



« Grottes grecques et chauves-souris :
Actions de gestion et changement d'attitude »

Educational Activities for School Students



THE TEACHER'S GUIDE



ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
UNIVERSITY OF CRETE



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atepe - ECOSYSTEM MANAGEMENT



ΥΠΟΥΡΓΕΙΟ
ΠΕΡΙΒΑΛΛΟΝΤΟΣ
& ΕΝΕΡΓΕΙΑΣ
MINISTRY OF ENVIRONMENT AND ENERGY



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Website of the LIFE GRECABAT project:

<https://www.lifegrecabat.eu>



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**LIFE
GRECABAT**

LIFE GRECABAT
(LIFE17 NAT/GR/000522)



How was the bag designed?

This bag contains learning activities for Primary and Secondary Education students.

The bag is part of the **LIFE17 NAT/GR/000522 - GRECABAT** ("Greek Caves and Bats: Management Actions and Change of Attitude", "Ελληνικά Σπήλαια και Χειρόπτερα: Διαχειριστικές Δράσεις και Αλλαγή Συμπεριφοράς") Program and its themes have been adjusted to the actions of the program. It deals with the relationship of bats and cave-dwelling invertebrates with their environment, the impact of human activity on them and the need to conserve our natural ecosystems.

To this purpose, it contains the following activities:

1. simpler and more complex activities (for children of different ages)
2. paper activities (ideally indoors, outdoors too)
3. single and group learning activities (encouraging cooperation and team work)
4. nature-based activities
5. activities to familiarize students with scientific methodology (observation, formulating hypotheses, outdoor samplings, drawing conclusions)
6. creative activities (to enhance artistic expression, creative writing)

Proper cave etiquette

- Stay near the opening of the cave to avoid disturbing the inhabitants inside.
- Limit the time you spend inside caves to minimize disturbance to its inhabitants.
- Take your trash with you when you leave the cave.
- Do not destroy stalactites, let the next visitors enjoy them as well.
- Toss your garbage in trash dumps, not at the entrance of the cave.
- Do not pollute and do not pump water out of caves, do not destroy the land surface covering cave roofs.
- Do not alter cave entrances, their inhabitants may not like it.

Instructions for each activity

Objective: What the students will be achieving

Group size: Number of students for best outcome

Duration: How long will the activity last

Location: Indoors or outdoors

When: What is the best season for carrying out the activity

Materials: Materials needed for the activity

A01: Activity for children aged 5-9 (Grades 1-3)

B01: Activity for children aged 9-12 (Grades 4-6)

C01: Activity for children aged 12-15 (Grades 1-3)



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Activities for children aged 5-9 (Grades 1-3)



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A01 Children's stories with bats

The teacher shall tell a short story followed by a discussion

Objective: A creative approach to nature

Materials: Not necessary

Group size: 5-30 students

Duration: 1 hour

Location: Indoors

When: Any season

Introduction

Storytelling allows students to approach a certain theme through different angles (verbally and emotionally, consciously and unconsciously).

A story can encourage discussion on nature, animals, humans and our interaction with the world.

Instructions

- Read or narrate a story with bats (like the story below). You can even use your own words.
- If necessary, take short breaks to answer questions.
- When the story ends, start a discussion. Then, you can tell another story.

Discussion

- Do we humans look like other animals, just like bats look like mice?
- Do all animals have the same mouth? Do they eat in the same way? Do they eat the same food?

Reference sheet

Shhh! During the day I'm sleeping

The lesser horseshoe bat used to spend the warm nights...eating.

He flew around the bushes squeaking "lu...lu...lu...lu..." and if he happened to listen to the echo bouncing off from a mosquito or a small fly, he would fly back and snatch it in.

"That's life!", he screeched between his bites.

"iiii... iiii... iiii..., if you want to feel full, you have to eat large moths", chirped the great horseshoe bat who hung from a tree branch. And then flew off to snatch a passerby moth and went back on the branch to munch on it.

"Er...er...er...er..., don't eat a flyer, eat a walker...er...er", exclaimed the myotis from the woods, then pricked up their mouse-like ears to listen to the spiders walking on the leaves or the millipedes crawling along the grass.

"Snaa...aaa...aaa..., snatch it fast and don't wait for it", clicked the bent-wing bat hopping from tree to bush and from fly to moth.

"Wow...wow...wow..., seize all opportunities, you can't have the same meal every night", mumbled



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the serotine bat who decided to leave the large beetles alone in their meadow for tonight and instead preyed on the large moths under the lights of the streets.

Dawn arrived and all the bats went to sleep.

Where? In the quietest, most secluded, darkest place of all.

