

PROMOTING INSECT BIODIVERSITY THROUGH EDUCATIONAL WORK WITH YOUNG PEOPLE



JANUN Hannover



АССОЦИАЦИЯ
ОБРАЗОВАНИЕ ДЛЯ
УСТОЙЧИВОГО РАЗВИТИЯ

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Forword: A question of survival

Alongside climate change, the loss of biodiversity is one of the major problems of our time. Species extinction is rapid. More and more animal and plant species are becoming rarer and rarer or disappearing completely and forever. Almost a third of all species are endangered. By 2030, the world could be one million species poorer, warns the United Nations World Biodiversity Council.¹

Ultimately, our livelihood is based on an intact natural world. Insects, without which our ecosystem would not function, play a very important role in this. They serve as food for others, such as songbirds. Of the approximately 300,000 species of flowering plants worldwide, around 80 percent depend on pollination by insects. More than 75 percent of the world's crops, including many fruits and vegetables, coffee and cocoa, depend on natural pollinators such as insects.²

The loss of biodiversity must be stopped.

This is what young people from Belarus, Spain, Germany and Serbia thought and founded the project "Youth for a biodiverse Europe". In the summer of 2022, they met as part of an international youth meeting in Serbia and created an insect-friendly display garden in the botanical garden of the city of Kragujevac, which was then to be inaugurated as part of a festival with many activities for children. Due to an unusually violent storm shortly before (perhaps caused by climate change), which took the tents of the participants with it and toppled trees, the festival had to be cancelled. Instead, a workshop for children was held a day later to try out the games and methods that the participants had previously engaged in.

After the youth exchange, the participants got active at home. They created insect-friendly gardens there as well, often together with children and young people. Workshops were also held to teach children and young people about the fascination of insects and their importance for us.

Finally, this brochure was created on the basis of all the experiences made, which may also inspire you to become active around the topic of insects.

All this was made possible by funding from the European Union under the Erasmus+ program. The projects on site in Belarus, Serbia and Germany were financially supported by the Lower Saxony Bingo Environmental Foundation.

We are all challenged to do something.

Warm greetings from Belarus, Spain, Serbia and Germany, where young people are working for nature conservation as part of their biology studies or in environmental groups, such as Ekofunkamp in Serbia and JANUN Hannover e.V. in Germany.

¹ Derived from <https://www.dw.com/de/massensterben-der-arten-bedroht-die-menschheit/a-59473127>

² Derived from <https://www.dw.com/de/massensterben-der-arten-bedroht-die-menschheit/a-59473127>

1 A closer look into the world of insects

1.1 What are insects and what is so fascinating about them?

They are everywhere - crawling, buzzing and flying through gardens, across meadows, by lakes and sometimes even in your own four walls - insects!

With a share of 70%, insects are the most species-rich animal species in the world. So far, researchers have discovered almost a million different species of insects. However, experts estimate that there could be as many as five million representatives of this class that have simply not yet been found. No wonder! **The smallest insect** recorded so far, the pygmy wasp *Kikiki huna*, is only 0.13mm small. It's hard to believe that researchers even discovered them in Hawaii. It is assumed that the size of the *Kikiki huna* could hardly be undercut. But it can always be bigger! **The largest insect** so far is the stick insect *Phoebaticus chani* found on Borneo with a length of 56.7 cm.

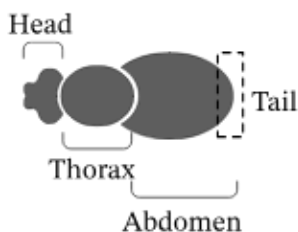


Source (picture): www.huffingtonpost.com.

Insects can be found **in every biotope and on every continent on earth**. Whether in the hot deserts of Africa or the freezing cold of the Arctic - they are everywhere!

Insects are cold-blooded creatures, so they crawl into sheltered, relatively warm places during the cold months of the year and fall into a hibernation or cold torpor. The Arctic midge, however, has adapted fantastically to its frigid environment. In the course of evolution, its genome has shrunk, and its small body is constantly producing proteins that protect its DNA. Other insects only produce these in stressful situations.

As varied as their habitats are, so are the species that belong to this class. In addition to beetles and ants, butterflies, bees and flies are also included as some of the major orders.



Source (picture): www.nagwa.com.

Insects are characterized by their common physique - **head, thorax and abdomen**. In addition, all representatives of this animal have six legs, which sit on their chests. Insects are invertebrates. Unlike mammals, they do not have an internal skeleton but an external one. It is made of a horn-like

substance called chitin and protects the creature like armor. Another **defense technique** used by many insects is the secretion of poisonous secretions or stinging. But mostly this should only be the last resort to defend itself from predators or other dangers. **Honey Bees**, for example, can only use their sting once, when they sting us humans. The bee then dies. But the defense of the bee colony is more important to the individual animal. In general, many insects are also characterized by a strong cooperation and coexistence. Not only do most bee species live as a small colony with a queen, **ants** also have state structures with clearly assigned areas of responsibility. Workers, for example, take care of supplying the colony with food or maintaining and expanding the building or hive. In case of danger, **bees** also act together. For example, if a hornet attacks the hive, numerous bees pounce on it and flap their wings, creating heat that kills the hornet. However, this tactic is similarly used in cold temperatures to warm the hive so that no bee, especially the queen, freezes to death.

Furthermore, insects have other fascinating properties that could almost be considered superhero power. For example, **butterflies** can taste with their antennae and feet, **water striders** can walk on the surface of water, and **ants** can carry forty times their own weight.

But insects are not only interesting in and of themselves, they also have many useful properties that benefit us humans.

Check out the quiz in section 3.5 to find out more about how fascinating insects are.

1.2 Why are insects important for our ecosystem and everyday life?

That insects are truly fascinating and exciting creatures is undeniable, even if many people fear them or are disgusted by them.

