BioBox

Biodiversity Crossborder Tool Box

Interreg Italia–Österreich

Co-funded by the European Union

BioBox

Imprint

Recommended citation: Hollerer et al. (2026). BioBox. Biodiversity Crossborder Toolbox. Carinthia University of Applied Sciences.

ISBN: 978-3-99076-114-4

Authors: Anna Hollerer, Marta Polizzi, Alice Bordignon, Elisabeth Wiegele, Evan Vincent, Francesco Boscutti, Maurizia Sigura, Costanza Uboni, Paolo Viskanic, Gerfried Pirker, Christina Paril
Layout, Design and Typesetting: Elisabeth Wiegele (CUAS), Anna Hollerer (CUAS), Marta Polizzi (CUAS), Alice Bordignon (R3GIS)

This publication was supported through funding by Interreg Italia-Austria project number ITAT-27-008, co-funded by KWF (Kärntner Wirtschafts-förderungs Fonds) and co-financed by Fh Kärnten (Carinthia University of Applied Sciences, CUAS), R3GIS and University of Udine.

FH Kärnten - gemeinnützige Gesellschaft mbH Villach, Austria, January, 2026, A.H., M.P., E.W., E.V., P.C.

... through this QR-Code you will get access to our ONLINE BioBox

- Get more information about our work
- Reach out to us and share your very own implemented BioBox project
- Access the material in other languages and in video format

Interreg Italia–Österreich

Co-funded by the European Union

BioBox

Table of Contents

Dearest Reader,
Welcome to the BioBox!

This booklet suggests measures and techniques on how to support biodiversity in your local neighborhood. Simple measures that can be scaled to fit a private garden as well as a city park are collected in the following pages. We invite you to reach out to nature and see the natural world and its inhabitants as neighbours in need of our protection. Biobox is part of an Interreg Italy - Austria Project. Interreg projects aim to facilitate cooperation amongst neighboring countries and to develop cross-border solutions.

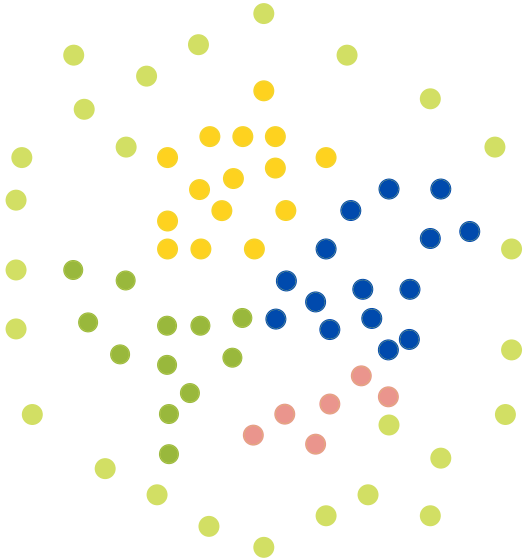
We wish you a lot of fun, wonder, and excitement while implementing and monitoring your chosen measures.

Your BioBox Team

Interreg Italia–Österreich
Co-funded by the European Union
BioBox

What is Biodiversity?

Take a pen and connect the dots.



What is Biodiversity?

Biodiversity is the network on which life depends. A diverse range of species creates resilient ecosystems that can withstand environmental change and continue to support life. Biodiversity is vital for a healthy planet and human well-being, providing essential services like clean air and water, food security, and climate regulation.

These essential services are called Ecosystem Services and describe the benefits that humans receive from natural ecosystems. They supply raw materials for medicines and building; prevent the spread of diseases; provide cultural and recreational benefits; and supports economic stability, among others.

Ecosystem Services

Cultural services

- recreational
- aesthetic
- spiritual
- enriching

Provisioning services

- food
- medicine
- fibre
- timber
- bioenergy

Regulating services

- water filtration
- waste decomposition
- climate regulation
- crop pollination
- regulation of various human
- diseases

Supporting services

- nutrient cycling
- photosynthesis
- soil formation

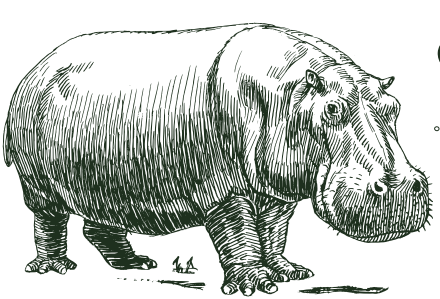
Graphic after Living Planet Report, WWF (2012)

However, biodiversity and nature should not be seen only as an entity that provides services for people. Rather, nature is an entity that has intrinsic value in itself. Humanity is part of this network and is impacted by any positive or negative changes to it.

To care for the natural world means to invest into the future and well-being of yourself. It also means investing in the most unique and complex network within the known universe!

Threats to Biodiversity

Biodiversity is threatened by HIPPO+



©pixabay via Canva.com

H*abitat loss*

I*nvasive Species*

P*ollution*

P*opulation Growth*

O*verharvesting*

+ Climate Change

"**Hippo +**" is an acronym coined by American scientist and biologist E.O. Wilson. It describes the five primary human-caused threats to biodiversity.

Habitat Loss: Driven by rural development, agricultural expansion, and unsustainable extraction practices such as mining and illegal forestry, the natural habitat of most species is shrinking and threatened.

Invasive Species: Neobiota are being carried around the world, enhanced by human activities such as shipping and trade, intentional or accidental release of pests and pets, recreational activities, and horticulture.

Pollution: Plastic pollution, light pollution, air pollution ... the list is seemingly endless. Pollution impacts the survival rate, reproduction and development of impacted species (humans too!).

Population Growth: Human population growth is tightly linked to the other drivers of the HIPPO+ - habitat destruction, pollution, overharvesting and climate change.

Overharvesting: Linked with the population growth of humans, overharvesting means that we deplete resources so fast that they can no longer replenish themselves. Unsustainable fishing techniques and timber harvesting are just two of the many examples.

+ Climate Change: Climate change is looming over the HIPPO, making it even more difficult for the ecosystems and species to recover or adapt.

Changing the trajectory of the HIPPO+ requires holistic societal changes, including coherent political action and local, community-backed solutions.

Prerequisites

Prerequisites

The measures suggested in this booklet are a great way to show up for your local birds, bats, and pollinators. Yet, they unfold their potential only when situated in the right surrounding.

What do we mean by right surrounding? Creating an environment in which nature can thrive means creating structures in which species can find shelter and food. It also means being aware of how we treat the soil and how animals will find their food. It means understanding what kind of noise and light level is harmful to different species. Last but not least, it also means reflecting upon the landscape of your own green space. Does it have naturally occurring hiding spots? Are there trees or more open spaces? Is it shady or sunny? Is the soil moist or more on the dry side?

These aspects are what we call "Prerequisites" in this booklet. To have a higher chance for the suggested measures to work, certain prerequisites should be established before putting the measures into place. Each measure in the following chapter will have the most important prerequisites listed.

Some of the prerequisites mentioned before can be changed by you and your actions like: how often you mow the lawn or what kind of light source you use in the garden. Other factors, such as the position of your house, cannot be altered. But this only means that some measures might not be right for you at the moment. As much as you might want to help all wildlife and plants, not every place is suitable for all species. They all thrive in different conditions, just like us! To highlight the underlying idea behind the prerequisites, they are clustered into three groups called **"Relax"** , **"Design"**, and **"Perspective"**.

"Relax"

Achieve more by doing less! Let the leaves stay on the ground and mow the grass a little later. Nature and your time schedule will be able to catch a breath.

Leaf Piles
When autumn brings leaves, create a pile instead of raking them up. Various insect species, small mammals such as the hedge hog, and birds benefit from this structure. Leaf piles act as a hibernating space and shelter, food resource, and create leaf mold substrate.

Mowing Regime
Give your lawn mower and your schedule a break and cut the grass less frequently. Additionally, take a "mosaic" approach by cutting only parts of the grass while leaving others to grow. Your green space will be able to bloom for all kinds of insects.

Lights Off
Light pollution is a major problem all over the world. By making sure that your green spaces have enough shadows and dark spots, switch off the lights at night.

"Design"

Which structure can enrich your green space easily and naturally?

Wild Corners
Wild corners are areas of unmanaged plants and shrubs. Not mowing or pruning this area can help to create a shelter, food source, or hide-out for many organisms and species.

Dead Wood
The importance of deadwood can not be stressed enough. As a host for many organisms, it provides them with food, habitat, and resources. Deadwood is impactful in all forms and sizes: as an old tree, a dry hedge (one of our measures), and as a dead-wood pile for beetles.

Flower Composition and Seed Mixture
As colorful and enticing as some exotic flowers are, some of them can become invasive or do not carry the nectar needed by native pollinators. Instead, choose locally-souced seeds and plants!

"Perspective"

Change perspective and see the world through the eyes of wild animals and plants. What might be hurtful to them, might be enjoyable or hardly noticeable for us.

No Pesticides

Just don´t. Instead, choose natural remedies such as homemade sprays like neem oil, horticultural oils, and soap solutions that target pests with minimal harm to beneficial insects and the environment.

Cat Management

As great as cats can be in green spaces, for many small animals their appearance does not signify cuddles. Due to their instincts and behaviors, cat management plays a big role when managing the security of other animals - specifically birds. Periodically keeping your cat inside in the morning or evening when birds are most active, or attatching a colorful collar with a bell can help ensure that they do not cause any harm.

Other BioBox Measures

Some measures might benefit highly from being paired with another measure. For example, within the pollinator measures, 'Sandarium' and 'Sun and Moon Meadow' can be combined, or 'Miyawaki Forest' and 'Micro Ponds' complement each other. In this case, the names of an additional measure will be listed together with the prerequisites as an " add on" or "nice to have".

Target Groups

Target Groups

This chapter provides an overview of the three animal groups which the measures aim to support and explains why they need our support to begin with. There are many more species, animals, plants, and fungi alike that need support and acknowledgement, but every journey starts with a single step. Take the awareness you gain from reading the BioBox booklet and use it for the other species out there!