Their cave.

"Splish...splash", dripped the water from the stalactites. The bats avoided them by listening to the echo of their voice, then flew over to their favorite roosts, where their hungry baby bats were waiting for them. They hang upside down from the roof - each horseshoe bat on its own, the myotis right next to each other, the bent-wing bat and the serotine squeezed inside holes - while mother bats let their babies cling on them to feed them milk.

On the ground, a group of cave crickets, woodlice, centipedes and millipedes were walking, preying or munching on a thick layer of guano (bat manure).

And they slept happily ever after... Until...

Disaster! One day, a bright light lit up and a group of humans entered to admire the cave.

"Wow!!!" they exclaimed, "What a miracle! Everyone should be able to enjoy this. We can place lights inside and come every day".

And so they did.

"What a fuss", screeched the lesser horseshoe.

"It's busy all the time", the myotis complained.

"The babies can't rest with all this light", muttered the serotine bat.

They took a flight across the cave, from end to end, until they found a quiet little corner.

And under the bats, all the crickets and the woodlice and the millipedes squeezed along too.

Dusk came.

The bats flew over the heads of the humans and squeezed out to exit from the new door.

They were starving. They hadn't eaten all day indeed. Thankfully, the night was theirs to forage for their food.

Dawn arrived and the bats returned into their cave, but they found door closed.

"What now? Where are we going to spend the night?", fretted the lesser horseshoe bat.

"Let's take off to this old house", said the great horseshoe bat.

But first, the myotis and the serotine bat, they had to sneak into the cave and get their babies. It was very difficult, but they made it.

This old house was abandoned for years. The wind, the light and the bats, they all slipped into the house through a broken window.

The bats flew over to the darkest of rooms, each of them picking their own corner, and slept by hanging from the ceiling or inside the fireplace or behind the door, under the bed even.

And so they spent there the whole summer, until their babies grew up.

Winter arrived. The wind and the rain slipped into the house through the broken window.

"I am getting wet, I need to squeeze in with you", snarled the lesser horseshoe bat.

"This is so jammed, I am used to sleeping alone", said the great horseshoe bat.

"What are we going to do? Spring is still far away!", muttered the serotine bat.

"Let's go back to our cave", the flock screeched.

Back in the cave, something had changed.
A sign said "Bats! Come over!",
"Warning! Bats inside!" said another one.
"There is no door!", screeched the lesser horseshoe.
"There is a fence with railings", said the myotis.
"Look, I can fly through the railings", uttered the serotine bat.
"Let's go to bed!", they all said and went in.
But something had changed inside the cave too.
"Deep inside, it's still dark", screamed the lesser horseshoe bat.
So they settled there and tried to sleep. And all the crickets, the woodlice and the millipedes squeezed along under the bats, without which they were really starving.
"Some humans are looking after our cave", said the lesser horseshoe bat.
"If only they looked after our trees too...", complained the great horseshoe bat.
"...and our moths...", added the serotine bat.
"Shhh! We want to sleep!" they all cried out together.
And they slept happily ever after...



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A02 Stories with finger puppets

Students are making paper animals, they put them on their fingers and play their own story

Objective: A creative approach to nature

Group size: 5-30 students

Duration: 1 hour

Location: Indoors

When: Any season

Materials

- Worksheet (1 per 4-7 students)
- Scissors (1 per 3-5 students)
- Colored pencils or crayons
- Adhesive tape

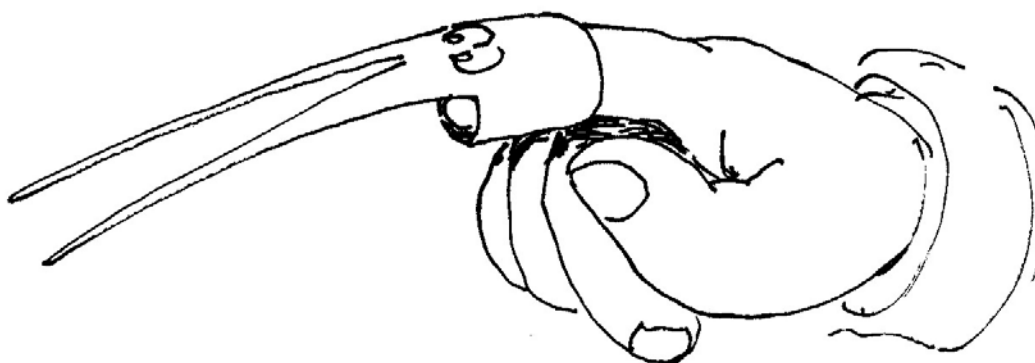
Introduction

Creating stories allows students to approach a certain theme through different angles (verbally and emotionally, consciously and unconsciously). A story can encourage discussion on nature, animals, humans and their interaction with the world.