Insects play a major role in biodiversity. It consists of species diversity, genetic diversity and diversity of ecosystems - i.e. the diversity of life. Biodiversity is not only extremely important for the preservation of flora and fauna, but also for the balance and stability of ecosystems, the supply of resources for us humans and our well-being.

It's hard to believe how important these little animals actually are for our daily life and what would be missing without them. In particular, the food shelves in our shops would be very empty. But not only would there be a shortage of food, clothes made of cotton or hemp would also be affected. Even the supply of medicines would be threatened.

One of the most important jobs insects do for us is pollinating plants. For example, around 90% of flowering plants and 75% of cereal species depend on insect pollination.

In search of food, insects such as bees fly from flower to flower to collect the sweet nectar and pollen. Small pollen gets stuck in the hair coat of the bees, which they then carry on to the next flower. In this, the pollen gets stuck on the sticky stigma. The plant has been successfully pollinated and



top: obtainable with insects

bottom: obtainable without insects

can form seeds and fruits. These are particularly important for the further propagation of the plant and thus contribute to the preservation of the species.

Basically, everyone benefits from insect pollination - the insects find their food, the plant can reproduce and we humans can, for example, harvest the fruits.

But insects have numerous other tasks in the ecosystem.

Above all, they serve as a source of food for a wide range of animal species. For example, birds, hedgehogs and many reptiles feed on them. Spiders also catch insects in their sticky webs to feed on them.

Insects are also actively involved in keeping ecosystems alive on and in the soil. In this way, they decompose organic waste, such as dead plants or carrion, and turn it back into nutrient-rich soil on which young plants can thrive.

Insects can also be described as every gardener's friend, as they put an end to many pests. For example, ladybugs eat about 100 aphids a day. So they are something of a natural pest control and could help reduce the need to use pesticides.

Insects therefore contribute to the conservation of biodiversity in many ways. They are also an important part of the ecosystem.

However, the total mass of flying insects has declined sharply in recent decades. In the 1990s, around four times more insects were flying than today. Many different species are on the "Red List" of endangered species. In Germany, almost half of the butterfly and wild bee species have already become extinct. Around 40% of all insect species worldwide are threatened with extinction.

Humans are primarily to blame for this development. In particular, increasing urbanization is a huge problem. Meadows and fallow areas are becoming more and more urbanized and also sealed, so that there is hardly any space left for plants. Furthermore, rock gardens reduce biodiversity, as little green can thrive here either. This makes it difficult for insects to find food at all, so that their population decreases sharply. This has further effects on the urban fauna, since birds, for example, also find less food.

In agriculture, crops are increasingly being cultivated in a monotonous crop rotation, e.g. wheat every consecutive year. This makes the plants more susceptible to pests and diseases. In order not to have to lose yield reductions, pesticides are increasingly used. Insecticides are therefore sprayed to protect plants from harmful insects. However, these also kill most other insects. Sometimes even those who would take over the natural pest control. Poisons against "weeds" also have a negative effect on insects and other microorganisms.³

We invite you to have a look at different games in section 3.2 of this brochure, which can help children and adults to learn more about how insects live and why they are so important.

³ Derived from <https://www.bmu.de/fag/warum-sind-insekten-besonders-wichtig#:~:text=Insekten%20sind%20wichtige%20Bausteine%20der>

1.3 How can we protect insects?

Since insects, as well as the biodiversity of ecosystems, are primarily threatened and destroyed by humans, it is our task to repair damage that has already occurred and to go into the future in a more sustainable way. Politicians in particular are often held responsible for enacting laws that are intended, for example, to reduce the excessive use of pesticides or to tackle the sealing of urban spaces. But it is well known that the enforcement of new regulations is usually a lengthy process and is often delayed or prevented by influential dissenting voices.

Consequently, it is up to all of us to take the initiative ourselves to save the environment and actively protect nature!

But what can each of us do about it? Here we propose 6 simple actions that anyone can do to support insect biodiversity.

1. Support organic farming

You should try to avoid buying products that contain pesticides or other environmental toxins. The most suitable are organic products. Although you often pay more for these, you help farmers to compensate for reduced yields and more work due to the non-use of pesticides. Overall, farmers can also make a major contribution to preserving biodiversity by running organic farms. They can also cultivate flower strips at the edge of their fields or grow different fruits instead of monocultures.



2. Use biodegradable cleaning products

Many soaps, shampoos and cleaning products contain harmful substances, such as heavy metals, and pollute the water, which is a habitat for many aquatic insects. To reduce the water pollution, the most suitable alternatives are those that do not contain any environmentally harmful ingredients and are biodegradable.

3. Reduce night-time light pollution

Night-time light pollution is a problem for night-active insects including fireflies and night moths because they are attracted to the source of artificial light, which causes their exhaustion and/or predation. To protect insects, you should turn off all unnecessary lights, use motion-sensitive lighting and switch to lamps emitting amber or red light, whose wavelengths are less attractive to insects.

4. Create insect-friendly habitats

A good thing is that insects need very little space to live, so creating even a small insect-friendly area in your garden, on your balcony, in front of your window or around the tree in front of your house can make a big difference. You can plant **insect-friendly plants in your garden or in a flower pot** (read more in section 2.1 of this brochure). **Homemade nesting sites** are also ideal for craft enthusiasts and hobbyists. Insect hotels are becoming increasingly popular due to their ideal conditions for safely laying eggs. We explain exactly how to build an insect hotel in section 2.2 of this brochure. However, to ensure that you don't fail to set up an insect hotel because of the

technical skills, you can buy them for little money in any hardware store. So-called "**seed bombs**"⁴ can also be made very easily, which you then simply drop by the wayside and from which wildflowers then grow.

5. Get involved in nature-conservation groups

You can become active and get in touch with local nature conservation groups in your area. Together you can plan interesting activities on how to protect insects.

