bees that had settled in tree cavities and collect honey. Later, they came up with an easier way, which no longer required searching for bees' nests and climbing up into the heights. They cut out the part of the tree where the nest was and moved it closer to the human dwelling.

Coal mining.

Another important craft that is no longer serving a purpose is coal mining - or charcoal making. A few words about the history of this craft can be found in the history chapter. Coal mining is often associated with the plundering of forests and the introduction of new forestry measures. It is one of the oldest crafts ever. Charcoal making had its greatest boom in the Middle Ages and modern times, when charcoal became an essential ingredient in the production of metals, glass, and gunpowder.

Charcoal production is a very complex chemical and physical process. In short, we can say that it is a method based on the principle of wood pyrolysis, or heating of woody biomass under a strongly restricted air supply. The resulting product is a carbonaceous mass with a very high calorific value. They achieved this by partially excavating a pit, piling the wood into it in a very expert way and then backfilling it with soil. This method was then replaced by the then very advanced technology of the so-called standing mill. This method was easier to control. The best wood for 'burning' was hardwood felled in winter.

The decline of this craft was recorded at the end of the 19th century when stone charcoal began to be mined. Today, we still need charcoal in small quantities, for example for the preparation of grilled dishes, in which our Republic is the leading country. Today, a few people are engaged in this medieval method to preserve tradition and commemorate history.

Smoothing.

This term generally refers to "resin mining". In our conditions, this raw material was primarily obtained from coniferous trees (pine, spruce, larch, and fir). This was done by mechanically scraping the bark along the length of the tree trunk with a special hook and later by making arrow-shaped grooves in the bark so that it could be taken regularly. The ability to form and dew this chemical compound (balsam) is possessed by tree species whose wood contains resin channels at the microscopic level. The chemical composition of the resin varies slightly from one species to another and changes with oxidation, which is

further enhanced by contact with iron; therefore, the collection was not carried out in metal containers to avoid the deterioration of the raw material.

People have been collecting resin since time immemorial. Several crafts (cobblers, coopers, wheelwrights, musicians, etc.) have not been without resin throughout history. The greatest development of this craft in Bohemia took place during the wars, namely during the 30-year war and between the two world wars.

The pitch was originally obtained from trees in the most primitive way by cutting the bark of the trees, where it was then collected in containers at the bottom of the trunk and further processed. This was done in the so-called 'round kilns', which were chambered cones of bricks with an inner chamber based on a bowl-shaped stone with a collecting channel. A fire was lit in the casing and collected pitch, stumps or branches were thrown into the furnace. The high temperature then took care of the rest, and pure honey tar flowed out of the furnace through a special channel and solidified in the air. Musicians used this primary raw material for rosin, butchers for rosin and the greatest consumption were for the cooper's guild. The resin also had its uses in medicine, either in the form of ointments, when it was mixed with lard, or as a form of turpentine oil, which was obtained from the so-called haze that rose like smoke above the furnace. Another already cloudy, oozing resin was used by shoemakers and finally a soot-blackened oily pitch called sweat mixed with oil was used by wheelwrights under the name 'kolomaz'.

The resin was therefore widely used in society. Unfortunately, the craft of pitching had one big negative for the forest. Foresters soon noticed a decline in quality construction timber, as the logs disturbed by the pitchers were heavily infested by wood-boring fungi and insects and thus deteriorated. Several adjustments were therefore made in our area, firstly resin harvesting was allowed in the stands that were to be milled that year. Furthermore, the resin collector was obliged to pay a certain amount for each barrel collected into the 'superintendent's pension', which led to the gradual abandonment of the trade by individual resin collectors.

The craft eventually died out in our country at the beginning of the 20th century with the industrial revolution, cheaper and newer materials produced in factories. But there are still countries where this natural raw material is still used, and the craft is still preserved. In the Czech Republic, we can see this activity only in various open-air museums. One could, however, consider collecting resin in the case of pine forests, where the cost of collection would be many times higher than the value of the wood itself.

Potash mining.

Potash is a chemical compound of potassium carbonate - a white, strongly hydroscopic salt of carbonic acid. It was and still is used in the manufacture of glass, in the textile and paper industries, and in other manufacturing industries.

Historically, this substance was obtained from wood ash, i.e., by burning whole hardwood trees "standing up"; after the whole tree burned down, the ash was obtained by leaching with water and evaporating the leachate to produce a substance called potash.

The burning of ash was banned by the Forestry Code in 1754 and was to be replaced only by ash from households or replaced by ash from other materials such as straw.

4.2.3.4. Forest crafts that are used today.

Willow trees, coppice trees.

The willow mills and sawmills are used to produce willow wicker for basketry. Areas up to 600 m above sea level, which are enriched with water, are used for this purpose, and may be flooded, but not muddy. Such areas should be drained, and the water table should not exceed 50 cm below the surface. The product is annual shoots or perennial willow canes 12-30 mm in diameter and over 120 cm in length. Plant willow cuttings in early spring by sticking the cuttings into previously prepared and deeply watered soil, perpendicular to the ground, so that the end of the cutting is level with the soil. The ideal spacing of the rows is 60-80 cm for easy management and the cuttings are planted 10-15 cm apart. Weed the willows several times a year and fertilize once a year.

Various weeds, such as the weed moth *Convolvulus arvensis*, or insects such as the alder beetle *Cryptorynchus lapathi*, are a danger to willow trees. The most damaging of the abiotic factors is late frost, which burns the shoots.

Typical willow species suitable for basketry are red willow (*Salix rubra*), purple willow (*Salix purpurea*), sea buckthorn willow (*Salix hippophaeifolia*), american willow (*Salix americana*), basket willow (*Salix viminalis*), almond willow (*Salix triandra*), white willow (*Salix alba*), yellow willow (*Salix alba*, var. *vitellina*).

Harvesting crops and fruits.

What the laws say - from the Forest Act and the Hunting Act:

- Based on the Forest Act, everyone can enter the forest at his own risk, to collect berries there for his own use. In doing so, he/she is obliged not to damage the forest, not to disturb the forest environment and to follow the instructions of the forest owner or his/her employees. In the forest, it is forbidden to enter stands where harvesting, handling

or transport of timber is carried out and to enter places fenced or marked with a no-entry sign. It is also forbidden to collect protected mushroom species.

- If we collect mushrooms in a way that damages the forest, enter places fenced off or marked with a no-entry sign, enter stands where harvesting is carried out, or violate any of the prohibitions listed in Section 20 of the Forest Act, we could commit another administrative offence and face a fine of up to CZK 100,00 from the state forest administration authority.
- For failure to comply with or violation of the obligation in Section 10(1) of the Hunting Act, the state hunting administration authority will impose a fine of up to CZK 30,000 on a natural person and for failure to comply with or violation of the obligation in Section 9(3) a fine of up to CZK 10,000 (see Section 63 of Act No. 449/2001 Coll., on Hunting).

Summary: The collection of crops and fruits from the forest is restricted by today's Forest Act, which imposes the condition of collection for own use and in a way that does not damage the forest.

Birch sap collection.

Birch sap "The right spring detox". Collecting sap not only from birch trees, is also a craft that can be dated back to the ancient history of mankind. Birch sap has been and is used to make syrups, sugar, drinks, and medicines.

The oldest and most degrading method of collection was the spring felling of a tree, in the stump of which a pit was dug to collect the sap, which was collected in the morning and evening, a method that is justified given that it was not a mass collection. With the demands of society, new methods of collection began to take hold, first by cutting off thick branches under which collection vessels were placed.

Finally, the method still used today of 'drilling holes'. These boreholes are drilled southwards at a 45° angle to a depth of 3 to 6 centimeters into the trunk. The number of holes depends on the thickness of the trunk. Drilling is carried out in early spring, ideally after a strong winter when root buoyancy is at its strongest; once suction begins, the sap is no longer of interest for processing. Tubes are inserted into the holes, from which the birch sap is drawn off into collection vessels. The liquid must be transported as quickly as possible to the collector for processing, as it is very perishable and 'ferments' (it is therefore collected every day).

The highest yields are reported for 30- to 40-year-old birch trees in the uplands. The largest processors are currently Poland, Ukraine, Belarus, and Scandinavia. Due to the scarcity of birch stands, it is not possible to harvest for industrial purposes in our area. Nevertheless, society is increasingly turning to natural and traditional raw materials. Therefore, sap is

imported to the Czech Republic, especially from Ukraine, preserved with citric acid for cosmetic purposes to produce (shampoos, conditioners, ...).

Folk healing.

The forest was once an important source for folk healing in addition to a source of food. The collection of medicinal plants in the forest has a long history that goes back thousands of years. People around the world have used plants for medicinal purposes, not only in traditional cultures but also in ancient civilizations. Although times have changed, people still love to use herbal infusions and preparations. Approximately 130-150 species of medicinal herbs grow in the Czech Republic. In addition to herbs, the medicinal potential of tree bark, edible fruits, cones (e.g., pine, hops, juniper) and other plant parts is also used.

Collecting medicinal plants from the forest is an activity that requires respect for the environment and the forest ecosystem. Medicinal plants can be used for natural healing purposes, herbal medicine, and traditional treatment.

When collecting medicinal plants in the forest, it is important to follow several principles to minimize negative impacts on nature and humans:

- Have sufficient knowledge about the plants you plan to collect. Plant identification is crucial to be able to correctly identify medicinal species and distinguish them from poisonous plants.
- Collect only as many plants as you need and do not leave a distinctive trail. Collection should be limited to preserve plant populations for future generations.
- Do not cut whole plants unless necessary. Instead, collect leaves, flowers, fruits, or other parts that you need. Intervention in nature should be as minimally invasive as possible.
- When collecting plants, try to minimize disturbance to the surrounding environment. Do not step on other plants or leave a mess.
- Avoid collecting plants that are endangered or rare. Collecting these species could upset the ecological balance.
- Collect only healthy plants. Plants with diseases or signs of damage will not have the desired medicinal effect.
- In some areas, the collection of medicinal plants may be regulated by laws and regulations. Be aware of local rules and follow them.

Hunting

Some form of hunting has been with us for thousands of years. If we want to talk about the prehistoric hunting of animals, which was the main livelihood of those people, we can, but people had to use their minds to outwit the animal they subsequently hunted. So, they had to use their reasoning skills to hunt successfully. This is the essence of hunting today.

As time passed, hunting became tied to land ownership and became a privilege of the nobility. This concept was called regal. We are talking about the 16th century, specifically 1573, when the Bohemian Diet took place, at which it was decided that the monarch and the nobility alone had the right to hunt on their land. They were surrounded by a large hunting party with dogs and the nobility hunted mainly on horseback. The protection of the game is also linked to this resolution. Here we can say that hunting as we know it today is beginning to take shape.

With the development of firearms, hunting intensified. Black game is ordered to be confined to game preserves, and at the beginning of the 19th century peasantry and small game farming develop. Foreign game species such as sika deer, mouflon and chamois are also imported.

Various associations of hunters were formed and since 1962 hunting is no longer tied to land ownership, but the right to hunt is now exercised by organizations - state forests, agricultural cooperatives, etc.

Since 2012, Czech hunting has been officially recognized as a protected monument by UNESCO.

Today, hunting is based on Act 449/2001 Coll. on Hunting and people who want to become hunters must pass a hunting exam, meet the conditions for owning a gun and pass an exam to obtain a Group C firearms license.

Christmas trees.

One of the most widespread and well-known Christmas symbols is inherently the Christmas tree. This is an old Czech tradition dating back to 1812, when Jan Karel Leibich decorated the first Christmas tree. Previously, this product was obtained mainly from educational interventions, after which the pressure on the aesthetics of the individuals in question intensified, so that unsatisfactory trees from the forest environment lost their usefulness. Consequently, plantations started to grow trees for this purpose.

This is a craft that has been known for more than 50 years, mainly in Denmark and northern European countries. The Czech Republic has only recently begun to move in this direction.

An important factor for a successful conclusion and good monetization is the selection of a suitable species and provenance for a given location, then the correct intensive care of the plantation and the correct shaping of the trees by trimming. It is recommended to establish plantations on gentle slopes as protection against frost. 1 x 1,55 m, 1,2 x 1,2 m to 1,0 x 1,0 m

are most used. The highest use of the area is in triangular staples. Older, more mature seedlings of 30-40 cm in height are planted. The best planting method is hand planting in 30x30 cm holes.

A very important activity on the plantation is the protection against beetle, either by grubbing, which increases the risk of trees being cut down, or by herbicide treatment, which in turn increases the risk of anomalies in the shoots of individuals.

The most common species in the Czech Republic are the white fir (*Abies alba*), the giant fir (*Abies grandis*), the Norway fir (*Abies concolor*), the Caucasian fir (*Abies nordmaniana*), the Korean fir (*Abies koreana*), the black pine (*Pinus nigra*), the Norway spruce (*Picea abietis*), the Norway spruce (*Picea pungens*), etc.

Forest therapy.

Today, even in the international environment, forest therapy is a relatively broad concept covering several ways to use the healing and supportive effects of nature to support human health, from physical to mental. Forest therapy has a strong tradition, especially in Japan and the USA. Simplifying a bit, it involves mindful walks in the forest, breaking away from the fast-paced lifestyle and stopping in nature, which has a healing effect on us. Nature is the therapist here; the expert is more of a guide or companion. We can intensify or emphasize the effect of nature with individual exercises that we can perform in nature. You can find some of them at the end of the book.

For many people, it is a discovery of a new world, a view of oneself, one's life and one's current place, which thus becomes a subject of reflection and introspection. Forest therapy can be specific also by the fact that there are specially created trails somewhere for smooth slow walking, whether educational or experiential.

Forest therapy is an innovative method of therapy that takes place experientially in nature and considers nature as a partner in the therapeutic process (Berger and McLeod, 2006). The basic premise of this therapy is that nature has healing and regenerative resources, and encountering these forces can promote parallel processes in human beings. Berger (2005) in defining the basic concept of "touching nature" claims that "unmediated contact and connection with nature allows the individual to connect with his basic nature; to feel authentic; to develop important factors of personality and lifestyle that have been difficult to express in the intensity of modern life." This definition refers to the eco-psycho-social perspective of natural therapy and the solutions it offers for the psychological and social stresses caused by modern lifestyles and technologies. This is achieved by creating a more meaningful connection with nature, which strengthens the personal connection between

body, spirit and mind, the interpersonal connection between group participants, and the transpersonal connection between people and their environment.

The phenomenon of forest therapy is slowly reaching the Czech Republic, where there is a forest in the vicinity of almost every city. This direction originated in Japan in the 1980s as a marketing product to attract people from the city to the forest, which it succeeded. The Japanese government financially supports the marking of paths in nature and the functioning of the centers from which people start, perhaps also because walking improves health, which reduces healthcare spending. Research into the forest in relation to mental health gave rise to shinrin-yoku, or forest bathing. It is used in a similar way to bathe in the sea or in an imaginary sunbath. If we take a meditative walk through the forest, it has a positive effect on our personal well-being in just two hours. Our blood pressure drops, we concentrate better, we are more creative.

This intuitive therapy is starting to be evidence-based as well. Enter the world of preventive medicine. Shinrin-yoku by itself cannot cure diseases, but it has its place in the field of prevention. In Japan, they have over sixty official forest therapy trails founded by the Forest Therapy Society. These are specially designed places that are more accessible, often barrier-free, supplemented with bases where you can hide, go to the toilet, and hold workshops. An essential aspect of shinrin-yoku is exposure to nature, experiencing it with the senses, and not complex exercises, knowing and experiencing nature from other conceptual or insightful perspectives.

All senses are worked here, smell, taste, sight, hearing and touch (the importance of walking barefoot). At the same time, the number of doctors certified in forest medicine is growing (Miyazaki, 2021).

Forests and nature are not new to us, but forest therapy is. It can be a new experience of a way of being in nature. Forest therapy aims to calm and alleviate the excessive stimulation to which we are exposed daily in artificial urban spaces. This is also why forest therapy is diverse and we can include meditation, yoga, stretching, and time in a network among the trees. Even in nature itself, individual activities can vary from contact with trees, moss, waterfalls, rivers, the night sky or snow-covered mountains. We can develop forest practice, for example, by focusing on contact with the ground while walking mindfully and trying to feel every muscle in the body.

Forest therapy is often criticized by experts for its simplicity. We can object here that it is rather a misunderstanding of the concept, when within forest therapy the main actor is the forest, or movement and being present in nature.

The benefits of staying in nature are endless. A robust body of both qualitative and quantitative research supports this claim while approaching it from different angles. Here they support the reduction of the stress hormone cortisol, the strengthening of the activity of the immune system, the renewal of attention, the increase of openness and creativity. Returning to nature and ourselves would benefit many of us on a societal scale.

Forest mind in a little more detail because we tried it.

Let us now look at the forest from the point of view of its medicinal effects on human health and the development of the so-called Green Care directions with a closer focus on the Finnish concept of the Forest Mind.

Trees and other plants communicate with each other using chemical gases called terpenes or phytoncides. The highest concentration of these substances in the air can be found in the summer, in humid weather and in the deep forest.

We humans have evolved in nature since time immemorial. From an evolutionary point of view, we live in cities only a fraction of the time. It is therefore not surprising that the human body also reacts to chemical substances secreted by plants. But what can be surprising is the high degree of their positive influence on our health, both physical and mental. For your interest, we can give a brief overview of what benefits a stay in nature can bring us:

- 10 minutes spent in nature leads to a drop in blood pressure.
- 20 minutes spent in nature improves mood.
- 60 minutes spent in nature leads to a sharpening of attention.
- 2 hours spent in nature leads to the recovery of the immune system.
- 5 hours a month spent in nature leads to an increase in positive emotions.
- 3 days in nature then lead to a strengthening of the body's immune system, an increase in the amount of protein that prevents cancer, a decrease in the amount of stress hormones, a stabilization of the blood sugar level, a decrease in elevated blood pressure, a reduction in the feeling of fatigue and depression, or an increase in the feeling of vitality.

It is therefore not surprising that, thanks to scientifically based reports that the forest heals, trends are emerging in the Czech Republic and around the world that use the healing and supporting effects of the forest in their concept. We can cover all these directions with the English term Green Care. In the Czech Republic, we can most often encounter the following concepts: Forest mind, forest therapy according to the American Association for Nature and Forest Therapy, Japanese Shinrin yoku (translated as forest bath), garden therapy, wilderness therapy or (psycho)therapy in nature, when the therapy room, i.e., a closed room with four walls, is replaced by free nature. In each of the above-mentioned directions, nature has an

important place - either through its healing influence, which is discussed above, or as an inspiring space for carrying out activities specific to each direction.

The forest mind is originally a Finnish concept of self-care and self-development that uses and deepens the healing effects of nature on health. Martina Holcová brought her to the Czech Republic and continues to help her flourish here. The forest mind is a so-called evidence-based method, it is supported by scientific studies. It is based on three pillars, which are positive psychology, mindfulness, and coaching.

The forest mind consists of simple exercises of a mostly non-physical nature. Their regular repetition leads to training of mind skills. Among the skills of the mind, we can include, for example, being able to be in the present moment, relax, be quiet and observe, be able to look for the good in life, be able to ask questions and look for answers to them, know your values and make decisions based on them... Forest mind more it leads to a strengthening of resistance and can also be beneficial as a prevention of burnout syndrome. The exercises are very varied, they take a few minutes to perform, and we can divide them into three categories according to the focus. The first category (so-called seeds) consists of exercises aimed at sharpening the senses, relaxation, being in the present and restoring strength. The second category (so-called seeds) contains exercises leading to awareness of one's own thoughts, feelings, bodily sensations, and mindfulness training. In the third category (so-called trees) we find exercises focused on deeper reflections on values and goals in life, but also on more difficult topics such as fears and pain. The forest mind finds application as an independent well-being activity, and which is a positive trend, it is increasingly used in the work of psychologists, psychotherapists, social workers, in education, in the healthcare sector, in the corporate environment...

"*During the opening of the trail, the participants present could try the Finnish concept of self-development and self-care in practice. The forest mind is about calming down, breathing in, breathing out, sorting out thoughts, training to be in the present, all with the help of simple exercises of a non-physical nature. Those who wanted could try a short exercise focused on hearing – trees swaying in the wind, leaves rustling, birds singing and other sounds characteristic of the forest. Looking curiously at everything around and enjoying the forest environment. Intensive use of touch and smell also plays an important role in Forest Mind. Not afraid to touch bark, moss, explore them and name your feelings. To remember what it's like to be part of nature. It is then that you can feel the beneficial influence of Forest Mind on body and mind. For the children, Forest Mind was enriched with various activities and games. The children tried to close their eyes and find out by touch through the wooden cut-out in the shape of forest animals the nature that is inside, whether the environment inside the cut-out is shimmering or stinging, whether it is pleasant for them or not, etc. The forest is a fantastic "playground". At home at the computer, children do not have the opportunity to explore the natural environment. The forest provides the right number of stimuli to allow*

optimal development of the senses. Regular walks in the forest reduce anxiety, stress, and improve mood. The forest awakens creativity not only in children but also in adults."

However, it is not enough to just read about Forest Mind, you must experience it. First, ideally accompanied by a certified Forest Mind instructor, whose list, as well as other information about this concept, can be found on the website www.lesnimysl.cz. What you can do now, however, is to approach each subsequent visit to the forest mindfully. To be aware of the positive effects of nature on health, immerse yourself in the healing atmosphere of the forest, sharpen your senses and "just" be. To use the outer natural world to discover our own inner world. For inspiration, we present an exercise called Landscape Sounds, which helps train being in the presence, observation, relaxation and leads to energy depletion. When you are in the forest, stop at a place that is comfortable for you and listen to the surrounding sounds. Perceive which ones come from afar and which ones come from nearby. How do individual sounds affect you? Remember the sound you like the most and later you can recall it, for example, in a closed room when you need a short refreshing breath.

5.3. Management in the forest.

5.3.1. Approaches to forest use.

At the outset, it is worth mentioning that the basic difference determining access to forest property was, is, and probably will be its scope. Most owners owned at best a few hectares of forest. Such property did not allow forest management in the true sense of the word, it was "just" an improvement to another way of livelihood and served as a source of fuel and construction wood mainly for own use. In a completely different situation were large feudal estates (e.g., noble, royal, ecclesiastic, urban). These were large enough to have their own professional management and allow for more systematic planning and purposeful use; the concept of our forestry today is based on them to a much greater extent than on thousands of smallholders. It has always been difficult to say anything of general validity about smallholders' forests; the variety of priorities and methods of use was too great (e.g., cattle grazing, digging litter, production of charcoal, harvest for animals, honey, and many other raw materials; see chapter 5.2 for more details). But this diversity almost disappeared: during communism, essentially all forests were state-owned and managed almost uniformly. This chapter will therefore be distorted in favor of the view of the big owners; in it, we will try to deal with the legacy of the last few centuries and simply explain why today our forests and forestry mostly look just as we know them, i.e. with a clear predominance of spruce trees in the spirit of the motto "no upheaval, no break, the right tree stands in the row!”.

Until relatively recently, the amount of yield was mainly understood as the increase in wood mass per unit area per time. At a time when it was not reasonable and sometimes even possible to transport large volumes of wood over long distances, it was necessary to have enough raw material close enough. And wood was extremely "strategic" - often the main and sometimes the only energy and construction raw material. Therefore, between the seventeenth and eighteenth centuries, in addition to the usability of wood from individual species, the speed of their growth, i.e., the production of wood over time, began to be monitored. In Central Europe, conifers, especially spruce and pine, became the clear winners of the assignment "as much wood as possible in the best possible way per unit of area per unit of time". They grow almost everywhere, fast, straight (ideal for universal sawmill processing), have small knots, can be used both for heating and for construction, and moreover, they tolerate schematic clear-cutting management well.

It is still necessary to mention the stability of the yield. In the spirit of the above-mentioned considerations, the so-called "normal forest of age classes" was established as a solution in Central Europe. In it, the forest property has the form of a mosaic, in which each part is composed of trees of roughly the same age. Pieces of the same age across the property were grouped into so-called age classes. The ideal goal was to achieve a normal forest; this was the state when the representation of each age class was the same on the property. Such a structure of the forest was supposed to ensure roughly the same yield on the property every year with roughly the same amount of work.

So, these are the basic considerations. Most of the mature forests that we have today in the Czech Republic and Central Europe were created precisely on this basis. Since forestry is in principle a slow development with a horizon of tens to hundreds of years with an annual change of roughly 1% of the total area, most of such forests will remain for a long time.

The principles described were largely valid until 1989; since then, two new views have gradually begun to approach them. Informally, we can call them "economism" and "ecological concept".

Economism is based on the fact that instead of in m3 of wood, the yield began to be calculated in monetary profits, i.e., the main goal is the best possible ratio of financial returns to costs. The pressure for efficiency in this sense then led to more intensive use (some might even say squeezing) of everything: forest, people, and technology. In principle, this approach has minimum reserves, and therefore tends to be unstable in the end, as we can verify with the current bark beetle calamity. On the other hand, even with this method, "no-intervention areas" are created - however, not for nature protection, but because it is simply not worth farming somewhere, as the costs exceed the potential profit.

The ecological concept can be understood in different ways, e.g., as the slightly euphoric declaration of several protected areas, especially in the early 1990s. However, I mean something a little different: the simple realization that the forest has a whole range of other functions than just the production of wood (albeit usually only that which usually "brings something" to the owners of the forest in the economic sense). Recently, however, society has begun to perceive these "other functions" as increasingly valuable, whether the forest fulfills the role of a backdrop for recreation, a biotope for the production of fruits and mushrooms, a refuge for various organisms, or the still far-underappreciated role of the forest as a landscape air conditioner and water bank. Most of the chapters of this publication are devoted to these "other functions". If we put more emphasis on these other functions, our forests may look significantly different in the future.

If someone wants an economically valuable forest, they can go through the chapter again. Hopefully, the previous lines will help him clarify what an economically valuable forest exactly means to him. However, he will then have to look elsewhere for instructions on how to achieve it (e.g. here: https://uzpl-fraxinus.mendelu.cz/index.php/konference-pestovani-lesu/sbornyky-ke-stazeni?download=123 :growing-in-passwords and links in chapter 5.3.2).

5.3.2. Basics of normal forest management.

5.3.2.1. Basics of forestry.

Forestry is a branch of the national economy that has both a production role (supply of wood and other forest products) and a non-production role, i.e., a protective role (shaping the local and global climate, regulating the water cycle in the environment, or preventing soil erosion). At the same time, it also has a social role (providing a place for recreation, free time, education and enriching the labor market).

Sustainable forest management brings many benefits. One of them is access to wood, which is a natural, renewable resource. It follows that it should play an increasingly important role in our lives. There are many possibilities for using wood. We use it to build houses, equip them or heat them. We make paper, packaging, tools, toys, or clothes from it. The production of high-quality wood raw material in large quantities and in the shortest possible time while preserving forest ecosystems can only be achieved through sustainable forest management. It should be emphasized that logging is only one of the phases of forest management. The main goal of forest management is to ensure the permanence of the forest and its multifunctional role in land use. This should be achieved while considering natural processes as well as social expectations we have from the forest.

5.3.2.2. The life cycle of a forest stand.

A forest stand is an ecosystem, but with exaggeration it can be considered an organism that goes through different stages of growth and development during its life:

- Established culture or invasion is the first period of life of a young generation of trees artificially or naturally 'introduced' to a cleared or newly forested area. It lasts from the natural emergence of seedlings or the planting of seedlings until the closure of the crowns, i.e. the contact of the crowns of neighboring individuals. The young generation has a high mortality during this period caused by threats from external factors such as drought, insects, fungi, frost, weeds, game, and mutual competition.
- A thicket is a stand of trees from the time when the crowns reach compactness until the time when the trees separate (die). This phase is characterized by intensive height growth. Individuals compete strongly with each other for light and compete for height differentiation.
- Stem growth is the period when the maturing of the growth begins. In this growth phase, the thickness usually increases peaks. As a result of the long-lasting full canopy and the decreasing access of light to the lower parts of the growth space, the individuals of the lower layer are naturally eliminated, and the lower branches die off. The stands are not very mechanically stable in the rod phase, they are threatened by snow and wind, especially at a high stand density.
- Rod material. In this phase, the height increases of light-loving species (e.g., Scots pine) decreases, while the maximum height increase is reached by shade-loving species (e.g. beech). Intensive thickness increase persists. Individuals have a distinct division into crown and trunk. The trees already reach usable dimensions during thinning.
- Juvenile growth. During this period, most trees begin to flower and bear fruit. Stands reach their final height and expanding crowns limit their growth. Diseased and weak trees continue to leaf out, but with much less intensity than in the previous stages. The result of these processes is the release of compactness, which contributes to the improvement of light conditions in the forest stand. Competition for light and water is reduced, leading to persistent thickness growth.
- Adult growth. The thick growth of the trees continues and reaches a climax. It is the age at which the stand is felled (if it is to occur), i.e., it is the time when the tree should be felled because it has reached its highest production value. This age depends on the type of tree and the habitat in which it grows. Under favorable conditions, the growth will begin to regenerate naturally by producing seeds.
- Old (overgrown) growth. This is the last stage of the life of the stand when the gradual death of the trees begins. How trees die depends on many environmental factors, such as habitat. In wet, swampy habitats, trees wither. This manifests itself in the withering first of the branches and then of the entire crown, while the trunk remains healthy. On

fertile soils, trees are characterized by longevity. The dying process starts with the rotting of the trunk and then with the dying of the crown.

5.3.2.3. Forestry.

Reforestation or restoration?

Regeneration means the next generation of forest to replace trees that have been felled or destroyed by natural disasters, wind, fungal diseases, or insect predators. Where there were no forests before, the introduction of new trees is called afforestation. Afforestation and restoration take place from the time the seeds germinate until the crowns of the trees close in on each other.

Recovery.

Currently, great emphasis is placed on natural regeneration, e.g., using seeds from trees growing in the vicinity (species with light seeds that are spread by the wind - e.g., Scots pine, warty birch, or black alder) or already growing on the restored area (species with heavy seeds – e.g., beech or oak). Natural processes can be assisted by preparing the soil for the seeds, crushing, or removing old branches and rustling, or tearing up the sod. A well-prepared soil is an essential element on the way to a successful restoration.

Afforestation.

When planning the species composition during afforestation, it is necessary to consider the habitat conditions and the functions that the future growth is to fulfill. If we want to achieve a high production of wood in a short time, it is recommended to choose conifer species. If we care more about the protective functions of the forest or plan to produce raw materials in the long term, deciduous species are a significantly better choice. Before planting saplings, it is advisable to check in advance whether the soil is infested (presence of insect pest larvae in the soil), as this could pose a great threat to the newly established forest. For afforestation, it is advisable to use mycorrhizal seedlings (seedlings enriched with special types of fungi that improve their development). In the first phase of afforestation, it is also possible to plant first species that prepare the soil by improving its quality and enriching it with organic substances. Pioneer tree species are used for this purpose, which are characterized by fast growth and a high production of light seeds. These rainbows also have low soil fertility requirements and are light-loving and grow well in open areas. These include, for example, Scots pine, warty birch, poplar, aspen and black alder.

Selection of species.

Choosing the right species is one of the most important steps to achieving a specific goal. Forest habitats usually have suitable conditions for multiple species to grow. Special attention must be paid to the rhythm of growth and the differences between individual species, this can affect their health and mechanical stability.

Taking care of the forest.

Reforestation or reforestation is immediately followed by a set of forestry interventions. It is necessary to regulate the density and correct distribution of trees in the stand, to take care of the stands in the form of maintenance cuts, but also to improve the soil and increase the species diversity of the undergrowth. The basic principle is to limit unnecessary interventions. All interventions and treatments should be based on natural processes.

The goal of forestry pruning is to facilitate the access of light, to increase the living space for the trees that we care for and to create suitable conditions in the interior of the forest that support the increase of biodiversity in the lower parts of the stand. By carrying out maintenance cuts, we support species that are valuable and desirable for production, thus anticipating the natural process of separating trees from the stand.

The nature of the maintenance work depends on the developmental stage of the stand. The first maintenance work during the cultivation period is soil care. We apply organic or mineral fertilizer, remove unwanted vegetation mechanically or chemically, and prune too dense tree seedlings. In this period, we try to achieve a species composition corresponding to the given habitat, with the right compactness and the right ratio of species. It is also important to identify and remove excessive growth (overgrown individuals) that shade the surroundings.
In the young forest, we remove defective individuals and those that hinder the development of others. This includes removal or stopping the growth of trees with technical defects, removal of branches and growths, pruning of the most compact parts, removal of diseased and pest-infested trees. Harvesting wood from young trees has little economic value, so we leave dead trees and branches in the forest, they are important for the development of valuable species of fungi, insects, but also lichens or mosses.

A long maintenance phase begins in the adolescent growth. Previously, we mainly removed defective, diseased, or unwanted trees. In this period, we first select the best individuals and support their development with appropriate pruning. At the same time, we remove trees that harm and obstruct them. We will leave the most valuable and best-shaped trees in the stand. We strive to achieve the highest possible production value, biological diversity, and readiness of the stand for renewal. Regulation of the species composition can also take the form of the introduction of so-called production underplanting – the creation of lower forest levels. These interventions are repeated until the age at which the trees are felled. Their

goals, intensity and frequency differ according to the successive stages of the growth of the plant.

At a later stage, when the development of the trees slows down, intensive training cuts should no longer be carried out, as this interrupts the compactness of the tree crowns. This can have an adverse effect on the climate of the forest and the condition of the soil. Caring for the growth ends with its felling.

Felling.

Felling indicates the direction of recovery and the future structure of the stand. These are activities whose goal is not only logging, but also creating suitable conditions for the new generation and for the development of trees in the stand. Due to the different requirements of individual tree species, there are several types of felling. For each of them, we find characteristic features regarding the felling technique, the size and shape of the felled area or the frequency of felling.

- Complete felling is characterized by the one-time removal of the entire stand from a defined area. However, stands (individuals left on an area with an ecological function) or plant groups are often left behind. Toll mining is usually followed by artificial recovery. This method is used in poor habitats or in heavily weeded stands, where it is very difficult to achieve natural regeneration. Toll mining is also used in case of mass die-off.
- Partial felling consists in the even use of the stand. This type of farming is characterized by longer recovery times. For heavily seeded or shade-loving species, regeneration under the canopy is used. The result of partial felling is a one-century and one-story growth.
- Gradual felling. These cuttings are characterized by a long recovery time, the use of cuttings with different frequencies. The result of successive fellings are multi-species stands with a more complex structure and varied age composition.
- Continuous felling. Trees of almost all age classes are found in continuously felled forests. This is individual or group felling of trees. It imitates the processes that take place in a natural forest. The aim is to achieve a balance between renewal, growth and loss (cutting and dying of trees). It is mainly used in mountains and in areas that are difficult to access for large-scale forestry work.

5.3.3. Where to go for forest management advice.

Forest management is essentially an endless ocean of variants and possibilities. It includes a whole range of disciplines (more detailed materials on related thematic areas can be found, for example, here: http://inobio.ldf.mendelu.cz/cz/ka1/inovace_stazeni). As with most human activities, many things become easier if we clarify the goal well at the beginning and describe the current state: the steps on the way to the realization of the goals are then sought much better. The basic forest management cycle is described as briefly as possible below.

The life of the forest and the management in it happen in cycles. The classic cycle of forest management begins and ends with the felling of a tree, a group of trees or the entire stand. Logging is followed by forest restoration, i.e., afforestation; this can happen naturally, sometimes it is useful to help with artificial regeneration by planting seedlings or sowing seeds (for more details, e.g. here: https://akela.mendelu.cz/~xcepl/inobio/inovace/Zakladani_lesa_I/).

If the afforestation was successful, after a few years the trees have outgrown the game and the competing vegetation and on most of the area they have joined (i.e., they start to touch with their crowns). When the vegetation is fully involved (i.e., the tree crowns have completely filled the space), it finds time for so-called educational interventions. This means coming back with a saw roughly every 10 years and cutting out individuals that we no longer want on the surface for some reason. These interventions have a key impact on the species composition, health status, stability, and growth of the stand. Goals and priorities may be different; you can familiarize yourself with the basic procedures and approaches, aimed mainly at the stable production of high-quality wood raw materials, e.g., here: https://akela.mendelu.cz/~xcepl/inobio/skripta/Pesteni_skripta.pdf, https://akela.mendelu.cz/~xcepl/inobio/inovace/Pesteni_lesu_II/ .

