LEARNING ABOUT FORESTS

FOREST ACTION FOR CLIMATE CHANGE MITIGATION

AN INITIATIVE FOR ENVIRONMENTAL EDUCATION

Educational Activities

Biodiversity • Energy

Fires • CO_2

Μαθαίνω για τα Δάση,
για την Κλιματική Αλλαγή Αναλαμβάνω Δράση

Дейности В Гората
За Ограничаване На Климатичните Промени

Acțiune În Pădure
Pentru Reducerea Schimbărilor Climatice

HSPN • BBFM • CCDG • CYMEPA

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Forest Action for Climate Change Mitigation - Educational Activities

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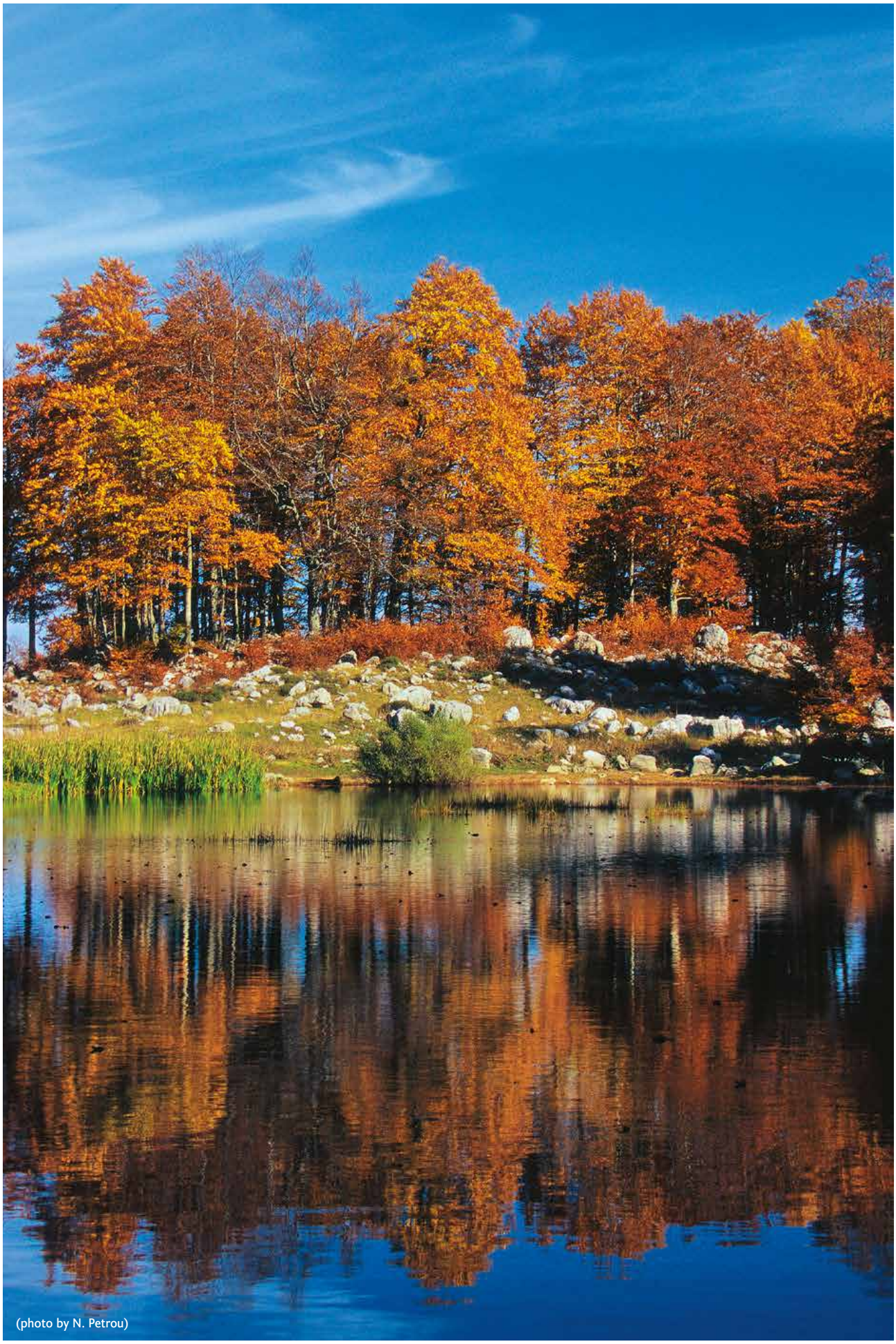
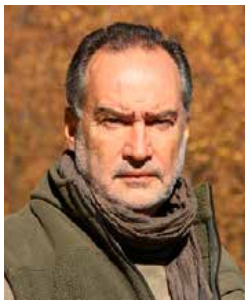


(photo by N. Petrou)



The **Hellenic Society for the Protection of Nature** (HSPN) is the oldest environmental NGO in Greece, founded in 1951, at a time when the necessity for nature conservation was inconceivable to most, and the international environmental movement was taking its first hesitant steps. Since then it has operated continuously, throughout the country, for the preservation of our precious natural heritage. Today the HSPN is active in five main areas: environmental intervention; conservation and nature protection; environmental education; sustainable management in the tourism section; and public awareness raising.

HSPN is also the oldest member of the **Foundation for Environmental Education** (FEE), in southeastern Europe, and operates all five of FEE's international Programmes, starting in 1992. Implementation of **Learning About Forests** (LEAF) started in 2001.

Education of the public, especially of the younger generations, has been an integral part of our mandate and activities since the founding of HSPN, long before the term "Environmental Education" was even officially established. Moreover, the conservation of flora has been among the main interests and priorities of our Society, with particular emphasis on forest ecosystems, and rare and endemic plants.

At HSPN, we strongly believe that one of FFE's greatest strengths is its extensive family of experienced national operators and its even more extensive family of dedicated educators and teachers involved in its Programmes. We also firmly believe in cooperation and sharing of resources, especially at the regional level, where our NGOs are affected by similar circumstances and face similar challenges.

In this context, we had been thinking for a long time about an educational project that would involve neighbouring national operators in a common goal. When the opportunity arose, through our cooperation with **Tetra Pak**, an international company that has a strong commitment to environmental values, we decided to design a project involving the LEAF operators in Cyprus, Bulgaria and Romania. When thinking about a subject, we decided to address climate change, one of the biggest issues of our times, and its various impacts on forests.

Thus was born **Forest Action for Climate Change Mitigation**, a project that will be implemented in all four countries under the coordination of HSPN. A project that would not have been possible without the generous support of **Tetra Pak Hellas S.A.**

Nikos Petrou

President of the Board of Directors
of the Hellenic Society for the Protection of Nature

A lesson in what can be achieved when countries work together to address shared environmental issues, the Forest Action for Climate Change Mitigation (FACCM) project has impacted on students from the Carpathian Mountains to the foothills of Mount Olympus.

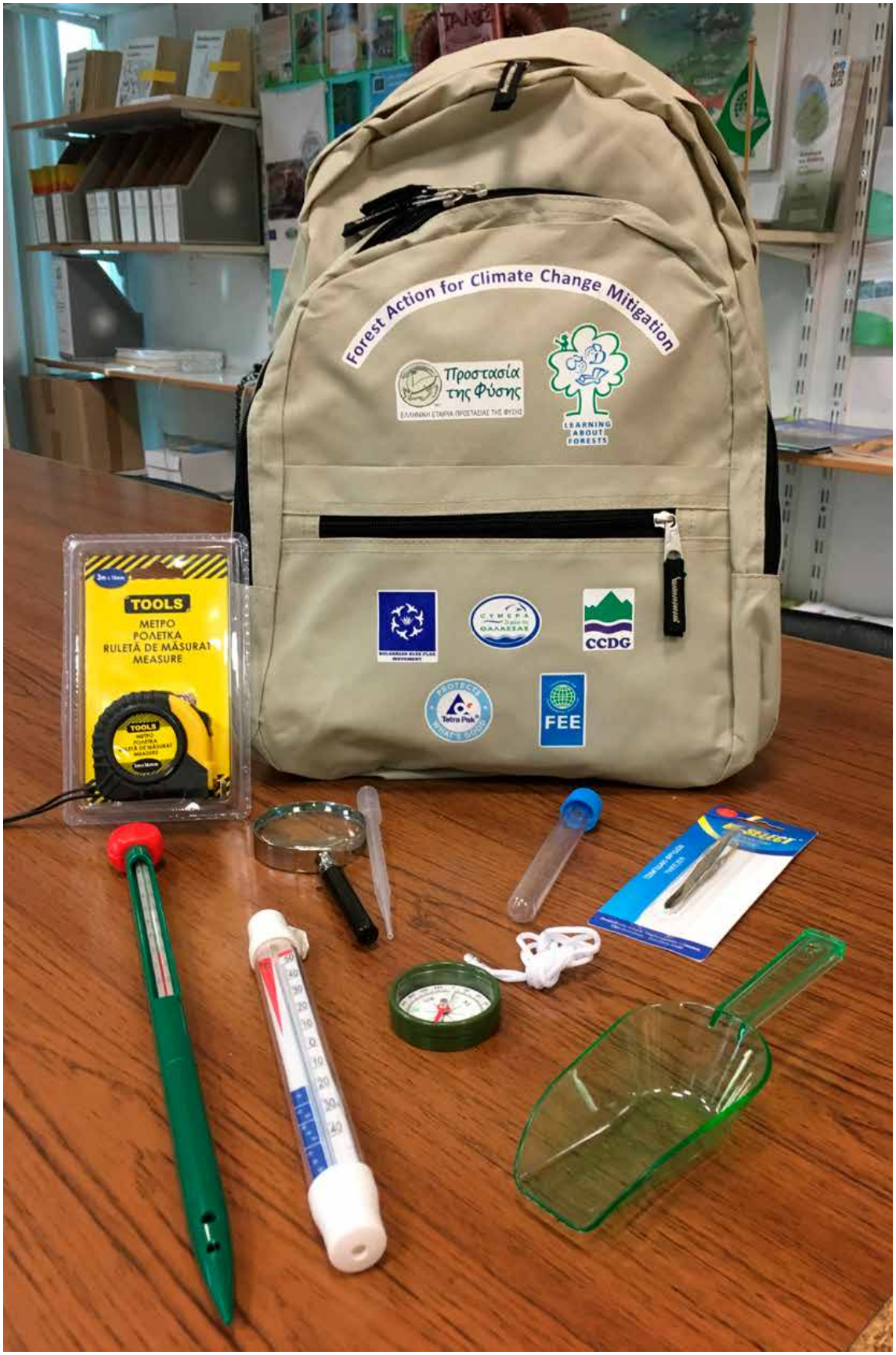
United by the Hellenic Society for the Protection of Nature (HSPN), schoolchildren in Greece, Cyprus, Bulgaria and Romania have been brought together through the Learning About For¬ests (LEAF) Programme to learn more about their shared climate and investigate the issues which affect their countries to an ever intensifying degree.