An environment is not the same for everyone. Every animal that lives in a certain habitat prefers certain areas to hunt, certain secluded corners to sleep in and certain routes that they follow to go from their table to their bed. If we look at the same cave through the eyes of a bat and a cricket, we will see two different worlds.

Instructions

- Hand out copies of the Worksheet and instruct students to choose 1-2 finger puppets each (e.g. one for each hand). Let them color and cut out the puppets they have picked and help them stick them and fit them around their finger.
- Create a story as a team and use the animals of the finger puppets as the main



characters. You can start off and then each kid can take turns and add an episode to the story (e.g. describing what they - their finger puppet- are doing at this stage in the story).

- Alternatively: Imagine that the room is a cave. Each student can become the animal of their finger puppet and try to imagine what their life would be like inside this cave. As the students start using their imagination, you can make some questions to help them out (Which part of the cave do you live in? Do you stay at the same place or do you move around? What will you feed on here? Where will you sleep? Do you live alone? Who lives next to you?).
- The students take turns to describe the life they have imagined. The rest of the students are listening and commenting.

Discussion

- This cave is a good place for an animal to live in. Why?
- Where would most animals sleep? Where would they eat?

Sources

Kidspot > Discovery Centre > 4-6 years > Craft > All finger puppet templates, <http://www.kidspot.com.au/discoverycentre/Four-to-six-Craft-Finger-puppets+5385+534+article.htm>

Cornell, J. (1994). Ας Μοιραστούμε τη Φύση με τα Παιδιά. Εκδόσεις Παρατηρητής, Θεσσαλονίκη, σ.46.

Ροντάρι, Τ. (1985). Γραμματική της Φαντασίας. Εκδόσεις Τεκμήριο, Αθήνα.

Worksheet

A02. Finger puppets

A03 Make a paper bat

Each student shall make a paper bat using a clothespin

Objective: To familiarize themselves with the size and the shape of a bat.

Group size: 5-30 students

Duration: 0.5-1 hour

Location: Indoors

When: Any season

Materials

- Worksheet (1 per student)
- Scissors (1 per 3-5 students)
- Wood clothespins (1 per student)
- A magnet or adhesive tape (optional)

Introduction

Bats live everywhere but go unnoticed because they sleep during the day and hunt at night.

Bats have "hands" with very long fingers which are connected with a thin membrane of skin. They use them as wings.

Bats fly in the dark. They can't see but their hearing is very good and they often have large ears.

Instructions

- Hand out copies of the Worksheet. The students shall make paper cut outs and use the clothespin to put them together and form the shape of a bat.
- They can add a small magnet or adhesive tape at the back of the clothespin and use the cut out as a fridge magnet.

Discussion

- Is there a certain part in bats that is particularly large? Why?
- Imagine you are bats. What would you be doing right now? What will you be doing when it gets dark?

Sources

- Naturmuseum Solothurn, Fledermäuse, Unterlagen für Kindergarten und Schule, p.24, <http://www.naturmuseum-so.ch/index.html>

Worksheet

A03. Make a paper bat

A04 Do bats and humans have anything in common?

The students shall examine bat anatomy drawings to spot similarities with the human body

Objective: To familiarize themselves with the size and the shape of a bat

Group size: 5-30 students

Duration: 0,5-1 hour

Location: Indoors

When: Any season

Materials

- Worksheet (1 per student)
- Pencils (1 per student)

Introduction

Bats and humans have many similarities in their anatomy that reveal their relationship and prove there was a common ancestor (who lived hundreds of millions of years ago).

Just like all animals, they have eyes, ears and radial symmetry around a central axis (they have two mirror-image, right and left halves - although there are animals with different symmetries, such as the starfish).

Just like all vertebrates, they have an internal skeleton (their muscles are attached to their skeleton) with skull, vertebrae, a pelvis, four limbs, elbows, knees, fingers with nails, a tongue, teeth and a pair of eyes-ears-nostrils.

Just like all mammals, they have hair, belly buttons and mammary glands.

Instructions

- Hand out copies of the Worksheet. The students shall examine the image on the Worksheet and spot details which are similar in bats and humans.

Discussion

- How many fingers does a bat wing and a human hand have? What does this tell us?

Worksheet

A04. Do bats and humans have anything in common?

A05 Drive the bat inside its cave

Labyrinth with threats and challenges faced by bats

Objective: To learn about the threats and challenges faced by bats.