Lukas Kadava/Unsplash


Jody Confer / Unsplash

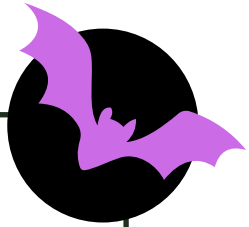

Ladislav Stercell/Unsplash

Bats

Bats contribute significantly to biodiversity by maintaining several key ecological functions. In tropical areas, fruit-eating bats are important seed dispensers and pollinators of tropical plants and most bats act as natural pest controllers. The guano (feces) of bats is deemed nutrient rich and is often harvested for its properties. Due to this, bats constitute an important species for agriculture. Because bats rely on healthy ecosystems for food, water, and roosting sites, their populations can indicate the health of the environments they occupy.

Nils Bouillard/Unsplash

Key Ecological Roles



Pollination: Bats are crucial pollinators for many plant species, with some tropical plants depending partly or wholly on certain bat species to pollinate their flowers. For example, the agave plant is extremely dependent on nocturnal bat pollinators for reproductive success, and declining bat populations may threaten the survival of these plant species.

Seed Dispersal: Bats play an important ecological role in material and nutrient distribution through seed dispersal. For example, flying-foxes serve as Australia's only nocturnal, long-distance pollinators and seed dispersers of native forests, making them the most efficient pollinators and seed dispersers of native Australian forest trees.

Pest Control: Microbats consume around 40% of their body weight in insects each night, which is expected to affect invertebrate prey population sizes and benefit the health of trees, pastures, crops, and revegetated areas. In the U.S for example, by consuming insects, bats save U.S. agriculture billions of dollars per year in pest control.

Biodiversity Indicators: Changes in bat populations can indicate changes in biodiversity, reflecting declines in insect populations or habitat destruction.

Denley Photography/ Unsplash

Birds

Birds serve as vital indicator species for overall ecological health (habitat and species abundance) because they are sensitive to environmental changes. They serve as important contributors to ecosystem serviceas like pollination and seed dispersal.

Andrey Strizhkov / Unsplash

Key Ecological Roles

Pollination: Birds such as the sunbird and the hummingbird are known as important pollinators in their ecosystems, especially in tropical and sub-tropical regions. Hummingbirds are essential pollinators for plants like salvia and penstemon.

Seed Dispersal: Birds such as jays have been regarded as expert seed dispersers due to their ability to cover much longer distances compared to other means of seed dispersal, such as wind, assisting in the regeneration of forests. Without birds' pollination or seed dispersal services, many plant species experience much lower reproductive success- leading to changes in plant community composition.

Pest Control: Birds like the barn swallow can consume as many as 60 insects per hour, rescuing pest-prone crops and providing natural alternatives to harmful pesticides. Birds consuming invertebrates reduce herbivorous insect populations, allowing plants to respond with increased growth and yield. Many bird species feed on insects that consume crops, reducing the need for pesticides and other chemical treatments.

Nutrient Cycling: Seabirds concentrate nutrients at their coastal breeding grounds in enormous volumes after eating fish and other sea creatures. For instance, dovekies in northwest Greenland move an estimated 3,500 tons of nitrogen from the ocean to the soil, boosting local grass growth and feeding grazers such as hares, geese, reindeer, and muskox. Seabirds also play a key role in cycling nutrients and fertilising marine ecosystems such as coral reefs.

Scavenging and Waste Removal: Birds such as the vulture act as essential scavengers by removing the carcasses of dead animals (carrion) and provide natural sanitation services. In India, declines in vultures led to increases in feral dogs because there was less competition for carrion as a food source. This resulted in increases in rabies outbreaks and human injuries from dog attacks.

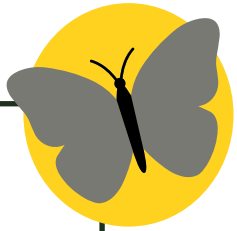
Ecosystem Engineering: Woodpeckers serve as home-builders for other cavity-nesting species, with research showing that cavity-nesters like titmice, flycatchers, and wrens are more likely to survive long-term if they build their nests in abandoned woodpecker cavities.

Pollinators

Pollinators face significant threats such as habitat loss, pesticides, invasive species, and climate change. This leads to ecological challenges and a negative feedback loop where pollinator declines threaten plant diversity which, in turn, further impacts pollinators.

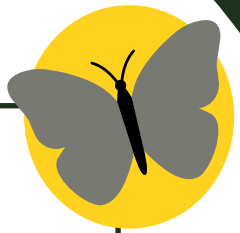
Cameron Ballantyne-Smith / Unsplash

Key Ecological Roles



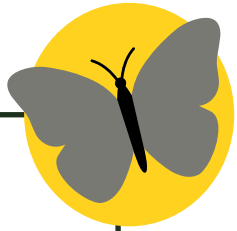
Plant Reproduction and Biodiversity: It is estimated that 87.5% of flowering plants depend on animal pollinators for reproduction. As essential matchmakers, pollinators assure the genetically diverse reproduction of over 75% of the flowering plants on earth. Their diversity and numbers underpin biodiversity in ecosystems across the planet through their critical role in plant reproduction.

Food Security: In agriculture, 87 of the leading global food crops and 35% of global production volumes from crops are dependent upon animal pollination. Even in urban and peri-urban settings, pollinators support family gardens, local crops, and food plants, contributing to food availability and quality.



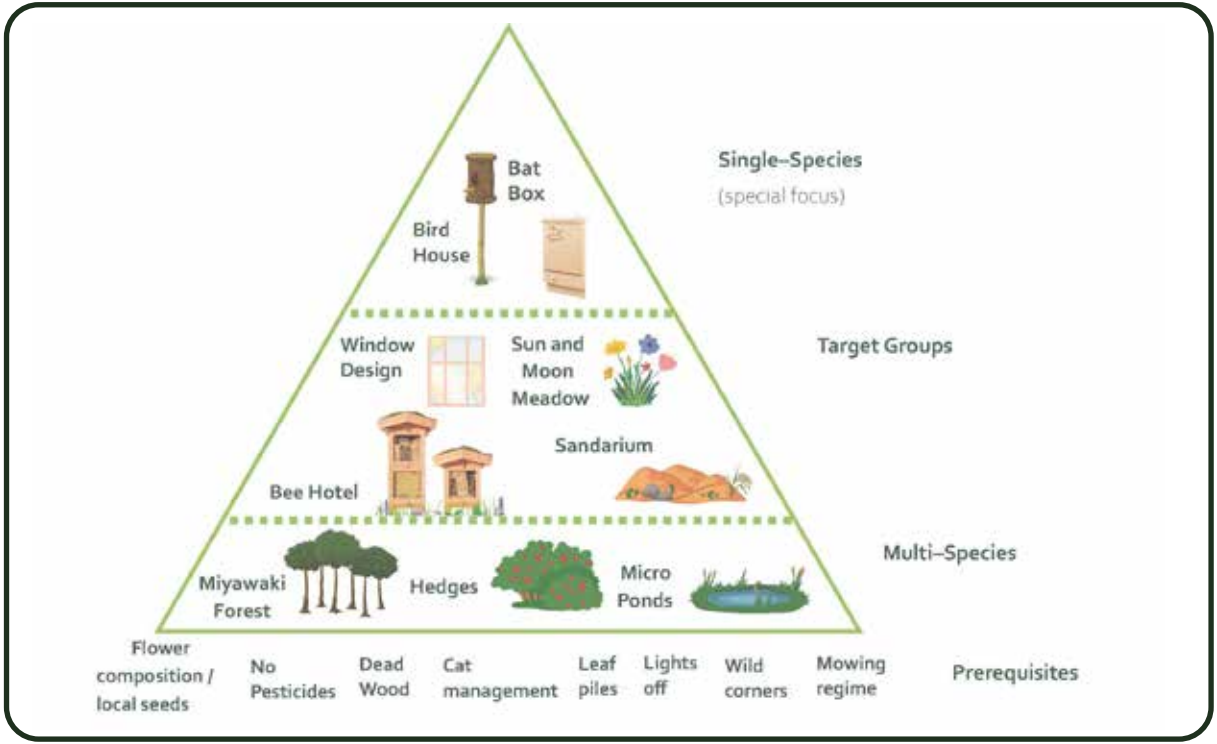
Pollinator Diversity Benefits: In natural ecosystems, pollinator diversity enhances pollination during environmental and climatic disturbances, solving the problem of pollen limitation. In agricultural ecosystems, pollinator diversity increases the quality and quantity of crop yield. Research has found that on any one farm, five or six wild bee species were able to provide half of the pollination. Most of the 100 bee species observed in the study were needed to meet that same threshold across nearly 50 farms in the region. This demonstrates that regional pollinator diversity is essential for reliable pollination services.

Diverse Pollinator Groups: Pollinators comprise highly diverse groups of animal species that transfer pollen in flowering plants. The most diverse and common pollinators are insects, but bats, birds, and some mammal species also help spread pollen around the globe.

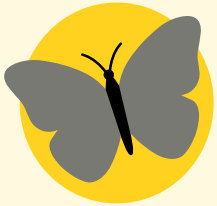


Ecosystem Resilience: If an ecosystem has more species, the fate of the ecosystem is less likely to be tied to any one species. As the number of pollinator species increases, the number of plant species they can support—and be supported by—also increases, and because of their pivotal role as primary producers, as the number of plant species goes up, the number of species of all other types of organisms in the ecosystem can also expand.

Ecosystem Function: Without diverse seeds in the seedbank of the soil, ecosystems cannot regenerate. Strong ecosystems sequester carbon, prevent soil erosion, filter water, and produce oxygen. Beyond their role in pollination, pollinators also contribute to nutrient cycling in ecosystems by aiding in the breakdown of organic matter– facilitating the release of essential nutrients into the soil.


Bat Box
Bird House
Single–Species
(special focus)
Window Design
Sun and Moon Meadow
Target Groups
Sandarium
Bee Hotel
Multi–Species
Miyawaki Forest
Hedges
Micro Ponds
Flower composition / local seeds
No Pesticides
Dead Wood
Cat management
Leaf piles
Lights off
Wild corners
Mowing regime
Prerequisites

Measures



Pollinators

Bee Hotels

How do the species benefit?
Bee Hotels are designed to provide nesting, breeding, and overwintering sites for beneficial insect communities such as pollinating bees, wasps, earwigs, and other predatory arthropods by simulating natural microhabitats such as hollow stems, beetle tunnels, and crevices in dead wood.

