Final Report

Expansion of the outdoor classroom at the Nussloch-Leimen quarry

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1. Introduction

The idea of designing and elaborating an outdoor classroom at the Nussloch-Leimen quarry for the 2014 Quarry Live Award arose from our own annual visits of the site and the fact that we have many years of practical experience in handling and implementing this educational concept. In addition to this, infrastructure of relevance for this undertaking was already available at the location, such as the experience trail and construction trailer with its equipment, for example.

2. The educational concept

The educational concept of teaching outdoors is based on the idea and conviction that nature provides an ideal setting for learning which offers excellent conditions for abiding educational work. Instead of learning models that have been derived from nature by heart in a school, nature will be actively experienced and perceived with all the senses, with interrelations recognized and understood. On this basis, students will certainly find it easier and more plausible to take a stand for the concerns of nature and the environment, and to develop a healthy and sustainable awareness of regional and cross-regional nature protection issues, yet without neglecting the need to secure resources at the same time.

3. Short description of the activities applied

3.1. Elaboration of study materials

The aim consisted of providing potential users of the HDCement and/or Nussloch quarry homepage - i.e. visitors of the quarry - with the working materials listed below in an appropriate format, thereby expanding upon the proposals that are already available.

3.1.1. Elaboration of materials for the phenological garden taking part in the "Global Phenological Monitoring" program

We are all familiar with natural phenomena that recur every year. The scientific term for the observation of these events is "phenology", which could be loosely translated as "study of appearances". Phenology hence concerns itself with development phenomena that periodically recur in nature every year. For plants, this involves observing the dates when characteristic growth stages set in, which are called "phenological phases". The phenological phases of plants include the budding of leaf buds, start of the leaves unfolding, opening of the flower buds, start of the flowering period, the full flowering, end of flowering, first ripe fruits, ripeness for picking, autumnal discolouration of the leaves, and leaf fall.

To enable observation of these phenological phases in situ at the quarry, a phenological garden has been created, and profiles were elaborated for the individual tree and shrub species cultivated, providing information about them and their observation phases (see section 4.1).

3.1.2. Elaboration of bird profiles for "bird song listening" locations

On a guided tour through the quarry, one will come across a great variety of noises. Trucks growling, conveyor belts rattling, not to speak of the blasting. But if one visits the right locations, one will perceive a twittering, singing and warbling all around. Visitors only rarely take the time to stop and try to put a name to these apparently insignificant background noises, however. That is the mission of this idea. It involved the identification of two locations and elaboration of profiles for the bird species encountered there. The attendant birdcalls should be made available to visitors on the HDCement homepage - along with the worksheets (see 4.1).

3.1.3. Elaboration of worksheets for the information panels provided at the quarry

The only activity carried out jointly with students was the creation of worksheets for the information signs placed in the quarry site. The idea behind this is simple. In the usual situation we, the teachers, discharge our teachings from behind a desk in front of the class over and into the heads of the students, and that frequently with readily prepared working materials. But what would happen if those to be taught showed the teachers how they envision their materials? Perhaps this could provide a possible way of drawing the teachers and the taught even closer together. The attachment includes three samples of uncorrected worksheets prepared by students for the individual information panels. The corrected versions and other worksheets will be completed by October 13 at the latest (see section 5.1).

3.1.4. Elaboration of an experimental game revolving around a fictitious expansion of the Nussloch quarry

This experimental game is designed to help students examine a real everyday situation critically. The students have possibly already got to know the quarry beforehand and collected information on the working methods of HDCement for extracting raw materials. The experimental game is now meant to put them in a position where they can experience for themselves that a quarry also harbours potential conflicts. What the experimental game picks up on thematically are aspects such as the protection of biotopes, biodiversity, location selection, renaturing and recultivation, as well as the extraction of raw materials. But besides these subject areas, the political and personal interests of the protagonists involved also have a part to play (and are represented by the students as theirs). This will help students practice their argumentation, discussion and conflict solution skills (see section 5.2).

