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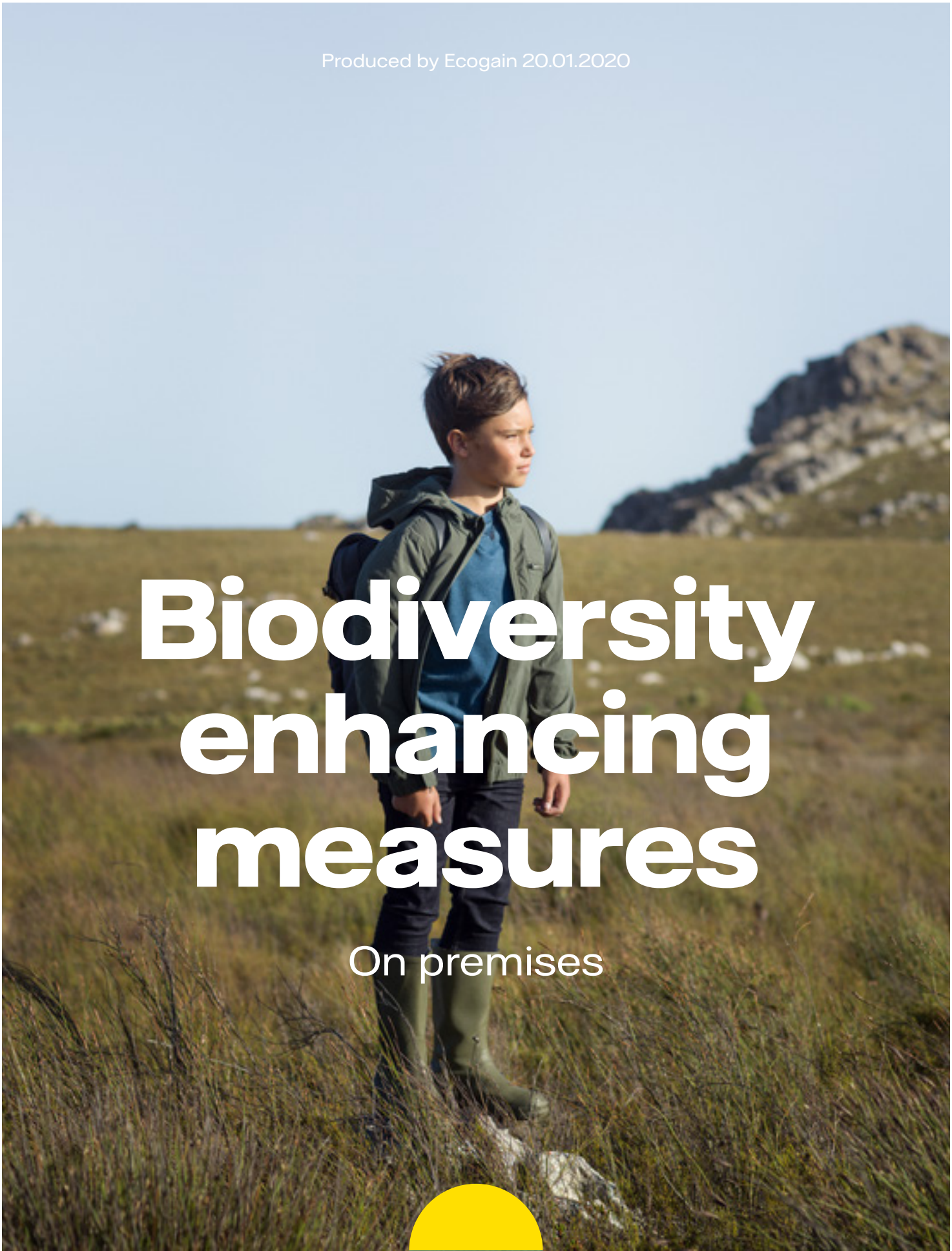

Biodiversity enhancing measures

On premises

VATTENFALL

Contents

About this document
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1. Introduction

“Biodiversity forms the web of life of which we are an integral part and upon which we depend.”
- The Secretariat of the Convention on Biological Diversity

Human wellbeing and, ultimately, survival are entirely dependent on the products and services provided by nature – often called ecosystem services.
Examples of ecosystem services include – among many others – storm protection, climate regulation, recreation, and the production of food, clean water, building material, energy and medicine.