If everything goes well and there is no emergency in the form of some kind of calamity (insect, snow, wind, pollution, etc.), the cycle returns to the beginning after 80-160 years (i.e. mining and restoration).

Video instructions for individual activities are available, for example, here: https://www.youtube.com/@svolsdruzenivlastnikuobecn2304/videos-videos
marked "for small forest owners", or here: https://www.youtube.com/watch?v=cHbzNhC-wnk&list=PLnYmywmWn7Pqu1Un_r9aE3Uk1o5dPGuJ , current methodological manuals here: https://www.uhul.cz/portfolio/radce-vlastnika-lesa-a-metodicka-doporuceni/).

5.3.4 Ecology and economy together.

From the previous chapter, you may get the feeling that the economic and ecological approaches to the forest are almost mutually exclusive, and if you have a forest, you must decide whether you want to grow wood or bugs and mushrooms. Hollows, instability, calamity, and degradation—these are terms that often apply to our managed forests. But do they have to be? Forest management takes many forms. Today's central European forests at lower to middle altitudes have been intensively managed since at least the Neolithic period, i.e., about 7000 years ago (in the following chapters, these forests are referred to as lowland forests for simplicity). For several millennia, they have evolved under the influence of human

activity, usually in the most unlikely places. When walking in the deep ravines of the Moravian Karst or in the dense meadows of Litovel Pomoravie, few people today would think that these forests have been cleared many times in past centuries and were commonly grazed by livestock. How is it that, despite the long-term and very intensive exploitation of lowland forests, so many naturally valuable sites and large areas have been preserved? It is not so much the intensity of forest exploitation as the forms and methods of exploitation. Our current economic forests are used in only one way, and the forms of management are quite uniform when looking at the forest more broadly. In many European countries, contemporary forest management is much more diverse. The forests in the Czech Republic are managed almost exclusively in the form of tall forests. The distinction between low, medium, and high forests represents the basic division of forest management. It describes not only management practices but also the nature of the stands, has a deep historical connection, and is also anchored in our forestry legislation. It is good to have at least some awareness of this division, and the following chapters will therefore move in this direction. In the ancient and early medieval periods, forests were used in an unorganized and sometimes very intensive way. For centuries, the dominant and most important type of management in lowland forests was coppice management (felling at a very young age and establishing new stands by coppicing from stumps) and forest grazing. Several species have adapted to such management. The gradual organization of management led to the creation of low and medium forests. The foothill and mountain forests developed differently, as they have long been little or not influenced by man. Low forests, also known as stump forests or coppice forests, are primarily used for firewood production. The cultivation of medium forests, also referred to as associated forests, has evolved to meet dual needs. They are more varied in age and thickness and consist of several tiers of trees—the echelons. The lower thinning is used to produce firewood, and the upper thinning is used to produce thicker diameter timber for construction and other processing.

However, farming practices in Central Europe changed fundamentally between the 18th and 19th centuries as the demands of forest production began to change. With the expansion of the use of coal for domestic heating, the importance of forests as a source of fuel declined, and the demands to produce construction and utility timber, which low and medium forests could not satisfy, grew. Forest grazing and other forms of forest use, which had been widespread until then, were banned. Forest management began to take shape in the form of high forest, also known as high-tribal forest or seed forest. Tall forest is generally characterized by its origin from artificially planted seedlings, its long-life cycle, and, in most forms, its high uniformity. New rational silvicultural practices have been developed, which have been emphasized as opposed to the perceived earlier chaotic exploitation. But the old forms of management were no less rational than they are today; only the methods were different. The differences between earlier and later methods are so great that the literature usually distinguishes between traditional and modern forestry. The type of management in a

forest ecosystem directly or indirectly influences or determines the conditions, structure, and diversity of life in it. Although ecological considerations did not previously exist, traditional forestry was a system that was favorable to the lives of many species that are now endangered. The conversion of low and medium forests to high forests has had a far-reaching impact on the entire lowland forest ecosystem. Conversely, dense forests probably prevailed in mountain areas in the past. Restoration of traditional forms of forest management is increasingly used as a means of protecting the biodiversity of lowland forests. There are many objections to such an approach among the staunch supporters of no-interference in protected areas. It is very important to ask ourselves what we want to protect in each area. Protecting natural processes while leaving them to develop on their own may conflict with the species conservation and biodiversity of lowland forests. The lowland forests of central Europe have been shaped by long-term human influence, and many of the species that grow and live there are adapted to traditional forest use.

The "natural Central European lowland forest" may not even exist. Low and medium forests were gradually converted to high forests, culminating in the mid-20th century. The opposition of the legal norms adopted under the previous regime to coppicing (e.g., Law No. 166/1960 Coll.) also stemmed from the fact that coppicing was regarded as a remnant of predatory capitalist forest management, even though it was mostly a way of using forests by the rural poor. However, they were against the mission of the economic forests, which was to produce quality timber. The change in requirements for timber production, the end of private ownership under the communist regime, state forestry policy, and the training of forestry experts and managers, which was heavily focused on the cultivation of high forests, all led to the disappearance of traditional forest management in our country. According to various sources, the current area of low forest in the Czech Republic is reported to be 0.1–0.7% of the forest land fund. Moreover, much of it is stubble land, which is no longer actively managed in this way (the extent to which these statistics are misleading remains to be seen). In many European countries, the distribution of and access to traditional forms of forest management are very different. Lowland forestry is relatively common in the Balkan countries, Italy, and Spain. The cultivation of medium-sized forests is mainly widespread in Germany and France. Traditional forms of farming are enjoying a renaissance in many other countries, such as Austria, Sweden, and Poland. In the Czech Republic, we had to wait until 2019 for legislation to be amended to allow low and medium forest management at all. Until then, it was subject to several exceptions and was mainly limited to various experimental areas and isolated protected areas. Our current foresters generally disdain traditional forms of management as outdated and inefficient. As time passes and scientific knowledge deepens, the demand for timber production is evolving (again, fuelwood consumption is rising significantly), and more emphasis is being placed on the non-productive functions of forests. In particular, the stands of economic forests are sensitive to climate change and are severely affected by various calamities. What used to be the case in the past is no longer the

case in many cases, and forestry must evolve and respond to change. Modern forest management cannot just be about timber production but above all about the ecological integrity, biodiversity, and sustainability of the forest ecosystem. Even some professional foresters are becoming increasingly interested in traditional forms of forest management and are trying to apply them as economically viable forms of management. In no way do we want to single out one type of management over another. Each brings something different, suited to different conditions, situations, and purposes. There is no doubt that tall forestry will continue to be the dominant form of forest management, given the current economic demands on forestry. Low and medium forest management could be recommended, especially for smaller private ownerships or communal estates, and will also be increasingly applied as a means of protecting the biodiversity of lowland forests. The following chapters describe in more detail the different types of forest management and their implications. However, they are far from being a detailed guide. They are primarily an overview of the possibilities and inspiration for how to conceptualize your forest. There are an infinite number of options and practices for specific stands and situations. These will depend primarily on the current state of the habitat, the habitat conditions, our capabilities, and our goals and expectations.

5.3.4.1. Low growing forest.

What is a low growing forest?

A low growing forest is a forest that grows exclusively from the stump (or even root) growth of dead trees. The stumps, especially of some trees and at younger ages, are easily converted, and new trunks grow from them. Therefore, multi-stemmed formations are typical of low growing forests. The felling interval (or coppicing period) is very short in this forest type. On average, it is only 30 years, but depending on the habitat and tree species, it could be much less. This cycle can have very many repetitions, and the stumps of a coppice forest are many times older than the trees.

The timber from the low growing forest is of significantly poorer quality, it is twisted and often curved in various ways, and has poorer technical properties. However, for the main purpose of these forests, these shortcomings of the wood are irrelevant. Low forests are primarily used to produce firewood or smaller and less valuable timber grades. Prior to the expansion of charcoal use, forests had to provide large quantities of easily workable firewood each year. For simplicity of management, low forests were associated with private ownership of small woodlands (so-called peasant forests), but large estates were also managed in this way. In the past, they were widespread, especially in the lowlands and uplands.

This is a form of forest that is very far removed from the natural functioning of the forest ecosystem, as repeated cutting and biomass removal have a significant impact on the metabolic cycle, and short periods of forest cover keep it permanently in the regrowth phase. However, this does not at all mean that it is a remote and species-unfriendly environment. On the contrary! Even in a small area, the low forest and its specific way of management create a varied mosaic of diverse habitats of light, young, dense, and dark groups at the clearing age. This provides a suitable environment for a considerable number of plants and animals with different habitat requirements. Low growing forests are an example where high management intensity directly determines high environmental biodiversity.

Cultivation of low forest

Low forest cultivation is concentrated mainly in lowland areas. The low forest is a cultural formation that, without managed intervention, will tend to disappear and be replaced by another form of forest. The main or only product is firewood. The natural values are a benefit that came by chance and that the simple peasant hardly noticed, let alone appreciated, in the past. Management in the low forest is very intensive. It is often referred to as coppicing or coppice farming. Cutting is carried out cyclically at very short intervals (clearings). The length of the interval is influenced both by the species of tree and the fertility of the habitat. The usual length is between 20 and 30 years, but it has never been longer than 5 years for willow trees and can exceed 50 years for alder, for example. Determining the correct length of time to harvest is a critical factor from a forester's point of view, as timber production declines rapidly after a certain year. Harvesting can be carried out in a single operation over a larger area to create a larger clearing, or in stages where individual trees or smaller groups of trees are harvested.

Larger areas of forest are usually cleared in the winter or early spring. To achieve the maximum effect in terms of biodiversity, it is necessary to remove wood regularly and over a short period of time to maximize the diversity of stand (light) conditions over a relatively small area. As already mentioned, in low forests, new growth is almost exclusively vegetative, with stump and sometimes root regeneration. Stump height has a major influence on the formation and quality of coppice. The principle is to keep the stump as low as possible. New shoots can grow up to 1–1.5 m per year, and the growth is very strong in the following years. In contrast, new saplings from seedlings tend to struggle to survive in the first few years, and growth does not occur until several years later. For the conditions of the Czech Republic, alders, oaks, hornbeams, maples, ash, elms, limes, willows, and poplars are recommended for low forest, and shrubs such as hazel, holly, or cedar can also be used. These are woody plants that are characterized by their high coppicing capacity. Conifers are completely unsuitable for this type of management. From a practical point of view, low forest management is relatively simple. The main thing is to set the clearing area

appropriately and to divide the forest into sections that will be harvested gradually. By creating a single stand that is restocked with coppice, we have not yet started to manage the low forest. It is all about the management system and the cyclical nature of the whole process. If the main economic purpose of this forest is to produce firewood, it is important for the owner that the supply of firewood be continuous. It makes no sense to harvest your whole forest at once and wait 30 years for the next fuelwood harvest. Low-forest management also has very low to zero growing costs. No new trees are planted, and in many places, no educational interventions are carried out. Thus, the only intervention in the forest may be the clearing of the stand. In terms of forestry management, low forest is particularly suitable for small forest owners, who are able to obtain timber at short intervals and do not have to wait several generations for direct benefits.

In the Czech Republic, low forest management has practically disappeared, and the once widespread stumps have outgrown and now have the character of so-called false logs. Typical coppice management in the Czech Republic is limited to experimental areas or isolated parts of some nature reserves. However, in some European countries, lowland forest still represents an important source of renewable energy. These are mainly the Balkan countries and some areas of Italy and Spain, and they are enjoying a Renaissance, for example, in Sweden, the Netherlands, Denmark, and Poland. There are even cases of stumps being introduced on abandoned farmland. The modern trend towards the restoration of traditional management is often motivated by the desire to restore species richness, which has declined significantly due to the disappearance of stumps in the areas concerned.

Low forest and its biodiversity

The way forests are managed has a huge impact on the composition of the vegetation and the number of species. Numerous studies show that the diversity of low and medium forest is higher than it would be in high forest or in completely unmanaged forest (the concepts of medium and high forest are described in the following chapters). Studies also show that many plant and animal species have a high affinity for low and medium forests. The vegetation of these forests is influenced by a large number of factors, all of which cannot be identified, let alone generalized or quantified in any way. Nevertheless, it is possible to point to the main ones, which include, above all, their light character and the heterogeneous structure of these forests. The light character of the stands is due to the frequent clearing of the trees. Often, the trees do not even grow to such a size that the crowns are fully engaged. As described above, in low and medium forests, harvesting is usually carried out in smaller areas, so that there are always areas in the stand that have just been washed with full sun, as well as shady areas just before harvesting. Low and medium forests are therefore made up of a dynamic mosaic of habitats at different stages of development, which contributes greatly to their diversity and thus to their species richness. Species diversity is higher in actively managed coppice and medium forests than in abandoned forests, where it declines

rapidly over time. Another reason for the species richness of these forests was probably the reduced fertility of the environment. Due to intensive and long-term biomass removal, these forests were more nutrient-poor than our current forests. Eutrophication of the environment is considered one of the main environmental problems threatening biodiversity.

In actively managed forests of this type, mainly light-loving plant species are found. However, it is important that these forests have provided suitable conditions for the occurrence of both light-loving and shade-loving species (plants and animals). Light forests provide a suitable habitat not only for plants but also for many insect species. This is well documented, for example, in the case of butterflies, where the diversity of the herbaceous undergrowth increases analogously with their richness. The ancient and repeatedly rejuvenating stumps in turn provide suitable habitat for species requiring old and decaying wood. Low and medium forests are also rich in bird and mammal species, which find a wealth of different habitats, shelter, and feeding opportunities. At the time of the decline of the low and medium forests, about a century ago, there was also a severe decline in plant and animal species. Many species have completely disappeared from large areas and are now endangered. Many species that are generally considered to be forest species are not at all suited for the present-day high forests, which are cultivated in heavy undergrowth and have a long rotation period. Species that are both forest-dependent and require sufficient light are in decline in Europe. Nowadays, these species survive, for example, in grasslands and forest edges. A return to historic forest management is being used by many countries around the world as a means of protecting biodiversity.

5.3.4.2. Middle growing forest.

What is the middle growing forest?

A middle growing forest, or mixed forest, is a combination of high and low forest. The term 'mixed' forest is a good way of saying that two regeneration types meet in this forest, as well as several stages (layers) of trees of different ages. The lower and densest layer is mostly coppicing forest with a short regeneration period and is managed in a similar way to the low forest described above. It is important, however, that this lower, predominantly coppice layer also contains some seed trees. Above the coppice stage there is an upper layer of variously aged trees. The upper layer is usually of seed origin and may consist of several generations of trees. As the age of the trees increases, the number of trees in each layer decreases.

Deciduous trees are grown on the lower floor, which have a reliable yield and tolerate shade better, but there are also trees that we want to grow further on the upper floor, and which are economically valuable. They are mostly oaks, but unlike the low forest, conifers can also

be found here. However, the shape of the middle forest can be very diverse, especially according to the needs of the owner and the emphasis on a particular floor. There may be a predominance of the breeding layer with very few trees in the upper layer, or on the contrary, the upper layer may be more involved. The upper layer can be just one generation of trees, or it can be made up of several generations of trees, and finally, it can also be of vegetative origin grown from cuttings, and seed renewal can only be sporadic.

The cultivation of middle growing forests served to ensure the needs of a dual nature. The coppice layer was used to produce firewood. The upper layer then provided wood with thicker diameters. Much of the same applies to the biodiversity of the middle growing forest as it does to the low forest. The result of specific and intensive management was a dynamic mosaic of diverse habitats with the occurrence of many species of plants and animals with different demands. With sophisticated management, the middle forest can be economically very interesting and produce very valuable wood for further processing. It is an almost ideal form of forest, where the world of planned forest management driven by a ruthless economy can be combined with the world of biodiversity and nature conservation requirements. With sophisticated management, the medium forest can also be economically very interesting and produce very valuable timber for further processing. It is almost an ideal forest form where the world of planned forestry driven by ruthless economics and the world of biodiversity and conservation requirements can be reconciled.

The middle growing forests in our country have unfortunately had a similar fate to the low growing forests and have disappeared from the economic forest in the Czech Republic. Their cyclical management was discarded, and they were converted to long-lived high forests. However, their remnants can still be found in our country in many places and over large areas. At lower altitudes, these are often the most biologically and aesthetically valuable stands.

Cultivation of the middle growing forest

The cultivation of middle growing forests is an intensive form of management that produces large quantities of timber. The most distinctive feature of the central forest is its stage structure, consisting of layers of different ages and origins. A coppice forest is created by leaving a certain number of individuals of ideally seeded origin in place each time the lowest coppice stage is cleared, at a normal interval of 20 to 50 years. These individuals give rise to several higher layers (usually 3 or 4) above the coppice, each more or less the same age. If the maturity of the coppice layer is about 30 years, the generation of higher layer divides this period gradually. Each stage has a different number of older trees, with the number of them decreasing as the age of the stage increases (the oldest trees being the fewest). Already at the beginning of a new generation of coppice, the trees that are of the highest quality and most promising for further cultivation as coppice are either planted or selected.

Each time a coppice stage is harvested, approximately 50–100 future height trees are left per hectare. At the same time, the number of trees in each generation of the upper stage is also partially reduced when the coppice is harvested. The total number per hectare should not exceed 150 to 200 trunks. A model example of the number of generations and stands in a forest with a coppice stand of 30 years may look as follows: coppice stand of age 0–30 years; a stand of the 1st generation of age 30–60 years; 90 trees per 1 hectare of forest; stands of the 2nd generation of age 60–90 years - 32 trees; stands of the 3rd generation of age 90-120 years - 8 trees; stands of the 4th generation of age more than 120 years - 4 trees. On extremely poor or exposed sites, the forest should tend to have fewer older trees with a higher proportion of vegetative regeneration, and on richer soils, a higher number with a higher proportion of generative regeneration. Management in the upper layer is selective, with the most promising individuals always being transferred to the next generation. In this way, the farmer grows and further enhances the best quality trees, which become the golden eggs of his forest. The harvesting of the coppice layer is carried out as a single operation with the harvesting of the older trees in all generations, so that the lower stages are damaged as little as possible.

In the middle growing forest, the lesser amount of light reaching the lower forest floor must be taken into account. Therefore, mainly shade-tolerant species with good stump yield are grown here. These are mainly lindens, maples, elms, and hornbeams. However, in our conditions, the main supporting species of the middle growing forest are oaks, which are the main type of tree for the upper layer. All native broadleaved species can be used in it though, especially the economically valuable maples, elms, cherries, and birches, but also firs, pines, and spruces.

The middle growing forest has its own charm and a very plastic character, which the forester can influence to a great extent. The above-described principles of management in the form of a middle growing forest can appear very complex to the layman. Indeed, you can approach it in a very sophisticated way; you can plan your management carefully, adapt your interventions to the current situation, react to the development of the stand, maintain an optimum relationship between the lower and upper layers, and on top of that, you can give extra care to selected trees. Such management places high demands on the expertise of the manager and an individual approach to the stand. You may or may not be able to do all of this in a middle growing forest. A middle growing forest can take many forms, and it is up to the owner what he expects from it and how he approaches it. As long as you don't need to produce a particularly valuable product range and value the forest primarily economically, this management can be relatively simple in the end. It is enough to determine the number of stages required and the approximate number of high trees that should remain in each stage after harvesting. And then harvest at regular intervals, say once every 30 to 40 years.

For small forest owners at lower elevations, the middle growing forest is the ideal forest form. Its economic charm lies primarily in the possibility of short production intervals and the advantage of a varied production. The diversity and balance of production also reduce the risk of losing the investment. This is compounded by a sense of 'social justice', since, as in the case of low forests, each generation of farmers benefits from the middle growing orest. The middle growing forest meets not only the economic requirements of foresters (although many of them may be unaware of this), but also the broader demands of society and nature conservation for other non-productive forest functions. Today, cultivation in this form of forest is most widespread in France and Germany but is experiencing a renaissance elsewhere. Motives for its reintroduction include the promotion of species diversity and a greater emphasis on other non-productive forest functions. In Czech Republic, the cultivation of middle growing forests is again sporadically appearing in some reserves and on various experimental sites. There are also isolated attempts to introduce this type of management in private or communal forests.

The middle growing forest and its biodiversity.

The characteristics of the forest environment and the dynamics of the stands are quite similar to those of low growing forests. Therefore, much of what is described above for low growing forests also applies to their biodiversity. The dynamic mosaic structure of the diverse habitats of regularly managed middle growing forests creates the conditions for high biodiversity in all its components. However, the middle growing forest provides even more habitat types than the low growing forest, and its habitat mosaic is even more diverse. These are different generations of higher trees. A particularly important aspect for the biodiversity of the central forest is that the higher trees tend to be largely sunlit. Many species are associated with sunlit trees or their trunks. In the high-tree forests, although they may be old stands with a natural tree composition, the conditions are quite unsuitable for these organisms. An example of such a species is our largest beetle, the endangered great horned beetle, which needs the sunny trunks of deciduous trees. In some protected areas in the lower elevations, nature conservation is therefore trying to introduce practices where the old trees are screened off.

A completely unique element in the forest stands is provided by standing over-aged live and dead trees. A mighty oak tree that has reached its economic optimum at a certain stage may continue to die quietly in the stand for several centuries. For as long as it exists, it will provide a habitat for a large number of other organisms. Dead and dying trees are a key element for a wide range of so-called saprophytic (i.e., dead wood-dependent) organisms. Unfortunately, these older trees are almost absent from commercial forests, making the species dependent on them rare and endangered. As it happens to old trees, over the years they are damaged by the withering and breaking off of branches, the formation of cavities,

the action of insects, fungi, and other organisms, etc. It is common forestry practice to remove damaged and over-aged trees from stands. Forestry legislation (Act No. 289/1995 Coll.) directly obliges the owner to carry out priority 'random harvesting', which involves the processing of dry, uprooted, damaged, or diseased trees. This is primarily to prevent the possible spread of harmful organisms and infections in the forest, as well as for safety reasons. In many cases, however, the procedure is completely irrational, justified simply because the stump 'doesn't look nice and that's just the way it's done'. The old and dying trees in the lower-altitude management forests are often remnants of former management in the form of a middle forest. Removing them from forests removes a completely unique habitat that may not be present for miles. Its replacement will not grow back for many decades, and God only knows if it will.

5.3.4.3. High forest.

What is a high forest?

A high forest (also called a high stem forest or seed forest) is a form of forest created from seeds by artificial sowing, artificial planting of seedlings or natural regeneration. It is generally characterized by a long production period (rotation), usually at least a century (depending on the species), and the trees harvested are usually of considerable size (compared to low growing forest and most medium growing forest production). In terms of stand structure, high forests tend to be dense, generally highly homogeneous in age, spatially monotonous and often focused on the cultivation of a single tree species. Even with this characteristic, however, they can take myriad forms. On the one hand, it can be a dark spruce monoculture completely devoid of undergrowth, which is almost a biological desert; on the other hand, it can be a beech forest with an admixture of fir trees, consisting of several layers of trees and with an occasional decaying giant forest where we can meet the spotted newt, the wood pigeon, or the coral fir.

The high forest is currently the most widespread economic forest form and, according to statistics, almost the only forest form in the Czech Republic (although the reality is not as clear-cut as mentioned elsewhere). However, management in this forest form is a relatively young method. In the boom period of medium and low forest cultivation, it was probably used only rarely. However, from around the mid-18th century and especially in the 19th century, the needs for forest use changed significantly - from a source of fuel, grazing for livestock, or a source of various forest fruits, forests became primarily a source of construction and utility timber. This process affected mainly the forests of the lowlands and uplands, where previously low and medium growing forests had been most widespread. There has been a change in the structure of stands, both in terms of height and species, a change in the method of regeneration from natural to artificial, and forestry is developing as an economic field.

Growing high forest.

The cultivation of the high forest is covered in detail in many textbooks and methodological procedures, and most of the cultivation and forestry concepts are related to it. This is because, with the development of high forestry, forestry began to be approached in a very rational and organized manner, and forestry began to develop as an economic field (recall, however, how highly sophisticated the concept of middle growing forest forestry can be). Our forestry legislation is also strongly focused on the cultivation of the high forest. The cultivation of the high forest can take many forms. The least environmentally friendly form of farming is the bare-soil form, which creates larger groves. This method has basically three phases: artificial planting, cultivation, and finally one-off or short-interval gradual clearing. This is followed by the replanting of the new forest. This results in stands of the same age, that have a full production cycle (regeneration) of approximately 100 years. This type of management severely reduces the biodiversity of the forest environment, damages the soil, disturbs the water regime of the landscape, and is prone to calamities, such as logging and bark beetle infestations.

Unfortunately, this is still the way in which most of our forests are managed. For the small forest owner, this method has another significant disadvantage, namely that it takes several generations to harvest a tree at maturity. In our forests, we should therefore strive for nature-friendly management: no clear-cutting, natural regeneration, a varied composition and structure of stands, and benefit from the forest as continuously as possible.

There are many ways and methods to reduce the negative impacts of forest management and to use spontaneous natural processes. The closest to natural forest management and its dynamics is the so-called selective management (selective forest). Selective management is particularly suitable for forests in the middle and higher altitudes. Unlike the forests of the lowlands and uplands, these have historically developed spontaneously, without human influence. Here, it is appropriate to apply close-to-nature management that simulates the natural forest ecosystem. Although some people may associate a selective forest with the idea of a natural forest, it is a unit created by long-term active human activity, and one of its main objectives is high timber production.

In a selective forest, trees of different species at different stages of development are permanently represented in the area. Trees of different ages, heights, and thicknesses alternate and intermingle. It is characterized by the full filling of the aboveground growth space and the maximum use of the growth potential, which distinguishes it from low and medium forests. The harvesting of mature trees according to the target thickness is carried out by selecting either individual trees or groups of trees. Harvesting makes room for the next generation, and regeneration is continuous and uninterrupted. Stand intervention

occurs at short time intervals of 5 to 10 years. Extending the interval leads to adverse changes in the structure of the selective forest. Selective management means maintaining the stand permanently in the peak growth phase. Compared to natural forests of the middle and higher altitudes, the decay stage is absent.

Thanks to its diversity, a selective forest is better able to resist harmful influences and perform other non-productive forest functions much better. It allows owners of even small areas to obtain a regular yield without having to wait. Permanence, security, and continuity of management are ensured over a much smaller area than with other high forest management methods. Some of the practices of close-to-nature management may be more costly than the use of clear-felling methods, but others will save money. This is because they are based on the philosophy of letting nature work for free. But economic gain is far from all that a forest provides; the wide range of its non-productive functions is very difficult to quantify.

Although considerable attention has already been paid to the issue of converting pastoral management to selective management in the Czech Republic, true selective forests do not exist in the Czech Republic. The main reasons are the long-term nature of the process, changing conditions (emissions, political decisions), and the occurrence of random influences. In our country, there are only stands in various stages of conversion. If there are stands with a structure close to selective, nature has played a greater role than the farmer in their condition. This may be the reason why selective management is often idealized in our country. Mixed, middle-aged, diverse stands with natural regeneration are the most suitable for conversion to selective management. Most selective forests are located in mountainous and alpine areas. This type of management is most widespread in Slovenia, Switzerland, and some mountain areas of Germany, Austria, and France. Isolated stands of selective forest can also be found in Slovakia and Moravia.

High forest and its biodiversity.

When assessing the impact of high forest cultivation on biodiversity, it is necessary to take altitude into account. Central European lowland and upland forests have been exploited in various forms and intensities for several thousand years, and their biodiversity has evolved under this influence over a long period of time. Forest management here has gradually developed into stump forests and middle growing forests. Due to the long-term development and duration of this management, many organisms have evolved along with it and adapted to it. Until a few decades ago, it was generally accepted that prehistoric European forests everywhere formed dense, connected, and continuous stands. Over time, however, scientists have been forced to reconsider this view. Even the lowland forests were much lighter and looser than today's high forests, for example in the Polabí region, before

intensive human impact on the landscape. Although the floodplain forests in the Libický luh National Park may look very natural, they are not and cannot be natural for many reasons.

In the lower and mountain areas, forests have developed differently. For a long time, man has had little or no influence on them. Since the 19th century, lowland forests have been intensively converted to high forests, and since about the middle of the 20th century, low and medium growing forests have been managed practically nowhere. This significant change in forest architecture, the loss of light, and, last but not least, the homogenization of the forest environment has gradually led to a great reduction in the biodiversity of lowland forests. The decline or even extinction of many species of plants and animals associated with light forests is a direct consequence of their conversion to high, long-lived, connected forests. There has been a shift towards poorer communities with a predominance of shade-tolerant species and no significant specialization in specific habitats.

This is not to say, of course, that connected forests are not worthy of protection or do not need it. There are several organisms that do require connected forests (although they are considerably fewer than those that need sparse forests). However, natural forests with high stocking rates and long-life cycles must be sought at higher elevations. However, natural forests with a higher density and a long-life cycle must be sought at higher altitudes. These are mainly beech forests and mixed mountain forests. But light also plays an important role in the biodiversity of the natural mountain forest. The closest thing to natural dynamics in high forest management is selective management. Selective harvesting increases, at least temporarily, the penetration of light into the undergrowth and can increase the occurrence and abundance of species with widely differing environmental requirements. An important characteristic of selective forest from a biodiversity perspective is that encroachment is very frequent but small-scale, resulting in a dynamic mosaic of very diverse habitats. Compared to natural forests, the decay phase is absent in a managed selection forest. However, compared to the same old holm systems, the difference in the amount of dead wood is considerable. The importance of old dead trees and fallen deadwood for biodiversity is undeniable. The spread of intensive farming systems has put some deadwood-dependent species at risk of extinction. Leaving tall stumps may be the minimum measure to provide at least some habitat for saprophytic organisms.

5.3.4.4. Legal frame for low and middle growing forest today.

Whether your land is classified as "forest land" or some other category in the land register is crucial for forest management. It is very likely to be 'forest land'. Other categories may include, for example, woodlands created by the growth of trees on former agricultural land. Management on forest land is regulated by the so-called Forest Act No. 289/1995 Coll. and

related regulations. Until 2020, it was still very complicated to manage in low or middle growing forest form from a legislative point of view.

Our legislation focuses on the production of timber in the form of logs and does little to reflect the social demand for different forest functions, the increasing demand for fuelwood, or the importance of low and medium forests for biodiversity conservation. It is not that the Forest Act explicitly prohibits the cultivation of low and medium forests, but its various restrictive provisions have made it virtually impossible to manage in this way. The provision prohibiting clear-cutting in stands younger than 80 years was quite crucial (§33 article 4). This provision could not be complied with in the case of low growing forest regeneration periods and harvesting cycles in medium growing forests, which are usually around 30 years. Another significant restriction was the prohibition on reducing the stunting by deliberate harvesting below 0.7 (§31 article 4). When harvesting in the central forest, the stunting of the retained stands falls well below this value. Anyone wishing to manage according to the principles of low and medium forests would have to obtain several exemptions. Legislative obstacles were another reason why such management has completely disappeared in our country. It has only recently started to appear here, especially in various experimental areas and in some protected areas.

At the end of 2019, an amendment to the Forestry Act (Act No. 314/2019 Coll.) came into force, which fundamentally changes the possibilities of cultivating low and medium forests. The attitude of the forest owner or manager is crucial. If he wants to manage a low or medium growing forest, then the legislation no longer prevents him from doing so. The current legislation stipulates a minimum period of 80 years in a high forest and 20 years in a low or medium growing forest (§33 article 5). Thus, the length of rotation is now differentiated in the law according to the type of forest in which the stand is classified. Here it is necessary to take a slightly larger detour to explain how our stand is classified as low, medium, or high forest. For all forest stands, so-called Forest Management Plans (FMPs) are drawn up at regular intervals (usually every 10 years). If you own more than 50 ha of forest, you have a FMP and are obliged to manage according to it. If you own less than 50 hectares, FMPs are prepared for your forests. The cost of the FMP is covered by the state, and the forest owner receives it free of charge from the state forest administration authority (at the level of municipalities with extended competence). If the FMP is accepted by the owner, it is binding for him. This is not compulsory, and he does not have to follow their recommendations, but certain rules for forest management still apply. The owner can influence and direct the creation of new FMPs for his forest according to his requirements and ideas. Part of the FMP is the so-called management book, which shows the state of the forest stands and suggests possible management measures. Here, the stands are also categorized as low, middle, and high. It is very important that the owner takes an interest in the development of the FMP and directs the classification of his stands into the appropriate

forest form. The role of the owner is very important! Changes in the approved FMP are complicated and only possible for serious and objective reasons (e.g., calamities).

Forest shapes are defined in the implementing regulation of the Forest Act in Decree No. 298/2018 Coll. (§ 3 article 2 (f)). There is a distinction between the economic form 1. high, for forest stands formed from seeds or planting material of forest trees; 2. low, for forest stands formed by coppicing, and 3. medium, for forest stands where the lower story was formed mainly by coppicing and one or more upper stories were formed mainly from seeds or planting material of forest trees. Importantly, age, height, or other characteristics are not decisive for classification as a shape, but only origin - from seed or coppice. Even old-growth stumps and medium forests that have not been coppiced for many decades are still low and medium forests. And there are still large areas of these in the Czech Republic! These stands are called false logs areas and are classified as high forest. The result is tens of thousands of hectares of administrative high forest with all the negative consequences of their improper management, owners, and biodiversity. Even a 120-year-old non-genuine stem forest, if of coppice origin, is still low forest. The provision on the division of forest management forms is not followed by the preparers of FMPs, and the state forest administration authorities ignore it when approving them and do not check compliance with it. This is mainly due to the forestry tradition or phobia of managing in a different forest form than the high forest form. Here again, we stress the role of the owner in creating forestry planning documents.

The provision in the Forest Act that the maximum width of clear felling should be limited to two heights of the surrounding stand (§ 31 article 2) may cause difficulties in restoring low and medium forest management. Given the usual stand height of coppice forests and the light requirements of the trees grown in this way, this provision may act as a barrier to the rapid and successful regeneration of stands of sun-loving trees. Exceptions to this provision may be made, but only in specific cases that are not relevant to the issue of coppice forests. Some other provisions of the Forest Act may complicate the management of low and medium forests to some extent, but they no longer prevent us from managing in these ways.

Low and middle growing forests were concentrated in our country at lower and middle altitudes. There is no historical tradition of their cultivation in higher areas, and current legislation does not even allow it. All forest stands on forest land are classified according to climatic and soil characteristics into 'forest types'. One of the important forestry documents is the so-called forest-typological map. The forest types are grouped into so-called target management sets. For each target management unit, the decree defines basic management recommendations (stand type, length of rotation, and regeneration period). For example, if our stands fall into the economic group of 25 nutrient habitats at lower altitudes, we can apply the stand type of hardwood stubble with a 20–40-year regeneration period. However, if we have forests somewhere in the foothills in management group 55 nutrient habitats at higher altitudes, then coppice management with a short regeneration period is not possible.

We can find out which forest type and target management group our stands are classified in from the FMP management books. Typological maps are also publicly available on the internet.

The current legislative framework no longer prevents us from growing low and medium growing forest types. What we will certainly face, however, is a lack of experience and methodological procedures. Growing recommendations for stunted and middle growing forests have almost fallen into oblivion in our country. The procedures for converting low and medium growing forests to high forests are very detailed. This is the direction in which forestry and forestry education have been developing for some 200 years. The opposite procedures, the conversion of false or true log areas to low or middle growing forest management, are gradually emerging. Among foresters, attempts to restore low and medium growing forest management are generally perceived as a return to outdated and forest-destroying practices and as a denigration of modern forestry and themselves. A professional forester can assist us in managing our forests. This is an authorized person who is either assigned to us by the state forestry authority (free of charge) or we can choose one ourselves (we then pay for his services ourselves). It is certainly preferable to have such an advisor who is enlightened, helpful, and who can help us with the restoration of traditional forest management.