3.1.5. Elaboration of a board game for post-processing and deepening the quarry visit

With this game, young quarry visitors can repeat and deepen their knowledge gained about the Nussloch quarry, and that in a playful manner. In the course of the game, the players take a tour of the quarry in the playing field while being tasked with exciting missions. In one place something is happening, in another one needs to answer questions and make use of one's knowledge, but one needs to beware, too, because there are also "Oops" fields such as areas of loose gravel: "Oops, you have slipped on the stones. Miss a turn to go easy on

your foot!". And if a blasting explosion was too loud you need to miss a turn to give your ears a chance to recover. So enjoy (see section 5.3)!

3.1.6. Mapping the vegetation at various meadow locations of the Nussloch quarry

Biotope mapping is applied to register habitats in a specific area and to evaluate and characterize them in terms of their meaning for the ecosystem. The students deepen their knowledge of species and learn a decisive biological working method for describing nature scientifically.

To this end, simple instructions have been drawn up that are easy to understand for inexpert teachers and students.

3.2. Practical activities at the quarry

3.2.1. Creation of a phenological garden (GPM)

Planting and labelling of the following tree species as part of the Global Phenological Monitoring programme:

"Perle der Weinstrasse" almond *(Prunus dulcis)*
"Werdavia" red currant, white variety *(Ribes rubrum)*
"Heldelfinger Riesenkirsche" sweet cherry, type Diemetz *(Prunus avium)*
"Vladimirskaja" sour cherry *(Prunus cerasus)*
"Klarapfel" apple *(Malus x domestica)*
"Golden Delicious" apple, type "Golden Reinders" *(Malus x domestica)*
"Double Philippe" or "Doyenne de Merode" pear (*Pyrus communis)*
"Dore de Lyon" sweet chestnut (Castanea sativa)

The planting of the trees is expected to be completed by mid-October.

3.2.2. Bird song listening

Provision of seating, preparation of the listening locations by slightly thinning out obstructive vegetation.

3.2.3. Cultivation of a herb garden

Planting and labelling of the following herbs all around the construction trailer: rosemary, thyme, hyssop, lavender, oregano, marjoram, sage. The planting of the herbs is expected to be completed by mid-October.

3.2.4. Miscellaneous

Procurement of materials for mapping the biotopes: magnifying glasses, tweezers, tape measures, stakes and barrier tape for cordoning off and dividing up the area to be studied, compass.

4. Attachment

4.1. Phenological garden (plants used)

"Perle der Weinstrasse" almond *(Prunus dulcis)*

The almond tree is native to the Eastern Mediterranean. A good harvest requires hot, dry summers and cool to cold winters. The almond tree is closely related to the peach and can be crossbred with it. This is also how the "Perle der Weinstrasse" cultivar was created. The name refers to its frequent cultivation in Rhineland Palatinate. Observed phases: UL BB BF FF EF RF

"Werdavia" red currant, white variety *(Ribes rubrum)*

In spring, the red currant plant bears racemes of small, greenish-white flowers. The German name "Johannisbeere" is based on the fact that the fruits will ripen by St John's Eve, June 24. The "Werdavia" cultivar is a white variety with cream-coloured, medium-sized berries. The white varieties of the red currant are increasingly cultivated again. Observed phases: UL BF FF EF RP

"Heldelfinger Riesenkirsche" sweet cherry, type Diemetz *(Prunus avium)*

The sweet cherry is a member of the Prunus genus, which also includes the plum, peach, almond, apricot and prune. The sweet cherry has relatively large, white blossoms. The reddish-black fruits taste sweet to slightly bitter. The fruits of the "Hedelfinger" cultivar are particularly large and dark. Observed phases: BB BF FF EF RP CL

"Vladimirskaja" sour cherry *(Prunus cerasus)*

The origin of the sour cherry could never be established with certainty, but it probably comes from south-west Asia. The blossoms resemble those of the sweet cherry. The sour cherry is self-fertile, which means that isolated trees will also bear fruit, as opposed to the sweet cherry. Observed phases: BB BF FF EF RP CL