Biodiversity is one of the main foundations that enables the provision of ecosystem services. It is also our best insurance to ensure that ecosystems will continue to function as they do today in a changing climate. In addition, studies have shown that biodiversity has a positive effect on the fulfilment of all Sustainable Development Goals.

Biodiversity trends
Biodiversity is under severe pressure globally. The World Economic Forum named biodiversity loss and ecosystem collapse one of the biggest global risks in 2019. Different forms of human land use occupy large areas, leaving less and less area available for species and ecosystems. As a result, many habitats are degraded and fragmented, as buildings, roads, and other man-made structures constitute barriers between them.

Vattenfall and biodiversity
Protection of nature and biodiversity is highlighted as one of Vattenfall’s key focus areas in our environmental policy. We strive to avoid, minimise, restore, and compensate for any negative impact from our operations. As one step in this effort, we want to make sure our premises constitute as far as possible an extension of, and connection between, habitats. Although some of the locations have limited space to implement any measures, even smaller measures directly on the building or in the relevant surroundings can have an important effect on biodiversity connectivity. Equally important is raising awareness about this important matter.
The measures are meant to initiate conversations about biodiversity and inspire colleagues and external stakeholders to adress the issue themselves.

Purpose of this document
This document is intended to be used to support decision making about biodiversity enhancing measures on the premises where Vattenfall is located. The following section of this document contains a set of important principles that should be followed when aiming to enhance biodiversity.

The rest of the document should be considered as a catalogue of possible measures that could be implemented. The sections can be used as inspiration when considering which measures are appropriate for different premises.

Biodiversity

Biodiversity is defined as the variety of organisms, species, and populations; the genetic variation within them; and the diversity of the communities and ecosystems they constitute.

2. Principles

Use native plants
Use native plants, preferably species that occur naturally in the region. Native plants are more beneficial to the overall biodiversity than exotic ones, since the different species have evolved together and adapted to each other and the regional fauna and fungi. This is particularly important for trees.

Avoid - and combat - invasive species
Invasive species are non-native species that spread rapidly in their new environment, where they outcompete native species, cause harm to ecosystems, and reduce biodiversity. Many threatened and endangered species are at risk because of invasive species. National environment protection agencies usually provide information about which species are, and risk becoming, invasive in their respective country.

Take advantage of local water sources
Avoid closing streams and ditches into culverts, and open up current culverts with water. Access to open water increases biodiversity and is often a much-appreciated element for human wellbeing.

Use flowering and fruit bearing trees and bushes
Fruit and berries, and flowers with nectar serve the dual purpose of 1) enhancing biodiversity by providing a food source for insects and other animals and 2) promoting human wellbeing by both being aesthetically pleasing and providing healthy and tasty snacks.

Use a variety of plants that flower during different times throughout the season
This promotes biodiversity by providing a food source for a range of insects that are active during different times of the season, and at the-same time provides aesthetic values for human wellbeing during the entire vegetation period.

Minimise hard surfaces
All green, gravel, and sandy areas are preferable to hard surfaces in regards to biodiversity as well as flood prevention.

Make sure outdoor light sources are pointed downward so as not to illuminate trees
Trees are used as roosting sites for birds, bats

and insects. They will, however, avoid trees that are illuminated at night.

Vary the maintenance of lawns
Some parts can be mown as lawns for people to use. Other parts could be turned into meadows while others could be used as flowerbeds. Consider if paths could be formed from cut lawns rather than gravel or hard surfaces.

Inform about the biodiversity measures
Raising awareness about the importance of biodiversity is as an important reason for implementing these measures as enhancing biodiversity itself. Let the premises be a source of knowledge and inspiration for employees and visitors by putting up signs with information about why and how the measures are beneficial to biodiversity.

Be inspired by nature
For best effect when choosing which measures to implement, let the surrounding environment lead the way. In a homogenous landscape, something different from what's already there can enhance the overall biodiversity, while in a fragmented landscape, the most effective measures will be the ones that imitate the existing habitats, creating a link between them.