It is necessary to briefly mention the situation where we have forest vegetation on land classified in the land register in a category other than 'forest land'. The issue of tree felling outside the forest is regulated by the Act on Nature and Landscape Protection No. 114/1992 Coll.

The tree felling outside the forest requires a permit from the municipal authority (an exception is, for example, the emergency condition of trees). This permit can only be issued for serious reasons after an assessment of the functional and aesthetic importance of the tree. However, it is not necessary to authorize or notify the felling of trees if the circumference of the tree does not exceed 80 cm at a height of 130 cm above the ground. In a low forest with a normal rotation of around 30 years, the trees do not even reach these dimensions. The size of the continuously felled area is also important. You do not need a felling permit if the area of the cut stands involved does not exceed 40 m2. Then it is up to your creativity on how to distribute the felling in space and time so that we do not have continuous areas without trees larger than 40 m2. We can proceed, for example, by gradually thinning the stand or by creating more and more holes. The permission for clearing an area greater than 40 m2 also applies to continuous stands of scrub. So, if you have a continuous area of scrub, for example on former agricultural land, you are not restricted in terms of Act No. 114/1992 Coll. and the felling of trees if you follow a few simple rules and can start to transform this scrub into a coppice forest. Nor are you restricted in trying to create thinning woods or in carrying out livestock grazing.

5.3.4.5. Forest cover exchange.

Three states play a role in this matter:

- What kind of vegetation is on the site?
- What kind of vegetation do I want to have there, or what is the goal?
- What kind of vegetation would be established there under existing conditions?

The more these conditions differ, the more difficult, and in some cases impossible, it will be to replace and possibly maintain the stand. The limits of what is possible are determined by the natural conditions i.e., mainly by the course of temperatures during the year and the availability of water, light, and nutrients.

What can we want? A different species, spatial, or age composition of the forest.

A change in species composition can be achieved either as a one-off restoration after the previous stand has been removed or has reached the end of its life or gradually through clearing or marginal cutting and subsequent replanting and underplanting, especially where there is a little lighter than before. However, the ecological requirements of the trees should always be taken into consideration; while this is quite natural for shade-tolerant trees, light-loving trees (e.g., birch, oak, and pine) often wither away in this case or chase the light so vigorously that their stems break after a few years because they are too long and thin.

The change in the age and spatial composition of the stand are almost always related. It consists in the gradual diversification of a monoculture, usually of the same age, by felling one or a group of trees. Again, the natural characteristics of the tree species must be respected; while some trees need only one tree to be removed and a carpet of undergrowth to be formed in the shade (fir, beech, and to some extent spruce), others need more intensive light to develop, i.e., the removal of several trees (spruce), and some tree species only thrive in full sunlight, which means removing trees at least to stand height (oak, birch, pine, and to some extent spruce).

Needs of the trees:

Forest stand conversion – a fundamental change in the tree species composition by early or accelerated regeneration to the target tree species representation. The reason for stand conversion is a fundamental mismatch between the production potential of the habitat, or secondary, long-term changed growth conditions (e.g., the effect of immissions), and the current tree species or ecotype composition of stands (most often spruce and pine monocultures).

Conversion of an economic method – deliberate change from one economic method to another. It always results in a change in the structure of stands and forests. The conversion of a bare-growing form of forest management method to undergrowth or of a pastoral management method to a selective management method is justified by the desire to make better, more complete, and long-term economic use of the growth potential of the habitat and to achieve ecological stability in the forest; it is carried out by a set of long-term management measures. The technique of such conversions uses mainly regeneration cuts, taking advantage of the ecological impact of the converted stand and a rather long regeneration period, while applying the principles of stock management. It is optimal to prepare stands for conversion at middle age. Reverse conversion is rarely carried out and brings short-term economic gain. Conversion of management practices is usually associated with stand conversion, and together they are the main tool for applying nature-friendly silviculture to forests that have been substantially altered from their natural composition by previous cultivation.

Conversion of forest form – the deliberate change of one forest form to another, brought about by a combination of silvicultural and other forest management measures. In the past, conversion of a coppice forest to a seed forest was most common. These were either direct, i.e., by artificial planting after a one-off clearing of the coppice, or indirect, where the ecological effects of the coppice are exploited for the duration of the conversion. The new stand is then established by combined regeneration (conversion by regeneration), by supporting seedlings and quality coppice individuals (conversion by rearing, pre-planting), or through a temporary associated forest. The reverse conversion of seed forests to coppice forests is possible, but unusual.

In general, I see stand replacement as the most extreme option, which I would only resort to when there is no other way (e.g., the disintegration of mountain stands due to immissions and their replacement with exotic spruces or black spruce; calamitous events, whether current bark beetles or historically, e.g., the monsoon in the 1920s, are also a great, but unwelcome, opportunity to convert large areas of forest). I would certainly prefer a gradual, targeted conversion in incremental steps, e.g., by thinning the original stand and then replanting or reseeding with seedlings of the target tree species, or by using natural regeneration. Revolution (radical change) is also possible in forests but carries much greater risks than evolution (gradual change).

5.3.5. When I dream about non-intervention forest - dream of a natural forest.

Few people are lucky, and their forest is perceived as so valuable that it is part of a nature reserve, zone I of a protected landscape area or a national park, where varying degrees of

non-intervention management are even required. Paradoxically, those lucky people would not usually call it luck.

Although due to the current bark beetle calamity and the purchase prices of wood, relatively many owners have started operating in non-intervention way too, in the normal forest, and most of the forests are the normal ones, it cannot be recommended to anyone. In most cases, sooner or later you will come across the Forest Law which imposes the ´care of a proper manager´. This imposes at least not endanger the property of neighbors by your non-activity/activity. If someone really wants to let their forest grow up like wood in the forest (Czech proverb – to grow without any care) and do nothing there, they should think about it before they buy it or get it.

Ideal places for such a purpose are one of the above-mentioned protected areas. This land is not very expensive, because there is usually not much to manage there, and this is also the reason why it has been preserved. On the other hand, it is in these areas the state often has a pre-emption right.

Another option is to buy younger stands of trees, that do not suffer from calamitous pests and can ´raise´ themselves, or to create their living space, to dilute. This could be possible with a young beech stand; fir stand or even some oak groves. But there are not that many opportunities to get on hold of such a forest, because when someone is already trying to establish a new forest, they usually do not do it to sell the land right after the most demanding work has been done.

The last option is to get a fresh clearing or dry forest, let life happen there and hope that nature will forest the place itself. But then again, there may be a conflict with the law, which by default orders the clearing to be afforested within two years and stable within the next five. Although this may look like unnecessary orders, in fact, it protects the public interest in performing forest functions like accumulation and retardation of water runoff, protection of soil against erosion, retardation of winds, etc. And after more than two years the establishment of a new forest is much more demanding, especially workwise.

Succession or spontaneous development

If we leave enough time for spontaneous development, under the current natural conditions in our country (Czech Republic), in most cases we will end up in a forest with a predominance of one tree species – pine, oak, beech or spruce. But the journey to this forest will probably take tens to hundreds of years.

Now the original vegetation disappears, and just the soil remains with enough nutrients, light and water, a roughly two-year ´window´ opens for the arrival of other plant species. It is

in this relatively short period that a decision is made on the further development of the site. Where trees appear, enjoying local conditions, a spontaneously connected forest of these species will be created within a few years. Where shrubs predominate (elders, roses, blackberries, etc.), a bushy thicket will be formed for years to decades. And where grasses will manage to create compact turf, there will be a meadow for years and often decades. This meadow will gradually overgrow with the shrubs, and eventually with the trees. Also, in the thicket will eventually trees take a lead, but it is often a process that one human life is too short to observe.

We speak about non-intervention all the time, but we have avoided our own non-intervention forests or forests with minimal human influence. Because they are basically not in our country (Czech Republic) and those that exist are protected and in the vast majority owned by the state.

So having our own wild natural forest is not that easy in the end...

5.3.6. Historic attitudes – forest pasture, coppicing, sparse-forest.

5.3.6.1. Forest pasture

What is a grazing forest?

Forest management was (and still is) essentially twofold. The first is forest management, or the extraction of timber for various purposes. The second is the non-forestry use of the forest to obtain non-timber biomass. This includes forest grazing. Today, we cannot even imagine a herd of cows or pigs in the middle of a Czech forest, and this may lead us to regard the grazing of domestic animals in the forest as something quite marginal. In the lowland forests of Central Europe, however, forest grazing, together with coppice farming (see the chapter Low growing forest), was the dominant and most important type of farming that shaped the forests and the landscape. In fact, it has been practiced since the beginnings of agriculture at the beginning of the Neolithic, when wild animals were domesticated. For most of the year, cattle were dependent on natural food sources (forest stands and fallow fields) for food and usually only fed modestly in winter (this was usually done by the so-called summer crops, which are discussed in more detail in Chapter XX). The year-round feeding of forage to housed animals is a relatively young method of livestock farming. Meadows as we know them today only came into being in the Baroque period.

Long-term forest grazing led to the creation of a very specific environment, which is often referred to as a grazing forest. The concept of grazing forest is quite broad. A grazing forest is not simply an area for grazing, but a combination of pasture and more or less scattered, often large and old solitary trees or groups of trees. Grazing forests and the cultivation of

low and middle growing forests primarily for timber production have been mutually exclusive as a type of management. This is also reflected in historical documents that address how to effectively protect the stubble forests from livestock encroachment. These forests were also grazed, but the animals were only let in at a stage when they could do little harm. In addition to grazing, pasture forests provided timber and other products.

Grazing forests are typical mainly of northern Europe and the Mediterranean area. In Spain and Portugal, for example, pigs can still be seen grazing in forests known as *dehesa* or *montado*. Grazing is also quite common in the forests of the Balkans and Ukraine. In Central Europe, we do not yet have a precise idea of the historical distribution of grazing forests. The park-like landscape at the confluence of the Dyje and Morava rivers, with its massive solitary oaks, which we admire so much for its aesthetics and biological values, is a remnant of very long-term grazing. Former areas of pastoral forest can be recognized, for example, by the presence of huge, gnarled oaks that are 'drowned' in a sea of younger forest.

Management in a grazing forest

In traditional pastoral forests, grazing was relatively low intensity. Relatively small numbers of animals grazed over large areas. Cattle, horses, goats, sheep, and pigs grazed in the forests. Which animals were involved is quite important because they differ in the way they affect vegetation and tree species. The presence of wild trees or groups of trees, or also scrubland, is typical. At lower grazing intensities, natural regeneration of trees covered by shrubs was also possible. Trees in grazed forests, unless they were oaks, were regularly pruned in various ways. One type of pruning can still be seen in the contemporary landscape, e.g., on willows that have been pruned to the head. The production of acorns was important for oaks as an additional source of food for animals. Regular pruning has led to an increase in the age of the trees. By reducing the center of gravity through pruning, the risk of older trees breaking or snapping due to the weight of their branches is also reduced. As with traditional forest management, much practical experience has disappeared with the demise of forest grazing. Since the middle of the 20th century, grazing in our forests has ceased altogether. If grazing is reintroduced or attempted in our country today, it must be remembered that this is primarily for the purpose of site management and biodiversity conservation, not for the purpose of breeding the animals themselves. Although it is clear, that grazing can also generate some benefits for the animal owners, experience with modern grazing in forests motivated primarily by nature conservation is still very rare in the Czech Republic (e.g., in the Bohemian Karst, Pálava, and Podyji). Therefore, caution is in order, but not too much caution. It is very worthwhile to experiment with the practice. It is very important to understand what we want to achieve by introducing grazing in the forest and to choose the appropriate procedure, the appropriate type of livestock, and the intensity of grazing accordingly. The effect of grazing on vegetation must be monitored and habitat management adapted accordingly. When it comes to restoring or maintaining the

diversity of light forests, two things are basically detrimental: grazing that is either too extensive or, conversely, too iterative. Grazing too extensively will have little effect, and the habitat will grow back anyway. Excessive grazing intensity unifies the herbaceous layer and prevents the rejuvenation of trees, without which grazing forests would gradually become open grassland. Efforts to introduce woodland grazing should be directed primarily to areas that have been grazed in the past or where the vegetation is still more or less open or was until recently. Here, the introduction of grazing can produce results in a short time. The aim of our efforts need not be to convert 'standard' forest cover at all. A long-neglected and overgrown meadow or pasture, or an old orchard or garden reminiscent of the thickets of a briar patch, is a perfect invitation to create a grazing forest. Above all, let us not try to "graze in the forest" but want to create a "grazing forest".

Grazing in the forest can basically take two basic forms, of which there is a wide range of possibilities. On the one hand, there can be natural (free), year-round, extensive grazing or semi-wild grazing using large grazers (bison, old breeds of horses}. At the other end of the continuum is the managed grazing of domestic animals in selected areas or only during certain periods. Projects of free grazing or semi-wild breeding are very rare in our country (e.g., the non-state nature reserves Milovice and Josefovské Louky Bird Park). Grazing with domestic animals is relatively easy to implement, despite the need for at least minimal veterinary care, housing and feeding in winter, and other care.

The introduction of grazing into already established stands should be preceded by an initial, more aggressive intervention in the form of partial thinning and thinning of the shrub undergrowth. Animals tend to avoid dense vegetation and stay in open areas. Thinning and regaining at least some of the character of a grazing forest through grazing alone would also take much longer. In terms of biodiversity and the nature of grazing forests, wild trees are key. They therefore need to be given great attention.

The management of solitary trees should include two basic objectives. The first is to ensure the long-term survival of existing solitary trees. The second is to ensure the existence of future generations of solitary trees, either by planting and protecting them or by encouraging natural regeneration in small fencerows where rejuvenation for grazing is insufficient. The ideal situation seems to be one where the area of open habitat is about 25-75% of the total area of grazing forest and the remaining area is created by tree canopy.

Currently, grazing of livestock in forests is an illegal management practice under the Forest Act. It is necessary that the forests be classified in advance in the appropriate category of special purpose forest. However, the classification of a stand as a special purpose forest and the granting of an exemption for grazing are by no means automatic. In the case of private owners, this practice is quite exceptional, and so far, it may only be on a case-by-case basis (an example is the stands in PP Na Ostrove in the Benešov district). If our land is not

registered as "forest land" in the land register, there is nothing to prevent us from introducing grazing.

Grazing forest and its biodiversity

The paradigm of an endless, continuous virgin forest that was supposed to cover the Central European landscape before the arrival of human farmers has been challenged many times by ongoing scientific knowledge and has been outdated for quite a few years now (however, it can still be found, for example, in natural history textbooks). At least in the lowlands and uplands, the Central European landscape was a diverse mosaic of forests, treeless forests, and various transitional formations. This mosaic was dynamically changing, and the areas of forest and forestlessness within it could be differently sized and unstable. The term "steppe question" has been adopted for the issue of forests, forestlessness, and man in prehistoric landscapes.

A crucial element in vegetation dynamics in prehistoric and early historic times was the action of large grazers such as bison, horses, etc. This theory was formulated in 2000 and is one of the articles explaining, e.g., the maintenance of light-loving species from the old Holocene to the present. The long-term forest grazing by domesticated animals and the structure of grazing forests largely simulates the prehistoric lowland landscape and the action of wild large grazers.

Grazing forests are highly heterogeneous environments with a combination of open grassland and sunlit tree or grove cover. This heterogeneity was already present over a relatively small area. Compare this with the current large areas of homogeneous forests, meadows, and pastures. This combination makes the biodiversity of pastoral forests extremely rich. It offers a suitable habitat for species of open habitats such as meadows, steppes, etc., as well as for species tied to trees or forests. In addition, they also offer habitat for species that are directly tied to open, light forests, and avoid the involved stands. Expert studies have documented the great importance of pastoral forests for the diversity of plants, birds, butterflies, and other insect groups, or even for the richness of lichens. The old solitudes represent a set of characteristic microhabitats that are hardly ever created in the forests involved. This is another of the essential characteristics that distinguish pastoral forests from forests primarily intended for timber harvesting, especially in the context of modern forestry and high-shaped forests. Massive solitary trees are identified as key elements for the biodiversity of tree-associated organisms, not only in Europe but worldwide. A comparison of the diversity of different groups of animals associated with solitary trees and trees growing in a connected forest shows that solitary trees host richer communities with many threatened species and, moreover, communities of trees in connected forests are often only a subset of what can be found in solitary trees.

The last remnants of a certain analogy of pastoral forests in the Czech Republic can be found in the game preserves. The number of animals in game preserves was often so high that they prevented spontaneous forest regeneration, and as a result, they often had an open park structure, like pastoral forests. In some areas, open forest stands with massive trees have survived to the present day. Such forests are an important refuge for species tied with light forest, particularly that part that is associated with dead wood. But many woodlands are also important botanically. Game preserves can only be positively evaluated in terms of biodiversity if the density of animals is low (examples include Žehuňská obora, Lánská obora, and the game preserve near Hluboká nad Vltavou). At high stocking rates, when more intensive feeding is necessary, the effect of game on the herbaceous undergrowth, for example, is quite devastating. As already mentioned, each animal affects the vegetation differently. From this point of view, the effect of animals on forest vegetation and its biodiversity is the least favorable compared to that of wild large grazers and some domesticated animals. Game animals (deer, fallow deer, roe deer, mouflons, etc.) act as undifferentiated grazers, concentrating on the best available food source at the time, where possible. Another element fundamentally influencing the shape of today's game reserves is the way in which forest stands are managed. Unfortunately, this often leads to the original character of the loose stands and the heterogeneous structure disappearing, and financial pressure or lack of information leads managers to intensive logging.

Orchards offer similar conditions to grazing forests or game preserves. These are among the most biologically rich habitats in our country. However, this is only true for extensive high-tree orchards where grazing or mowing maintains a rich herbaceous floor and where scrub and old fruit trees are also found. The problem is that traditional orchards are a rapidly disappearing relic of smallholder agriculture. Modern orchards, with their bushes and intensive chemicalization, are more arable land in terms of biodiversity than an orchard in the traditional sense.

The disappearance of grazing forests in our country.

Forest grazing has a negative impact on forest cover from a silvicultural point of view. It loosens the stand, reduces the volume and quality of timber, and severely reduces or even completely prevents forest regeneration. Even so, it was a perfectly normal way of farming in the Czech Republic from the beginnings of agriculture at the beginning of the Neolithic period until at least the second half of the 18th century. At that time, there was a fundamental change in management practices and requirements for the production and use of forest stands in central Europe (this is described in more detail in chapter about Low growing forests). In this period, forest grazing is seen as an undesirable management practice. The regulation of forest grazing in the legal system in the Czech Republic appears in the forest regulations (patents) issued by Empress Maria Theresa in 1754 and 1756. For example, they restrict grazing in pastures and thickets. The patents marked a fundamental change in society's view of forests. However, the ban on forest grazing was a long-term and

gradual process that was only intricately enforced. It was, after all, a perfectly normal way of keeping domestic animals up until that time.

After all, it was a perfectly normal way of keeping domestic animals until then. However, forest grazing was gradually abandoned, and livestock began to be kept under a roof during the summer. The scattered trees of the former grazing forests were deliberately removed to increase the productivity of the intensive meadows and pastures, or the grazing forests were reforested to increase the volume of wood. Here and there, forest grazing persisted until around the Second World War. It was only during the communist period that forest grazing came to an end completely, due to the expropriation of estates, the end of private farming, and the transition to intensive livestock farming on cooperative farms.

If a Czech forester were to encounter grazing cattle in the forest today, it would probably come as much of a surprise to him as if he were to meet a bear or a giraffe. In modern forestry (the term is defined in Chapter 5.X, Ecologically and economically at the same time?), forest grazing is perceived as harmful, threatening to the forest, and inherently immoral. It is also illegal. Among foresters, there is even fierce opposition to allowing forest grazing. This is true even in the case of specially protected areas, where it would be the most effective tool for protecting biodiversity. Yet the state hunting authorities routinely declare game reserves, and their forests are categorized as special purpose forests - recognized game reserves - without much difficulty. What is somehow overlooked is that in many game reserves, due to the extreme intensification of game production, forests are in a fundamentally worse state than they could ever have been in principle as grazing forests. Apparently, game grazes more nobly than domestic animals. As contemporary findings from Ukrainian forests with natural conditions similar to our Beskydy show, the influence of domestic animal grazing is not entirely clear from a forestry point of view either. In some localities, intensive grazing is undoubtedly harmful and threatens the very nature of the forest. On the other hand, dispersed grazing in most sites is at least not harmful, and in individual cases its positive effect on buffering and promoting forest regeneration can be discussed.

If we look at neighboring countries, forest grazing is prohibited in Slovakia, Poland, and Germany, as it is here. Only Austrian Forest law allows grazing in forests to a limited extent and leaves its regulation to local authorities. In Ukraine, forest land can be designated for hay harvesting and cattle grazing. Forest grazing can be found practically everywhere. Grazing forests are no longer found in the Czech Republic. Their remnants are, for example, park landscapes with old solitary trees at the confluence of the Morava and Dyje rivers. Large areas of the local floodplain forests were once also pastoral forests. The spatial structure like pastoral forests is found in some reserves where the grassland is mowed (e.g., Čertoryje in the White Carpathians). Experimental activities with forest grazing focused mainly on biodiversity are currently taking place in the vicinity of Brno (Hady), in the Pálava

Protected Landscape Area (NPR Děvín) and the Bohemian Karst (NPR Karlštejn) or in NP Podyjí.

5.3.6.2. Pruning of trees.

History and basic principles of regular tree pruning.

Regular pruning of trees results in substantial shaping of the trees, which has a significant effect on the biodiversity of the habitat. Pruning has taken many different forms, with the aim of obtaining sticks and branches of different diameters and for different purposes. From the perspective of contemporary Central Europe, this way of using trees, like forest grazing, can be difficult to imagine. However, for many centuries, people's livelihoods and needs were significantly different from what we have today. The regular pruning of trees was quite a common way of using trees, practiced for centuries, and the harvesting of e.g., annuals, i.e., leafed branches fed to cattle, was already common for prehistoric farmers. The earliest direct evidence to date of the use of long-cultivated trees to produce long straight sticks comes from a Mesolithic settlement in the Netherlands dating back to 5400 BC. Some forms of pruning are still commonly practiced on trees around us today, they just no longer have a direct economic purpose. These are mainly arboricultural maintenance of trees in parks, cities, avenues around roads, various tree lines, etc. So far, willow wicker trees have economic importance in our country, persisting thanks to our violent Easter tradition and the popularity of baskets. However, in some parts of the world, e.g., the Middle East, this management of trees is still common and significantly shapes the appearance of the landscape there. Even in some European countries, for example, the tradition of feeding on willows persists to this day (e.g., in western Norway, in some Alpine valleys, in parts of Greece, Romania, and the Balkan countries). In others (e.g., the Nordic countries and the UK), restoration of historic forms of coppicing has been underway for many years as a conservation initiative.

In fact, regular tree pruning is a form of coppicing, where the regenerative capacity of trees is exploited. However, trees are not pruned at low stump height but at a higher height. Not all tree species can regenerate at a higher stem height. It is particularly strong in willows, while hornbeams, maples, elms, black poplar, lime, alder, ash, and, in the Mediterranean and British Isles, beech, were regularly pruned. It is entirely absent from conifers. The motivation for this type of management was the combined use of the landscape, which included grazing cattle. Trees were felled at a height where there was no longer a risk of damage to the coppice. Trees used in this way were a common part of grazing forests. They were also trees growing along roadsides, in fences, and on property boundaries. They could also occur in stumps primarily used for firewood production.

The interval of pruning varied according to its purpose. An interval of around 7-20 years provided wood suitable for fuel or toolmaking. With a very short seasoning period of 1-3 years, the trees provided wicker and thin branches suitable for fodder for livestock or basketry. Thicker branches are referred to as ´ochlest´, and branches and wicker for fodder are referred to as annuals. In many areas of Europe and Asia, annuals were, and in many places still are, the main product of trees and forests. They are used as fresh fodder during spring and summer, dried in small bundles at the end of summer, stored like hay, and used for winter feeding. Summer crops were also obtained by mowing the meadows.

The methods of regular pruning are very diverse and shape the trees into many forms. Their names usually do not even have a simple equivalent in czech language. Moreover, there are numerous transitions between the different forms. Therefore, we will present only the most basic ones.

Pollarding.

The term pollarding is often identified with the Czech term for top cutting. Regular pollarding was carried out at a height of 1-5 m1,2,3. Regular pruning leads to the formation of headed trees. The head shape is because when branches are regularly pruned, the excessive formation of healing tissues and adventitious buds at the pruning point creates a thickened mass that can resemble a head on the trunk. The appearance of the 'head' is completed by thick and thin branches resembling hair. This type of pruning has been most commonly used in willows, but it is also found in other species.

Shredding.

A satisfactory Czech equivalent of this term does not yet exist. In this type of shredding, the trunk of the tree is left at full height up to the top of the crown, but all side branches are trimmed. Sometimes the upper part of the crown or the strongest twisted branches are left. The trunk then produces abundant young shoots, which are regularly harvested for summer crops. This treatment increases leaf production, and, despite the height of the tree, harvesting the annuals is physically easy. In addition, the narrow and tall shape of the tree lends itself to a more heavily stunted stand, which still retains more or less the physiognomy of a forest. A certain analogy to this method of pruning can be seen in the contemporary Czech landscape. In avenues or along roads, trees have been trimmed by shortening their lateral branches to achieve tall growth and narrow crowns.

Coppicing.

In Czech, this method of pruning is known as coppicing. In it, the tree is cut just above the ground, and the young stumps grow out of the low stump. This is the way that shrub willows

were grown in the basket maker's coppice. Pentecost was probably obtained in this way only to a limited extent. The term coppicing is also used to refer to coppicing in the sense of low forest cultivation. It is the same type of coppicing, but the purpose, period, and mass of wood were different.

Pruned trees and biodiversity.

The regular and vigorous trimming of trees can appear to some as mutilation. That any species would even benefit from it is just silly. After all, the best tree is one that is healthy, tall, and vigorous. And yet it is not. Especially in cultural landscapes, where every part of the landscape is somehow transformed and intensively exploited and naturalness in the sense of human encroachment does not exist (it should be added, however, that the former exploitation of the landscape was much more intensive in many respects and there are many areas lying fallow today). Regular pruning encourages the formation of cavities and other microhabitats in dead wood. This is important for many organisms associated with dead wood. In a forest, the presence of dead wood seems somehow natural, but in a cultural landscape. For example, along the dirt road to Mělník, on the embankment of the pond near Bohumín or along the old embankment near Pardubice? After all, the dead wood habitat may be much more common in cultural landscapes than in most of our forests. Hollows are generally considered to be one of the most important elements for the biodiversity of forest organisms. Significantly, pruning leads to the formation of hollows and other microhabitats at a younger age than in unpruned trees. In addition, pruned trees are often well-shaded, and sunlit wood and microhabitats are preferred by many endangered species. Pruning encourages the formation of cavities in the tree trunk, not in the branches. Such cavities tend to be larger and can host multiple species of cavity-dwelling organisms. Not only invertebrate cavity specialists, but also numerous birds and small mammals (snails, bats). The regular removal of branches lowers the tree's center of gravity and thus stabilizes it. This reduces the risk of the tree collapsing due to the heavy weight of the overgrown branches. The tree can live for several hundred years. This is quite important as it can provide dead wood and suitable microhabitats for many other organisms for a very long time. Most of our forests are felled at around 100 years of age, with oak and beech stands slightly older. Tree hollows and deadwood are very rare in these forests.

The abandonment of regular tree pruning has led, and continues to lead, to a loss of old trees in the landscape. Indeed, if previously pruned trees are no longer pruned, the weight of the growing branches can cause the trunk to break and the tree to decay. In addition, over the last 200 years or so, there has been and continues to be deliberate removal of old coppiced trees because they were and are considered 'dangerous', 'defective', or potential sources of disease for healthy trees in the surrounding area. In many cases, it would be sufficient to carry out a health cut and return the tree to its original established shape. The rejuvenated tree would then survive perhaps several generations of human life. As these

trees decline, the habitat necessary for the survival of many endangered organisms inevitably declines. How much is our landscape and nature losing, for example, by cutting down avenues around roads just because nobody has cared for them for decades and nobody wants to? Dropping a large, dry branch on a car from a pruned, old headed lime tree is not really a threat.

Regular tree pruning in the sense of historical management practices should be included among the measures to support biodiversity and endangered species that are specifically linked to such an environment. These activities, together with the higher proportion of aged solitary trees (including old fruit trees) in the landscape, have ensured the continuous persistence of suitable conditions for the occurrence of many organisms associated with sunlit trunks, hollows, crevices, and other microhabitats typical of senescent stages of trees.

How to prune to promote biodiversity.

Tree care is a discipline of arboriculture (generally tree care). There are also methodological practices that are primarily focused on caring for biodiversity and endangered species. In practice, this mainly concerns trees in the open countryside, but these practices can also be applied in forest stands.

Tree pruning is not demanding but should be regular. The pruning period depends on the type of tree, but also on our ability to use the wood. It can be one year for wicker, around 7 years for firewood in the case of willows, and 15-30 years for hardwood species. From a financial point of view, the management of pruning is quite easy. The benefit is the wood obtained if it is used in a purposeful way (probably most often for fuel).

We can create new pruned trees mainly from young trees up to 30-40 years old or from plantations. Careful consideration should be given to the height at which the cut is made. The coppice is palatable to herbivores, so it is useful to keep it out of their reach. This is especially important to think about if we want to prune a tree in woodland or pasture. A roe deer can reach a height of about 1.3 m, a cow 2 m, and a horse up to 3 m. Most trees should be pruned in the winter or early spring. For example, ash trees are better pruned in late summer. Trees (especially ash) are sometimes pruned in their second year, so we don't need to panic if new branches and leaves don't start sprouting the first spring after pruning. Both the individuals being pruned, and the pruned areas of the trees need to have plenty of light. For the establishment of new pruned willows, we can proceed by planting willow stakes 10 to 15 cm in diameter in the pre-spring (the stakes must be fresh and sunk deep enough). By doing this, we can ensure that trees with cavities are established in a very short time, perhaps only 15-20 years. Pruned trees can also be created from mature trees (trunk diameter > 30 cm). We will only resort to this for trees that are easy to prune. Older individuals of most species are harder to prune than young ones. In this case, it is also very

advisable to stagger the pruning over several years. Trim the terminal branches first and see how the tree responds, if it responds positively, continue trimming the thicker branches and gradually achieve the desired crown shape.

Pruned trees are most often established in the open countryside in tree rows, in borders and draws, in riparian stands, along paths, and along roads. They are also established in reserves and can be part of pastures and woodlands. However, special care must be taken when establishing a coppiced tree in woodland. Most often, we will resort to this when it involves the restoration of an old, once-pruned tree. Finding such specimens is not such a problem in cultural landscape woodlands. Large areas of woodland are former pastures and meadows, and these trees are a relic of these. In a dense forest, the old, pruned trees would die quickly due to competition and interference from younger and taller trees. It is therefore necessary to free the old trees from the undergrowth by felling the immediate surroundings first. This should be done in at least two stages a few years apart, as sudden strong sunlight may not be well tolerated by an old tree (even oaks, which are otherwise light-loving, are sensitive to this). If the tree responds well to the release, the terminal and then the thicker branches can be gradually pruned.

The introduction of tree pruning may meet resistance from the public, dendrologists, conservationists, and neighbors. It is often perceived negatively simply because it is rarely encountered today. Only explanation and education will help. We do not harm the tree by pruning it. Objections can therefore only be sympathetic or aesthetic. By pruning, we reduce its center of gravity and the likelihood of the tree breaking or being uprooted by the wind. The oldest trees in the UK, for example, and often in this country, are the ones that have been pruned. Freshly pruned trees may not be to everyone's taste, but they grow back quickly and end up being beautiful. I hope no one thinks that the headed willows are an eyesore in our landscape.

It should be pointed out that our laws may view tree trimming as causing damage to the tree. The Nature and Landscape Protection Act generally prohibits 'damaging and destroying' trees. However, the legislation also considers current expert knowledge and the needs of endangered species protection and states that 'it is not an unlawful interference if it is carried out for the purpose of preserving or improving one of the functions of a tree species, in the context of the care of a specially protected species of plant or animal, in the context of the care of a specially protected area. The legislation does not attach any other formal condition to the 'care of a specially protected species of plant or animal'. Nor does it require that a specially protected species be already present on the site before the intervention. However, if we want to interfere with an older tree, it is always at least advisable to consult the intervention in advance, e.g., with the Agency for Nature Conservation and Landscape Protection of the Czech Republic (as a professional nature protection organization) and agree with the relevant state nature protection authority. We

should be sure that the intervention, even if properly carried out and justified, will not be assessed as causing damage to the tree species. Compassionate and aesthetic considerations may also prevail with the authority. This is also why it is better to create pruned trees from young specimens.

An alternative to historic forms of woodland use – sparse forest.

Reduced shading can be achieved by conventional forestry practices. We preferentially remove non-native and habitat-unsuitable tree species. Maintaining sparsely covered forest stands requires a certain degree of regular forestry management. It should be remembered that our thin forest is an anthropogenically conditioned habitat which, if left to develop on its own, would disappear again. The creation of thin woods should be directed mainly to lowland and upland forests, which have been intensively influenced since the Neolithic. The drier and poorer habitats of thermophilus and acidophilous oak forests are suitable. Here, less favorable conditions inhibit the regrowth of woody plants, and our interventions to maintain thinning may not be as frequent and intensive. However, we can also create a thinning forest in a wetland alder or river meadow. We must not forget to maintain clearings, which we do not reforest in any case, but instead maintain them by, for example, cutting back woody debris. In nutritious habitats, redwood probably cannot do without more regular maintenance of the undergrowth by mowing or grazing. This not only eliminates the more intensively rejuvenating woody plants, but also suppresses nettles, brambles, reeds, and other weeds that would probably be completely dominant there. Occasionally, mowed sparse alder in a stream floodplain can have a very rich undergrowth, and the habitat, which is neither meadow nor forest, is attractive to many animals. The creation and especially the intensive maintenance of a thinning forest by mowing or grazing will be considerably easier if we do so on a parcel of land that is listed in a culture other than forest land. Forestry legislation presents substantial obstacles that can only be overcome by making exceptions to the law.

There are still many places where the stands of what could be described as thin woodland remain. As a rule, these are the driest and warmest areas or areas of rocky canyons – České Středohoří, Podyjí, Český kras, Křivoklátsko, Pálava, etc. They are often characterized by frequent clearings and low scrub, which not only give them a romantic character, but are also of great importance for the diversity of these areas. These are mostly former coppice forests, which still retain their bright character many decades after coppicing have ceased. They have been preserved in places where tree growth has been very slow, and which have little appeal for contemporary forestry management. On the other hand, former pastoral forests, e.g., around the confluence of the Morava and the Dyje rivers, have disappeared completely. Their remnants are the massive, centuries-old oak trees that are now part of dense forest stands.

5.3.7. Forest trees and agriculture – agroforestry and other methods.

Do you know what agroforestry is? Maybe you don't know this term at all, maybe it has already confused you somewhere, but you are still not sure of its meaning? You are the owner of a forest or fields, or you are already an active farmer, or perhaps you are just considering an investment in land and at the same time you are looking for methods of management that would not only be profitable, but also resistant to increasingly significant climatic fluctuations, protect and care for the soil, retain rainwater in place, would they prevent erosion, increase biodiversity and still have a landscape-forming effect? Are you thinking about how to invest in the long term and leave something valuable to the following generations and at the same time have a short- and medium-term return? Does that sound a little fantastic to you? They don't have to. Agroforestry can really do all this, and you can read more about it in the following lines.

5.3.7.1. So, what is agroforestry?

In a nutshell, agroforestry is the cultivation of trees and agricultural or horticultural crops on the same plot, or unit of area. The goal is to create production systems for human needs while protecting and diversifying important economic, environmental, and human resources. Agroforestry also differs from traditional forestry and agriculture in that, instead of focusing on a single component (the crop), it focuses more on mutual interactions between multiple elements in the entire system.