"Klarapfel" apple *(Malus x domestica)*

The apple is native to the temperate north. The cultivated apple varieties have been created by cross-breeding and are summarized under the name Malus x domestica. The blossoms form clusters and are white, dark pink or dark reddish purple, but usually white to pale pink. As apples are not completely self-fertile, another apple variety needs to grow nearby. The fruit of the apple plant is not formed from the ovary, but from the hypanthium, making the apple an accessory fruit. The "Klarapfel" cultivar can be harvested as early as August. Observed phases: BB BF FF EF RP FL

"Golden Delicious" apple, type "Golden Reinders" *(Malus x domestica)*

The apple is native to the temperate north. The cultivated apple varieties have been created by cross-breeding and are summarized under the name Malus x domestica. The blossoms form clusters and are white, dark pink or dark reddish purple, but usually white to pale pink. As apples are not completely self-fertile, another apple variety needs to grow nearby. The

fruit of the apple plant is not formed from the ovary, but from the hypanthium, making the apple an accessory fruit. The "Golden Delicious" variety is usually ripe by September. Observed phases: BB BF FF EF RP FL

"Double Philippe" or "Doyenne de Merode" pear *(Pyrus communis)*

The pear tree bears individual whitish-pink blossoms. The fruit set requires cool temperatures. Their relatively early blossoming in comparison with other fruit trees and shrubs, earlier than apples, for example, makes pears more sensitive to late frosts. In contrast to the apple, the blossom is always white, irrespective of the peel of the developing fruit. Observed phases: BB BF FF EF RP FL

"Dore de Lyon" sweet chestnut (Castanea sativa)

The sweet chestnut is native to the Mediterranean and Near East. Spring and early summer see the formation of pale-yellow, male catkins. The female blossoms are less conspicuous. The fruits (chestnuts) ripen in October. Observed phases: UL BF FF RF FL

Sample information panel designed in an A5 format

<table>
<tr><td colspan="2">"Perle der Weinstrasse" almond (Prunus dulcis)</td></tr>
<tr><td>The almond tree is native to the Eastern Mediterranean. A good harvest requires hot, dry summers and cool to cold winters. The almond tree is closely related to the peach and can be crossbred with it. This is also how the "Perle der Weinstrasse" cultivar was created. The name refers to its frequent cultivation in Rhineland Palatinate.</td><td>  </td></tr>
<tr><td colspan="2">Observed phases: start of the leaves unfolding, opening of the flower buds, start of the flowering period, full flowering, end of flowering, first ripe fruits</td></tr>
</table>

5.1. Worksheets for the information panels

5.1.1. Worksheet for the "Rhine rift" information panel

Create a profile using the text

The Rhine rift cuts through the landscape between Frankfurt and Basle for a length of 300 km and width of 40 km. People were already attracted to this location before the Christian era because the area in and around the Rhine rift offered ideal climatic conditions for agriculture. The Rhine was used as a basic food resource and transport route at one and the same time. The rift still continues to subside by ca. 0.7 mm a year and is one of central Europe's most earthquake-prone areas.

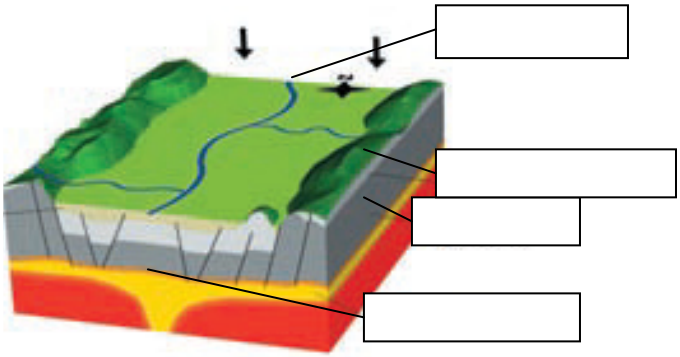
1. Name: …….....
2. Location:…….....
3. Longitude: …….
4. Latitude: …….
5. Climate: …….
6. River: ……
7. Effect: ……

1. Fill the gaps in the text.

The history of the Rhine rift began 70 million years ago at the…….., shortly before the dinosaurs became extinct around the world. At the time Europe split up into ……. that drifted away from …….. Under the ……..along the rift, a kind of cushion formed, consisting of glowing……. . The earth's crust bulged out at the beginning of the Tertiary. It was distended, creating the …… . The rift has …….. by …… in the 60 million year process. This has also involved ……., for example (Katzenbuckel, Steinsberg). At times, ……. would also advance into the rift. This structure was filled up again by the deposits from lakes and rivers.

