

# THE LIVING GARDENS HANDBOOK

HOW TO TURN YOUR GARDEN INTO A PARADISE FOR NATURE AND YOURSELF



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Living  
Gardens

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## IMPRESS

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### Further information

<http://www.interreg-athu.eu/livinggardens>

<http://www.global2000.at/livinggardens>

<https://www.balatonregion.hu/projekt/living-gardens>

## GREETINGS FROM COMMUNITIES

### **Ferenc Novák, Mayor of Zalakaros**

The show garden serves as a good example how to protect the endangered native animal and plant species. In the neighbourhood of the Thermal Lake, we implemented complex interventions to conserve the biodiversity. The flowering meadow provide important habitat for bees and insects. The deadwood, installed in the middle of the lake, serves as a resting place for migratory water birds. To protect animals, we also installed toad and hedgehogs houses, insect hotels, and bird and bat boxes. The applied solutions inspire visitors to implement similar measures in their own garden too.

### **Lajos Gál, Mayor of Gyenesdiás**

We established the show garden near the Diás Watermill, where we implemented various measures to protect biodiversity. Amongst others, we created wildflower meadow. We planted native deciduous trees and shrubs. We installed shelters, such as insects hotels and butterflies houses, to provide protection for the endangered animal species, while the dead wood arrangements and stone piles also provide habitats for small animals and insects. The show garden not only informs, but also motivates visitors to act and increase the diversity of species at their own gardens.

### **LAbg. Andreas Kollross, Mayor of Trumau**

As part of the Living Gardens project, we have dedicated ourselves to wild bees. Directly behind the municipal office, more flowering areas were created, a lean-to bed, a natural meadow and a lavender field. The lying dead wood supports beetles and wood bees and the wild roses serve as a nectar source for bees. In addition to a species-rich perennial flower meadow, willows were planted as early bloomers, and nesting boxes and a loamy sand mound were constructed for ground-nesting wild bees. The embankment of the Werksbach was landscaped with insect-friendly plants.

### **LAbg. Christoph Kainz, Mayor of Pfaffstätten**

We have created our Living Gardens show gardens in proven cooperation with committed citizens and the landscape conservation association at various locations in the village; among other things, we have also used traffic islands to create beds for rare, Pannonian plants. The biodiversity of the newly created flower meadow near the playground will show itself in all its glory next spring, and a reptile castle made of stones will provide shelter for lizards.

### **Alfred Reinisch, Mayor of Tattendorf**

In our Living Gardens show garden we have installed four different habitats. First, the visitor sees the toad pond in the water habitat. Adjacent to it there are natural flower meadows but also the wild corners. The deadwood arrangements are real eye-catchers: standing piles, lying trunks or the pile of branches with a so-called wood cellar. And if you want to make yourself comfortable, you can use the dry stone walls to rest and watch the reptile castle and the sandarium from there.

## I. INTRODUCTION OF LIVING GARDENS

### Why should you do something for biodiversity in your garden?

A nature-oriented garden is not only a beautiful recreation space for humans, it also serves as a habitat for many plant and animal species. There is enough space for all of them, filling your garden with life and diversity.

### A global Biodiversity crisis – and what your garden can do about it

Nature is disappearing everywhere, in faraway places but also at home in our own country. Our forests, fields and gardens are increasingly uniform. Scientists are already talking about a species extinction on the scale of the one, which ended the times of the dinosaurs. Only this time, humankind itself, and not a comet, is the driving force. Now is clearly the time to act! One way how you can support biodiversity is by giving plants and animals spaces to live and dwell in your own garden. The intention of this booklet is to help you do so. It is not difficult to turn your garden into a little ecosystem that can become the home of wild bees, butterflies, birds and many others.

Ecosystems are networks of animals and plants that are interrelated in a variety of ways - as food suppliers, pollinators nesting places or homes. We humans are also inextricably linked to the environment – for the same reasons. Our food comes from plants and animals, we enjoy being outside and it benefits our health. Nature inspires us with her beauty and our kids use it as playground.

### General rules for ecological gardening / A healthy variety for a living greenery

#### Do's

#### 1.) INTRODUCE NATURAL GARDEN ELEMENTS & SPECIAL HABITATS

Various natural garden elements help design your garden in multiple ways, offer a habitat for a diversified world of animal and plant species and create space for a balanced cycle of nature. The latter, in combination with near-natural garden cultivation, develops into long lasting harmony.

Special habitats can accommodate animal and plant species which would otherwise have more difficulties in finding a habitat in a garden. This natural garden element comprises moist biotopes and also dry biotopes. Low-growing plants lap around the joints and cracks of dry-stone walls, in which many useful creatures find accommodation. A pond, whether big or small, enriches the garden through the element of water, thereby offering a place to live also for animals and plants requiring a moist environment.

#### 2.) PREFERENCE FOR NATIVE PLANTS

A diversified greenery including deciduous trees, even climbing plants, wild shrubs, perennial and annual flowers not only delights humans over the whole year with its floral diversity, its fruits and colours in autumn or structures in wintertime. It is also an important habitat for insects, birds and mammals, providing them with shelter, nesting and food. Local woods are particularly precious: the more diversified the species composition, the better it is. Typical regional shrubs are particularly well adapted to the location.



Fig.: Native animals are best adapted to native plants.

### 3.) LET IT GROW: FLOWER MEADOW AND MEADOW ELEMENTS

Meadows delight us thanks to their colourful and rich variety of flowers, as well as the ever-increasing number of insects visiting. Many meadow plants are irreplaceable for the insects that are useful for the house garden. Already smaller meadow spaces are considered as important natural garden elements for fostering useful creatures. Whether small meadow islands or large wild flower meadows, the natural gardener mows these areas twice or three times a year, thereby making the seeding of flowers and herbs possible.



*Fig.: Let it grow and bloom.*

### 4.) ALLOW WILDERNESS TO EMERGE: THE UNCONTROLLED GROWTH OF PLANTS AND A WILD CORNER

Many “weeds” turn out to be medicinal herbs or, at least, attractive wild herbs. Plants that come to the garden by themselves and blossom enrich variety, cover and protect the soil, attracting many useful creatures. In a lawn, herbs are seldomly, such as dandelions or daisies, for example. The natural lawn is made up of grasses and the most different kinds of herbs.

Hedges or shrub beds trimmed with rarely mown wild flowers allow plants to selfseed. Also the flower bed or the joints of slabs offer space for slow-growing plants which nevertheless cover the soil. Many small niches are offered by a wild corner. The most distinctive feature of such an area is the fact that it is practically left on its own except for rare procedures, along with a quiet location. In many cases, it is the “sprawlers” among the plants that spread, such as stinging nettle, ghostplant, burr or ashweed, which are irreplaceable for insects.



*Fig.: Wild corners with spontaneously growing plants are a booster for biodiversity.*

### 1.) DON'T USE CHEMICAL-SYNTHETIC PESTICIDES ("POISON")<sup>1</sup>

Preventive plant protection keeps your plant healthy! The selection of sturdy plants, at least 80% indigenous plant species typical for the location, resilient crop and ornamental plant varieties, sustainable and gentle soil management and the promotion of beneficial organisms make near-natural garden care possible. As a result, the use of chemical pesticides is no longer necessary.



*Fig.: Pesticides are a threat to beneficial insects and other living beings.*

### 2.) DON'T USE CHEMICAL-SYNTHETIC FERTILIZERS ("ARTIFICIAL FERTILIZERS")

Composting, preparation of herbal manure, mulching and green manuring provide the basis for the supply of nutrients, as well as for the preservation and development of a healthy soil in the natural garden. Chemical-synthetic fertilizers, in contrast, are water-soluble and can seep into the groundwater, thereby contaminating our drinking water. Should your garden plants require any additional nutrients, use organic fertilizers, preferably compost.

### 3.) DON'T USE PEAT

Peat mining destroys the moorlands, which have become rare. Moreover, products containing peat are transported over long distances, CO<sub>2</sub> is also emitted into the atmosphere when used in gardens. Therefore, in the natural garden, peat is neither used in the garden area nor in case of potted plants. If you use packaged potting soils, please make sure that the soil mixtures offered contain no peat.



*Fig.: Peat belongs in moorlands.*

<sup>1</sup> Pesticides that comply with the EU-organic regulations or the „Natur im Garten“ criteria are allowed [[ [https://www.naturimgarten.at/files/content/2.%20UNSER%20ANGEBOT/2.8%20NIG%20G%C3%BCtesiegel/Natur%20im%20Garten\\_G%C3%BCtesiegel\\_Kriterien\\_2019.pdf](https://www.naturimgarten.at/files/content/2.%20UNSER%20ANGEBOT/2.8%20NIG%20G%C3%BCtesiegel/Natur%20im%20Garten_G%C3%BCtesiegel_Kriterien_2019.pdf)]]

## Which animal groups and what species can be promoted in your garden?

Gardens can be as different as their owners – and depending on their size, their features and their location they might attract a different set of species. Generally speaking gardens can be a perfect and valuable habitat especially for those species that we used to find in our traditional cultural landscapes before they were turned into monotonous landscapes without habitats and food for animals. Especially many insects – from wild bees, beetles to butterflies – but also reptiles, amphibians, small mammals and birds are often found in gardens. From all the possible species that you might encounter in your nature garden we have selected a set of 7 plants and 7 animals as flagship species or groups. Their common characteristics are that they are settled in the Pannonian region and are (or were) often found in landscapes dominated by extensive agriculture, such as arable land, grassland or special crops. They are also easily recognizable by laypersons, which makes them easy to detect and the measures to promote them are well known and tested. Additionally the measures suggested to help them also help numerous other species with similar habitat requirements.

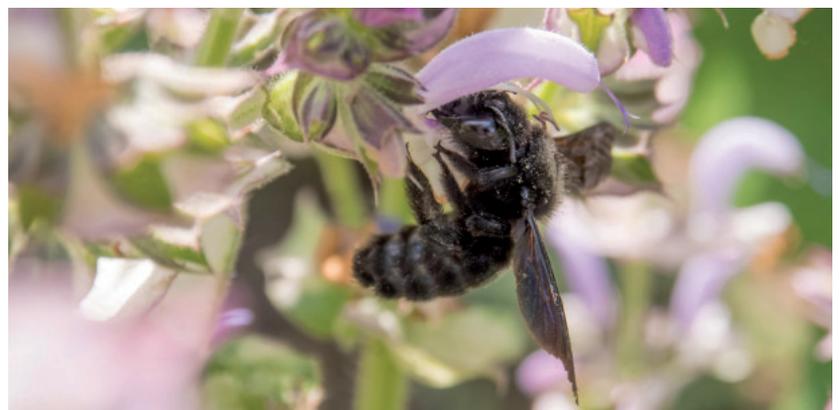


Fig.: Living Gardens are home for many rare species.

# THE LIVING GARDEN FLAGSHIP SPECIES

## ANIMALS

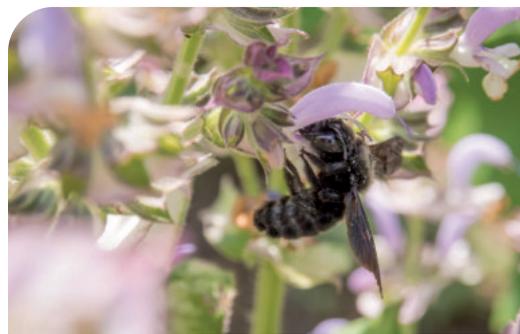


**GREEN LIZARD**  
(*Lacerta viridis*)

**STAG BEETLE**  
(*Lucanus cervus*)



**ALPINE LONGHORN BEETLE**  
(*Rosalia alpina*)



**WILD BEES**  
(*Xylocopa* sp.)



**BATS**  
(*Chiroptera*)

**SOUTHERN FESTOON**  
(*Zerynthia polyxena*)



**EUROPEAN GREEN TOAD**  
(*Bufo viridis*)



**VINEYARD SNAIL**  
(*Cepaea vindobonensis*)<sup>2</sup>

## PLANTS



**AUSTRIAN SAGE**  
(*Salvia austriaca*)<sup>3</sup>

### SAW-LEAVED SPEEDWELL

(*Veronica austriaca* ssp. *teucrium*)



### PASQUEFLOWER

(*Pulsatilla (Anemone) vulgaris*)<sup>4</sup>



**SMALL-FLOWERED SWEET BRIAR**  
(*Rosa micrantha*)



**EASTERN MARSH FERN**  
(*Thelypteris palustris*)

### TEASEL

(*Dipsacus* sp.)