When to implement the measure?
Can be implemented throughout the year. Ideally before spring (February and March).

When will the species be able to use the measure
It takes from weeks to months.

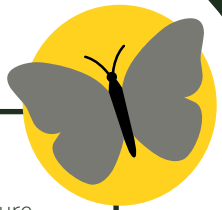
Prerequisites

- Deadwood
- No Pesticides
- Wild corners
- Sun and moon meadows (p.42)

DIFFICULTY 2

TIP

It's better to avoid the consumer-marketed bee hotels! They are not as effective as building your own hotel.



STEP 1: Structurally sound

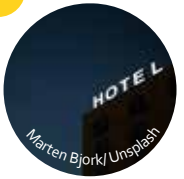
Use untreated, recycled wood (e.g., European spruce, old furniture drawers). Construct a wooden box 20–30 cm deep, open on one side, with a sloping, overhanging roof to shed rain. Or simply re-use an old shelf! If the structure is freestanding (on a post), it must have a solid back to protect against wind and rain.

If mounted on a wall or fence, a back panel is optional.Optionally, coat the outside only with water-based varnish or fence paint. Avoid solvent-based treatments since they may deter bees.

TIP

Wild Bees are incredibly diverse in their requirements and behaiviour.

If these beautiful creatures tackle your fancy, dig into the amazing literature out there!



STEP 2: Make It Cozy with...

- Drilled wood blocks (18–20 cm deep holes, diameter 2–10 mm) - drill the holes in the longwood.
- a variety of diameters to attract different species.
- wood from deciduous trees only.
- Bamboo canes (sealed at one end, 20 cm long), carefully cut and cleaned.
- Bundles of dry plant stems (raspberry, bramble, teasel, reed), placed upright and fully sheltered from rain.

STEP 3: It's A Hotel Not a Hostile

- Orientation: South or southeast-facing to ensure early morning sun (insects are cold-blooded and need warmth to move and fly around).
- Height: Mount at least 1 meter above the ground.
- Shelter: Must be firmly fixed and protected from rain, ideally under an overhanging roof or eave.
- Avoid vegetation in front of holes because flying insects need a clear flight path.

STEP 4: Add Some Seasoning

Spring to Summer (March to August)

- Watch for bee activity, like mud- or leaf-sealed holes indicate nesting.
- Do not disturb during active nesting. They are not ready for their rooms to be cleaned.

Late Summer to Autumn (September–October) watch for:

- Old sealed tubes (from the previous year): mark sealed tubes with colored markers to track emergence.

Winter Storage (October to March)

- Let the Bee Hotel lie dormant over the winter months.

STEP 5: Stay Consistent

- Prepare new nesting blocks or tubes before spring emergence and replace tubes and wood presenting traces of parasites, fungi, mites and mold.
- Taking care of an insect hotel is just as important as building one. Without timely maintenance and clean-up, a once-occupied insect hotel may not attract a new batch next season

Materials

- Structure: Natural, untreated wood with no cracks; or simply an old shelf
- Driller
- Filling material: bamboo sticks, paper rolls (thin), reed sticks, hardwood, clay tiles (Strangfalzziegel).

Optional: coat the outside only with water-based varnish or fence paint. Avoid solvent-based treatments, since they may deter bees.

Sandarium

How do the species benefit?

A Sandarium mimics naturaly open, sandy areas with sparse vegetation that are essential for many ground-nesting insect species. Solitary bees, in particular, rely on dry, sun-exposed patches of ground for nesting. Paired with nectar-rich flowering plants, deadwood, and materials such as empty snail shells, the habitat attracts bees and other beneficial insects, such as beetles and wasps. It's like an insect trip to the Bahamas.

When to implement the measure?

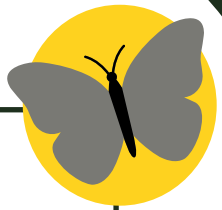
Autumn to early spring.

When will the species be able to use the measure?

Months to years - need for patience! Nature will take its course.

Prerequisites

- Deadwood
- No Pesticides
- Wild corners
- Sun and moon meadows (p.42)



DIFFICULTY **1-2**

TIP

No space for a bigger Sandarium then create a Pocket Sandarium? Try with a flowerpot full of sand placed in a dry, wind sheltered area!

STEP 1: It's All About Location

After locating the right area in your garden (sunny, warm, dry, sheltered from the wind, and ideally located southeast to southwest), it's time to prepare the designated area. The area should have a minimum size of 40x40 cm and be free from bushes or other obstacles. Bees need as much free access as possible. They don't like to be bushed around.

STEP 2: Start Digging!

By marking the area (min. 40 x 40 cm), start digging 50 – 100 cm deep. If the soil is very loamy or wet, use gravel or brick fragments to create a drainage system for the Sandarium. Atop the drainage material, add the sand to a heap and press down on it gently. The sand heap should be at least 50 cm deep.

TIPS

If using sand, put wet sand in a cup and turn the cup around; if the sand does not fall out of the cup during drying, it's the perfect grain size.

The soil you have in place will also work well, just make sure to keep it bare ground.

STEP 3: Set The Stage

To provide food sources, a few nectar-producing plants can be now added to the Sandarium. Dead wood material and snail shells provide precious shelter for other species as well. Pithy plant stems are especially needed by wild bees that only nest in the broken stems of these plants.

STEP 4: Give It Some Love

Keeping the stems vertical is crucial since horizontal stems will not be used by the wild bees in need of this particular shelter. Do not mulch, fertilize, or water – there is no need for this! At least 80% of the area should remain free of vegetation so it is important to weed manually if plants begin to take over the sand surface. It is also important to not disturb the soil, especially during nesting season (spring to late summer).

Materials

- Unwashed sand with different grain sizes
- Gardening tools (spade, shovel, gloves)

Optional

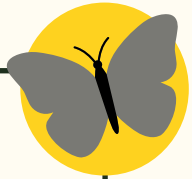
- Wood and stones for borders
- Brick fragments of gravel
- Deadwood (tree roots, branches, etc.)
- Snail shells (Large Garden snail Helix pomatia)
- Pithy plants for plant stem nesting wild bee species

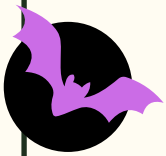
Here are some examples of insect-friendly plant species for your Sandarium:

- Viper's-bugloss (*Echium vulgare*)
- Knapweeds or Starthistles (*Centaurea* spp.)
- Yarrow (*Achillea millefolium*)
- Oregano (*Origanum vulgare)*
- Thyme (*Thymus* spp.)

Check the online BioBox for more!

Sun and Moon Meadows





How do the species benefit?

Flower meadows are green spaces filled with pollen-rich plants to sustain our pollinator community. While Sun Meadows support diurnal (day-time) pollinators such as bees, butterflies, and hoverflies, a Moon Meadow will benefit our nighttime pollinators, like moths, equally - if not more important for our plants!

When to implement the measure?

Mow early in the year and then let the area grow and bloom through the summer.

When will the species be able to use the measure?

From days to weeks - it's a very fast measure!

Prerequisite

- No Pesticides
- Lights off
- Wild corners
- Mowing regimes
- Deadwood
- Leaf piles
- Sandarium (p.38)
- Bee hotels (p.32)

DIFFICULTY 1

TIP

You can put the plants directly in the soil if you have the space but use pots instead if you don't want the plants to spread too much in your garden!

STEP 1 - There's no place like home

Find a space, however big- lots of nectar-rich and shelter plants will grow well even in tiny areas! You can get creative and use a repurposed container on a step, windowsill, or balcony. Even the smallest garden can provide important food and shelter for moths and other wildlife, so no excuses!

If you have a few meters of space, try planting a mix of large and small flowering plants, along with shrubs (see Four-Season Hedge), and maybe small trees. Flowers with lots of nectar feed adult moths, while some leafy plants and shrubs provide food for their caterpillars.

To create your meadow, mow early in the year and then let the area grow and bloom throughout the summer.

Do a single tidy cut in July, removing the grass clippings. Only mow again if really needed until the end of summer. Then leave the area through autumn and winter to provide shelter and food for caterpillars and other wildlife.

TIP

If you have larger space, you can plant small trees (e.g., apple, oak, bramble). They will take a few years to grow, but they will provide food sources, shelter, and nesting sites for the years to come.

STEP 2: Pick Me! Pick Me!

Now you have to choose your plants: here you can find a list of interesting plants for birds, bees, butterflies and moths! Choose from a wide variety of plants to make it suitable for a wider range of bees, butterflies, moth species, and their caterpillars, which depend on plants to complete their life cycle. There are many good nectar plants that are easy to grow in sunny, sheltered spots, and some even produce scent at night.

If there are not many wildflowers yet, you can add seeds or plants. It usually takes about two years for most seeded wildflowers to bloom and up to five years for the meadow to fully establish. The more wildflowers you have, the more species will benefit.

TIP

Select carefully your seeds or flowering plants: choose always and only local and wild flowers, depending on your area and climate!

STEP 3: Turn The Lights Down Low

Position your meadow in an unlit area of your garden, or make little adjustments to reduce impacts to the bare minimum. There are lots of options which allow both people and wildlife to thrive at night. You could...

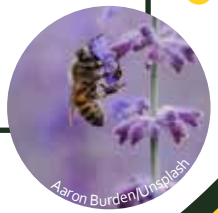
(1) change your outdoor lights by installing timers so they are only on when needed;

(2) use curtains and blinds to reduce light spillage from inside the building;

(3) or simply remove any unnecessary lights in your garden. Switch 'em off when you're not using the area and let wildlife enjoy your beautiful, biodiversity-friendly garden!

STEP 4: Have fun!

Now that you've planted your plants, you can also discover which animals will come to visit! Using identification books or Apps such as iNaturalist, you can sharpen your eye and knowledge about your tiny visitors!