end of the Cretaceous period – sea water – one another – earth's crust – volcanic activity – 2-4km – magma – subsided – rift structure – two halves

2. Label the diagram



Magma cushion – Cap rock – Rhine - Bedrock

5.1.2. Worksheet for the information panel "The region's geology"

Instructions:

1. Read through text 23, "Geology in the Region", carefully and mark the most important information. Then memorize it.
2. Solve the following assignments without the help of the original text as far as possible.

Assignment 1)

Fill the gaps in the text with the required terms!

➔ Terms: *flooded, loess layer, collision, Pangea, Triassic, tropical, Rhine rift, Tertiary*

The history of our region's geology can be divided into five great time periods. These are the Permian period (280-248 m years ago), the _____ (240 m years ago), the Jurassic (205 m years ago), the _____ (65 m years ago) and the Ice Age (50,000 years ago). The origin lies in the _____ between the two continents that wedged in central Europe at the time. The resulting landmass was called "_____". This vast continent then broke apart when the dinosaurs were in their heyday. The rising sea level and _____ climate caused central Europe to be _____. But when the sea ultimately retreated, the crust expanded, creating the _____. Then the residual detritus from a number of collisions was deposited in it, finally forming the _____ that is so important for our agriculture.

Assignment 2)

Answer the following questions:

1. Which types of rock is the bedrock of the Odenwald region made up of?

➔

2. What is today's cement production based on?

➔

3. When did the great flooding of central Europe take place?

➔

4. Name three fold mountains!

➔

5. How was the fertile loess layer formed?

5.1.3. Worksheet for the "Loess" information panel

Loess is a calciferous, loose sediment that is particularly also found in the Kraichgau region, were large parts of the earth's surface are even covered with it. It is silt-sized and has a beige colour. The climate's history can be deduced from the loess by way of the various layers.

1.) Tick the right answer:

In central Europe, loess was exclusively formed …
☐ ...in places with volcanic activity.
☐ ...under Ice Age conditions.
☐ ...under interglacial conditions.

2.) Fill the gaps in the text using the listed words:

(wintertime - Alps - carry off - glacial valleys - fine-grained - glacial milk)

Today's loess deposits in southern Germany largely originate from those areas of the _____ that were glaciated during the Ice Age. The _____ material created by glacial abrasion was carried away by the melt water, forming a liquid referred to as _____ . This liquid reached the Ice Age's _____, which dried out in _____ , so that the wind could _____ the fine particles and spread them over the surrounding areas.

3.) Create true sentences using one item from each column:

The glacial valleys dry for ca.	7- 8	meters of loess were deposited in the last ice age alone.
At the Weisse Hohle ravine near Nussloch, ca.	20,000	meters thick can be found in some places in Nussloch.
Loess deposits up to	20	year-old ash.
Eltville tuff consists of ca.	15	months in winter.

5.2. Experimental game

The experimental game can be played in two ways:

Version 1: Apart from a short description of the situation, the groups of students are only provided with brief information about the views of their respective interest groups concerning the planned expansion of the quarry.

Each group of students independently elaborates arguments to underpin its position in a panel discussion. The results can be backed up in the form of a mind map for better understanding. After this preparatory stage, the arguments are brought forward in this panel discussion. The students are meant to jointly search for a solution that is acceptable to all parties. Where a consensual agreement proves elusive, the drawing of joint conclusions is required.

Version 2: Apart from a short description of the situation, the students are provided with information texts covering the arguments of the individual lobbyists. The students are tasked with working out the fielded arguments and introduce them in a panel discussion. The students are meant to jointly search for a solution that is acceptable to all parties. Where a consensual agreement proves elusive, the drawing of joint conclusions is required.