Four principle themes have defined this project and engage students on some of the most pressing forest-related issues of our age. Participants have learned about the role trees play in supporting Biodiversity, providing a source of renewable Energy, their increasing suscepti¬bility to Fires as well as their ability to heal the damage they cause and ultimately the role trees can play in Climate Change by tackling atmospheric CO_2.

By gamifying the study of climate change, the FACCM project actively addresses the problem of changing climate through fun and engaging activities, which educate participants on these forest-related climatic issues. This approach not only teaches the students about the issue of climate change, but, in keeping with the LEAF ethos, it does so in an exciting, hands-on manner which the participants can enjoy and remember.

The success of the FACCM project is measurable not solely in the numbers of students taking part and their increased knowledge: the true achievement lies in equipping the participants with the understanding of what they can do to live sustain¬ably, protect their environment and above all else enjoy the natural world around them.

Barry McGonigal
International LEarning About Forests Director


Forest Action for Climate Change Mitigation
Προστασία της Φύσης
LEARNING ABOUT FORESTS
TOOLS
ΜΕΤΡΟ
ΡΟΛΕΤΚΑ
RULETĂ DE MĂSURAT
MEASURE
CCDG
FEE

Forest Energy and Climate Change

CCDG • Romania

EDUCATIONAL ACTIVITY TITLE

A.1 Forest climatic influence

THEME: **Forests and Energy/Climate Change**

Country: **Romania**
Writers: **Arion Alina**, **Roșca Irina**

Brief description of the activity: The students will observe, measure, compare the climatic characteristics in the school neighbourhood, the concrete playground, and the school park, and finally identify the connections between forest and climatic parameters (air temperature, thickness of snow layer, soil humidity). The activity will teach them that the more trees are in the schoolyard, the fresher and healthier the air is.

Goals and objectives: Experiential educational approach, outdoor education, interdisciplinary approach.

Detailed description

Learning intentions: Students will understand the connection between forest and climatic parameters (air temperature, thickness of snow cover, soil humidity) and the importance of forests for climate change mitigation.

Students understand that everyone can plant a tree and help fight climate change.

Success criteria: Students can:

- grasp the differences between the values measured and registered in two locations: the school playground (a concrete area) and the small forest in the school park;
- identify the reasons why they might want to save trees and increase their number where they live, play and learn;
- understand they can help the community forest grow;
- record and draw observations;
- create a short story;
- take action.

Materials: thermometers, paper, colored pencils ,rulers , pens

Time: one day per month (October, December, February, April, June)

Teaching sequences:

1. **Introduction to benefits of trees and to climatic influence of trees** (outdoor activity) – 45 minutes

Students share their thoughts on the following questions: e.g. What exactly is a tree? How many parts does a tree have? How do they grow? What do trees need to grow? Why must we plant trees? Can you imagine life without trees?

Students are led to the conclusion that trees are living creatures and provide many benefits to us, every day. (e.g. as trees grow, they are able to mitigate climate change by removing carbon dioxide from the air and releasing oxygen into the atmosphere. They offer cooling shade, block cold winter winds, attract birds and wildlife, purify our air,

prevent soil erosion, clean our water and add grace and beauty to our homes, gardens, parks, schoolyards and other communities.)

2. **Preparations for the outdoor activity**: get in touch with the instruments and materials the students will use later (thermometers to measure the air temperature, rulers to measure the thickness of the snow cover, paper, coloured pencils for the graphics) (15 min)

3. **Outdoor activity:** measurements, direct observation, taking notes and registering the values measured (according to a previous schedule, already mentioned).

4. **Indoor activity**: drawing graphics, comparing them.

The students will periodically showcase the graphics as the result of their research that will lead to a conclusion: they will finally have felt better in the forest than on a concrete area; trees can live without people, but people can't live without trees. That means people must protect and preserve forests in order to be alive and the students will be aware of the fact that they must plant more trees in the school park or replace the dried trees with living ones. Additionally, planting the right trees in the right places (eg. Conifer trees planted near our home will help block winter winds and reduce heating costs) conserves energy and reduces the energy bills, while helping to fight climate change.

5. **Plant trees** for the small forest in the school park (outdoor activity) – 40 minutes – in March/ April

6. **Forest tales** (indoor activity) – 40 minutes (see page 46)

7. **Evaluation** (indoor activity) – 20 minutes

8. **Homework**: Take action! (outdoor activity)

Be Green! Plant a tree with your family and friends in your own garden/yard!

Planting trees in your city's urban areas is a winning investment for the city, its citizens and the environment. Urban areas without trees can become "heat islands" with significantly higher temperatures than other commercial and residential areas with trees. Adding more trees to your city streets, parks, schools and downtown areas will help keep communities cooler, reducing energy needs.

EDUCATIONAL ACTIVITY TITLE

A.2 The Forest - Nature's Powerhouse

THEME: **Forest and Energy**

Country: **Romania**
Writers: **Țogoe Petra** and **Păgilă Camelia**

Brief description of the activity: The activity itself is going to be held in the inside yard of our school: on one hand because it is more easily to control fires lit for the experiment and on the other hand because we want to protect the forest against undesired fires.

Firstly, the activity consists of determining the effect of different species of wood on heat output when burned. 5 fires will be lit at the same time. The temperature of water will be measured by the pupils in charge after 3 minutes, 6 minutes and then again after another 3. The recorded data will establish the relation between the type of wood burned and the temperature of the water.

Secondly, this experiment determines the effect of different species of wood on burning time. After recording the temperature of water, pupils in charge are asked to measure how long it takes before the entire quantity of wood is burned.

The experiment will prove that each type of wood has a certain caloric power and people use it according to this property for heating and for other wood products.

In order to dry them up before being used in the activity described below, a trip to the forest to gather pieces of wood is planned. The wood collected will be of different types: acacia, maple, oak (in our case). The pieces of fir-tree and pine spruce will have been collected beforehand from the Christmas trees.

Goals and objectives: Raising awareness of the forest role as a major renewable energy source.

Objectives:

- To demonstrate that wood is a source of energy ;
- To register data ;
- To prove that different types of wood provide different amounts of caloric energy ;
- To draw the conclusion that each type of wood could be used with maximum efficiency for different applications (fuels, building materials, paper, furniture, boats, musical instruments);
- To give valuable information about efficient choice of different types of burning wood in order to lead to a sustainable usage of the forest power source

Materials:

- pieces of wood from acacia, maple, oak, fir-tree, pine spruce, cut to the same size
- scales
- camping saw (if necessary)
- lighters
- stopwatches
- thermometers
- shear legs
- water
- water dish with handles
- pitcher to measure water;

Target group: 6th graders

Time: 100 min

Detailed description

1. **Activity organization**
   - The class is divided in 6 groups of 6
   - Each group is assigned a role: group 1 – the reporters; group 2 – experiment with acacia wood; group 3 – experiment with maple wood; group 4 – experiment with oak wood; group 5 – experiment with pine spruce; group 6 – experiment with fir-tree wood
   - Each group from 2-6 has previously collected the type of wood necessary for this experiment
   - Each student of group 1 has got cameras in order to film the activity of each one of the other groups
   - Carrying the activity on the school premises – the patio, the open space enclosure in the middle of the school

2. **Announcing the goal** of the experiment

   The experiment consists in using different types of wood to heat the same amount of water in order to establish which wood type gives the most thermal energy as well as noticing which wood type burns the longest.

   The teacher instructs the children in order to avoid incidents as following:

   - No pushing or playing around during the experiments.
   - No playing with lighters/matches.
   - Attention to the wind direction when the fire is lit in order to avoid lighting up something else nearby.
   - Do not leave the fire unattended.
   - Careful manipulation of hot water.
   - Careful manipulation of thermometers.
   - When the experiments are completed, pay attention to totally extinguishing the fire.

3. **Organizing the groups**:

   A jar with labels is already prepared. Students pick a label and join the appropriate group: Acacia, Oak, Maple, Fir-tree, Pine Spruce. The group of “Reporters” has been already chosen because they have to be prepared with cameras and have the skills to use them appropriately. Moreover, the reporters’ tasks have already begun because the beginning of the activity is filmed by one of them. Each of the 5 reporters will be in charge with one of the groups, recording their activities. In the end the reporters will have filmed the experiment itself, and each experiment results. Reporter 6 is in charge with filming the beginning of the activity and the final report of each group.

   Within the other groups students are assigned roles as:

   - “*Fire person*” is the child in charge with the wood, arranging it in the form of a tepee and of checking it during the burning process.
   - “*Heat person*” is the child in charge with measuring the temperature of water at the times given.
   - “*Timekeeper*” is the student in charge with the stopwatch in order to announce when to measure the temperature of water.
   - “*Recorder*” is the student in charge with writing down the results of the experiment.
   - “*Spokesperson*” reports orally to the class /instructor, summarizing the group’s activities and/or conclusions.
   - “Safety checker” keeps an eye on the manipulation of fire and hot water in order to avoid incidents.

     The distribution of the roles can be also made by drawing labels from a hat already prepared.

4. **Process**

- **Presentation**

  The instructor begins as following:

  All the energy mankind uses comes from the environment. What about the electricity we use every day? Does it come directly from the nature? Of course, it doesn't.

  Humankind produces electricity using the earth's resources, like coal or natural gas. Both coal and natural gas are called "fossil fuels" because they were formed deep under the earth's surface during dinosaur times. The major problem is that fossil fuels can't be replaced - once we use them all, they are gone forever. Another issue is that burning fossil fuels causes pollution, which contributes to climate change.

  What should people do under these circumstances? They should think about new solutions of producing energy in such a way that will not affect the climate and that will be applicable for the future generations.

  Renewable energy is the name for the energy which is realised from resources that nature will renew, like wind, water, and sunshine.

  Renewable energy is also called "clean energy" or "green power" because it doesn't pollute the air or the water. In the same category we can place bio energy. This type of energy is derived from biological materials such as wood, agricultural crops and wastes. If sustainably managed, bio energy derived from plants can be considered renewable because new trees or plants can replace the ones used to produce energy. Moreover, this type of energy has great benefits in terms of climate change mitigation as it is based on the balance between CO_2 captured during plant growth and CO_2 released when producing, processing, transporting and burning the bio fuel. Besides being renewable, bio energy also generates less greenhouse gases and it is more energy efficient,.