6. Learn yourself and help others to learn about insects

Finally, and probably most importantly, be curious about the (insect) world around you and learn about the small creatures you share the planet Earth with. Walking in nature with short breaks when you can look closer at flowers and bushes to discover the buzzing life is a very enjoyable way to spend time outside. To identify insects (and also other animals and plants) you can use the *iNaturalist App* or similar tools. You can also find interesting blogs and websites in your language, or you can take photos and write posts on social media about insects yourself to make for example your friends interested. In this way, you can help others appreciate their beauty and change the negative perceptions, which are often culturally formed (f.e. through scary films with giant spiders), but have actually very little connection to reality. Keep in mind that we can only protect what we love, and we can only love what we know. We invite you to check out section 3.4 of this brochure to learn some tips that can help you to observe insects.⁵

⁴ Here you can read how to make seed bombs: <https://www.wildlifetrusts.org/actions/how-make-seed-bomb>

⁵ Derived from <https://www.pnas.org/doi/10.1073/pnas.2002547117>

2 Creating living habitats for insects

2.1 An insect-friendly garden, balcony and flowerpot

If you have a small green area around your house, work or study place, you have a wonderful chance to turn it into an insect paradise. Just keep in mind the following aspects.

What to plant?

To attract a variety of insects to your garden, it is important to plant a **diversity** of plants. Not all plants that are visually appealing to humans are also attractive to insects. By planting flowers of different shapes and sizes, you can attract a wider range of insects.

It is recommended to plant **native trees and shrubs** in the garden. Native plants do not need a process of adaptation to the environment, they develop faster and they attract native insects and birds that have a long history of tight ecological relationships with them. For example, *hawthorn*, *sloe* or *oak* are perfect for this. **Plants with single flowers** are also ideal for insects. Ornamental plants often have double flowers, making it difficult for insects to reach the nectar within, or no nectar at all. In contrast to this are flowers, for example, which only have a wreath of flowers around the center of a flower.

Native wildflowers are ideal. They are also far more robust and easy to care for than exotic wildflowers. But not only the nectar of flowers offers insects food, *herbs* also attract many insects, as most pollinators find their food plants by smell rather than sight. For example, *fennel*, *dill* or *sage* are very useful. In addition, as a gardener you can still benefit from them by using them in cooking or for homemade teas. **Annual or biennial plants**, such as carrots, are also valuable as many insects rely on their special growth cycle.

Attention butterfly friends! *Stinging nettles* are not only incredibly healthy and versatile in the kitchen, they are also true butterfly magnets. Just a few nettles will make butterflies flock to it!

Examples of insect-friendly plants:

- ❖ Crocus
- ❖ Honeysuckle
- ❖ Foxgloves
- ❖ Lavender
- ❖ Hawthorn
- ❖ Hellebore
- ❖ Bluebells
- ❖ Forget-me-nots
- ❖ Hardy Geraniums
- ❖ Mint
- ❖ Marjoram
- ❖ Iris
- ❖ Hollyhocks
- ❖ Sunflower

TYPES OF FLOWERS



When to plant?

The best time to plant most plants is in late winter or early spring (February-March) after the last frost in the region. In this case, the flowers have time to take root before the harsh summer conditions set in. However, some species, such as perennials, can also be planted in the fall, depending on the area.

The optimum time of day for planting flowers depends on the climate and time of year in your area. The most important criterion is the amount of direct sunlight and heat, as these conditions can be harmful to newly planted and delicate flowers. When planting flowers, always pay attention to the conditions in your area, not the time of day. ⁶

What else do insects like?

If the garden is large enough, a water-**pond** is also a good idea. Many insects lay eggs in water to raise their offspring, so it is a great safe place for them. But not only insects, such as dragonflies, damselflies, water beetles and water striders, would find a suitable living area there, other animals could also be given the opportunity to drink and bathe. Especially on hot summer days, birds are not averse to a little cooling off!

If you decide to make a pond, remember to create a sloping edge in your pond by using a branch for example to enable the animals to get in and out. Although many are great swimmers, climbing can be a real challenge. Another tip is to plant plants that oxygenate water and plants with long stems that protrude from the water below. These stems are of great benefit for dragonfly and damselflies, whose larvae crawl onto plant stems and wait until their wings harden enough to fly.

And if you do not have a big area to build a pond, do not worry, as there are plenty of alternatives. You can turn a large cooking or plant pot, an upturned dustbin lid or even a disused sink into a small nature pond. Choose a location that will not get sunlight all day long, and either dig a hole to place the artificial container or simply place it on the ground. Slightly larger buckets can also be filled with water and equipped with small aquatic plants. This also allowed some splashing birds to be observed. In fact, a small, flat bowl with a little water and maybe a little moss is enough to provide a desired water source in summer.

Overall, a pond represents an ideal added value for the preservation of biodiversity, as it also offers a home for amphibians such as frogs.

The offer of **nesting places** or **wintering possibilities** is also important. In autumn you can easily leave log piles, **piles of leaves** or **undergrowth in shady spots**, or simply sweep **fallen leaves** under hedges. Worms and Insects like woodlice, millipedes, centipedes, but also animals such as hedgehogs, can hide there in winter if they hibernate. Protected from predators and in relative warmth, they then survive the cooler months until spring. But such hiding places are also useful during the rest of the year, as they also serve as a place for laying eggs.

Piles of rocks and stones provide shelter for a variety of living things. Try placing such piles in different places in the garden to attract as many species as possible. Some animals like their little

⁶ Read more tips here <https://www.plantician.com/what-is-the-best-time-of-day-to-plant-flowers-in-your-garden/#:~:text=Most%20flowers%20grow%20best%20when,the%20fall%2C%20depending%20on%20location>

shelters in a shady and damp place, whereas others prefer a shelter in the sun. Also remember to use a variety of sizes and don't disturb the pile once it's created.

