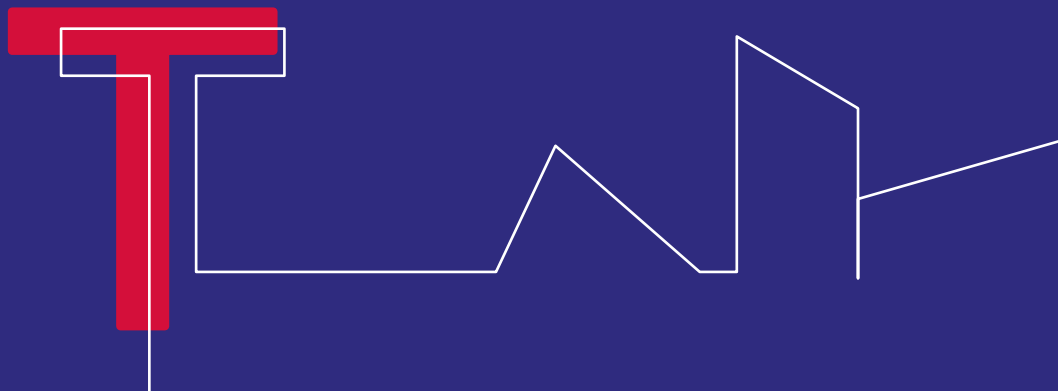




# PORTFOLIO

## Animal-oriented Design Solutions



LAND Research Lab,  
June 2022

# | The value of urban biodiversity

The rapid urbanization and spread of urban areas has profoundly changed landscape structure causing habitat loss and fragmentation and threatening its capacity to carry life.

Nevertheless, ecological research showed that the urban environment can host a wide range of wildlife species, providing ecological niches and recognizing the potential of urban environment for biodiversity conservation (Convention on Biodiversity, 2012).

Biodiversity mapping is a powerful tool to study and monitor the presence of wildlife in urban built-up areas, allowing to evaluate the urban ecosystem suitability to host non-human guests or the specific impact of urban greening practices in a neighborhood.





## INTRODUCTION

The dominant influence of humans on ecosystems and climate caused an unprecedented loss of biodiversity worldwide. The main driver of species diversity decline is the rapid urbanization and spread of urban areas that profoundly changed landscape structure, causing habitat loss and fragmentation, and threatening its capacity to carry life.

Ecological research showed that the urban environment can host a wide range of wildlife species, providing ecological niches also in its built structure (*Hauck et al., 2018*) although conflicts with human interactions and conventional management of urban spaces tend to eliminate these habitats. Nevertheless, the potential of urban environment for biodiversity conservation is now recognized (CBD, 2012) and cities are taking action to enhance nature and the related Ecosystem services supply through the implementation of connected Green and Blue Infrastructure and Nature-Based Solutions.

Animal-inspired Design is a methodology aimed at prioritizing conservation aspects in urban open space planning process, such they are integral part of the design.



## ANIMAL-ORIENTED DESIGN: TAKING URBAN NATURE CONSERVATION TO THE NEXT LEVEL

### Mainstreaming biodiversity into urban open spaces

Creating wildlife inclusive urban spaces goes beyond the concept of conventional species conservation as it is aimed at promoting and improving human-animal interactions in the urban ecosystem. Including biodiversity aspects into planning procedures is recognising that landscape architecture and conservation of species in Cities can only be successful if combined (*Weisser et al., 2017*). This can be achieved conceptually by considering urban wildlife and biodiversity as proper users of urban public space, on an equal footing with human beings. Animal-oriented design differs from traditional conservation efforts because it prioritizes target areas that are generally not considered for wildlife conservation since they are located in the urban built-up area, allowing the creation of new habitat opportunities in a proactive way (*Apfelbeck et al., 2020*).

This approach allows to consider the critical needs and the life cycle of target species into the design process of open spaces, creating a suitable environment both for human and animal users.