Materials

- Flowering plants or seeds
- Soil
- Shovel
- Gloves
- Watering can
- Other gardening tools


Yoksel Zok/Unsplash


Glen Carrie/Unsplash

What about the others?

You can also encourage action locally by asking your council or whoever manages green spaces near you to change their mowing schedule, allowing grass to grow longer and wildflowers to bloom between May and July.

What About Plant Species?

Plant list for sun meadows

False chamomile (*Anthemis arvensis*), cornflower (*Centaurea cyanus*), chamomile (*Matricaria chamomilla*), ruffled damsel (*Nigella damascena*), poppy (*Papaver rhoeas*), buttercup (*Ranunculus arvensis*), violet (*Viola arvensis*), lavander (*Lavandula angustifolia*), thyme (*Thymus vulgaris*), Meadow clary (*Salvia patensis), Sage (Salvia officinalis*)

Plant list for moon meadows

White Campion (*Silene latifolia)*, Night-flowering Catchfly (*Silene noctiflora*), Fringed Pink (*Dianthus superbus*), European Honeysuckle (*Lonicera caprifolium*), Dame's Rocket (*Hesperis matronalis)*, Perennial Honesty (*Lunaria rediviva*), Meadowsweet (*Filipendula ulmaria*), Catnip (*Nepeta cataria*), Wild Marjoram / Oregano (*Origanum vulgare*)

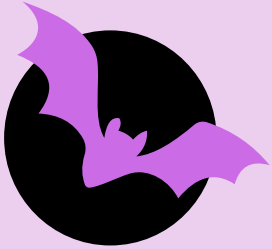
Not All Plants are the Same!

Beware! Avoid these species, and remove them if you find them in your garden- they are invasive and steal space from your plants by spreading uncontrollably. Moreover, their nectar may be toxic to both people and animals: sakhalin knotweed (*Fallopia japonica, Fallopia sachalinensis*), giant hogweed (*Heracleum mantegazzianum*), canadian goldenrod (*Solidago canadensis*), South African ragwort (*Senecio inaequidens*), annual fleabane (*Erigeron annuus*), canadian horseweed (*Conyza canadensis*), common couch grass (*Elymus repens*), common ragwort (*Jacobaea vulgaris*), chinese mugwort (*Artemisia verlotiorum*), common ragweed (*Ambrosia artemisiifolia*).

And just for long-term maintenance...

- Leave plant debris like fallen leaves and old stems on the floor to provide a cosy place for caterpillars to hide
- Avoid using peat-based compost and pesticides, including insecticides and herbicides, as they are harmful to the whole ecosystem you have created
- Let some patches of grass and weeds grow year-round. This can provide food and shelter for even more wildlife that call Moon Meadows their home.

Bats

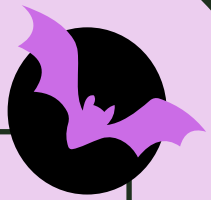


Identify and Protect Bat Roosts

Are there bats sharing your space? It is important to identify existing bat roosts on buildings within your neighborhood. If you have spotted any, sound the bat alarm and raise awareness that these roosts need protection and care, especially during construction or renovation works. Loss of natural roosts has increased the importance of manmade structures for bats to the point that artificial roosts are becoming essential in the survival of many bat species, providing them with stable microclimates. However, even these manmade roosts are now under threat due to demolition of old buildings, renovations, changes in use, artificial lighting, and the trend towards air-tight buildings. All of these have implications for bat populations roosting in or on buildings. Don't be a joker and respect the batmen and women.

Some extra facts!

Bat roosts in buildings vary seasonally. Maternity colonies occupy warm roof voids in late spring and summer while hibernating bats prefer cool, stable microclimates in cellars, wall cavities, or under tiles during winter. Some species, like *Pipistrellus* spp., favor narrow, enclosed spaces, whereas others, such as *Rhinolophus* spp., prefer larger, open roof voids. Many bats also use a network of multiple roosts across a building or several buildings, moving between them according to seasonal needs.



How do the species benefit?
Existing roosts are preserved and protected, while disturbance from human activity and construction is reduced. Maintenance of a year-round roosting network support the wellbeing of the local bat population.

When to implement the measure?
Preferably at the end of winter or (even better) during autumn.

When will the species be able to use the measure?
It takes weeks to years (and lots of patience!).

Prerequisite

- Wild corners
- Lights off
- Deadwood
- No Pestizides
- Cat Management

- Hedges (p.85)
- Sun and Moon Meadows (p.42)
- Micro ponds (p.93)

DIFFICULTY 1-5

STEP 1: It's A Bird, It's a Plane, It's A...Bat Roost!

Look for small gaps, cracks, crevices under tiles, fascia boards, soffits, around windows and doors (common entry <2 cm) and for droppings under roosts and for grease/staining marks.

Listen for echolocation calls and social vocalizations and watch bat activity at dusk or dawn in your area.

STEP 2: We're Going To Need Protection

In Europe, bats and their roosts are usually protected under international agreements (e.g., Habitats Directive, Bern Convention, EUROBATS)! Check for local cases: each country may have its own specific rules about what you can and cannot do near roosts.

Avoid disturbance: noise, bright lights, pets (cats), access by humans and modify entrances to protect bats from predators if necessary (e.g., metal sheeting, buffers)

Use noise barriers or vegetation buffers to reduce anthropogenic noise, if the noise can not be stopped.

STEP 3: Easy Does It

Avoid works during active roosting/breeding season (hibernation; May–Aug maternity). If roost disturbance is unavoidable, install temporary bat boxes nearby.

Use one-way exclusion only outside maternity/hibernation periods and ensure all bats leave roost safely before irreversible works.

Before carrying out any renovation or construction work, contact local wildlife authorities or a licensed bat ecologist to make sure you are acting legally and safely

STEP 4: Keep It Up

Preserve trees, vegetation, and water sources around roosts and retain linear habitat corridors to facilitate range shifts. Avoid fragmentation of core habitats and
prohibit use of pesticides, herbicides, or toxic chemicals in proximity to roosts.

STEP 5: Spread The Word: Bats Are Cool!

Inform family, friends, building owners, and neighbors about bats and generally promote safe coexistence practices and awareness of roost networks!

Bat Roost Checklist

What to check for over time?

1. Observe: bat activity, cracks and crevices, droppings.
2. Adapt: adjust light and sound level around; add protective strcutures (metal sheets, buffers,...).
3. Offer: if disturbance is unavoidable, install temporary Bat Boxes.
4. Offer 2.0: mantain green spaces, dead wood, water resources and linear structures.
5. Never: Don't ever, under any circumstance, use persticides!
6. Connect: With local wildlife centers, bat communities.
7. **Always: when in doubt contact you local wildlife / bat rescue center!**

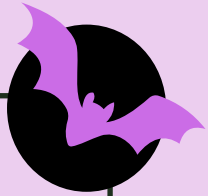
Bat Boxes

Bat Boxes are artificial roosts designed to encourage bats into areas where there are few roosting sites. There are various designs of bat boxes- from a wooden box you can make yourself to external, ready-assembled boxes and even integrated bat boxes that can be built into walls. Different bat species need different spaces. Bat Boxes are more likely to be used if they are located where bats are known to feed. Ideally, several boxes should be installed and positioned in different directions so that the sun and shade can provide both warm and cool conditions. Boxes should be put as high as possible to try and avoid predation from cats on the ground or nearby structures. On buildings, boxes should be placed as close to the eaves as possible. Bats use dark tree lines or hedgerows for navigation, so putting boxes near these features could help bats find the box.

A.Hollerer / FH Kärnten

Denley Photography/Unsplash

Bat Boxes



How do the species benefit?
Bat Boxes provide bats with an alternative roosting site which they can use to safely raise their young. These alternative roosting sites are important alternatives for bats due to the loss of both natural (old trees, caves, rock crevices) and artificial (roof crevices, attics, cellars) roosting sites.

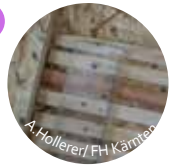
When to implement the measure?
Preferably at the end of winter or better during autumn.

When will the species be able to use the measure?
It takes weeks to years for bats to start using the houses.

Prerequisite

- Lights off
- Cat management
- Wild corners
- Micro ponds (p.85)
- Sun and Moon Meadows (p.42)
- Hedges (p.93)

DIFFICULTY 3-5



STEP 1: Think Outside The Box (Site Selection)
Locate existing roosts, flight paths, feeding area around your home. When looking for a suitable place for the Bat Box, avoid vegetation (below or in front, roads), windows, balconies, high human activity, artificial light, and predators and identify sun/shade exposure to provide microclimate variety. Place the Box high enough (3–5 m) for safe flight!

STEP 2: The Chamber of Secrets (Box Design)
Multi-chamber, vertical boxes with air vents create a gradient of temperatures offering cooler zones during heatwaves and warmer areas at night. Avoid small single-chamber or bird-sized boxes as they do not offer the best shelter. If compensating for lost roosts, match internal width to original roosts when designing the new Bat Box and consider "passageway" boxes for access to original roosts

TIP

The difficulty level depends on the design of the Bat Box, and if you want to make it yourself. The easiest way is to buy an pre- made Bat Box. For well designed Bat Boxes, see the List at the end of this Chapter.

STEP 3: Let's Build It! (see Step-by-Step Visuals)
Cut the wood panels according to chosen multi-chamber design.
Assemble chambers with screws and weatherproof caulk and add the "bat ladder" to the interior surfaces for bat grip.
Seal the exterior with light-colored water-based paint/stain (3 coats) or leave the wood untreated.
Mount securely: high (3–5 m), avoiding windows, balconies, vegetation below. Optionally, add deflector shelf to reduce droppings on windows

STEP 4: That's Just Right (micro-climate regulation)
Provide a mix of sun-exposed and shaded boxes and adjust shading or add awning if bats show signs of overheating.

STEP 5: How Is Your Room? (maintenance and recording)

Check annually for maintenance: caulking, painting, removal of wasp nests

Observe the bat activity; signs of heat stress include bulging bats, fanning wings, daytime flying

Record guano, emergence counts, and occupancy to see how well the Bat Box is used. Adjust placement, shading, or number of boxes if the occupancy is low

STEP 6: Safe House (safety and protection)

Never touch or handle bats directly and protect existing roosts whenever possible!