  Have you ever sat by a campfire or fireplace? If so, you've seen biomass energy in action!

  Biomass means "natural material." When biomass energy is burned, it releases heat, just like the wood logs in your campfire. But the question is: does different type of wood burn the same? Does it produce the same amount of heat?

- **Practice**

  The aim of our experiment is to determine which type of wood heats the same amount of water at a higher temperature and which type of wood takes longer to burn?

  The five groups assigned have 5 different types of dry wood: acacia, maple, oak, fir tree and pine spruce. Firstly, you use the scales to weigh a quantity of 500 grams of wood each. You are not allowed to use more wood during the experiment. You will arrange the sticks in a teepee form in order to set the fire. Each of you has got shear legs to put on the fire to heat 300 ml of water in the dish provided. Each group has a stopwatch and a thermometer. After you lit the fire you will place the shear legs right on top of it and place the water dish on. Start the stopwatch and you will measure the temperature of water after 3 minutes and write it down. You will do the same operation after other 3 minutes and finally after 9 minutes. Then you will measure the entire time your type of wood burns.

  Meanwhile the reporters film the entire process in progress for each group.

- **Follow up**

  At the end of the experiments the groups' spokespeople present their observations and measurements. The "reporter" in charge with the beginning of the activity records their 1-2 minutes' presentations.

5. **Conclusions**:

  The teacher will conclude:

  Wood is the substance used for heating and cooking from the beginning of mankind. Wood is the product of trees. Once trees are cut down they either go to a mill to be made into lumber or are made into firewood to be sold to consumers. It is also possible

for people to obtain permits to cut down trees for their own use.

There are two different types of wood: hard wood and soft wood. Hard wood is the product of a broad-leaved tree like oak or maple. Hard woods will produce more heat and burn longer than soft woods but are harder to ignite. Soft wood is an open grained wood from pine trees and other evergreens. Soft wood burns fast and is easier to ignite, so it is usually used for kindling.

Paper is most commonly made from soft wood and hard wood is usually used to make carvings, furniture, and other decorations.

All in all, forest can provide us with energy. If used wisely and with care to plant at least as much as we use, forests are a reliable source of renewable energy able to reduce the production of harmful greenhouse gases and to diminish climate change.

Evaluation

Each group has been filmed during the experiment and presenting results of their experiments. The reporters will work together using their video recorded material to create a video clip on

"The Forest- Nature's Powerhouse", no longer than 7 minutes. In order to do so, students use critical thinking to select the most relevant material, to add the appropriate musical background under Creative Common License, to add (English) subtitles, to come to a consensus with the other members of the group.

After 10 days, their final product is presented to the children involved in this activity and assessed by "likes" and "dislikes". Each vote will be accompanied by reasons. The activity is also filmed and kept for record.

Notes

This activity is an interdisciplinary approach as it encompasses Physics, Languages (English), Civic Education, Environmental Studies, Media Studies.

The experiential educational approach is challenging for students with logical-mathematical intelligence and spatial visual ones. The interpersonal intelligence is challenged by working in random groups as well as learning through kinaesthetic methods which allow the participants to move around during the activity. The learner of naturalistic type is triggered by the use of natural materials. The verbal linguistic learner is the one tapped by the words used in reporting, the conclusions of the experiments as well as the video presentation, together with the musical learner reached by the background music of the video.

Let's not forget that this activity has to be preceded by the collection of wood necessary for the experiment and its drying up. The coniferous type of wood is collected individually from the kids' Christmas trees, activity which helps the intrapersonal learner to reflect in his/her own environment about, for example, the waste of so many fir trees and pine spruce for the Christmas season. At the same time the naturalistic learners and the kinesthetic learners will enjoy the trip in the woods to collect the deciduous type of wood.

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EDUCATIONAL ACTIVITY TITLE

A.3 Funding Local Climate Initiatives

THEME: **Forest and Energy/Climate Change**

Country: **Romania**
Writers: **Florentina Chif**u

Brief description of the activity: the children will find out about local climate successful initiatives from different articles. They will present the initiatives pointing out the steps followed by the participants and organizers in order to obtain funding for their goals and organize successful activities.. At the end, they will work together for a project to plant trees in the village or in the park near school.

Goals and objectives: Understand how local climate resilience plans can contribute to the global development goals.

Increase the insights on effective strategies for climate change adaptation and mitigation.

Learn about opportunities for organizing local climate initiatives.

Materials: images, photos, articles about local climate initiatives

Time: 2 hours

Detailed description

The children will read about the great plantation on the 28th of October 2017 in Cluj County, near Cluj-Napoca city, at Tritenii de Jos, Romania. There, in a huge area of 100000 square meters, 40.000 trees were planted. Over 4500 Romanian volunteers have planted trees in this area. This forest was called Transylvania Forest and was sponsored by Transylvania Bank and Tăsuleasa Social. The children will follow the photos on the internet and will talk about other local climate initiatives.

They will answer the questions:

- Why is planting trees a climate initiative?
- How does planting forests influence the climate change?
- What do you have to do to organize such an activity in your region?
- Who helped the villagers plant the trees?
- Who organized this local initiative?

The children will discover that such an initiative needs:

- a sponsor;
- an organizer;
- volunteers.

The children will discover that local authorities can help them combat the consequences of air pollution, land degradation, deforestation and rising sea levels. They have to identify the problems in the community, find ways of solving them and address to the local authorities to help.

Evaluation

The children will work in teams of six members. They have to work together for a project: to plant trees in the village or in the place that needs it the most. They will have to find a sponsor and some volunteers in order to implement the project in the future.

EDUCATIONAL ACTIVITY TITLE

A.4 Alternative and Renewable Energy Sources

THEME: **Forest and Energy**

Country: **Romania**
Writers: **Florentina Chifu**

Brief description of the activity: Through pictures, children will learn about forests and their traditional use for energy, in order to understand that this use is a major cause of deforestation in many countries. The will also acknowledge that the solution for saving forests is to invest in developing alternative energy sources.

Goals and objectives:

- Promoting alternative and renewable energy sources.
- Raising awareness of climate change caused by the forest industry, and by the use of wood as an energy source.
- Developing environmentally responsible behaviours

Materials: photos, images, drawings

Time: 2 hours

Detailed description:

Wood used for energy

Through pictures, children will recognize the traditional use of wood from ancient times. Much of the wood harvested worldwide is used for energy production. Wood has a long history as an energy source and sill is a significant energy source, especially for domestic use in rural areas of many countries.

Disadvantages

- Low energy capacity compared to fossil fuels.
- Studies have found that the inefficient use of fuel wood (and of other bioenergy material) results in significant exposure to indoor pollution. Women, children and the elderly face higher risks, owing to the long hours spent around solid fuel-based fires.
- Deforestation of the Earth.
- Climate change because of the deforestation.

Alternative and Renewable Energy Sources

The children will answer these questions:

- What's happening with the urban and forest waste?
- What's happening with the agro-industrial processing wastes?
- What's happening with the mill residues?
- How can these residues be recycled?

They will learn that many countries can produce biofuels in large quantities from forest and mill residues, agricultural crops and agro-industrial processing wastes.

Research provided new opportunities for utilizing a wider range of lignocellulosic biomass from timber mills, agro-industries and urban waste, as well as from traditional agricultural and forest residues. Researchers discovered ways to use solar, wind and water energy.

Advantages

- Reduced production costs.
- Higher energy conversion efficiency and greater cost effectiveness for bioenergy in the future.
- Forest biomass as a renewable source of energy which is able to reduce greenhouse gas emissions compared to fossil fuels.
- Growth in the forest, which reabsorbs the carbon emitted by the energy generation process.

Evaluation

The children will work in teams of four members. They have to compare forest energy and fossil fuels and each team has to write the advantages of using each energy source.

(photo by A. Vidalis)

Forest Biodiversity and Climate Change

BBFM • Bulgaria

EDUCATIONAL ACTIVITY TITLE

B.1 Protection of Biodiversity in the Forests of the Closest National Park or Protected Area

THEME: **Forest and Biodiversity**

Country: **Bulgaria**
Writers: **Pavlinka Stefanova, Bogdana Kalacheva**

Brief description of the activity: Students (age 12-13) watch a short presentation with a video about "The Protectors of our planet Earth" (pieces of information taken from stories.undp.org and youtube). Sustainable Development Goals 13 and 15 are discussed. Students work in pairs in the classroom to complete a fact file on "Life on Land" (Goal 15). Students collect more materials and share them in their Facebook page. They have to take photos or videos of different species living in the forest of the closest National Park or protected area during their family walks or during school hiking trips.

Students are divided into 5 groups in order to prepare 5 posters about the diversity of the flora and fauna in the forests and the importance of their protection. After creating their posters on paper, they are presenting them personally in front of a guest speaker – a representative of the National Park or protected area. Students talk to the local expert. A final product - a video with pictures and clips from their teamwork, their work on the posters and their presentation, is prepared. The posters are displayed in the school. The teacher publishes the video in the school website and together with the students searches for ways to promote it to a wider audience at a major school eco event or during special environmental classes.

Goals and objectives:

- Holistic and Interdisciplinary approach;
- Emphasis on local aspects of climate change;
- Educating for sustainability;
- Involving 17 Sustainable Development Goals with the National Curriculum.

Materials: A PowerPoint presentation, "Life on Land" – a worksheet with a gapped text, paper, pictures, coloured pencils

Time: 3x40 minutes (classroom activities); 2-week period for outdoor activities and research activities at home

Detailed description

Step 1 (40 minutes)

The teacher gives some general information on Goals 13 and 15 and explains their connection to forests and biodiversity. Then students watch a short movie about the Planet Earth and its beauty and a presentation about "The Protectors of our planet Earth – In Peru's Southern Amazon, the indigenous Harakmbut people are warriors against climate

change". Then students are divided into pairs and are given a copy of the worksheet "Life on Land" with gapped text in it. They are assigned 5 minutes in order to go through the text and predict the missing information. 2-3 pairs of volunteer read the text with the information they have filled in. The others can comment on the suggested answers. Then the teacher gives the correct answers. Finally, students discuss threats that local forests, animal and plant species face, climate change and its influence on the forests and especially the species in the closest National Park or protected area. Students are divided into 5 groups and tasks are assigned.

