ELENA

Experiential Learning and Education for Nature Awareness

Project duration: 2013 - 2016

School activities with living animals based on the Tiere ***live*** approach

ELENA

Educating with living animals

The trans-european project *ELENA* with partners from Georgia, Hungary, Romania and Germany aims to support a sustainable way of living and acting during a human lifetime. Through personal experiences with living animals, the awakened positive emotions can form a link between knowledge an action and motivate children to find ways to live in more harmony with nature. It was funded by the European Comission.

Find more: **www.elena-project.eu**

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This project has been funded with support from the European Commission
Lifelong Learning Programme


Bees
Activities with Bees
Lifelong
Learning
Programme
Tiere live

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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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Content Translation of the new Activities 9 and 10

Activity 9

Bees – valuable pollinators in danger

Abb.38: Bees pollinate the fruit we harvest

Season: March to September

Grade level: 5-8

Time: ca. 5 school periods

subjects: biology, geography, german, ethics, art, math

Aim of the activity:

- Awareness for biodiversity and its value for man
- Conception of causal relation in ecosystems
- Realize human influence on biodiversity
- Encourage sustainable behaviour
- Motivate to adopt responsibility for wild animals
- Work and solve tasks independently
- Encourage interdisciplinary thinking

Materials:

- Identification key Attachments A1_1, A1_2
- Attachment A9_1 Value of bees for man
- Attachment A9_2 Discussion of values
- Attachment A9_3 Value of bees – diversity of species
- Attachment A9_4 detective game
- Attachment A9_5 math worksheet
- Paper, pencils, ruler
- Stop watch
- Poster/Flipchart/cards, marker

Scientific Background

Bees, if they are honeybees or wild bees, are important pollinators and of great value for man. Without bees many crops wouldn´t yield good return. The food production is highly dependent on bees and other pollinators. Moreover bees ensure the survival of many wild plants and animals and are crucial to save biodiversity. However, bees are exposed to different kinds of danger – often caused by human actions.

Implementation

- Direct contact to the animal is important to enthuse pupils. We recommend to combine this activity with at least one of following activities in this module: Activity 6, Activity 7 or Activity 8
- The topic “pollination” should be approached in biology class before starting this activity.

Step 1: The class goes to a flower meadow, flowering plants in the school yard or nearby.

Step 2: The pupils observe one bee and make notes to answer following tasks:

- What bee species is it? (Attachment A1)

- Measure the time, follow the bee and count to how many flowers it flies. (1 to 5 minutes, teacher can stop time for all pupils)
- Is the bee changing the plant species? Which plant is it going to?
- The findings are discussed in class.

Step 3: Value of bees for man
The teacher informs the students about the value of pollination and what would be missing, if there were no bees anymore. (Background information for teachers in Attachment 9_1). Every student (or small group) thinks about what would change in their daily life, if there were no bees anymore. They write down the main points and some students read aloud their examples.

Step 4: Discussion of values
Discussion of values and biodiversity (suggestions for teachers in Attachment A 9_2).

Step 5: Game: diversity of species. (Attachment A 9_3)

Step 6: The case of the disappeared bees – detective game (Attachment A 9_4)

Step 7: How we can help bees
The class discusses together or in groups possibilities to help bees and writes their conclusions down on a poster/flipchart/cards.

- Afterwards a practical action can be performed, e.g. planting flower meadow on the school yard; building nesting aids for wild bees (see activities 2-4 in bee module).

Additional material: Arts

Students observe a bee. They draw a bee and write down why bees are important for them. Best time for this would be between Step 4 and Step 5.

Additional material: Mathematics

Additionally there is a math-worksheet (Attachment A 9_5) with sample calculations based on own observations (Step 2) and data about the value of pollination and the decline of bee colonies in Bavaria. It might be part of the activity – so students have to calculate the first part of the worksheet between Step 2 and Step 3 and second part between Step 6 and 7. Or the worksheet is used in the next math lesson to discuss the topic again to deepen student´s knowledge.