It is also a good idea to leave even a small area untouched and let it develop the way nature wants. Additionally, you can leave a bare patch of earth on a sunny spot, which will attract mining solitary bees.

Overall, try to create a range of different habitats in your garden using water areas, logs, leaves, bricks, untouched "wild" spots etc. Of course, you do not want your garden to look messy, but a little bit of wildness will surely do go to insects.⁷

How to take care of your garden?

A good garden takes time and care. Caring for your garden involves several important steps.

Watering your plants regularly is crucial, as well-watered plants produce more nectar in their flowers, which is better for bees and other pollinators, especially in hot weather when plants growing in the wild will also be producing less nectar.

Plants also need enough sunlight to thrive, but different flowers require different amounts of sunlight.

It's important to avoid using pesticides, as garden pests are part of the natural food cycle, and pesticides can contaminate the soil and harm our health and environment.

Leaving dead heading until late spring and some wildflower stems standing during winter can provide overwintering sites, food, and shelter for insects and other invertebrates.

Being tolerant of insects that chew on plants or nibble on fruit can encourage them to visit your garden more often, and you may even decide to plant sacrificial plants to provide food for insects.

Taking the time to identify the insects in your garden can help you appreciate the range of species and derive more enjoyment from your garden. There are a variety of different tools to help you identify insects, plants and nature around you. One example is the *iNaturalist App*.

Finally, remember that different plants may have different needs, so it's important to know your plants to make them happy.⁸

An insect-friendly flower pot: a bit of space is enough

If you don't have a garden, but maybe have a **balcony**, you can implement most of these tips on a small scale. Wildflowers also grow magnificently in **flower boxes or pots**. Why not just plant a nettle in a pot and put it outside in front of the window? Colorful visitors would definitely be expected. Insect hotels in the ideal balcony size can also be hung up.

⁷ Derived from <https://www.kew.org/read-and-watch/how-to-attract-insects-garden>

⁸ Derived from <https://www.amentsoc.org/insects/insects-and-man/gardening-for-insects.html>

2.2 Insect hotels

Many people are becoming more and more aware of how important it is to protect insects. A simple way to help them a little bit has become increasingly popular in Germany in recent years - insect hotels!

The first insect hotels were built in England at the beginning of the 19th century. At that time they were still used for observation, but the advantages that insects have from them are still the same.

An average garden is home to more than 2,000 different species of insects! Very few of these creatures cause any appreciable damage to plants, and there are many more insects that actually help us fight those that do! By providing the right habitats, we can significantly increase the number of "beneficial" insects in the garden. In the same breath, for example, fewer pesticides and crop protection products would have to be used to protect plants, and the yield of fruits and vegetables would improve.

Insect houses also provide a hibernation aid for beneficial animals such as ladybugs, butterflies, lacewings and other garden beneficials. That is why it makes sense to install an insect hotel in the winter months.

On the other hand, various species can also nest and find shelter there in spring and summer.

Insect hotels therefore enjoy a large number of guests throughout the year.

Accordingly, the various needs must also be addressed.

Some species like cool, humid conditions while others prefer the sun. In order to accommodate as many of them as possible, the insect "villa" should be positioned or hung so that part of it catches the sun, but the rest is in the shade, for example under a tree or near a hedge. A flat surface should be chosen for the construction of a standing house, as it can become quite heavy and therefore requires a solid base.

Insect hotels can have very different designs. Whether in the form of a small house, a simple box or perhaps a circle, they all work in the same way. Even a small house on the windowsill is more than nothing.

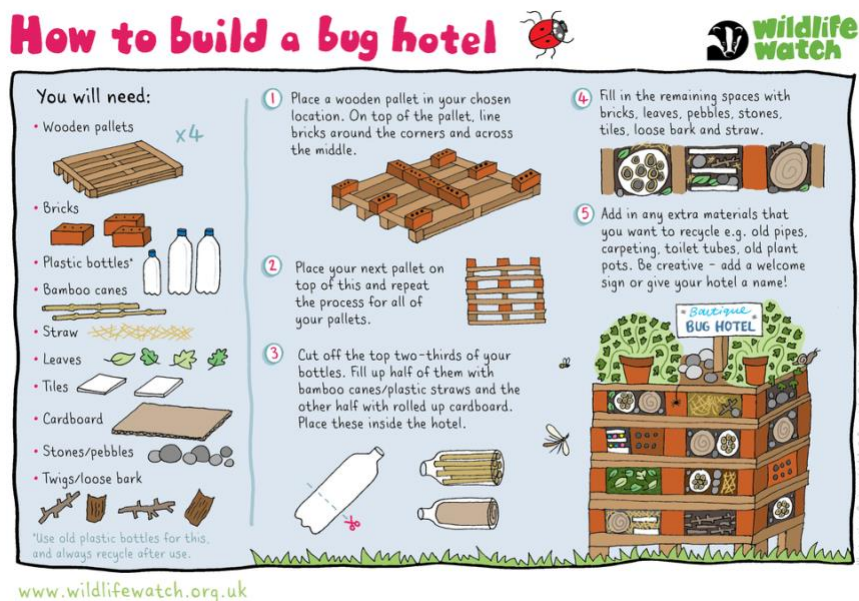
The basic structure generally consists of wooden boards. These are nailed or glued together like a house. Several "floors" and "rooms" should be created. They are filled with various natural materials. which have different benefits for different insect species.

However, the wrong filling materials can do more harm than good to the insects. For example, wild bees can injure their wings in the nesting aid if the wood is too rough or the wrong material is used. Clear plastic or glass tubes can also become a death trap.