Step 2 (at home and outside – 2 weeks' time)

Students collect information, share it on their Facebook page and start taking photos and videos during their family walks in the forest or during the organized school hiking trips. Students are invited to start working on the preparation of their posters and powerpoint presentations.

Step 3 (40 minutes)

Students present the posters and Powerpoint presentations in front of their guest speaker and ask questions regarding the condition of the local forests, animal and plant species. The representative of the forestry or the National Park answers the questions. Finally, students are invited to compare and contrast the facts, both from a local and a global perspective.

Step 4 (40 minutes)

The teacher summarizes the information received during the previous lesson and finishes with brainstorming possible solutions to the problems identified. The students create an educational video. The teacher publishes the video in the school website and, together with the students, looks for ways to promote it to a wider audience, at a major school eco event or special environmental classes.

Evaluation

This is a project-based activity. Students are evaluated through a questionnaire filled in at the end of the project activity. The teacher takes notes while watching them team-working and cooperating throughout the whole project. Several times during the implementation of the project, the teacher gives index cards to the students and asks them to respond to two questions, one on the front of the card, the other on the back. General questions, such as "what does the 15th Sustainable Development Goal say?" can be posed. The teacher can also ask more specific questions about various aspects of the topics presented through the activity.

Notes

This is the gapped text "Life on Land" that students are expected to fill in. All the words/numbers in brackets are missing.

"Human life depends on the (earth) as much as the ocean for our sustenance and livelihoods. Plant life provides (80) percent of our human diet, as we rely on agriculture as an important economic resource and means of development. Forests account for (30) percent of the Earth's surface, providing vital habitats for millions of species and important source for clean air and water. It is also crucial for combating climate (change).

Today we are seeing unprecedented land degradation, and the loss of (arable) land at 30 to 35 times the historical rate. Drought and desertification are also rising, amounting to the loss of (12) million hectares and affects poor communities globally. Of the 8,300 animal breeds known, (8) percent are extinct and (22) percent are at risk of extinction.

The SDGs aim to conserve and restore the use of terrestrial ecosystems such as forests, wetlands, dry lands and mountains by (2020). Halting deforestation is also vital to mitigate the impact of climate change. Urgent action must be taken to reduce the loss of natural habitats and biodiversity which are part of our common heritage."

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EDUCATIONAL ACTIVITY TITLE

B.2 Classroom Experiments "Global Warming" and "Flooding"

THEME: **Forest and Biodiversity**

Country: **Bulgaria**
Writers: **Christina Karabelova**

Brief description of the activity: Students conduct two classroom experiments in order to observe the consequences of climate change in the forest. The first experiment shows the effect of global warming and the second one the effect of flooding on the forest.

These activities are suitable for preschoolers and students in primary school.

Objectives

- Describing forests' reactions to flooding and extreme heat.
- Explaining relations between plants and animals and climate change.
- Demonstrating the destructive impacts of climate change in the forest by conducting the experiments.
- Explaining relations between biodiversity and the lack of water and high temperature.
- Drawing conclusions.
- Respecting plants and animals in the forest.

Goals

- Developing critical thinking and comprehension.
- Developing sense of sustainability.
- Promoting environmentally responsible behaviours and values.
- Raising self-awareness of possible impacts of climate change.
- Educating children to respect and protect biodiversity in the forest.

Materials: 3-4 fresh leaves, a glass of fresh water, camera, 1 hairdryer

Time: two class periods

Detailed description

1. Put a fresh green leaf in a glass of water.
2. Have students take pictures of the leaf daily for five days and create a documentary.
3. Make them compare and analyze pictures of DAY 1, DAY 3 and DAY 5. Observe the process of plant rotting.
4. Use the leaf sample to explain to the students the actual effect of flooding on plants or forests.

Evaluation:

This experiment is successfully completed if all the standards are met - relevance, effective-ness, efficiency, overarching developmental impact and sustainability.

Detailed description of Experiment N.2 (Global Warming):

1. Use two samples of fresh leaves. Have the students touch them. Explain how soft and gentle the leaf is when it is alive and green.
2. Let the students dry one of the leaves for 40 seconds with a hair dryer. In just 10 seconds the leaf turns yellow and begins to dry out.
3. Make the students touch the leaf again. It is already fragile and dried. Describe what happened.
4. Make a conclusion: water in the leaf evaporates under high temperature and eventually

the leaf dries/plants die.

5. 5. Compare the hairdryer to global warming and leaves to forests.

Evaluation: This experiment is successfully completed if all standards are met - relevance, effectiveness, efficiency, overarching, developmental impact and sustainability.

Notes: The class may be split into 3 groups.

Bibliography:

https://www.worldwildlife.org/

EDUCATIONAL ACTIVITY TITLE

B.3 Badges “Save the animals in the forest” and mailbox “Sharing is caring”

THEME: **Forest and Biodiversity**

Country: **Bulgaria**
Writers: **Kaloyana Dimitrova**

Aim: Raising awareness of the impacts of climate change in the forests.

Brief description of the activity: Students have to create badges that promote the conservation of animal species in the forest and to write messages –ideas, suggestions and advice– on how to protect the forest and its inhabitants from harmful human activity and climate change and to put them in the specially prepared mailbox.

Goals:

- Sustainable consumption
- Caring about the animal species in the forest
- Conservation of ecosystems and biodiversity
- Peaceful, inclusive and responsible societies for sustainable development
- Global Partnership for Sustainable Development

Objectives:

- Parenting to Nature
- Environmental education
- Tolerant attitude to biodiversity
- Ecological significance of the forest
- Developing a sense of ownership and environmentally responsible behaviours
- Promoting values and behavioural change
- Educating for sustainability
- Creative thinking

Materials: cardboard, scissors, coloured pencils, animal pictures, carton box, photos, pictures of forest, paper tree templates, glue, tape, markers, colour pencils, green paper for decoration.

Time: 80 min

Age of the children: 3rd grade

Detailed description

Step 1: Students have to create badges from paper (in the form of a circle) that promote the conservation of animal species in the forest. Use as an inspiration the logo on some brands of cardboard packaging like Tetra Pak and the “Forest Stewardship Council” (FSC). Investigate on which cartons you find these logos. At the end an

exhibition of badges is organized and the pupils evaluate their own ideas.

Step 2: Students create a colourful mailbox, decorating it in creative ways, associated with the forest.

Then by writing short notes like letters, addressed to the forest and the people, they are giving their suggestions, ideas and tips on how to prevent the harmful impact of the changing climate on forests as a result of global warming. Students are also invited to come up with ideas as alternative options against harmful human activities that result in deforestation.

When the children finish writing the letters, they make a short "ceremony": they put the letters in the mailbox, hoping that they will reach the forest and the rest of the people in the world, so that together we make this planet a better place.

Choose a big school event where you can read these messages for raising awareness among children and a positive change in their behaviour.

Evaluation: Excellent ideas, creative suggestions, emotional discussions, excellent educational achievements.

Notes: Children become deeply invested in the theme and they are united around the cause of salvation of the forest as a main key to fighting the climate change impact.

Bibliography :

https://www.worldwildlife.org/threats/deforestation

https://www.worldwildlife.org/species

https://kids.mongabay.com/lesson_plans/lisa_algee/deforestation.html

https://www.theguardian.com/environment/2011/feb/11/forests-trees-climate

http://www.pnas.org/content/104/50/19697.full

EDUCATIONAL ACTIVITY TITLE

B.4 Forest biodiversity and climate change

THEME: **Forest and Biodiversity**

Country: **Bulgaria**
Writers: **Ekaterina Haralampieva, Vidilina Ruseva**

Aim: Raising awareness on the impact of climate change in the forests.

Brief description of the activity:

I. A **presentation** for warm-up (Forests and Biodiversity presentation).
II. Solving a **crossword**: "Forest puzzle" (see page 47).
III. **Simulation Game**: There are two teams of 4 students. The first one presents the happy bears. They have plenty of food, water and shelter. They are satisfied with their habitat. The second one has no water, limited variety and quantity of food and no shelter. The game allows children to simulate the life and needs of wild animals in order to realize the reasons for migration. The lack of proper life conditions due to climate change leads to migration and biodiversity loss.
IV. **Dramatization**: "The Lonely forest".
V. A **game**: "The Lively Tree". Trying to build a '3D' tree real image enables children to feel the value of each leaf and each twig, and appreciate the value of every living tree. The game allows students to feel the trees as living creatures that are static and therefore completely defenceless against the assaults of unscrupulous people.

Goals and objectives:

- Strengthening of cooperation
- Holistic and Interdisciplinary approach
- Experiential educational approach
- Outdoor Education
- Emphasis on local aspects of climate change
- Developing a sense of ownership and environmentally responsible behaviours
- Promoting values and behavioural change
- Involving Sustainable Development Goals with the National Curriculum
- Educating for sustainability: emphasis on local aspects of climate change, deforestation and its effects.
- Raising awareness about the importance of forests as a factor that determines life on earth
- Developing empathy for other life species
- Discovering and understanding the interconnection between forest ecosystems, biodiversity and climate change

Materials :

- Presentation
- Crossword "Forest puzzle"
- For the simulation game: berries, nuts, pears, honey, cups and plates,
- A tree model, for the "Lively forest" game: paper sheets printed with 4 kinds of trees on them (e.g. poplar, willow, oak, pine), 4 envelopes.

Detailed description:

I. Presentation for warm-up (Presentation is attached)

The teacher helps the students familiarize themselves with the topic using the presentation, providing basic knowledge on the topic of the project. The idea is to provoke some questions,

to raise awareness on the issue.

II. Solving a crossword "Forest puzzle" (see page 47)

Students solve the crossword. The teacher announces an exchange of crossword puzzles already completed between the students sitting together in a rank and displays the ranking table via the multimedia projector. Each student checks the crossword of their neighbour and records the percentages. Teacher collects information in a model: "How many of you have achieved ...%?" and summarizes the results.

III. Simulation Game

Divide the students into two groups. Each group consists of 4 students.

1. Tell them that they are hungry bears and it's time to eat.

Ask the first group to go to a table, where the teacher has arranged: a bowl of raspberries, a bowl of blueberries, some honey, some pears, and nuts. Invite them to have as much as they would like.

The second group goes to a table, where the teacher has arranged: some nuts and some pears (less than the number of the participants in the activity). Invite them to have as much as they would like.

Give each group approximately 2 minutes to act out the eating activity.

Then the teacher asks each group:

- Are you hungry?
- Was there enough for each bear?
- Did you have a variety of food?

2. Tell the bears they are thirsty and it is time to go to the river.

Give each group approximately 2 minutes to act out the drinking activity.

The first group finds on their table cups full of water.