Attachment A 9_1

Value of bees (Teacher information)

Bees are of great value for man. Not only because honey and other bee products are sold; the biggest value derives from pollination of many plants which provide food for humans. 84 percent of the approximately 260 most important plants used for agriculture in the EU, depend on pollination by insects. The value of food, pollinated by insects is estimated to be € 2,5 billion per year in Germany and ca. $ 153 billion per year worldwide.[1] Not only honeybees, but also wild bees are crucial for the pollination of crop plants.[2]

If there were no bees anymore, considerably less food would be produced. Especially fruits, vegetables and oleiferous plants are dependent on pollination by bees. Even if these plants are able to produce fruits due to self-pollination or wind pollination, the yield would be much lower than usual. An apple tree for example, yields 63 percent more, if it is pollinated by bees[3]. Consequently food prices would escalate.

Bees are essential, not only for global nutrition, but also for human health. Bees pollinate many healing plants and with fruits and vegetables most vitamin suppliers. Additionally to honey, honeybees provide products like propolis or royal jelly that are used in medicine and cosmetics.

Endangerment

In some parts of the world bees have already disappeared. In China apple trees are pollinated by man, because chemicals in agriculture caused the eradication of bees.[4] In recent years widespread deaths of honeybees happened in the US and Europe too. Frequently whole bee colonies disappeared without a trace. (Colony Collapse Disorder) and a satisfying explanation is missing so far.[5] In Germany the number of honeybee colonies has declined extremely in the past decades.[6]. 54 percent of wild bee species in Germany are endangered and are named in the Red List.[7]

[1] Naturkapital Deutschland – TEEB DE (2012): Der Wert der Natur für Wirtschaft und Gesellschaft – Eine Einführung. München, ifuplan; Leipzig, Helmholtz-Zentrum für Umweltforschung – UFZ; Bonn, Bundesamt für Naturschutz. S.31
[2] http://www.welt.de/wissenschaft/umwelt/article114029771/Wilde-Insekten-muessen-Honigbienen-unterstuetzen.html
[3] http://www.deutscherimkerbund.de/165-Der_DIB_Bestaeubungsrechner
[4] Markus Imhoof & Claus-Peter Liecckfeld (2013): More than Honey – Vom Leben und Überleben der Bienen, orange-press, Freiburg. S. 129ff.
[5] Markus Imhoof & Claus-Peter Liecckfeld (2013): More than Honey – Vom Leben und Überleben der Bienen, orange-press, Freiburg. S. 25ff.
[6] http://www.deutscherimkerbund.de/161-Imkerei_in_Deutschland_Zahlen_Daten_Fakten
[7] Klaus Mandery et al. (2003): Rote Liste gefährdetet Bienen (Hymenoptera: Apidae) Bayerns. http://www.lfu.bayern.de/natur/rote_liste_tiere_daten/doc/tiere/apidae.pdf

Possible questions for lesson: Every student (or small groups) thinks about what would change in their daily life, if there were no bees anymore – for example:

- What would I eat for breakfast, if there were no bees anymore?
- Would the snack, I brought to school today, exist without bees?
- Could I eat my favourite dish, if there were no bees anymore?
- …?

You can use this example for getting started:

Breakfast with bees
It´s a sunny day, you wake up because the birds are singing in the garden. Energetically you go to the breakfast table. It is colourful and filled with: oat flakes with almonds and fruit, orange juice, herbal tea, sunflower-seed-bread with margarine, strawberry jam and honey. You enjoy your breakfast and don´t think about the fact, that this variety is only possible, because many little animals pollinate our crops.

Breakfast without bees
It is a sunny day, you wake up and it´s really quiet. Since the bees are gone, there aren´t any birds in your garden. You go to the breakfast table and it looks quite empty: A bowl of oat flakes and some milk.