### CHAMOMILE

(*Matricaria chamomilla*)



<sup>2</sup> The photo is made by xulescu\_g. The image is used under „Creative Commons Attribution-Share Alike 2.0 Generic“ (CC BY-SA 2.0) license.

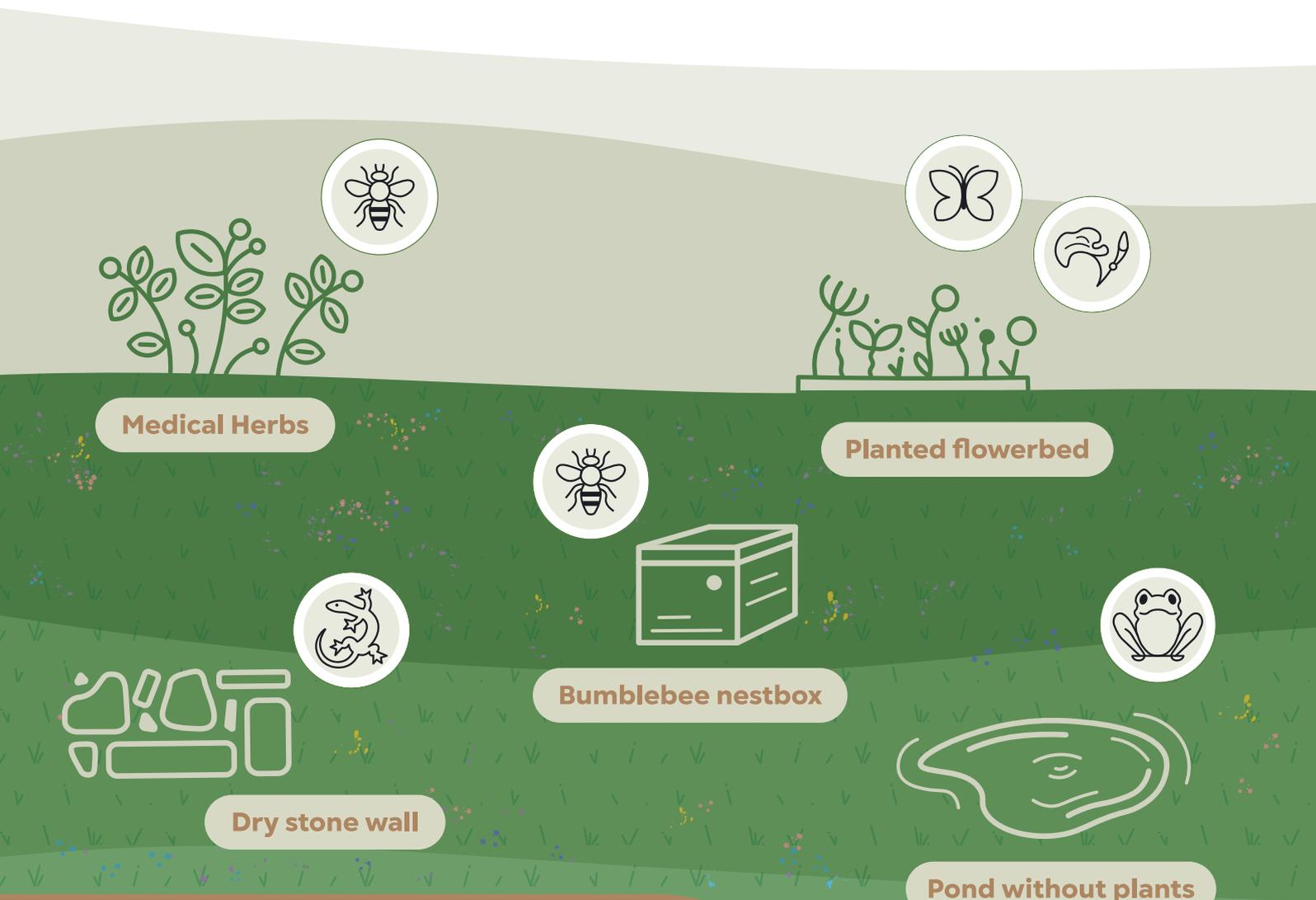
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<sup>3</sup> The photo is made by Stefan.lefnaer. The image is used under „Creative Commons Attribution-Share Alike 4.0 International“ (CC BY-SA 4.0) license.

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# HOW DOES AN IDEAL LIVING GARDEN LOOK LIKE?



**Stag beetle**  
*Lucanus cervus*



**Southern festoon**  
*Zerynthia polyxena*



**European green toad**  
*Bufo viridis*



**Alpine longhorn beetle**  
*Rosalia alpina*



**Birthwort**  
*Aristolochia clematitis*



**Green lizard**  
*Lacerta viridis*



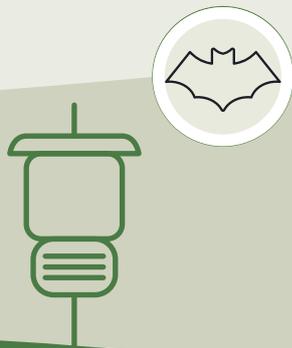
**Wild bees**  
(e.g. *Xylocopa* sp.)



**Bats**  
(e.g. *Chiroptera*)



**Vineyard snail**  
*Cepaea vindobonensis*



Bat box



Natural meadow



Bird nestbox



Pond with plants



Insect hotel



Trunks lying

Trunks standing



Sand lens



Reptile castle



Dead wood pile

## II. DIFFERENT LIVING GARDEN BIOTOPES

### 2.1 Meadows and flowering areas

#### 2.1.1 NATURAL MEADOWS IN SETTLEMENT AREAS - IMPORTANT STEPPING STONES

Every square meter of flowering meadow area brings food and habitat for hundreds of insect species, which in turn are food for songbirds and other small animals. The denser the network of such flowering areas is, the more likely the animals have a chance to move from one meadow to the next and find enough food, habitat for development and - very important - also for overwintering. The closer foraging areas, nesting and mating sites are to each other, the more energy female wild bees, for example, save when building their nests, and the more offspring they can produce.

What many people do not know - meadows, even the most colourful, species-rich ones, are a human-created and shaped habitat that is historically only a few centuries old and dependent on mowing for its continued existence.



Fig.: Natural meadows and meadow-like areas are important stepping stones for many living creatures.

#### Creating a biodiverse meadow – step by step

The development of a flower meadow requires patience, because many meadow plants need several years of growth until they bloom. Some species, such as mullein, also flower only once, meaning that after several years of developing a rosette, they die after flowering, must go to seed, and then only develop again from seed. Some species from cover crops, such as poppy species, are field plants that bloom in the first year and then disappear. But patience is worthwhile, because the garden owner is rewarded with one of the most beautiful and species-rich habitats in our latitudes.

#### STEP 1: CHOOSING THE RIGHT SEED

Using the right seed is the key to the successful establishment of flower meadows.

The first requirement is that the seed actually consists of meadow plant species. Many inexpensive „flower meadow“ seed mixes available in stores actually contain almost exclusively annual field weeds such as poppies, toad-flax, dogseed and cornflowers. They bloom profusely in the first year. The next year, they are already gone because they depend on annual plowing of the area. Many meadow plants, on the other hand, are perennial - which means that they live more than two years. Some bloom in their first year, while others take a few years to come into bloom and then bloom annually. In a professional wildflower meadow mixture, therefore, meadow species that develop at different rates are selected, and a few field weed species such as corn cockle are mixed in as a cover crop for the first year, so that spectators are not disappointed. From the next year on, the meadow species will take over the flowering aspect. It takes several years for the area to fully develop and for all the sown plants to actually bloom! But with the right care, the meadow will remain colourful and diverse for decades without much further effort.

The second important seed-requirement is the selection of native and, preferably regional meadow plant seeds. Even a few kilometres away, rainfall, temperatures and soil conditions can vary significantly due to geographic location. The regionally occurring plants of a species are adapted to these different conditions. Wild plants from the region are therefore usually also best able to cope with the conditions of the region, are more robust, less suscep-

tible to disease and thus mean the least maintenance in terms of work and costs. Seed mixes from distant states or neighbouring countries are therefore not recommended. Many species - especially insects, including many butterflies and wild bees - are dependent on very specific native plant families or plant species because they have evolved together over hundreds of years. The more of these plant species an area hosts, the more wildlife species it provides food and habitat for. Mullein, for example, is a food plant catering about 90 insect species.

### **Expert Tip: Where can I get native seeds?**

In Austria, the REWISA network can supply regional, strictly certified wildflower seeds for the whole country according to the specific soil and site conditions. In Hungary, the "Őshonos Vetőmagok Boltja" is specialised in the sale of native plant seeds. In the webshop we can choose from a wide range of seed mixtures, finding the most suitable ones to the local soil and climate conditions.

### **STEP 2: THE RIGHT TIMING**

In the Pannonian region, due to the spring drought, the planting of a flower meadow is recommended exclusively in the fall until the end of October at the latest, in any case before the first ground frosts. The germinating young plants then use the winter moisture to form deeper roots.

### **STEP 3: PREPARATION OF THE AREA**

Meadow plants require open soil and light for germination. Therefore, the seed must not be scattered directly into an existing meadow or lawn. For seeding, the area is turned over, the sod is completely removed and the soil is pulled smooth. Skimming with sand is usually not necessary - contrary to many tips in the literature - as there are suitable meadow plant species for every soil. Sand is a very valuable and highly demanded raw material worldwide, the extraction of which involves great destruction of nature. If you still have to lean with sand in very loamy, heavy soils, you should use, for example, old sandbox sand that is no longer used.

### **STEP 4: SEEDING**

The seed is now spread onto the soil surface - it must never be worked into the soil or covered with soil, as most meadow plants need light for germination. If the soil is very dry, water carefully once immediately after sowing so that the seed is not blown away. Seeding on lightly moist soil is optimal.

Do not water afterwards! Do not fertilise under any circumstances!

If you already have a meadow with flowering herbs in your garden and would just like to make it more species-rich, we recommend partial sowing, in which only a few square meters are broken up and sown in an island-like manner. In the next few years, the meadow plants will then spread to the surrounding meadow.



*Fig.: Seeds must be spread on open ground.*

### **STEP 5: MAINTENANCE OF THE FLOWER MEADOW**

**Do not water:** In general, wildflower meadows should not be watered because the plants must manage themselves with the habitat conditions that exist on site. Watering often encourages fast growing, undesirable ruderal species that can suppress wildflowers.

**Mowing:** Meadows need regular mowing, otherwise competitive grasses will soon dominate, causing flower diversity to disappear because the plants lack the light and open ground to grow and to germinate young plants. Mowing always means that the cut grass must be well removed from the area and open soil gaps are revealed. If the cut grass is left lying (mulching), again the herbs are stifled and the meadow becomes grassy. In order to preserve herb rosettes, which often develop in the previous year for the next year, mowing should not be deeper than 8 cm, better at a height of 10 cm.

In the dry Pannonian region a single mowing is usually sufficient and is best done before the end of June. It is optimal to stagger the mowing, i.e. for example to mow one part at the end of June/beginning of July and a second part only at the beginning of August and to exchange the two parts annually. In this way, later-flowering species are also able to seed and an important food supply remains available for many insects.