### From species selection to wildlife-inclusive design features

To consider biodiversity into planning processes it is necessary to select a list of target species to promote in the project area. The selection of target species is a delicate task since it involves both the socio-cultural and the ecological spheres and must be agreed upon by stakeholders and users to prevent conflicts. The selection of species must be done by accurately study the ecological context of the project area in a multiscale perspective, considering the relation to the existing habitat types and ecological network on and around the development site and the dispersal barriers that limit the species number.

Studying the species life cycle from a biological perspective allows to identify the specific requirements and the critical needs to be implemented into the design process to create wildlife-inclusive open spaces, such as the food sources and the protection from predation.



## The role of participatory processes

The broader engagement and participation of stakeholders is a fundamental point in the animal inspired design, since it gives the possibility to the community members not involved in the design team to take part in the selection process of the target species, increasing the chances of positive human-wildlife interactions later (*Apfelbeck et al., 2019*). The socio-cultural dimension of the animal-oriented design process is directly represented by the stakeholder participation .

## Lessons learnt from existing best practices

According to the existing case studies and the multidisciplinary professionals involved in these projects (*Apfelbeck et al., 2020*) the key features for animal inspired design implementation are the following:

- Interdisciplinary design teams that involve ecologists
- Consideration of the full life cycle of the target species
- Monitoring and evaluation of actions and feedbacks
- Participatory approaches that inform and engage local stakeholders

Ecologists are often included in project as external consultants, and they mainly deal with Environmental Impact Assessments. For a proper wildlife-inclusive design it is fundamental to involve ecologists and biologists since the early stage within a multidisciplinary team, allowing synergies between different disciplines. The involvement of such professionals is a key element to correctly dress the species portraits, identifying their needs all along their life cycle. The process is shaped in close relation to the ultra-local scale; in this context, since ecological communities cannot be controlled, there can be a lot of variability in the reality compared to the initial expectations. For this reason, another fundamental point is to prepare a consistent monitoring and evaluation plan of the project, allowing correction based on the success of the animal inspired actions and allowing to translate it into best practices. Finally, participatory approaches are fundamental to adequately inform and engage the local stakeholders, introducing the socio-cultural sphere as a key element of the design process. This step is fundamental to evaluate the acceptance and appreciation of wildlife and such approaches may also strengthen communities and foster relationships among residents and local citizens.



## Solutions to build and add to your space:

The destruction of habitats is amongst one of the main causes of fauna species loss in today's world. Human settlements and development are intricately related to habitat destruction. Habitat loss is an important risk not only for the fauna species dependent on said habitat, but it also can be a nuisance for human health (*Wageningen University, 2011*).

In a world that is increasingly at risk and compromised by increasingly cumbersome threats, it is important to focus on what can be done, immediately intervening on the resources available to combat these events. The loss of biodiversity is a phenomenon now established and studied by many researchers, on a large scale and for this reason in the following portfolio we will focus on the most 'concrete', quick and easy actions to improve the condition of our natural environment on a small scale.



1. Bug-hotel
2. Birds house - © NABU
3. Benjes hedge - © Muenzl
4. Amphibians house - © RSPB
5. Shitake in trunk - © Wurth

## Solutions to manage and adapt your space:

For cities, the design of 'green infrastructures' and the implementation of 'nature-based solutions' have been proposed to maintain the important ecosystem services and to protect a healthy level of biodiversity. Biodiversity is declining worldwide and human land use is the major driver of this decline.

Biodiversity plays an important role in the emerging challenges and extreme events as results of climate change. Everyday it is getting more urgent to act with adapting solutions and new interventions to the existing assets of our cities, that have to be easy and quickly replicable. The key challenge of our time is precisely here, to act now and immediately. Vulnerability to climate change can be exacerbated by other stresses, including the loss of biodiversity, damage to ecosystem services, and land degradation. Adaptation will become an increasingly important part of the development agenda. Enhanced protection and more sustainable management of natural resources (The World Bank, 2008).