Explanation: Almonds and fruit for the cereals are scarce goods since the bees are gone. Oranges and herbs were dependent on pollination by bees too. The yield of sunflower- and rapeseed is reduced that's why margarine is really expensive. There is no fruit left to make jam out of. Oats and milk products are left, but even those would become more expensive. Forage crops like clover or soy would yield less without bees and dairy cows would become diseased more often, because the variety of plants they feed on isn´t given any more.

To illustrate this, the teacher could bring some products and let the pupils guess which products are pollinated by bees and which aren´t.

Attachment A 9_2

Discussion of values (Suggestions for teachers)

84 percent of the approximately 260 most important plants used for agriculture in the EU depend on pollination by insects. The value of food, pollinated by insects are estimated an. $ 153 billion per year worldwide.[8]

That's only an estimated value. It isn´t possible, to measure monetarily how important bees are for human beings. It is not possible to calculate the exact value of nature. We take everything we need from nature: food, water, cloths, energy, medicine… Even some technical inventions are based on nature (bionics). It is not possible to predict, whether a species will be essential for humans in future. Perhaps this species will be important to produce medicine or a whole ecosystem depends on it. Only when a species has ceased, we will learn the consequences. The preservation of biodiversity – which contains species variation, ecosystem variation and genetic variation – is essential for man, because many species have a direct benefit for man or will have it in future.

The economic value of pollination by bees can be calculated roughly, but to tell an actual value of bees generally is impossible. Not everything has a monetary value. What is the value of a beautiful flowering meadow? We can´t measure everything, sometimes it´s only a personal value.

Possible questions to pupils:

- What meanings and values has nature to us?
- Does nature (a specific species) have an intrinsic value beneath the benefit for man?
- Do men have the right to decide whether a species lives on or ceases?

[8] Naturkapital Deutschland – TEEB DE (2012): Der Wert der Natur für Wirtschaft und Gesellschaft – Eine Einführung. München, ifuplan; Leipzig, Helmholtz-Zentrum für Umweltforschung – UFZ; Bonn, Bundesamt für Naturschutz. S.31

Attachment A 9_3

Game: “Bees in ecosystem”

Every student gets a card with a short description of a bee, a plant or another animal. Now every student searches for two other animals/plants which are connected with his/her animal/plant and holds their hands. In the end the class forms a circle or a net and all students are connected. The students tell one after the other, why they are connected with their left neighbour until all cards are mentioned.
The teacher discusses the role of man in this system.
Humans increased the diversity of species by bringing plants to Middle Europe or breeding animals (apple, horse chestnut tree, sunflower, rape, honey bee). Humans depend on lots of species directly (apple, sunflower, rape, all bees as pollinators) and human beings have the power to eradicate species, sometimes unintentionally by using chemicals, polluting the environment, destroying habitats, intensifying climate change, hunting animals....

What would happen if man didn’t breed honeybees anymore and destroyed all habitats of wild bees? Now all students carrying a bee card leave the group. The system isn´t closed anymore, there is something missing if these species vanish. The class discusses which other species are affected and if there are species that would be able to fill the place of the missing ones.

There are 24 cards with animals or plants and a short description. If there are more or less students, animals or plants can be removed or added. However, it is important to maintain a logical connection between all species and to change the text appropriately. It is also possible to omit the text and let every student think about with which plant/animal he/she could be connected to.

Hedgehog *(Erinaceus europaeus)* The hedgehog feeds on insects, snails, worms, berries and fruit. For example it eats roman snails and wood strawberries.	**Wood strawberry** *(Fragaria vesca)* Wood strawberries are not only cherished by humans, but also by different wild animals (for example hedgehogs). Ripe fruits develop only when it is pollinated by insects e.g. by the grey mining bee.
Grey mining bee *(Andrena cineraria)* Female grey mining bees collect pollen from flowering plants like wood strawberry and rape. They bring the pollen into the brood chamber of their nests and place an egg on the pollen supply.	**Rape** *(Brassica napus)* When rape is pollinated by bees (e.g. grey mining bees) it brings a better yield. Not only farmers are happy about the fruits, also wild animals e.g. wild boars like to eat rape.