### **Expert Tip: Valuable even without flowers!**

Many meadow inhabitants are not flower visitors at all. A widespread misconception is that meadows are only of value to insects when they are in full bloom. Once the grass turns brown, there is often a public need to mow the messy areas after all. Why should you not do that? On the one hand, flowers can still be found in these areas in the fall as well, providing food for flying flower visitors. This is usually not visible from a distance. For this, one has to venture into the meadow and observe the multitude of butterflies, wild bees and hoverflies.

On the other hand, there are also developmental stages of flower visitors - such as butterfly caterpillars! - and many other insects such as grasshoppers, cicadas and beetles, which eat other parts of the meadow herbs and grasses, pupate on them or in them and do not need flowers to live, but very much need the late mown meadow! Also many bird species - insectivores and also species such as goldfinch and serin, which collect seeds, benefit from the abundant food supply.

## **2.1.2 WILD CORNER - LETTING NATURE BE NATURE**

Wilderness areas are disappearing from our planet. Although it is of course not possible for us to turn our gardens into wilderness areas that attract wolves, bears or other large iconic animals, which we probably would not want to have in our gardens anyway, you can easily create a small wilderness spot in your garden.

This will not only attract many small animals from beetles to butterflies or depending on size and maturity also some smaller mammals like hedgehogs – it will also spare your time and provide you with a fantastic spot to observe and dwell in an (almost) natural ecosystem. What do you need to do? Well: Nothing! Or almost nothing.



*Fig: Wild corners are possible in every garden.*

### **STEP 1: FINDING A GOOD PLACE**

The first step is to select the spot in your garden where you want nature to take over. The thing to keep in mind is that size might matter. If you, for example, want to attract butterflies to the stinging nettles in your garden they need to cover at least 1 m<sup>2</sup> – otherwise the butterflies will not lay their eggs as the food supply would not be sufficient for their caterpillars.

## STEP 2: HANDS OFF!

The second step is to leave this spot alone – but (like any good national park manager would do) keep observing it. Depending on environmental factors like amount of sun, soil quality, moisture, different types of plants will settle – and with them animals which feed or nest on them. The characteristic of the plant and animal communities in your wilderness-spot might change over the years – new plants or new animals might take over and change the appearance of your mini-nature-reserve.

## STEP 3: MAINTENANCE – IF NECESSARY

Finally at the end of the growing season there is a maintenance measure you might have to take. If your wilderness spot includes meadows you should mow them at the end of the year - as you probably will not have bison roaming your garden to take over that job.

### 2.1.3 PLANTED FLOWERBED

Colourful flowering beds with perennials are an attractive eye-catcher with relatively low maintenance requirements. They can also benefit numerous insect species when planted with native perennials or close relatives. Because perennials grow back every year, new bedding plants are not needed each year. This helps save time and money!

For the Pannonian region, selected nurseries have a wide selection of native wild perennial species that tolerate low nutrients, drought and heat well and rely on good soil permeability as found in a perennial bed. These species include thistle, spurge, mullein, man's bedstraw, alanth, flax, leek, aster and baby's breath species as well as many herbs such as sage and thyme species, oregano and rosemary.



*Fig: Flowerbeds with native plants can be an absolute eye-catcher.*

## STEP 1: CREATING THE FLOWER BED

Select a sunny place for the bed. Dig the area 20-30 cm deep and lay a geotextile. Use as substrate a mixture of 40% gravel (grain size 0-16 mm), 50% gravel/angular grain (grain size 8-16 mm) and 10% compost of good quality.

## STEP 2: PLANTING

In the Pannonian region, the planting time is exclusively in the fall, so that the plants can develop a good root system with the winter moisture.

Dig the planting holes, insert the plants and water them. Apply gravel/angular grain (grain size 4-8 or 8-16 mm) on the bed surface. In any case, the plant balls must be completely covered with the gravel, otherwise they will dry out.

## STEP 3: MAINTENANCE

The maintenance effort is low. Pruning of perennials should be done once a year - a part of the plants in autumn, a second part of the plants only in early spring - so there is always a shelter, a wintering possibility and food for insects, or in case of fruits and seeds also winter food for birds. Removal of weeds and foliage, etc. can be necessary up to three times a year. Watering should be done as needed, which is usually only during drought. During the growing season of the first one or two years, take good care that the plants have enough water, as the root systems still need to develop. However, do not overwater under any circumstances, as the drought-loving species do not tolerate this!

### Expert Tip: Enhance the habitat

The beds can also be further decorated with deadwood logs and larger stones, thus creating shelter for many animal species at the same time - from insects to lizards.



Fig.: Traffic island before and after planting native plants and creating natural structures with deadwood and sand.

### 2.1.4 HERBS & MEDICAL PLANTS

Plant biodiversity in your garden is not only beneficial for many insects and other animals – it can also contribute to your own health and well-being! The rich flora of the Austria-Hungary cross-border area includes a large number of medicinal plants. In general, medicinal plants, i.e. herbs and spices, do not require any extra care. Therefore, it is relatively easy to create a herb garden at home, which is not only beautiful and fragrant, but also very useful. Maybe there are already medicinal plants in your garden, just you know them as herbs or spices, like rosemary, oregano, lemon balm and thyme.

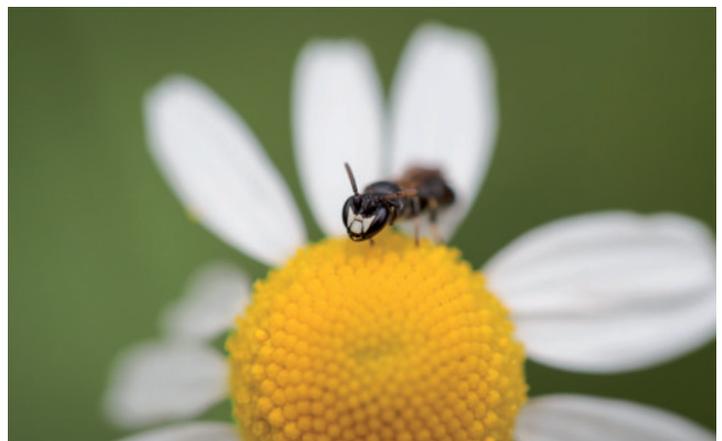


Fig.: Healthy herbs such as chamomile and lavender are good for people and for bees.

Most herbs require sunshine and nutrient-rich soil. However, they can also be grown in pots and containers in the backyard or on the balcony with almost no gardening knowledge.

Although most herbs require a minimum of 6-7 hours of sunlight a day, there are some herbs that can tolerate partial shade as well. For instance, it is recommended to plant lavender, basil, rosemary, juniper, coriander, borage, sage, oregano and nettles in sunny areas. Angelica, lovage, strawberry, mint, chives and lemon balm prefer partial shade, while comfrey, valerian and common lungwort tolerates shade as well.

### Some garden herbs that are good for you and good for bees



**Basil:** is good for stomach spasms, loss of appetite, intestinal gas, kidney conditions, fluid retention, head colds, warts and worm infections. It is also effective to treat snake and insect bites. Moreover, it is recommended for women to use it before and after childbirth to promote blood circulation, and to start the flow of breast milk.



**Peppermint:** is effective for treating headache, muscle aches, joint pain and itching. It is also good for curing coughs and colds, reducing pain, improving mental function and reducing stress.



**Lemon balm:** is a calming herb. It is effective for reducing stress and anxiety, promoting sleep, improving appetite, and easing pain and discomfort from indigestion.



**Rosemary:** is a stimulant and memory enhancer plant. It is effective for treating headaches, digestive problems and gallbladder problems.



**Marigold:** is effective to treat skin problems, including minor skin injuries, inflammation, contusions, bruises and varicose veins. It also promotes wound healing for eczema and sunburns.



**Lavender:** is a sedative and muscle relaxant plant. It is effective for treating headaches, insomnia and digestive problems.

#### Expert Tip

Also many wild herbs and weeds have health benefits for us humans! Here are three very common and very healthy plants that are most likely already grow in your garden.

**Stinging nettle:** The stinging nettle cannot only be used to make delicious spinach; good tea can be made from its young leaves, which has diuretic and anti-inflammatory effect, and can be used especially for cystitis and urinary tract infections.

**Ribwort Plantain:** From the leaves of ribwort plantain can be obtained cough-relieving tea, but also an instant remedy for wounds and stings.

**Chickweed:** Almost everyone knows chickweed from their own garden. For someones the vigorous herb can be a nuisance, but it is also a delicious wild vegetable and a very versatile medicinal plant. The ingredients of chickweed have a tonic, anti-inflammatory, stimulate digestion and metabolism and have a diuretic and detoxifying effect.

## 2.2 Hedges, shrubs and trees

### Woody plants have a lot to offer!

They form valuable structures in the garden – all year round. The native shrubs are adapted to the location and therefore very robust. With colourful fruits and leaves, they are not only eye-catching for us humans.

Mixed hedges are based on the model of nature. They create important transition zones to it. Especially nearby habitats with completely different characteristics, such as lawns, water surfaces, trees or forests, they increase the biodiversity in the garden through urgently needed nesting sites, shelter, wintering opportunities and food. Hedges but also solitary shrubs should always be accompanied by a herbaceous fringe, because numerous larvae find their habitat there. The lawn mower should therefore never cut under the crown!

### HOW MANY INSECT SPECIES ARE DEPENDENT ON THESE SHRUBS AS FLOWER VISITORS, LEAF EATERS, WOOD RODENTS, ETC.?

Wild shrub	Longhorn beetle Cerambycidae	Weevils Curculionidae	Bugs Heteroptera	Leaf bugs Acanthosomatidae	Moths Lepidoptera	Total
<b>Goat willow</b> <i>Salix caprea</i>	38	30	31	26	77	202
<b>Hawthorns</b> <i>Crataegus sp.</i>	10	48	19	13	56	146
<b>Blackthorn</b> <i>Prunus spinosa</i>	15	23	5	14	73	130
<b>Common hazel</b> <i>Corylus avellana</i>	25	23	24	16	22	110
<b>Wild roses</b> <i>Rosa sp.</i>	10	10	3	33	31	87
<b>Blackberry</b> <i>Rubus sect. Rubus</i>	-	13	7	29	32	81
<b>Alder buckthorn</b> <i>Frangula alnus</i>	6	-	3	2	28	39
<b>Common buckthorn</b> <i>Rhamnus cathartica</i>	6	-	3	2	28	39
<b>Common hazel</b> <i>Corylus avellana</i>	1	1	1	11	22	36
<b>Bloody dogwood</b> <i>Cornus sanguinea</i>	2	5	-	1	16	24
<b>Fly honeysuckle</b> <i>Lonicera xylosteum</i>	-	2	2	7	12	23
<b>Wild privet</b> <i>Ligustrum vulgare</i>	-	4	1	2	11	18
<b>Spindle tree</b> <i>Euonymus europaeus</i>	7	1	1	-	7	16
<b>Wayfarer</b> <i>Viburnum lantana</i>	2	2	1	2	6	13
<b>Gelder rose</b> <i>Viburnum opulus</i>	2	2	1	2	6	13
<b>Elder</b> <i>Sambucus nigra</i>	-	-	2	-	11	13

Source table: Reinhard Witt, „Wildsträucher in Natur und Garten“. 1985, Verlag Franckh/Kosmos, Stuttgart [www.reinhard-witt.de](http://www.reinhard-witt.de)



*Fig.: Shrubs and hedges are hiding places, habitats, food sources and structure building elements.*

## **A good start and a long life: how to plant shrubs and trees**

The right planting is the basis for a long life of our green woody partners.