Group size: 5-30 students

Duration: 0,5-1 hour

Location: Indoors

When: Any season

Materials

■ Worksheet (1 per student)

■ Pencils (1 per student)

Introduction

Bats are rarely threatened by predators (there are only a few owls and hawks that can catch bats). There are mostly threatened by human activity.

By using so many pesticides on crops, we are reducing the population of insects which are the food for bats. At the same time, we are slowly poisoning them (one bat can accumulate significant amounts of pesticide residues if they feed on a lot of insects who have been poisoned with chemicals).

By clearing natural vegetation, we are reducing the insects that live in plants and exterminate old hollow-bearing trees.

By building many wind parks, we are killing the bats who hunt around the turbines (bats avoid the blades, but they cannot withstand the sudden change of pressure of the air when a blades spins near them).

By placing lights in the caves, we are disturbing the bats who spend the winter or raise their young in them.

Instructions

- Hand out copies of the Worksheet. The students shall drive the bat through the labyrinth all the way to the cave, by avoiding treats.

Discussion

- Does a bat face many threats during its life? Are these threats enough to kill them or do they make them starve?
- Do most threats have to do with bad weather, wild animals or humans?

Worksheet

A05. Drive the bat inside its cave

A06 Bats and moths

A blindfolded student shall be a bat which screams "Where?" and tries to catch other kids who are the moths and answer back "Here".

Objective: To familiarize themselves with the bat's hunting methods.

Materials

- Two handkerchiefs

Group size: 6 students

Duration: 0,5 hour

Location: Indoors

When: Any season

Introduction

In Greece, there are 36 bat species that go unnoticed, apart from the ones that hunt at dusk or under street lights.

All bats in Europe feed on insects. They have small eyes and big ears, because they use their hearing to hunt in the dark: they produce very high-pitched sounds (ultrasound, at frequencies above human hearing) and listen to the echo bouncing off of objects or insects. The closer the bat to the insect, the more frequent the calls they produce (up to 200 per second) to get a clearer "picture". Some moth species listen to the sounds of the bats and hide in vegetation, while others (such as the species from the Arctiinae family, which taste really bad) avoid getting caught by producing "click" sounds which allow bats to recognize them.

Instructions

- The team forms a large circle in a room without any obstacles.
- Two blindfolded students shall be the bats and four blindfolded students shall be the moths. The bats yell "BAT" as many times as they want and immediately after, the moths respond with "MOTH". The bats try to locate the moths with their hearing and touch them. If a moth gets caught, they must exit the circle.
- Play the game again and make sure that all students have been both bats and moths.

Discussion

- How do we use our senses to find our food?

Sources

Several websites, e.g.

http://lnr.cambridge.gov.uk/uploads/bat_and_moth_game.pdf

<http://www.batconservation.org/drupal/game-bat-moth>

A07 Make a map with sounds

Each kid shall put marks on the paper for each sound they hear

Objective: To familiarize themselves with natural sounds. To understand the variety of sounds in nature.

Group size: 5-10 students

Duration: 1 hour

Location: Outdoors

When: Any season

Materials

- 10 x 15 cm cardboard cards (1 per student)
- Pencils (1 per student)

Introduction

Apart from what we see in nature, there also are things we hear: leaves rustle, tree trunks creak, streams burble, the wind whistles...

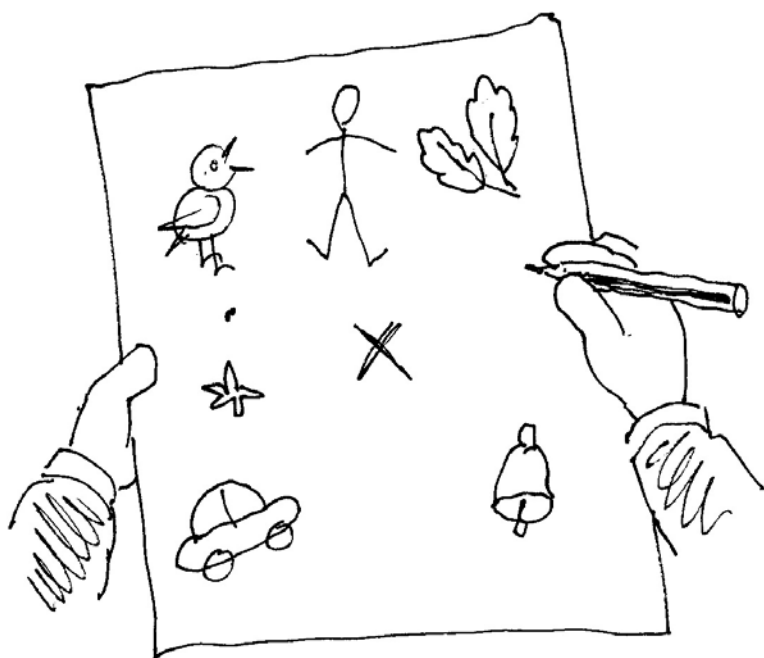
When we close our eyes and open our ears, we are better able to discern the sounds of wild animals behind those of humans. We will be able to listen to the chirps of male birds in the spring, the flicker of birds and butterflies, the chorus of cicadas or the clicking of grasshoppers, the night cry of owls and frogs, perhaps even the sound of baby creatures as they welcome their parents bringing food to their nest.