Research over the past 20 years has confirmed that agroforestry can be more productive, profitable, and sustainable than forestry or agricultural monocultures. Temperate agroforestry systems are already widespread in many parts of the world and are even central to production in some regions.

The success of agroforestry depends to a large extent on the extent to which the forest and agricultural parts are integrated so that they help each other and do not compete. So proper system design is essential.
The list of agroforestry systems is of course larger than in this article. However, I will focus further on the most important ones, especially from the point of view of the production function. Let's also consider that each category can have its other subcategories.

5.3.7.2. Silvicultural systems.

Agricultural or horticultural crops are grown at the same time as woody plants to provide annual production while the woody plants grow. The trees are grown in rows, between which there are strips of varying widths for growing crops.

Lower vegetation layers in the intermediate rows.

Any annual or perennial crop can be grown between tree rows. Winter crops, in particular, (i.e., sown in autumn) can make very efficient use of near-full sunlight when deciduous trees are in their dormant stage and may be the best choice for narrow avenues where the trees are quite tall. According to the original approach to silviculture systems, it should be important to cultivate the interrows (or at least tear them up with deep spikes) - the trees are then planted only in the layer of soil that is not affected and does not compete with the undergrowth. Which originally ruled out the concept of no-till farming in the intermediate rows. However, according to the latest knowledge and practice, especially from production syntropic agricultural systems, with appropriate design and management, not only does competition not occur, but on the contrary, cooperation and interconnection of all components of the system, i.e., cooperation of all levels and synergistic effects to such an extent that these systems can exclude inputs from the outside such as delivered mulch, fertilizers and plant protection sprays, etc. I personally believe that given the latest knowledge about what processes take place in the soil, how important edafon is for successful cultivation and its high diversification and therefore how much it is important for humans to interfere with the soil as little as possible, rather just to support the processes that keep it in excellent condition, I dare say that over time, plowing of the soil will be abandoned more and more. Then, of course, it will be necessary to rename this category:-)

Tree floor.

It can be trees for further craft or industrial processing, firewood, or fruit or shell crops. Pollarding or coppicing farming is also possible, with the first method affecting the middle rows the least.

Design and establishment.

Rows of trees are spaced at least 10-14 m apart to ensure sufficient space for cultivation work. Usually, the size is chosen according to the available agricultural technology so that the cultivation of the soil is efficient. It is advisable to arrange the rows in a north-south direction, but if it is a location on a slope, it is good to consider the establishment of rows and overall work with the soil in relation to the terrain, i.e., following the contours (so-called Keyline design).

Both single and double rows of woods can be used; another alternative is a triple row with high-value trees interspersed between rows of nurse trees to aid the upright growth of the target trees during which they are pruned. However, the design possibilities are far from exhausted. It is always necessary to take into account the initial conditions, the intention of the farmer, the possibilities of the location, etc.

Shrubs and other plants can also be planted on the sides of main trees for better wind protection and other uses. Trees can be planted in rows at a finite distance or at a shorter distance for thinning later. The second method allows for a larger selection of quality wood species.

Yields (per unit area) of alley crops are not reduced by shading until the height of the trees reaches the width of the alley. At this stage, the system can be converted to silvopastoral or continue to grow in the lower levels of the plant that require shading.

5.3.7.3. Silvopastoral systems.

They involve trees deliberately introduced into a forage production system (or rarely forage introduced into a tree production system), the whole being designed to produce a high-value, woody component while continuing to produce forage and grazing indefinitely or for a considerable period of time.

Grazing system – herb layer.

It is usually a permanent, periodically grazed herbaceous plant. Nowadays, regenerative grazing is becoming more and more popular in organic farming, thanks to the quality of the soil, fertility is preserved and, last but not least, it also benefits the animals. Another option could be pasture cut for hay or silage. White clover (especially wild species) is more shade tolerant than other pasture legumes and it is desirable to include it in mixtures.

Tree floor.

It can be forest trees or fruit species or shellfish. Nitrogen-fixing trees can also be used to supply nitrogen for forage crops. The tree layer can be cultivated in the form of a tall, medium, or low forest.

It is most ideal to plant the tree layer of fruit trees on a high trunk form, so that there is enough space for grazing under them. Grazing in orchards is historically one of the most common agroforestry systems in our territory.

Shellfish plantings are less common in our country, and it is highly desirable to establish them. Apart from the walnut (Juglans regia), which is quite a domesticated tree here, it is good to consider the introduction of other less used species such as the edible chestnut (Castanea sativa), the black walnut (Juglans nigra) and others. Among the lower species, we should not neglect common hazel (Corylus avellana).

All fruit trees can also be grown as valuable for their wood, whose color, pattern, and other properties can be widely used in furniture and other fields. We would then not have to use exotic trees from rainforests, which are often mined and traded in not entirely legal, fair, and ethical ways.

Design and establishment.

Livestock management is essential to prevent damage to trees by grazing, trampling, abrasion and knockdown. Deciduous animals damage trees more often than large grazing animals or poultry. Deciduous trees are more easily gnawed than conifers. In any case, with this method of management, it is necessary to consider the protection of woody plants, especially at a young age.

Conservation may also include seasonal exclusion when trees are most vulnerable, placement of salt/mineral licks to promote even distribution of livestock, rotational grazing in sub-units, individual fencing of particularly valuable species, etc. Grazing may reduce competition between grass and trees for moisture and nutrients and limit the occurrence of rodents.

Trees can be planted evenly in wide spacings (e.g., 10 x 10 m), in rows with fodder interrows (10-30 m wide) between them or in groups. All methods require some form of weed control.

5.3.7.4. Forest gardens.

A forest garden is a designed and managed agronomic system based on trees, shrubs and perennials. These are designed to mimic the structure of a natural forest - the most stable and sustainable type of ecosystem in our climate.

The main goals of the system are:

- Be biologically sustainable, able to cope with disturbances such as climate change,
- yield revenue and provide a range (often large) of different products,
- low maintenance requirements.
-

Forest garden products often include fruits, nuts, edible leaves and shoots, spices, medicinal plants, cane, binding fibers, basketry materials, honey, firewood, fodder, mulch, game, sap products. Forest gardens have been used for millennia in tropical regions, where they still often form a major part of the food production systems that people rely on, even if they work elsewhere most of the time. They can also provide useful sources of additional income. They usually have a smaller area, often 0.1-1 hectare.

In temperate regions, forest gardens are a more recent innovation, emerging in the last 40 years. Their popularity is growing thanks to the permaculture movement. The main limiting factor for woodland gardens in our climate zone is the amount of sunlight available to the lower layers of the garden. In tropical regions, strong light conditions allow even the lower layers to receive significant amounts of light, whereas in temperate regions this is usually not the case. To compensate for this, the lower layers in temperate forest gardens must be carefully designed, considering the demands of the plants, the level of incident light, etc.

There are many crops that can tolerate shade conditions, but many of them are still not well known and used. Many common shrub or perennial species need bright conditions and for these it is necessary to define more open lighted areas. Temperate forest gardens are mostly family gardens of smaller areas, which does not necessarily mean a disadvantage because the designer can focus on the vertical instead of the horizontal direction. Even a small area farmed only with hand tools can reach dizzying numbers in terms of species diversity, which will be difficult to achieve on large production areas of commercial entities.

The key features that contribute to the stability and self-sufficiency of LZ are:

- Great biodiversity.
- Careful inclusion of plants that increase fertility, such as nitrogen-fixing plants, e.g., alder (*Alnus* spp.), boxwood (*Caragana arborescens*), gorse (*Elaeagnus* spp.).
- The use of dynamic accumulators – deep-spicing plants that can use mineral resources deep in the subsoil and bring them up to the upper soil layer where they are available to other plants, e.g., cowslip (*Petasites* spp.), comfrey (*Symphytum* spp.), licorice (*Glycyrrhiza* spp.) and sorrel (*Rumex* spp.).

- Use of aromatic plants selected specifically for their ability to attract predators of common pests.
- Use of varieties resistant to pests and diseases.
- The increasing role of tree cover and leaf litter to improve nutrient cycling and drought tolerance.

Designing – vertical design.

The forest garden is arranged in up to seven "layers" or "floors". Layering is one of the most typical distinguishing features of forest gardens. The distribution of species within it depends on many variables, including plant requirements for location, light, moisture, good/bad companions, mineral requirements, pollination, pest protection, etc. There may be more layers, but for the sake of brevity I will stick to these basic:

- Tree so-called "umbrella floor".

It is the highest layer of trees. May include species such as chestnut trees [Castanea spp], various types of walnut trees (*Juglans* spp., *Carya* spp.), dogwoods (*Gleditsia triacanthos*), apple trees (*Malus* spp.), mulberries (*Morus* spp.), pears (*Pyrus communis*), cherries (*Prunus avium*) and others.

- A layer of small trees and large bushes.

They are mostly planted between trees and under the crowns of trees. It can also be some types of taller trees that we would include in the previous group, but they are grafted on less tall rootstocks. Our classic fruit species include plums, apricots, peaches and their other relatives (*Prunus* spp.), as well as hazels (*Corylus* spp.), viburnums (*Viburnum* spp.), elderberries (*Sambucus* spp.), medlar (*Mespilus germanica*), dogwoods (*Cornus* spp.), from the more exotic species, for example, flycatchers (Amelanchier spp.), hawthorns (*Crataegus* spp.), quince (*Cydonia oblonga*), mulberry (*Asimina triloba*), persimmons (*Diospyros* spp.), various bamboos (mainly *Fargesia* spp.), cephalopods (*Cephalotaxus* spp.), horse chestnut (*Castanea pumila*), gorse (*Elaeagnus* spp.) and yellowwood (*Zanthoxylum* spp.). Others may be growth trees that will be pruned to remain bushy, such as beech (*Fagus sylvatica*), linden (*Tilia* spp.) and garlic (*Toona sinensis*) all with edible leaves.

- Shrubs

They mostly tolerate shading. They can include common species such as currants, gooseberries (*Ribes* spp.), raspberries and some species of blackberry (*Rubus* spp.) and others such as honeysuckle (*Lonicera kamtchatica*), chokeberry (*Aronia* spp.), dogwoods, but here rather those of Asian origin (*Cornus kousa*), mahonia (*Mahonia* spp.) and others.

- Perennials

Some of them are medicinal and contribute to ground cover by self-sowing or spreading. These may include bluebells with edible leaves (*Campanula* spp.), comfrey (*Symphytum* spp.), lemon balm (*Melissa officinalis*), mint (*Mentha* spp.), sage (*Salvia officinalis*), as well as various shade perennials with edible shoots, e.g., heathers (*Hosta* ssp.), Solomon's seal (*Polygonatum* spp.) and fruits, e.g., Solomon's plume (*Smilacina racemosa*).

- Ground cover plants

They are mostly creeping carpet-like plants that form a living mulch for the "forest floor". Some of them can be slightly taller perennials (see above), others form low carpets such as strawberry (*Fragaria vesca*), hoofed plant (*Asarum europaeum*), periwinkle (*Vinca minor*), Canadian dogwood (*Cornus canadensis*), toddlers (*Claytonia* spp.) and ground cover brambles (e.g. *Rubus calycinoides* and *Rubus tricolor*).

- Climbing and wrapping plants

These species are usually late additions to the garden because of course they need sturdy trees to climb. Or we can use them to support the trunk or old departing trees, if the forest garden is being established, for example, in an old orchard, or create a structure that they can support. These can include resistant kiwifruit (*Actinidia* spp.), grapevines (*Vitis* spp.), as well as *Akebia* spp. and, of course, brambles (*Rubus idaeus*).

- Rhizosphere

Each proposal should take into account the different habits and requirements of individual species for rooting, even if root crops are not grown much in the forest gardens. Perennials with useful roots include, for example, licorice (*Glycyrrhiza* spp.), barberry (*Berberis* spp.) or Siberian ginseng (*Eleutherococcus senticosus*) whose roots provide a good dye and medicinal preparations. Various useful fungi can also be inoculated into this layer, but we could easily consider it as another separate layer.

Forest farms.

In forest management, high-value special crops are grown under the protection of forest cover, which is managed and managed to provide suitable conditions. This is a way of using forests for short-term income while growing high quality trees for the wood processing industry. The amount of light in the stand is changed by pruning or, conversely, by adding trees. Existing tree stands can be interspersed with annual, perennial herbs and/or woody plants.

There are five main categories of these specialty crops:

- Foodstuffs
- Decorative objects
- Craft products

- Wood products
- Medicines

The system can usually be established by cutting down the existing forest, leaving the best trees for further timber production and creating conditions for growing undergrowth crops. These are then intensively planted and farmed to provide short-term income. Areas used for forestry are usually small (2.5 ha and less) and systems usually focus on one crop and wood but can be designed to produce multiple products. Since these systems are not widespread in our country yet, I will use some of the existing ones in North America as an example:

- ginseng + maple syrup + bee products + wood,
- shiitake mushrooms (grown on felled logs) + wood,
- ferns and grass (*Xerophyllum tenax*) for decorative products + mushrooms + wood,
- ginseng + nuts + black walnut logs on veneer,
- Christmas trees + wood.

Agroforestry on the Czech websites.

Czech Agroforestry Association - https://agrolesnictvi.cz/

Case studies of existing agroforestry systems from partner countries of the AGFOSY project - https://www.agroforestrysystems.eu/cs/pripadove-studie/

website of the author of the article focused on forest gardens - https://jedlyprales.cz/

website of Zuzana Špaková - proposals for agroforestry systems - https://www.stromyvpoli.cz/

5.3.8. Forests with different purposes.

In this chapter you will find interestingly viewed aspects of thinking about the forest in all complex directions. But you can also find inspiration in chapter 7 among the stories of the forest that we have dealt with directly, examples of special forest goals in Poland and Estonian insights into the use of the forest.

The central word of the project for which this contribution is intended is enclave. Enclaves of life, enclaves of the forest. These are almost synonyms, if we consider that forests are the carrier of 80% of terrestrial biodiversity (1). An enclave is a specific territory or element within another, say, predominant type of territory. As far as forests are concerned, plantations predominate in our country. We do not mean this in a derogatory way, but densely planted, contemporaneous stands of a few tree species, which in most cases would not grow naturally in the given place, are plantations. Together with agricultural areas, such forest stands in the landscape form a very coarse-grained and monotonous mosaic (if one can even speak of mosaics) of intensive cultures.

Thinking about enclaves in this environment makes sense. A draw in a vast field, a restored wetland, an uncut strip of flowery meadow, an old alley... Or an enclave of forest (in forests or fields) that is really a forest. Perhaps you are an inexperienced holder of a small acreage forest, thinking that your forest could become an enclave. Maybe you don't know how to do it. We do not have the ambition to present an exhaustive guide, but rather to inspire and suggest some starting points. And, also to create space for an enclave of rather provocative ideas, which we try to honestly rely on current scientific knowledge.

5.3.8.1. What do I expect from my forest and what is its nature?

Let's say you have a small or relatively small forest. Let's consider a forest area of less than 50 hectares, because according to the Czech Forestry Act (2) this is the limit from which the owner is obliged to draw up a forest management plan. For forests of smaller areas, the relevant forestry authority procures at its own expense forest management outlines, which the owner of the forest can pick up. The map and economic book of the forest economic curriculum can also be viewed freely on the website of the Institute for Economic Management of Forests (3). Both the plan and the curriculum are developed over 10 years. We dare to assume that you do not know much about forestry issues, either professionally or legislatively, and are rather at a loss.

We recommend that you start with a basic question: what do I expect from my forest, or what is important to me in my forest? It is ideal to ask this question directly in the given forest, walk through it, sit down for a while, quiet down and perceive it - its form, sounds, smells, visible and insignificant inhabitants that make it home. In this situation, someone will be overshadowed by a sizzling vault, while others, given the reality of recent years, will find themselves in a stand of standing spruce or pine trees, or on the scorched stubble after a cleared stand. Regardless of the starting situation, try to look at the forest in a truly long-term perspective and repeat the question of why it is important to you. So that some of the readers do not feel disqualified, we hasten to point out that the right to ask such questions does not belong only to the private owner in his forest, but to anyone in public forests, which, after all, prevail in the Czech valley.

Especially if you are a newly minted forest owner, you should be prepared for the fact that the professional forestry public, which you will meet primarily in the person of your professional forest manager, forestry legislation, but also the lay public, are often clear about the mission of your forest, and may not be it is not at all easy for you to go on your way. There is a very deep-rooted assumption that the forest should mainly serve the production of firewood and that there should be order in it (we will get closer to the issue of "order" in the forest later in this text). The root of this assumption goes back roughly three

hundred years, when our predecessors dealt with the lack of wood, which was a strategic raw material at the time. At that time, the problem was solved using the model of the so-called normal forest, or the forest of age classes. Forest properties were divided into a checkerboard of contemporaneous monocultures of easy-to-grow and economically advantageous tree species - Norway spruce and Scots pine (straight, easily processed wood), while the part of the "checkerboard" with the oldest, so-called toll-ripe growth (about 100 years old) was to be felled flight). The excavated area was immediately planted (possibly renewed by natural rejuvenation from the seeds of the excavated vegetation), so it became the youngest field within the "chessboard". The effectiveness of this system was considerable, especially at the beginning, but its negative consequences, caused by a fatal deviation from the natural nature and ecological laws of the forest, became apparent very soon. There has been a homogenization of forests, an impoverishment of their biological diversity, a susceptibility to widespread decay and the degradation of forest soils by acidification, worsening with each generation of conifer monoculture (so-called borealization).

For a better understanding of the nature and history of our forests and forestry, we recommend, for example, a series of articles published by Josef Fanta in Živa (4). Forestry legislation and practice to this day are based on the mentioned historical situation and the concept of a forest of age classes. You will soon realize that the forest law basically requires you to always ensure the maximum possible wood production on your property in time and space, especially in the sense of the obligation of fast and dense afforestation (more precisely, renewal) wherever a gap larger than 4 ares appears. You will also find that anyone can freely enter your forest and collect basically anything, except wood thicker than 7 cm (the so-called grubs).

Our forest and forestry environment is thus a mixture of freedoms and unfreedoms, while the duty of purposeful use in principle takes precedence over the freedom of nature.

It's no secret that we don't have much advice for those of you who have an immediate maximum profit plan with your forest. We can only appeal to those who, for example, bought a hectare of forest with a plan to harvest it completely, to abandon their intention and try to proceed more sensitively, because clear-cutting is in severe conflict with the ecology of the forest.

The economic point of view of the forest owner is, of course, legitimate, and it is necessary to distinguish so-called "wood eating" from solid intentions. Especially if the forest property is an important element in the livelihood of its owner, either in terms of sale or direct utilization of wood. We ourselves sit on a wooden chair, use paper or heat with wood. However, even a predominantly economically motivated owner should consider that the forest is not a normal production environment. A forest is not (or should not be) a field for

woody plants, which we also perceive from the fact that, unlike agricultural land, all forests are classified by the Nature and Landscape Protection Act (5) as important landscape elements. A forest is a very complex ecosystem, an organism, and if we deny it this essence, we pay more than our earnings as a result. After all, this was clearly demonstrated in the bark beetle calamity of recent years, for which climate change was more of a catalyst than a cause; the cause must be seen mainly in the way of management up to now (6). It can be stated that what is ecological is also economic as a result, i.e., first ecology, then economy, which is not the reverse (7).

Pro Silva Europa, a European platform of foresters applying the principles of forestry close to nature, strives to operate production forestry on an ecological basis, which has also had a Czech branch Pro Silva Bohemica (8) for many years. The goal of Pro Silva is to abandon the concept of contemporaneous vegetation and to make maximum use of the creative forces of nature.

Regarding the economy, we would also point out that forestry needs diversification of income, which should also come from ecological services. There is a connection with carbon storage, on the one hand in old forests and old trees, and in wooden products with a long life, ideally made in the country.

With regard to the mission of this contribution, we want to further focus on those owners of small forests who do not primarily see production potential in their property but are mindful of today's pressing challenges. While three hundred years ago our predecessors were dealing with the crisis of lack of firewood, we are currently facing a climate crisis and a biodiversity crisis (9). We believe that forestry legislation and practice are not yet adequately prepared for this task. In the framework of forestry, there is talk about many functions of forests, which are divided into production and non-production functions. As a result, however, we are still riding the wave of the idea that by fulfilling the production function, all other functions are automatically ensured. However, this is only partially true. A commercial forest (plantation), with which we have the most common experience, can perform a solid recreational function (if it does not turn into a calamitous clearing), but it fails, for example, from the point of view of protecting biodiversity. So if you highlight these issues in your brief, just as the public does in the debate on state forest management, the forestry sector should reform its setup and tools. It should be noted that we already have the scientific basis for such steps.

5.3.8.2. Natural forest – ideal or a scarecrow?

What can you imagine under a natural forest? Forests have been developing for millions of years, roughly ten thousand years since the last ice age, under the ever-increasing human

influence. Historical man has become a part of the natural dynamics of forests in many places, especially in the lowlands. In the mountains, which were never very attractive to our ancestors due to their inhospitality, man practically did not become a part of the dynamics of the forests, because they were exploited and settled relatively recently. People conquered the forest in most areas, almost exterminated it in some places, and then significantly changed it in the era of modern forestry (4). However, we have not extinguished the natural potential and dynamism of forests. We choke the essence of the forest, but when we release the pressure, this essence immediately breathes. Is it good or bad?

Few people will tell you that they don't like nature. However, the love of nature does not seem to be reflected in ideas about the "correct" forest. Inexperience with the natural forest (with forest nature), spanning a number of human generations, plays its role, i.e., we have a shifted starting point of perception of the forest. This aspect is called shifting baseline syndrome (10). The experience and ideal of a well-permeable, refined, cultivated and tidy forest that has its own master dominates. Who does not know the fairytale song ´Hajný je lesa pán´(The Forestman is the king of the woods). This predisposition affects both the lay and professional public. A natural or restored forest, if it is not a mere small-scale attraction, is rejected as a degraded form of forest and a "forest mess". Very often we come across the opinion among the public that the real forest consists of planted and cared for trees, while the work of nature is just worthless "raids".

Distrust of the natural forest is also encoded in forestry terminology. Forest cultivation evokes the possibility of refining and cultivating the forest ecosystem, while without cultivation it will go wild and reduce its utility. However, a forest is not a field, a garden, or an orchard. It does not need man for its full prosperity. An apple tree in an orchard or a rose in a garden will become stunted without human care, but fifty-meter fir trees and enormous biomass production can be found even in the forest, where man has never set foot. It can be argued that it is not only about breeding, but also about making it accessible, streamlining growth or ensuring a safe working environment. Yes, but let's not forget humility before the natural essence of the forest. We should not succumb to the impression that we are improving the environment in the forest.

Let's try to imagine what natural forests looked like. They were very colorful. Trees of various species and ages grew in them, including very powerful and age-like individuals. They weren't thick and dark forests, at least not everywhere the same. Let's imagine the depth evoked by fairy tales as a vast, difficult-to-penetrate variable mosaic, shaped by natural disturbances, the so-called disturbances of the tree floor.

The mountain ridges are covered with spruces, which are restored by storms and bark beetles. We can still observe this dynamic, for example, in the Šumava National Park (12). In the hilly areas of our country, beech forests would predominate, i.e., forests with a

predominance of forest beech, potentially the most represented species of our woody composition. Even these forests would be shaped mainly by the wind. A new generation of beech grows in the gaps left by the dead giants, during stronger events, for example, maple or oak come to the fore. On steeper slopes and screes, lindens, ash trees and elms thrive in addition to the beforementioned maples. The streams are accompanied by alder trees, in the lowlands and floodplains we would find oak forests of various types, in the lagoons and blind branches of unregulated rivers, soft trees - willows and poplars - would be reflected among the shadows of the fish amid the croaking of frogs.

We have very simply outlined the natural, so-called potential tree species composition of Czech forests. The reconstruction and classification of forest communities is dealt with by forestry typology, which defined forest types and their ensembles based on altitude, tree composition, herb layer and soil type. For those interested in more detailed information, we recommend, for example, the work of the excellent Czech forest typologist Eduard Průša (13).

It should be noted that even forestry typology needs to be seen as a dynamic field regarding ongoing climate change. It also turns out that, in addition to altitude and habitat conditions, the regime of the beforementioned natural disturbances, which are a key factor in forest dynamics, have a large and previously unknown influence on the composition of communities.

If we stay virtually in natural forests, it would be precisely the disturbances that would create a diverse range of habitats, microhabitats, and structures. Wind, bark beetles, storms, frost, large grazers (bison, wild horse, wild horse), fire, floods, ancient man in the lowlands and his cutting, forest grazing, burning. The result is massive dead trunks rotting on the forest floor, overgrown with mosses and fungi. The forest floor is layered and shaped by upheavals (14), in whose root balls birds' nest, woodpeckers carve cavities in sun-drenched trunks and ancient trees, and brightly colored beetles (carpenters, blacksmiths, woodpeckers and others) develop. Sunlit areas, light forest and forestless areas are full of flowers and butterflies. The forest is teeming with life and every creature has its place, its opportunity, its function.

Today, natural forests can be considered the remnants of primeval forests that have been spared significant human manipulations and which occupy less than one percent of the European forest area (15). And further, for the purpose of these considerations, we consider a natural forest (not according to the used definitions of the scale of forest naturalness) to be a forest in which there is no management, regardless of its previous nature, i.e., a so-called cultural forest, left to natural dynamics. And as we have already indicated, the historical role (especially enlightening) of pre-industrial, ancient man in long-settled localities can also be included in this dynamic.

5.3.8.3. Biodiversity – not a function, but a condition of functions.

We do not emphasize biodiversity only because of professional interest. Biodiversity is not just one of the many functions of forests, but rather a factor conditioning other functions, including the function of wood production. The seriousness of the biodiversity crisis and the need for its protection are reflected in political and professional concepts (16). Biodiversity in the broad sense of the word includes genes, species, populations, communities, interactions, cycles, chains, etc. With the depletion of biodiversity, the immense and so far, insufficiently explored forest fabric is threatened, within which, among other things, the restoration and nutrition of woody plant stands takes place. From this point of view, we do not distinguish between a product and a pest in the forest, because every component, however small, seemingly insignificant, or even supposedly harmful, is important for the ecosystem as a whole (17). The most life can be found in the soil and dead wood, which are the two components of the ecosystem that have been hit the hardest in cultivated forests.

If someone is really striving for a forest enclave in the current landscape, they should focus on the issue of forest biodiversity protection. A dissertation was devoted to this issue, to which we can refer the reader for more information (18).

The transformation of forests outlined above into uniform cultures, especially spruce and pine, is the most threatening to forest biodiversity, and criticism of this system has been appearing for more than a hundred years (19). Unfortunately, even today, the new planting of spruce in the clearing is not an exception, for example because in a situation of overpopulation of herbivorous animals, it is the cheapest option for rapid regeneration of the stand, which a professional forest manager will recommend to the forest owner.

However, the change in tree species composition and the method of management (contemporaneous versus non-contemporaneous stands) is not the only aspect of the threat to biodiversity. Two phenomena have critically decreased in the landscape: old forest and light forest. Among the characteristics of these types of environments are very old trees bearing valuable microhabitats (see below for more details) and various forms of dead wood, while the biological value and attractiveness of these structures increases precisely with illumination (insolation). It is worth noting that from the point of view of adaptation to climate change and its mitigation, the role of old forests and old trees for storing carbon is very important.

5.3.8.4. If I want to have an economically valuable forest.

Who?

We assume that few people are reading this text because the forest will provide them with financial profit. This has been the main task of forestry since approximately the end of the 18th century, and the issue is therefore elaborated in great detail, for example, in textbooks on forestry economics and economic management of forests. In older times, forests were used significantly differently: certainly, more varied, often more intensively (cattle grazing, raking litter, production of charcoal and a number of other raw materials...), on the other hand, large areas were not used at all. However, the historical methods of forest management are discussed elsewhere (chapter 5.2.1 and 5.3.3); in this chapter, we will try to deal with the legacy of the modern age and explain in a simplified way why today our forests and forestry look exactly as we know them, i.e. with the predominance of spruce, cut in the spirit of the motto "no upheaval, no break, the right tree stands in the row!" .

The aim of the forest owners was to secure a yield that would be both as high as possible and as stable as possible. Why it was about the highest yield is probably clear. The meaning of stability is less clear: basically, it is about the volume of work and income being as similar as possible every year, ideally the same - with this, the number of people, technology and processing and sales capacity can be best planned and used.

There are two related difficulties: on the one hand, the beforementioned goals are contradictory (usually the higher the production, the lower the stability). Another difficulty arises from the fact that our needs and values evolve over time. The price of human labor, the price of transport, technical possibilities, the possibilities of using wood raw materials and perhaps even the climate... all this has fundamentally changed in the last century. At the same time, the century is the period during which most forests are established in our conditions. To estimate what our grandchildren will value when today's saplings and seedlings form the skeleton of the future forest; this was, is and will be the greatest challenge of every householder.

Next, we will take a closer look at the basic procedures by which classical forestry tried and still tries to fulfill the basic goals, i.e., the amount and stability of the yield. Until relatively recently, the amount of yield was mainly understood as the increase in wood mass per unit area per time. At a time when it was not realistic and sometimes even possible to transport large volumes of wood over long distances, it was necessary to have enough raw material close enough. And wood was extremely "strategic" - often the main and sometimes the only energy and construction raw material. Therefore, between the seventeenth and eighteenth centuries, the utilization of wood of individual tree species and the speed of their growth, i.e., wood production over time, began to be monitored. The clear winners of the assignment "as much as possible usable mass per unit of area per unit of time" were conifers, in the first-place spruce, in the second pine. They grow almost everywhere, fast, straight (ideal for sawmills), can be used for heating and building, and tolerate schematic clear-cutting management well. It is still necessary to mention the stability of the yield.

In the spirit of the above-mentioned considerations, the so-called forest of age classes emerged as a solution in Central Europe. The point is that the entire forest property was divided into several (approx. 10) equal-sized parts. Each part represented a so-called age class, i.e., forest stands of roughly the same age (plus or minus 5 years), which were to be managed in the same way. The age classes should ideally be evenly represented and thereby ensure a stable yield over time.
These are the considerations and procedures based on which most of the mature forests that we have today in the Czech Republic and Central Europe were created.

The principles described were largely valid until 1989; since then, they have been gradually replaced by two other approaches. Informally, we can call them "economism" and "ecological concept".

Economism is based on the fact that income began to be calculated in money rather than m3, i.e., the main goal is the best possible ratio of financial returns to costs. The pressure for efficiency in this sense then led to more intensive use (some might say squeezing) of everything: forest, people, and technology. In principle, this approach has minimum reserves, and therefore tends to be unstable in the end, as we can verify with the current bark beetle calamity. On the other hand, even with this method, "no-intervention areas" are created - simply because it is not worthwhile to farm there, because the costs exceed the potential profit.

The "ecological concept" can be understood in different ways, e.g., as the slightly euphoric declaration of a number of protected areas, especially in the early 1990s. However, I mean something a little different: the simple realization that the forest has a whole range of other functions than just the production of wood (even if it is basically only the one that currently "does something" for the owners of the forest). Recently, we have come to the realization that we often perceive these "other functions" as more valuable, whether the forest fulfills the role of a backdrop for recreation, a substrate for fruits and mushrooms, a refuge for various organisms, or the still far-underappreciated role of the forest as a landscape air conditioner and water bank. Most of the chapters of this publication are devoted to these "other functions". If we put more emphasis on these other functions, our forests may look significantly different in the future. But since about 1% of our forests change every year, it will take some time.

So, if someone wants an "economically valuable" forest, they can go through the chapter again. Perhaps the previous lines helped him to clarify what an economically valuable forest actually means to him... however, he/she will have to look elsewhere for instructions on how to achieve it (e.g. here: https://ldf.mendelu.cz/uzpl/pestovani_v_heslech/pestsyst_/prev_prev_prem.html)

5.3.8.5. Forest as wilderness.

With the diminishing of the natural environment on the whole Earth, which actually almost does not exist, and with the realization of the fact that there is not even a place on earth where man has not intervened, on the other hand, in countries where we have the time and thoughts for it, we dream of pieces of wilderness, we look for them all over the planet, in urbex and in the mountains, and many of us also dream of having it somewhere, creating a space for it. Let's face it, as small forest owners we cannot achieve this. But we can create a place that fulfills some of our requirements for tranquility, natural clutter, native species and the structure or architecture of the forest, which saturates us with the impression that there is nothing far around. You will learn about what to do to strengthen the processes, species and views we are interested in in Chapter 6 and other parts of our guide. However, you cannot avoid the influence of man, environment, and history, you will find that in the previous chapters.

But if you really want to preserve a piece of untouched natural wilderness, focus your resources elsewhere and look around the world, support the purchase of a natural or close-to-nature location in the Place for Nature program with ČSOP or ČSO. Or find out where buying out forests or wetlands you can resist the pressure of developers in various scientific projects.

And the wilderness as an experience?
I don't want to advise you, watch movies, but basically, it's the easiest. Or throw yourself into practical nature conservation in places where the law minimizes the influence of the environment and people. But since what we really want in the wilderness is mostly scenery and observations, even as a tourist you will find plenty of experiences. It's just that in most places it won't be the wilderness, for that you probably must go to the cold regions of the Earth.

5.3.8.6. Community forest.

In recent years, projects with the concept of shared care, responsibility, and benefit, such as community gardens, have gained great popularity. A forest can also be communal.

Community forest is a concept that combines nature conservation and social participation. It is a way of managing forest land that allows local communities to actively participate in the care, management, and use of forest space. Unlike the traditional approach, where the

forest is managed by only one organization (such as the state), a community forest is open to the public and involves cooperation and sharing of responsibilities between different entities. The basic aim of a community forest is to create a sustainable ecosystem, promote biodiversity, improve the environment, and provide residents with space for recreational, educational and social activities.

The idea of a community forest was born as a reaction to a change in the approach to forest management and an emphasis on the involvement of the community and the public in the care of a certain area. The development of this idea is rooted in the concept of community ownership and joint management of natural resources. Interest in this type of forest management and forest restoration is growing worldwide and many projects with the idea of community management have already been implemented.

Community forests, as well as other forests managed to support biodiversity, can contribute to its protection and development. Local communities can get involved, for example, by monitoring and monitoring the state of the forest and its ecosystems. If it is an area in which the forest is damaged, for example due to forest fires, bark beetle calamity or logging, community forests can serve as a place for joint planting of new trees, thereby restoring and recultivating the area.

Community forests are often accessible not only to the community that cares for them, but also to the public and offer opportunities for recreation such as hiking, cycling or picnicking. Likewise, a community forest can also be an educational forest, providing educational programs for schools and community groups, and can serve as a model of sustainable forest management, where logging is done with a view to preserving the biodiversity and health of the forest. Local communities can also run small timber businesses and use the wood for their own needs. Perhaps the most important aspect of a community forest, however, is the social aspect. Community forests enable locals, groups and communities to engage in volunteering activities, which reinforces a sense of belonging to the locality, belonging to the community and sharing a common goal.

Basic characteristics of a community forest:

- Social participation. Local communities have the opportunity to actively participate in decisions regarding the care of forest land, planning activities and use of space. This increases the feeling of ownership, responsibility, and interest in the given forest.
- Sustainability. Community forests are often designed with sustainable agriculture and reforestation in mind. Emphasis is placed on minimizing the negative impact on nature and preserving biodiversity.
- Education and awareness. Community forests can serve as learning sites for residents, schools and visitors to learn more about local nature, ecosystems and sustainable management. More in the Educational Forest chapter.

- Recreation and relaxation. Community forests are often open to the public and provide space for a variety of outdoor activities such as hiking, picnicking, relaxation, and sports.
- Species diversification. Community forests can be planted to include different species of trees and plants, increasing biodiversity, and supporting healthier ecosystems.
- Social interaction. Community forests encourage social interaction between residents, which can strengthen community bonds and mutual understanding.

The selection of tree species for a community forest depends on many factors, such as climatic conditions, soil characteristics, the local ecosystem, the goals of the community forest, and the needs of locals. When choosing species, it is important to pay attention to the sustainability, biodiversity, and ecological stability of the forest area. It is important to consult the selection of species with the locals in order to achieve an optimal balance between the various factors and the needs of the community.