Wild boar *(Sus scrofa)*

Wild boars usually grub for roots in the forest soil. In a landscape made by human, they also eat plants like rape or horse chestnuts.

Horse chestnut tree *(Aesculus hippocastanum)*
To develop horse chestnuts the blossoms of the tree must be pollinated by insects e.g. bumblebees. The fruits are eaten by animals like wild boars.

Buff-tailed bumblebee *(Bombus terrestris)*
The buff-tailed bumblebee is a wild bee. Like honeybees it lives in a colony, but only the queen overwinters. Buff-tailed bumblebees pollinate many plants e.g. chestnut tree or sunflower.

Sunflower *(Helianthus annuus)*

The Sunflower originates in America, but is cultivates in Europe too. It is pollinated by insects like the buff-tailed bumblebee. Many birds e.g. the blue tit feed on the fat-containing seeds in winter.

Blue tit *(Parus caeruleus)*

The blue tit mainly feeds on insects (e.g. tawny mining bee). In winter blue tits eat seeds too, for example flower seeds from the birdhouse.

Tawny mining bee *(Andrena fulva)*
Tawny mining bees pollinate many fruit trees/bushes e.g. apple trees. Beside men who destroy their habitats, wild bees have natural enemies too, for example birds like the blue tit.

Apple tree *(Malus domestica)*
Apple trees yield fruit, when they are pollinated by bees. Several bee species fly to apple blossoms e.g. tawny mining bees. In autumn the apples feed animals, for example dormice.

Dormouse *(Glis glis)*

For its long hibernation from end of September to beginning of May the dormouse has to build up fat reserves. It feeds on seeds from trees (e.g. linden) or fruits like apples.

Small leaf linden *(Tilia cordata)*

Linden blossoms smell strongly of nectar to attract insects. Honeybees pollinate the linden blossoms and seeds can develop which are spread by wind and eaten by animals (e.g. dormouse).

Honeybee *(Apis mellifera)*

Honeybees are bred by man. They collect nectar and pollen on many crop and wild plants. When bees pollinate the blossoms of small leaf linden or rowan trees, many animals benefit from the fruits in autumn.

Rowan *(Sorbus aucuparia)*
The white blossoms of rowan trees are pollinated by insects like honeybees in springtime. In autumn and winter birds (e.g. blackbirds) like to eat the red fruits, which is why they are called "Vogelbeeren (bird berries)" in german.

Blackbird *(Turdus merula)*

In spring and summer blackbirds feed mainly on insects and worms. In winter they have a preference for red fruits like rowan berries and haws.

Dog rose *(Rosa canina)*

In summer the dog rose is pollinated by insects (e.g. red mason bee). From the pollinated blossoms, red fruits (haws) develop, that feed birds (e.g. blackbirds) in winter.

Red mason bee *(Osmia bicornis)*

Red mason bees are common wild bees in Germany. Females collect pollen from many different flowering plants (e.g. from dog rose and meadow sage) as food for their offspring.

Meadow sage *(Salvia pratensis)*
Meadow sage is part of the mint family. Only insects with a long proboscis like the tree bumblebee are able to reach the nectar within the violet blossoms. Some bees (e.g. red mason bees) collect mainly the pollen of the blossoms.

Tree bumblebee *(Bombus hypnorum)*
Tree bumblebees are wild bees which live in colonies. The worker bees collect nectar and pollen from different plants (e.g. meadow sage or blackberry) to feed the colony and the brood.

Blackberry bush *(Rubus fructicosus)*

The blackberry blossoms are pollinated by insects, for example by tree bumblebees. Not only humans like to eat its fruits, the red fox loves the sweet berries too.