Always involve a bat specialist for species-specific guidance

If you are replacing a lost roost. provide multiple boxes for the bats.

Last but not least: Avoid drawing bats to unsafe areas (roads, windows, balconies)

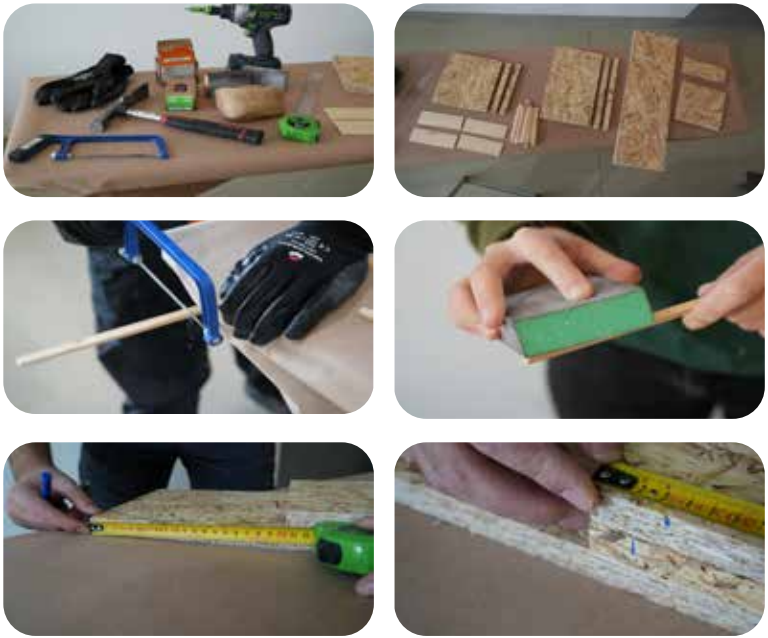
Bill Nino / Unsplash


A.Höllerer / FH Kärnten

Step-by-Step Visuals

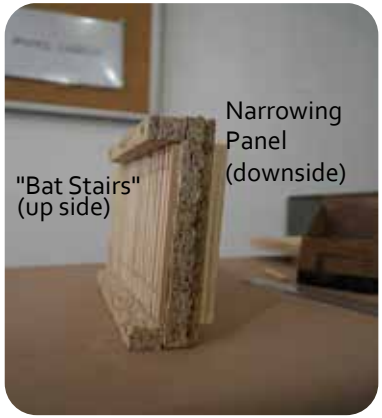
Material Box (lenght-width-height)

- 3 panels:
  64 x 20 x 1.8 cm
  26 x 20 x 1.8 cm
  24 x 20 x 1.8cm
- 2 pair of side panels:
  64 x 2 x 1.8 cm
  26 x 2 x 1.8 cm
- 4 Narrowing panels:
  15.5x 5.5 x0.4 cm
- 55 "Bat Stairs":
  15.5 x 0.5 x 0.3 cm
- Screws: exterior grade
- Drill, Saw, Screwdriver, Measuring tape, pencil
- Optional: metal deflector/shelf, insect mesh



A.Hollerer / FH Kärnten

"Bat Stairs"



A.Hollerer / FH Kärnten

A.Hollerer / FH Kärnten

Birds

Window Design

How do the species benefit?
To some, the problem may seem invisible. Reflections of vegetation and the sky in window panes and glass surfaces leads birds to believe they can fly through the glass which results in bird collisions. Appropriate window design can significantly reduce bird collisions by making windows more visible to birds. Commonly used bird silhouettes (nice try) are not effective and can attract rather than repel birds towards glass surfaces. Therefore, scientifically-tested window design solutions need to be implemented.

When to implement the measure?
Anytime!

When will the species be able to use the measure?
Usually a few days.

Prerequisite
- Cat management
- Lights off

DIFFICULTY 1-5

TIP

Best results are achieved by using colors black, orange and white.

STEP 1: Something's Not Right

Start by spotting the windows where collisions have already happened (or where you see feathers/powder marks).

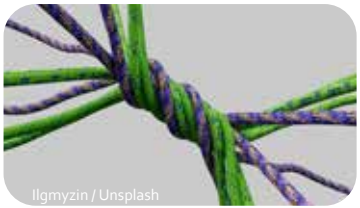
Prioritize large, reflective, or transparent panes; glass facing trees/sky; glass you can see through to more greenery (a "tunnel" or passage effect).

Check glass near feeders, water features, gardens, shrubs, courtyards, and at the end of walls or narrow walkways that funnel birds.


Zhivko Minkov / Unsplash


Evgenii Zolotarev / Unsplash


Darren Richardson / Unsplash


Ilgmyzin / Unsplash


Uliya Kurilova / Unsplash

STEP 2 : Pick the Right Tweetment

For homeowners:

Long-term solutions: exterior insect screens, paracord curtains, fritted/etched/frosted/UV-patterned.

DIY fixes: tempera paint patterns, tape/stickers, or exterior films.

Renovations: install bird-friendly glass during renovations work.

For renters:

Non-permanent fixes: paracord curtains hung from removable rods, removable stickers, washable tempera paint, chalk, soap (easy to wash off).

Interior workarounds: venetian blinds left partially tilted to create visible lines.Ask your landlord: suggest exterior screens or UV-patterned films if upgrades are possible.

STEP 3: Use the "5×5 Rule"

Apply your pattern on the outside of the glass when possible (most effective).

Keep gaps ≤ 5 cm both horizontally and vertically (a 5×5 cm grid).

Dots ≥ 6 mm in diameter; stripes ≥ 3 mm wide.

Choose white or light/medium colors for best contrast in most conditions.

If using paracord, space cords < 10 cm apart (5–7 cm is ideal).

Can you clearly see the pattern from 3 m away? Birds can too!

STEP 4: Lights out

Turn off nonessential lights at night, especially during spring and autumn migration.

Close blinds/shades and shield outdoor lights.

Use timers or motion sensors to cut unnecessary glow at night.

For nightly migration forecasts near you, check tools like BirdCast.

STEP 5 : Tweak Don't Trick

Place feeders and bird baths within 1 m of glass, so birds can't gain speed. Avoid setting attractive plants directly behind untreated glass that would attract birds

Break up "see-through" views (e.g., from front to backyard) with patterns or screens (see Step 2).

STEP 6 : Test Your Skills

View each treated window from outside at different times of day.

If reflections hide your pattern, increase pattern density or choose a lighter color, to have more contrast.

For hard-to-reach windows, try a temporary inside test (e.g., with bright colored post-its); if you can see them clearly from outside through reflections, a carefully applied inside solution may work—otherwise, treat the outside or hire help.

STEP 7: Put Your Head Down And Look Up
During migration, check daily (morning & evening if possible).
If collisions persist, tighten spacing (denser than 5 cm), expand treatment to more panes, or switch methods.

STEP 8: Quick, Someone Call A Bird Doctor!
If you find an injured bird around your area (home or office), gently place the bird in a paper bag (or ventilated box) lined with paper towel and keep warm, dark, and quiet.
Contact a licensed wildlife rehabilitator (e.g., via local wildlife agencies or organizations).

STEP 9: It's A Decision, No More Bird Collision
Photograph your solution and spread the word with friends, family, and online.
Include bird-friendly specs in renovation plans.

Materials
DIY

- Window paint, candle wax, Soap, reflective stickers or old CD
- Paint brush

Pre-Made

- Shades
- Bird collision foil

Window design check-list

1. Identified top problematic windows
2. Chose a treatment (paint / stickers / film / paracord / screens / glass upgrade)
3. Applied outside with proper spacing (≤ 5 cm) and size (dots ≥ 6 mm, stripes ≥ 3 mm)
4. Set up lights-out plan (timers, shields, shades), especially during spring and autumn
5. Moved feeders/baths to within 1 m of treated glassTested visibility from 3 m, multiple times of day
6. Started simple log; adjusted if any strikes

Bird Houses

How do the species benefit?
Bird Houses contribute to the conservation of bird species, particularly the ones that are more used to living with humans. Bird Houses are a good way to rapidly increase the supply of nesting sites and/or refuges within urban areas where urbanization often results in a lack of suitable niches such as nests, old trees, or where building materials (dry grass, twigs, mud) are insufficient.

When to implement the measure?
Preferably at the end of winter or better during autumn. Resident birds will "window shop" for their future nests during winter already!

When will the species be able to use the measure?
It takes days to months for birds to start using the houses.

Prerequisite

- Cat management
- No pesticides
- Wild corners
- Lights off
- Hedges (p.85)

DIFFICULTY 1-5

Cleanliness Is Close To Birdliness: Bird Houses installed by humans have to be cleaned once a year after the season. Otherwise the residue of last years inhabitants will collect and create an unhygienic environment for the next renter.

A Place To Call Home: In urban areas, house martins and swallows are two of the species that need the most support. Due to unsuitable nesting sites and the lack of building materials for them (mud), these two bird species have a hard time finding places for their nests. This is why we focus on the house martin nest on the following pages. Everyone deserves a place to call home.

How to Build a House Martin Nest

DIFFICULTY **1-2**

STEP 1: Site Selection. Make sure emergence from the Bird Houses is not impeded by trees, wires, or other obstacles. Install the Bird Houses at a minimum height of 2 meters to make sure they are not accessible to cats and other predators but easily accessible for maintenance and cleaning. Align the entrance hole from north to southeast to avoid excessive sunlight from the south and cold, humid winds blowing from northwest and southeast.

Check Your Surroundings! If there are occupied bird houses nearby, work and assembly must be completed before early April or beginning of October to avoid disturbance.

STEP 2: Build The Nest.

Gather or cut two two wooden boards with the approx dimensions of 20cm x 20cm and 2cm thick.

Inflate the balloon (approx. 15cm diameter) and wrap it with Newspaper and cling film so that the plaster mixture comes off easily and does not stick to the baloon.

Position the baloon onto the edge of one of the pieces of wood-centering it. Hammer nails around the perimeter of the baloon in order to hold it's position and reinforce the mould.