6. Pollinator hedges
7. Sand on green roof - © Sempergreen
8. Green space management - © NatureScot
9. Water pond - © RSPB
10. Worm supporting solutions- © Sweetser



## | AOD1 Bug hotel

**What?** Creation of shelter for different bug species

**Why?** To provide a safe hideaway for wildlife and help make use of garden waste.

**When?** Optimal to be constructed in every period of the year, in Autumn some materials can be found easier such as straw, dry grass and hollow plant stems.

### How?

1. Take the fruit box or alternatively the wooden planks and assemble as if they were a box, leaving one side completely open
2. Create separate areas always using wooden planks as a divider, so as to create separate micro-areas for each species
3. Fill in the structure with the elements reported below 'What to put inside'.
4. Glue over the entire surface of the box if you want a net so that the material inside does not fall
5. Place the structure upright in a sunny and sheltered area from the wind, possibly close to aromatic plants. (Source: LipuVarese, 2020)

### What to put inside?

Dead wood and loose bark for beetles, centipedes and spiders;

Bamboo reeds for solitary bees and bumblebees

Larger holes with stones and tiles, which provide the cool, damp conditions frogs and toads like – if you put it in the centre you'll give them a frost-free place to spend the winter;

Dry leaves, sticks or straw for ladybirds and other beetles and bugs;

Corrugated cardboard, straw and wood for lacewings.

### Curiosities

Animal pollination is the fundamental basis for the functioning of ecosystems, the conservation of habitats and benefits for humans, including the production of food, fibers, wood and other products What are the good insects? These are harmful insects, greedy for harmful insects, they help us in preventing plant diseases of useful to parasites, or allies because they are faithful pollinators (LipuVarese, 2020). Ladybirds and Lacewings' larvae for instance, eat aphids, a pests very dangerous for plants.



## | AOD6 Pollinator hedges

**What?** Pollinator hedges are flower buffer bands for increasing biodiversity in agricultural environments and environmental restoration in natural areas.

**Why?** the aim is to host useful and pollinating insects that ensure the productivity of crops and the natural pest control and pollination. A study from the Ecology Letter states that flower strips are more effective at promoting natural pest control, while older and more diverse hedges are more effective at promoting pollination (SINAB, n.d).

### How?

1. Choose a place, preferably facing South with good sunshine throughout the day, but at the same time protected from the wind.
2. Treat the soil with garden tools to prepare it for planting or get some wooden boxes or pots.
3. Choose the plants to use, the native ones and the spontaneous ones are preferable because they require little maintenance. Also use plants with scalar flowering (lavender, thyme, rosemary, camellias, azaleas and others) so as to have flowers every season and to guarantee constant nourishment to insects. Alternatively, plant the seeds of the plants directly.
4. Provide containers with water (including rainwater) for nearby insects.
5. Keep the flowering band cleared from weeds.

(Source: Codiferro, n.d)

### Curiosities

Many of the flowering plants we know need pollinating insects to survive. Thanks to them, pollination and subsequent reproduction takes place. About one in three bites of the food we eat every day, we get it thanks to pollinators. Furthermore, these small insects keep healthy ecosystems alive capable of cleaning the air, stabilizing the soil, protecting from environmental disasters and safeguarding wild animals. Many of the pollinating insect species are diinishing due to the loss of their natural habitats and the disappearance of the food they eat. Air and soil pollution, the abuse of chemicals, some diseases and changes in climate patterns, all contribute to the decrease and displacement of pollinating insects (Codiferro, n.d).





## | AOD2 Birds house

**What?** Creation of shelter for different birds  
**Why?** To provide a safe hideaway for wildlife and help make use of garden waste.  
**When?** The best period to construct a birds - house range from Autumn to Winter otherwise the placement of too early nest during hot months will led to the presence of different bugs that would ruin the wood making unusable by the birds (Lipu, 2014).