The second group finds out that there are less cups that the number of the participants, and that there is no water inside.

Ask the first group:

- Was the water OK?
- Was there enough water for all of you?
- Are you still thirsty?

Ask the second group the same questions.

3. Send the bears to relax/get some sleep/hide in the forest

The first group finds a tree model. The students sit or lie down around the tree.

The second tree has no trees to relax, sleep or hide. They stay up, while the first group acts out relaxing activity.

Give each group 2 minutes to act out the relaxing activity.

Ask each group:

- Did you manage to relax?
- Was there a proper place to get some sleep/to relax/to hide?

Ask the students to name each group according to what they got, how they feel after having done the activity.

Possible names:

The happy bears/The sad bears

Ask them to write down their group names on the whiteboard or on a poster and the reason why they feel this way- happy or sad.

Ask the sad bears if they could change their place with the happy bears, would they do it.

Would they move to another area?

Evaluation: The simulation game is a proper way to develop one of the key competences – "Participating and Contributing". It helps to build up "Action Competence" – being ready, being willing and able to take action and to be involved in real situation and problems of the environment.

IV. Dramatization "The Lonely Forest".

The teacher invites the students to watch a play.
Two students play roles: the forest and the child.

The Lonely Forest

Child: Hello, beautiful forest. How are you today?

Forest: I am sad.

Child: Why?

Forest: Because today I said goodbye to the last brown bear which lived here.

Child: Why did it leave?

Forest: The bear was hungry. There were no bees to make honey for the bears.

Child: But where did they go?

Forest: They died when the farmers sprayed pesticides on their crops.

Child: What about wild berries. Bears love them!

Forest: Humans picked them up to sell them.

Child: Fish in the river?

Forest: Oh, my child! There is no river any more. It has dried out. No river, no fish! The bear was tired, too.

Child: Why was it tired?

Forest: Because there was no place to hide and sleep.

Child: What about the trees and bushes?

Forest: Some of the trees were cut by the people. They were greedy for money! Some of them were blown down by the storm. Some burnt down in fires. The pine trees got sick. They didn't feel well. The weather was too hot for them.

Child: What a pity!

Forest: The bear was angry! It couldn't sleep well in winter.

Child: How come?

Forest: It wasn't cold enough. The temperatures were high. The climate changed.

Child: Why did it change?

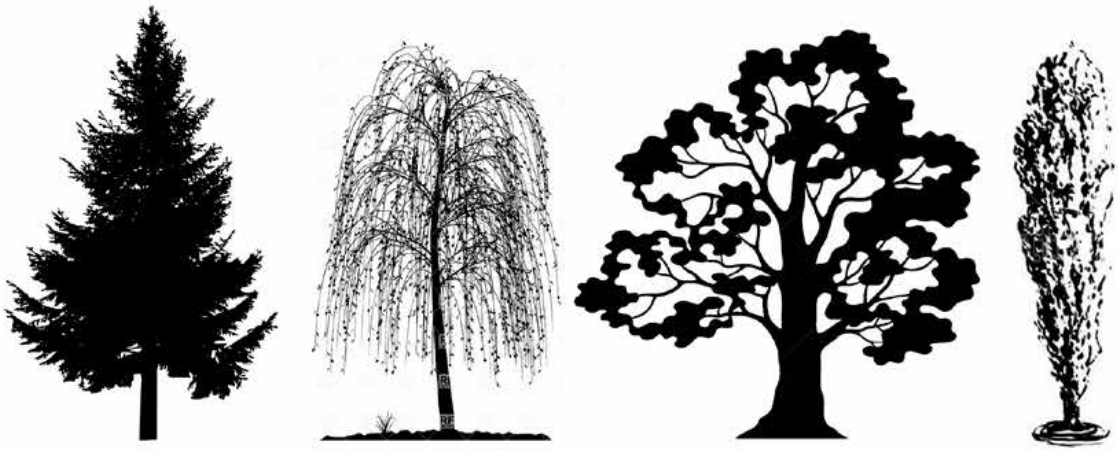
Forest: Because of you, humans on the planet Earth! There is too much carbon dioxide! The temperature is getting higher. The climate is changing. My children - plants and animals are dying, moving, changing...

Child: I feel so ashamed! How can I help? What can I do?

Forest: You can do much, my child! Walk, don't go by car or bus! Plant some trees! Recycle, reduce and re-use items. Don't be greedy! Don't take more than you need! Protect and take care of endangered species! Tell your friends about the problem! Forest needs your love and care! Go, my child! Don't waste time. There is still hope for us...

V. A game "The Lively Tree"

The teacher divides students into four groups. A representative of each group pulls out an envelope with a sheet of paper in it. There is a different tree contour on each paper. The task of each group is to create a three-dimensional model of the tree they have chosen; involving all students in the group (they can lie on the floor, step on a high chair, use clothes or school supplies as a requisite, etc.). The other participants try to recognize the kind of a tree.



Forest Fires and Climate Change

CYMEPA • Cyprus

EDUCATIONAL ACTIVITY TITLE

C.1 Little Forest Guardians

THEME: **Forest Fire**

Country: **Cyprus**
Writers: **Giorgos Georgiou, Christine Shamaela**

Brief description of the activity: The Students realize that, as guardians of the forest, they are obliged to inform their schoolmates and fellow citizens about the ways of protecting the forest. For this reason, they make signs about the "eco code" in the forest. They visit the forest to clean it from dangerous products and to place the sign.

Goals and objectives:

- Raising awareness of the benefits of forests to ecosystem and the need to prevent forest fires
- Strengthening of cooperation
- Experiential educational approach
- Outdoor Education
- Developing a sense of ownership and environmentally responsible behavior
- Promoting values and behavioural change
- Educating for sustainability
- Goal 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss

Materials: signs (wooden A3 board and pieces of wood), permanent colouring markers, acrylic paints.

Time: 4 x 40 minutes

Detailed description:

Lesson 1 (2x40): The construction of signs with their Code for preventing fires and protecting the Forest

The students, after they had lessons about the benefits of the Forests for the Ecosystem, are entitled to sit in groups of four and make signs referring to the measures that we all have to take in order to prevent the fires in the Forest. They use capital letters for their signs; write small but meaningful messages, with pictures and colours so as to draw the attention of the forest visitors. Such messages could be:

- DON'T THROW YOUR CIGARETTES IN THE FOREST
- PROTECT THE FOREST LIKE YOU PROTECT YOUR EYES
- OUR FUTURE DEPENDS ON THE FOREST. PROTECT IT.
- CALL 1407 IF YOU SEE A FIRE
- DON'T THROW GARBAGE IN THE FOREST
- BIODIVERSITY IS VERY IMPORTANT PROTECT IT

Lesson 2 (2x40): The Little Forest Guardians in Action

All the students visit the Forest with their parents and other citizens of the community, in order to raise awareness to the community, to clean the forest and place the signs there.

Evaluation:

Evaluation takes place throughout the lesson through observation. The teacher records his/her observation soon after the lesson. Final evaluation takes place at the end of the unit through a test which examines whether the main objectives of the unit have been completed successfully.

Bibliography:

Forest Law

http://www.cylaw.org/nomoi/enop/non-ind/2012_1_25/index.html

National Forest Policy of Cyprus

http://www.moa.gov.cy/moa/fd/fd.nsf/fd17_gr/fd17_gr?OpenDocument

Guide for the implementation of the curriculum on Sustainable Development and Enviromental Education

EDUCATIONAL ACTIVITY TITLE

C.2 Soil erosion and restoration measures

THEME: **Post-fire ecosystem restoration**

Country: **Cyprus**
Writers: **Ioannis Georgiou, Antonis Polydorou**

Brief description of the activity: The students will explore the phenomenon of soil erosion as an immediate consequence of a wildfire and develop tools for prevention.

Goals and objectives:

- Raising awareness of the impacts of wildfires to the soil and exploring ways to restore the ecosystem
- Strengthening of cooperation
- Experiential educational approach
- Outdoor Education
- Identify the negative effects of wildfires to the ecosystem
- Get to know the phenomenon of soil erosion and explore the consequences of wind and rainfall erosion to the ecosystem
- Developing a sense of environmentally responsible behavior
- Educating for sustainability
- Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems

Materials (for each team): 2 hard carton boxes with a v-shaped cut on one narrow side, electric fan, nylon sheets/Tetra Pak unfolded package, soil, watering can, water, piece of soil with planted grass, 2 small Tetra Pak bowls, seeds

Time: 40 minutes

Detailed description:

1. Students split in teams of 5. Each team places soil into both the carton boxes the nylon sheets/ Tetra Pak unfolded packages and then fill both boxes with soil. Then they place the soil with the planted grass to the first box.

2. They direct the electric fan towards the surface of the first box and operate it. They repeat the same process with the second box. They make their observations. They should be able to observe that the soil without any vegetation is not stable and is pushed away by the wind.

3. They place the two boxes in an inclined position of 30 degrees. Then, using the watering can filled with water, they slowly pour water from the upper edge of each box. They stop until the Tetra Pak bowls are almost full. Then they inspect the water in the Tetra Pak bowls and they make their observations. They should observe that the water in the bowl in front of the box covered with vegetation is clearer that the other one which means that soil without vegetation can be washed away very easily.

Evaluation: Evaluation is ongoing and is based on the level of participation of each student. As a form of a final evaluation it could be asked from the students to describe in text the process of erosion and its consequences.

Notes :1 The boxes could be wooden as well.

Bibliography:

Curriculum Development Service (2007).First steps in science: teachers book. Nicosia, Cyprus: Ministry of Education and Culture

Schreiber A. (2014). Making seed balls: an ancient method of no-till agriculture. Retrieved October 14, 2017 from

https://permaculturenews.org/2014/06/18/making-seedballs-ancient-method-till-agriculture/

EDUCATIONAL ACTIVITY TITLE

C.3 Ecosystem restoration measures: seed balls

THEME: **Post-fire ecosystem restoration**

Country: **Cyprus**
Writers: **Ioannis Georgiou, Antonis Polydorou**

Brief description of the activity: The students will explore the process of restoration of the ecosystem in affected areas and develop tools to support restoration with minimum intervention in the nature processes.

Goals and objectives:

- Raising awareness of the impacts of wildfires and exploring ways to restore the ecosystem
- Strengthening of cooperation
- Experiential educational approach
- Outdoor Education
- Identify the negative effects of wildfires to the ecosystem
- Exploring ways to restore the ecosystem at an affected area
- Developing a sense of environmentally responsible behavior
- Educating for sustainability
- Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems

Materials (for each team): clay, potting soil, seeds, water, mixing bowl.