Role descriptions

German Nature And Biodiversity Conservation Union NABU: You are an active member of NABU. Environmental protection and biodiversity come first for you, which is why you want to prevent the planned expansion of the quarry. You have travelled here specifically to present your views in the panel discussion. The expansion of the quarry will surrender even more natural spaces to exploitation, destroying existing habitats of animals as well as plants. You are particularly concerned about the rare species of orchid to be found in the quarry, which are protected. A targeted relocation is not all that easy either because the orchids symbiotically depend on specific root fungi in the soil. The blasting in the quarry and constant lorry traffic exposes any animals to remain in the quarry to significant levels of noise pollution. This greatly affects their lifestyle and can even mean that they need to leave their habitat. The dust and exhaust pollution connected with the quarrying also contribute to this. The fencing in of the quarry site, required for safety reasons, considerably curtails the free movement of animals between the Odenwald and Kraichgau regions.

Citizen's initiative: You are a member of a citizen's initiative established by local residents and farmers, and represent them in their attempt to prevent the planned expansion of the quarry. The local residents fear that the constant lorry traffic and blasting associated with the quarrying will lead to considerable noise pollution. The pollution with harmful substances and fine particulates will also increase in the wake of the quarry expansion. This understandably irks the local residents because it intervenes in, and hence changes, the landscape balance while they would rather preserve its idyllic-pastoral character. But the homeowners also see themselves faced with another problem: If the quarry expansion should come too close to their respective properties, cracks are possibly to be expected in the walls, caused by the shock waves of the blasting. The farmers are trying to put a stop to the quarry expansion

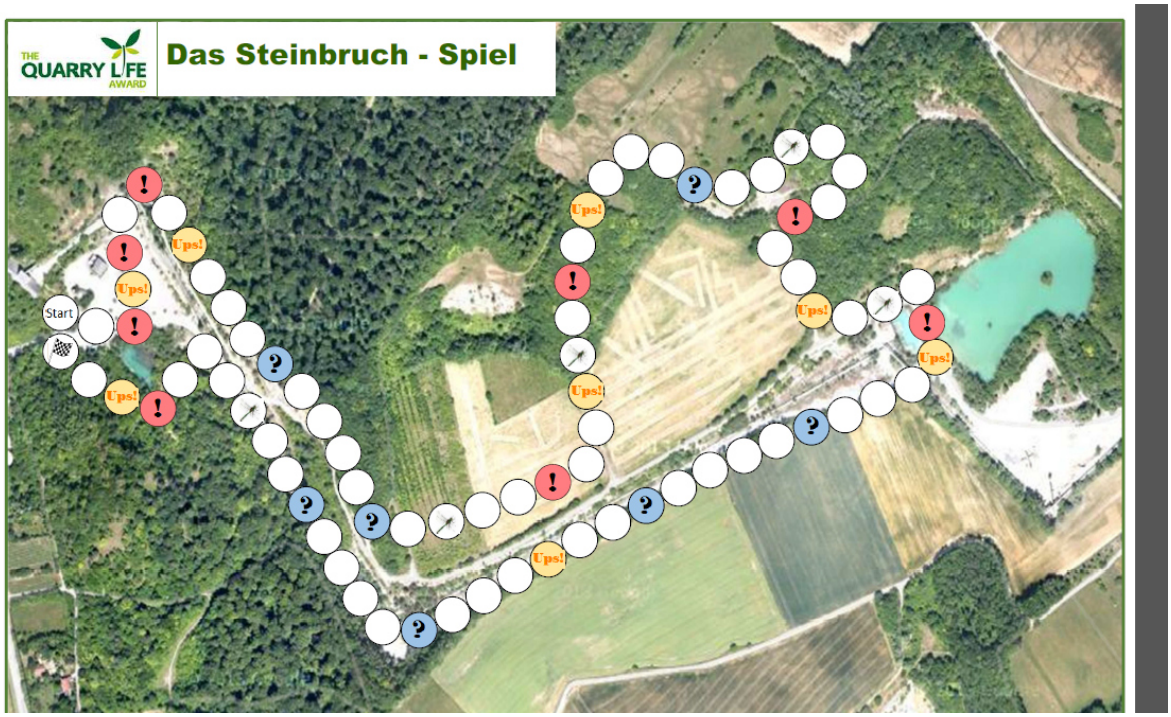
because they will lose valuable arable land and meadows, depriving them of part of their economic base.