### **STEP 1: CHOOSING THE RIGHT PLANTS**

There are many wild shrubs and trees that are beautiful and ecologically valuable garden companions. Depending on your wishes and requirements (e.g. if they should be fruit carrying, winter green or provide a good visual protection) there are different species to choose from. These two websites will help you to choose the right plants:

Shrubs: [www.willheckehaben.at](http://www.willheckehaben.at)

Trees: [www.willbaumhaben.at](http://www.willbaumhaben.at)

### **STEP 2: CHOOSING THE RIGHT PLANTING TIME**

Woody plants without soil (bare roots) are planted after the leaves are fallen and before budding is started. Planting material in the pot can be planted all year round, as long as the soil is not frozen.

### **STEP 3: CHOOSING THE RIGHT PLACE**

The amount of sunlight or shade needed depends on the type of your woody plant. Be sure to inform yourself about the specific requirements of your new shrub or tree. The planting distance is at least 1.5 m for free-growing hedges, and half the final diameter for trees. This is usually undercut and later leads to complex or unsuccessful pruning measures. If there is little space, shrubs in tree shape are suitable. Elderberry, hawthorn and lilac, for example, grow to a height of 7 m - 10 m.

### **STEP 4: PLANTING**

A good, loose planting pit is just as important as avoiding competition from emerging plants (grasses) in the planting disc, at least for the first 5 years. With mulch made of organic garden material (leaves, lawn clippings, shredded material), we ensure a good water balance in the root area as well as habitat and feed for soil life. For details see description of "sandwich-mulch method" below. Irrigation water hardly evaporates and in times of climate heating, shading and cooling of the root area is a key success factor.

## STEP 5: WATERING REGIME

At the start, the wood gets a large portion of water. Diameter of the bale in centimeters by 2 gives the minimum amount in liters. 35 cm diameter = 70 liters of water (7 watering cans!)

In the first year, 100 liters per m<sup>2</sup> per month are needed in addition to the precipitation, while in heat phases twice as much water is needed.

## The sandwich-mulch method



*Sandwich-mulch method © Natur im Garten/K. Weber*

**STEP 1 / PICTURE 1:** Removal of the turf - diameter 1.2 - 1.5 m

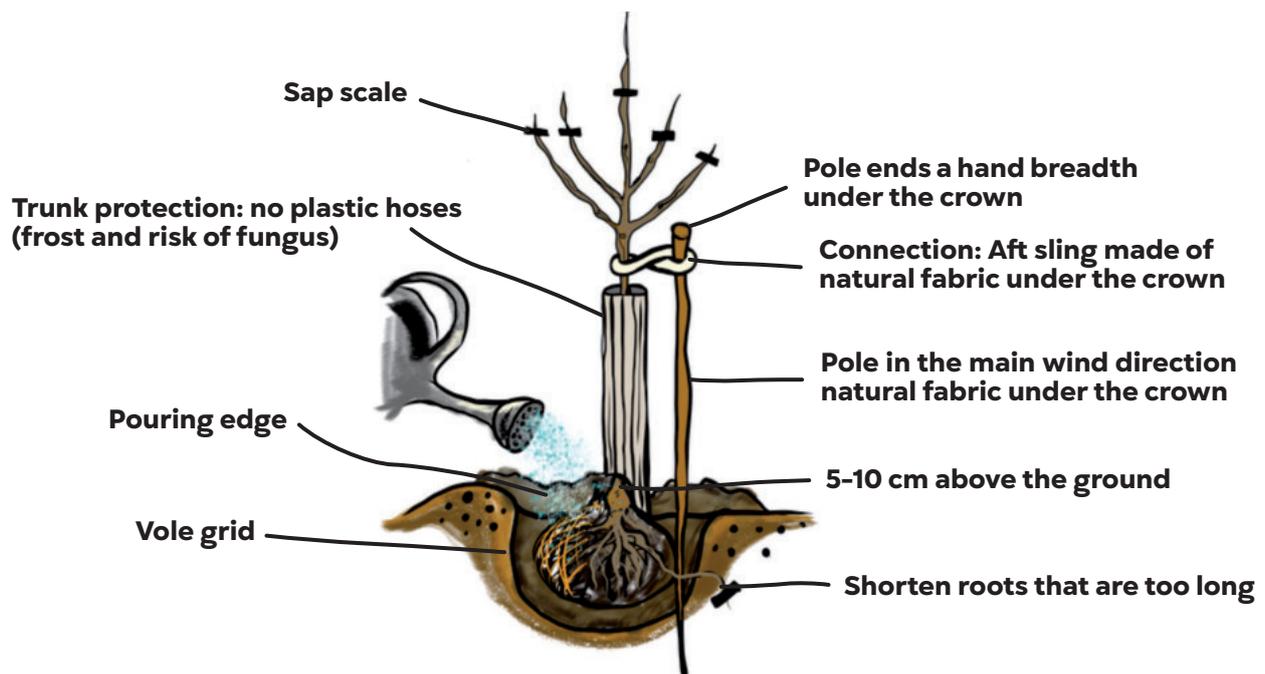
Applying compost or spreading horn shavings.

**STEP 2 / PICTURE 2:** Making a lightproof layer from cardboard. The germination of seeds and the growth of grasses are thus prevented.

**STEP 3 / PICTURE 3:** Applying mulch, depending on the material, a different application height is necessary. After 14 days, the mass moistened by dew or rain should form a compact layer of 8 - 10 cm height. Suitable materials: shrub chaff, lawn clippings (apply in thin layers, preferably dried), hay, straw, hemp hurds, flax hurds, miscanthus/china reed.

### Important

The trunk must be free of mulch material; distance to trunk about 5 cm; the log must be allowed to air off.



*Fig.: How to plant your tree or shrub?*

## 2.3 Stone Biotopes

Stones are an important habitat for an amazing number of species. They are colonized on the surface by lichens and mosses, which are themselves home to many small animals such as tardigrades and rotifers. The caterpillars of the lichen tardigrades - a group of butterflies - in turn feed on lichens. Under one or many stones live numerous species that seek a protected, dry place such as isopods, beetles, ants, spiders, ant crickets, small snails and many more. In larger cavities under stones, lizards, toads and newts can be found hiding from excessive heat and predators.

For heat-loving species, sunlit stones provide an important source of warmth - after all, they can heat up to over 50°C in the sun and retain this warmth well into the night. At the same time, it remains relatively cool under a stone or cairn. For many cold-blooded animals, whose bodies are always at ambient temperature, stones and stone habitats are therefore the ideal place to seek out the place with the right temperature at the right time. The warm one to become active, the cool one when it is too hot.

### 2.3.1 REPTILE CASTLE

By combining stones and wood, placed far into the ground, a reptile castle simultaneously provides a habitat for warmth-loving species as well as deadwood dwellers and a good hibernation site.

Lizards and other reptiles, as cold-blooded animals, need sunny places where they can warm up. At the same time, the animals are always on guard against enemies. With its combination of sunny stones that retain heat for a long time in the evening and good hiding places in the gaps, the reptile castle offers the ideal habitat for fence lizards. In the cold season, the reptile castle is used by numerous animals as winter quarters without ground frost.



*Fig.: The combination of stones and other natural elements such as flowers, hedges, deadwood or sand forms a great habitat for lizards and other animals.*

### Building reptile castle step by step

#### STEP 1: SELECTION OF THE RIGHT LOCATION

Ideally, the reptile castle is located in a wind-protected, sunny and quiet place in the garden.

#### STEP 2: DIG & BUILD UP

Dig a pit in the depth of one meter. The size of the pit should be about 3x2 meters. As drainage, a layer of gravel or sand ten centimeters deep is filled. Then, large stones and at least upper-arm-thick pieces of deadwood are layered in. It is important that cavities are always present - both in the pit and in the rising pile, because this is where the animals can hide. On the north side, the excavated soil is piled up against the castle.

#### STEP 3: MAINTENANCE CARE

Once completed, the reptile castle requires little maintenance. It should be ignored after creation so as not to disturb its inhabitants. Over time, plants will overgrow the castle and further enrich the habitat. Overgrowth of more than one-third and heavy shading should be prevented.

### 2.3.2 DRY STONE WALL

The construction of dry stone walls is one of the oldest known construction methods. This craft has been practised in Austria and Hungary for at least 3,500 years. Stones were laboriously collected in the fields and vineyards by hand in order not to hinder agricultural work. The stones were artfully stacked and wedged together to build walls, huts or wells. Since 2021, the craft of dry stone walling has been recognized as a UNESCO intangible cultural heritage.

By not using cement, dry stone walls are water-permeable and withstand heavy rainfall better than concrete walls. Dry stone walls are more robust against frost and plant growth. Properly built they can last hundreds of years due to these properties. Apart from human labor, their construction requires hardly any energy and spares resources and the environment.

For animals and plants dry stone walls offer varied habitats. Hot and sunny, cold and shady, dry and moist places are in close proximity. The numerous ungrouted interstices provide hiding places for lizards, snakes, amphibians, arachnids, and insects. Harmless field wasps use the cavities to build their burrows. They are important beneficial insects in the garden as they collect many herbivorous insect larvae. Wild bees, such as the black mortar bee, build their nests on the stones.

In shady areas, mosses, striped ferns, and wall cimbeworts green the stones. Sunny and hot spots are colonized by survivalists, such as various species of wall pepper, houseleek and saxifrage. The variety of plants makes the dry stone walls bloom colourfully and become an eye-catcher in the garden.

**Construction:** Detailed instructions on how to build a dry stone wall would go beyond the scope of this manual. Since the construction of a dry stone wall should be well planned, and requires know-how and some practice it is recommended to first attend a course for this purpose. In Eastern Austria there are numerous offers, for example at the Weinbauschule Krems (<https://ifs-krems.ac.at/>).

**Maintenance:** Once the wall has been erected, it requires little maintenance. Once a year, the wall should be checked for damage. Overgrown parts of the wall should be carefully uncovered so that no more than half of the visible surface of the wall is overgrown.



Fig.: Fundament and professional construction of a dry stone wall.



Fig.: The Common Wall Lizard (*Podarcis muralis*).

#### Expert Tip

Attention! Under no circumstances should stones be collected from the landscape for the construction of the dry stone wall. These are already valuable habitats for animals and plants and should not be removed from their surroundings. Obtain the stones best in reuse, for example, if an old stone house is demolished in the vicinity or stones are removed at a construction site nearby. If you buy the stones, avoid long transport routes and make sure that the stones were mined under fair conditions.



Fig.: Different types of stone walls with and without flowers.

## 2.4. Deadwood

Deadwood is full of life! Numerous animal and fungal species depend on deadwood. Over 1,300 species of beetles and 2,500 species of fungi live directly or indirectly from deadwood. Birds, bats, hornets, tree bumblebees, and numerous other animals require dead or old wood, hollow logs, or tree cavities to survive. In addition to its important role as a habitat, deadwood serves as a carbon and water reservoir, and thus fulfils important functions for climate protection and climate change adaptation.

Deadwood means diversity, but deadwood itself can be diverse and come in a variety of forms as well - whether it is a single dead branch on a living tree, a lying decomposing log on the ground, or a standing dead stump. Depending on the tree species, exposure to sunlight, the degree of decomposition of the wood, and many other factors, a wide variety of communities can develop in and on it.

Many deadwood inhabitants have become rare or are threatened with extinction today. Species that require large, old, slowly dying trees no longer find a habitat in commercial forests where trees are felled after 70 to 150 years, or in parks, where deadwood is often removed for safety reasons. Anyone who creates structures with deadwood in their garden therefore provides a valuable habitat for a wide variety of fascinating animal and fungal species.

### 2.4.1 DEAD WOOD PILE & WOOD CELLAR

A deadwood pile in a quiet corner of the garden or highly visible as a deliberately planned design element provides nesting, shelter and hiding places for numerous animals and beneficial garden organisms. Hedgehogs and toads use the cavities in the pile of branches as shelter. Many beetles, wild bees and hoverflies need deadwood for their development. If the pile is sunlit, lizards will be happy to have a safe place where the cold-blooded animals can sun-bath and get up to operating temperature.