Time: 40 minutes

Detailed description:

1. The teacher and students, in collaboration with the Forestry Department, identify a recently burned area and, together with the parents association, organize a field visit to support the reforestation process.

2. On the spot, they discuss and observe the natural process of regeneration of the forest. They prepare mud using soil and water and then they create seed balls where each ball contains a number of seeds from plants that grow naturally in the given forest area.

3. It will be explained that a seed ball is actually a container that protects the seeds from the birds that eat them and at the same time provides a fertile environment for the seeds to sprout. It is also explained that the seed ball method for reforestation is not interfering with the natural process as other reforestation practices.

4. When the seed balls are ready, students and parents walk around and throw the balls in the burned ground in order to cover a large area. The seed balls will be left there protected by birds and with the help of the rain and the sun, following the nature rules and rhythms, will eventually grow into new plants for the forest.

Evaluation

Evaluation is ongoing and is based on the level of participation of each student.

Bibliography:

Curriculum Development Service (2007).First steps in science: teachers book.Nicosia, Cyprus: Ministry of Education and Culture

Schreiber A. (2014). Making seedballs: an ancient method of no-till agriculture. Retrieved October 14, 2017 from

https://permaculturenews.org/2014/06/18/making-seedballs-ancient-method-till-agriculture/

EDUCATIONAL ACTIVITY TITLE

C.4 Raising awareness of the impacts of wildfires in the forest ecosystem

THEME: **Climate change and forest fires**

Country: **Cyprus**
Writers: **Georgia Papageorgiou**

Brief description of the activity: As the title portrays, this activity aims at enhancing students' understanding of the negative consequences of wildfires on the forest ecosystem.

Goals and objectives:

- Raising awareness of the impacts of wildfires in the forests, acknowledging their increased risk due to climate change
- Strengthening of cooperation
- Experiential educational approach
- Outdoor Education
- Emphasis on local aspects of climate change
- Increase the environmental literacy of students
- Develop a sense of ownership and environmentally responsible behaviour
- Promote values and behavioural change
- Educate for sustainability (Sustainable development goal number 15)
- Forest appreciation, sensory awareness

Materials: blindfolds, mirrors

Previous knowledge:

1. Students are familiarised with the concept of the ecosystem and ecological balance.
2. Through previous activities, students have concluded that climate change increases the risk of wildfires.

Detailed description:

1. Outdoor games/activities (at the forest) 2x40min

Students visit a forest. They walk through it and observe the plants, the soil and any animals or soil organisms they find. Afterwards they play some games.

a. Meet a tree. The students are divided into pairs. One student of each pair wears a blindfold. The other player leads the blindfolded player to a special tree, one that has intriguing characteristics. Upon reaching the tree, the blindfolded player feels the texture of the tree's bark, feels how big the tree is by putting his arms around it, and explores the tree's branches and leaves. The guide can silently guide the player's hands to interesting places on and around the tree. After getting to know their trees, the blindfolded players are brought back to the starting point, where their blindfolds are removed. They then try to find their tree. With this game students connect with trees in a memorable way.
b. Becoming 'one' with the forest: students walk slowly under the trees in a line while holding a mirror flat at the end of their nose, so they can look straight up in to the canopy and feel like they are walking through it. The teacher leads the group on their tree top walk. Upon finishing, students and teacher come together in a circle to share experiences and explore what they saw, heard and felt. The different shapes of leaves and colours that they saw are also discussed.

2. Visit to a burnt forest ecosystem 2x40 min

Students visit a forest after a severe forest fire. They observe the plants and the soil, as they

did on their previous visit, and look for any animals or soil organisms. They repeat the games they played before to realise the ecological disaster caused to the forest, they observe the soil erosion and witness possible works aiming at the ecosystem restoration. Students are asked to compare the two ecosystems.

If possible, a forest officer can be invited to inform pupils on the causes of forest fires, how fires can be quickly detected and reported, the measures taken to reduce the potential for a fire outbreak or spread and on how fire suppression is facilitated by specific actions and measures.

Evaluation:

Students are evaluated throughout the activity as well as through the final comparison exercise.

Bibliography:

https://ohorizons.org/blog/sustainable-development-goals

http://www.soils4kids.org/about

(photo by N. Petrou)

Forests, CO_2 and Climate Change- Trees as carbon storage

HSPN • Greece

EDUCATIONAL ACTIVITY TITLE

D.1 Discovering my ecological footprint

THEME: **Forest and climate change**

Country: **Greece**
Writers: **Kalatha Christina, Drizou Despina**

Brief description of the activity: A game in which students discover their ecological footprint and the impact of their personal lifestyle on climate change.

Goals and objectives:

- To introduce the concept of ecological footprint (carbon footprint)
- To understand how sustainable different personal behaviours are
- To find out how they can change their behaviour
- To understand how changes of our behaviour affect the environment

Materials:

- Pen and a copy of the questionnaire for each student calculators
- Outside space or schoolyard

Time: 5 hours totally

2 hours needed for teaching and connecting forest (photosynthesis) with the carbon cycle and climate change, 1 hour for introducing the concept of ecological footprint, 1 hour for playing the game and 1 hour for discussing the conclusions.

Detailed description of the game:

1. The teacher introduces the questionnaire. It includes questions about students' personal lifestyles referring to their consumption. According to their answers they make "steps" and they reach "points".
2. Students stand in one straight line, holding a questionnaire and a pen.
3. One question at a time is read out by the teacher and every student steps forward according the "steps" corresponding to the answer they give. Then every student marks the particular answer on the questionnaire.
4. After having read all the questions students observe that each one has reached in a different point. At that moment they realize that the distance they have walked shows their personal ecological footprint.
5. Finally, they come together in a group and take time to individually sum up the points of all their answers. The teacher explains what the number means and lets the student compare their footprint with the global average.
6. Next day students are divided in groups and discuss the following:
   - How did those who moved on feel? And those who were left behind?
   - Which behaviour and which action they could change in their personal life in order to reduce their carbon footprint?

- Is it a life choice or a necessity to reduce their footprint?

Evaluation: The final evaluation of the activity is to complete a questionnaire. Students should be able to express what they learn about forest-carbon cycle and climate change as well as to show the understanding of the concept of carbon footprint. They also should be able to propose specific ways to reduce their carbon footprint.

Notes: *Forest ecosystems play a unique role in the global carbon cycle circulating CO_2 between the air, plants, animals and soil. Forests balance the concentration of CO_2 in the atmosphere by absorbing and releasing CO_2. Nowadays, by burning fossil fuels (such as coal, oil, and natural gas), driving cars, using electricity or making products, people are adding carbon to the atmosphere (in the form of CO_2) faster than natural processes can remove it. That's why the amount of CO_2 in the atmosphere is increasing. Deforestation and wildfires are releasing also a large amount of CO_2 in the atmosphere. Because CO_2 is a heat-trapping greenhouse gas, the increase of its concentration in the atmosphere could have a significant impact on climate change.*

The ecological footprint estimates the area of land and ocean required to support one's consumption of food, goods, services, housing and energy and assimilate one's waste. It is expressed in "global hectares". Nowadays the expression "carbon footprint" is used to express the total set of greenhouse gas emissions caused by a person, an organization, an event or a product.

Bibliography:

www.ifm-sei.org/files/up/ATACC-publication-web.pdf

Ecological footprint questionnaire

Total your score by adding the circled values from the above questions

If ones score is:

- less than 150, the ecological footprint is smaller than 40000m^2.
- 150-350, the ecological footprint is between 40000m^2 and 60000m^2.
- 350-550, the ecological footprint is between 60000m^2 and 78000m^2.
- 550-750, the ecological footprint is between 78000m^2 and 100000m^2.
- more than 750, the ecological footprint is greater than 100000m^2.

Students compare their footprint with the global average.

For example, the average footprint in the UK and Canada is 60000m^2, in Austria 50000, in Nicaragua 30000, in Sri Lanka 10000.

Teacher points out that only 21000m^2 per person are available on earth. If everyone in the world used more, we would need more than one earth to sustain us.

Appendix: Ecological Footprint Questionnaire

HOUSING	Steps	Points
How many people live in your household?		
1	3	30
2	2	25
3	2	20
4	1.5	15
5 or more	1	10
How is your house heated?		
Natural gas	3	30
Electricity	4	40
Oil	5	50
Renewable energy (solar, wind)	1	10
How many individual taps (in your kitchen, bathrooms, and outside) and toilets do you have in your house?		
Less than 3	0.5	5
3-5	1	10
6-8	1.5	15
8-10	2	20
More than 10	2.5	25
What type of home do you live in?		
Apartment/ flat	2	20
House	4	40
FOOD		
How many meals per week do you eat meat or fish?		
0	0	0
1-3	1	10
4-6	2	20
7-10	3.5	35
More than 10	5	50
How many meals do you eat per week prepared from fresh ingredients (not 'ready' meals or frozen pizzas)?		
Under 10	2.5	25
10-14	2	20
14-18	1.5	15
More than 18	1	10
When purchasing your food items, does your family try to buy locally produced goods?		
Yes	2.5	25
No	12.5	125
Sometimes	5	50
Rarely	10	100
Don't know	7.5	75
TRANSPORTATION		
If you or your family own a car, what type of car is it?		
Motorcycle	1.5	15
Small compact	3.5	35
Mid-sized	6	60
Large	7.5	75
Sports, 4 by 4 vehicle or mini van	10	100
Pick-up truck or full-size van	13	130

	Steps	Points
How do you get to school/ work?		
Car	5	50
Public transport	2.5	25
School bus	2	20
Walk	0	0
Bicycle, rollerblade or skateboard	0	0
Where did you go on holiday/ vacation within the last year?		
No vacation	0	0
Own country, own region	1	10
Own country, different region	3	30
International	4	40
Intercontinental	7	70
How many weekend trips per year do you take by car or plane?		
0	0	0
1-3	1	10
4-6	2	20
7-9	3	30
More than 9	4	40
PURCHASES		
How many large purchases (stereo, TV, computer, car...) has your household made in the last year?		
1-3	1.5	15
4-6	3	30
More than 6	4.5	45
Have you bought any energy-efficient products in the past year instead of non-energy efficient (fridges,etc.)?		
Yes	0	0
No	2.5	25
WASTE		
Do you try to reduce the amount of waste you generate (eg. Buying food in bulk, refusing junk mail/ flyers...)?		
Always	0	0
Sometimes	1	10
Rarely	2	20
Never	3	30
Does your household compost?		
Always	0	0
Sometimes	1	10
Rarely	1.5	15
Never	2	20
Does your household recycle paper, cans, bottles etc.?		
Always	0	0
Sometimes	1	10
Rarely	1.5	15
Never	2	20
How many rubbish bags of waste do you fill each week?		
One half-full garbage bag	0.5	5
1	1	10
2	2	20
More than 2	3	30

EDUCATIONAL ACTIVITY TITLE

D.2 The first step: learning in our schoolyard

THEME: **Forests, CO_2 and climate change - Trees as carbon storage**

Country: **Greece**
Writers: **Ioannis Vasiloudis**

Brief description of the activity: Pupils will recognize trees in the schoolyard. They will calculate the total amount of carbon dioxide that can be held by trees in the schoolyard. Finally, they will decide on the role that forests have in the phenomenon of climate change. The activity will be designed on the principles of discovery and cooperative learning.