### How?

1. Obtain 20 mm thick unplanned white or red spruce wood. Pressed wood or plywood are not sufficiently breathable and therefore unsuitable.
2. The sizes of the holes and walls vary according to the species of bird that will be housed. Below a detailed diagram.
3. Enlarge two holes in the base plate by approx. 5mm in diameter for air circulation and cleaning
4. Brush the outer surface of the wood with linseed oil to protect the outer walls against moisture and fungi.
5. Place the structure on a trunk or pinned it on a different surface\* preferably slightly inclined downwards on a height of 3 m. A tip is to tie the structure with iron wire or plastic cords in order to be easily dismantle when maintenance and cleaning is needed. The best exposure is the one facing East / South - East, and the opening must not be exposed to the sun or atmospheric agents.

Bird species	Roof	Side wall	Front wall	Base	Back wall	Entry wound
Blue tit, gret tit bird	20x20	25x17x28	25x13	13x13	28x13	26-28 mm
Gret tit bird, woodpecker, sparrow	22x22	25x18x28	25x14	14x14	28x14	30-32 mm
Black redstart	22x22	25x18x28	25x14	14x14	28x14	1-2 x 32 mm
Starling	24x24	30x20x34	30x16	16x16	34x16	45-50 mm
Dove	27x27	35x22x40	35x18	18x18	40x18	70-85 mm
Jackdaws	27x27	35x22x40	35x18	18x18	40x18	80 mm
Owl	35x35	44x29x50	44x25	25x25	50x25	120 mm

Source: Schmid, 2019

### Curiosities

\*Certain species such as the Blackbird prefer nests inserted in dense vegetation such as ivy and bushes, so please consider this location as alternative.



## | AOD7 Sand on green roof

**What?** Place sand on green roof to help birds and other living species.  
**Why?** a green roof provides a favourable living environment for animals such as birds, butterflies and bees. Here they find food and/or reproduction opportunities that are otherwise not available in the immediate vicinity. Placing sand in which bees can dig burrows, a thick layer of substrate for pupation, oak tree trunks and an insect hotel in which insects can lay their eggs or hibernate (Sempergreen, 2021).

### How?

For creating green roofs two main methods can be applied:

- Seeding
- Plug planting: it is also important to include species which flower in early spring and autumn as this will provide an extended pollen and nectar source for invertebrates throughout the year.

Seeding is the most cost effective option, however plug planting of wildflowers can be beneficial as this provides a resource for invertebrates during the first few years whilst the seeded plants become fully established.

Placing sand on a part of the roof can contribute to the benefits. (Source: buglife, 2019)

### Curiosities

Green roofs can provide some benefit for invertebrates and other wildlife.

Green roofs can provide a wide range of environmental benefits including:

- Providing habitat at roof level, especially within urban areas, can have significant benefits for wildlife, notably invertebrates and birds;
- Improving water quality through filtration.
- Reducing energy consumption by reducing the need for heating and cooling;
- Vegetation on a roof removes carbon from the atmosphere as part of photosynthesis and releases oxygen;
- Specifically sand on green roofs can be used by birds to clean their feathers.

The sand that is processed into the bird's feathers will absorb excess oil to help keep the feathers matt. The oil-soaked dust is then easily wiped off to keep the feathers clean and flexible for more aerodynamic flight and efficient insulation. Dry skin and other debris can also be removed with excess dust, and regular dusting can help suffocate or minimize lice, feather mites, and other parasites (Guerra, 2021).



## | AOD3 Benjes hedge

**What?** Benjes hedge that consists of piled up branches

**Why?** provides an increasing amount of protection and habitat for animals as it develops and an increasing amount of new life is generated within the hedge (Gardena, 2022). It serves in particular wren, robin, small mammals such as hedgehogs and dormice, as well as small reptiles such as lizards, and others like toads or insects (Garden Landscape, n.d).