Scientists who study birds are often carefully listening to these sounds and take notes on a rough map. This way, they can estimate, for example, how many pairs of blackbirds are nesting inside the woods, without having to locate each nest.

If we listen carefully with our eyes closed, we are paying more attention to sounds. And if we place our palms behind our ears, half-closed as if they're cups, we will be able to better listen to remote, faraway sounds.

Instructions

- Hand out one card to each student. Each card shall have an "X" marked in its center. This is a map, and X indicates the location of the student. When they hear something, they must place a new mark on the card: a drawing, a cross, a doodle, a line, a musical note etc. The mark shall show the direction and the distance of the sound which was heard in relation to X.
- Ask them to sit down on the ground and listen with their eyes closed. Show them how they can improve their hearing by half-closing and



placing their palms behind their ears (if they place them in front of their ears and facing backwards, they will be able to listen to sounds coming from the back without having to turn around).

- Choose an area with a diversity of sounds (e.g. away from the traffic) and give them 1-2 minutes to choose their position. Let them record the sounds for 5-10 minutes, then whistle or imitate a natural sound to call their attention.
- When they gather back, ask them to share the map they made with the rest of the team.
- **Expansion:** Choose two different locations: a quiet forest and a buzzing street. Ask each student to make one map for each location. Then, ask them where they felt better. This is an opportunity to have a discussion around noise pollution.

Discussion

- How many different sounds did you listen to?
- Which of the sounds did you enjoy better?
- Which of the sounds did you hear for the first time?

Sources

- Sharing Nature Worldwide, Nature Activities > Focus Attention > Sound Map, <http://www.sharingnature.com/nature-activities/focus-attention.php>
- Cornell, J. (1994). Ας Μοιραστούμε τη Φύση με τα Παιδιά. Εκδόσεις Παρατηρητής, Θεσσαλονίκη, σ.42.
- Λιζάκ, Φ. & Περτιζέ, Ζ.-Κ. (2005). Δραστηριότητες για να Ανακαλύψω τη Φύση. Εκδόσεις Μεταίχμιο, Αθήνα, σ.24.

Activities for children aged 9-12 (Grades 4-6)



B02 Become a bat

Each student shall play a certain bat species by wearing the respective mask and by trying to imagine what its life is like

Objective: Be creative. Focus on the environment.

Group size: 5-30 students

Duration: 0.5-1 hour

Location: Outdoors

When: Any season

Materials:

- Worksheet (1 per student)
- Scissors (1 per student)
- Rubber bands (2 -4 per student)
- Stapler (1)

Introduction

An environment is not the same for everyone. Each of us follows certain routes to get where we want. Animals normally follow the same routes which connect the places they prefer to rest in, find their food and raise their young.

If we look at the same environment through the eyes of two different creatures, we will see two different worlds. It's like traveling by staying still.

Instructions

- Hand out one Worksheet to each student and help them make a bat mask.
- You can start a discussion about what these creatures are expecting from the habitat they live in (food, a shelter to sleep in, a warm shelter to spend the winter).
- Find an area with vegetation and choose a place with a view.
- Each student can become the animal represented by the mask they have picked and try to imagine what their life would be like in this environment.
- As students start using their imagination, you can make some questions to help them out (Where exactly do you live in this environment? Do you stay in the same place or do you move around? What will you be eating around here? Where will you sleep? Do you live alone? Who are your neighbors?).
- The students take turns to describe the life they have imagined. The rest of the students are listening and commenting.

Discussion

- Is this a good environment for an animal or a plant to live in? Why?
- Where would most animals sleep? Where would they eat?

Sources

Λιζάκ, Φ. & Περτιζέ, Ζ.-Κ. (2005). Δραστηριότητες για να Ανακαλύψω τη Φύση. Εκδόσεις Μεταίχμιο, Αθήνα, σ.46.