How do they work with the topic of community forests in Great Britain? https://www.communityforest-trust.org/englands-community-forests

5.3.8.7. Educational forest.

The concept of the educational forest began to develop as a response to the growing interest in environmental issues and the need for public education. An educational forest is a specific type of forest area that is used for educational and educational purposes. It is a place where people, especially students, visitors, and the public, can learn about nature, ecosystems, forest biology and environmental protection. The basic goal of such a forest is to provide interactive and practical education in a real forest environment. The ideal location is near schools, parks or recreational areas.

It is advisable to complement the forest with elements such as information boards, trails, interactive elements, and natural materials that support learning and discovery. Visitors can thus form a better idea of forest communities, tree species, wildlife, or any other aspects of nature's functioning. Various programs, workshops and educational activities for schools, families and other groups are often organized in the educational forest. This interaction with nature through guided education allows them to gain a deeper understanding and respect for the environment, while also promoting an active lifestyle, sustainability, and conservation.

This type of forest should be carefully managed and maintained to provide an adequate environment for visitors to learn about the issue. It is also possible to create an educational trail in the forest, such a forest does not need to be modified and maintained as intensively as an educational forest, even if its purpose is also aimed at educating visitors.

For an educational forest, it is appropriate to choose those types of trees that are representative of local ecosystems and that can provide visitors with various educational experiences. We should choose native trees that are typical for the given region and climatic conditions. The inclusion of native species is also important to protect local biodiversity. An educational forest should contain diverse types of trees, species with different leaves, fruit trees that can show visitors the process of flowering and fruiting, and such trees that provide food, shelter and nesting places for local animals and birds.

The discipline of forest pedagogy is also related to the educational forest. Specially trained foresters can introduce forestry and natural science topics to children and adults through an experience directly in the forest environment. If you are interested in this topic more deeply, or if you want to become a trained forest pedagogue, look at the website https://www.lesnipedagogika.cz/

In 2012, the forests of the Czech Republic in the village of Jablunkov in the Moravian-Silesian region made available a 'Forest for play and knowledge'. The area includes a short children's educational trail with several information and educational panels, a wooden relaxation gazebo that also serves as an outdoor classroom for group teaching of forest pedagogy lessons, and a geobotanical exhibition containing local stones and plants. There is also a pond with typical local plants in the area.

5.3.8.8. Therapeutic forest.

Just as we can perceive nature on an imaginary scale from flowers in the home and city parks to the wild, there are many ways the forest can be adapted and what we can do in it. Some forests do not have to adapt to humans at all in order to feel the positive effects of nature on our health, except perhaps for availability and possible paths.

Various arrangements and incentives for forest visitors help to increase the accessibility and effectiveness of staying in nature. It can be defined parts with different surfaces, where we walk barefoot and where we can concentrate on our every step. Getting into the here and now. In the forest, there can be benches and tables with diverse views, where we do not wander in our mind, but with our sight or other senses in the landscape. The starting point can also be the construction of a background or shelter, where you can hide from bad weather and where you can also recharge your batteries in peace. Increased road maintenance can then contribute to accessibility. The diversity of the landscape can then encourage a longer stay, fascination, inquisitive discovery.

We should already have one side, the forestry side. There are many ways to exercise and stay in nature as a visitor or someone who is exposed to the forest. However, the ethical aspect, where we do not destroy the environment, remains essential. The claim is not necessarily preservation or conservation of nature, but at least its preservation in the state in which we entered the natural environment.

A therapeutic forest, also known as a medicinal forest or natural therapy, refers to a natural environment (typically a forest or woodland area) that is intentionally used for its medicinal and therapeutic benefits for human well-being. The concept is based on the belief that being in nature, especially in forested areas, can have a positive effect on physical, mental, and emotional health.

Medicinal forests draw on the principles of ecotherapy and the wider field of natural therapy. Being in nature can reduce stress, anxiety, and depression, improve mood and self-esteem, boost immune function, enhance cognitive abilities, and promote overall well-being. These benefits are attributed to a variety of factors, including the calming and restorative effects of the natural environment, exposure to phytoncides, increased physical activity while walking or hiking, and opportunities for mindfulness and relaxation in natural environments. Therapeutic forest programs and practices may include guided nature walks, forest “bathing” (immersing in the forest atmosphere), outdoor meditation, nature exercises, and other activities designed to facilitate a deeper connection with nature and promote personal well-being. It is worth noting that the term "therapeutic forest" can be used more broadly to describe any forest or natural environment that offers benefits for relaxation, stress reduction and personal rejuvenation, regardless of whether it is part of an organized therapeutic program.

There are different types of forested environments or nature-based interventions, each with its own focus and approach. Here are some examples:

- Forest Bathing: Forest bathing, also known as Shinrin-yoku, is a Japanese practice that involves immersing yourself in the atmosphere of the forest. It emphasizes mindfulness and deepening the connection with nature through sensory experiences. A forest bath often includes slow walks, meditation and gentle exercises in a forest environment.

- Guided Nature Walks and Forest Therapy: These programs involve guided walks in natural environments, typically forests or woodlands, led by trained facilitators. The walks are designed to encourage participants to engage with nature, observe their surroundings and connect with the healing properties of the forest.

- Ecotherapy or wilderness therapy: Ecotherapy includes a variety of nature-based therapies that use outdoors, including forests, to promote mental and emotional well-

being. Wilderness therapy specifically focuses on using natural environments such as forests, mountains, or rivers as a backdrop for therapeutic interventions, often involving outdoor activities, group discussions, and individual reflection.

- Horticultural Therapy: While not directly related to forests, horticultural therapy utilizes the therapeutic benefits of gardening, working with plants, and being in the natural outdoors. It can take place in gardens, arboretums, or wooded areas where individuals engage in horticultural activities and experience the restorative effects of nature.
- Green exercise and adventure therapy: These interventions combine physical activity, outdoor adventure, and exposure to the natural environment. Activities such as hiking, mountain climbing, canoeing, or cycling in forested areas provide opportunities for exercise, adventure, and connection with nature, which contribute to overall well-being.

- Forest schools and nurseries: Forest schools focus on providing education and experience in the outdoors, including forests. These programs emphasize child development, experiential learning and connecting children with nature. Forest schools often include activities such as exploration, play and environmental education.

- Animal-assisted therapy in nature: This type of therapy involves integrating interactions with animals, such as therapy dogs, horses, or wildlife, in a natural environment such as the forest. It combines the benefits of animal-assisted therapy with the healing properties of nature.

- Equine-assisted therapy: Equine-assisted therapy uses interactions with horses as a therapeutic tool. Although not specific to forests, equine therapy can take place in forested areas where individuals engage in activities such as horse care, horse riding, or horse care, under the guidance of trained therapists.

- Forest Retreats: These retreats provide an immersive experience in nature, typically in forested areas. Participants engage in a combination of guided activities, meditation, relaxation, and reflection in a natural environment to promote healing, stress reduction and personal growth.

- Nature-based mindfulness programs: These programs combine mindfulness practices with exposure to natural environments, including forests. Participants engage in mindfulness meditation, breathing exercises and awareness techniques while being present in nature, strengthening their connection with their surroundings.

- Nature conservation and restoration programs: Engaging in forest conservation and restoration activities can also have therapeutic benefits. Working in forested areas,

planting trees, and participating in ecological restoration projects can provide a sense of purpose, connection with nature, and personal satisfaction.

- Therapeutic gardens in woodland settings: Some therapeutic gardens are specially designed in wooded areas, allowing individuals to engage in gardening, relaxation and sensory experiences while benefiting from the natural environment.

- Wilderness Retreats: These locations aim to provide individuals with extended periods of time immersed in wilderness areas, often including forests. Participants engage in activities such as camping, hiking, and solitude that allow for reflection, personal growth, and connection with nature.

- Forest art therapy: Forest art therapy combines artistic expression with the healing properties of nature. Participants create art in a wooded environment, using natural materials, inspiration from the surroundings and the therapeutic benefits of the creative process.

- Forest Yoga and Meditation: Yoga and meditation practices can be integrated into a forest environment, combining the physical and mental benefits of these practices with the rejuvenating effects of nature. Forest yoga classes or meditation retreats provide opportunities to practice in a natural environment.

- Forest Sound Therapy: Forest sound therapy involves using natural sounds such as birdsong, rustling leaves or running water as a therapeutic tool. Listening to these sounds in a forest environment can induce relaxation, reduce stress, and promote a sense of calm and well-being.

- Forest Mind-Body Practices: Various mind-body practices such as tai chi, qigong, or forest energy healing techniques can be adapted to practice in a forest environment. These practices combine movement, breath work and the energy of the natural environment to promote balance and well-being.

These are just a few examples, and the field of natural therapy is evolving, and new approaches and programs are being developed. Individual practices can also target specific populations such as people with disabilities, seniors, war veterans, and the like. Specific types of therapeutic forests may vary depending on the goals, resources, and expertise of the practitioners and organizations involved.

6. How to create an enclave of life.

6.1. How to achieve enclaves of forest life?

If we were to acquire a (small) forest and want to contribute to the protection of biodiversity, we would base it mainly on the current situation of the forest in question and the context of the landscape. The isolation of habitats is a big problem for biological diversity. There should be an interconnected network of suitable habitats in the landscape, enabling the existence, migration and spread of populations of endangered species of organisms. They are often endangered precisely because they have high requirements for a certain type of environment, and at the same time a low migratory capacity (18). The mentioned network should contain sufficiently large "islands" of ecologically valuable habitats, fulfilling the role of refugia and "Noah's Arks", but also additional smaller biotopes, so-called "steppingstones", in the less valuable, economic part of the landscape.

Nature is not helpless and can take over if we give it a chance. It is possible to apply respect for nature absolutely and leave the enclave of the forest to its own development. In many cases, this will be the best we can do. Strict forest protection is a legitimate tool (20), which, moreover, the European Union has committed to using on 10% of the forest area by 2030 (21), which is still an immeasurably distant goal in our country. This step is most recommended in the case of old forests with a composition of tree species close to nature.

Increased prudence when leaving the forest in a non-intervention regime is necessary especially for commercial spruce stands, as the Forestry Act orders the felling of trees if, if they were left, there would be a risk of the spread of harmful agents; this means primarily bark beetles (bark beetles). In the same way, it is necessary to be careful in locations with increased movement of people. As we have already mentioned, the public can freely enter the forests. They do so at their own risk, but, for example, in the event of a dry tree falling on a marked hiking trail, the development of the forest owner is not guaranteed. When an enclave of "liberated" forest is created, it is therefore appropriate to ensure, if necessary, selective logging along busy roads, to place warning signs at the border of the enclave, or to ask the state forest administration body to restrict access to the forest if there is a

temporary risk of increased danger. In the ideal case, the enclave is a priori difficult to access (ravines around watercourses, steep slopes, etc.).

The stands of sterile land are also very promising. This is a habitat that nature is dynamically reclaiming, there is a high supply of biotopes, dead wood and enough light, there is often a natural regeneration of trees suitable for the habitat (FIG. XX), the soil is not damaged as in the case of cleared or milled brushwood. Many experts have requested that the thoughtful incorporation of dryland stands be an integral part of post-disaster forest restoration, but mostly there has been a lump sum extraction of these stands (22). The preservation (so-called retention) of land does not necessarily have to be large-scale, but at least mosaic-like, taking into account safety and operational aspects.

Another way to an enclave of forest life is the restoration of the light forest in the form of some historical management, for example by forest grazing or felling. The care of light forests is well covered by a methodology in which you will find enough necessary information (23). However, it is necessary to prepare for the fact that the Czech legislation does not go too far against these forms of care; for example, forest grazing cannot be implemented in an economic category forest at all.

In addition to non-interventional or, on the contrary, significantly active management in the interest of protecting biodiversity, you can use a variety of integrative tools with which you support biodiversity within the framework of conventional farming. Basic recommendations in this sense are provided by the article Minimum for the protection of biological diversity in Czech forests (24). The key to the biodiversity of the forest is dead wood and biotope trees, i.e., mainly old and massive individuals, carrying so-called microbiotopes, or microhabitats (for example cavities, cracks, mushroom fruiting bodies, etc.). An estimated half of all forest organisms are tied to dead wood and biotope trees (25). It is the fact that these types of biotopes are disappearing in forests that is one of the main reasons for the threat to biodiversity. If we talk about enclaves, biotope trees are a kind of micro-enclaves, the preservation of which should be a standard in every forest. You can find more information about this fundamental issue on the website Lesodiversita (26), which also includes a mobile application of the same name for monitoring biotope trees, and in the Methodology of dead wood in commercial forests (26).

Consider that to maintain forest biodiversity, an average of 30 m3 of dead wood per hectare should be present in forests, with bulky dead wood being the most lacking (27). This need collides with the understandable desire to monetize every piece of wood. Even if we choose wood that has no general economic value when leaving the wood to live and rot, we may still feel a current financial loss. But without it, the forest will not be permanently ecologically and subsequently not even economically sustainable. Quantifying a loss in this

sense is similar to valuing a worker's sleep with a negative value of the products he could have produced instead of sleeping.

A big obstacle to ensuring the presence of dead wood in the forest is also the public's ingrained idea of the need for a tidy, clean forest in which there is order. An untidy forest does not seem to be under responsible management, it may not even be healthy. In this sense, however, clearing the forest means clearing the essence of the forest. In addition to damage to biodiversity, there is also a disruption in the cycle of nutrients that are released from rotting wood.

There is also a forestry concept, originating from North America, which is built on the protection of biodiversity and adapts the effects of management to the regime of the above-mentioned natural disturbances. It is ecological forestry (18), which strives for the continuous occurrence of the so-called biological heritage of disturbances. Such heritage is, for example, dead wood and aging and very old trees. Another aspect of ecological forestry is the variability of logging, similar in design to the usual natural disturbances of the given region.

A forest owner who desires an enclave of forest life will have a worse starting position, on cleared brush, or in young, artificially established monocultures. However, even these surfaces are not lost. As we have already stated, nature can take over. It is necessary to avoid intensive technologies and building plans and sensitively perceive the incentives of nature. We recommend waiting patiently for the natural renewal of trees or supporting it with a network of pioneer species (birch, crane, willow, etc.). In this sense, you can encounter the relentlessness of absurdly short legal deadlines for afforestation (restoration), even if there are institutes of exceptions. With educational interventions in young stands, it is advisable to strive for the species diversity of the stand (we recommend not to apply the so-called shoulder felling, which was used in times when some tree species had a reputation for weeds - typically birch) and to support the mosaic of the environment with irregular intensity. More information can be obtained in the materials on ecological forestry mentioned above (18).

If you dream of creating an enclave of life, we recommend researching the state and history of the landscape that your forest co-shapes, taking an interest in what lives in your forest, especially the rare ones (perhaps it is a last-ditch effort). Somewhere it will be ideal to passively create a forest enclave (because why couldn't the forest also be part of the cultural landscape?). Elsewhere, the history of the site may call for the active restoration of a relatively recently extinct light forest. If you are economically attuned, you have at your disposal tools that enrich forestry activities with thoughtful management of dead wood and habitat trees. All of this can be combined, especially on larger forest property. The current level of knowledge leads us to the fact that at the landscape level, it is not a suitable way to

achieve a single form of multifunctional forest, but to thoughtfully connect passive and active nature protection, management with biodiversity in mind, and commercial areas.

6.2. Exploring and observing my enclave of life.

Research and observation as a reason for the forest.

After all the meetings of forest activists, reformists, forest lovers and others, it is more than clear to us that for many founders of the "other" forest, observing it, being in it (for himself or for others) and enjoying its growth is the very reason of why he opens these pages at all. Then just don't forget to enrich your perceptions with a really large number of expert forestry, natural science and social sources, map lovers can even better see the forest and the yoke of the site through rich sources of information about natural conditions and development. We already mentioned how and where to look in chapters 4 and 5.

Observation of the forest as part of its cultivation.

It is also a fact that even if you do not intend to see your forest often, it is advisable to observe what is happening in it and it will also benefit the success of its growth towards your goals. You can find a lot in the documents, but observations of what happens when in the surrounding landscape, how the local climate and neighboring vegetation are developing, how and where animals move, how foresters and farmers farm around, how people move and how neighbors plan their interests, you can't do without it when planning a small enclave.

Staying in the forest and observing it as an opportunity.

If it is not against your intentions, how you imagine and plan the otherness of your forest, then we also have one common advice of activists: offer something from your experiences and plans to yourself and other people. It can be just a quiet place near a walking path to stop at anything that reminds you of your plan (a statue, a clearing, a sign or even a forest place like you created in childhood), or something more - sitting on the edge under a flowering or shade tree, a traditional or artistic blackboard, a taste of the diversity of your forest on the edge, etc. Present your plan so that people themselves accept and understand where you are gradually heading (and we don't always have to write, place barriers and protection). We see the forest enclave of otherness as an opportunity to inspire others as a good step towards a greater change in thinking about the forest in a different way.

Whether you are more of an observer or more of a grower, we have dealt with forest disputes a lot in the project and have come up with a few useful tools for us. For records, we have created Forest Cards where, in addition to the location and status fields, it is good to

write other developments and plans, and even a task plan and list of inspirations. Of course, you can add and modify them.

In addition to the records, where today you can already have everything in one place, many activists of other forest enclaves finally came to the conclusion that it is also good to have permanent places for observation and to offer yourself and others a completely inconspicuous comfortable place, such as a bench, a view from the undergrowth , a dry place under a shelter or just a stone wall under branches. So, observation points, even the observer needs shelter.

6.3. What can I have in my enclave of life?

In the following sections, you will find a menu of reflections on how to think about the enclave from the point of view of its suitability for other organisms, for diversity as a central value, and for the very narrow interests of some species. A forest is a very broad concept and its appearance and hospitality for people and other organisms, as well as equipment with various other elements, is a diverse range of imaginable possibilities and details. And as it is written in the previous chapters: a small stand of trees and woody plants in the landscape does not even have to be legally a forest plot, and then it has even looser rules for management. We want to inspire you, not convince you that you must have it all in your enclave of life, which is your piece of land in the middle or on the edge of a forest or in a deforested landscape. So let the following offer be to your taste.

6.3.1. Do I want a rich forest?

We can't see the forest for the trees.
Most people see only trees in the forest, and some even consider the forest to be a stand of trees that provide useful wood. However, the forest is much more. It is a complexly organized system or so-called ecological system - an ecosystem, made up of a large number of organisms. These are connected by mutual ties. By invisible pathways of energy flow and the cycle of substances, organisms are closely connected with their environment. Most of the connections may not be clear at first glance and and about many we have no idea at all. It's complicated in every ecosystem, but in a forest, it seems a bit more complicated.

How many organisms live in the forest or in some part of it? In a few hectares of forest, there may be five species of trees and shrubs, up to hundreds of all vertebrates, dozens of

species of bryophytes, dozens of species of herbs, hundreds of species of fungi, hundreds to thousands of insect species, hundreds to thousands of other invertebrates, and we have only a little idea of microorganisms. Trees are only a small fraction of our forest's diversity. In all our forests there are usually only tens of tree species. And still the forest and its protection are very often approached in a way that protecting the forest means first and foremost protecting and supporting the trees. So, we don't see the forest for the trees. Yes, there is no forest without trees. But if we want to effectively protect and support the biodiversity of our forests, we must focus primarily on other groups of organisms and their requirements. There are very few endangered species among the trees. Oaks, beeches, spruces, or pines do not really need our protection as a species. But, for example, all 27 types of bats living in Czech Republic are protected by law, all our reptiles are protected, hundreds of species of herbs and insects are endangered. Dozens of forest species survive in the last localities and many species, especially insects, are already extinct. In many cases, the cause of this drastic loss of species is the way of forest management, or the approach to its protection, when we do not see the forest for the trees.

It is necessary to point out that THE METHOD of forest management has a significant influence on forest biodiversity. The fact that the forest is intensively managed does not mean that it is being damaged or impoverished. In many cases, the opposite is true! Many types of forest vegetation, which we would call natural, are the result of a long-term impact. The myth of the ideal natural forest left to spontaneous development is behind the decline in diversity and the extinction of many rare species. Forestry management directly determines or influences the tree species composition and structure of the forest stands. The dominant tree species and structure of the stand determine the characteristics of the forest environment and thus its biodiversity. The different management methods and their impact on biodiversity are described in detail in previous chapters.

Let's take as a basic premise of naturally valuable forest species and age diverse forest, formed mainly by woody plants of natural composition (depending on the altitude it is oak or beech, spruce only in the higher mountains). In the following chapters we will no longer describe how to manage the forest if we want one. We will focus primarily on the support and creation of various ´anomalies´ that disrupt the homogeneity of the forest environment and increase its diversity. Because species diversity depends primarily on environmental diversity.

Disrupt the forest, support biodiversity!

When studying forest biodiversity, we find that a large part of it is tied to the environment, which disrupts the homogeneity of the forest stand and is actually not strictly forest. Many species are very closely linked to these forest anomalies and are absent in a strictly defined forest environment. These are, for example, various wetlands, springs, water areas of

various sizes, rocky outcrops and rubble, natural steppes or forest-steppes, meadow enclaves of all sizes, forest clearings and forest-free parts of all kinds. For example, clearings are an important refuge for many rare and endangered species of plants and insects. We could also include here windthrows and fractures, landslides and dying parts of the forest due to attacks by various pathogens and insects. And all these above are considered anomalies and are undesirable and suppressed elements in the vast majority in most especially commercial forests. The diversity of most forests in Czech Republic is in the style - spruce, spruce, stump, spruce, spruce, stump, spruce. Such an environment is very species-poor and is dominated by generalists (species that do not care what environment they live in). The process of the decline of specialists and the predominance of generalists is called biotic homogenization. The forest formed by trees of natural composition, which in most of our territory are various deciduous trees (mainly oak or beech), will in most cases be significantly more varied in species. And now let's imagine that we can complement, guide, and create the diversity of the forest environment in many ways, procedures, and elements. And often it doesn't even have to be at the expense of the economic benefits of the forest.

The following chapters describe how to promote diversity and the presence of different groups of organisms in the forest. These are mostly interventions and procedures that have a more or less complex effect on forest diversity. However, we can also implement a number of measures specifically for a certain group of species. Procedures for protection and support of biodiversity of different groups of organisms or different types of environments and elements of naturally valuable forests are described in detail in numerous specialized publications and methodological manuals (Cepáková et Hort 2013, Čížek et al. 2016, Čížek et al. 2020, Konvička et al. 2004, Krása 2015, Matějka et al. 2016, Mikátová et al. 1995, Pešout et al. 2019, Zatloukal 2014 atd.). The following chapters focusing on individual groups of organisms are based on these numerous detailed materials.

6.3.2. Animals in the forest.

6.3.2.1. Insects.

Insects are the most numerous group of animals. Approximately 30,000 species are currently known in the Czech Republic. The insects were affected very severely by the changes in our forests. First, it is the extinction of traditionally managed light forests of lowlands and hills, which have been on a large scale converted into dense and tall stands since the 19th century. Secondly, the extinction of natural forest stands in higher altitudes. Without reproduction insect populations usually do not last a single season and their ability to migrate is mostly limited. At the same time, most insect species have relatively large space requirements. While a few acres of a suitable habitat are sufficient to maintain a plant's population, an insect population needs a much larger area. And while plants only need one

habitat type, in the case of insect species, the habitat requirements of larvae and adults can vary greatly. They therefore require at least two different habitats and usually very close to each other.

Insects bound by their development to woody plants are called *arboricola* insects. And it is among these insects that there are many representatives of endangered animals throughout Europe. Only very few of these species can be described as primary pests, i.e., those that are able to attack a healthy tree and kill it. These include the well-known European spruce bark beetle. A subgroup of arboricola insects are sapro-xylophagous species, which need dying and dead wood for their life, or wood infected with various species of fungi. We can find among them a number of striking and attractive large beetles, which belong to the endangered species. For example, flower chafers (*Cetonia*), click beetles (*Ampedus*) or hermit beetles (*Osmoderma*) live in tree cavities, in dying trees can be found number jewel beetles (*Anthaxia*), *Cucujus* species, and longhorn beetles (*Cerambycidae*) and in rotting wood on the ground larvae of our largest beetle - european stag beetle (*Lucanus cervus*) - develop, as well as of other stag beetles (*Dorcus*) or european rhinoceros beetles (*Oryctes nasicornis*).

In the insect-forest relationship (respectively insect-tree), most people may have the first idea of a beetle in the mouldering trunk of a fallen tree in a damp shady forest. This idea is correct, but it is just a narrow section of insect needs for the diversity of their habitats. Let´s also think about a beetle at a height on a sunny trunk, a standing tree is more attractive for some species of arboricola insects. On standing trees, the variety of species is higher, but it goes hand in hand with a higher number of endangered species. The diversity of insect species does not decrease even with fallen trees. Only the number of typically arboricola insects decreases and the number of epigenic insects increases. Epigenic insects are bound to the wood indirectly and use it, for example, for wintering or as a shelter.

The following sections describe the elements and characteristics of the forest that support insect diversity and are essential for many endangered species to survive and introduce some of the methods to achieve these. And let's keep in mind that sometimes it will mean trickier forest management or smaller financial profit. However, the economic function of the forest does not have to be substantially reduced at all. The described elements and characteristics are mostly a kind of extension of various forest managements, which are described in chapters 5.X. The elements and properties of the forest described below are useful universally for all types of forest environment. That is why the chapter about insects is longer. Let's repeat that vegetation, which consists mainly of age-diverse woody plants of natural composition is a basic premises for naturally valuable forest.

Old trees.

Old trees are key to maintaining natural diversity. And these are the ones that are rapidly disappearing from the forests involved. It is therefore essential to care for existing veteran trees in an appropriate way, while at the same time creating their successors in a targeted way. The key is to keep old trees alive and standing for as long as possible. Due to their age, they are generally less vigorous and are very often oppressed by their younger neighbors, with whom they are unable to compete for light, water, and nutrients. The intense competition common among trees in dense forests kills old trees quite quickly. It is therefore important to care for the surroundings of old trees and to clear them from the standby cutting down surrounding trees. However, this must be done gradually, as a sudden change in conditions can kill them as well. At the same time, selected younger individuals should be released in the stand to one day replace the existing veteran trees. It makes sense to select primarily locally native species as future veterans.

In general, the larger the tree, the greater its importance for biodiversity. What lives and grows in and on it is also influenced by the species of tree. In this respect, oaks are the richest. Close behind would probably be other deciduous trees such as maples, ash, elms, or beech. Fruit trees, poplars (including so-called hybrids), willows, or birches are also quite attractive. But even a completely non-native sycamore or an old acacia can host endangered and protected species. So, removing non-native veterans would be a harm.

An old or dead tree can be problematic and dangerous to the surrounding area. Particularly if it is located next to a road, a building, or another more heavily trafficked location. We would not like to stir up controversy about the danger that such a tree may pose in certain circumstances. Nevertheless, it is noticeable that we are becoming somewhat hysterical when it comes to the threat to life from a falling tree. Old and dead standing trees can be professionally treated so that they do not pose a threat to the surrounding area and the risk of strong branches falling, the crown breaking, or sudden uprooting is as low as possible. Even a three-meter trunk torso is still of great importance.

´Vystavky´.

Trees that are left standing in a clearing after harvesting are called *vystavky* in czech language. Leaving these high trees is also quite common in commercial forests. For example, after a spruce forest has been harvested, one or more deciduous trees that were part of the stand are left in the clearing. They can be fir, larch, pine, or spruce as well. However, conifer stands are much more susceptible to damage, e.g., by strong winds. Their importance in terms of forest biodiversity is also not as great as that of deciduous trees. However, if you are restoring, for example, a pine monoculture, even a few pine trees are still better than no trees at all. Trees that would be of little economic benefit to harvest (e.g., trees that have grown unsuitably or have been damaged in some way) can also be retained as stands.

However, today's vystavky are very different from those that were left during traditional forms of management in the past (especially in the cultivation of the central forest) and are de facto not true vystavky. The original ones have been prepared for their character for a long time. Today's ones are released suddenly, for which they are not prepared. They are predominantly tall, high-crowned specimens, as a result of which they break easily, and their canopy suffers from sudden overexposure to sunlight. As a result, the specimens often die shortly after the surrounding vegetation is removed. Selected trees should therefore be gradually prepared for release by thinning or selective harvesting in their surroundings, even several decades in advance. However, such a procedure is still rare in practice. Nevertheless, leaving them in the clearings is beneficial. Despite all the disadvantages, they provide at least temporary habitats for many species, both when they are standing and later, after they have fallen to the ground.

They do not have to be evenly spaced in the grassland. Often, this would not even be possible. Leaving a few trees in a compact clump is also an option, perhaps increasing their resilience. It may also be appropriate to leave trees in this way that are rarer in the wider area or in woodland generally. These include elms, cherry trees, fir trees, etc. The key question is how many specimens to leave in an area. From the point of view of protecting, e.g., saprophytic insects, it is of course best to have as many as possible, but each individual is better than a completely cleared area. The minimum in a managed forest should be 2-4 trees per 1 ha of forest, a favorable situation is around 20 individuals, and a compromise is 10.

Veteranization.

Finding a dying tree, especially a very old one, in a managed forest or in the open countryside is almost a feast. The aging process can be deliberately accelerated by proper pruning or trimming. This is known as veteranization. Trees are deliberately made into veteran trees, even if their age does not yet correspond to this. However, the modified tree must also have enough light and space to grow! This does not mean that we want to kill the tree through veteranization, although this can sometimes be the aim. The aim is primarily to speed up the formation of micro-habitats typical of old and dying trees (cavities, cracks, fractures, areas without a border, etc.), which are important for the organisms attached to them.

Coppicing and other forms of regular tree pruning can be considered as veteranization (continuously rejuvenated stumps can be many times older than the trees growing from them). These practices and their impact on tree character and biodiversity are described in more detail in Chapters 5.X. Ringing also contributes to veteranization. Ringing was (and in some places still is) one of the methods of timber extraction. The bole of the tree is cut, which breaks the conductive webs and allows the tree to dry standing. The dry wood is then

felled and used as fuel. Dry wood is lighter and easier to transport. But we skip the last step and let the tree stand and decay naturally.

Creating habitats for different organisms is not damaging to trees. Of course, interventions also need to be evaluated in relation to the tree species involved. In most cases, it will be possible to consider the support of an endangered species to be of greater benefit than the damage to common tree species, but the reverse may also be true. We will not, for example, carry out veteranization on exceptionally large and vigorous specimens or on trees that are rare in forests (e.g., birch, field pear, elm, etc.). We will choose mainly younger and middle-aged trees and trees that tolerate pruning well.

Dead wood.

Dead wood in the forest also includes standing dry or still dying trees, which have already been described in the section "Old trees". In this section, we will take another look at dead wood and mention other aspects of dead wood in forest stands. The shortage of deadwood is one of the major problems of contemporary forestry. The volume of deadwood, especially in commercial forests, is pitiful, and it is still dominated by 'deadwood' (wood up to 7 cm in diameter). In commercial forests, its volume amounts to 4-10% of the stand stock, while in reserves left to develop spontaneously, it is 20–50%, and locally even more. Often, the only form of dead wood in the forest is stumps. These are then the last refuge of arboreal insect species. Unfortunately, "modern" forestry practices include stump removal and mechanical soil preparation. Surprisingly, this often happens in protected areas.

We can enrich the vegetation with dead wood, especially during educational interventions and logging, when we leave the stumps and uprooted trees in place, but we can also leave some logs or parts of logs lying around that we would otherwise take away. In addition to these, live exhibitions should be left in the forest, which will increase the amount of dead and decaying wood later. The forest owner may lose some of his profit by leaving some of the wood in the stand, but the damage caused can be compensated for from the state budget funds earmarked for this purpose. There is a separate methodology for leaving dead wood in the stand. Sufficient deadwood in forests ensures that the forest is free of encroachment, i.e., the forest is left to develop spontaneously. In this case, trees are not cut, and no wood is removed from the forest. However, the no-logging approach is only applicable in some places. It is particularly relevant at mid- and high altitudes or in extreme habitats, for example, debris forests on steep slopes. For montane forests and debris forests, it is an adequate approach that also suits the saprophytes, or shade-loving species and generalists that live there. These mainly require sufficient dead wood. However, in traditionally intensively used lowland forests, the no-logging approach is inappropriate and, on the contrary, leads to their impoverishment and the loss of habitat for several endangered plant and animal species.

Many myths and superstitions persist about old trees and dead wood. For example, they are a source of fungal diseases and pests. Most of the organisms that need dead and dying trees are attached to them and do not find a suitable habitat on a living or healthy tree. Conversely, organisms that cause tree death and are potentially dangerous to healthy trees are no longer found on older dead wood.

In the Forest Act, dead or damaged trees are mentioned in the provision on incidental logging, which is imposed on forest managers. Incidental harvesting is the processing of dry, uprooted, diseased, or damaged trees. Therefore, such trees are routinely removed in transport-accessible stands of management forests. The meaning and impact of this provision of the Forest Act will not be discussed here. "An old or dead tree does not belong in the forest and must be removed". This is probably the most common argument that forces the forester to keep the forest "tidy".

By contrast, under the Nature and Landscape Protection Act, specially protected species are protected in all stages of development, and their habitat, which in many cases is dead wood in various forms, is also protected. The 2016 Government Resolution on the Czech Biodiversity Strategy sets out measures for forest ecosystems, among others, to "promote the biological functions of forests, in particular by increasing the proportion of logging residues and wood left to mature (standing and lying)". If the forest owner and the forest manager are enlightened, the retention of dead or dying trees should be incorporated into forest management plans or curricula.

Import of dead wood.

There may be situations where deadwood cannot be produced in the stand now. However, we can import it from elsewhere. This is an option when the shortage of deadwood is acute or when we want to encourage species linked to later stages of decomposition. The installation of loose logs or parts of logs is sufficient for this purpose. The rate of decomposition and the attractiveness of the wood to some particular insect species can be influenced by placing the wood in a sunny or shady location, in a dry or damp place. In cities and parks, but also in suburban forests and other places with more frequent public traffic, we prefer to build beetle boxes. It is nothing more than a cluster of logs arranged into a composition. The important thing is that the trunks should also have bark. Most trunks are partially embedded in the ground; some may be loose. However, care must be taken for safety, and the trunks must be stable. You can't prevent children from being part of the bug house for a while. From the general public's point of view, it is a hassle-free feature, and with the placement of brief information about its purpose, it will also serve to educate and raise awareness.

Light conditions of the vegetation.

The vital importance of light and sparse forests providing suitable habitat for a wide range of organisms has already been described in the chapters on forest grazing and on low and medium forests. In the high-stemmed commercial forests involved, completely unsuitable conditions prevail for these organisms. They require, for example, sufficient insolation of resources otherwise commonly available even in the involved forest, for example, insolated dead wood in the case of many saproxylophagous beetles. Further, these are often organisms that simultaneously use both the non-forest and forest components of the habitat and disappear unless they have both in virtually the same place. In addition, a large proportion of insects are tied to undergrowth herbaceous vegetation, which serves as a food source for their various developmental stages. The development of the herbaceous undergrowth is very closely related to the amount of light that passes through the undergrowth of trees. For example, when studying butterfly species, it has been found that their richness increases in analogy with the diversity of the herbaceous undergrowth. At the time of the decline of light forests, about a century ago, there was also a severe decline in butterfly populations, and today a large proportion of species are endangered.

There are a number of options for achieving a lighter forest character. These include traditional low and middle forest management practices that maintain a dynamic mosaic of light and dark parts of the forest. In terms of overall biodiversity, medium woodlands, which combine the benefits of coppice stumps and the need for old trees, are likely to be preferable in most situations. Another way to achieve light stands is through targeted thinning by reducing stunting and forest grazing. However, forest grazing is difficult to enforce. All these practice and management methods are described in more detail in Chapter 5.X. One important and not very controversial tool for creating open forests is the thinning of forest edges.

Forest edge thinning.