Red fox *(Vulpes vulpes)*

The fox is a deft predator. Its prey is for example the field mouse. However, it feeds not only on meat and carrion, but also on fruits e.g. blackberries.

Field mouse *(Microtus arvalis)*
Field mice feed on grass, herbs, cereals and other seeds. For example it eats red clover. An enemy of the field mouse is the fox.

Red clover *(Trifolium pratense)*
Red clover is food for livestock and wild animals. For example the field mouse eats red clover. The clover blossoms are pollinated by insects (e.g. red-tailed mason bee) only then many seeds may develop.

Red-tailed mason bee *(Osmia bicolor)* Female red mason bees collect pollen (e.g. from red clover blossoms) and bring it as food for their brood into their nests which are in empty snail shells (e.g. from copse snails).	**Copse snail** *(Arianta arbustorum)* A natural enemy of the copse snail is the hedgehog. Some bees like the red-tailed mason bee use empty copse snail shells to build nests for their brood.

Attachment A 9_4

Detective game: “Case of the disappeared bees”

Introduction:

When beekeeper Max Mustermann in Markt Immen was looking for his beehive, all his honeybees were gone. Just a few newly hatched bees with crippled wings were sitting on the honeycombs. But what happened to his bees? Where are they gone? Try to solve the case together!

The class is divided in 5 teams. Each team gets one hint about the disappearance of the bees. One team member who can share the information, stays at his place, the other team members go to the other groups and gather the clues from the information. Then they have to go back to their original team and put the story together.

Hint 1	The intensive agriculture around Markt Immen has changed the landscape. There are only big monocultures with one kind of rape or corn. In between there are no flowering weeds, blossomy field borders and hedges are missing. The meadows are cut up to seven times a year just before blossom time. In settlements all grass verges and lawns are cut curtly. Because of the missing flowers, the bees couldn´t find enough food to reserve honey. Besides, the missing variety of different flowering plants damps the bee’s immune system.
Hint 2	The regional farmers apply chemicals on their fields to poison weeds and pests in order to get more yield crops. These chemicals also harm useful pollinators such as bees. Some chemicals, called neonicotinoids, affect the bees’ sense for orientation and honeybees often aren´t able to find back to their hive again.
Hint 3	Markt Immen is also affected by climate change. After mild winters in the last years the blossom time has changed a little and the food availability for bees has changed with it. The last weeks were very rainy. Honey bees don´t leave their hives when it is raining and so they couldn´t collect much nectar and pollen and the bee colony was getting weaker and weaker. Because of the rising annual temperatures some illnesses and parasites could multiply and spread on many bee colonies.
Hint 4	Max bought his honeybees from a special breeder who breeds especially peaceable bees. The bees don´t sting Max and the honey amount harvested last year was very high. But other attributes such as robustness and adaptability got lost in this breed.
Hint 5	Little robust and weakened bees are especially predisposed to fungal infection, viruses and parasites. The most common parasite on bees is the varroa mite. It feeds on the bee`s blood and because of its bite viruses are able to enter the bee. If the mite infests the bee larvae, the bees hatch with crippled wings.

In the end the class discusses the solution.

Addition for teachers: It has happened that whole bee hives vanished in reality, especially in USA where this phenomenon is called Colony Collapse Disorder. They didn´t find a clear scientific explanation for it. However, it is evident that a lot of different factors play a role. The mentioned reasons in the game all affect the loss of bees in Germany. The game shows that there are several dangers for bees and that all these dangers can conclude in losing whole bee hives or, in the end, losing all bees.

The game names honeybees, but wild bees are endangered too. In the discussion dangers for wild bees such as habitat loss and less flowering plants nearby their nests can be added.