### How?

1. After determining the location of the hedge you can plant smaller trees and shrubs as natural "fence posts" at an appropriate distance to one another (approx. 2.5 metres). Wooden posts that hold the deadwood in place. Perfect in this case are hardwood, such as slow-growing fruit trees, oak, beech and like.
2. Avoid cutting-out plants such as the blackberry.
3. It is recommended to use larger branches below to provide small mammals such as hedgehogs with sufficient living space and to use smaller branches and twigs upwards.
4. Between these, you place layers of cuttings from deciduous trees. The branches are layered approximately three metres wide and one metre high to form thicket barriers, then intertwined with each other and shaken. However, light and air should still be able to get to the ground so that germinating plants can still grow through them. (Source: Gardena and Garden Landscape)

### Curiosities

Fungi and bacteria developed inside the hedge contribute increasingly towards turning the tree cuttings into humus which promotes soil life (Gardena, 2022).



## | AOD8 Green space management

**What?** Care and maintain open spaces, especially green ones.

**Why?** To increase biodiversity across urban areas and provide a rich ecosystem of different species

### How?

- Provide the green space of elements that help environmental protection such as: birds house and feeder.
- Trees provide shade, shelter, structure on a site as well as food and nesting sites for wildlife. Appropriate native tree species should be chosen to fit site conditions. Groups of trees or woodland provide areas of habitat used by a ranges of birds, pollinating insects and other animals and for example could allow for the development of forest school activities.
- Freshwater and wetland habitats support a huge diversity of life. Where deep water is a concern, consider creating bog and other wetland habitats instead, or shallow areas of water, which will all benefit wildlife.
- Play and recreation areas can incorporate natural elements that contribute to the experience and promote biodiversity.
- Choose species of plants for both sensory and wildlife value, and include sustainable materials that can also enrich habitats such as log piles and large stones or boulders. These provide habitats for invertebrates, fungi, mosses and lichens, as well as perches for birds and small mammals. (Source: NatureScot, 2022)



## | AOD4 Amphibians house

**What?** Creation of safe spaces for amphibians  
**Why?** not enough natural places – like holes in or safe ground locations – for toads, frogs and amphibians to hibernate over the cold winter months.

**How? (Hibernaculum for amphibians during the cold months)**

1. Dig a hole about 50 cm deep and 1.5 metres across
2. Fill the hole with logs, branches, bricks and rocks
3. Slot in entrance tunnels using the drainpipes at the sides. The tops of the drainpipes should be at ground level.
4. Cover the bricks and branches with soil until you have a mound about half a metre high. Make sure that you don't cover up the drainpipe entrance holes.

*(Source: The Royal Society for the Protection of Birds RSPB, n.d)*

**How? (Toad hole for amphibians to sleep)**

1. Find a place out to the way, under a bush is especially good, somewhere where other people won't find it
2. Take a pot and dig a hole about 10cm deep as long as your pot.
3. Tip the pot in the hole on its side so that it's half buried. The mouth of the pot should face south (out of most strong winds and rain)
4. Half-fill the pot with leaves and moss and scatter more around the pot.

*(Source: The Royal Society for the Protection of Birds RSPB, n.d)*

### Curiosities

We owe the cleanliness of the waterways to the tadpoles that feed on algae, and it is the frogs that free us from numerous types of insects - which they eat - which, in addition to annoying us on hot summer nights, can also carry dangerous diseases.

Furthermore, thanks to the permeability of their skin, able to absorb any chemicals present in the environment, frogs also act as indicators of the quality of the environment in which they live *(Carboni, 2019)*.



## | AOD9 Water pond

**What?** A mini-pond to provide a place for amphibians  
**Why?** providing a home for frogs, toads, dragonflies, pondskaters. Birds and mammals also use ponds as places to drink and sometimes bathe.