That's why the right choice of filling is the be-all and end-all. Here are some examples to consider:

- ✓ **Deadwood:** An increasingly rare habitat, deadwood is essential for the larvae of wood-boring beetles. It also supports many fungi that help in breaking down the wood material. Centipedes and woodlice cavort in crevices under the bark.
- ✓ **Hollow Stems:** Hollow stems, such as old bamboo canes or holes drilled in logs, make good nesting sites for solitary bees.

- ✓ **Straw and Hay:** These provide opportunities for numerous species to burrow and find safe wintering spots.
- ✓ **Dry Leaves:** Dry leaves provide homes for a variety of insects by mimicking the litter on the forest floor.
- ✓ **Loose Bark:** Beetles, centipedes, spiders and isopods like to hide under rotting wood and bark.
- ✓ **Corrugated Cardboard:** A piece of rolled up corrugated cardboard placed in a watertight cylinder provides a home for lacewings.
- ✓ **Dry Sticks:** Dry sticks are great for hibernating ladybugs.
- ✓ **Nectar-producing plants:** Nectar-rich plants should be planted around the new insect house to provide food for butterflies and bees.



Source (picture): www.wildlifetrusts.com.

But watch out!

Great spotted woodpeckers and tits, such as the blue tit, like to rob insect hotels. The loose tubes are often pulled out of insect hotels in order to help themselves to the small crawlers. In the case of the great spotted woodpecker, the closed brood tubes are picked open with the pointed beak.

Therefore, you should make sure that the insect hotel is protected from such predators.

NABU recommends a stretched, colorful net or grid that is stretched around the nesting aid at a distance of 20 centimeters. The colorful nets are easily seen and avoided by birds and do not pose any danger. So that the insect house does not become a death trap for insects or birds.

All in all, such an insect hotel is a great help for insects and the preservation of biodiversity in your own garden or on the balcony.

3 Insects and biodiversity in educational work with children and young people

3.1 Insects: A great topic for environmental education

Insects are fascinating, their way of life diverse, adapted to almost all regions of the world up to Antarctica, often highly complex, if we think for example of an ant colony. It is estimated that there are around 5 million species of insects in the world. They are indispensable for life on our planet. We encounter them almost daily and sometimes they are annoying, mosquitoes for example. Some even scare some people, like the wasp that took an interest in my apple pie. Many people are disgusted by some of them, such as spiders, although they are not insects at all.

Without insects, the world would look very different, a crucial component of the ecosystem would be missing. Would there actually be cherries or apples if the blossoms on fruit trees were no longer pollinated by insects? Coffee and chocolate - only with insects. What would you still be able to buy in the supermarket if there were no insects? Check out section 1.1 of this brochure to read about how diverse and unique the insect world is.

There are many reasons why it is good for children and young people to know more about insects. Maybe they can even be fascinated by the world of insects. The little animals deserve it:

- Insects are an excellent way to explain ecological relationships.
- How we humans are responsible for the decline of insects through our behavior can be conveyed with many simple examples.
- Insects are fascinating, their abilities almost unbelievable. Studying them can strengthen respect for nature, especially among children and young people.
- It is good when children and young people lose their fear of insects and spiders, they find fun in meeting them. After all, they are still around, even if there are no longer as many of them and the diversity of species is not as great as it was years ago.

With this brochure, we want to provide suggestions for nature education work on the topic of "insects". Various games and methods are presented that you can use and apply without having to be an expert.

Give it a try and have fun!

3.2 Nature education games about biodiversity and insects

1. The Ecosystem game

Understanding in a very easy way how animals and plants are connected to each other in nature by eating and being eaten. An opportunity to introduce the term "eco-system", „Web of life“ and “Food chain“.

Number of participants: 6 – 12 participants, if you do have more participants, split the groups in two

Best age: 6 years and up

Material: One ball of wool (or two if you split the participants)

How the game works: You need to build a circle and one of the participants gets the ball of wool.



The first person who holds the ball of wool in his/her hands needs to decide what animal or plant he or she is and whom he/she eats or by whom he/she is eaten. Like “I am a small bird and I am eating a worm”. Now this first participant needs to throw the ball of wool, by keeping the end of the wool, to another participant by saying “I am a little bird. You are a worm and I am eating you”. This chosen worm is catching the wool-ball. Now he/she needs to decide whom the worm is eating or by whom the worm is also eaten. For example “I am a worm and I am eating a leaf from a tree”, throwing now the wool-ball to the chosen “leaf”, by holding one piece of the rope until everybody is part of it and everybody is a plant or

an animal holding the rope together. Now it should look like a web where everybody is connected directly through the rope with two other participants of this game. It now looks like an eco-system-net.

Now in our game one of the animals or plants disappears (becomes extinct). To show how this affects the other animals, the chosen animal or plant should pull the rope a little bit. That should show: If you are not part of the eco-system anymore, it affects the ones you eat or the ones who eat you. The two who are directly connected with the one who pulls, feel through the rope that you are pulling at it. If they feel that they are affected, they also need to pull what is again affecting others. In the end every participant in the circle is pulling the wool-rope. This demonstrates, everybody is connected in an ecosystem. That is why it is important to protect everybody in nature, because everybody is needed to keep the ecosystem stable. If participants are older or if the program is dedicated to a specific ecosystem, you can also appoint an ecosystem like "forest" and that all the participants (chosen plants and animals) should belong to this ecosystem.

2. The Camera game

The idea of this game is to motivate the participants to slow down and to look more closely to the beauty of nature. It is also about trusting each other in teams of two.

Number of participants: 2 or more

Best age: 8 years and up

Material: some space outdoors, preferably in a natural area like forest

How the game works: The “photographer” person stands behind the camera person and holds him/her by their shoulders. The camera person keeps his/her eyes closed. The photographer now guides the camera on a search for beautiful and interesting pictures that are connected to insects. It could be an insect itself, or a blossom of a flower or something else.