Attachment A 9_5

Math-Worksheet:

Part 1 Value of pollination

1) Based on your observation:

- *What bee species is it?*
- *Measure the time, follow the bee and count to how many flowers it flies.*
- *Is the bee changing the plant species? Which plant is it going to?*

a) Calculate to how many flowers the bee you observed pollinated in 1 minute!
b) Write down the answers from all your class mates and calculate the average per observed species!

2) For a glass of honey (250g) a honey bee colony has to fly to 6.000.000 flowers.
a) To how many flowers does the bees have to fly to for 1g of honey?
b) How many hours does one bee has to collect to produce 1g of honey? (use the average from 1b for honey bees)

3) A single honey bee leaves the bee hive up to 9 times a day und visits 250 flowers per fly. A furry bee visits up to 8.800 flowers a day. Which species pollinates more flowers per bee?

4) In Germany around 25.000 t of honey are produces every year. Every german person eats around 1,1 kg honey per year. There are ca. 81 million people living in Germany.
a) What percentage of the honey consumption in Germany, is produced in Germany?
b) If one kilo honey is worth € 9,50, how much is the economic value of honey production in Germany?
c) The value of agricultural products, which depend on pollination by insects is around € 2,5 billion. What percentage of this value is the value of honey production (see 4b)?

5) A research shows that sunflowers, that are pollinated by bees produce about 503 seeds per flower, while the same sunflower variety produces only 81 seeds per flower without bees. How much bigger is the yield with bee pollination?

6) Mr. Meier harvested 40 kg of apples, 30 kg of pears and 20 kg of cherries in his garden. If there were no bees to pollinate his trees, he would have harvested only 14,8 kg of apples, 3,3 kg of pears and 7,6 kg of cherries.
a) What percentage of his yield refers to bees?
b) Which fruit profits most from bee pollination?

Part 2 Decline of bees

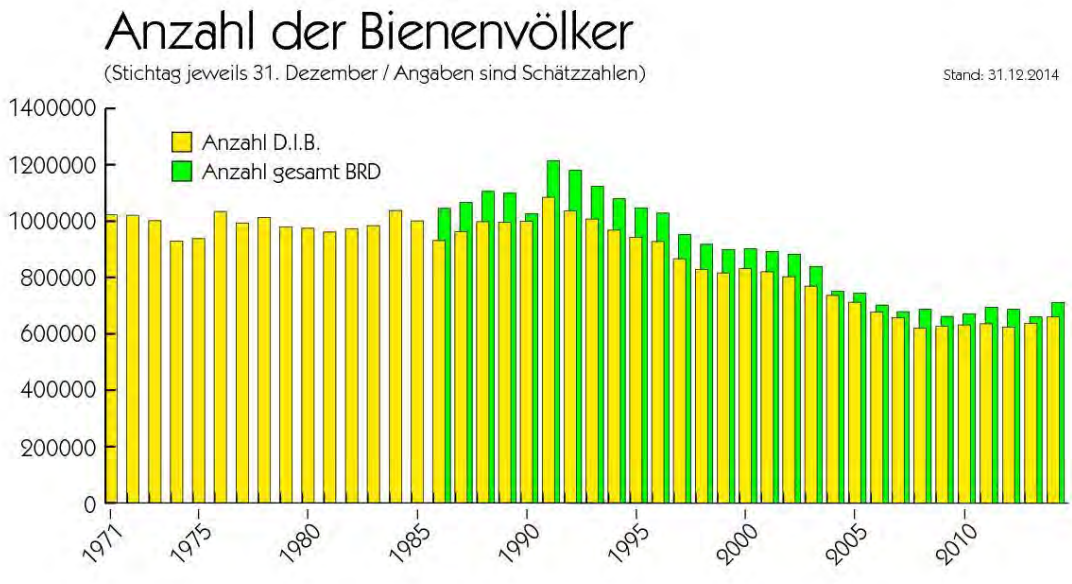
7) In Bavaria 166.370 honey bee colonies were counted in 2014. Though there has been a little increase in the number of bee colonies in the last few years, the total number in 2014 is much lower than in 2004.
a) Use the numbers below and calculate the numbers of honey bee colonies during the years 2004 and 2013!