Worksheet

B02(A)-B02(D). Become a bat



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B04 Survive winter like a bat

Team-based game with students-bats who must find a roost for sleeping and a cave to spend the winter

Objective: To understand that bats need different environments to survive. To realize that by altering the environment, we impact the lives of the animals who inhabit them.

Group size: 15-30 students

Duration: 1 hour

Location: Outdoors or indoors

When: Any season

Materials:

- Floor signs (e.g. sheets of paper or cardboard, 2 per 3 students)
- Paper and pencil

Introduction

Each animal species needs food and shelter. Bats find their food (insects) in hunting grounds with natural vegetation, but when they don't hunt, they need shelters (caves, porticoes or old buildings) to rest in or go into hibernation during the winter when they can't find insects.

Two times a year, bats are traveling from their hunting ground to a shelter to spend the winter. And every day, they move between their hunting ground and a nearby roost to sleep.

To build or farm their land, humans are clearing wild greens and destroy barren rocks, this way making significant hunting grounds or bat shelters useless.

When a hunting ground or a shelter disappears, the bats that used to live there must search for a different place. And if there is no such suitable place within a short distance, they die.

Instructions

- Select a roughly 20 meter long space. Place marks at the sides of the space and split them in two groups: hunting grounds one side and shelters to spend the winter on the other side.
- The kids can play the bats by stepping on a hunting ground (in the summer) or a winter shelter. Each hunting ground or shelter shall fit three bats only. Each bat who cannot find space to step into the hunting ground or shelter "dies" and leaves the game.
- Explain that bats rely not only on hunting grounds, for their food, but also on shelters to spend the winter. Each hunting ground and shelter fits a specific number of bats (only three for the purposes of this game) and the bats that stay out, they die.
- Start playing the game with all bats inside the hunting grounds. When you announce that winter is coming, all bats must jump to the shelters. This is a good year and none of the bats dies.
- Remove one hunting ground by saying that humans destroyed it. Then, tell them that spring arrived. The three students that will not be able to find a hunting ground to step into, "die" and step out. They can re-enter the game next winter, as young bats.
- If you wish, you can draw a simple chart to record how many bats there are at the beginning of each season. This way, you will be able to see the population of bats going

up and down, something which is normal for all animal species.

- Take out one shelter by saying that humans destroyed it (for example by demolishing an old building or by installing lights inside a cave). Then, remove, e.g. four hunting grounds by saying that they were destroyed because humans cleared vegetation or exterminated the food of the bats with insecticides.
- As more kids step out of the game, you can give them the chance to re-enter. Add new hunting grounds (e.g. forests and bushes that grow back after a fire) and shelters (e.g. shelters that were re-built by environmental organizations).
- Repeat the change of seasons about 10 times. Offer changes that reduce the bats, but also changes that help them increase.

Discussion

- Do bats become fewer due to human activity or are there natural causes as well?
- Do bats become fewer suddenly or gradually?
- Are there more ways to hurt animals other than killing them?

Sources

- Ducks Unlimited's Teacher's Guide to Wetland Activities, p.20,
- <https://www.hanovercounty.gov/DocumentCenter/View/3801/Wetlands-Teachers-Guidepd>

Worksheet

-

B10 Cave board game

Snakes-type game with three pawns (bat, cricket, human) which shows how different actions can be both beneficial and harmful at the same

Objective: To understand how each change in the cave impacts each species differently. To realize that some activities bring profit but cause damages.

Group size: 3-6 students per game

Duration: 1 hour

Location: Indoors

When: Any season

Materials:

- Printed board game (1 for each group)
- Coins or other small objects to be used as pawns
- Dice (1 for each group)
- Markers or crayons (optional)

Introduction

Caves are shelters for unique cave-dwelling creatures, such as different bat species and a diversity of invertebrates.

The 36 bat species that exist in Greece hunt during the night in different environments (forests, bushes, meadows, fields, wetlands etc.) but also need caves, porticoes, abandoned buildings or tree cracks to sleep during the day, raise their young and spend the winter.

A diversity of cave-dwelling invertebrates (crickets, beetles, spiders, isopods, millipedes, centipedes, snails etc.) live near bat colonies to feed on guano (bat manure) or one another.

Life is tough for these little creatures which are affected by climate changes (droughts, climate change) but mainly by human activity. The clearance of vegetation of hedgerows (natural fences of bushes and trees) destroy the hunting grounds of the bats and other predators that feed on insects and rodents. Frequent human presence in caves and old mines disturbs the bats that rest there.

The board game imitates real life (based on rules and chance), but of course it's much simpler.

Instructions

- The students play the board game in groups of 3-6 (Worksheet) by using a die and ready-made or self-made pawns (coins, rubbers, etc.).