In the cold season, numerous animals use the deadwood pile as winter quarters. If the deadwood pile is built in a pit, as a wood cellar, its inhabitants will find particularly good protection from ground frost there. This is how you can build a perfect deadwood pile with cellar in your garden:

**STEP 1:** Dig a two-by-two foot pit with a depth of one foot.

**STEP 2:** Gather branches of various thicknesses and sizes. Leftovers from the last shrub pruning can be used as well. The branches are placed vertically in the pit. Branches, roots and logs of various thicknesses are now loosely piled above the pit. It is important that cavities are always present - both in the pit and in the towering pile, because this is where the animals can hide.

**STEP 3:** Look after the pile. If the wood sinks over time, just refill the pit.



*Fig.: Pit gets filled with all types of wood to build a wood cellar for bugs, millipedes, reptiles, amphibians and others.*

#### 2.4.2 TRUNKS - LYING

Lying deadwood stores moisture, at least towards the bottom, and provides hiding places and hibernation opportunities for slow worms, frogs, newts and many small creatures. Invertebrates such as isopods, snails and worms are abundant here and in turn serve as welcome prey for vertebrates.

Lying deadwood is decomposed by wood-degrading fungi and numerous insects over a period of years. Depending on the species, thickness and microclimate, this process can take varying lengths of time. Soft woods such as poplar and willow can be completely decomposed within a few years. Lying beech logs are turned into humus within ten years when exposed to moisture. Hard, tannin-rich oak, however, can take decades to decompose.

Depending on the degree of decomposition, tree species, thickness, exposure and sunlight, quite different species of fungi and animals will make their home.

#### Instructions

Providing lying deadwood in your garden is super simple. A tree trunk, as thick as possible, is placed in a quiet corner of the garden, where it is allowed to remain for the next few years and slowly degrade into humus.

#### Maintenance care

If the trunk is overgrown by plants (e.g. brambles, wild grapevine or similar) always partially remove them, especially in the case of trunks that you want to expose to the sun

**Expert Tip:** If you have more space you can choose a sunny spot and a shady spot to encourage different species of animals and plants.



*Fig.: All kind of forms, sizes and types of wood are allowed and useful.*



*Fig: Lizards like to hide in piles of wood.*

### **2.4.3. TRUNKS – STANDING**

Standing, sunlit deadwood is a particularly valuable and rare habitat for many endangered fungi, wild bees, beetles and many other insects.

Cavities and hollows in tree trunks provide nesting and roosting sites for birds such as owls, redstarts, tits, nut-hatches, woodpeckers, and hibernation sites for bats. Often tree cavities are not used just once, but find new animal lodgers each year. Occupying old living quarters of others occurs frequently in dead wood. Old bore-holes of beetle larvae are also recolonized - for example, many wild bee species build their nests there.

Bats enjoy crevices in the wood or between wood and bark as hibernation and resting places. Standing deadwood especially benefits bat species that find it difficult to settle in artificial bat boxes. Many beneficial insects such as ladybugs and other insects overwinter in crevices.

Even decomposed wood continues to serve as food for highly specialized insects. Numerous beetle larvae, such as those of the large rose chafer and stag beetle, often live in hollow, mulch-filled logs for years in the larval stage, feeding on rotten, fungus-covered wood and mulch before metamorphosing into the adult beetle.

#### **Construction**

The easiest way to establish standing deadwood in your garden is to use what is already there, if safety permits. Old and dying trees should be preserved as long as possible and not cut down. Individual branches can be cut back to lighten the load on the tree. If the tree must be cut for safety reasons, a chest-high stump can be left standing as it will still be colonized by numerous species - such as the stag beetle.

If you do not have old, dead trees in your yard, you can create these structures by yourself too:

**STEP 1:** If you want to specifically place deadwood logs in your yard, dig a hole with at least 1/3 of the log length as the depth and the diameter resampling that of the log. If multiple logs are placed, there should be at least two feet of space between each pit.

**STEP 2:** Then the logs (e.g. copper beech, ash, elm or robinia) are fixed in the hole - e.g. with large stones or bricks. Smaller gaps can be filled with grit in portions and tamped down again and again. It is important that the log is well and firmly anchored! If you only have thinner trunks available, you can also place them close together in a common hole, fill the gaps with wood chips and clamp the trunks together, e.g. with a metal band, so that the wood chips cannot trickle out.

### Expert Tip: Just leave it and time will tell...

It is particularly important to leave the deadwood lying around for many years so that the natural decomposition processes can take place in all stages, right up to the formation of mulm and humus. It is precisely the stages of decay that are of the greatest value to the inhabitants.



Fig: Standing trunks are habitat for many beetles such as the endangered alpine longhorn beetle (*Rosalia alpina*).



Fig: Cradle for the stag beetle (*Lucanus cervus*) - the trunks are buried about 1.5 meters deep and the spaces in between are filled with wood chips. Tree stumps with a height of approx. 1 m can also be left in the garden to build a stag beetle cradle.



Fig: Woodpeckers also benefit from old trees and deadwood.

## 2.5. Supporting wild bees and their relatives in my garden

All of us know the honeybee – but did you know that there are about 850 species of wild bees in Austria & Hungary? The probably best known of them is the Bumblebee – but also here we are not talking of one species! 45 different bumblebees live, fly and pollinate in our region.

Wild bees are very important pollinators! Some plants rely mainly or solely on them for reproduction. They are so called key-stone species in our natural and cultural landscapes – meaning that if they disappear many other species will go too, maybe leading to the collapse of whole ecosystems. But also the wasps – close relatives of the bee-family – are far more diverse as most of us know. Beside the common wasp – which many of us perceive rather as annoying – over 300 different wasp species exist in our region. In addition to the true wasps and the burrowing wasps, there are many other wasp families, such as dagger wasps, clay wasps, hatching wasps and golden wasps. Most of them – like most of the wild bees – don't live in colonies but on their own. The wasps might not play such a big role as pollinators but they are important keystone species as well. They are very effective predators that help to keep ecosystems – and also our gardens in balance. Some of them are even bred and sold as beneficial insects that you can release in your glasshouses – or even in your kitchen to e.g. fight food moths (these are very very tiny wasp, which you can hardly see, that prey on the eggs of the food moths).

Wild bees mainly colonize structurally rich gardens. Nesting aids alone are not sufficient to attract and support them. Most of the garden elements which are introduced in this booklet will also benefit wild bees (and many many others). Especially important for the wild bees are elements such as natural meadows, native wild plants, year-round flower supply, biotope wood elements, „wild corners“, stone elements, open ground areas, empty snail shells, water sources. By providing these structures in close proximity (e.g. max. 100 m) together with nesting aids, you can specifically reach under their wings. In the following we will show you how you can provide different types of nesting opportunities to these fascinating animals!



*Fig: Austria and Hungary have a high diversity of wild bees in different shapes and colours.*

### 2.5.1 OPEN GROUND / HEAP OF EARTH / SANDY SOILS

Many insects, among them many wild bee species, need open ground or sandy soils to build their nests and nurseries. Actually, the half of our wild bee species build their homes into the ground.

Depending on the species bees require different types of substrate for nesting. Most of them are solitary bees – some of them like the bumblebees are social and some of them build their nests next to each other although the individuals don't interact with each other. Some of them require very specific conditions in terms of soil type (sand, loam, loess), grain size, cohesiveness, moisture, compaction, exposure and vegetation (unvegetated to dense vegetation).

Beside the ground breeding bees also some wasps dig their nests into the ground. Not only the common earth wasp – which lives in larger states - but also many solitary wasps need open ground to dig their nests. Once they have settled down and dug their holes you can observe them bringing their prey into their nests. Depending on the species of wasp, this could be caterpillars, spiders or other insects. Another very fascinating animal to observe on sandy soils is the ant lion, which builds its traps in sandy grounds. Also some beetles prefer sandy habitats – but usually will require larger areas as they do not only use these spots for nesting but also for hunting and living.

There are different things you can do to provide a nesting site for earth and sand bees – even on your terrace or balcony it is possible to provide a habitat for them!



*Fig: Many bee species build their nests in the ground. Some bees even build entrance towers or chimneys.*

#### How to build habitats for earth & sand bees

##### 1. Building a sand-lens in your garden

It is best to create your sand lens between October and February. The wild bee season starts in March. The first species start then and build their nests. If you want to provide an attractive nesting site in your garden everything starts with the selection of the right spot:

##### STEP 1: CHOOSING THE RIGHT SPOT & SIZE

The sand bed should be at least 40X40 cm – preferably bigger. Of course, the larger the area, the more valuable it is. But keep in mind, later on more work is needed for their maintenance too.

Choose a sunny & dry spot: For wild bees to start the day buoyant, they need to fill up on warmth.

Larvae also thrive better in warmth. Make sure that the location is in the sun all year round. You should take care that the site is far enough away from heavily growing plants and that there is little foliage nearby. Rainwater should drain away easily. For your convenience it is important that the location is also easily accessible for maintenance - and for later observations.

Regarding the proximity of your sand-lens it is important that there are enough flowers nearby. Wild bees often fly only a few hundred meters. They therefore need sufficient suitable nectar and pollen on site. It is important to have a good food supply of native wild plants throughout the year. There should always be something in bloom. Bee forage plants that can tolerate drought and heat are suitable for this purpose. For example, Mediterranean herbs such as rosemary, lemon thyme, oregano, sage, lavender, but also bellflower species, feather, peony or Carthusian carnations, St. John's wort or musk mallow. Important! Do not buy plants that form double flowers or flowering plants from hybrid breeds, because they hardly develop nectar or pollen!

**Very important:** Plant your sandarium sparsely. The goal is to offer the wild bees free space for nesting. You can also plant the forage plants at the bottom of the sandarium or close by.

**Also important:** Good hiding places. Small structures such as piles of branches or hedges provide hidden places to rest and spend the night.

### STEP 2: CHOOSING THE RIGHT SAND

Suitable sand should not be too friable and not too clayey. „Play sand“ for the sandbox is unsuitable because it is washed and no longer contains clay. Sand „off the wall“ can be obtained in gravel works. It is best to get unwashed, coarse sand with different grain sizes from a quarry.

**Expert Tip:** Do the sand test: fill the wet sand into a yoghurt cup and turn it upside down to dry. Does the mould hold together well when dry? If so, the sand structure fits.

### STEP 3: DIGGING THE HOLE

Dig a hollow at least 50 centimeters deep, so that the wild bees later have enough space for their nest tubes. If your soil is very clayey, you can also add a drainage layer of broken brick or coarse gravel at the base of the trough.

### STEP 4: FILL IN THE SAND

Fill the sand into the trough and pile up a hill or slope. This will allow rainwater to run off easily and the sandarium will dry out quickly. Tap the mound firmly with a shovel to compact the material a little more.

### STEP 5: CREATE A NICE BEE ENVIRONMENT

Now apply dead wood on top of the sand bed or around it: branches, roots, old vines, firewood. Why? The wild bees gnaw off the dead wood, because they need this material to seal their breeding tubes and cavities.

### STEP 6: MAINTENANCE

Remove grasses and strongly growing plants by hand 1-2 times a year best in spring or fall. Some wild bees gnaw nests in plant stems that are filled with soft pith inside, e.g. in the stems of blackberries or hedge roses. Please leave such stems or cut them off in spring, tie them together and place them upright against a fence or wall. This will allow the young bees to hatch.

If the sand pile is overgrown or the sand is washed away, build a new sand lentil elsewhere. Please do not pour new sand on the old site. Otherwise the wild bees can no longer hatch in the soil and will be buried alive.