Trend of bee colonies (increase or reduction of bee colonies compared to the previous year [9]):
2005 = - 19.381, 2006 = - 22.963, 2007 = - 11.141, 2008 = - 21.788, 2009 = - 2.718, 2010 = - 806, 2011 = + 1.493, 2012 = – 8.489, 2013 = + 3.466, 2014 = + 7.784

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bee colonies											166.370

b) Draw the calculated numbers as columns into the diagram below.

c) Compare your diagram with the diagram below (numbers of bee colonies in Germany). Is it the same trend? When did the biggest number of bee colonies occur?



D.I.B. …. Deutscher Imkerbund

Source: http://www.deutscherimkerbund.de/161-Imkerei_in_Deutschland_Zahlen_Daten_Fakten

[9] Data source: Deutscher Imkerbund 2014 (German bee keeper association 2014)

Activity 10

Detective “beefriend” – the bee-friendly school yard

Season: March to September

Grade level: 5-8

Time: ca. 1 school period

subjects: biology, geography

The aim of the activity is to observe the own school yard and develop ideas for a bee-friendly garden design. Let the students become detectives and observe the school yard from a bee’s point of view.

Aims of the activity:

- Learn about habitats of bees
- Get to know different bee species
- Realize human influence on biodiversity
- Encourage sustainable behaviour
- Motivate to raise responsibility for wild animals
- Work and solving tasks independently

Materials:

- Identification keys , attachments A1_1; A1_2, A2_1, A2_2, A2_3
- Attachment 10_2 Information Wild bees
- Paper, pencil, ruler

Scientific Background

Many habitats of wild bees have vanished because important structures - e.g. flowering patches, hedges or natural stone walls - disappeared to optimize agriculture. Meadows are cut several times before blossom of wild herbs and big monocultures, even if they bloom, don´t provide food for specialized bee species. Rotten wood and open soil are scarce, but there are more and more places sealed with concrete. Even our house gardens are tidy. Old plants (nesting habitats for some wild bees) are cut down and cleared away immediately and the well-cut lawn is a green dessert from a bee’s point of view. Even flowers – such as ornamental double flowers – don´t support food and even are pollen free sunflowers were bred. As a consequence wild bees and honeybees don´t find enough food in any saison.
How is the situation in your own school yard or garden? Are there similar structures as mentioned?

Implementation

- Direct contact to the animal is important to enthuse pupils. We recommend to combine this activity with at least one of following activities in this module: Activity 6, Activity 7 or Activity 8
- Students get information on wild bees and their habitats (Attachment 10_2).
- The class investigates the school yard. Every student or small group draws a sketch of the school yard (or gets a map from the teacher) and thinks about a legend for their map. Pupils mark places that are potential habitats of wild bees, potential food places (flowering plants) and all places where they find living bees on their map. The bee species can be identified with the keys in attachments A1 to A2.

Afterwards, pupils discuss their findings in class. How many bees could be found? How many potential habitats are at the school yard? Are there plants bees feed on? Afterwards they decide if the school yard is bee-friendly or how it could be improved.

Further activities:

We make a bee-friendly school yard! Pupils realize a practical activity e.g. a wild bee corner at the school yard: sow flowering plants, build nesting sites (see activities 2 to 4 in bee module). To make a school garden with herbs and vegetables makes the school yard bee-friendly too (see text box).

Bees at the schooal garden

A school garden with vegetables or fruit trees makes the school yard more bee-friendly. On the flowers of plants wild bees and honey bees can be observed, which increase the yield of the school garden at the same time. A honey bee hive (see activity 8) in the school garden brings additional benefit. Beneath fruit and vegetables, honey and other bee products can be produced and honey bees can be observed all-the-year. Students can eat their own school products or sell them e.g. at feasts, markets or school snack bar.