Mayor of the Nussloch borough: You are the mayor of the borough of Nussloch. Taking part in this panel discussion is a matter of course for you because you always speak up for the interests of your community. You are principally in favour of expanding the quarry because it will secure continued tax revenues for the borough's budget, as well as maintaining existing jobs in the region. Companies such as this one additionally contribute to the maintenance of existing infrastructures. The maintenance and expansion of economically active companies meanwhile reinforces the region's image as a well-known company location. At the very same time, you are also aiming to preserve the region's qualities for local recreation, and to avoid possible conflicts with upset citizens, or to settle them amicably. This makes it difficult for you to do justice to all interest groups in this matter.

HeidelbergCement: You are a member of the supervisory board of HeidelbergCement. You are introducing the company's quarry expansion concept at this panel discussion because you wish to minimize possible conflicts and assuage the worries of local residents and NABU. The expansion could serve you to reinforce the position of the location within the company while using the already existing machinery and appliances, as well as the existing infrastructure, at the same time. Likewise, employees from the region can be assured of the continued existence of their jobs. But besides economic interests, your company also prioritizes sustainability, and therefore an environmentally compatible approach. The extraction of resources is a temporary intervention in the landscape balance. But this can be compensated again in the medium and long term. Any later use will keep an eye on nature conservation. Targeted renaturation measures are planned. A good example of this is the Schlangensee lake, where nature is left to its own devices after the end of the quarrying. An adequate buffer zone will be established around adjacent properties to keep the nuisance for local residents as minor as possible.

5.3. Board game

The game includes 1 game board, 1 die, 4 pieces, event cards and identification cards. 2 - 4 players can play it.



(The Quarry Game)

Game preparation: Every player selects one of the coloured pieces and places it in the "Start" field. The event and identification cards are placed face down in separate stacks next to the playing field. Every player throws the die once and the player with the highest number starts.

The rules: The player whose turn it is throws the die and advances his or her piece by the number of points.

Event fields: If a player lands on a red event field, the player on the left will read him or her the topmost event card from the stack.

If his or her answer is correct, the player can throw the die again and advance by that number of points. If the answer is wrong, he or she will remain in the event field. The playing card used is then placed at the bottom of the stack of event cards.

Identification fields: If a player lands in a blue identification field, the player on the left will show him or her the uppermost identification card from the stack. In doing so, this second player needs to ensure that he or she covers up the solution shown under the illustration with his or her hand. If the player provides the correct name of the animal or plant, he or she can throw the die again and advance the piece by that number. If the answer is wrong, he or she will remain in the identification field. The playing card used is then placed at the bottom of the stack of identification cards.

The dragonfly: Players who land on a field showing a dragonfly can advance their piece up to the event field. The player on their left will read out an event card and a correct answer will let the first player throw the die again and advance his or her piece by that number (see event fields).

Oops fields: Staying in quarries is also always attended by a number of risks…

If a player lands on a yellow Oops field, he or she will need to carry out the respective instructions, depending on which field it is. The numbering below corresponds to their order in the game board.

1st station - loose gravel: "Oops, you have slipped on the stones. Miss 1 turn to go easy on your foot!".

2nd station - bee hotel: "Ouch! You've been stung by a bee. Go back 2 places to get something for cooling the sting from the construction trailer.“

3rd station - meadow location: "You are excitedly observing a kite and forgot to stay with your group. Go back 3 fields."

4th station - wood and forest: "You need to run away from a pack of wild boar and take refuge in a deerstand. Miss 1 turn to wait for them to go away."

5th station - rock faces: "The blasting was too loud for you. Go back 2 places to let your ears recover."