### STEP 7: HAVE FUN OBSERVING YOUR WILD BEES!



*Fig: Sandy open soils are inhabited by wild bees.*

## 2. Building a mini sand-lens for the balcony

Smaller spaces can also be transformed into wild bee nurseries. In pots, raised beds or at the edge of houses and paths, a busy buzz can quickly be heard. Even small, plate-sized areas are colonized if the substrate is right and the insects are not disturbed.

### STEP 1: GET A CONTAINER

Get a pot, balcony box or wash tub with holes for water drainage. A height of 35 cm is ideal.

### STEP 2: GET THE RIGHT SAND

Get enough sand to fill your container. Read above about how to choose the right sand!

### STEP 3: FILLING THE CONTAINER

First lay about 5 cm of gravel in the pot. This way, even if the saucer is soaked with water from the rain, the insects' nests will not be under water. Fill up with sand. Some insect species like loose sand on the edge, others like the solid surfaces. Therefore, press the sand down a little and distribute it evenly.

### STEP 4: ADD SOME DEADWOOD

If there is enough space, you can create some additional deadwood structures at the edge of the pot or next to it.

## 3. Nesting sites for bees nesting in soil.

Not all bees prefer sand or sandy soils to dig their nests. A considerable amount of wild bees also like to dig their holes into soil. You can easily support these bees by providing them with nesting possibilities in your garden. All you need to do is to select a rather sunny area and push off the turf completely, compact the clay soil a bit, and then leave it to itself for a while.

With a little luck, the fence beet sand bee, the gatekeeper narrow bee, or the yellow-banded furrow bee, find this offer and use it as long as it is not yet overgrown again. Such colonizations can also be observed again and again on regularly travelled dirt roads or on unvegetated soccer fields of schools.

### Expert Tip

Do not want to create a sand lens, but still want to do something for ground-nesting wild bees? Simply remove the plants on a small, slightly sloping area or create a break-off edge on a slope with a spade!

## 2.5.2. HOUSES AND HOTELS FOR BEES AND OTHER INSECTS

Artificially created nesting aids, colloquially also called „bee or beneficial insect hotels“, offer a great opportunity for direct and close observation of nature. In this way, the way of life and the diversity of wild bees and other creatures can be explored by interested garden owners. Under very ideal circumstances, the nesting boxes can house 30-40 bee species. However, the „hotel guests“ are usually rather widespread species. Therefore, the artificial nesting aids cannot replace natural structures, which can also provide a home for many rare species.

### Species of bees that are often found on nesting aids include

- Mason or Mortar bees
- Hole bees
- Leafcutter bees
- Masked bees
- Scissor bees
- Woolly bees

Some species, such as the spring furry bee or the garden woolly bee, only sleep in the nesting boxes on individual nights, but set up their brood chambers in other places.

But not only bees like to settle in the insect hotels. A functioning ecosystem also means that predators and parasites of wild bees, such as golden wasps or fungus wasps, settle in the bee nesting sites. Although a few sensible measures can be taken to protect the bees, such as protecting the nesting site from birds with a wire mesh on the front side, one should not interfere too much with the natural balance and also tolerate the other animals.

## Build useful nesting aids yourself

**Expert Tip:** Beware of ready-made bee hotels that you can buy in DIY stores, garden centres or other shops! They are often not built properly and can cause more harm than good! If you want to buy a ready-made insect hotel, it is worth checking it against the criteria mentioned below. This way you can be sure that you are buying a product that is fit for purpose!

### STEP 1: CHOOSING THE RIGHT PLACE

For successful colonisation, it is important that the nesting aid is placed correctly. The following points should be observed:

- Sunny and warm location
- Facing south-southeast (morning sun is ideal)
- Protection from wind and rain (roof, wall), away from the weather
- Firm stand/stable suspension
- Unobstructed view
- Close to food plants
- Do not place the nesting aid in the warm in winter



*Fig: There are different types of nesting aids for wild bees. Often the cheap self-made solutions are better than the purchased so-called "insect hotels".*



*Fig: Bees' opponents and parasites, such as gold wasps, can also be observed at the nesting boxes.*

## STEP 2: BUILD THE FRAME

There are many ways to design an insect hotel. Usually, different elements are combined in a frame structure - that would be the classic insect hotel. However, you can also place individual elements - e.g. cans filled with reed stalks - in different places in the garden.

Make sure to use untreated wood. Construct a roof with a back wall and floor from boards. The roof serves as protection against wind and moisture.

In order to attract as many different species of bees as possible, it makes sense to design the nesting aid as varied as possible and to provide different nesting possibilities.

## STEP 3: BUILD THE ELEMENTS OF THE NESTING AIDS

**Hardwood blocks with drilled holes** (debarked hardwood, e.g. ash, beech, oak).

You only need some blocks of wood and a drill to built this useful element.

Important! Drill holes in the longitudinal wood (where the bark was).

- Drill holes with a diameter of 2-9 mm
- Passages from 5 to 10 cm deep
- Combination of different diameters and passage depths, most often 3-6 mm diameter
- Drill holes not frayed (sand surface/entrances smooth, re-drill passages)
- Leave the drills closed at the back, knock out the drilling powder.

**Solid and rotten deadwood** (standing vertically, partly with boreholes).

Specialised species such as the wood bees (*Xylocopa* sp.) found in the Pannonian region, representatives of the leafcutter bees (*Megachile* sp.) and fur bees (*Anthophora* sp.) colonise rotten tree stumps, branches and logs of hardwood. Dry, rotten wood is preferred, e.g. dead branches on the tree or dead but still standing trunks. If you want to integrate deadwood elements into your bee hotel consider these tips:

- Wood from fruit trees or wild shrubs is suitable.
- The wooden elements should have a minimum diameter of 8 cm, for standing elements they should be 100 cm long.
- They should be protected from splashing water from the ground and from above, a good distance to the ground is 30 cm, if possible place them under the eaves or in a dry place.

## Loam/loess walls

Cut loess in the natural sediment structure and place it in an embankment of stones or wooden boxes, filling remaining gaps with moist loess. Place it in a sunny and dry place. When dry, pre-drill individual holes with a diameter of 5-8 mm and approx. 10 cm in length.

## Reed or bamboo tubes

Hollow, dry stalks such as reeds, bamboo or perennial stems are suitable. Reed mats are also suitable.

The diameter of the stems should be 3-9 mm, their length at least 15 cm. If you cut them a smooth cut with a sharp tool is crucial. After the stems have been cut, they are bundled and tied together. You can also put the stems in a tin or fill the holes of a perforated brick with them. The knots of the stems are ideally on the backside and thus form a natural closure.

**Expert Tip:** Reeds and other stems will not splinter if you cut them fresh or soak them in water before cutting. Important: Let the stems dry after cutting!

## Interlocking tiles with holes

Extruded interlocking tiles are special roof tiles made of fired clay with parallel hollow chambers running through them. The round or oval openings of these tubes are located next to each other on the front sides of the tiles. Extruded interlocking tiles have holes 5-8 mm in diameter, depending on the make. This is just right for many wild bees.

## Stalks containing pith

(e.g. blackberry vines, mullein, thistles, elder) with a length of approx. 1 m should be stuck upright with the cut edge facing upwards, either individually in the ground in protected places or mounted on the side under the eaves of a insect hotel.

## STEP 4: MAINTENANCE

Nesting aids can largely be left to their own devices. However, old and broken nesting aids can always be replaced with new ones. Used nesting tubes should not be cleaned. Living larvae could be damaged.

**Expert Tip:** You should avoid these mistakes at all costs:

- Do not drill into the cutting disc or the front wood (they are sometimes colonised, but not optimally because the wood becomes cracked).
- The large holes in hollow bricks are not suitable for colonisation by bees.
- Do not use tubes with a diameter of more than 1 cm.
- Do not use airtight and watertight tubes, otherwise mould will be formed.
- Do not use wood that has been treated with wood preservatives.
- Do not use coniferous wood.
- Do not orient the nesting site towards the north.
- Do not hang the nesting aid loosely, it should not wobble.
- Do not place the nesting aid in a warm place in winter.
- Do not place empty snail shells in the nesting box, but spread them out in the rock garden, preferably under hollow stones (e.g. Roman snail, Forked bush snail, Western heath snail).
- Pine cones, wood wool or wood shavings are not suitable for bees and are not colonised by them.
- Do not use wood without boreholes.
- Do not use flamed surfaces because they deter insects due to their smell.

When buying ready-made bee or beneficial insect hotels, make sure that these mistakes are excluded!

## Bumblebee Nestbox

Bumblebees have their own requirements in regards to nesting. They use hollow trees, piles of wood or mouse holes to build their nests in. So it is always good to leave such structures and small animal buildings in the natural garden.

Dave Goulson a famous natural garden pioneer says: "There are only a few places where bumblebees never nest - unfortunately these include the bumblebee nest boxes offered in all garden centres". Therefore, we recommend to rather build them by yourself.



*Fig: Bumblebee boxes can be built very simple. Many bumblebees are happy with a simple wooden box.*



*Fig.: The nest inside of a bumblebee box.*

### **Above ground nesting site for field, garden, stone and meadow bumblebees**

If it can be a bit bigger, cardboard and wooden boxes are also suitable for building bumblebee nests. These structures also have the advantage that they allow to observe the bumblebee nest by carefully lifting the roofs. For this you need a crate and a slightly smaller cardboard box with at least 20 cm side length, a cardboard tube, wood shavings, dry moss and hay.

#### **STEP 1: THE WOODEN BOX**

First, the wooden box needs an entrance hole. This is quickly done with a 30 mm Forstner drill. Drill the hole in the centre of the front of the wooden box. Before placing the cardboard box in the crate, place two wooden strips inside the crate as spacers for the cardboard box.

#### **STEP 2: THE CARDBOARD BOX**

The cardboard box should be unprinted if possible and no chemical products should have been stored in it beforehand. Insert a cardboard core from a roll of aluminium foil or cling film into the cardboard box, so that a tunnel is created leading into the box. Place the cardboard box in the wooden box and connect the hole in the cardboard box with the hole in the wooden box using the cardboard tube. The tube can have a slope.

#### **STEP 3: FILL WITH NESTING MATERIAL**

Now you can fill the box with nesting material. The bottom layer is chopped wood. Then use the dry moss you have collected and build a nice nest for the bumblebees. Sheep's wool or cotton wool are also suitable, but nothing made of synthetic fibres. Material from abandoned mouse nests or tit nests is also very suitable for bumblebees. Use the soft material to form a small passage as an extension of the entrance tube and a nest hollow about the size of an apple.

Long hay from a natural meadow is suitable as a cover. You can weigh down the lid of the box with a wooden block or a stone.

#### STEP 4: LID AND LANDING PLACE

In front of the entrance hole of the wooden box, add a small landing area. Simply screw on a piece of roof batten. Finally, put a lid on the wooden box, preferably made of waterproof material. It is best to place the bumblebee house on wooden blocks or bricks so that it also stays dry from below.

#### Maintenance

The annual cleaning and refilling of nest material takes place in winter. In February, the bumblebee queen begins the search for nesting sites – until then all nests should be ready.

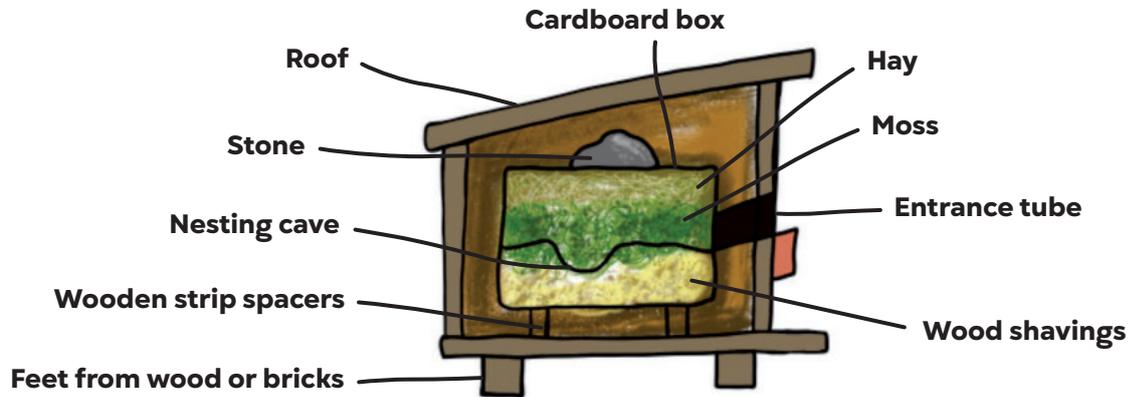


Fig.: Bumblebee box.