Forest edges can be 'hard' or 'soft'. A hard edge is the abrupt transition of a forest into a treeless area. Typically, it is the interface between forest and field, or machine-cut meadow, or fenced pasture. The forest edge is often an impenetrable wall of trees and shrubs that shades out everything beyond it. The soft edge, on the other hand, is a gradual transition between forest and treeless woodland, often with individual trees and shrubs. It is actually a strip of light woodland and a very important habitat in terms of biodiversity. For example, in a study of arthropods in the deciduous forests involved in the south-east of the country, it was found that the number of species is more than 60% higher in the edges than in the interior of the stands. The wider the soft edge, the better. But even a strip a few meters wide makes sense. A soft edge will be most beneficial on the sun-exposed, south to west-facing side. However, it makes sense on either side of the forest. At pasture edges, the fence can be

moved a few meters into the woods, and the cattle will then do much of the work for us. When we look at cadastral maps, we find that forest grows very often also on the land attached to a permanent perennial vegetation. Then we do not have to worry about breaking forest laws. However, thinning the forest edge by grazing can take a long time. Therefore, it is advisable to start by cutting back some of the trees at the grazing margins and, if necessary, elsewhere. The forest law's lower limit of 0.7 for stunting allows up to about a third of the trees to be felled, which in many cases can significantly improve the situation. In addition, at the edge of the forest, the light supply is also increased from the side of the stand. However, sometimes a more radical intervention is desirable, which can only be carried out after obtaining the appropriate exemption. The thinned edge of the forest can be allowed to grow back and then thinned again after some time, or regular aftercare can be provided, and the edge will remain 'soft'. Here again, more extensive grazing (at the edges of the pasture) is very suitable.

What about the clearings?

Clearing is an image of forest destruction, and many people find it hard to bear when they see a clear-cut or dead forest. They have a hard time understanding that the vast majority of our forests are economically important and grow in approximately century-long cycles. "But the forest has been standing there for as long as I can remember!" Certainly, centennial memorials are few. Nothing is black and white, there are two sides to every coin, and everything bad is good for something. And so, it is with the clearings. The classic clearing with stumps and logging debris is the last habitat that regularly offers sunny, larger diameter timber and bare ground. In today's connected management forests, they are one of the last habitats that allow at least some of the light forest biota to survive. They allow for the existence of many species of insects. Today, practically only in our clearings can we find lions or wood larks, and they are sought after by lizards, snakes, and other vertebrates. If we want to get at least some economic benefit from the forest, we cannot avoid logging. Forestry practice knows many methods of so-called 'grazing-free' management. However, passive management is much more common in large clearings. In the current predominant spruce and pine monocultures, this method is in most situations the only cultivation option. Huge clearings are also created in these low stability stands during various calamity conditions: felling, massive multiplication of various harmful organisms (typically the spruce bark beetle), or mass dieback during prolonged drought. We cannot avoid grazing even if we want to transform our dark spruce forest into a forest of natural species as quickly and efficiently as possible. The main question then is how the resulting clearing should be managed.

If the clearing is overgrown by natural rejuvenation, another phase of light forest with scattered shrubs and young trees is usually created. This can last for quite a long time and allows many other types of sparse forests to exist. Clearings are left to natural rejuvenation,

for example, in Scandinavia or the Baltic States. In these countries, light forest species are less threatened than in central Europe, where artificial afforestation is common. Forest law in this country forces owners to reforest. Once a forest has been cleared, they must provide a so-called 'crop' within six years. This means keeping the trees in the grazing area so tall that they are no longer damaged by animals. The loose, scrubby phase of a spontaneously emerging forest is quickly replaced by a uniform, dense young forest. Forestry legislation also directs reforestation methods, such as planting in a ridiculously dense clump, which goes completely against the principle of light forests. While natural rejuvenation rarely creates a monoculture, forced afforestation, unfortunately, almost always does. This is a perverse demand, both economically and biologically. It forces the owner to cultivate the forest in a way and for a purpose that may not be essential to him.

And finally, beetle boxes.

Beetle boxes are certainly not as common as bird boxes. But their purpose is the same. To some extent, they can replace natural cavities if they are absent from the vegetation. Experiments in Sweden have shown that up to 70% of the saprophytic insects that lived in the sites occupied the boxes. However, it is not the case that boxes (of any kind, not just for beetles) can replace the natural habitat. It is only a substitute and temporary solution, and the emphasis should be on encouraging the formation of cavities in trees. In no way can their use be used to justify the felling of cavity trees. However, the boxes are a very useful tool in ecological education as they allow direct observation of the interesting cavity fauna.

6.3.2.2. Amphibians.

There are currently 21 species of amphibians living in the wild in the Czech Republic. This is a group of animals that has received a lot of attention, especially in the last 20 years or so. All our amphibians are more or less endangered and, with the exception of the brown frog, are among the legally protected species. Species that were common and abundant until recently, such as the newt and the toad, are gradually disappearing from our landscape. Suitable habitats for their breeding are gradually disappearing, and many existing water bodies (especially ponds) are not suitable for them. Moreover, the numbers of individuals in occupied habitats are generally very low.

All amphibians need suitable aquatic habitats in which to breed. The character and quality of the surrounding environment are also very important. Amphibians sometimes migrate over relatively long distances, and their habitat is far from being restricted to water. Many species are only in the water for a short time and live on land for most of the year, often very far from any water. For amphibians, a landscape with a predominance of natural wetlands (peat bogs, dead-ends, etc.) or a landscape with a mosaic of wetlands and ponds is optimal. A cultivated landscape with islands of optimal habitat is also suitable for the vast majority of species. Many species also prefer or frequent woodland environments. These are the

spotted newt (mainly beech forests), the Danube newt (exclusively in the floodplain forests of southern Moravia), the mountain newt (in all types of forests from lowlands to the highest altitudes), the square newt (in the Czech Republic only in a very small area in western Bohemia), the Carpathian newt (in the mountains of northern and north-eastern Moravia), the agile frog (prefers sparse deciduous forests), the yellow-bellied toad (prefers treeless forests, it retreats to forests because of the higher humidity), the common toad, the common newt, and the brown frog (undemanding species found in various types of environments).

Amphibians seek forests that are permeable to them, with clear undergrowth and open areas along roads, clearings, woodlands, etc. They are also forests without a mosaic of open areas and with limited patency, but with a natural tree composition. In forests or within migratory distance, there must be water areas suitable for breeding amphibians. Unfavorable are forests without water, single-species cultures of mainly conifers, and large areas of thickets, which are impassable for most species.

What helps and what hurts the forest stand.

Large-scale clearing, which creates monotonous areas with no shelter, is completely inappropriate. These are difficult for amphibians to deal with. This particularly affects slow-moving amphibians such as the spotted newt and newts. The milling of stumps and the full preparation of clearings for reforestation are completely unacceptable. Amphibians are thus deprived of shelter and food resources and are directly killed. For the same reasons, the removal of bracken, which also occurs during large-scale felling, is harmful. If slash is burned on previously deposited piles after harvesting, the piles must be relocated before burning. Amphibians, reptiles, and other small animals seek shelter in them and would be burned.

An important element for amphibians in forests is an abundance of dead wood. The presence of fallen logs and branches significantly increases the number of hiding places. It appears that the continuity factor of stands is also very important for some amphibian species. As recently as the 1970s-1990s, the short-toed toad and green toad were observed to occur mainly in sparse oak or sandy pines in the Nymburk, Mělník, Cheb, Mimon, East Bohemia, Broumov, etc. Nowadays, however, these species hardly live in forests. One of the reasons for this may be the conversion of former light forests into shady logs.

Drainage of forests is completely inappropriate. From the lowlands to the mountains, wet and waterlogged forests have been cut through by drainage ditches, and forest streams have been dammed and buried. Unfortunately, this is still commonly happening, despite all the proclamations about the need to retain water in the landscape.

Water areas.

Water areas suitable for breeding amphibians are a necessary condition for their existence. Of our species, only the spotted newt breeds in small, fast-flowing streams; all other species require standing water. That is why we maintain existing water bodies in forests and build new ones there. Creating suitable water areas is one of the most effective single tools for promoting biodiversity in general. It can range in size from a few square decimeters to hundreds of meters and can be filled with water permanently or only periodically. Water areas in forests should not be fully shaded by trees. At lower altitudes, up to about 600m above sea level, it is preferable to leave the trees on the north side of the pool, so that the leaves fall into the pool, but at the same time, it is not overgrown. At higher elevations, all-day light is preferable, but the presence of some trees in the vicinity is favorable. The creation of water bodies to support biodiversity is a very broad topic and is the subject of several specialized methodological guides. It is discussed in more detail in section: Small water features.

Ditches and flooded tracks on the roads.

Various ditches are often encountered at the edges of forests, along forest roads and across forest stands. The inadequacy of forest drainage has already been mentioned. It is desirable to fill in or at least dam the ditches. In this way, more water is retained in the environment and a small area of water can be created. If the ditches are flooded with water, we do not drain them in any case. We can also locally remove some of the sediment from heavily silted ditches to create a small water surface again. However, the intervention should not affect the drainage of the surrounding area and the drainage of water from the forest.

When walking and cycling through the forest, we often find that the forest paths are rutted and full of mud, puddles, and flooded potholes. Yet for the alpine newt, common frog or yellow-bellied toad, such places can be a blessing and are quite sufficient for them. The movement of machinery creates longitudinal pools that often remain fulfilled with waterbirds for much of the year. While the movement of machinery may kill a few individuals, the continuous and regular disturbance that maintains the pools is always more beneficial than no activity at all. That is why we do not drain puddles and flooded potholes on roads, we do not backfill with anything, and we do not pave or asphalt roads at all. We carry out the necessary work in the forest associated with travelling at a time when we do the least damage - in winter when there is a longer frost or in summer during the worst drought. If drainage is strictly necessary for forest management, we recommend creating alternative small pools in the vicinity. Amphibians are very conservative and return to the same place all their lives.

6.3.2.3. Reptiles.

There are 13 species of reptiles permanently found in the Czech Republic, 12 of which are native. As a non-native species, the red ear terrapin is widespread in our territory. All of our native species are included in the Red List of the Czech Republic and are also among the species protected by law. Even previously quite common reptile species, such as the common lizard or the grass snake, are currently declining. For example, in the case of the common lizard, the number of localities in the Hradec Králové and Brno regions has declined by 30 percent or more over the last ten years, while the abundance of individual populations has declined significantly.

Most of our reptiles prefer open habitats with a possibility of shelter. These include sunny slopes, open wetlands and wet meadows, extensive pastures, cultural landscapes with a varied mosaic of habitats and scattered greenery, but also various secondary habitats such as road and railway embankments, sand pits, quarries, etc. Overgrowth of such habitats leads to their degradation for reptiles. Care of reptile habitats is therefore primarily the appropriate maintenance of treeless habitats.

This does not mean that reptiles are not found in forests and woodlands. Some species are very common in them. Mountain areas with continuous forests and wooded lowlands are preferred by the common European adder. In these areas, it seeks out sunny but damp places such as grasslands, clearings, juniper woodland, heathland, moorland, overgrown stony hillsides, and rubble fields. It is also a slow worm, which has no specific requirements for site sunlight and vegetation character. It also lives in sparse woodland, woodland edges, or woodland clearings. The common lizard also seeks out forest edges, forest roadsides, forest clearings, and glades. The viviparous lizard lives in wet alder woodlands, floodplain forests, and more open forest wetlands. The grass snake lives in forests near watercourses, near bodies of water, and in floodplain forests. In warmer areas, in rocky river valleys of medium and larger rivers, the dice snake lives. The very rare tree snake lives in light forests and cultural landscapes in the Podyjí, Pohorje, and White Carpathians. The dry habitats of forest-steppe character of the warmest regions of the country are inhabited by the green lizard.

In addition to the care of suitable habitats, the practical conservation of reptiles focuses mainly on the creation and maintenance of elements suitable for their occurrence. This is primarily the provision of shelter, hibernation sites, and breeding sites.

Shelter creation.

Dry stacked walls or stone drifts are very suitable measures to increase the ruggedness of the terrain and the supply of suitable shelter. Their importance for reptiles is generally underestimated. However, it is a very effective measure. It is important not only to build

suitable structures but also to maintain them. Covered with vegetation, unsunny walls are no longer attractive to reptiles, and they gradually abandon them. If we want to encourage reptiles in our forest, we should always build them in sunny places, ideally on the southern and western edges of the forest.
The presence of dead wood or brush piles also makes the environment more attractive to reptiles. These provide shelter and also contain other species that are food for reptiles. This is another reason for not piling or burning the logs after harvesting. Burning the piles not only removes a potentially suitable feature for a number of organisms, but also kills the individuals currently in the piles, or disturbs them at an inopportune time for their survival.

Creating snake hatching places.
A hatching place is a created feature designed primarily for the undisturbed reproduction of reptiles and the development of a new generation.

It is not complicated; it just needs some space and a suitable place. It's basically a wooden playpen filled with a certain material. The floor plan should be at least 2 x 2 m and the height 1 to 1.2 m. The enclosure is made of logs, leaving a gap of at least 6 cm between them. Gaps are necessary to allow reptiles to get in and out. A first layer of sticks and large branches will be added to the bottom of the tube. Other material such as sawdust and shavings, bark, wood chips are layered on top of this, e.g., manure, compost, leaves, hay are also suitable substrates. The material underneath is the coarsest and the material on top is finer. The hatching place will start working after two to three years. The smouldering processes in the generate suitable heat and moisture. The substrate should be regularly replenished or renewed so that its thermal function is not lost. Replenishment once a year between April and June is best, when there is no risk of damage to eggs, overwintering individuals, or disturbance to gravid females.

Habitat selection is very important in the establishment of the hatching place. The site should be sunny to ensure sufficient warming of the substrate, but it must not be exposed to the sun to the extent that it dries out completely. Ideally it should be located near other suitable wintering sites for reptiles (walls, rock drifts, ruins of buildings).

6.3.2.4. Birds.

Many bird species are very closely linked to the forest environment. Otherwise, they are only found in environments that resemble forests to some extent, e.g. large parks. Forest environments are also inhabited by a large number of species that commonly live in cultural landscapes. Forest bird communities vary according to the type of forest - depending on its species composition, the age of the stands and their age and spatial diversity. The protection of birds in forests should therefore be implemented primarily by protecting entire forest

ecosystems, and partial interventions and measures generally have a complex effect on forest biota. In general, forest birds have been particularly affected by the conversion of broadleaved and mixed forests to conifer monocultures, the low diversity of stands mean that there is a limited range of food and nesting opportunities, there are very few old broadleaved trees and dead wood in forests, and certain types of forests that were favored by some species have disappeared.

Despite all the negative impacts and transformations of our forests, forest birds are still relatively well-off overall. In Europe, farmland birds are the most affected and waterbirds seem to be similarly affected. Across all ecological groups, however, it is true that the more specialized species for certain environments are declining in our country over the long term.

Old trees and trees with holes.

Old, dying, or dry trees are key resources in forest stands. These are those that may occupy only a small part of the area, but their presence, quantity and quality are nevertheless crucial for many species. For birds, these trees are primarily necessary nesting sites and also an important source of food, as each old or dead tree is colonized by a large mass of insects. However, very few of these trees remain in commercial forests and many forest bird species have therefore become rare and endangered.

Trees with well-developed natural cavities are very important. Such cavities are caused by the disturbance of the heartwood of the trunk by rotting or hollowing out by woodpeckers. The frequency of cavities is directly related to the age or damage to the tree. Many forest birds need cavities for nesting but cannot hollow them out themselves. They are thus dependent old and variously damaged trees left in forest stands. Rare species nesting in tree cavities include the stock dove, pygmy owl, and others.

The trees should therefore not be harvested and should always remain in the area for natural regeneration, at least in some numbers. This is not only the case for trees where the presence of a nest cavity is obvious, but also for trees that are potentially suitable. In areas of harvesting intervention, these trees need to be marked in advance and removed from the intended harvest. Ideally, these trees should also be recorded on forestry stand maps. The care of old trees, leaving older trees in the stand, and their numbers are described mainly in the chapter on insects.

Are bird boxes not enough?

Clearly not enough. In today's forests we are trying to compensate for the lack of natural birdhouses in trees with man-made birdhouses. The number of birdhouses put up here and there only gives a false impression of how much one has done for nature. But in most cases,

it is not a conservation measure. The boxes in the forests have only a low occupancy rate and are sometimes a trap for the birds. If they are not cleaned regularly, they are soon useless. Even if we put up bird boxes and clean them regularly, we cannot replace the naturally occurring cavities. Some species simply won't accept the boxes. They are therefore of educational value rather than being able to support forest bird populations in any significant way.

Forest edges – mantles.

The current Czech landscape is very lacking in the transitional environment between forest and open countryside, or forest mantle. As already described in the chapter on insects, today's forest edges are mainly "hard" - the dense forest wall is immediately followed by arable land or cultivated meadow. The structured forest canopy is made up of a vegetated forest edge, followed by an outer mantle of scrub and sometimes a specific fringe herbaceous community. The scrub also penetrates the interior of the forest proper, forming an even inner mantle. The forest edge is ideally composed of vigorous and long-lived woody plants. Typically, this is the oak mantle at the edges of the spruce monoculture. In forestry practice, stand edges are generally spared, primarily to protect the adjacent stands from strong winds and sunburn. In a landscape where few areas of natural value remain, forest edges and mantles are an important carrier of biodiversity. Their high importance for bird communities, but also for other groups, especially insects, is confirmed by a number of studies from the world and the Czech Republic. In secondary coniferous forests, some species of native broadleaved forest are found in the forests. Typical specialists of forest edges are, for example, the northern wryneck or the common bunting.

From the point of view of biodiversity, valuable forest patches consisting of strips of woody and herbaceous vegetation have been created spontaneously and in most cases on what was originally agricultural land, not on forest land. The main risks of the disappearance of these transitional formations are basically twofold. The margins are tolerated by owners and tenants of agricultural land until they start using subsidies for farming, the amount of which is based on the size of the cultivated area. The logical reaction is the destruction of the forest cover up to the cadastral boundary of the agricultural land. The second risk of the disappearance of the structured forest cover is continued spontaneous succession and the complete predominance of dense and dark stands of shrubs or trees. Light-loving species are concentrated on valuable forest edges and the maintenance of a thinner stand of trees at the forest edge is necessary to sustain them. Where there is a high involvement of scrub at the woodland edge, it is recommended that the scrub is loosened and this character maintained (cutting back some of the scrub, mowing to the woodland edge or grazing to the woodland edge, etc.).

6.3.2.5. Mammals.

There are currently 89 species of mammals in the Czech Republic. Fifteen of them, which represents about 17%, can be classified as non-native (the number of mammals currently living in the country varies slightly from one source to another and changes over time). Many mammals are tied to the forest environment, or the forest is an essential part of their habitat. Mammals are divided into large and small groups according to their size. Large mammals include all our artiodactyls (roe deer, deer, mouflon, wild boar, etc.), European beaver, canids, bears and felines, and the larger weasels (otter, badger and sometimes marten). Most mammals are small. The most numerous groups are the flycatchers (27 species live here), followed by rodents and insectivores.

It is not the purpose of this publication to describe the principles and measures for the conservation of large mammals. The conservation of large mammals uses legislative, financial (e.g., compensation for damage caused), conceptual tools at the level of large territorial units (e.g. landscape permeability), and special programs aimed at individual endangered species. A large proportion of our large mammals, including many non-native species, are a normal part of our nature and are not threatened in any way. On the contrary, they often affect other organisms to a greater degree negatively or even severely damage the forest environment. On the other hand, some native species of large mammals are among the most endangered species. However, we will hardly adapt our hectares of forest to attract lynx, bear, or beaver, but we can create an environment in which bats, plover, squirrel and many other small mammals will thrive. The diversity of small mammals is naturally higher in lowland and upland forests. The reason for the lower number of species in upland forests is due to less favorable climatic conditions, less food supply, less shelter in predominantly spruce forests, and greater uniformity of these stands. The same pattern applies to other groups of organisms.

Cavities, cavities, and more cavities.

A favorable forest environment for small mammals is the same as will be favorable for birds, insects and other groups of organisms. In general, it is a forest with a more varied species and age composition of mainly deciduous trees, a developed herbaceous, and shrub layer, and the presence of old trees and dead wood. Not only birds and many insect species, but also many small mammals need the various cavities in the trees for their life. These include voles, smaller weasels, mice, a large proportion of bats and occasionally squirrels. How to encourage and ensure the presence of cavities in the vegetation and generally suitable trees not only for small mammals has been described in previous chapters (displays, old trees, retained breaks and snags etc). Therefore, we will only elaborate further on how important this element is for some small mammals.

All our 27 bat species are protected by law and almost all of them use the forest environment in some way. Some species are very closely tied to forests, have their roots and hunting grounds there, and can be described as typically forest species (e.g., big-eared, and black bats). Other species use roosts in the forest and buildings in the surrounding landscape, and still other species fly into the forest primarily to hunt for food. They use larger and smaller cavities, crevices, crevices under bark and large beetle tunnels as roosts in forests. The microclimate of a cavity is the most important factor for a bat to colonize it. A single bat summer colony can use up to 40 different roosts during the season, depending on which one offers the right microclimate at the time. Summer colonies of females and their young prefer warmer, sunny locations, often on the edges of forest stands or seek out stands with lower tree densities (those bright forests again!). At the same time, bats are conservative, using the same roosts for several generations. Obviously, a single old tree in a stand will not ensure the existence of bats. During normal forest management, when specific bat roosts are not known, bats are naturally destroyed. However, if such a tree is known (the use of bats can be determined by various signs of residence), it should be marked and left in the stand during harvesting, optimally in a smaller group of other trees.

The red squirrel lives in deciduous, mixed, and spruce forests, and is a very conspicuous species due to its diurnal and year-round activity. It is highly adaptable and is often found near human dwellings, in larger parks, cemeteries, etc. The fact that it is so much 'in plain sight' means that we do not have to register its decline. However, it is happening and has been listed as a protected species. There may be many reasons for the decline of squirrels, and it is hard to say which is the most significant. It is probably due to the lack of suitable nesting opportunities and the number of their predators (often cats in the vicinity of human dwellings). The squirrel nests in the canopy of tall trees, where it builds spherical nests, and less often also uses suitable spacious cavities.

Other rare small forest mammals that need trees with cavities to live in are dormice. In addition to this, they use underground burrows of other rodents and moles, rock cavities and hiding places in huts, haylofts, and other forest structures. They may also inhabit bird boxes during the summer. All oour voles are protected species. The commonest is the European Fat Dormouse, which lives in oak woodland and beech woodland in much of the state (but is not known from the whole of the Highlands, for example). Locally it is also very abundant, as many a cottager could tell you. The garden dormouse is found only in a few localities in western Bohemia and Sumava, and the occurrence of the forest dormouse is restricted to the uplands and highlands of northern and northeastern Moravia.

Small mammal boxes.

Bats also find similar conditions to their natural roosts in bat boxes. They can often be found in bird boxes, but special boxes that better suit their requirements are more suitable. Due to

their parameters, bat boxes are not suitable for birds and are therefore not inhabited by them. The boxes are used by bats especially in the growing season. They are not very suitable as winter shelters.

In the past, bat boxes were very popular in some countries. However, they are like bird boxes. It is not yet clear whether bat boxes help to increase bat numbers or whether they are just used as alternative roosts. For the conservation of more endangered and specialized forest species, such as the big-eared bat, the erection of bat boxes is of little importance. Effective conservation of bats in forests can be achieved primarily by ensuring sufficient natural cavities. However, where the supply of natural cavities is very limited, they are justified - e.g., in coniferous forests and young stands.

Like bats, we can offer squirrels and dormouse as substitutes for cavities in the form of specific boxes. The boxes for squirrels are large and have two large opposing entrance holes. They can be placed at greater heights. The squirrels will use them especially during severe weather and when they are young. Swifts use the boxes as a summer home, but sometimes also as a wintering site, depending on the climatic conditions in the locality.

Water features.
The presence of wet woodland, woodland ponds, pools, streams, or rivers greatly increases the attractiveness of woodland to many mammal species. For bats, for example, water bodies and streams are particularly important for foraging. They hunt their prey either directly over water or in riparian vegetation.

6.3.3. Herbaceous undergrowth

The floristic diversity of our forests consists mainly of species of herbaceous undergrowth, which are usually many times more numerous than species of the tree and shrub floor. The natural species composition of the woody plants of central Europe is simply very poor and relatively uninteresting in terms of biodiversity. The diversity and composition of the herbaceous forest undergrowth is primarily based on the ecological conditions of the habitat. The geological conditions, the hydrological and soil conditions of the site, and the climatic conditions (altitude is sometimes mentioned but is not in itself an ecological characteristic) are the main determinants. Furthermore, the geography of the place is also reflected in the forest flora: the warm-loving oak forests of southern Moravia and the warm regions of Bohemia have a slightly different composition simply because individual species are found only in certain areas (complexes). Botanically, the lower positions of the Carpathians stand out as one of the richest forest areas in our country, but other islands

with significant botanical forest diversity also appear. These are mainly the limestone areas of the Bohemian and Moravian Karst, the Posumavi limestones, and the Pavlov Hills. Species-rich forests also develop on the calcareous sediments of the Bohemian Tableland, especially in eastern Bohemia. It seems that botanically rich forests are found in our country mainly where there are basal soils. In short, the undergrowth of acid beech will always be species-poor, and blueberries will never grow in a floodplain forest.

Various classification systems of natural forest vegetation are based on the botanical composition of the stands (although this is not entirely true of the naturalness of the forest). Probably the most widespread and comprehensive system is the so-called phytocenologic classification. The second very widespread system is forest typology, which is the basis for forest management. However, when trying to capture the botanical diversity of our forests, its shortcomings are revealed. It does not reflect, for example, the geographical differences between different areas (see the warm-loving oak woodlands). For the informed layman, the Catalogue of Forest Habitats of the Czech Republic may be a good source for getting acquainted with the diversity of our natural (eh!) forest vegetation. The following text no longer describes the impact on the herbaceous flora and plant species of the conversion of originally diverse deciduous forests to the same age-old coniferous culture. That would be just carrying coal to Newcastle. Let us focus on its other characteristics and the possibilities for a more developed and species-rich undergrowth.

It won't work without light.

We know from observations in nature that the species richness of herbs and shrubs in forests also depends on the density of the tree canopy. A shady stand with a dense tree canopy on the same geological substrate will have fewer herbs than a dense forest. Light plays an important role in forest ecosystems, and its reduced availability becomes a limiting factor for the development of the herbaceous canopy. Stands with sufficient light can also be the result of traditional forest management practices such as stumping or forest grazing.

The average long-term change in plant biodiversity in our forests is around zero. In some locations it has decreased, in others it has increased, and in some places, it has remained practically unchanged. However, there has been a clear decline in biodiversity in lowland forests, which in the past were mainly managed as low growing forests (stub forests) or medium growing forests. With the development of modern forestry and the gradual conversion of these traditional forms of forests into high forests, many light-loving plant species have disappeared, leaving only shade-loving ones. The point is that in low and middle forests, the cycle of alternation between light and dark phases of the stand is several times shorter than in high forest cultivation. Many of the more light-loving species are unable to survive the very long dark phase of the high forest, even in the seed bank. Many formerly common plants of lowland forests are now on the red list, and the forest vegetation

is generally homogenizing. The rarest plants that have been adapted to the conditions and management of low and medium forests include the critically endangered lily bellwort, willow-leaved ox-eye daisy, hairy primrose, scented lily of the valley, and pea-pea. More well-known are some orchids, such as the slipper orchid, the red orchid, or the purple coneflower. Numerous less threatened woodland herbs have also been pushed out of the high woodland into the woodland edges and borders, such as the white trefoil, bastard balm, bloodroot, deerweed, bluebells, and many others.

Low and middle forests are the richest in species. Therefore, restoring their cultivation in at least some lowland forests would be the best way to maintain or restore their overall biodiversity. Plants have an advantage over animals in that many plants need literally only a few square meters of suitable habitat to survive. There are various ways to create and maintain lighter woodlands. These are described in more detail in the chapters on different forest management methods.

Small treeless areas in forest complexes.

Different treeless areas in the middle of forest stands can have the same or very similar effects based on sufficient light input. For the sake of simplicity, we will call them clearings. On the one hand, clearings are an environment in their own right, which significantly increases the biodiversity of the forest (a typical forest 'anomaly'). Secondly, more light penetrates the adjacent forest, which further positively influences its biodiversity. The importance of forest edges for biodiversity has already been described. We are not referring here to clearings caused by, for example, tree uprooting, but to areas of more permanent and larger woodland.

In principle, these clearings can have two origins. The first possibility is a natural occurrence: the conditions on the site are such that trees are not allowed to grow there, or they grow there only very sparsely and are crooked and low. Typically, these are rock outcrops, scree, rocky slopes, etc., which are very dry habitats with very shallow soil or no soil at all. Arid-loving (xerophilous) herbs are more prevalent in such clearings. In the upland belt, such clearings are usually characterized by considerable species diversity, and their occurrence is very characteristic of some areas of the country (e.g., Křivoklátsko, Český kras, Pálava, deep canyons of Czech and Moravian major rivers, etc.). Alternatively, trees are prevented from growing by high waterlogging. In the floodplains of lowland rivers, there are dead arms and pools with varying degrees of land cover and diverse wetland vegetation. In foothill and mountain forests, there are vernal pools that can restrict tree growth over areas of many hundreds of square meters. At all altitudes, there are different types of peat bogs where forest growth is blocked by the water regime and low nutrient content.

The second way in which a clearing can appear in a forest is through human intervention. Their purpose may have been varied, and they have often long since lost it. They may have originated as unwooded areas after the original forest was cleared and were maintained by grazing by forest animals or livestock. Some areas are maintained by hunters. Sometimes they are remnants of long-vanished settlement enclaves in the middle of forests. Especially in the border mountains, they may be the remains of agricultural areas that were extensively reforested after World War II. These clearings are usually subject to considerable dynamics due to the gradual overgrowth of trees. However, some of them have persisted for decades without human care, resisting tree growth only thanks to forest animals. All forest clearings are of great importance for plant and animal diversity. Unfortunately, they are commonly artificially reforested, or at best, left to their fate and gradually overgrown by encroachment. Therefore, we do not reforest the forest-free areas, but rather try to maintain them. If we do not have the opportunity or the energy to look after them regularly, it is sufficient to clear them at least once every few years.

Development of herbaceous undergrowth in the new forest.

Unlike trees in forests, the herbaceous undergrowth is not deliberately planted, but consists of different species itself. The success of establishing forest flora in young stands depends on several factors. These are mainly the seed bank in each area (the stock of seeds in the soil from the previous stand), the ability of each species to spread, the distance of source populations, soil characteristics, and the level of competition. Forest flora will recover most quickly if it has already been growing on the site in the previous stand that was removed. Seeds do not have to be dispersed from anywhere, but the flora recovers from the seed bank, and, in addition, a number of species are able to persist in grazing. Many plants can survive in the seed bank for decades, and populations recover quickly once they have been reseeded. This is a sure chance for the recovery of light-loving species after the reforestation of existing lowland forests. The development of the forest undergrowth will also be faster if there is an older forest stand with herbaceous species nearby.

Newly established forests on agricultural land or newly established deciduous stands in a sea of spruce monocultures are normally poor in herbaceous undergrowth. In a completely isolated fragment of forest in an agricultural landscape, the ground floor, consisting of forest herbs, develops only after many decades. Long-term comparisons show that biodiversity in such cases can be comparable after about 80-105 years. This is mainly because many species that are typically found in forests are unable to spread across open landscapes. A potential solution to the problem could be human-led restoration. Forest management alone is an effective way to restore the diversity of the herbaceous floor. Lighting or the creation of clearings helps the habitat be occupied by more light-loving species. Planting forest herbs can also accelerate natural development. These practices are still only at the study level. Experimental sowings are in principle successful, but studies of this type require a longer

period to draw concrete conclusions. If anyone wants to try this route, we strongly urge them not to buy any commercial seeds but to collect them themselves. The main reason is to protect the genetic diversity of natural populations. Feel free to collect your own seeds of spicebush, creeping bent grass, or spring pea in the stand on the other hill, but don't spread alien genetic material in our forests that will harm native populations.

Nettles and other weeds.

The idea of a species-rich undergrowth can sometimes be thrown off by soil characteristics or the invasion of non-native species. In stands established on former farmland or in stands next to fields, species that can tolerate large amounts of nutrients in the soil (so-called eutrophic species) often grow. Such species include, e.g., stinging nettle. This sturdy herbaceous plant sometimes completely dominates the forest undergrowth, and less competitive species are unable to grow in its dense undergrowth. Like nettles, some other native competitive species can also grow in the forest u undergrowth or in a clearing. Native species that expand rapidly into new habitats are referred to as expansion species. In our forests, for example, blackberries, raspberries, sow thistle, bush cane, elderberries, etc., behave in this way. Species expansion has occurred and continues to occur when habitat conditions change. Typically, this is the creation of a grassland that is quickly overgrown by aggressive species. Often it is eutrophication of the environment, which can have a variety of causes. The conditions are also greatly influenced by the tree species grown. Spruce monocultures in lowland forests transform forest soils very significantly. Removing or suppressing the expansion species in the forest undergrowth is hardly conceivable and is essentially a matter of removing the effects, not addressing the cause.

Under silvicultural technology, expansion species are suppressed in the clearings. In silvicultural terminology, these are beech trees, which are grasses, brambles, raspberries, or shrubs. It is usually removed (or harvested) mechanically with a brush cutter or by the application of herbicides. The purpose of suppressing buckthorn in clearings is to release planted trees that it would otherwise overgrow and kill. Before we pick up a brush cutter and tackle the raspberries, let's be clear about what our priorities are and what we actually want from the forest. Recall what we wrote about clearings in the chapter on insects (5.7.1). In our conditions, the forest will grow by itself almost everywhere. It just takes a little longer, which is what we want for the diversity and variety of the forest. If a clearing overgrows spontaneously, it usually creates another phase of light forest with scattered shrubs and young trees, which allows other species of plants and animals to exist.

Of the non-native herbaceous species, the undergrowth of our forests is most influenced by the small-flowered sedge. It is native to Central Asia and is one of the most widespread invasive plants in Europe. In lowland forests, it sometimes forms a distinctive dominant feature of the undergrowth, but in mountain areas it is less common. It is still not very clear

how or to what extent it affects native species. Experiments in heavily infested oak woodlands show that alien bindweed suppresses light-growing plants of smaller stature most strongly and species flowering in early spring. However, it often grows densely and over large areas, so complete removal from forests is virtually impossible for economic reasons. However, we can control it in smaller areas, especially in valuable areas. It is feasible to suppress it, either by clearing or grubbing up. The weakness of the nettle in the fight is that it is an annual and removing it before seed production weakens its seed bank in the soil. The good news is also that the native forest undergrowth can be restored in just a few years.

6.3.4. Rarer tree species.

Forest management always favors certain tree species, which become more abundant while other tree species become rarer. Hundreds to thousands of years of intensive exploitation of lowland forests have probably led to a marked predominance of oak at the expense of other tree species. The composition of forests has completely changed with the advent of modern forestry since the end of the 18th century, when new stands are mostly established by artificial afforestation with economically preferred tree species, hence the monocultures of spruce and pine, but also beech and oak. Economically insignificant or neglected tree species are not planted or are planted only to a very small extent. This is one of the main reasons why many of our tree species grow only very rarely in forests and are also included in the red list. Paradoxically, these trees are sometimes deliberately cut down as part of the management of the plantations. Not to be unfair, the disappearance of some trees has other causes (fungal infection causing graphosis in elms), and some species are naturally rare. For example, the ranges of some species of cranes are very small; it may be a hill or even just a single valley, and the number of individuals of a given species is counted only in the dozens. Several species of shrubs, bushes, and trees are included in the Red List of Threatened Species of the Czech Republic, and only a minority are protected by law. Of the trees, only the Scots oak is protected; the red yew is also of tree height, and the Czech crane is a smaller tree.