Mix a thick dough of plaster and straw (ratio 2:1) with a little water and add one teaspoon of charcoal powder from crushed barbecue charcoal to create a 150 ml dough.

Apply a layer of this mixture approximately 15 mm thick to the outside of the balloon. Start at the corners and leave a gap at the bottom edge so that the balloon can be removed later. Form a recess in the top centre (also on the edge) for the entrance hole.

STEP 3: Dry The Nest. Allow the nest to dry thoroughly for some days. Remove the balloon, Newspaper and cling film from the mould and round off the adhesive edge and flight opening.

STEP 4: Assemble The Pieces. You can now screw the two boards together at a right angle so that the top of the nest (with the opening) sits perpendicular to the other board.

Step 5: Find A Snug Spot. Now you can attach the finished nest under the eaves. To do this, attach the nest to boards with contact adhesive and fix them to the wall with wall plugs.

STEP 6: Eaves Droppings. To catch the droppings of the bird, add a wooden board about 2 meter underneath the nest. If you don't mind the droppings, the board is not needed.


A.Hollerer / FH Kärnten


A.Hollerer / FH Kärnten

Materials

- A Baloon (15 cm diameter)
- Old Newspaper
- 2 wooden boards (20x20 cm)
- Handsaw
- Spoon
- Spatula
- Nails (4 - 5 cm long)
- Sandpaper
- Angle
- Plaster
- Contact adhesive
- Cling film
- A Plastic cup
- Sawdust or Small Animal Litter
- Straw- or Plantstalks


A.Hollerer / FH Kärnten


Lukas Kadava/Unsplash

Step-by-Step Visuals

TIP

You can use the same instruction for swallows, but only construct ONE nest.

Swallows prefer to nest solitary; house martins enjoy other birds close by.





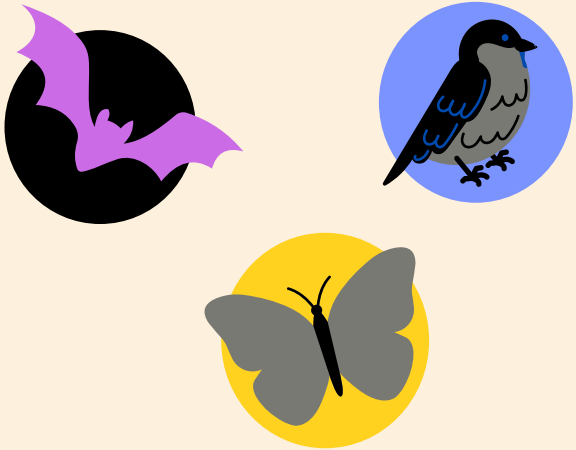

A.Hollerer / FH Kärnten






A.Hollerer / FH Kärnten

Multi-Species



Miyawaki Forest

A Miyawaki Forest, or tiny forest, is a rapid reforestation method developed by Japanese botanist Akira Miyawaki in the 1970s and further developed by Shubendhu Sharma in the early 2000's. Dense clustering of native trees and understory plants are used to restore degraded land.

This diverse, multi-layered community should mimic the natural forest ecosystem and help to grow resilient plants.

E.Wiegele, Fh Kärnten

A.Hollerer, Fh Kärnten

How do the species benefit?

The Miyawaki forest creates a highly diverse structure that serves as habitats for many species. It provides shelter and food resources, depending on the selected shrub and tree species. This multi-layered community mimics a natural forest ecosystem that helps to grow resilient plants and contributes to forest regeneration. Resilient plants means a resilient forest – or as Bob Ross might add "happy little trees".

When to implement the measure?

November to January

When will the species be able to use the measures?

The forest will fully establish itself in a couple of years, but the positive effects on the species will be visible after just a few weeks.

Prerequisite

- Light pollution
- No Pesticides
- Mowing regime

DIFFICULTY 1-5

1. Ready… (Prep and Select): Select native tree and shrub species and identify the planting area. The plot must be prepared by removing any debris and weeds. The entire area should then be dug to a minimum depth of one meter to improve soil aeration. If the soil is degraded, organic matter, mycorrhizal fungi, or mulch can be added to enrich it.

2. Set… (Plant): The planting should mimic a natural, multi-layered forest, with different species placed randomly to promote competition and healthy relationships between the plants – like a thriving metropolis! The high density and wide diversity are key to this ecological engineering method. To plant, a small pit is dug for each plant, ensuring all roots are below the surface. The soil around the plant should be spread gently and not compacted.

3. Grow! (Maintain): The forest will need care for the first 2-3 years to become established. Maintenance tasks include not removing litter (organic matter should be left to decompose), watering as needed, and mulching. The mulch, applied in the first year, helps protect the soil and suppress weeds and should be maintained throughout the establishment period.

Site specific maintenance needs for the first 2-3 years will include:

- Removing litter – organic matter can be left, as it will add beneficial microbes to the soil.
- Watering – frequency will be dependent on rainfall and soil conditions, local climate, and terrain.
- Mulch – mulch should be applied in the first year but can be reapplied in the second and third years if required.

A.Hollerer/ Fh Kärnten

A.Hollerer/ Fh Kärnten

Material

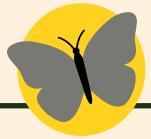
- Perforation and water retention material (e.g. straw, husks, wood chips, mulch)
- Spade(s)
- Shovel (s)
- Gloves (s)
- Watering can
- Lawnmower

You might need at least 2-3 happy little helper!

Plant list (example)

Purple willow (*Salix purpurea)*
Common dogwood (*Cornus sanguinea*)
Hazel (*Corylus avellana*)
European spindle tree (*Euonymus europaeus*
Wayfaring tree (*Viburnum) lantana*)
Guelder rose (*Viburnum opulus*)
Cornelian cherry (*Cornus mas*)
Common hawthorn (*Crataegus monogyna*)
Alder buckthorn (*Frangula alnus*)
Blackthorn (*Prunus spinosa*)
Black elder (*Sambucus nigra*)
Bird cherry (*Prunus padus*)
Common yew (*Taxus media* 'Hicksii')
Grey alder (*Alnus incana*)
Black alder (*Alnus glutinosa*)
White willow (*Salix alba*)
European ash (*Fraxinus excelsior*)
White poplar (*Populus alba* 'Nivea')
Eurasian aspen (*Populus tremula*)
European white elm (*Ulmus laevis*)
English oak (*Quercus robur*)

Hedges



How do the species benefit?

Hedges provide crucial food resources for pollinating insects in the early stages of spring and energy-rich fruits for birds during the fall and winter. The creation of a hedge also helps to increase ecological corridors for bats, establish habitats with a suitable structure for nesting, provide shelter for smaller wildlife, and improve the landscape beauty.

When to implement the measure?

Plant in the autumn to give the roots a strong foundation for spring growing.

When will the species be able to use the measures?

The Hedge will fully establish itself in a couple of years, but the positive effects on the species will be visible after just a few weeks.

Prerequisite

- Deadwood
- No Pesticides
- Wild corner
- Lighs off

Variations

Four-Season Hedge: is a plant community composed of a variety of shrubs of different heights. Unlike a traditional hedge made of a single type of evergreen, a Four Season Hedge is designed to offer a variety of textures and colors, providing crucial food resources (nectar and pollen) for pollinating insects, in the early stages of spring when other sources are scarce, and energy-rich fruits for birds during the fall and winter. The creation of a hedge also helps to increase ecological corridors, establish habitats with a suitable structure for nesting, provide shelter for smaller wildlife, and improve the landscape beauty.

Sweet Hedge: We have established that hedges are a precious space for various species and offer food, shelter, and nesting material to them. Embracing the sweet side of life, we now look at a hedge type that can also feed us : the Sweet Hedge. Ripe with berries, this hedge brings colour and taste into your green space and supports wildlife as well as your own sweet tooth!

Dry Hedge: How can something dead provide so much life? A Dry Hedge, or a Deadwood Hedge, consists of cut trees and shrub clippings. These are loosely arranged lengthwise between several posts. The hedge thus forms a natural wall that creates the basis for new habitats.

(Step-by-Step descriptions for all three hedge variations can be found on the following pages. The building instruction of the Four-Season Hedge and the Sweet Hedge will be labeled as "Wildlife-Friendly Hedge", as the necessary steps are identical and only the planting list differs).

How to Create a Wildlife-Friendly Hedge

DIFFICULTY **1-2**

TIP

The most critical period for a new hedge is the first year. You will need to water the plants regularly during the dry season and keep the area free of weeds so that the young plants do not have to compete for water and nutrients.

STEP 1: Hedge Your Bet On The Right Space
To support wildlife you'll need a bit of space for a staggered, double row of plants that flower and fruit at different times. The success of your hedge depends on selecting species that are well-suited to your local climate and soil, so focus on a mix of native or naturalized species.

STEP2: Pick Your Plants
Find an extensive List of the species at the end of this chapter.

STEP 3: Get Dirty
Start by clearing the area of any weeds, ensuring at least 30cm on both sides of the proposed hedge line is weed-free. This helps the roots establish more easily as they won't need to compete for nutrients. Dig a trench, which should be about twice the width of the root ball or bare roots and deep enough so the root system can grow. Make sure to add organic matter (e.g. compost) or organic fertilizers.

STEP4: Plant The Whips
Get cracking by cutting a piece of cane or wood to the recommended distance for the plants. Use the stick to measure the correct spacing for each plant. Repeat down the trench.

TIP

Try to avoid cutting the hedge back to the same point even if trimming every year. Raising the cutting height on each occasion by about 10–15cm will increase the berry crop and improve the shrub health.

STEP5: Fill It And Water It– It'll Be Mulch Help

Cover the roots with soil and gently firm the soil around the roots. This simple action eliminates air pockets which could cause frost damage during winter. Be careful not to press too hard; the goal is to secure the plants – not to compact the soil and restrict root growth. Then, give your plants a thorough watering until the ground is completely drenched. As you do, watch to ensure the water drains away. If it pools, the soil might be too compacted, and you'll need to gently disturb it. Finally, apply a layer of mulch (e.g. hay, composted wood chips) around the base of the plants. This is a crucial step that helps the soil retain moisture, regulate its temperature, and suppress weeds – giving your young hedge a much better start.