Biodiversity principles
- Use native plants
- Avoid invasive species
- Take advantage of local water sources
- Use flowering and fruit bearing trees and bushes
- Use plants that flower during different times throughout the season
- Minimise hard surfaces
- Point outdoor light sources downwards
- Vary the maintenance of lawns
- Inform about the biodiversity measures
- Be inspired by nature

3. Habitats

Meadow

Turning a lawn into a species-rich meadow is a good investment for biodiversity

Ecological motives
Meadows have been part of an agricultural tradition for centuries, until large structural changes transformed the agricultural practises in the 20th century. The continuous removal of hay – and therefore nutrients – from the meadows made them nutrient poor, which favour a high species richness of plants. In nutrient-rich soil, a few species will dominate and outcompete the large variety of species. With a high diversity of plants, a high diversity of insects will follow. Some plant species attract butterflies while others attract bumblebees etc. A large diversity of pollinating insects attracts birds and predatory insects. Therefore, a meadow is a high-quality habitat serving as an important base for biodiversity, while requiring little maintenance.

Key principles
- To successfully create a species-rich meadow, the soil needs to be nutrient-poor.
- To create a meadow on nutrient-rich soil, you either have to replace the soil with new sandy nutrient-poor soil or cover the current soil with biodegradable geotextile, and cover it with nutrient-poor soil, at least 30 centimetres deep.
- Make sure to buy seeds from a retailer that uses native species, and that the seeds also originate from the respective country.
- It is important that the meadow is mown every year after it has flowered and the flowers have released their seeds. The hay then needs to be removed from the meadow to keep the soil nutrient-poor.
- **Low maintenance:** Just mow once a year and then remove the hay from the meadow.

Pond

Access to water always increases biodiversity in a landscape where water is not already the dominating feature

Ecological motives
Open water is a great enhancer of biodiversity and a positive element for insects, birds, amphibians, and many other animals. Ponds without fish are an important habitat for many of these animals but are unfortunately rare in today's landscape. Freely growing vegetation around the pond provides shelter and shade which benefit many species. Open water is also a very positive element for human wellbeing, providing aesthetic and recreational values.

Key principles
- If there are no ponds on the premises, a new one can be created by digging.
- While a pond of any size will increase biodiversity, it is preferable if the pond is at least 20 square metres.
- It's important that the pond has gently sloping banks. Therefore, the size of the pond will determine its depth. However, if possible, make the pond at least 1 metre deep at the deepest part.
- Dead wood in the water provides shelter for animals and growing substrate for mosses and algae. Use logs or branches depending on the depth of the pond.
- Allow a margin around the pond where plants, bushes and trees can grow freely. This enhances the quality of the pond as a habitat for many species.
- Benches around the pond allow people to more easily enjoy the benefits of it.
- **Very low maintenance:** The pond might become overgrown with vegetation once every few years, depending on its size. It will then need to be cleared of some of the vegetation. Preferably, this could be done by digging, to also remove excessive sediment from the pond.

Stream

Running water provides an oxygenrich water environment, enhancing biodiversity

Ecological motives
Just like a pond, a stream running through a landscape is an efficient enhancer of biodiversity. It provides several different habitats, such as the water itself, the bottom substrate, and the shorelines. Flowing water is a habitat for different species than the pond, and because of its length, it generates a large area of vegetation margins – a particularly species-rich environment

Key principles
- Open up any ditches in culverts to allow the water to contribute to biodiversity and human wellbeing.
- To further diversify the habitat, where the spatial setting allows it, small ponds could be created along the stream; either by just widening the stream or alongside it with a narrow connection to the stream.
- Allow vegetation to grow freely in the margins along the stream.
- Allow the stream to meander through the landscape to increase the area of vegetation margins.
- Pollination values as well as aesthetic values for human wellbeing could be enhanced by adding flowering plants along the stream. Make sure to use species that are adapted to this environment.
- A bridge over the stream or a platform with benches could make it easier for people to enjoy the environment.
- **Very low maintenance:** Some dead wood in the water can enhance the habitat for many species. However, if dead wood or other material gather so much that the stream starts to dam up, this can cause the water to start flowing along an alternate route. If this could cause problems on the premises, the dam then needs to be removed.