Discussion

- Can we change the way we live?
- What can we change in our daily habits to help the wild animals that live near us?

Worksheets

B10(a), B10(b). Cave board game

Activities for children aged 12-15 (Grades 1-3)



Life
GRECABAT

LIFE GRECABAT
(LIFE17 NAT/GR/000522)



C02 Compare two bat habitats

Εξετάζουν στο Google Earth δύο γειτονικά τους τοπία, από τη σκοπιά των νυχτερίδων

Objective: To compare different habitats and explain their differences.

Group size: 5-30 students

Duration: 1 ώρα

Location: Indoors, but with one field trip for each habitat

When: Any season

Materials:

- Computer with Internet access
- Camera (e.g. smartphone)

Introduction

With satellite images, scientists record and monitor different environments: they map forests and rivers (Forest Protection Service), they record burned land (Fire Service), they record illegal buildings or zones prone to floods (Ministry of Environment), they match property and land to their owners (Land Registry), they locate areas which are extensively used by visitors (management studies), they monitor weather phenomena (e.g. clouds-snowcover-wave, Meteorological Service). With the use of satellite images which capture the visible and infrared light, they are able to locate archaeological finds or assess humidity levels in agricultural fields.

Even Google Earth satellite images (which capture visible light only) offer a range of possibilities which we would otherwise not be available to us through field visits. With these, we can search for, compare, map and even show our favorite place to a friend, remotely.

Method

- **Install the free version of Google Earth Pro on dekstop** (<https://www.google.com/earth/desktop/>).
- **We select a small piece of land in our area**, in a location we can easily find and visit. It may be a piece of forest land, farmland, a valley, a river bank, a village etc.
- **We create a polygon on the selected piece of land**, e.g. by placing four marks that form a roughly rectangular shape (click on "Add Polygon", select a name, the color of the line and 0% area opacity to make the image



transparent). Each polygon is temporarily saved in the "Temporary Places" section but we can also save it permanently in the "My Places" section by giving the name we have chosen (e.g. "Slope 1", "Mesochori-Crops", "Pineforest", "Oakforest-1"), then export it as a kml or kmz file and send it by e-mail or transfer it to other devices (by doing so, we shall only save or send the outlines we have drawn and not the entire satellite image within these outlines).

- Then, we zoom in until the polygon takes over our screen and we **save the image as a jpg file** (click on "Save Image") to ensure that our polygon is also available offline (and print it whenever we like).
- We can **repeat the process with a different piece of land in our area**. Make sure that both polygons are of similar size (go to "Status Bar" at the bottom right and make sure elevation is the same - if the status bar is not shown, you can set it from the "View" menu), but not exactly the same (for example, you can select traditional crops with hedgerows and modern crops, farmed and abandoned fields, southern and northern mountain slopes, forests with gaps and without gaps, straightened and natural riverbeds).
- **If possible, visit and take photographs of the areas we selected**. Take notes of anything that impresses you and may help you understand the environment (e.g. if it's a valley or a slope, if there is surface water, the type of vegetation in the area, human activity, if any).
- **Observe Google Earth images (and our photos) carefully**. How many bat species do we think that they can live in each of these two areas? Is there a suitable habitat for the bat species that need dense forests, forests with clearings, bushes, meadows or fields with a few trees/bushes, creeks or lakes? Is there a suitable shelter for the bat species that need caves (look for rocks in the image), old, hollow-bearing trees (we look for trees with high foliage diameter), old buildings, bridges? Could it be that one of these areas is more suitable than the other? Why?
- Alternatively: Select **a place in your area and a different place faraway** or even at a nearby country.



- Alternatively: After selecting the two polygons, **trace the main elements in the area (crops, streets, buildings, trees, creeks, lakes etc.) with paper and pencil**, by making sure that the two ends of each line are connected in order to form closed shapes - like mosaic tiles. Then, color the tiles with different colors (not necessarily realistic) to create two different multicolor landscapes, like a puzzle. What are the differences between the two drawings? Are there differences in the size or the shape of the tiles? Or in the grouping of the tiles? Or in something else?

Discussion

- Is the environment which is "better" for the bats also "better" for humans? Why?
- How can we manage a habitat to make sure it's "good" for both humans and bats?

Sources

Google Earth Pro (<https://www.google.com/earth/desktop/>)

C04 How will you manage a cave?

Role play for managing a cave

Objective: To understand that caves meet the needs of many different species (including humans) To understand that humans can impact the environment of a cave both negatively and positively. To realize that environmental protection does not necessarily suppress human needs. To make hypotheses.