STEP 6: Hedge Fund Management

It is expected that not 100% of the planted species will survive. Plants that have died will need replacing if their loss has resulted in substantial gaps. It is necessary to avoid the use of fertilizers that favor nitrophilic species. Also the use of herbicides and pesticides must also be eliminated to avoid damage to biodiversity.

Plant List for Sweet Hedge

Black Elder (*Sambucus nigra*)
Seabuckthorn (*Hippophae rhamnoides*)
Austria: Pannonicum and Danube Au
Sloe (*Prunus spinosa*)
Rose hips (*Rosa spec.*)
Rowan (*Sorbus aucuparia*)
Cornelian Cherry (*Cornus mas*)

Plant with care! These bushes can grow extensively:
Blackbery (*Rubus fructicosus*)
Raspberry (*Rubus ideaeus*)

TIP
Good quality hedges should have attractive margins for wildlife, such as native grasses or flowers, or ornamental flower beds to attract pollinators.

Plant List for Four-Season Hedge

Gooseberry (*Prunus spinosa*)
Willow (*Salix viminalis*)
Common Hawthorne (*Crataegus monogyna*)
Crap Apple tree(*Malus sylvestris*)
Hawthorne (*Crataegus laevigata*)
Bird Cherry (*Prunus padus*)
Rowan (*Sorbus aucuparia*)
Elder (*Sambucus nigra*)
Cornel (*Cornus mas*)
Dog Rose (*Rosa canina*)
Buckthorne (*Rhamnus cathartica*)
Common Privet (*Ligustrum vulgare*)
Hornbeam (*Carpinus betulus*)
Hazelnut (*Corylus avellana*)
Barberry (*Berberis vulgaris*)

Maintenance: Keep grasses or native flowers at the margins to attract wildlife.

Material

Planting tools:

- spade, hoe, fork, wheelbarrow
- Water provides post-plant irrigation for up to 1 year
- Brace poles and ties: to ensure stability.
- Mulch: organic material (bark, wood chips, straw) to reduce weeds and maintain soil moisture.
- Compost

AND A TIP...

It is necessary to consider the growth characteristics of the species to assess the hedge's height and width, light and shade conditions, root space, and watering requirements.

Warning! The berries or foliage of some shrubs and trees can be toxic to people or livestock, be careful!

Dry Hedge

DIFFICULTY 2

The Dry Hedge creates a favorable microclimate and the decomposing clippings provide sufficient nutrients for a safe habitat and a rich food supply over a long period of time. In the right condition, the Dry Hedge can last up to 20 years, providing a stable habitat for many organisms and nutrients for the environment. It's making the hedgelines!


A.Hollerer / FH Kärnten


A.Hollerer / FH Kärnten

Step 1: Let It Shine. A sunny and dry place is ideal which means 3 – 4 sunny hours per day. Erecting a Dry Hedge in a shaded and less dry area is not ideal and will slow down the greening of the hedge itself.

Step 2: Think About The Future. Most hedges are about 1.50 m in height but you can build them as high as you wish. Just consider the amount of dry plant material that you have and will have in the future – the dry hedge needs to be maintained after all

Step 3: It's Pretty Base-ic. Anchor the wooden poles in the earth in an interval of 50 to 100 cm. This depends again on the dry plant material that you are using. If your material is mostly short, choose an interval of 50 cm. If you will have a lot of long material, choose an interval of 100 cm.

Step 4: Stock Up. Once the base structure is standing, you can fill it with your dry plant material. Long and heavy logs should be placed in the lowest part and used occasionally to weigh down the smaller twigs and branches. Use material from conifers and evergreen trees only to a small percentage, as too much of them will change the pH level of the soil and can lead to soil acidification.

Micro Pond

How do the species benefit?
The Micro Pond functions as a resource for water and food (small water organisms and insects). The small water body also helps small animals to cool down. Water resources like these can help animals during hot and dry months where their regular water resources might have fallen dry.

When to implement the measure?
March, April, and October

When will the species be able to use the measures?
The measures are immediately available for the animals — within a few days you will be able to see the first differences!

Prerequisites
- Lights off
- No pesticides
- Sun and Moon Meadow (p.42)

DIFFICULTY 1

TIP

Rain water is ideal for the Micro Pond as it does not contain any chemicals. If you use tap water, let it sit for some days to ensure that possible chlorine and other additives have disappeared.

Step 1: Identify The Right Location. A location which is sunny for parts of the day is ideal.

Step 2: Choose The Right Container. Avoid using plastic containers. Choose sustainable material like ceramic, wood or metal instead. Creating a Micro Pond is great to upcycle old household items like a wash basin or a pot.

Step 3: Create The Micro Pond. Place the container in the designated spot. It does not have to be buried in the ground if you don't wish to do so. Add stones and gravel to the container to create ranges of depth and structure inside the pond. Fill the pond with rain water and add water plants (see plant list for more details).

Step 4: Additional structure for wildlife. To make the Micro Pond safe for small animals, especially non-aquatic animals, structures to climb in and out of the pond need to be added. To help pollinators, birds, and bats to drink from the pond, see if you can add a small "island" made out of rock in the middle of the pond. The animals can rest on this structure better and drink water more easily.


Bady Abbas/Unsplash


Anna Kharkivska/Unsplash

Variations

Adapted for regions in which mosquitoes are (becoming) problematic. Due to the spread of tigermosquito (Aedes albopictus), standing water bodies of all sizes are becoming increasingly problematic in Europe. All mosquitoes use standing water bodies for their larvae, making Micro Ponds potentially a breeding ground for them. If you are living in an area, in which these animals are a problem but you would still like to implement a Micro Pond, these Micro Pond adaptions might be for you!

DIFFICULTY 1

Micro Pond with Sprinkler

Adding a sprinkler to the Micro Pond can help the oxygenation and water flow in the pond as well as hinder mosquitoes from depositing their eggs in the water body.

Mateusz D /Unsplash

DIFFICULTY **1-2**

TIP

Mosquito larvae won´t be able to develop fully within three days, so stick to the schedule of emptying it!

Set an alarm so you don´t forget!

3 -Day- Micro Pond

Its set-up is closely related to bird baths so this version does not contain a lot of structure provided by water plants or gravel.

Step 1: Place the container on the ground or your fixture and fill with water. Add sticks or other natural elements, to act as a ladder.

Step 2: Empty it out after three days and refill with fresh water. That way, mosquito larvae won't be able to hatch but birds, bats and polinators can still benefit from the water resource.

Building a 3-Day Micro Pond

DIFFICULTY 1-2

You want to build your own 3 Day Micro Pond? Great!
All you need is some clay, a place where you can use the kiln and glaze (check with your local ceramic workshops!) and you can build a 3-Day-Micro Pond following these instructions.




A.Hollerer / FH Kärnten

Material

- Impermeable container (use natural material when possible)
- Gloves
- Plants (for decoration, see below for details)
- Bricks, ramps, rocks
- Mini bubble fountain (optional, to add oxygenation)

For the container you can use large pots, a laundry basket (but try to avoid plastic), sink, or large tube.

Plant list

Depth 0 cm to 10 cm

Lesser spearwort (*Ranunculus flammula*)
Water forget-me-not (*Myosotis palustris*)
Purple loosestrife (*Lythrum salicaria*)
Creeping jenny (*Lysimachia nummularia*)
Marsh Marigold (*Caltha palustris*)
Water mint (*Mentha aquatica*)

Depth 0 cm to 30 cm

Yellow Iris (*Iris pseudacorus)*
Arrowhead (*Sagittaria sagittifolia*)
Common water plantain (*Alisma plantago-aquatica*)
Water violet (*Hottonia palustris*)

Depth 20 to 50 cm

Starwort (*Callitriche stagnalis*)
Hornwort (*Ceratophyllum demersum*)
Miniature waterlily (*Nymphaea "Pygmaea Helvola"*)
Flowering rush (*Butomus umbellatus*)
Mare´s tail (*Hippuris vulgaris*)

Notes

Literature

Antoine, C.M. and Forrest, J.R.K. (2021) "Nesting habitat of ground-nesting bees: a review," Ecological Entomology, 46(2), pp. 143–159. Available at: https://doi.org/10.1111/een.12986.
Barker, M.A. and Wolfson, E.R. (2021) The Birdhouse Book: Building, Placing, and Maintaining Great Homes for Great Birds. Cool Springs Press.

Berthinussen, A., Richardson O.C. and Altringham J.D. (2021) Bat Conservation: Global Evidence for the Effects of Interventions.Conservation Evidence Series Synopses. University of Cambridge, Cambridge, UK.

Bretzel, F. et al. (2016) "Wildflowers: From conserving biodiversity to urban greening—A review," Urban Forestry & Urban Greening, 20, pp. 428–436. Available at: https://doi.org/10.1016/j.ufug.2016.10.008.

Dodds, M. and Bliston, H. (2013) A comparison of different bat box types by by bat occupancy in deciduous woodland, Buckinghamshire, UK. Available at: https://scholar.google.com/scholar_lookup?hl=en&volume=10&publication_year=2013&pages=24-28&journal=Conservation+Evidence&author=M.+Dodds&author=H.+Bilston&title=A+comparison+of+different+bat+box+types+by+bat+occupancy+in+deciduous+woodland%2C+Buckinghamshire%2C+UK (Accessed: October 28, 2025).

Cane, J.H. (1991) "Soils of Ground-Nesting Bees (Hymenoptera: Apoidea): Texture, Moisture, Cell Depth and Climate," Journal of the Kansas Entomological Society, 64(4), pp. 406–413.

Dulisz, B. et al. (2022) "Effectiveness of using nest boxes as a form of bird protection after building modernization," Biodiversity and Conservation, 31(1), pp. 277–294. Available at: https://doi.org/10.1007/s10531-021-02334-0.

Garland, L., Wells, M. and Markham, S. (2017) "Performance of artificial maternity bat roost structures near Bath, UK."

Hall, D.M. et al. (2017) "The city as a refuge for insect pollinators," Conservation Biology, 31(1), pp. 24–29. Available at: https://doi.org/10.1111/cobi.12840.