When the photographer sees something that he/she can connect to the topic of insects and he would like to “take a photo” of it, he/she points the camera's lens (eyes of the camera-person) at it, framing the object he wants to “shoot.” Then he/she presses carefully the shutter button (which is the shoulder or the head of the camera-person) to open the lens. After 3 - 5 seconds the photographer should press the “button” again. That means the camera needs to close its eyes again. While having the eyes open for this short time the camera is not allowed to move his/her head to look around, just look straight the way the photographer has set it up. Now the photographer moves on together with his camera to search for the next nice place to take another picture.



It's important that the camera keeps his/her eyes closed between the pictures, so that the 3 to 5 second “exposure” will have the impact of surprise.

Encourage the photographers to be creative in choosing and framing the pictures. Tell them, “You can make stunning photographs by taking shots from unusual angles and perspectives. For example, you can both lie down under a tree and take your picture looking upward, or you can put your camera very close to a tree's bark or some leaves. Try looking down into a flower. Be open to the opportunities of the moment.” Because the Camera Game uses nature experiences instead of verbal explanations, very young children can participate just as well as adults. It's very touching to watch five-year-olds guide their parents or grandparents, taking pictures and sharing their delight in natural things. The preferred “exposure time” is 3 to 5 seconds. With longer exposures, the camera's mind begins to wander, reducing the impact of the picture just as too much light overexposes real film.

After taking three photos, take the camera back to the starting point of the game. Now the camera opens his or her eyes and the task of this person is to find exactly the three photographed spots.

Then participants can switch roles, the camera becomes the photographer and the other way around.

3. Bees and Water

A honey bee can transport up to 60 milligrams of water which is about half their own weight! The water collectors fill their honey bladders with the cool water and fly back to the hive fully loaded. When it is hot, the insects cool their hive with water and thus protect the brood. Collectors fetch water, which the nurse bees distribute drop by drop in the hive. Evaporation increases the humidity - and the temperature in the hive drops. If it is really hot, bee colonies produce almost no honey. Then they are almost exclusively occupied with cooling and fetching water.

Number of participants: 2 or more

Best age: 6 years and up, if possible 3 teams or even more, each team with some children or a family.

Material: For each team a sponge, a bucket with water, and a bucket without water

How the game works: Every team represents bees of one hive and their task is to bring water to the hive (from the bucket with water to the empty bucket), because the hive needs to be cooled down

by water. Every team has a sponge, a bucket with water at the beginning and an empty bucket at the end. A good distance between the buckets is 6 to 10 meter, this is the distance where the watered sponge needs to be transported.

Each team gathers around their bucket with water. One person from each team fills the sponge with water and runs to the empty bucket to squeeze water from the sponge into it. Then this person runs back to the team and gives the sponge to the next person. The game finishes when all water has been transported from one bucket into the other. The team who does it faster and has more water in the other bucket wins.



Optional challenge: One of the moderators can play a role of a bird who eats bees and when the bird touches the bee who has the sponge, the bee cannot continue the journey to the empty bucket and need to return to their team. Another team member now needs to continue.

4. Smell Memory

Insects - including bees and wasps - smell with their antennae. There are thousands of small hairs on these antennae. Each of these hairs is like a little nose. And when a scent molecule arrives, for example the scent of a flower, it is like a key that is inserted into a lock: The scent molecule docks on and the information about how it smells is passed on to the bee. With its two antennae, the bee can also find out from which direction the scent is coming. All this happens very fast. When flying, the bee has to decide where the tastiest nectar is, who belongs to its colony and who does not, the insects also communicate with each other through scents. Some scientists even say that bees can smell better than dogs.

This game trains and tests your own sense of smell.

Number of participants: can vary, each person plays for themselves, it is possible to compete with others who find more smell pairs.

Best age: 6 years and up

Material:

- small non-transparent containers (see the picture) with a cover that allows odors to pass through, such as cloth. In each case, two containers contain the same thing, which is odorous.
- Pen and paper
- Different kinds of things with a smell, such as herbs, dry and wet soil, wood etc.



Odorous materials are put into the little containers and covered with something that does not prevent the smell, or has a hole. The kids now need to smell all the containers and find pairs of containers with the same smell. The goal of the game is to find out as many pairs as possible.

For younger children, there should be no more than four pairs in total, i.e. eight containers, for teenagers/adults there could be more.

Option: each container (f.e. cups) has a number, each participant receives a paper and a pen and needs to write their guesses on the paper next to the numbers. In the end, answers are checked and

compared. Or the participants guess and you tell them if they were right or wrong. If they were wrong they should continue to find the second container that fits. As a game-instructor you can also ask the participants what they smell, to help with finding the right answer. While talking you can explain to the participants how insects smell and why it is important for them to smell well.

5. Hunting Like a Bat

Learning about the unique way in which bats hunt and having a lot of fun.

After sleeping in winter, which can last up to six months, bats hunt for insects at night from spring to autumn. Every night they eat insects that make up about one third of their own body weight. That is up to ten grams per animal and night. The bat flies almost silently through the darkness, hunting for moths and mosquitoes. When hunting, the bat relies on its hearing, even though it can see relatively well.

With its famous ultrasonic echolocation, it detects its prey and orientates itself. Ultrasonic sounds are emitted through the mouth or nose and the echoes are used to analyze the distance, direction, size, shape and structure of the prey insect.

Number of participants: 10 or more.

Best age: 5 years and up

Material: one blindfold, f.e. a dark non-transparent scarf.

First, Introduce the topic of the game with questions and answers:

- What animals hunt at night and can fly? (Answer: f.e. bats)
- What do bats hunt?
- How do they hunt at night?



After all participants know more about bats and how they hunt you can start the game with the following words: „Now we will do it similar to the bats.“

The group forms a circle of around 3 - 4 meters in diameter and chooses a person who will be a bat. Then this person comes to the center of the circle and their eyes are covered with a blindfold. Designate two or three other participants as moths and ask them also to come to the center of the circle. The bat tries to catch the moths.