Open sandy area

Open sandy areas are home to many rare or endangered species

Ecological motives
Open sandy areas are another habitat that has become scarce in today's landscape. This is due to changed practices in the forestry and agricultural sectors, making grazing on poor soil uncommon. Sunlit sandy areas become warmer than the surrounding environment, providing habitat for plants, insects and lizards that are adapted to this particular environment. Many of these species have become rare or endangered as their available habitats have become scarce.

Key principles
- Areas with sandy soil could be opened up by just scraping off the top layer.
- The open sandy patches should cover at least 2 square metres.
- The sandy area should be sunlit during a large part the day.
- Areas facing south or southwest are preferable.
- In areas without sandy soil, open sandy areas can be created by adding a layer of sand. The sand layer should be at least 30 centimetres thick.
- Seeds of native plants for nutrient-poor meadows could be sparsely spread on the sand area, but make sure that they don't cover the ground and that there are some open patches free of plants.
- Flowering plant species around the sandy areas provides feeding places for insects that nest in sand.
- A stone wall or rock pile can provide hibernation possibilities for lizards, see the Structures section.
- **Low maintenance:** Disturb the patches with a rake once a year to keep them open. Do this early in the spring, before any insects have established a nest in the sand.

Wooded pastures

An oak tree grows for 200 years, is mature for 200 years and dies for 200 years

Ecological motives
Wooded pastures can be very speciesrich, especially if the trees are old.
Grazing increases the diversity of the flora, which in turn increases the diversity of the insect fauna.

Old trees are important biodiversity hubs that are irreplaceable as hosts for many rare and endangered species. Unfortunately, old trees are rare today because of intensive forestry. When an oak or pine, for example, reaches 200 years of age, they start to become habitats for a variety of insects, birds, lichens, fungi and other species that depend on the trees. The tree will by that time start to form cracks and hollows, which allow insects, birds and fungi to colonise the tree, which will then become an important feeding site for many birds and other animals.

During the continued aging and dying processes, the species composition of organisms living in and on the tree will shift to other species that rely on even older trees. Even after the tree has died, the standing stem or lying log that remains will host yet other species of insects, fungi, lichens and mosses. Old trees will in other words serve a critical role in an ecosystem for several hundred years, highlighting the importance of having a longterm perspective when planning for increased biodiversity.

Key principles

- Preserve any wooded areas and native trees on the premises.
- Consider replacing any non-native trees with native species.
- Where it's not possible to host grazing animals, the habitat could be created by removing shrubs and undergrowth in a forests, in order to increase the sunlight exposure of the trees.
- When planting new trees, use pine (Pinus sylvestris) on nutrient-poor soil and oak (Quercus robur) on more nutrient-rich soil, preferably.
- A skilled arborist can veteranise a tree to speed up the onset of holes and cracks.
- **Notes on maintenance:** If the habitat is used for grazing, the animals will require daily attention. The habitat will need no other maintenance. If there are no grazing animals present, the forest may need to be cleared of shrubs and undergrowth once every few years to maintain the trees' sunlight exposure.

Community garden

A community garden is an effective biodiversity enhancer as well as social networking hub

Ecological motives
A community garden is an area where people can come together to cultivate their plants of choice. Since many people prefer to plant flowering or fruit bearing species, the garden is an effective biodiversity enhancer, providing feeding sites for many insects and other animals. In addition, studies have shown that community gardens are important platforms for community building and knowledge sharing. A community garden on the premises could allow the employees to contribute to increased biodiversity, improve the workplace environment, and provide fresh produce to take home.

Key principles
- Suitable both on the ground and on accessible roofs.
- Combine with structures that provide nesting habitats for insects for optimal effect. See e.g. insect hotels, bumblebee houses, open sandy areas and dead wood in the Structures section.
- **High maintenance:** The garden needs to be actively managed in order to stay appealing and not become a nuisance. However, the employees using the garden will manage it themselves, so the need for external maintenance is none-low. Therefore, make sure there is an interest among the employees for a community garden before implementing.

Green wall

Green walls could reduce barrier effects and help raise awareness

Ecological motives
Buildings are biodiversity barriers, preventing many species to move between habitats. Green walls can reduce the effects of these barriers and turn them into a link between habitats for some species. It could also help connecting a green roof, such as the roof meadow on the next page, to surrounding green areas. Because of their visual presence, they could also be a conversation starter, helping to raise awareness about biodiversity. In addition, green walls shade the building and could reduce the need for temperature regulation.