Group size: 15-30 students

Duration: 2 hours

Location: Indoors

When: Any season

Materials:

- Colored pencils or markers
- Large sheets of cheap paper
- Worksheet

Introduction

Environmental management is not necessarily associated with secluded and inaccessible areas. Often, we have to decide how to manage a small-scale creek or a slope with bushes near our house. We need to compromise some of our own convenience to make sure that the natural environment in our area is preserved in good condition. How can we achieve a balance between minimum compromise and maximum preservation?

Every time we need to build a new project in our area, we need to answer the following question: "Where are we going to construct it?". We need to follow a specific order of steps, the same steps taken by scientists and local authorities in similar, real-life situations:

First, we must assess the level of necessity for the project: What needs is it going to meet? How imperative are these needs? Are there alternative solutions?

We must assess the area's environmental value: Does it contain habitats, plants or animals which are threatened or protected in Greece or the European Union? Does it have habitats of special beauty or cultural value? Does it contain elements of ecological and touristic value (for example hiking paths, viewpoints, natural attractions)?

Then, we must examine the potential alternative solutions for the project. Is there any suitable land for construction (e.g. smooth slopes)? Is there access (for example, a road nearby)? How close will it be to its users? Will one large project suffice or is it possible to have two smaller constructions?

Finally, we must collect all available data and discuss all solutions.

In fact, however, this ideal scenario is not always applicable. Very often, a certain group of people impose their own opinion, because they were the first to make their proposal or because they were more persuasive. This means that some areas do not get the form of development that deserves them. However, it is still possible to introduce changes, if we use proper argumentation.

Instructions

- Imagine that near your school, there is a small cave inhabited by 5 protected bat species and 5 cave-dwelling invertebrate species, out of which one species exists in this cave only.
- The City Council has decided to open the cave for visitors. To this end, they must make the opening of the cave larger (and place a door), build a concrete path inside the cave and install lighting.
- Hand out the Worksheet and let the students read it individually. Give them 10 minutes to come up with possible solutions on where exactly the construction can be built.
- Ask the students to share their proposals. Write them down on a large piece of paper on the wall and then take it off and keep it aside.
- Split students in small groups and let each group pick the management team that they will be representing. You can see some suggestions below, but students can make their own research in the field they have selected.
- A group of residents (restaurant owners, taxi drivers) want the project because they believe that it will attract visitors and increase their income.
- Another group of residents wants to keep the cave as is, in its natural state, because it is inhabited by a native invertebrate species (which will be permanently extinct should the cave change). Moreover, they do not want to reduce the population of bats because they prey on mosquitoes and moths across the whole area.
- The archaeologists of the Archaeological Authority want to examine the cave for archaeological findings before issuing any license for construction. Due to staff shortages, it may be months or even years before this can take place.
- The scientists from the Environmental Authority do not approve the construction of this project in an area with protected animal species.
- The contractor and the construction company employees want this project and they want to have it constructed near the road in order to reduce construction costs.
- The class is re-organized and each group presents their arguments and proposes different alternatives.
- Compare their proposals with the proposals made at the beginning of the activity.



- Let the students make wrong choices and show them what their mistakes are at the end of the activity to help them understand the problems coming up in each scenario.

Discussion

- What type of additional data would you need to prepare more complete proposals? (for example, topography, climate, vegetation, land uses, wild life, available budget, historical data, legislation, existing development and protection zones)
- Where could you get these data from?
- Is it possible to make up for the damage caused to the natural environment with something else, for example by protecting a different cave or by improving the bats' hunting ground?

Sources

- Branching Out: The North Carolina forest stewardship activity guide, p.43,
- <http://www.fs.fed.us/outdoors/naturewatch/implementation/Curricula/Forest-Steward-Activity-Guide.PDF>
- Wetlands: Webbed Feet Not Required, Teacher's Guide, Ducks Unlimited Canada, p.73,
- http://www.environment.gov.ab.ca/edu/pubs/6278_Wetlands_Teacher_Guide.pdf
- US Forest Service, Investigate your environment: Land use simulation, p.3-8, <http://www.fs.fed.us/outdoors/nrce/iye/extend/chland.pdf>

Worksheet

C04. How will you manage a cave?

How can we learn more?

For the LIFE GRECABAT project and the bats,
you can visit the project's website:
<https://www.lifegrecabat.eu/>



the project's facebook page:
<https://www.facebook.com/LIFEGRECABAT/>



For cave-dwelling animals in each cave in Greece,
visit the free-access database
(<https://database.inspee.gr/>), which has been
developed by the Hellenic Institute
of Speleological Research.