Whenever the bat calls out “Bat!” the moths call back “Moth!”

Explain to the participants: “Every time you hear the bat call out 'Bat!' it means that his/his radar signal is hitting you. He/she sends it out to see if there is anything out there. When you shout back the word 'Moth!' it represents that the sound bounces off you and returns to the bat like a radar signal. Now the bat knows that moths are close - and she/he's ready to hunt! - to touch the moths with his/her hands.“

The moths try to escape from the bat, but just inside of the circle that is built by the other participants. The bat tracks down and tags the moths by listening to their responses. It takes good concentration to be a successful bat. The circle built by the kids is the hunting area. This way the children learn how bats hunt.

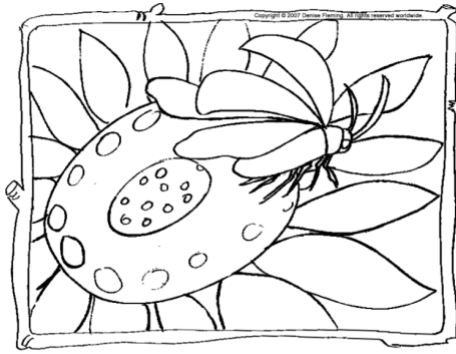
3.3 Creative work with hands

Insect coloring

Drawing and coloring insects is a great way for children to pay closer attention to insects and learn about their anatomy. By doing so, children can focus on how insects look, what patterns their bodies have, how many legs and wings they have and of what shapes they are.

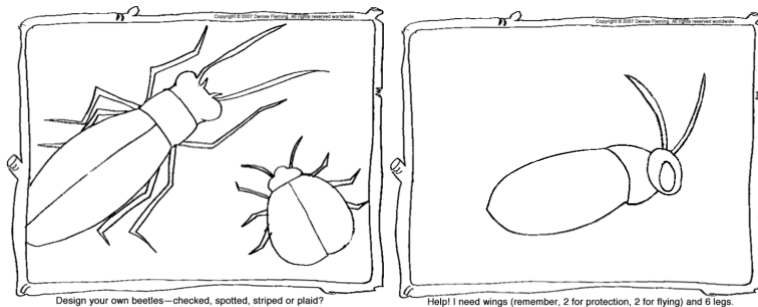
You can consider the following options:

a) Coloring insects



Source (picture): www.denisfleming.com

b) Designing and coloring insects (in a simpler version, participants just need to add stripes, spots etc., and in a more difficult version - to draw missing insects' parts, like legs, wings, antennas etc.)



Source (picture): www.denisfleming.com

Material list:

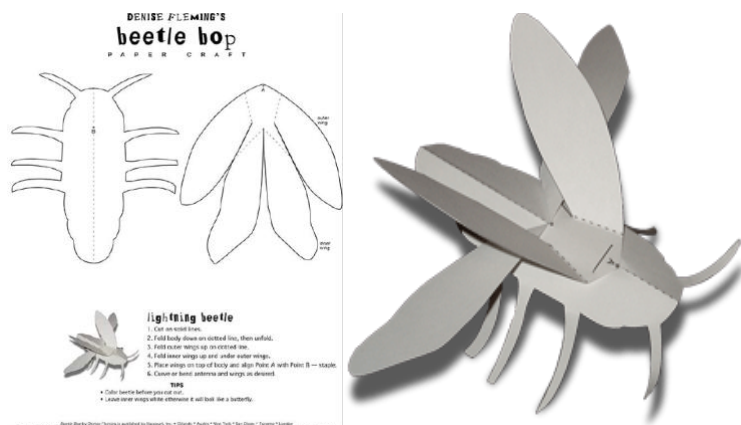
- Printed templates for designing and coloring^{9 10}
- Colored pencils, markers, crayons, paints, paint brushes etc.
- Space arrangement, f.e. tables and chairs

⁹ Link to download templates for insect coloring: <http://www.denisfleming.com/pages/book-activities/beetle-bop/activities.html#gsc.tab=0>

¹⁰ Link to download the templates for designing and coloring insects: <http://www.denisfleming.com/pages/book-activities/beetle-bop/activities.html#gsc.tab=0>

Insect modeling

Another way to learn more about insects and develop a positive attitude to them in a fun way is modeling insects. For example, children can make hats or masks in the shape of different insects, or they can make paper models and play with them.



Source (picture): www.denisfleming.com



Source (picture): www.supercoloring.com.

Material list:

- Printed templates for insect hats, face masks and paper models¹¹
- Colored pencils, markers, crayons to color the templates before cutting them out
- Scissors

Face painting

A great way to have fun and connect with the beautiful world of insects is face-painting. Children can choose which insect they want to become, f.e. a bee, a ladybug, a butterfly, a beetle, and with just a bit of time and inspiration you can help them to become one for a day.

¹¹ Link to download the templates (models and hats): <http://www.denisfleming.com/pages/book-activities/beetle-hop/activities.html#gsc.tab=0>



Source (picture): www.paintersbest.com

Material list (a basic kit):

- a pallet with 6 or more face colors
- 2 round brushes of different width
- 1 flat brush
- 1-3 half-round face painting sponges
- a soapy cleaner to clean the sponges and brushes
- water

Some tips for face-painting:

- Try to choose the pallets with face paints which are non-toxic, hypoallergenic, vegan, and cruelty-free (**do not** use regular acrylic paints for face painting)
- Wash or disinfect your hands frequently
- Clean the kit after the event with soap, then rinse with cool or lukewarm water and let it dry thoroughly (good care will make brushes last)
- Use a gentle facial soap to remove the face makeup ¹²

Building a simple insect shelter

As you know already, bugs are an important part of our ecosystem. By creating a small bug shelter out of a plastic bottle, you can observe them from the window of your own house.