## 2.6. Ponds (for toads, other amphibians and more)

The life of amphibians is closely linked to water. With the exception of the viviparous alpine salamanders, amphibians have to visit their spawning waters every spring to lay their eggs. All 18 amphibians occurring in Austria and Hungary are on the red list of endangered animals and strictly protected. Besides pollution the loss of habitat is the main threat to their survival. Luckily, you as a garden owner can easily support amphibians! Anyone who owns a plot of land or garden can create targeted habitats and spawning water bodies for amphibians. Even a pond with a few square meters of surface area and a depth of 30 cm is a valuable habitat. The establishment of spawning waters is one of the most effective measures in amphibian conservation.

Different groups of amphibians (frogs, toads, salamanders and newts) have different spawning habits and spawning water body requirements. Decisive factors for suitability as a spawning ground include the size of the water surface, water depth, sun exposure, plant cover and vegetation, bottom substrate and duration of water cover. In the following we provide tips for two different types of water bodies, each attracting different amphibian species: ponds without and ponds with plants.

#### General advises for the creation of amphibian spawning ponds & habitats in your garden:

In order to successfully create an attractive spawning pond the following requirements, conditions, and criteria should be met:

- In the surroundings of the newly created pond there should already be water bodies and habitats where amphibians live. From there, amphibians can migrate and colonize your water body.
- Runoff water from agricultural areas where fertilisers and pesticides are used should not be able to enter the pond.
- There should not be a busy road between the toad pond and nearby natural areas.
- The pond should be covered with water all year round.
- Juveniles are especially dependent on hiding places on land. These include rock, soil, and wood piles near the water's edge. Hedgerows and tall shrubbery also provide good hiding places and habitats.
- The spawning pond should be free of fish!

To make your garden attractive for the adult amphibians it is advisable to create structure-enriching elements of wood, earth and stones around the pond to provide a habitat for the adults. Daytime hiding places are usually found in open, unshaded areas, and during the breeding season are usually located near the water under stones, in walls, earth or rock crevices, and small mammal burrows, where entire groups of toads can sometimes be found. In loose soils, the animals can also dig their own holes, which are then used over a longer period of time.

### Basics about the garden pond

You can create a pond in many different ways. This applies equally to the shape and the materials used. The following materials are basically possible.

#### POND LINERS

Pond liners have the advantage that you can use them in a variety of ways. However, the material can be problematic, especially PVC, which contains plasticisers. These are questionable from a health and environmental point of view! In addition, PVC and PE pond liners become hard and brittle over time. In the worst case, the pond will leak. In this respect, pond liners made of synthetic rubber, so-called EPDM liners, are considered much better. EPDM stands for ethylene propylene diene monomer.

#### POND TRAYS

Prefabricated pond trays are particularly suitable for small ponds. They can be roughly compared to a bathtub. Often different levels are pre-modelled, resulting in different water depths.

#### CLAY

The most natural material for pond construction, however, is clay. With appropriate compaction, the material is largely waterproof. However, the processing is very time-consuming and you need a material layer of 50-100 cm. Therefore, we will not go into more detail here, as this would go beyond the scope of this brochure.

### 2.6.1 POND WITHOUT PLANTS

This chapter focuses on the European Green Toad, which is a typical and important amphibian species in the Pannonian project area. Not only its appearance, but also its trilling call makes this small and beautiful toad unmistakable. It settles in newly formed pools, waters or lakes without vegetation in which it deposits its up to 8 m long spawning strings. It prefers well-sunned, shallow and flat spawning water bodies with longer water cover and shallow banks that are not or barely overgrown with plants. Beside the Green Toad there are also other amphibians, which prefer spawning waters without plants, like the Yellow-Bellied Toad, also the Common Toad will use plant-less ponds for spawning.

#### STEP 1: DIGGING THE SPAWNING POOLS

The first step is to remove the top layer of humus and then excavate the pools. Since the green toads appreciate shallow spawning pools the finished ponds have maximum depths between 20 and 40 cm. At this stage attempts are made to create structurally rich banks with shallow but differently inclined sections and to create a long shoreline with bays and peninsulas. This should later help the formation of a variety of different habitats.

**Expert Tip:** To prevent the pond liner from cracking under the weight of the water or being damaged by walking on it, a layer of sand about 5 cm thick is spread and covered with a weed fleece made of natural material.





*Fig: Building of a pond. The pond is sealed with pond liner.*

### **STEP 2: PLACING THE POND LINER**

Then the pond liner is laid and welded in place. Subsequently, the mineral substrate (gravel 8-16 mm) is applied and later mixed with stones of different grain sizes and distributed in variable layer thicknesses (5-30 cm high). Large natural stones can be occasionally placed in the pond depressions to increase the structural diversity of the aquatic habitats. For all mineral components, make sure to use materials that are typical for the site (in the project region, e.g. stone field gravel and Leitha Limestone).

### **STEP 3: DESIGNING THE BORDER AREAS**

In order to meet the preferences of the green toads, all planting is omitted. At two peripheral areas, cairns from larger natural stone material (Leitha Limestone) were built as retreats, hiding places and shady spots. Deadwood is also well suited for creating hiding places. A system of interconnected underground cavities and crevices, passable for toads, was deliberately modelled as well. At the edge of the cairns, which is far from the water, the soil material from the pond excavation was piled up to give the toads the opportunity to burrow into the soil. In the pond itself, fallen wood was placed. Only deadwood that had already been washed out was used. In this way, eutrophication or pollution of the spawning waters can be prevented.



*Fig: Stone structures as hiding places for amphibians.*



*Fig: The finished ponds for green toad.*

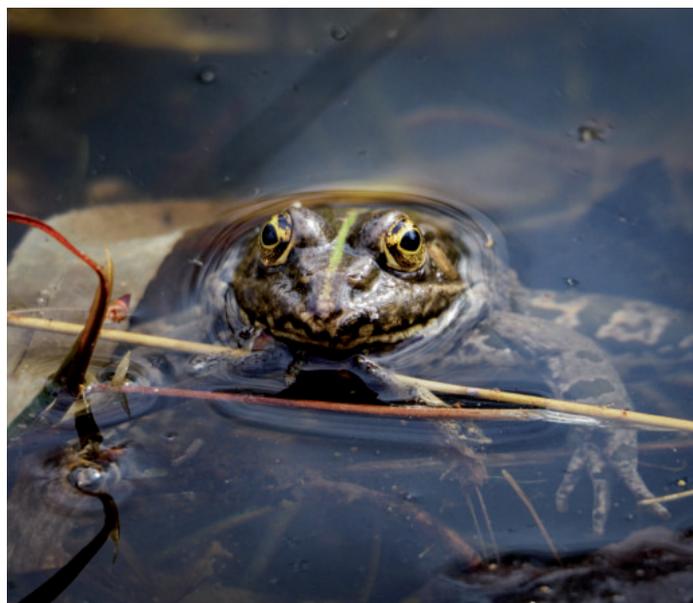


Fig: Green toad (left) and other amphibians depend on such ponds.

## 2.6.2 POND WITH PLANTS

Some amphibian species, such as many newt species, in turn prefer water bodies provided with aquatic and riparian plants. Therefore, other variants of ponds are of course also possible. In principle, every potential spawning water is an asset for species conservation.

### STEP 1: CHOOSING THE LOCATION

A suitable place for a pond should:

- Be sunny, because aquatic plants also need light - but if possible, also get several hours of shade, so that the water does not heat up too much in summer. A good guideline is five hours of sun per summer day.
- Keep a distance of about three metres to trees to be protected from leaves and damage by roots later on. Especially trees with shallow roots (e.g. birch or vinegar tree) as well as bamboo of the genus *phyllostachys* and other sprouting species should not grow close to the pond to avoid later damage to the pond liner by roots.
- As far as size is concerned, the larger the pond, the more stable the ecosystem will be and the less often you will have to intervene. As a rule, a largely stable ecosystem will establish itself in a pond of about 8-10 m<sup>2</sup>.

### STEP 2: PLANNING

Before you start digging holes in your garden, you should think carefully about how the future pond should look like. Different depth zones are important because they provide habitats for different plants and animals. Deep-water zones from a depth of 80 cm are frost-free even in winter. The transition between the different zones should be as gentle as possible. The gradient should be a maximum of 50%. To be ecologically valuable, the pond needs the following different depth zones:

- Swamp zone: shore zone with a depth of 0 to 20 cm.
- Shallow water zone with a depth of 20 to 80 cm.
- Deep water zone with a depth of 80 to 150 cm.

Using these criteria, draw up the first drafts of your pond on paper. You can also plan the planting at the same time.

**Expert Tip:** If the pond is sufficiently large and has a variety of plants, usually there is not too much problems with algae later on. Additional filter technology can then also be omitted. Algae are mainly caused by a high nutrient input, such as leaves.

### STEP 3: DIG OUT THE POND BASIN

First, mark out the outline of your pond with short wooden stakes or simply mark it with a line of lightcoloured sand. Then excavate the entire pond area to the first depth level. Then mark the area of the next deeper pond zone and excavate that too. Continue in this way until you have reached the bottom of the pond. For larger ponds, it is worth hiring a mini-excavator for the earthworks.

If the ground is stony, dig the hollow about 10 cm deeper and fill it with an appropriate layer of building sand - this will prevent the pond liner from being damaged by sharp stones.

### STEP 4: LAY THE POND LINER

It is advisable to first lay down a protective flow (e.g. weed flow). The liner is first laid out on the whole ground surface and then adjusted so that it lies on the ground everywhere. To do this, it must be carefully folded in some places. Then weigh down the pond liner with stones and line it with gravel. This will conceal the somewhat unsightly pond liner.

### STEP 5: PLACE WATER PLANTS & FILL WITH WATER

Once the construction work is complete, you can plant the pond and the bank. To plant aquatic and marsh plants, first place a layer of sand or a sand-gravel mixture in the new pond. Do not use garden soil! Plants with a very strong urge to spread, such as water lilies, can be placed in plant pots.

### STEP 6: FILLING

Finally, it is ready. Fill the pond with water. If possible, use lime-free rainwater. It will take some time until an ecological balance has been established in the garden pond.

**Important:** Do not introduce any animals! Especially not fish - and definitely not goldfish! Your pond will be filled with life all by itself in the coming weeks and months.