The following list of species represents trees that are rarer in our forests and that we could return to our naturally valuable forest. These are species that are usually commonly available in nurseries. We will not be dealing with tree species that are extremely rare and could only be obtained from self-collected seeds at a natural source site. These are mainly various thermophilous species of cranes and oaks and a few species of birches. Often, these are species that only experts can recognize. When planting, we must take care to plant the species only in a suitable habitat and within its natural range. For example, we will not plant the thermophilic silver crane in the Šumava region or the oak in the Jičín region. We also pay attention to the genetic origin of the seedlings when planting trees (not only rare ones, but

all of them!) so as not to disturb the gene pool of local populations. In the past, seeds imported from various parts of Europe were used for economic trees, which proved to be inappropriate over time. The origin of the planting material is therefore monitored to a certain extent. Failure to respect the origin of seedlings often has a negative impact even decades later (e.g., in the event of extreme weather fluctuations). The territory of the country is divided into 41 natural forest areas and 10 forest vegetation stages. Ideally, seedlings should come from the same area and the same or adjacent vegetation stages. Therefore, always find out the origin of the seedlings! Most of the species presented are characterized by very high quality, well used, and valued wood. So, these are also interesting and promising tree species from the forestry point of view. When your great-grandson cuts down on elm or birch tree you planted and sells it for a pretty penny, he might remember you. The descriptions of trees are based on Flowers of the Czech Republic and the publication Trees of the Czech Republic.

- **European Turkey Oak (*Quercus cerris*)**

It is classified as a highly endangered species on the Red List of the Czech Republic in the national classification. In our country, it occurs naturally only in the warm-loving oak woodlands of the lowlands and hills of southern Moravia and should therefore be planted only in this area. The northern limit of its natural range is near Brno. However, it has been introduced to many other places in Moravia and Bohemia. It is a thermophilic tree with medium light requirements and low rainfall requirements. It has lower light requirements than our other oaks and develops well even in light shade. It grows on both basic and acidic soils and is undemanding of soil. It tolerates acidic, shallow, and poor substrates well. It tends to avoid soils rich in calcium. It is also cultivated for forestry in South Moravia. The wood is of poorer quality than that of other domestic oaks.

- **Downy Oak (*Quercus pubescens*)**

It is listed as endangered on the Red List, and in the same category, it is also listed as a species protected by law. In the Czech Republic, it occurs in the warmest areas of central and western Bohemia and southern Moravia. It has been introduced elsewhere outside its natural range. It is a light-loving and thermophilic woody plant that grows mainly on calcareous rocks. It avoids strongly acidic soils. It is very drought tolerant and occurs on shallow and dry soils of upland slopes. On deeper soils, it can grow more vigorously. Its wood is only usable for fuel and has no other economic importance.

So, it is also an interesting and promising tree species from a forestry point of view. If your great-grandson cuts down elm or birch tree you planted and sells it for a pretty penny, he might remember you. The descriptions of trees are based on Flowers of the Czech Republic and the Trees publication of the Czech Republic.

- **Wild Pear (*Pyrus pyraster*)**

This pear occurs scattered throughout most of the state from the lowlands to the foothills, but mainly in the warmer uplands. It is most common in floodplain forests, oak woodlands, warm-loving oak woodlands, woodland habitats, and upland scrubby slopes. Individual specimens also grow in cultivated agricultural landscapes where they can be a prominent landmark. It is a light-tolerant, drought-tolerant species, growing on more fertile substrates and on moderately moist to drier soils. In addition to anthropic influences, the wild pear is threatened by hybridization with the common pear, so offspring are no longer of this species. It has dark, very high quality and hard wood, which is used in carving, joinery, and small wooden products. It is indispensable as a rootstock for grafting fruit varieties of the common pear. The fruits of the pear tree are very small, hard, and not very tasty. However, they are food for animals, as are flowers for insects living on the nectar.

- **Wild Apple (*Malus sylvestris*)**

The distribution of this apple is poorly known. This is due to the occurrence of hybrids with the domestic apple tree, which can easily be confused with the forest apple tree. This hybridization is a serious threat to the forest apple population. It grows scattered in the uplands throughout the territory but is less common in the lowlands and foothills. It is most common on the edges of floodplain forests, oak woodlands, ravine forests, and on scrubby hillsides. It is a light-loving tree, tolerating even light shading. It grows on a variety of rocks and usually on more fertile and moderately moist soils. The wood of the apple tree has found special use in carving, joinery, and woodturning because of its hardness and coloring. Its fruit was also used in the past, but the same applies to it as to the wild pear. The wild apple tree is used as a grafting rootstock for grafting cultivars of the domestic apple tree.

- **European Silver Fir (*Abies alba*)**

This fir grows almost all over the country. It is absent or very rare in the warmest regions and scarce even at the highest altitudes, where it rarely exceeds 1100 m above sea level. It has retreated significantly from our forests in the past. Its sensitivity to heavy industrial air pollution is most often cited as the main cause. However, its share in our forests began to decline sharply earlier with the introduction of the full clearing economy. It could not match spruce in productivity. Moreover, young fir trees suffer greatly from the nibbling of forest animals. In many places, this factor is so limiting that fir trees without protection have no chance to grow. Surprisingly, forest grazing by cattle has not harmed the fir trees, and the oldest fir stands in the Beskydy Mountains are remnants of former grazing forests. The fir tree is one of the few of our trees that can tolerate deep shade, in which it naturally regenerates. It grows on deep, mineral-rich, and poor, moderately moist to moist soils. It can also tolerate waterlogged or stony soils. In forests, it occurs as an admixture in beech forests and ravine forests, as well as in oak woodlands, acid oak woodlands, and in waterlogged spruce forests of foothills and mountains. Only rarely is it a dominant plant. In the past, fir was preferred as construction timber and was used extensively in water construction. Its wood splits well, which used to be an advantage in the production of shingles. Fir wood is

also used in the manufacture of musical instruments. The fir tree as a Christmas tree has already been replaced by the Caucasian fir.

- **Wild Service Tree (*Sorbus torminalis*)**

In our country, these trees are scattered in the hills of the warm regions of the country: in southern and central Moravia, central and northwestern Bohemia, and around the Bohemian Tableland. It is a part of warm-loving oak forests, dry-loving oak-hickory forests, calcareous beech forests, or acidophilous oak forests. It grows on arid soils with varying fertility and on different geological substrates. However, it prefers fertile rocks such as limestone, basalt, siltstone, etc. It has always been an interspersed tree in forests. Among other woody plants, it has little competitive ability, low fertility, and late, irregular fruiting. Management is reducing its already small presence in forests. It has dark, hard wood, which used to be highly valued, e.g., in the wheelwright and woodcarving industries, and even today commands a high price on the market. Its fruits are food for forest animals. In autumn, it is unmissable in the forest as its leaves turn bright colors.

- **Wych Elm (*Ulmus glabra*)**

It can be found from the hills to the foothills throughout the country. It is only rare in the lowlands, in the valleys of the large Moravian rivers, and in the Bohemian Tablelands. It grows mainly in debris and ravine forests, less often in beech forests, and rarely in floodplain forests. Its representation in stands is usually only weak. It occurs on moderately moist, humic, and nutrient-rich soils. It can also tolerate a considerable amount of skeletal soil and strong undergrowth, especially when young. On the other hand, it does not tolerate soil drying out in summer. In recent decades, all our elm species have been severely damaged by the disease graphosis, and elms have almost disappeared from large areas. The mountain elm is probably the most resistant to graphosis. This may also be since it is found mainly at higher and wetter elevations, where the disease is not as severe. Nevertheless, it is hardly used at all in forestry. Like other elms, its dark heartwood was and is highly valued and is used in the furniture industry. It is often planted as an avenue tree, and different colored cultivars are found in parks.

- **Field Elm (*Ulmus minor*)**

This elm is mainly found in warmer areas, in the lowlands and hills. However, it grows only rarely in the Silesian lowlands and is almost absent in the hills of southern and south-western Bohemia. Here, it seems to only occur from planting. There are two ecotypes of this elm. The floodplain ecotype grows in floodplain forests of the lowlands, and the forest-steppe ecotype grows in oak woodlands, warm-loving oak woodlands, and forest-steppe habitats of the warmer hills. The floodplain ecotype requires high water tables and tolerates flooding well, while the woodland ecotype can tolerate drying shallow soils. The most favorable habitats for this elm are mineral-rich, deep, and moist floodplain forest soils. The

floodplain ecotype tolerates shade well, while the forest-steppe ecotype behaves as a distinctly light-loving tree. The deciduous ecotype is characterized by cork bands on the trunk and branches when young (the drier and warmer the habitat, the more often we find elms with cork bands). Of all our elms, this elm has suffered the most from grabiosis – a fungi disease. As recently as the 1950s, this elm was still quite abundant in warm-loving oak woodlands and forest steppe, but it is now dying off significantly even in floodplain forests. It is virtually unplanted in forestry. Of our elms, it has the most durable wood, which has been used in wheelwrighting and for building boats and water structures. It is still used in the furniture industry. It is planted in parks and tree plantations.

- **European White Elm (*Ulmus laevis*)**

In our country, this elm is scattered in the lowlands, especially in the floodplains of large rivers. Along streams, it is also found in places in the uplands. It is also very often planted, e.g., in avenues, so that it is spread over a much larger area than its natural range would be. It grows naturally as part of floodplain forests and riparian scrub. It requires deep, nutrient-rich soil with a high-water table. It can tolerate short-term flooding but will persist where the water level drops severely in summer and the soil dries out. It tolerates shading well in the stand, especially when young. Forestry is useful in floodplain forest restoration but is hardly used at all. It seems to be more resistant to grabiosis than other elml. This elm has wood that is less hard and durable than our other elms, but it is used in furniture making because of its specific pattern. Its bark was also formerly worked, like that of lime. It is often planted, for example, in avenues or in towns and can grow into a distinctive and long-lived landscape landmark.

- **European Yew (*Taxus baccata*)**

This yew is scattered or rare throughout the country, mainly in the mid-altitudes, especially in areas with markedly rugged terrain. Centuries ago, it was quite abundant throughout its range. Today's sites are only remnants of its former distribution, which is mainly due to its intensive past exploitation, grazing, and full clearing. In the Czech Republic, it survives in a few isolated original localities, usually on steep and inaccessible sites that have escaped intensive forestry. It is still more common in the Křivoklát region, in the Povltaví region near Štěchovice and Drbákov, in the Moravian Karst, in the foothills of Šumava, east of Svitavy, and rarely grows in the Beskydy Mountains or in the Lužice Mountains. Yew grows mainly in debris forests or in mixed forests with beech and fir. It requires humic and sufficiently moist soils, usually on a basic substrate. It is often found in rock crevices, but these tend to be shady habitats with sufficient rainfall and high humidity. It is the most shade-loving of our woody plants but grows well in open areas. However, it does not tolerate sudden changes in lighting. Since prehistoric times, it has been sought after for bow and spear making. Its wood has been a sought-after material in carving, tiling, and marquetry. Yew readily reverses after pruning and easily forms and propagates from cuttings, which has predestined it for

widespread use in horticulture, e.g., for creating hedges and shaping in gardens and parks. It tolerates the polluted air of large cities very well and is often planted there.

- **Bird Cherry (*Prunus avium*)**

The bird cherry is scattered and abundant from the lowlands to the lower mountains. It is a common part of the cultural landscape and is not endangered or rare. It is commonly found in meadows, along roadsides, in copses, on scrubby hillsides, or in woodland edges. However, it is much rarer in woodlands, which is why we have included it in this review. It grows mainly in oak woods and warm-loving oak woods, but also in floodplain forests and rarely in beech forests. It prefers deeper, fertile, and sufficiently moist soils. It has relatively high light requirements. Shaded canopies do not flower, wither, or die. In forests and on the landscape, flowering trees and fruits are an important food source for a wide range of animals. Cherry wood is very valuable and is mainly used in furniture and toolmaking. Its main economic importance, however, is in fruit growing. The species is grown for its fruit in many varieties throughout the world, and the bird cherry is an important rootstock for grafting. However, we will only use native wild bird cherries for planting in forests.

6.3.5. Microclimate.

Forest ecosystems play an important role in regulating the climate and local microclimatic conditions. The forest creates its own climatic environment, which is best seen when one goes to hide from the summer heat in the cool cathedral of the tall treetops. Of the climatic variables, trees mainly affect the amount of solar radiation, temperature, air humidity and wind speed.

Tree crowns affect the amount of solar radiation, which controls the amount of incident light and the thermal regime in the forest environment. During the day, leaves, needles, and branches absorb and reflect solar radiation, while at night the crowns of trees trap the radiation of heat accumulated during the day. More generally, the forest moderate's temperature extremes, not only during the day, but also throughout the year. According to research, forests in Europe are on average 2°C cooler in summer and 2.1°C warmer in winter. In addition to the temperature, the crown canopy influences the air humidity, which is typically higher than in the surrounding forestless landscape by approximately 5% on average. Trees regulate humidity by actively evaporating water from their leaves during transpiration, which increases the shading effect and lowers the temperature even more. In cities that overheat in summer, this provides a desirable natural air conditioning effect: the shade of trees is cooler than the shade provided by buildings due to water evaporation. Deciduous trees with a large leaf area generally have a higher rate of transpiration than conifers, the summer humidity in deciduous forests growing in comparable conditions is generally higher than in conifers, and the temperature is lower.

The trees also form a barrier to the flowing wind, and the speed of the air flow decreases from the forest edge towards the interior of the stand. Flow retardation reduces wind erosion of soil in the landscape, just as it is used in linear plantings of windbreaks, which are used to break up large swaths of fields. A lower air flow rate further limits drying and thus affects air humidity.

As already indicated above, different types of trees have different effects on the forest microclimate due to their properties. Shade-loving trees forming dense crowns and a high canopy such as beech or fir let in little sunlight into their undergrowth, and their interior is shady and humid, and the number of plant species is usually limited. On the contrary, light-loving trees such as pine or birch let in more light and enable the survival of heat - and light-loving organisms.

An optimal forest microclimate is a must especially for tree seedlings, which often require shade and higher air humidity and represent the most vulnerable phase in the life cycle of trees. The fact that the forest is made up of a mosaic of different-aged forest and small patches of forest also leads to the fact that the climatic variety is also much higher here - from fully sunlit glades and belts, through young stands of various connections and ages, light forests with rich herbaceous undergrowth to old heavily involved shady forests. This mosaic of ideal species- and age-varied areas provides a wide range of habitats for other types of organisms, such as heat- and light-loving insects or, conversely, shadier, and wetter stands where mollusks and amphibians can hide.

In addition to the trees themselves, the forest microclimate is also influenced by other environmental conditions, especially altitude, orientation and slope of the habitat, soil conditions and character of the surrounding landscape. For example, a dense lowland forest on south-facing slopes will have a large effect on the microclimate, while relatively little difference between the forest and its surroundings will prevail in sparse forests at higher altitudes. Of course, the character of the habitat also determines the suitable tree species for planting. For example, in dry areas it is possible to plant trees that are capable of increasing air humidity and reducing temperature, and in cold areas, on the contrary, species with thinner crowns that form less shade allow more sunlight to enter the forest.

6.3.6. Technical features.

Technical features in the forest can be defined as all man-made constructions, equipment and small buildings and other unnatural elements.

6.3.6.1. Roads and paths.

A separate group consists of linear structures - communications - forest roads or paths.

A forest road is mentioned in the Czech road traffic rules as a type of purpose-built road. Forest road is a term reserved for roads primarily used for forestry; in addition to them, forest trails and forest footpaths serve tourist and other public purposes. While a road passing through a forest is not considered part of the forest, forest roads are generally covered by the Forest Act. Some forest roads belong directly to the owner of the forest, some may belong to other owners. In 2016, the new ČSN 73 6108 renamed the existing 3rd class forest roads to forest roads and 4th class forest roads to technological lines, thereby significantly narrowing the term forest road.

Categorization of forest roads.

Forest roads in the Czech Republic are defined and categorized in ČSN 73 6108. ČSN 73 6108 The Forest Transport Network (3/1996) divided forest roads into 4 groups, i.e. forest roads of the 1st to 4th class (abbreviations 1L to 4L), and separately mentioned forest paths and forest footpaths. ČSN 73 6108 The forest road network calls forest roads only forest roads of the 1st and 2nd class, while the existing forest roads of the 3rd and 4th class are listed as transport routes for the production functions of the forest, which no longer fall under the legal definition of road transport, designation However, 3L and 4L remained for them.

A 1st-class forest road is a haulage road, allowing year-round operation by standard vehicles, equipped with a road surface that allows for winter maintenance. The minimum lane width is 3 meters, the recommended lane width is 3.5 meters, and the minimum passing width is 4 meters. The maximum longitudinal slope is 10%, in short sections in the mountains up to 12%. According to the new ČSN from 2016, they must always be equipped with a road, complete drainage of the crown and body, and turnouts.

A 2nd-class forest road is a haulage road, allowing at least seasonal traffic by a standard vehicle. It is recommended to equip the road surface with reinforcement or a simple road with a dusty surface if the subsoil itself is not strong enough and well drained. The minimum lane width according to the 1996 standard was 2.5 meters (already 3 meters according to the 2016 standard) and the minimum passing width 3.5 meters. The longitudinal slope should not exceed 12%, without strengthening on non-cohesive soils 10%, on cohesive soils 8%.

The forest road category is given in the form "class free-width / design-speed", for example "2L 4.5/30".

Lesní svážnice (3rd class forest road until 2016) is an approach road passable for tractors and special approach equipment, and in favorable cases also for off-road motor vehicles. The minimum clear path width is 3 meters. The surface can be operationally reinforced, partially reinforced, or unreinforced. Weighbridges do not have to have switches.

A technological line (until 2016 a forest road of the 4th class) can be an approach road or an approach line for hauling wood down a slope with an unpaved surface and an unremoved organic layer of soil, with a width of at least 2 meters, without additional equipment.

Since forest roads of the 3rd class often become a secondary water network and the cause of erosion due to their large longitudinal slope and minimal technical equipment, the Ministry of Agriculture is trying to gradually replace them with optimized roads of the 1st and 2nd classes. Forest roads of the 4th class were not to be listed as forest roads in the future, they were to be replaced by temporary clearance lines.

Parts and accessories of forest roads.

According to ČSN 73 6108, the forest road network also includes forest depots, switchbacks, turning points, rescue points, heliports, etc.

A forest warehouse is a permanent area for treatment, storage and loading of firewood or other materials for forestry operations (e.g., machinery and construction materials). It may also serve as a heliport, rescue point, etc. The forest dump is only intended for temporary storage of firewood.

Water catchment (drainage channel) is an open drainage device that is placed in the crown of a forest road or culvert diagonally to its axis. It can be a product or a building structure.
A crossing culvert is a transverse building object in the crown of a road or culvert, most often in the form of reinforcement from quarried stone, used to transversely divert occasional water flow across the crown of the road.

An open channel with a continuous grid is a drainage device with an open U-shaped upper part, covered by an inlet grid. It is used for both transverse and longitudinal drainage. It is most often used at the mouth of a forest road.

A seepage ditch and a seepage pit are devices designed primarily to divert surface water to deeper layers.

Forest paths and footpaths.

ČSN from 2016 newly lists forest trails as a separate group within the elements of the forest road network and explicitly mentions that they are not considered land transport within the meaning of the law. Forest trails are designed with parameters suitable for forestry operations, while trails for recreational use are mentioned as "other trails in the forest". The surface of the trail can be paved or unpaved, there can be individual steps or staircases in the trail route. The minimum and maximum values of longitudinal and transverse slope are not established.
All forest roads, paths and footpaths outside built-up areas are subject to mandatory registration with municipal authorities according to the Nature and Landscape Protection Act and may not be disturbed or established without the consent of the authorized municipal authority. Considering that the mere treading of a footpath without targeted construction activity probably does not fall under the term "establishment" and the spontaneous disappearance of a path does not fall under the term "disturbance", footpaths can in fact easily arise and disappear without the consent and knowledge of the authorities.

The forest path is designed in parameters according to the purpose (walking, cycling, riding, skiing, etc.)

The forest footpath is established in such a way that it captures places of tourist interest (cardinal points). The pavement surface is exclusively natural (natural subsoil, stone, wood). Specific principles for the establishment and construction of roads and the road network will apply to roads in the forest with an increased recreational function.

SUPUKA, VREŠTIAK (1984) state the principles of composition of such paths: The paths should go through the most interesting parts of the forest. Paths must be maintained in such a way that they are passable by all visitors, except for special routes. Roads must not be dominant in the composition. The natural shape of the road is important - the crossing of roads must not be violent, rectangular, and sharp crossing of roads is only suitable for straight directions that cross but do not connect to each other.

Every journey must have a clear destination, the visitor must know where and where the journey leads to, how demanding it is, what it is possible to see and do business on it. Roads should be made of natural materials, and those that are safe and at the same time do not interfere with nature.

Tourist marking system.
Tourist signs are very much related to forest roads and paths.

The territory of the Czech Republic and Slovakia has one of the most perfect and dense networks of tourist signs for hiking. The first hiking trail on the territory of what was then Hungary was marked out by the Sitnia Club in 1874 in the vicinity of Hodruš in the Štiavnické Hills. The first Czech routes were marked by the Radhošť Mountain Unity around 1884 and the Czech Tourists' Club in 1889. In 1912, the first long-distance route through Brdy to Šumava was completed, and rapid development followed until 1938. Marking has been carried out free of charge since the beginning by volunteers - markers. Some nature trails are established and maintained by nature conservation authorities and organizations.

The Club of Czech Tourists uses the so-called strip markings of four colors – red, blue, green, and yellow, usually painted on trees, pillars, and other objects. The mark consists of a horizontal-colored band, above and below which is a white band.

The colors of the tourist signs have their meaning: red – for a long-distance (ridge) path; blue – for a significant journey in the region; green – for a trip in the district; yellow – for connectors of previous paths. For turning, this basic shape is supplemented with an arrow of uniform design. If several marked routes run together, they are marked with a combined mark in the exact color order. Detours to important places near the main marked route are marked with meaningful shaped markings (there are 4 types) of the same color as the main route. Signposts (signposts) with local and direction tables of a uniform design, usually made of metal, are placed at important places and crossroads.

Educational trails.
A special type of marked hiking trail is an educational trail.

Educational trails inform visitors about the natural or cultural highlights of the natural space they lead through. The educational trail can deal with one or more topics, depending on the direction of the route it is divided into circular or continuous. The trail should be designed with the difficulty of the route in mind. The basic element of the educational route is the information panel (see below), there is also the possibility of using guide texts, printed brochures in information centers, or connection with interactive applications via mobile phones.
According to the KČT methodology, the educational trail is marked with a white square with a slanting green stripe. Educational trails established by other entities, however, are often marked in other ways. Marked paths are marked on tourist maps, sometimes also on other types of maps. They are protected by misdemeanor laws.

(https://kct.cz/turisticke-znaceni)
(https://theses.cz/id/mizran/zaverecna_prace.pdf)

6.3.6.2. Facilities in the forest with an increased recreational function.

The representation of individual objects, as well as their distribution in the forest used for recreation, depends on the specific shape of the forest, terrain, undergrowth, etc. Facilities objects should not disturb the natural character of the environment, therefore natural, preferably regional materials should be used in their production.

Nowadays, it is also possible to use fully recycled plastic materials that resemble wood in appearance (for example, for the construction of special raised walkways or game elements).

Equipment objects can be:

- Tables and benches, located in the forest area.
- Recreation facilities, such as gazebos or shelters, are spread over the entire area of the recreational forest. They are used for relaxation and should at the same time beautify the forest and participate in its composition. These include benches and tables, gazebos, pergolas, or shelters.
- Recreational and sports facilities, including children's playgrounds, strengthening elements for adults and other sports elements, obstacle courses, haptic trails, forest minigolf, etc. An example of a recreational and sports facility can be an obstacle course. The obstacle course is proposed in the active zone of the recreational forest. It goes through several stations, evenly spaced from each other, with each station having one type of obstacle, a seating element and an information board that offers a way to overcome the obstacle. The obstacles are made of natural, local materials so as not to disturb the character of the forest. (https://theses.cz/id/mizran/zaverecna_prace.pdf)
- Cultural, social, and educational facilities serve to distract, entertain visitors, and learn about nature. These include educational routes, zoo corners, amphitheaters, fireplaces, monuments, dance floors, a music pavilion...
- Boards and signaling equipment must be placed very carefully in the space, they must not disturb and at the same time they must be very visible. SUPUKA, VREŠTIAK (1984) divides signs into orientation, prohibition and command, warning, and traffic signs. They also recommend placing more information on one board so that the trail is not cluttered with boards.
- Hygienic facilities - this includes toilets and waste bins, distributed evenly along the more frequented routes, which the maintenance vehicle will be able to access.

6.3.6.3. Educational boards, information panels and stands, interactive features.

6.3.6.4. Technical objects in clearing forests.

A specific group of technical objects and elements in forests are technical objects in ancient coppice forests. Many old technical objects have been preserved in the locations of clearing forests, which are no longer used and have lost their original purpose. Nevertheless, they deserve special attention and protection.

These include, for example, coal platforms, old tunnels, mining heaps, quarries, clay pits, sand pits, underground shelters, military trenches, and ramparts. Small "peasant" quarries are most often found in forests.

The occurrence of coal platforms (milestones) in forests of sapling origin proves the very intensive influence of forests in the past by logging. The construction of a horizontal platform with a circular, oval, and rarely even a square plan was an important condition for burning charcoal in millers. The most striking are the remains of the coal platforms in the sloping terrain, where the soil excavated during the burying of the platforms into the slope was used in the modeling of the second part of the platform on the slope (Bobek & Matoušek 2015). Coal platforms are very common in the forests of Krivoklat, where charcoal has been burned for centuries. Milestones in the Křivoklát forests can be found even in the most inaccessible places on the steep slopes above the Berounka river and its side tributaries (Pecha 2015). The most interesting and memorable historical technical objects in the localities of ancient forests include loches - underground passages or spaces excavated mainly in soft rocks (primarily loess, but also sandstone) that served as shelters or pantries. The construction of lochs has its roots in prehistoric times, but the most common are medieval and early modern lochs (Kos 2003). The occurrence of loaches was found, for example, in the site of the ancient Morkůvky forest in ORP Hustopeče (Huková 2014), in a deep gully, buried in loess clays in an important site of ancient stumps PR Bosonožský hájek (ORP Brno), or on the edge of the ancient cutting forest and the village of Rokytná (ORP Moravský Krumlov), where there are a number of cellars dug into the loess.

Sources of information and extension materials on the topic
https://fraxinus.mendelu.cz/vymladkovelesy/technicke-objekty/

6.3.6.5. Sacred objects in the woods.

Among the constructions, i.e., technical objects, built by man in the countryside and forests, small sacral buildings can also be counted.

Important small monuments that can be found in forest locations include buildings and other objects of small sacral architecture, especially crosses, crucifixes, chapels, stations of the cross, monuments and sacral images, usually placed on trees. Small sacral objects belong to the prominent manifestations of Christian liturgy in the cultural landscape (Kopeček, Lõw & Kučera 2015).

Stone crosses belong to the rarest small sacral objects in our landscape (Kolektiv 2007; Bělohradský, Belicová & Bořil 2013). Stone crosses were usually placed where some tragic event had taken place, memorial stones often depict the instrument used to commit the murder.

The territory of ORP Moravský Krumlov is rich in the occurrence of sacred objects. The newly restored cross by the academic sculptor Petr Roztočel dates from 1881 in the forest clearing above Moravský Krumlov, where there is a beautiful view of the city. Another stone cross, which was built "to praise God in honor of the gracious summer of 1901 by Ferdinand Novák from Ivančice", is located at the intersection of forest roads in the well-known area of Réna nad Ivančice. Another cross is erected at the intersection of forest roads near an elevation of 415 m above sea level at a place called U stavni v Moravsko Krumlové Obora, the year 1856 is on the stone plinth, the year 1930 is next to the bilingual German-Czech inscription "Dokonáno jest", the cross itself is metal. A modern cross from 1999 was erected elsewhere in the park and includes the inscription "I beseech you Lord God, give this place peace and quiet". One of the forest chapels, which are otherwise relatively rare, was also found in the Moravian Krumlov Nature Reserve.

Sources of information and extension materials on the topic: https://fraxinus.mendelu.cz/vymladkovelesy/sakralni-objekty/

6.3.6.6. Hunting features.

Hunting equipment is a specific group of technical elements and devices. Hunting equipment is an integral part of hunting. They represent an important component of our cultural landscape and are also a kind of "business card" for every hunter. These are pulpits, folk seats and self-feeders, or feeders. They are also traditionally made of wood.

Sources of information and extension materials on the topic: https://www.mysliveckazarizeni.cz/

6.3.7. Water resources and areas.

Why small water features?

A minor water feature or pond is a natural or artificial depression in the ground that is permanently or periodically filled with water. Its size can range from a few square decimeters to hundreds of meters. They are natural reservoirs of water in the landscape, have a positive effect on the surrounding vegetation and local climate, and are home to many species of plants and animals, many of them rare and endangered. Their aesthetic and landscape values cannot be overlooked. In the following lines, we will deal with pools primarily in terms of their importance for biodiversity.

Human activity in the landscape has long been such that, with few exceptions, natural

creation and regeneration of ponds is impossible. But even artificially created ponds quickly become very valuable natural habitats. Building them is one of the most effective single tools for promoting biodiversity ever. It is relatively simple and inexpensive, and the positive effect is almost immediate. Frog eggs appear the following spring in a pool created in autumn, and dragonflies immediately start circling above the new water surface. Where there is water, there is life! Some may argue that why build ponds when we have ponds? Ponds are not to be equated with fishponds. Fishponds have various technical features (dams, sluices, etc.), usually have an inflow and outflow, and are built mainly for the purpose of fish production, for which they are fertilized, limed, and the fish are fed. The characteristics and biota of ponds and pools can vary quite considerably.

What a pond should look like.

There will never be a one-size-fits-all guide to building the ideal pond. If only because the requirements of different organisms, such as different species of amphibians, vary considerably and it is simply not possible to please everyone. It is therefore always better to create several smaller pools of different depths, sizes, and bottom characteristics than one large pool. The idea is to create as wide a range of conditions as possible for as many species as possible. But not everyone can build a spectacular wetland over several hectares. Even one small pond makes sense and can significantly support, for example, the critically endangered moor frog.

Ponds should generally be spatially and deeply dissected. They should contain both shallow areas with rapidly warming water (up to about 30 cm deep) and deeper areas with a maximum depth of 80-100 cm. The shallow parts are essential in all ponds and should cover at least 30-50 % of the surface area. For small ponds of a few meters to tens of square meters, a maximum depth of only 50-60 cm is sufficient. Depths of more than 1.5 meters are no longer biologically justified. Ponds are often inappropriately constructed in such a way that they are deep (more than about 30 cm) over most of their surface area and have steep banks. For large ponds, the ideal bank slope is around 5°. For the smaller ones, we usually cannot afford such sloping banks. A smoothly sloping bottom is better replaced by stepped depth changes of about 10-20 cm, and the transitions between steps should be sloping with a minimum slope of 1:3. The shape of the pools is not very important for most organisms and is more of an aesthetic consideration, so that the pond does not look too artificial.

In general, it is advisable to build ponds with sufficient sunlight. Most of our amphibian species, for example, prefer a pond with a lot of sunlight. If trees surround the pond, they should be removed at least on the south side. For greater bottom diversity, larger rocks, branches, or stumps should be placed in the new pond. Bank armoring is not desirable.

Water level fluctuations and drying out of the pond.

A large depth and stable water level does not mean that the pond is at all more favorable for organisms, and that water fluctuations or even the drying out of the pond is something fundamentally harmful. This myth probably stems from the idea that organisms in a dry pond will largely die, and we cannot imagine how they could survive or even benefit from drying out. However, a large proportion of organisms can cope with desiccation without any problems, and freezing does not pose a serious problem either. Conversely, many harmful organisms will disappear from the pond at this point (especially fish, which, e.g., decimate amphibian communities). The fluctuation of water levels throughout the year is a natural phenomenon and is very desirable or even necessary for the proper functioning of the pond. It is one of the important features that distinguish ponds from fishponds and which many organisms in conventional ponds lack. The zone between the maximum water level in winter and the minimum water level in summer is extremely interesting and important for pond organisms. It is in these shallow parts that the greatest species richness of the pond is concentrated. Attempts to stabilize the water level by, for example, permanently connecting it to a watercourse are misguided. The deep zone is not a necessary condition or a prerequisite for the biological richness of the pond. Therefore, do not be afraid to build very shallow ponds, even if they are only 10-20 cm deep. Building shallower ponds also has a significant practical effect: there is no need to remove such a large amount of soil and solve problems of how to dispose of it. It also reduces the risk of breaking the impermeable layer of soil that holds water at the bottom (this is especially true for ponds built outside of floodplains).

How to do it?

We assume that a reader considering making a pond will build it on his own with limited resources. Therefore, the following lines will deal with small ponds ranging in size from a few square meters to a few tens of square meters and which will be dug with hand tools. Before the first excavation, it is necessary to consider whether the site is biologically more valuable in its existing state. We tend to build ponds on degraded or poorly biologically significant sites, for example, with stands of nettles, bracken, monotonous reeds, willow scrub, etc.

The pond should have sufficient water for at least several months of the year. The selection of a suitable site is essential for a well-functioning pond. The pond must retain water naturally, without the use of impermeable sheets and other construction measures (this is an extreme solution with many limitations and disadvantages). Similarly, we avoid connecting pndls to watercourses. There are two ways of determining the water content of a site, or a combination of both. An indicator of the hydrological condition of a site is the presence of plants associated with permanently or long-term waterlogged habitats. The second method is to excavate a small test trench to a depth of two spades. In it, we observe whether it is filled with water. If there is at least minimal water flowing into it, the site will

be suitable. If we are not sure, we leave the trench open and monitor it throughout the year, especially in the summer when the water shortage is greatest. We also assess the nature of the soil in the trench. A clay-like soil should follow beneath the topsoil. This acts as an insulating layer in the deeper parts and will hold water in the excavation. Sandy, gravelly soils, or heavy layers of loose soil are not suitable.

Excavating a pond by hand is physically very demanding, but again, we can get by with very simple equipment, and there is no need to worry about the logistics of the equipment. All we need is a spade, a shovel, and possibly a bucket. Before excavating, we roughly think about the size, the depth, the relief of the bottom, the nature of the shoreline, and the storage or use of the excavated soil. We start by removing the topsoil over the entire area of the future pool before moving on to excavate deeper areas. It is most effective to deepen and shape the pond systematically in stages to a depth of one spadefuls. The perpendicular walls of the excavation are gradually beveled to an acceptable slope. If the pond is already filled with water during excavation, it is necessary to continuously scoop it out with a bucket. Larger and faster-filling basins are built in sections separated by earth dams, which are eventually removed.

The construction of ponds can get considerably more expensive if the removal of soil is necessary. Sometimes removal is not even technically feasible. That is why we try to continuously loosen and spread the soil around the pond during the excavation, but only in a layer of 10-15 cm at most. In the case of pond built on a gentle slope, the soil is used to form a low, semicircular embankment in the direction of the slope. The first year after the intervention, these places do not look very aesthetic, but once the soil has been stripped and covered with vegetation, it is often impossible to tell where the soil was deposited.

Newly constructed ponds are left to evolve completely on their own, and no planting of plants or translocation of animals is done. The pond will be colonized completely spontaneously by the species it suits.

In most cases, ponds are dug by machine. After all, the power of a few tons of machinery will speed up the work. Crawler machines with dredge or slope buckets are generally preferable. There are already several specialist companies or groups involved in the creation of natural ponds. The idea is not just to dredge a hole but to create a suitable habitat with rugged banks, shallows, and an irregular bottom. This can be a major problem when a dredger used to excavate for technical purposes is commissioned to do the digging, and the end result will not satisfy either party. A suitable machine can be hired, and its operation can be mastered in a short time by a person with at least some skill. DIY and gardening work is thus immediately expanded to completely new dimensions.

Pond maintenance and restoration.