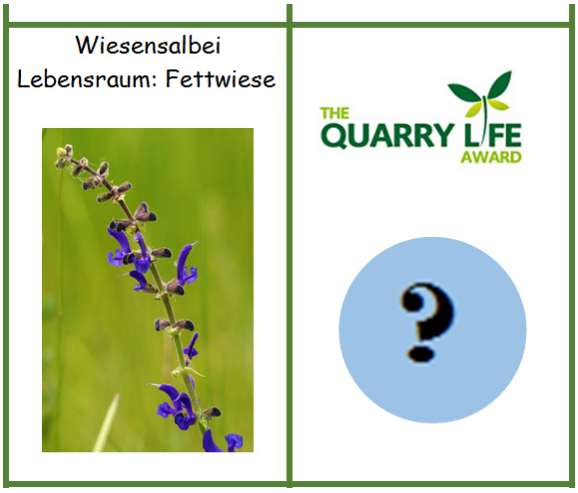
6th station - Schlangensee lake: "Oops, you were caught splashing water on a fellow student and need to go back 3 places as a punishment."

7th station - access road: "You are tired and don't feel like walking any further. Miss 1 turn."

8th station - wetland habitat: "Oops, you have fallen into the pond. Miss 1 turn to let your clothes dry."

End of the game: The first player through the finish line has won the game.

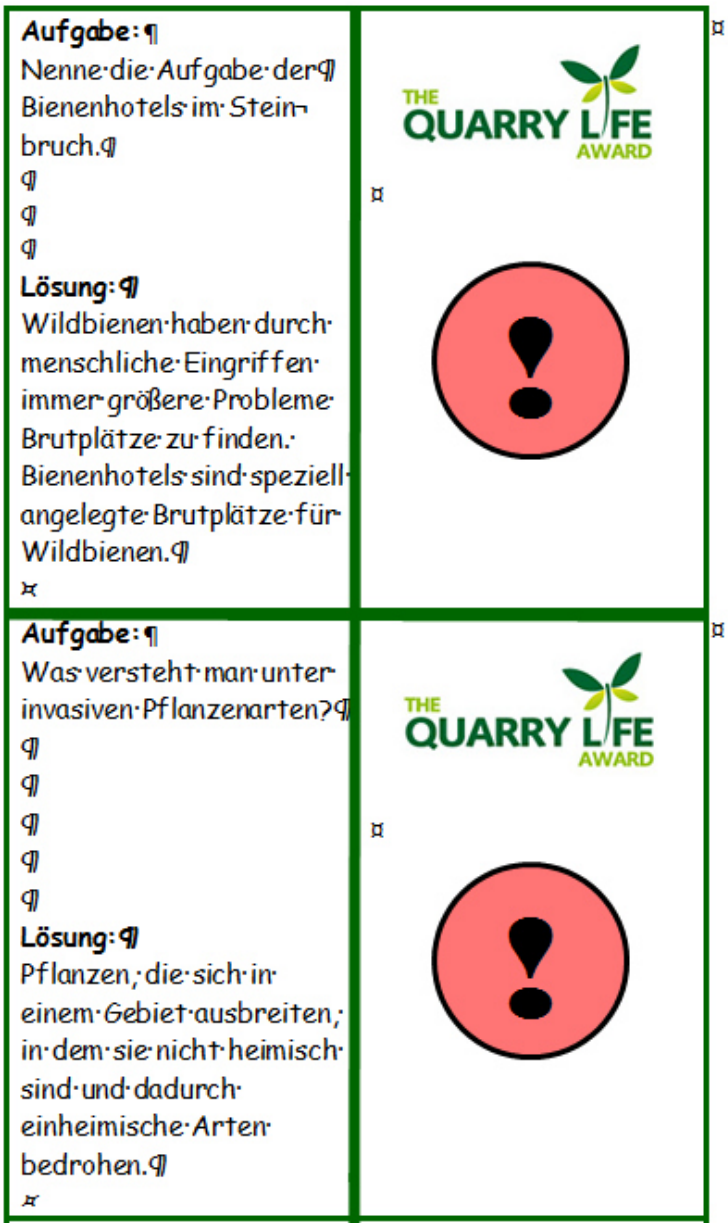
Sample identification card



Meadow sage

Habitat: rich pasture

Sample event cards



Question:

What is the bee hotel in the quarry for?

Solution:

Because of human intervention, wild bees experience ever greater difficulties in finding suitable nesting sites. Bee hotels are nesting sites specifically designed for wild bees.

Question:

What does the term "invasive plant species" mean?

Solution:

Plants that spread in areas they are not native to, thereby threatening native species.