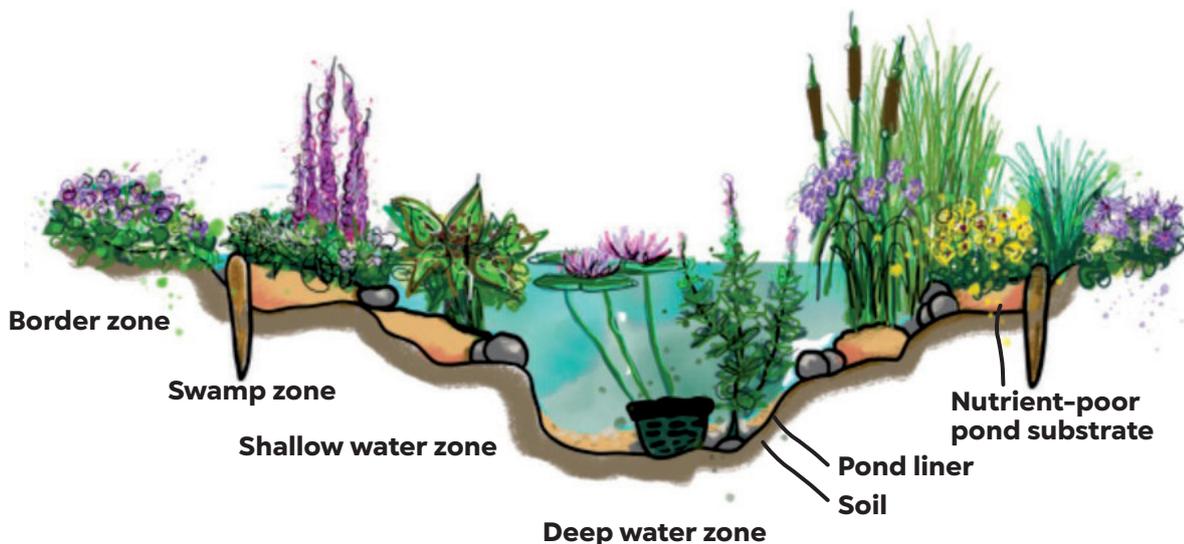


Fig.: Different zones in a pond.

**Table 2: Plant list for ecological valuable planting with native plants**

NAME	BOTANICAL NAME	WATER DEPTH IN CENTIMETRE	COMMENT
<b>SWAMP ZONE</b>			
<b>BLOOD LOOSESTRIFE</b>	<i>Lythrum salicaria</i>	0 – 10	Can stand permanently in water
<b>PENNYWORT</b>	<i>Lysimachia nummularia</i>	0 – 2	Can cover up the edges of the pond liner
<b>MARSH MARIGOLD</b>	<i>Caltha palustris</i>	0 – 10	Spring botanist by the pond, reblooms in autumn
<b>WATER FLAG</b>	<i>Iris pseudacorus</i>	0 – 30	Beautiful yellow flowers
<b>MARSH FORGET-ME-NOT</b>	<i>Myosotis palustris</i>	0 – 5	Compact growth, sky-blue flowers
<b>WATER MINT</b>	<i>Mentha aquatica</i>	0 – 10	Fragrant, purple perennial flowers in summer
<b>SHALLOW WATER ZONE</b>			
<b>ARROWHEAD</b>	<i>Sagittaria sagittifolia</i>	10 – 30	Interesting arrow-shaped leaves
<b>COMMON WATER-PLANTAIN</b>	<i>Alisma plantagoaquatica</i>	5 – 20	Dainty inflorescence Swan flower
<b>FLOWERING RUSH</b>	<i>Butomus umbellatus</i>	5 – 30	Pink inflorescences
<b>MARE'S-TAIL</b>	<i>Hippuris vulgaris</i>	20 – 50	Leaves protrude from the water
<b>FEATHERFOIL</b>	<i>Hottonia palustris</i>	10 – 30	Rare native primrose
<b>DEEP WATER ZONE</b>			
<b>COMMON FROGBIT</b>	<i>Hydrocharis morsus-ranae</i>	50 – 100	Floating leaf plant, forms small white flower carpets on the water surface
<b>WHORL-LEAF WATERMILFOIL</b>	<i>Myriophyllum verticillatum</i>	over 50	Underwater plant for water purification
<b>FRINGED WATER LILY</b>	<i>Nymphoides peltata</i>	50 – 100	Yellow sea of blossoms
<b>SEEROSE</b>	<i>Nymphaea alba</i>	50 – 200	Classic beauty, different varieties

**Expert Tip: And what about gnats?**

Once the small ecosystem in your natural pond has settled down, you will not see any gnat larvae after 2-3 weeks because they are a popular food source for many pond inhabitants such as amphibians, water beetles and dragonfly larvae. However, you should avoid fish in the natural pond, as they disturb the ecological balance in the small body of water and pollute the water.

## 2.7. Nesting structures for bats & birds

Not all birds build their nests on branches or on the ground. Some birds breed in burrows, i.e. holes formed naturally in the trunks and branches of older trees or holes carved by woodpeckers. Unfortunately in settlements and agricultural areas the population of old trees, which would be thick enough for burrows, is low, decreasing or has already disappeared. Moreover, as damaged or dead trees are removed for safety reasons, there are less natural places for cavity-nesting birds to raise their young. Therefore, it is recommended to place artificially made nest boxes for birds in public areas, such as in city parks and gardens. In these safe boxes, the birds – and other animals like bats – can build their nests, raise their young and hibernate over winter.

### Types of nest boxes

Based on the different size and needs of the birds, different nest boxes can be used. In general, there are two main types of bird nest boxes, which are suitable for different species of birds. The first is a small holed nest box and the second is an open fronted nest box. Both of these will require siting in slightly different ways.



Fig: Different types of birdhouses.

**Nest box with a small hole at the front (type A)** is the most popular type of nest box as there are many variations available to attract different species of bird. There are three main factors to consider for a small-holed nest box: the size of entrance hole, the area of the inner space and the height it needs to be placed (accordingly we distinguish type A, B and D - see figure below). This will determine which birds will visit the nest box and make their home inside.

**Open fronted nest boxes (type B)** are partially open at the front rather than having a small entrance hole. Thus, we should place them somewhere hidden from predators. They are best positioned 1-2 m off the ground and can be attached to a wall, fence or tree that has sufficient vegetation such as shrubs and creepers growing around it, allowing cover for visiting birds.

Type A



Type B



### Where should nest boxes be placed?

One of the biggest advantages of nest boxes is that they can be placed not only in trees, but almost anywhere (e.g. on buildings, walls, high fences, etc.) since birds can easily adapt to the various circumstances.

### Tips and recommendations to place a nest box in your garden:

- The best time to place nest boxes is September to November, because birds use nest boxes not only during the breeding season but also during the wintering period.
- Never position a nest box where it gets day-long direct sunlight, as it will simply get too hot inside and any young birds will perish. We should also avoid rainy and windy places. The ideal position of nest boxes if they face north or north-east.

- Make sure there is a direct flight path to the entrance of the nest box. Keeping it clear of obstructions will make it easier for birds to find the nest box and allow them to gain easy access in times of need.
- Avoid placing nest boxes too near to bird feeders and birdbaths, as high levels of activity from visiting birds will cause disruption to established nests and may even lead to it being abandoned.
- Most species of bird are territorial, so having too many nest boxes in one area can cause problems. Try to distribute them evenly around the garden, ensuring there are sufficient food sources available for each one.
- When attaching a nest box to a tree, try not to use nails or other materials that will rust and cause damage to the tree. An alternative is to use an adjustable strap or galvanized wire.
- Make sure there are perches and areas of foliage for cover nearby. Nest boxes with a perch below the entrance can assist predators rather than the birds, so they are not recommended.

### **Do not forget to clean the nest box!**

Most bird species do not breed twice in the same nest. They look for a new place or build a new nest on top of the old one. Therefore, after each breeding season it is recommended to clean the nest boxes – or at least once a year and to remove the accumulated nesting materials.

Cleaning the box will also remove small parasites and other invertebrates for example earwigs which will often also take up residence in the box. When we clean out the box, we use a small stiff brush. There is no need to use water, as it is best to keep the inside of the box as dry as possible. This annual cleaning also provides a good opportunity to check the condition of the nest box. If it is damaged or in poor condition, we should repair or remove it.

### **Bat boxes**

Most bats are nocturnal. They fly and forage for their food at night. They use echolocation to locate food and avoid obstacles. They have the ability to create and hear noises that humans cannot hear. The sound waves bounce off of objects and back to the bat, which can then judge the size and distance of the object. During the day, they need safe places to sleep. Caves and burrows provide the kind of protected shelter in which bats can thrive. Hanging from the ceiling of a cave, bats are out of reach of most of their enemies. However, we can find bats population in urban environment too living in attics, wall cracks, eaves, etc. Experts are carrying out extensive research to study them, and they implement various conservation programmes to inform the public and dispel negative preconceptions about bats. As bats find less and less safe places in the cities due to the decreasing number of old and hollow trees and the increasing number of modern and gap-less buildings, it is important to place artificial boxes in the settlements for bats as well.

Bat boxes differ from bird nest-boxes in their design: they have a larger opening on the underside of the box. The bat box is basically made up of two pieces of parallel wood planks with a 25 mm gap between them. The entrance to the bat box is usually located at the bottom, where there are crossing beams or wire mesh to help bats to enter the box. The narrow gap prevents predators from gaining access to the bats, but consequently only smaller bats can enter the box. Half-inch ventilation slots are needed in all bat boxes unless they live in cooler climates. These vents are ideally placed no more than one-third above the bottom of the box. In winter or cooler weather, bats go to the upper, more enclosed part of the box. Similarly to bird nest boxes, artificial bat boxes can be placed on tree trunks or can be hung from tree branches, but they can also be installed on the walls of buildings, balconies or at window sills.



*Fig: Different types of nesting aids for bats.*

### III. INTRODUCTION OF THE PROJECT AND PARTNERS

The Living Gardens project aims to raise awareness of local residents on the importance of biodiversity and encourage them to take action to protect natural values. In the framework of the project, show habitats are established in five municipalities in the cross-border area located between south of Vienna and west of Lake Balaton: at Pfaffstätten, Tattendorf and Trumau in Austria, and Gyenesdiás and Zalakaros in Hungary. The show habitats are open for the public and serve as sample sites, encouraging visitors create similar habitats in their own gardens as well to protect endangered species. The following partners supported the five project municipalities and contributed to the creation of the present handbook:



**Lake Balaton Development Coordination Agency (LBDCA)** is a non-profit organisation founded in January 2000 by the Lake Balaton Development Council. The Agency performs professional and operational tasks to promote the development of the Lake Balaton Region. Besides the implementation of long-term regional development plans and the allocation of development grants, LBDCA also dedicates great importance to increase knowledge and raise awareness about environmental and nature protection, and to promote environmentally sound behaviour.

[www.balatonregion.hu](http://www.balatonregion.hu)

„**Nature in the Garden**” is supported by the province of Lower Austria and pushes the greening of gardens and green spaces beyond the province’s borders. The core criteria stipulate that private, semi-public and public areas should be designed and maintained without synthetic chemical pesticides and fertilizers and without peat. Great emphasis is placed on biodiversity and native and ecologically valuable plants. The core task is to impart knowledge and skills for the ecological design and maintenance of gardens and green spaces.

[www.naturimgarten.at](http://www.naturimgarten.at)



**Landschaftspflegeverein Thermenlinie-Wienerwald-Wiener Becken** is building the Network Nature Region, a network of people and organizations who work together to create natural areas in order to secure biodiversity and climate protection in the Vienna Basin - Thermal Line region. Main focus is on supporting the creation and maintenance of species-rich green spaces, landscape management for the preservation of valuable natural areas together with the population, schools and businesses, as well as extensive nature education, which brings people closer to nature on their doorstep again.

[www.landschaftspflegeverein.at](http://www.landschaftspflegeverein.at)



**GLOBAL 2000** is an independent Austrian environmental organization and a member of Friends of the Earth, the largest international network of environmental organizations. Since 1982, GLOBAL 2000 has been working to uncover potential hazards for humans and the environment and to provide solutions for pressing environmental problems. GLOBAL 2000 closely monitors the development of environmental policy in Austria and EU. It is committed to ecological fairness and a future worth living both locally and around the globe.

[www.global2000.at](http://www.global2000.at)



**Dr. Otto Moog** is aquatic ecologist, retired but still active professor at BOKU (University of Natural Resources and Applied Life Sciences), Institute of Hydrobiology & Water Management, Vienna, Austria. Citizen and biological/ecological advisor to the municipality of Tattendorf, and former environmental councilor from 1995 to 2005.