Goals and objectives: The goal of this activity is for the pupils to recognize the contribution of forests to climate change mitigation. Additionally, the pupils should develop positive attitudes towards the environment, understand man's interdependence with the natural environment and the need for sustainable development and, last but not least, develop cooperation and communication skills.

Materials: sheets of paper, pencils, markers, cartons, trees cards, tape measure, internet connection.

Time: 5 hours

Detailed description:

1. *(Suggested time: 45 min)* **Pupils will identify the trees in the schoolyard.** Pupilswill be provided with cards that represents different types of trees. They will be shared in groups and each group will observe and recognize the trees that exist in the schoolyard. Then they will classify the trees and exchange the first observations. At the end of this activity a brainstorming will take place concerning the importance of trees and their uses. We will write the different ideas on a poster paper or the board.
2. *(Suggested time: 90 min)* **Pupils will describe and draw the trees in the schoolyard.** They will be divided into groups and search on the internet or in the school library for information about the trees of the schoolyard. They will prepare posters with information material about the trees such as name, classification of the trees, where these trees thrive, how much height they reach and at what age, etc.
3. *(Suggested time: 45 min)* **Pupils will adopt a tree in the schoolyard.** They will measure the circumference, the diameter, the age and the height of this tree and at the end, they will calculate the carbon mass of the tree. The age and the amount of carbon stored in trees depends on a number of things including tree species, growth conditions in the environment and density of surrounding, so these calculations will be empirical and use the web application National Tree Benefit Calculator.

   At first, pupils will measure the circumference of the tree at breast height (1.5 meter off the ground). They will also be able to calculate the diameter of the tree, using the tree circumference.

   Diameter = circumference/3.14

   Then, they will calculate the age of the tree using this formula:

   Age = circumference (in cm)/2.5.

   Additionally, they can calculate the height of the tree using this empirical way: a pupil will be asked to walk away from the tree but every so often bend forward and look through their legs back to the tree. At the moment when the pupil can just see the top of the tree,

he/she stops. Then another child measures the distance along the ground from the tree to the marker. This distance is about equal to the tree's height.

Then, the pupils estimate the carbon mass of the tree using the following empirical formulas (Leys, 2011):

I. Estimate the volume of the tree:

Tree volume (m^3) = Tree height (m) x diameter2 (m^2) x 0.7854/3
(for conically shaped trees e.g. pines) or

Tree volume (m^3) = Tree height (m) x diameter2 (m^2) x 0.7854
(for cylindrically shaped trees e.g. eucalypts)

II. Estimate the mass of the tree:

Tree mass (kg) = Volume of the tree (m^3) x density of wood (kg/m^3)

(Use an average dry oven density of 700 kg/m^3 for hardwood eucalypts of and 400 kg/m^3 for softwood pine to calculate the tree mass)

III. Estimate the CO_2 sequestered per tree:

CO_2 sequestered per tree (kg) = Tree mass (kg of fresh biomass) x 65% (dry mass) x 50% (carbon %) x 3.67 x 120%

VI. Estimate the CO_2 sequestered per tree per year:

CO_2 sequestered per tree per year (kg) = CO_2 sequestered / age of the tree (yrs)

Alternatively, the pupils can use the web application National Tree Benefit Calculator to estimate the CO_2 sequestered per tree per year more or less (conversions should be made from centimeters to inches and from pounds to kilograms).

4. (Suggested time: 45 min) **Pupils in groups will construct posters about the contribution of the trees to reduce CO_2 in the atmosphere.** They will make connections between forests and climate change and in the end they will make proposals for sustainable forest management.

Evaluation:

The final evaluation of this activity is an excursion to a forest. There, pupils should be able to describe how forests influence concentration of carbon dioxide in the Earth's atmosphere and to propose at least two specific recommendations on how people should treat forests in a way that enhances their function of carbon sinks.

Bibliography:

Outdoor & Woodland Learning Scotland (2017), retrieved from: http://www.owlscotland.org/images/uploads/resources/files/measuringtrees2.pdf

Leys, A. (2011), retrieved from:

http://forestlearning.edu.au/images/resources/3_Carbon%20and%20its%20storage%20in%20forest%20and%20wood%20products.pdf

National Tree Benefit Calculator, http://www.treebenefits.com/calculator/treeinfor.cfm?zip=&city=&state=&climatezone=Inland%20Valleys

EDUCATIONAL ACTIVITY TITLE

D.3 Learn by playing

THEME: **Forests and CO_2 - Trees as carbon storage**

Country: **Greece**
Writers: **Tziatzia Angeliki, Chatzimichail Mariana, Serafeim Eleni**

Brief description of the activity: Students divided into groups, get a pile of Lego bricks assembled as following: one red and two green, as they represent carbon dioxide. They play a game with a spinning wheel and two-coloured cards (red and green), which show various activities-behaviours, green for positive activities-behaviours like tree planting and red for negative, like tree cutting. Each team turns the arrow and if it gets green on the dashboard it gets a green card. Green cards include positive behaviours and they can give carbon. If it gets red on the board, they get a red card. Red cards force them to take more carbon dioxide. The team that will win first is the one that gets rid of carbon (the red breaks).

Goals and objectives:

- To understand the interrelationships between the forest ecosystem and humans.
- To give students feedback and information on the forest ecosystem.

Materials:

a. 24 knowledge cards (see page 49)

b. a spinning wheel

c. Red and green laminated cards with activities-behaviours. Every card describes some behaviour and its corresponding impact on the forest ecosystem or to climate change. Each card leads players to give up carbon or to take more carbon dioxide for their team.

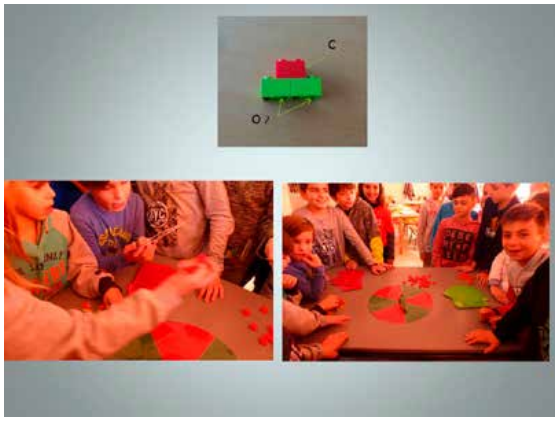
d. Red and green Lego breaks in ratio one to two, that join together to form carbon dioxide.

Time: 2 to 3 teaching hours are needed for students in order to create the game, 1 hour is needed for playing the game.

Detailed description:

Knowledge cards are used for older kids. In order to be able to spin the spinning wheel, they should first answer a knowledge card. Each player in the group gets a knowledge card he/she reads it and if he/she answers correctly, turns the wheel. If not, the next player continues.

Students divided into two groups of 12 pupils take twelve clusters of blocks representing carbon dioxide. In addition, one more pile is placed in the centre, in order to be used during the game. The cards are on the table in two columns (red and green) separately. Players, of each team, turn the arrow on the spinning wheel one after another and score a colour. Depending

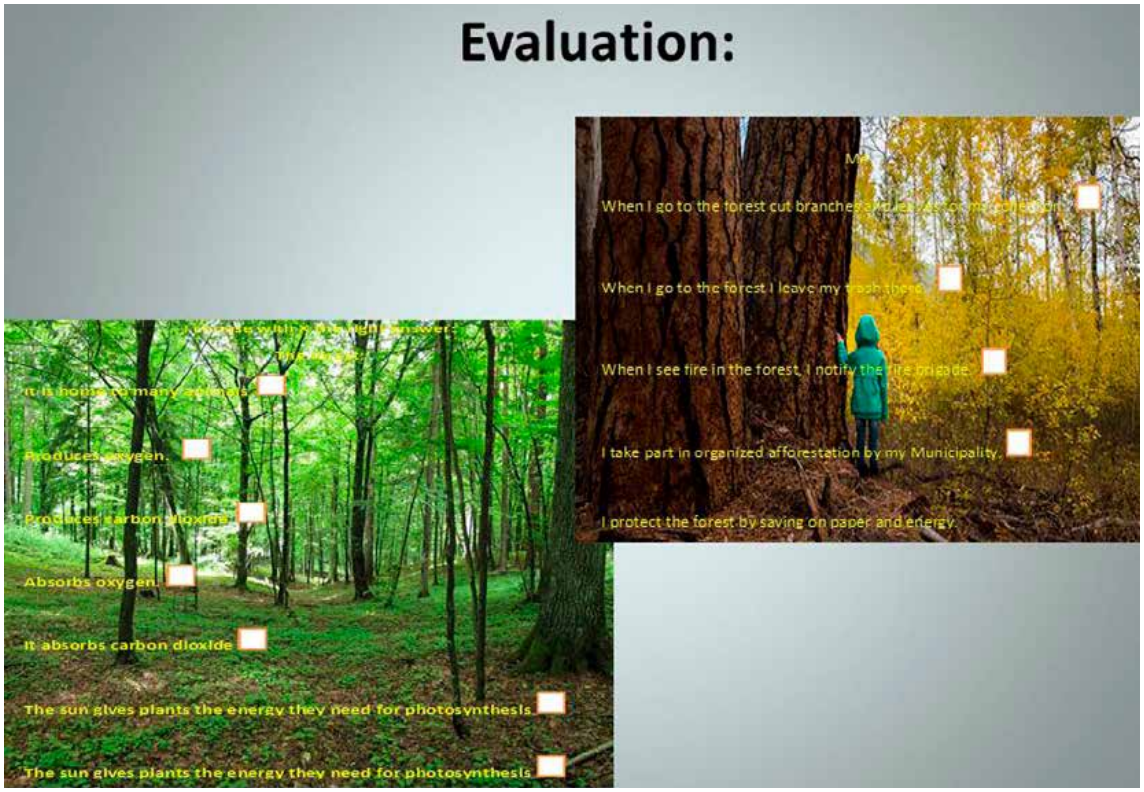


on the colour, they choose the appropriate card (red or green) from the columns and read the instructions written on it. If they get a positive (green) card, they give carbon from their pile, but if they take an aggravating (red) card, the team takes a new cluster of blocks representing carbon dioxide, from the central pile. The winner team is the one that first accomplishes to dispose of the carbons.