Ponds are not stable habitats. If they are not restored, they gradually silt up and disappear. This process is called grounding. The length of the process is highly variable and depends on the size and depth of the pond, the intensity of the grounding, and also the rate at which the pond is drying out (permanent ponds foul faster than intermittently drying ponds). Thus, the basic prerequisite for the permanent existence of a pond is its restoration.

Any intervention in a pond should be preceded by at least an indicative biological survey. Rare and endangered species, which we do not want to damage through intervention, are very likely to be present in the pond. Therefore, we will plan the intervention in such a way that it will benefit the rarest species as much as possible. Intervention in the pond always means a short-term deterioration of conditions and some disruption of the local community.

The best time for intervention is late summer and early autumn. During this period, many organisms have already finished reproducing and developing and have left the aquatic environment, while at the same time organisms that will develop overwinter in the pond are not yet present. It is also the period when there is the least water in the ponds. Ideally, restoration should be carried out when the pond is completely dry. If there is water in the pond, it is advisable to remove it gradually. But sometimes this is not possible, and more difficult work is ahead. Maintenance of ponds consists mainly of the partial removal of sediment. The most common problem in pond restoration is disproportionate dredging, where the original bottom material is removed along with the deposited leaves and other sediment. We also lighten the site by the partial removal of woody debris as well as sensitive weeding of vegetation in the pond area.

If we have the opportunity, we do not restore old and grounded ponds, but rather create a new pond on the site. Some species prefer fresh and fully sunlit ponds with bare bottoms, others prefer the final stages when there is practically no water left in the pond. Ponds at all stages of development have their importance! If we do not have this possibility, we always restore only a part of the ponds so that we still have ponds in different stages of development on the site. If we have only one pond, we can also restore it in parts over several years.

Legal framework.

We will probably plan the pond on our land. If not, the consent of the owner is a matter of course. The natural inclination is to keep the administrative issues to a minimum, ideally eliminating them altogether. These should be avoided if our ponds will be small water bodies that are not intended for economic or recreational use (e.g., fish farming), have no visible inflow or outflow, are without any technical facilities (hardened dams, outlets, etc.), and are expected to revert to the original state of the land gradually and naturally. Such a pond should not meet the definition of landscaping or change of land use under Act No.

183/2006 Coll. (the so-called Building Act). This Act stipulates that ponds up to 300 m2 in size and up to a maximum depth of 1.5 m do not require a land use change decision or planning consent, nor a building permit or notification. According to Act No. 254/2001 Coll. (the Water Act), according to Section 55, a pond should not be a water body if it does not have a dam or technical objects (an outlet, a safety spillway, etc.). When building ponds, we can also encounter Act No. 541/2020 Coll., on waste, which determines the procedure for depositing the sediment (excavation) of the pond on agricultural land. If we are in a biologically more valuable area, there is a reasonable expectation of the presence of a protected species and interference with its habitat. These matters are dealt with in Act No. 114/1992 Coll., on Nature and Landscape Protection.

Many subsidy programs support the construction of ponds. However, if they are used, we cannot do without some degree of administration. We always recommend discussing the intention to create or restore a pond with nature conservation workers, preferably from the Czech Nature Conservation Agency, well in advance. They can provide valuable information and advice, point out various pitfalls, guide our plans, inform us about the possibilities of subsidy programs, and even help with some of them.

6.3.8. Forest nurseries.

The purpose of the creation and existence of forest nurseries is to provide planting material for the fastest and most successful restoration of the forest. For this, the planting of seedlings is currently used the most. In the Czech Republic, forest nurseries have a "guild" organization called the Association of Forest Nurseries. On their website you can find basic information and the address of the main potential producers of planting material in the area (https://www.lesniskolky.cz/)

It takes advantage of the fact that the seed and later the sapling survive the most risky period of the tenderest youth in the "greenhouse environment" of the forest nursery. There, it is well taken care of in every way (optimal amount of light, water and nutrients, protection from pests, inappropriate competition, etc.) and after being transplanted into the forest, it has had a head start for several years. Thanks to this, forest regeneration takes place much faster; compared to alternatives (grids or use of natural regeneration), this procedure tends to have a better price/performance ratio (both in terms of work and finances). When using planting, the result is usually significantly more predictable and essentially independent of the original growth, which are usually advantages.

On the contrary, the negatives of forest nurseries are mainly the shock of being transplanted into worse conditions, possible deformation of the roots (mainly in case of non-compliance

with the technologies in the nursery, but especially during planting) and the potential spread of latent (slowly developing or hidden) diseases.

The cycle of work related to forest nursery is as follows: collection of raw material (fruits, cones, seeds) -> processing of raw material (e.g., shelling of cones) -> storage of raw material -> sowing -> growth-> nursery (transplanting) -> collection -> dispatch -> planting. More detailed information can be found, for example, here: https://akela.mendelu.cz/~xcepl/inobio/inovace/Zakladani_lesa_2/

7. Case studies.

Forest stories from the Czech Republic, paths to forest patterns in Poland, Estonian ... which we created for a while.

7.1. Forest Vršovka.

Podorlicko, Czech Republic
Adam Kučera

From an early age I was fascinated by wild nature. Its power, beauty and slow but confident rhythm. On a large scale, wild nature in Bohemia is a thing of the past. However, if we really want to, we can find signs of it in every unkept garden, in the meadows or in less accessible locations. The idea of buying a piece of land where I could observe the ways of nature and possibly give them some rough direction has been with me for so long that when I had the opportunity to buy such a piece of land, I did not hesitate. The seemingly negative aspects, such as the illegal landfill, the bark beetle damaged trees and the scrubland, became an opportunity in my eyes. An opportunity to not only fulfill my dream of owning a forest, but to do something useful, something real, that I would have in my hands. In short, to 'do something for nature' (although I am fully aware of the naivety of such thinking).

The main goal for me was to interfere in the life of the forest as little as possible. But human life is too short to make the transformation from an unnatural and 'dead' forest to a natural, living, self-sustaining forest. I therefore had to take certain measures to see something more than the decay caused by the bark beetle and the management of the land, which was aimed only at profit. So, the first task for me was to remove the dry spruce and larch trees to make room for trees that would thrive on the site, and that would also be native - that is, to disturb the ecosystem as little as possible. I am fortunate that the forest rejuvenates itself. There are a number of young ash, maple, birch trees and now and then an oak tree from the neighboring forest. That would be enough on its own, no doubt. But I didn't want to disturb the local animals, who might accuse me of not caring about them and just looking at the trees. For their sake, and in the name of diversity, I planted solitary wild apple trees in suitable places. While I was at it, I also added many oaks and beeches, alders, and birches, planted with the help of my many friends and acquaintances who deserve my warm thanks. I also owe a special thanks here to my colleagues in the Enclave of Life project, who stepped up in times of need with good expert advice or spade in hand to help as needed.

The big challenge for me was dealing with the illegal dumpsite. It was old, overgrown, partly swallowed by the landscape and the bush. Hauling out hundreds of kilograms of medicines, broken glass, old tires, and containers of all kinds was not a pleasant or quick job. Not to

mention that a good quarter of the waste was so overgrown and decomposed that it was simply not in my power to do anything with it. In this place, as well as in the rumfield directly adjoining the landfill, I have planted trees that will hopefully cope with the situation better than I can.

The last major action was the experimental establishment of a small wetland. The meadow in the neighborhood is perfect for it, and I am convinced that if the experiment is successful, it will be a diversification and a contribution to diversity, to local life. Now it is almost finished on my side. I have no specific vision for the future. If animals and plants thrive here, if nature has an open path, I have fulfilled my mission.

7.2. Medieval Forest.

Orlické Mountains, Czech Republic
Bohumír Dragoun

In 1992, we started to intervene in the area of the Villa Nova Archaeological Open-Air Museum
in the composition of the forest belonging to the area. Our aim was to demonstrate the use of the forest in the past - in the Middle Ages.

In the core of the site, selected trees - ash, maple, and lime - were felled and used as a demonstration of coppicing, one of the oldest forms of forest cultivation. Stumpwork is documented in sources as early as the 12th century, but its origins are much older. Since the mid-1990s, stumps have reached the so-called middle growing forest. The same area is used for grazing, demonstrating pastoral forests that were lighted and into which fruit trees (in this case apple trees) were planted as food for the cattle.

In the area near the pond, hazel, lime, and ash trees were planted. However, after 12 years of life, these were broken by spring snow and did not recover due to grazing.

In the area behind the pond, part of the area is kept as the middle growing forest. That is, with small-diameter trees.

In the area of the redoute, a hazel grove was established as part of the Enclave of Life project. The hazel was very popular in the past for the high nutritional value of its nuts. We have evidence of this already from the late Stone Age. Above this, they provided quality wicker with a neutral taste suitable for contact with food: bowls for drying or for storage.

In 2011, small-leaved linden trees were planted in the 'sanctuary' area (on the northern side of the area) to demonstrate the head - summer trees. So far, three of the larger linden trees are providing the annuals, the others are slowly growing up. The annuals have been used as forage in the past. Today you will not find annuals in our landscape.

In 2016 a coppice was established with white willow and basket willow. Two dozen heads serve as wicker production for basketry purposes. A blood willow is planted among the willows, but it is clipped at the base.

The area of the Villa Nova Archaeological Open-Air Museum seeks to demonstrate in small areas the diverse range of uses the forest has been put to in the past.

7.3. Edible Forest Tetov.

Polabí, Czech Republic
Helena and Viktor Hejn

The story of the edible forest in Tetov began around 13 years ago, when Viktor and Helena met and started dreaming of a future together. One of their dreams was to have their own piece of land that they could lovingly care for.

Gradually, that dream began to take on clearer dimensions, thanks to the inspiration we gained while living in New Zealand. We wanted our own piece of land, neither big nor small, where we could create our own oasis. The key words for us were landscape restoration, diversity, emphasis on native species and, most importantly, self-sufficiency. We wanted our land to be not only beautiful and full of life, but most importantly, a source of quality food for us and our children. Then, when we drove around central Bohemia, we found a plot of land that exactly matched our ideas. It was a challenge from the very beginning. It was 1.2 hectares of intensively cultivated field, but paradoxically it is not suitable for a field at all, because there is only a hard layer of clay that looks more like stone than soil. Because of this, the field has had to be constantly chemically fertilized, which has resulted in virtually zero fauna. But for us, this was an opportunity.

We have divided our work in transforming the field into an edible forest/garden into several sub-objectives. As we had no practical experience with similar projects before, we modified, removed, or added new objectives in the course of our work. The first thing we did was to familiarize ourselves with the Czech legislation regarding the way of land use and the termination of the lease contract to the agricultural association. We then left the land fallow to rest and gradually began to cleanse it of the chemicals used. We planted our first trees - four almond trees and six walnut trees. For the first two years the field became green with

annual weeds - burdock, nettles, blackgrass, and other persistent weeds. We knew that this was the first and necessary stage of what is called natural succession, the period when these tough plants are sent out to heal the exposed soil and provide the first nutrients, but the sight of a field overgrown with thistles did not give us much pleasure. In addition, wild boars began to move onto the land, not only destroying the planted trees, but more importantly ripping up the soil, which could not regenerate. So, we had to fence the whole plot and we also bought a mowing tractor with a flail to kill the weeds before they bloomed and seeded. These two big investments paid off. The wild animals stopped destroying the land and the weeds soon began to be replaced by herbs.

Every year we have also planted many trees and bushes and sown many herbs. We have tried to take into account native Czech species such as the black elder, the sorb tree and the common blackthorn, which form a natural barrier with the garden near the house. Last year we planted an avenue of royal walnut trees as well as about 60 spruce, fir, beech, and maple trees in the corner of the property as a natural barrier with the neighbors. To this we have added bushes of toadflax, mulberry, blackberry, gooseberry. The next goal was to plant the perimeter of the property with common foxglove, holly, and Turkish foxglove. We started that this spring when we planted the longest, windward side with 250 foxgloves. However, due to the crazy drought this summer, we had to invest in an irrigation system as the hazel and other trees started to die. Herbs that have appeared on the property include oregano, thyme, chamomile.

The challenges of converting a field into a living, food-giving forest/garden were, are and will be many. We are learning as we go and by trial and error.

Our next goal is to continuously plant more and more trees and finally, to create a natural swimming lake with fish in the deepest part of the property and even more thanks to the water to invite and create the best possible conditions for birds and amphibians. We are also planning to acquire a pair of sheep for easier maintenance and to enrich the soil, but only when they do not pose a threat to the planted trees and shrubs.

At the moment, we are still at the beginning of our journey. But it's already fantastic to see the number of butterflies, bees, bumblebees, and other insects grazing on the flowering oregano. Counting the number of lizards and grass snakes that have taken up residence in the bushes or chatting with the villagers who have gratefully come to pick a bouquet of daisies and chamomile. We are already warmed by the knowledge that, although there is still a lot of work to be done, we are on the right track and our efforts are worthwhile.

7.4. Vávra´s Forest.

Broumovsko, Czech Republic
Filip Vávra, Šárka Vávrová
Our intention was to buy a house with agricultural land and start a small family organic farm. After several years of searching, in 2010 we bought a Broumovský-type farm with the original line of agricultural land and adjoining forest land (including a mature stand of 1 ha of spruce (130 years old) with several firs and beeches). We were happy for the forest, but at the same time we were aware that the overgrown spruce monoculture has a large supply of wood, but its perspective in this form is economically unsustainable in the long term. Our idea was the gradual clearing of narrow strips and planting with the support of natural rejuvenation, so that the result would be a spatially, age- and species-varied forest resistant to the effects of climate change, which, in addition to its ecological functions, provides wood for heating and later also construction wood.

Since a barn was demolished at our homestead, in 2013 we had a narrow and long strip cut down (for construction lumber for the construction of the barn). This was to keep the stand from opening too much to gusts of wind and to prevent the soil from drying out too much for planting and promoting rejuvenation. In autumn 2013, the clearing of 0.25 ha was reforested (beech, fir, maple) and fenced. When pruning, we suppressed the very lush blackberry and left trees from natural rejuvenation (birch, rowan). This area connected nicely, the birches partially overshadowed the beeches, and after 9 years we pruned it (about half of the birch trees) to make room for the beech.

In 2018 and 2019, part of the old spruce stand was broken by a windstorm, and in 2018-2021 it was repeatedly affected by bark beetle plague. It was a race with a bark beetle while clearing fallen trees and inspecting possible tree infestations in the vicinity. After three years, we did not manage this plant and after consultation with the forest manager, in 2021 we had the area, half of which was attacked by the sycamore, cut down (exhibitions of fir, beech and 1 piece of birch and a covering wall of spruce and fir on the NW were left).

In autumn 2021, we organized planting for the public (beech, summer oak, fir, larch) and the fence was extended to the entire plot. When pruning, we again suppress the very lush blackberry and we also leave the trees from natural rejuvenation (fir, spruce, beech, birch, rowan), with the fact that over time we will carry out an educational thinning of the stand. We believe that we are at the beginning of the journey to a sustainable and resilient forest that will provide the earth and man with its gifts.

7.5. A forest for bees.

Augustów, Podlesie, Poland
Polskie Lasy Państwowe, Nadleśnictwo Augustów

Can I have a forest that can be home to wild pollinators? Or better yet - can I fulfill my dream of a forest that will provide me with real bee honey? Although it may seem complicated, the answer to both questions is yes.

People have been enjoying the benefits of the forest for centuries. One of the most interesting benefits is wild honey. The first mentions of forest beekeeping or beekeeping in Poland date back to the 14th century, although there are many indications that this profession existed earlier. The greatest boom falls in the 16th and 17th centuries. But let's think about what your forest must have to be pollinator friendly, or in other words, what to do to make bees want to live in it?

A suitable species composition of the forest and access to water are key. But which forest is suitable? One of the most important trees in the species composition of the honey forest is the linden, and it is often its numerous presence that guarantees success. The forest should be moist, but not heavily shaded. A well-lit undergrowth will be characterized by a richness of flora species, which increases the food base of bees and other forest pollinators. So, what species should we be concerned about?

About trees such as lindens, hazels, willows, maples, cranes, elms, and wild fruits (pears, cherries, apple trees). The presence of coniferous trees, i.e., spruces, pines, larches, and firs, will also be valuable. In general, it should be remembered that the more species-diverse a mixed forest is, the better it is for pollinators.

About shrubs such as blackberries, raspberries, hawthorn, buckthorn, honeysuckle, and dogwood.

About herbs and small bushes - blueberry, cranberry, cranberry, heather, willow, thyme, lungwort, purslane, motherwort, lily, snowdrop, gorse, and other flowering plants.

As mentioned above, it's good when the forest is wet, but what does that mean? Any presence of small watercourses (brooks, springs) in the immediate vicinity of your forest will have a favorable effect on the water conditions in the area. Water superstitions will also be favorably influenced by a high level of underground water or the proximity of stagnant water or swamps and bogs.

Another question that probably comes to mind is the legality of activities such as hanging a beehive or making a beehive directly into the trunk of a living tree. In a private forest, the consent of the landowner is sufficient, and if we operate on our own territory, there are no obstacles.

And how to make a forest beehive? The most popular forms of beehives are elongated depressions excavated in the trunk of a living tree or modified cavities, closed by a wooden screen. The cavity is about one meter long, 10 cm wide and 30 cm deep. The second type of hives are the so-called beekeeping logs. These are hollow logs, open from below or above, secured by a canopy. Such hives are hung from trees using ropes or tapes. The great advantage of this solution is the absence of interference with the living tree. The disadvantage is the shorter lifespan of such beehives, the need to ensure fixing and a higher probability of their damage due to adverse weather conditions or animals (e.g., bears). With proper care of the canopy, continuous repair of damaged flaps inside the hive or simply opening empty hives for the winter and closing them in the summer, our hives will last for many years. One of the older hives, located in Belarus, has been in use for over 60 years!

We are clear about the legality of our activity; we already know what types of plants should be in our bee forest and how important the presence of water is. But where to get bees? One of the options is to embed the swarm directly into the forest hive after swarming. The second option is to wait. The bees will come by themselves. It's like hanging birdhouses - we know the species' preferences, we know how to make them and where to put them, but we're never sure what or if anything will nest in them. It should also be mentioned that wild beehives are a potential home not only for wild bees, but also for wasps, bats and many other insects and small mammals. Let nature take its course.

They have current experience with forest beekeeping in Brdy: https://www.modernivcelar.eu/8473-na-brdy-se-po-staletich-vratily-brte

7.6. Forest for bats.

Southern part of the Kraków-Częstochowa Plateau, Poland
Ojcowski National Park

Bats are the only mammals that can fly. We usually associate them more with caves and abandoned post-war shelters. And rightfully so! Bats are active at dusk, which means that during the day they seek shelter most often in caves, in the attics of houses, in abandoned buildings or in specially suspended shelters. Can the forest be a friendly place for bats? Yes, but it depends on what kind of forest we have.

For bats to inhabit your forest, they must find:

- The right amount of food.
- A place to hide during the day.
- Access to water.

Bats living in Poland are insectivorous. Their diet consists of mosquitoes, moths, and beetles, which they catch after dark using echolocation. The presence of insects is influenced by their direct access to surface water, especially stagnant and slow-flowing water. If there are abandoned buildings, wells, shelters, forts or natural caves near the forest, there is a good chance that bats are already using them as a daytime shelter, nesting place or even a wintering place. In addition, bats in forests often seek shelter in hollows and under the protruding bark of trees. You can make life easier for them by hanging special shelters. Bats use them only in summer. The most common bat houses are wooden, although structures made of concrete and other materials also exist. Also, the size of the shelters is different, and we can choose depending on our options and needs. It is interesting that the bat houses are completely different from the commonly known bird houses. The main difference is the entrance located at the bottom.

The presence of bats will have a positive effect on the forest - the insect population will significantly decrease, and biodiversity will increase. If you decide to invite bats into your forest, it is good to remember that they are wild animals. We do not look in shelters or try to catch the bat in any way. The best indicator of the presence of bats is bat droppings under the shelter.

What parameters should wooden bat houses have and where should they be hung? The successful project was implemented in the Czech Republic in Slavkovský les.
https://www.forumochranyprirody.cz/odborne-informace/poznatky-z-praxe/netopyri-budky-ve-volne-krajine-jak-zvysit-uspesnost

7.7. Secondary forest.

Bobrowniki, Kuyavian-Pomeranian Voivodeship, Poland
Fundacja Las na Zawsze

You've probably seen many times a forest area that has been clear-cut, meaning that all or nearly all the trees in that area have been cut down. If you have a piece of land like this, it's probably hard to imagine it as a forest, and I'm not surprised at all - uneven surface, lack of trees and bushes, tree stumps...

Fortunately, this can be fixed. Since in areas after complete eradication we are still dealing with forest soil in which microorganisms and fungi typical of forests are active, secondary afforestation can be carried out without any additional measures to improve the soil structure. However, before we start planting, we need to find out which species are characteristic for the given place and at the same time suitable for the given environment. Remember that the tree seedlings will grow in the open, so it is important to choose light-loving and frost-resistant species at the first stage.

At this stage, also plan any paths you would like to have in your enclave. Consult a local forester about trees, who will advise you on how to create a diverse and healthy stand. Planting is done in early spring or late fall. Shrubs and grasses will probably appear on their own once the trees have grown. With possible plantings to supplement the undergrowth, wait until the growth has grown to a height of several meters.

7.8. Restored forest.

Męcikał, Brusy, Pomerania, Poland
Fundacja Las na Zawsze

The forest, like any other area, is susceptible to the influence of weather conditions, human activity, or climate change. Every few years, the topic of forests degraded because of a cataclysm reaches the media. An example is the forest fire in the Rudy Raciborskie area, which occurred in 1992. It is the largest forest fire in Central Europe after the Second World War, caused by human activity - a spark from the wheels of a braking train. The fire consumed almost 10,000 hectares of forest. Another example is the hurricane that caused damage in 2017 especially in the Kujawsko-Pomorskie and Pomorskie regions. 45,000 hectares of forest were destroyed.

Unfortunately, despite efforts to minimize the damage caused by natural disasters, they occur and will continue to occur. But what to do if my forest is destroyed due to unforeseen events (fire, hurricane, or flood)? Can I do anything to save my forest enclave? Yes, fortunately, nature has the ability to self-regenerate and with our participation can restore the forest.

Because it is a restoration (not a forest establishment), you have available an area where there is already forest soil, with the appropriate structure and rich in suitable microorganisms. Forest restoration itself is about ensuring the return of biodiversity. It is worth taking care of a suitable selection of trees, typical for a specific area and habitat. It is advisable to consult your intention with the local forest manager, who can provide the necessary material support. It is important to preserve species variability so that a

monoculture does not arise, which is much more susceptible to the influence of adverse natural conditions (e.g., strong wind) and pest attacks than a forest with a diverse composition and with preserved levels typical of the given biotope.

Remedial work should include cleaning the area, assessing the losses, necessary treatment and planting. A key factor is the time it takes for our restored forest to become a beautiful mature enclave.

7.9. Forest friendly to large mammals

Podlesie, Poland
Białowieża National Park

Can large mammals live in my forest? First, we define what we mean by large mammals... in our imagination we see roe deer, deer, wild boar, elk or even bison. Whether and which of them will want to visit your forest depends largely on the region in which your property is located and its immediate surroundings. If you live in the mountains, you can forget about the presence of bison, but for the inhabitants of Podlesí, it can be a dream come true.

Let's take a look at selected species of large mammals in Polish forests (of course, we can't leave out the relatively rare king of the forest – the European bison!). When we long for their presence, we must know how to provide them with favorable living conditions. So, let's now think about the habitats in which you can meet individual animals and what they need to appear on our territory.

Let's start with the European bison (*Bos bonasus*). Over 2,200 European bison live in the wild in Poland (data from 2021). It is one of the largest animals living in Polish forests, it weighs up to 900 kg and is up to 1.8 m tall at the withers. Meeting a bison always evokes great emotions. However, it should be remembered that the European bison, although calm and majestic, is still a wild animal and can be dangerous when it feels threatened. That is why it is always worth keeping the appropriate distance. But let's get back to habitat conditions. Most of the bison live in Podlesie (including Białowieża Forest, Augustovské Forest, Knyszyn Forest), but they are also found in Western Pomerania, Wielkopolskie and Subcarpathian Voivodeships. The population of these animals is growing every year.

The occurrence of the European bison in the natural environment depends on the presence of mature tree stands and extensive forest complexes with mid-forest meadows. The basis of food for these large animals are herbs and grasses (making up 70 to 90% of the food) growing on the forest floor (especially on wetlands), occurring in clearings, meadows, and fields. The bison's diet includes bark and shoots of trees and shrubs, acorns and even

blackberry leaves. An adult individual eats 40-60 kg of food per day. So, let's summarize what your forest must have for European bison to live in it:

- Old growth.
- Neighborhood of a large forest complex.
- Proximity to an area where bison already occur naturally.
- Availability of food, i.e., fields, meadows.
- Availability of water.

The European badger (*Meles meles*) is one of the largest predators found in forests almost all over the country. Although the badger is relatively large (body length 90 cm and weight approx. 20 kg or more), it is quite difficult to meet. It is usually active at night and sleeps safely in its burrow during the day. Mixed and deciduous forests with rich undergrowth are suitable for badgers, preferably adjacent to agricultural land. It is interesting that this mammal willingly lives even in old orchards and is not particularly bothered by the close presence of humans (it happens that it chooses culverts or holes under residential buildings for its den. The badger is essentially an omnivore and adapts to resources near its burrow. The basics of its diet are earthworms, insects, small and young mammals, birds, carrion, cereals, and fruits. What conditions will be favorable for the appearance of a badger in your forest?

- Mixed or deciduous forest.
- Rich undergrowth - numerous bushes.
- Proximity to fields.
- Burrowing conditions.
- High biodiversity - food source.
- Access to water.

Red deer (Cervus elaphus) is the largest ungulate inhabiting Polish forests after the moose. It measures up to 140 cm at the withers and weighs up to 210 kg. Its presence is characteristic of mixed and deciduous forests. Due to the impressive antlers of the males, deer prefer light forests with not too dense undergrowth. They are found all over the country, in all major forest complexes. The basis of deer food is plants, especially young shoots, leaves, bark and fruits of deciduous trees and shrubs, but also grass. In winter, due to lack of food, deer eat dry grasses, mosses, lichens, and young shoots of conifers. If deer are near cropland, they will appreciate beets, cabbage, potatoes, and grains. Deer are shy animals and do not feel comfortable near people. So, can it appear in your forest? Yes, if your forest:

- It is part of a larger forest complex or is in its immediate vicinity.
- It is a quiet area that is not intensively visited by people.
- It does not have a dense undergrowth but provides a food base.

Foresters feed forest animals, including deer, in winter. It is important that you do not feed them yourself without consultation. Deer are still wild animals that shouldn't get too used to people.

The roe deer (*Capreolus capreolus*) is probably the most popular mammal of Polish forests and fields. A doe is often mistakenly called a female deer. It is therefore necessary to emphasize that the roe deer is a separate species that measures approx. 90 cm at the withers and weighs 35 kg, so it is much smaller than the red deer. Roe deer lives practically in all deciduous and mixed forests and thickets in Poland and has adapted to life in fields and even gardens near people. The basis of its diet are grasses, leaves, mushrooms, forest fruits and herbs. Can a deer spawn in your enclave? Yes, most likely provided that:

- It is a deciduous or mixed forest.
- There are agricultural lands in the vicinity.
- The area is rich in food.
- The territory is not crossed by very busy roads, which hinder migration.
- In or near the forest, there are thickets and bushes in which it can hide.

As with deer, do not feed fawns without consulting them. They are wild animals and trying to domesticate them reduces their chances of survival.

The wild boar (*Sus scrofa*) is a common and the only wild species of the Suidae family in Europe (height at the withers 110 cm, weight up to 320 kg). Although it is considered a pest by farmers due to crop damage, its presence has a positive effect on forest ecosystems (e.g., it reduces the number of insect larvae wintering in the soil). It mainly inhabits areas with high forest cover. It feels best in deciduous and mixed forests, which provide it with shelter and food. The wild boar is omnivorous. Acorns and beech are the basis of his diet. In addition, it finds earthworms, insects, small rodents, plant rhizomes, fungi and even carrion in the undergrowth. In the case of proximity to agricultural fields, the wild boar can cause great damage to crops, especially tubers and corn. The probability of a wild boar appearing in your forest is very high due to its widespread occurrence and low habitat requirements.

The European moose (*Alces alces*) is one of the largest terrestrial mammals in Europe, measuring from 1.5 m to 2.3 m at the withers and weighing up to 800 kg. It is characterized by long strong legs and impressive antlers with typical shovels. Moose are extremely difficult to encounter, especially because of the habitats they choose. They mainly inhabit moist forests and moist wooded areas, swamps, bogs, floodplains and the surroundings of lakes and rivers. They retire to coniferous forests for the winter. Currently, the population of moose in Poland is estimated at 21,000 (note: Moose is a critically endangered species in the Czech Republic.) It is a herbivore and its diet consists mainly of green plants – water and mud in summer and undergrowth plants, pine and spruce needles, bark and tree shoots in winter. In addition, moose feed on grasses, sedges, leaves, buds, fruits of shrubs, shoots of

deciduous trees (willow, alder, aspen, birch) and young conifers (especially pine). Whether moose appear in your enclave depends on natural conditions. Damp and wetland forests and the proximity of extensive forest complexes will help its presence.
Of course, there are many more mammals living in Poland, so it's a good idea to look first in the surrounding forests. Assess whether they are deciduous, coniferous, or mixed, whether they are rich in water, what the undergrowth looks like, what is in their neighborhood and what food base they can provide for game. Go for a walk and observe the tracks of the animals that live here. These will give you the most valuable clue as to what animals may also appear in your forest. Contacting the local forester will also be a valuable source of knowledge. Remember that the forest is a living organism that is governed by its own laws. Observe nature and work with it instead of working against it and fighting for sometimes unrealistic and unattainable dreams.

7.10. Forest therapy or forest bath?

Supraśl, Podlesie, Poland
Polskie Lasy Państwowe

Have you ever noticed what happens to your body and mind while walking in the woods? We have long known that the forest has a calming effect on us, thanks to essential oils, forest bacterial flora, the right amount of sunlight, humidity, etc. The forest is full of natural stimuli affecting all our senses. All this has a positive effect on the process of relaxation and regeneration (including stimulation of the sympathetic nervous system, normalization of blood pressure and blood sugar levels). However, let's go back for a moment to the aforementioned bacterial flora of the forest. Did you know that *Mycobacterium vaccae*, present in forest soil, has been the subject of intensive research by scientists from all over the world for many years? So far, they have managed to prove that it has an anti-depressant effect on humans, among other things, by stimulating the production of serotonin (i.e., the hormone of happiness). It is estimated that the very stay in the forest affects our immune system, supports its function, and stimulates the endocrine system to self-regulate. But how do we know all this? In the 1980s. in Japan, for the first time, they began to conduct scientific research on the effects of the forest environment on humans. Since then, several serious scientific publications focused on this issue have been published, and the topic is being further researched.

Although often used interchangeably, forest bathing and forest therapy are two different things. A forest bath is a stay in the forest, during which you concentrate on what surrounds you, on the sounds, colors, and smells. You can enjoy swimming in the forest alone or in the company of someone else, or with a trained guide.

Forest therapy is a form of treatment, it is a therapy that should be done with the support of a qualified therapist to help you recover mentally. Forest therapy can be a complementary therapy in the treatment of depression, post-traumatic stress disorder, etc. Unfortunately, especially in Polish literature, these two concepts are ambiguous and merge into one. Here, we will focus more on forest baths, which can be performed by everyone individually.

Is every forest suitable for medicinal purposes? Yes, but not completely. For relaxation purposes, light forests with clearings, streams, and rivers, with clearly defined paths, are much more suitable. A light forest with a clear structure and not too dense undergrowth is clearer for us, more sunlight falls on the forest floor, and therefore we feel safer in it than in a dark, dense forest. The sound of running water, especially in the form of small streams, has a calming and relaxing effect on our nervous system. And clearly marked paths allow us to keep our bearings, so we can focus on what we see, hear, and feel without worrying about getting lost. Is it better to choose a coniferous, deciduous, or mixed forest for forest bathing? The first scientific studies indicate that coniferous forests have a calming effect on our organism mainly thanks to the turpentine and essential oils they secrete. Deciduous forests, on the other hand, have a stimulating effect on us thanks to the amount of leaves that move in the wind and rustle under our feet, thereby providing additional stimuli to our brain. It is best to choose a forest in which we feel good and which we like.

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Can my own forest be a therapeutic forest? Sure! Although depending on the terrain, the species composition or even the compactness of the stand, it may require intervention. You may want to create a road network, or the growth will need to be pruned. In any case, it is advisable to consult the local forest manager about your intention and find out what the forest management plan drawn up for your area says.

If you are interested in the topic of forest therapy and forest baths, learn more about it. Recently, this topic has become topical and quite a few publications have been written. Psychiatrist Dr. Katarzyna Simonienko, who is one of the leading pioneers of forest therapy in Poland and who in recent years has written several interesting books about the secret of 'using the forest'.

7.11. An untouched forest.

Świnna, Żywiec, Silesia, Poland
Private owner

When we hear forest, we usually imagine a pristine area with centuries-old trees and lush wild vegetation. Could this be your dream forest? A forest without intervention? Let's start with what a forest without intervention is. This is a forest area that is excluded from any economic activities, which means that no logging takes place in it, no large machinery enters it, and the forest is left to its own devices. Whether and how the forest will function if left to itself depends to a large extent on the location and the type of neighboring land. It is important to preserve the self-regulating functions of the forest, and for this the participation of animals, including large mammals, is very important. Usually, forests without intervention become stands located in hard-to-reach places, such as mountain slopes, escarpments, or wetlands.

In the end, it will be somewhat similar to a primeval forest, but with the difference that in order to be able to speak of a primeval forest, specific conditions must be met, including the fact that the area is part of a large area of natural forest, close to the original species composition, and a large area of which the land was not previously used for agriculture.
In summary, a forest without interventions is a forest:

- Without settlement.
- Inaccessible.
- Biologically diverse.
- With lush vegetation.
- Without economic activity.
- Without human activities.

So, what should you do to make your forest like this? The answer is simple, let nature work and watch your forest become wilder and wilder.

7.12. The forest is rich in species.

Borne Sulinowo, West Pomerania, Poland
Stanisław Karłowski Foundation

Biodiversity is a very frequent word in recent years, which appears in various contexts and forms. But what does it really mean? Biodiversity is the differentiation of the natural environment. It is a term for many species of plants, animals, fungi, microorganisms, habitats. In other words, it is the natural diversity that surrounds us.

What kind of forest is rich in biodiversity? It is a forest in which there will be many species of plants and animals, which will be highly diverse, i.e., the opposite of monoculture. The forest is the most complex and richest terrestrial ecosystem found on our planet. But does this mean that every forest has rich biodiversity? Yes, if we consider only virgin forests that have not been transformed by man. A commercial forest, which is a monoculture, has much lower biodiversity. The main reason is the considerably limited number of tree species that can be found in the commercial forest, and this is indirectly reflected in the composition of the undergrowth and in the presence of animals.

So can your forest, whatever it is, become a biodiverse forest? Yes, but he will need your help. Unlike undisturbed forests (where no maintenance or management is done), a biodiverse forest may need your intervention. The basis of your actions should be the creation of a properly functioning green area. As with all events, the first step here will be a walk through your forest and neighboring lands. Analyze what is there now, how these areas are used and whether water is available. Maintenance, pruning and additional planting may be required. The selection of trees should be based on trees and shrubs typical of your area. By placing birdhouses or planting individual species of wild fruit trees on the edges, you will encourage the birds of your area. That's all? No, the biodiversity of your forest will also be supported by the previously mentioned bat houses, forest beehives or, in some places, leaving dense undergrowth for other animals. However, remember that all measures must be adapted to the character of the area in which your forest is located and that you should consult a local forester who will provide you with his knowledge and experience.

THE END.

Guidebook through
Forest Punk

Advices for creators of diverse forest enclaves

Cover photography: Agnieszka Fiszka-Borzyszkowska
Graphic design: Kristýna Boleslav

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