**How?**

1. Dig a hole big enough for the washing up bowl to sit comfortably in. Try to make it as level as possible
2. Fill the bottom of the bowl with gravel. Build a ladder of large stones up one side so that mice and voles can escape. Put in a dragonfly perching stick or two. Wedge the base of each stick under heavy stones.
3. Fill the bowl with water – rainwater if possible
4. Cover the edge of the bowl with stones and logs. Bury potted plants in pebbles, then drop in other pond plants. *(Source: The Royal Society for the Protection of Birds RSPB, n.d)*

### Curiosities

Water attract dragonfly that eats mosquitoes ('umbrella species')



## | AOD5 Shiitake in trunk

**What?** Logs with shiitake mushrooms.  
**Why?** To create a diversified and rich ecosystem

### How?

Get a freshly cut log (within the last 72 hours). Apparently 100-150mm diameter is ideal, length preferably no less than 60 – 75cm.

2. If you have a log with thick bark you have to de-barked it.
3. Drilled each log with 20 holes, evenly spaced around the log, width 8.5mm. The basic idea here is to fill the holes in the log with shiitake spawn (mycelium). Plug spawn (shiitake spawn that has colonized a wooden plug) is one way of doing this. Colonizing sawdust with shiitake spawn, and putting that in the holes, is another way.
4. Take a spawn plug and tap it into the hole, until you run out of holes.
5. Seal all open surfaces on the log, in order to ensure that other fungi spores don't take over your log. The best way to seal the log is with beeswax, as it's the most natural substance for the job. The mushrooms absorb whatever they come into contact with, so obviously you don't want to use petroleum or artificially based waxes or sealants on your food. *(Source: Bradley, 2011)*

### Curiosities

Shiitake mushrooms are considered to be medicinal mushrooms in some forms of traditional medicine. Shiitake offer good amounts of fiber, as well as B vitamins and some minerals *(Raftery, 2020)*.



## | AOD10 Worm supporting solution

**What?** Creating places for attracting Earthworms  
**Why?** Because worms are the foundation of a healthy and thriving garden. The earthworms's tunnels improve soil aeration and drainage, making it easier for plant roots to penetrate the earth. Earthworms' casts also improve soil structure and nutrient availability which increases garden productivity. Their movement mixes up the soil while creating a network of burrows to help air and water move through the soil *(Sweetser, 2021)*.

### How?

To encourage the arrival of worms the things to do are:

- Reduce tilling the soil;
- Leave organic matter on the surface;
- Add manure and compost;
- Ditch the chemicals;
- Use an organic mulch to keep soil moist and cool.

And is also important to remember that:

- Earthworms need moisture to live since their bodies are 80% water, but because they breathe through their skin, too much water can drown them;
- They prefer loamy soil. Overly sandy soil is abrasive and dries out too quickly;
- Earthworms are cold-blooded so 50 to 60 degrees is optimum.

*(Source: Sweetser, 2021)*

### Curiosities

Worms can absorb oxygen through their skin, can eat their own body weight in soil, and - despite having no eyes - navigate by sensing light and vibrations in the soil. Worms's populations fluctuate naturally with the seasons. Adults die off in the summer and young ones hatch out in the fall. Over the winter they burrow deep below the frostline. Some species winter over as eggs and hatch out in the spring *(Sweetser, 2021)*.

# The value of urban biodiversity

## From species selection to wildlife-inclusive design features

To consider biodiversity into planning processes it is necessary to select a list of target species to promote in the project area. The selection of target species is a delicate task since it involves both the socio-cultural and the ecological spheres and must be agreed upon by stakeholders and users to prevent conflicts. The selection of species must be done by accurately study the ecological context of the project area in a multiscale perspective, considering the relation to the existing habitat types and ecological network on and around the development site and the dispersal barriers that limit the species number.

Studying the species life cycle from a biological perspective allows to identify the specific requirements and the critical needs to be implemented into the design process to create wildlife-inclusive open spaces, such as the food sources and the protection from predation.

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