Harmon-Threatt, A. (2020) "Influence of Nesting Characteristics on Health of Wild Bee Communities," Annual Review of Entomology, 65(Volume 65, 2020), pp. 39–56. Available at: https://doi.org/10.1146/annurev-ento-011019-024955.

Harris, B.A. et al. (2025) "Consumer-Ready Insect Hotels: An Assessment of Arthropod Visitation and Nesting Success," ResearchGate [Preprint]. Available at: https://doi.org/10.18474/0749-8004-56.2.141.

Hoeh, J.P.S. et al. (2018) "In artificial roost comparison, bats show preference for rocket box style," PLOS ONE, 13(10), p. e0205701. Available at: https://doi.org/10.1371/journal.pone.0205701.

Johnson, L.S. (1996) "Removal of Old Nest Material from the Nesting Sites of House Wrens: Effects on Nest Site Attractiveness and Ectoparasite Loads (Remoción de Materiales de Nido Viejos de las Áreas de Anidaje de Troglodytes Aedon: Efectos en la Atractividad de Áreas de Anidaje y en las Cargas de Ectoparásitos)," Journal of Field Ornithology, 67(2), pp. 212–221.

Jägerbrand, A.K. and Bouroussis, C.A. (2021) "Ecological Impact of Artificial Light at Night: Effective Strategies and Measures to Deal with Protected Species and Habitats," Sustainability, 13(11), p. 5991. Available at: https://doi.org/10.3390/su13115991.

Jo-Lynn (2017) "Insect Hotels: A Refuge or a Fad?," The Entomologist Lounge, 18 September. Available at: https://entomologistlounge.wordpress.com/2017/09/18/insect-hotels-a-refuge-or-a-fad/ (Accessed: October 28, 2025).

Lerman, S.B. and Milam, J. (2016) "Bee Fauna and Floral Abundance Within Lawn-Dominated Suburban Yards in Springfield, MA," Annals of the Entomological Society of America, 109(5), pp. 713–723. Available at: https://doi.org/10.1093/aesa/saw043.

López-Uribe, M.M. et al. (2015) "Nest Suitability, Fine-Scale Population Structure and Male-Mediated Dispersal of a Solitary Ground Nesting Bee in an Urban Landscape," PLOS ONE, 10(5), p. e0125719. Available at: https://doi.org/10.1371/journal.pone.0125719.

Loss, S.R. et al. (2022) "Review and synthesis of the global literature on domestic cat impacts on wildlife," Journal of Animal Ecology, 91(7), pp. 1361–1372. Available at: https://doi.org/10.1111/1365-2656.13745.
Lowenstein, D.M., Matteson, K.C. and Minor, E.S. (2015) "Diversity of wild bees supports pollination services in an urbanized landscape," Oecologia, 179(3), pp. 811–821. Available at: https://doi.org/10.1007/s00442-015-3389-0.

Lowenstein, D.M., Matteson, K.C. and Minor, E.S. (2015) "Diversity of wild bees supports pollination services in an urbanized landscape," Oecologia, 179(3), pp. 811–821. Available at: https://doi.org/10.1007/s00442-015-3389-0.

Merino, S. and Potti, J. (1995) "Pied Flycatchers Prefer to Nest in Clean Nest Boxes in an Area with Detrimental Nest Ectoparasites," The Condor: Ornithological Applications, 97(3), pp. 828–831. Available at: https://doi.org/10.2307/1369195.

Muratet, A. and Fontaine, B. (2015) "Contrasting impacts of pesticides on butterflies and bumblebees in private gardens in France," Biological Conservation, 182, pp. 148–154. Available at: https://doi.org/10.1016/j.biocon.2014.11.045.

NABU (n.A.) Benjneshecke. Available at: http://nabu-zukunftsgarten.de/projekte/wissensblog-naturnaher-garten/benjeshecke/ (Accessed: August 01, 2025)

NABU (2023). Bauanleitung Mehlschwalben-Kunstnest. Available at: https://www.nabu.de/tiere-und-pflanzen/voegel/helfen/nistkaesten/01086.html (Accessed: September 20, 2025).

Patton, A.J. (2025) "Why mow?: A review of the resulting ecosystem services and disservices from mowing turfgrass," Crop Science, 65(1), p. e21376. Available at: https://doi.org/10.1002/csc2.21376.

Politi Bertoncini, A. et al. (2012) "Local gardening practices shape urban lawn floristic communities," Landscape and Urban Planning, 105(1), pp. 53–61. Available at: https://doi.org/10.1016/j.landurbplan.2011.11.017

Potts, S. and Willmer, P. (1997) "Abiotic and biotic factors influencing nest-site selection by Halictus rubicundus, a ground-nesting halictine bee," Ecological Entomology, 22(3), pp. 319–328. Available at: https://doi.org/10.1046/j.1365-2311.1997.00071.x.

Potts, S.G. et al. (2003) "Linking Bees and Flowers: How Do Floral Communities Structure Pollinator Communities?," Ecology, 84(10), pp. 2628–2642. Available at: https://doi.org/10.1890/02-0136.

Potts, S.G. et al. (2010) "Global pollinator declines: trends, impacts and drivers," Trends in Ecology & Evolution, 25(6), pp. 345–353. Available at: https://doi.org/10.1016/j.tree.2010.01.007.

Prendergast, K.S. (2023) "Checking in at bee hotels: trap-nesting occupancy and fitness of cavity-nesting bees in an urbanised biodiversity hotspot," Urban Ecosystems, 26(5), pp. 1381–1395. Available at: https://doi.org/10.1007/s11252-023-01381-5.

Smith, R.M. et al. (2006) "Urban domestic gardens (VIII) : environmental correlates of invertebrate abundance," Biodiversity & Conservation, 15(8), pp. 2515–2545. Available at: https://doi.org/10.1007/s10531-005-2784-y.

Sze Wing Yiu, Justin P. Suraci, Grant Norbury, Alistair S. Glen, Joanne E. Peace, Patrick M. Garvey,Problematic cats in urban reserves: Implications for native biodiversity and urban cat management,Global Ecology and Conservation,Volume 60,2025,e03584,ISSN 2351-9894,https://doi.org/10.1016/j.gecco.2025.e03584.(https://www.sciencedirect.com/science/article/
The Tree Council (2025) "Hedge Hub," Hedgelink. Available at: https://hedgelink.org.uk/hedge-hub/ (Accessed: October 29, 2025). pii/S2351989425001 8.

Sheng, G.Q., Ingabo, S.N. and Chan, Y.-C. (2024) "Evaluating the impact of bird collision prevention glazing patterns on window views," Building and Environment, 259, p. 111657. Available at: https://doi.org/10.1016/j.buildenv.2024.111657.

Stanback, M.T. and Dervan, A.A. (2001) "Within-season Nest-site Fidelity in Eastern Bluebirds: Disentangling Effects of Nest Success and Parasite Avoidance," The Auk, 118(3), pp. 743–745. Available at: https://doi.org/10.1093/auk/118.3.743.

Tahir Akram, M. et al. (2025) Miyawaki technique for sustainable urban greening and ecological restoration: A review, ResearchGate. Available at: https://doi.org/10.1079/cabireviews.2025.0028.

Tassin de Montaigu, C. and Goulson, D. (2023) "Habitat quality, urbanisation & pesticides influence bird abundance and richness in gardens," Science of The Total Environment, 870, p. 161916. Available at: https://doi.org/10.1016/j.scitotenv.2023.161916.

The Wildlife Trust (2015). How to build a bat box. Available at: https://www.wildlifetrusts.org/actions/how-build-bat-box

Zamora-Marín, J.M. et al. (2024) "From small waterbodies to large multi-service providers: Assessing their ecological multifunctionality for terrestrial birds in Mediterranean agroecosystems," Agriculture, Ecosystems & Environment, 359, p. 108760. Available at: https://doi.org/10.1016/j.agee.2023.108760.

Further Resources:
1. DeepL Translator , https://www.deepl.com/de/translator ; used for Translation processes
2. Academic AI, https://fh-kaernten.academic-ai.at/general-chat ; Literature research
3. Claude Opus 4.1., https://use.ai/de/chat ; Literature research


E.Wiegele / FH Kärnten

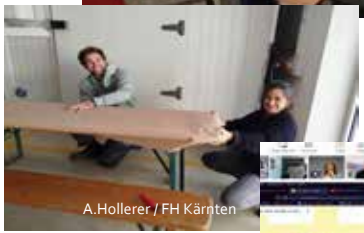

A.Hollerer / FH Kärnten


E.Wiegele/
FH Kärnten

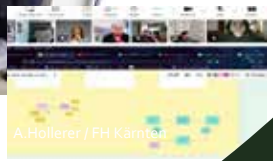

A.Hollerer / FH Kärnten


A.Hollerer / FH Kärnten


A.Hollerer / FH Kärnten


A.Hollerer / FH Kärnten


A.Hollerer / FH Kärnten


A.Hollerer / FH Kärnten

Not the End...

BioBox Online

In addition to the Booklet, an online version will be offered from 2026 onwards. This website will act as an extension and interactive platform, on which individuals can reach out to the project, get informed, and stay updated. To make the BioBox as inclusive as possible, the material will also be available in easy language, video format, and sign language.

Acknowledgment

Thanks to all the experts of University of Vienna, University of Udine, independent researchers and experts, our Italian and Austrian Associated Partners, our departments and colleagues, all individulas involved and who supported us with their feedback and creativity ... and coffee.

Interreg Italia–Österreich | Co-funded by the European Union | BioBox

BioBox Project Partners

KÄRNTEN University of Applied Sciences

Europastraße 4
9524 Villach, AT
www.fh-kaernten.at
forschung@fh-kaernten.at

R3GIS managing spaces

Via Ipazia Straße 2
39100 Bolzano Bozen, IT
www.r3gis.com
biobox@r3gis.com

UNIVERSITÀ DEGLI STUDI DI UDINE
HIC SUNT FUTURA

Via delle Scienze 206
33100 Udine, IT
www.di4a.uniud.it
biobox@uniud.at