Key principles
- For best effect, combine with a green roof.
- Particularly in urban environments, it's important to incorporate some kind of nesting opportunities in the walls, see e.g. insect hotels and bird and bat boxes in the Structures section.
- Consult an expert on green walls for best results.
- **Varied maintenance:** The vegetation could need maintenance, depending on species composition. The wall could come with its own irrigation system or require external irrigation, depending on type.

Roof meadow

A roof meadow could turn a current barrier into a link between haabitats

Ecological motives
A roof can be utilised as an asset to biodiversity. A meadow is a high-quality biodiversity-booster. In addition, the prerequisites on a roof for creating a dry and sandy, nutrient-poor meadow are good, so it is a suitable habitat of choice. By itself in an urban environment, the roof meadow will be an ecological island of little importance for biodiversity, but together with current or future surrounding green areas and structures, it could constitute a stepping stone between habitats, reducing the effect of a biodiversity barrier.

Key principles
- The sand layer should be nutrient poor and at least 30 centimetres deep.
- Seeds for dry, nutrient-poor soil can be bought. Make sure you buy them from a retailer that uses native species and that the seeds also originate from your country.
- In an urban environment, it is important to add structures that provide nesting habitat for insects, so that the roof contains both feeding and nesting grounds. See e.g. insect hotels, bumblebee houses, open sandy areas, and dead wood in the Structures section.
  and surrounding green areas and structures, see green wall in the previous spread.
- It is important that the meadow is mown every year after it has flowered and the flowers have released their seeds. The hay then needs to be removed from the meadow to keep the soil nutrient-poor.
- **Low maintenance:** Just mow once a year and then remove the hay from the meadow.

Photo: Urbio

4. Structures

This section contains a catalogue of smaller structures that could be added in order to enhance the biodiversity of a habitat.

Solitary trees

Old trees constitute an irreplaceable habitat for many species and by extension a feeding site for many more. Preserve any trees growing on the premises as far as possible, especially older ones, and let sunlit trees remain unshaded. Plant new trees that could become valuble for biodiversity in time.

Groups of trees and bushes

Trees and bushes can be planted or allowed to grow in groups to create microhabitats; this provides moisture-loving species with habitats and shelter for small birds and other animals.

Logs and dead trees

Logs and standing, dead trees are valuable elements in an ecosystem. They are host to many insects, larvae, fungi and other species, and provide feeding sites for birds, predatory insects and other animals.

Stone walls and rock piles

Sunlit stone walls and rock piles are important structures for many organisms, providing shelter and hibernation sites for amphibians and reptiles, and nesting sites for insects.

Sand piles

Sand piles provide nesting habitat for many bees and other insects and provide habitat for plants adapted to dry areas.

Outcrops and thin soil

Outcrops and areas with a thin, nutrient-poor soil layer are home to a set of species that are specialised to these particular environments. These thin soil layers are rare in park environments today.

Boulders

Boulders provide substrate for lichens and mosses, which attract insects, spiders and molluscs. They, in turn, attract small mammals, lizards, and birds. Make sure that sunlit boulders are kept unshaded.

Piles of dead wood

Sunlit piles of dead wood provide nesting sites for many insects and small birds.

Piles of brushwood

Set aside a spot for a garden compost, where hay, leaves, branches and weeds can be placed for decomposition. Such a compost heap can be used by small mammals such as hedgehogs for shelter and winter nests.

Insect hotels and bumblebee houses

Insect hotels come in a lot of different forms. They can be bought or made by hand and provide nesting sites for bees and other insects. Insect hotels should be placed in sunlit locations and preferably close to flowers. Bumblebee houses could be made by burying a flower pot turned upside down in the soil so that only the bottom with the hole is above ground.

Bird and bat boxes

Since old, hollow trees are rare, bird and bat boxes provide nesting opportunities otherwise lacking in the landscape today. There is a variety of different kinds of bird and bat boxes, including the classic wooden boxes as well as innovations like bird and bat bricks that can be incorporated into buildings. For best effect, use boxes that are suitable for species that are present in your area.

Balcony and window boxes

If it's not possible to implement a green wall, any balcony or window box planters will have some effect in linking a green roof to surrounding habitats.

on behalf of

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