A good example is the secondary school Rottmayr in Laufen. As part of the senior class practice seminar, a school garden was implemented. At the same time with a Fairtrade-stall, where pupils sell snacks with herbs from the garden and other regional products or Fairtrade products to their colleagues. A honey bee colony in the school garden pollinates plants and produces school´s own honey.

In this project pupils learn about dealing with agricultural plants and honeybees, as well as how to keep supply chains sustainable and small. Moreover ecosystem services such as the direct benefit of bees for people can be observed live.

For more information about school garden see Attachment A10_1

Attachment A 10_1

Literature school garden

Examples of active schools

Contacts concerning horticultural questions

Attachment A 10_2

Worksheet Wild bees

Read the text and answer the questions below!

Bumblebee and face-masked bee – big and small – bees can look quite different.

Bees

In Germany there are ca. 560 bee species. The best known is the honey bee which is breed by human as farm animal. All other species are called wild bees.

Loner instead of bee swarm

This sand bee is a solitary bee.

Contrary to honeybees, most wild bee species are solitary bees. These bees don´t live in a colony with a queen and worker bees, but build their nests and look after their brood alone. There is no division of work and they don´t stock honey. After mating with a male bee, the female bee builds a nest with 4-30 breeding cells. The bee brings a mixture of pollen and nectar into every breeding cell and lays one egg on it. From the egg evolves a larva, which feeds the food reserve within three to four weeks and pupates afterwards. In the end a fully-fledged bee hatches out of the nymph. In most solitary living bee species the next generation hatches in the following year or there are two generations per year, one in spring and one in summer.

The garden bumblebee lives in a colony, but only the young queen overwinters.

Besides solitary bees, there are communal bees, which build their breeding chambers in a common nest that is shared by two or more female bees.

The honeybee and some wild bee species e.g. the bumblebee, live in colonies and belong to the group of social insects. They live within bigger groups and divide their work. There are queens which lay eggs and worker bees which collect nectar and pollen, feed the brood or guard the nest.

Moreover there are parasitic bees alias cuckoo bees which lay their eggs into the nests of other bee species.

Sweet blossoms

Bees feed on nectar and pollen. A sufficient blossom supply is essential for every bee. Females which have to feed their brood, collect additional nectar and pollen and bring it into their nests. Pollen is

the most important food component for the larva. Some wild bee species collect only pollen from specific plant species and therefore depend on these plants.

Deadwood piles and stonewalls are habitats for wild bees

Bees and flowers

Bees need flowering plants as food source, but plants need bees for pollination and reproduction too. Flowering plants only build fruits and seeds, if the male pollen (dust) reaches the stigma on the blossom. Some plants are pollinated by wind, but many plants need insects to transport the pollen from one flower to the next. Not only bees are adapted to specific plants as food source, but also plants are adapted to their pollinators for example with different shapes of the blossoms.

Whereas honey bees leave their hive only in good weather and prefer flowers at sunny places, many wild bees pollinate also under bad weather conditions with cooler temperatures and also plants at shadowy places. Therefore wild bees play an important part in pollination of crop and wild plants.

The bee in the snail shell

Depending on the species wild bees build their nests in different places. Some bees dig holes in open soil, others carve out plant stalks or rotton wood. Some use existing hollows in wood, soil, rock cracks or plant stalks. There are even wild bee species which build their nests in empty snail shells.

Many bees coat their nests with special secretions from their glands – in case of bumblebees and honey bees we call the product wax. Other bees coat their hollows with clay, sand or small stones, some use even plant material e.g. leafcutter bees.

Exercises:

1. What social behavior can bees have?
2. What do bees feed on?
3. Where do wild bees build their nests?
4. Do you detect bees, food plants for bees or places where they could breed in the school yard? Draw a sketch of your school yard and search for wild bees and their habitats!
5. Is your school yard bee-friendly? Discuss in class!