Materials:

- A large plastic bottle cut into two cylinders,
- A garden rope or string for hanging (you can use old shoelaces)
- Anything you can find in the park or forest nearby: sticks, twigs, pine cones, bark, pieces of moss etc. ¹³

¹² More details on face-painting <https://www.facepaint.com/pages/how-to-face-paint#:~:text=A.,brushes%20and%2For%20sponges>.

¹³ The video instruction on how to make a simple insect shelter / bug hotel (in English): https://www.youtube.com/watch?v=Smv_9vgN39A



Source (picture): www.redtedart.com.

Clean a 1,5- or 2-liter plastic bottle and cut off the bottom and the top parts. Push the string through the cut plastic bottle leaving about 15 cm on both sides to make a knot and hang the shelter on a tree later. Fill in the bottle with the sticks, twigs, pine cones, bark and other natural elements you can find around. They should sit tightly in the bottle and not fall out. Finally, put the shelter down by some bush or hang it on a tree. Observe and wait a few days for the first insects to arrive at their new home!

3.4 Insect Science

An insect-friendly garden can truly be a thing of beauty, but with so much busy buzzing, jumping and flying it can be difficult to understand what is going on, and who are the protagonists of all that activity. These two questions are at the base of the science of insects, entomology, and to start to answer them we will have to consider a few methods and materials.

First of all, how can we get a good look at an insect? In the case of slow-moving beetles this is no problem, but for weary butterflies and bees **a pair of short-distance binoculars** can come in handy. In some cases, even this is not enough for proper observation, and then we can use **a butterfly net** to catch the insect. This is not recommended in the case of delicate butterflies, which are very easily damaged, and care must of course be taken when manipulating bees and wasps. A butterfly net can be easily made with an old badminton racket and some more or less see-through cloth. Make sure to make the net deep enough so that you can swing the cloth around itself, creating a pouch where the insect will remain trapped.

Materials for a butterfly net:

- an old badminton racket
- a see-through piece of cloth 50x50 cm (use what you have at home)
- scissors
- thread
- a needle

The obvious complement to the butterfly net is **a convenient transparent container** where one can put a trapped insect and observe it calmly. Make sure to punch some **breathing holes** in the lid if you plan on observing the insect for a longer time, f. e. for some hours. With just a tiny bit of extra work, you can even attach a magnifying glass to the lid to make a cheap and useful field microscope!

Once we have got a good view of our insect, we may want to know a bit more about it. To this end there are many useful books available, but as a very basic beginning we will want to place the insect in its correct order. Is it a bee or is it a fly? Is it a beetle, or perhaps rather a bug, or even a

cockroach? A tool, such as a simple dichotomous key, can be used to identify insects¹⁴. With a bit of practice, answering this process will become second nature.

Dichotomous key

A tool used to determine the identity of an organism



1. a. Wings covered by a hard covering (exoskeleton).....**go to 2**
 b. Wings not covered by exoskeleton.....**go to 3**
2. a. Body is round shape.....**Lady bug**
 b. Body is elongated..... **Grasshopper**
3. a. Wings point toward the back.....**Housefly**
 b. Wings point toward the sides..... **Go to 4**
4. a. Wings are large and broad.....**Butterfly**
 b. Wings are long and thin..... **Dragonfly**

Source (picture): www.coursehero.com.

Of course, insect science can get extremely technical and complicated, since there are so many different kinds of insects, some of them tiny. There are also all kinds of ecological relationships between insects and their host plants, and among insects themselves. To answer these questions is to dig deeper and deeper into the beautiful field of entomology. We wish you lots of fun on this journey!

3.5 Little Crawlers Quiz

In the frames of the "Youth Active for a Biodiverse Europe" the youth-environmental-organization JANUN Hannover e.V. developed the "KleineKrabblerQuiz" (Little Crawlers Quiz) to playfully familiarize small children and young people with the fascinating properties of insects and to get them excited about these small animals.

The quiz consists of twelve question and answer cards. Each question revolves around a special fact about an insect, e.g. "With what part of their body do butterflies taste?". There are always three possible answers, e.g. a) with their feelers, b) with their proboscis or c) with their feet. It is then up to the children to answer the question. The correct answer is explained in more detail on the solution cards with an additional text, including additional exciting facts about the insect.

¹⁴ Some resources that can help to identify insects (in English):

- Online identification key <https://www.amentsoc.org/insects/what-bug-is-this/adult-key.html>
- A pictorial key to the order of adult insects https://extension.entm.purdue.edu/401Book/pdf/order_pictorial_key.pdf

The "KleineKrabblerQuiz" is to be played in two groups or with one questioner who gives a question to a group, which then guesses it. The person asking the question also has the solution cards and solves the question accordingly by reading or having the answer text read out.

The "KleineKrabblerQuiz" can be played with children of primary school age as well as with teenagers or even adults.

The game was fully researched and visually designed by Janun.

We invite you to use the material (in English or German) and to download it from this website: www.janun-hannover.de.

A little final word

We hope that this brochure has been a source of inspiration to learn more about the fascinating world of insects and how to protect them. Insects are a vital part of our ecosystem and play an important role in the pollination of plants and the decomposition of organic matter. In addition, many insects are beneficial to humans, such as bees that produce honey and beetles that help control crop pests. It is important that we all do our part to protect insects and their natural habitat. We can do this through our own everyday behavior, such as reducing the use of pesticides and planting flowers to attract pollinators. We can also involve children in educational activities, such as the games described in this booklet, to help them learn about the diversity of insects and the importance of protecting them.

In short, insects are an essential part of our natural world and we must do everything possible to protect them. We hope this booklet has been useful in inspiring people to learn more about insects and take steps to protect them.

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