Evaluation:

Worksheet: A table of concepts with choices on what forests do and what I can do for the forest.

Notes:



A man consumes about 250 kg of oxygen per year.

A tree gives oxygen that 5 people need per year.

In every 10.000 sqm of forest there are about 500 trees.

10.000 m^2 of forests produce 4.000 kilos of oxygen per year

One-acre of forest binds from the atmosphere about 400 kilograms of carbon dioxide in one year and converts it –with photosynthesis– to about 400 kilos of oxygen, of which more than half (about 250 kilos) is free – as much oxygen as a person needs to consume per year.

EDUCATIONAL ACTIVITY TITLE

D.4 What I want to know about the forest

THEME: **Forests and CO_2 - Trees as carbon storage**

Country: **Greece**
Writers: **Tziatzia Angeliki**

Brief description of the activity: Children, looking at sources such as encyclopaedias, internet, books and magazines, discover the function of photosynthesis and its contribution to both carbon dioxide consumption and oxygen emission as well as the contribution of the forest ecosystem for climate change mitigation. With the assistance of the teacher they make a power point presentation.

The Goal:

- To develop and cultivate psychomotor skills.
- To recognize values, to discover ways of research and to experiment.
- To help children develop creative expression.
- To understand the interrelationships between the forest ecosystem and the humans,
- To experience the forest functions in general and especially those related to the consumption of carbon dioxide, and thus its contribution for climate change mitigation.

Time: six teaching hours for the preparation of presentation

Detailed description of the activity:

Students are divided into 4 groups of 6 people and collect information on the functions of the forest ecosystem, presenting them in plenary session. They decide what they will put in the presentation. They sit on the interactive board and computer and make the presentation, with the teacher's assistance. They include all the information related to the forest, photosynthesis, and human activities that burden the atmosphere with carbon dioxide. In the end, they make a code of conduct and integrate it.

Evaluation:

1. The evaluation takes place during a visit to the forest. There they should follow the code of conduct they described in their presentation. They also must describe the process of photosynthesis and the contribution of forests to climate change mitigation.
2. Worksheet: A table of concepts with choices on what forests do and what I can do for the forest.

Notes: "Forest the air-cleaner" presentation.

APPENDIX

A.1 – Forest Tales

EDUCATIONAL ACTIVITY TITLE

Forest tales

Country: **Romania**
Writers: **Arion Alina**, **Roșca Irina**

Brief description of the activity: After an outdoor activity, the students will create a story (a circle-writing).

Goals and objectives: Interdisciplinary approach Outdoor Education

Materials (if used): paper, pencils

Time: 45 minutes

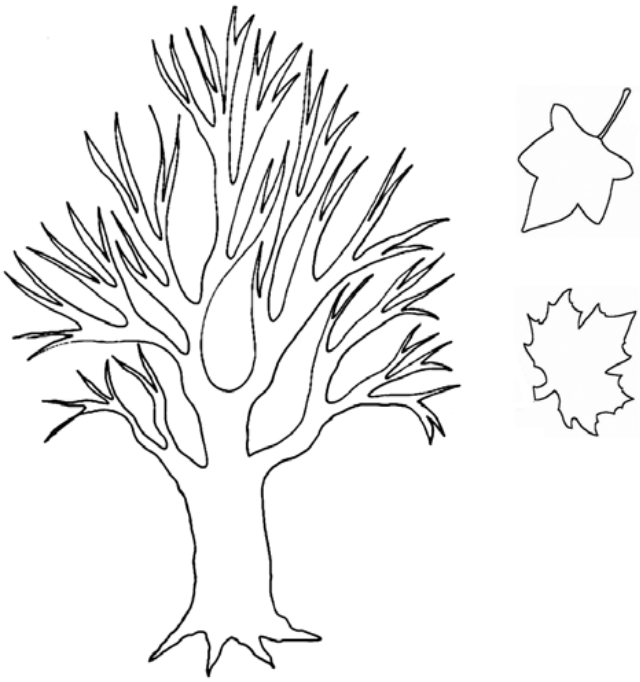
Detailed description

The teacher invites students to form groups of four to six people and sit together around a table. Each group will create a story on a topic established by the teacher, about plants/ trees/ animals/ birds, that should include details about what they have observed during the outdoor activity (a trip in a forest).

Circle-writing is a fun way to do creative writing with friends. The student who starts the activity has a short amount of time to write an introduction of the story. Once the time is up (3 minutes), each student passes the sheet of paper to the person on the right. The student is thus challenged to continue the story where his friend left off. The story will continue to be passed through the group until everyone gets at least two leaps. Eventually, the teacher reads the whole story.

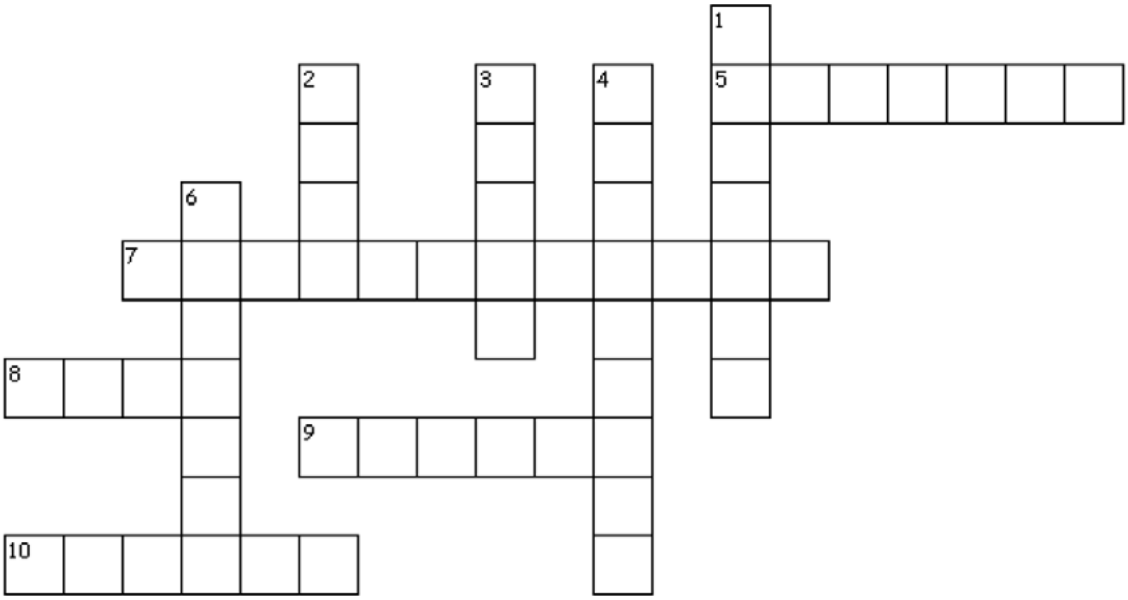
The students are supposed to recognize information gathered before during the already made outdoor activity

Evaluation: The teacher invites students to complete The Tree of Expectations with The Snapshot Wish



B.4 – Forest puzzle

A PUZZLE



Across

5. The natural environment of an animal or plant
7. The diversity of life forms on earth - species, genes, and ecosystems
8. A large furry mammal which prefers eating plants, honey and fish
9. A large area of land covered with trees and other plants where many animals live
10. Empty of living creatures, deserted and lonesome

Down

1. A place or facility that gives protection against weather or danger
2. Anything that contains nutrients and is eaten by living creatures in order to maintain life, health, and growth
3. A clear liquid that has no taste or odour and takes the form of rain, rivers, oceans, and lakes
4. A community of living things, together with their environment
6. To change habitat or location moving from one region into another

A KEY

BEAR
A large furry mammal which prefer eating plants, honey and fish
BIODIVERSITY
The diversity of life forms on earth - species, genes, and ecosystems
ECOSYSTEM
A community of living things, together with their environment
FOOD
Anything that contains nutrients and is eaten by living creatures in order to maintain life, health, and growth
FOREST
A large area of land covered with trees and other plants where many animals live
HABITAT
The natural environment of an animal or plant
LONELY
Empty of living creatures, deserted and lonesome
MIGRATE
To change habitat or location moving from one region into another
SHELTER
A place or facility that gives protection against weather or danger
WATER
A clear liquid that has no taste or odor and takes the form of rain, rivers, oceans, and lakes


(photo by N. Petrou)

D.3 – Forest and CO_2 - 21 green and red cards

You can cut out the cards in the following pages and use them in the activity D1 (page 41).

Congratulations!!! You protected your forest leaving behind you nothing but your footprints.
Give two carbons

Congratulations!!! You protect the forest by keeping it clean.
Give two carbons

You had carefully study with your team the forest and the living organisms that live in it !!! Well done!
Give a carbon.

You took part in the restoration of the urban forest !!! Well done!
Give two carbons

You took part in the tree planting action of your municipality.
Well done!!
Give three carbons.

You took part in the planting of the nearby mountain.
Congratulations!!!
Give three carbons.

You went a nice walk with friends in the forest and enjoyed the fresh air
and oxygen. Well done!!!
Give two carbons.

An educational visit with your class in the nearby forest
!!! Perfect!!!
Give two carbons

You went on a nice walk with your parents in the forest.
Perfect!!!
Give two carbons.

Thousands of trees were cut to become furniture ...
Take two carbon dioxide

The machine cut a lot of trees for the road to pass ...
Take two carbon dioxide

The machine cut thousands of trees to make paper ...
Take three carbon dioxide

The fire burned the entire forest.
Take five carbon dioxide

The forest was destroyed due to climate change
Take two carbon dioxide

The forest was cut for timber.
Take two carbon dioxide.

You waste energy unnecessarily by leaving the lights on.
Take two carbon dioxide

You used the car instead of public transport, bicycle or walking.
Take two carbon dioxide

You didn't change the lamps of your home with energy-saving lamps.
Take two carbon dioxide

You haven't install a solar water heater.
Take two carbon dioxide

You waste too much electricity by leaving electrical appliances on.
Take two carbon dioxide

You left the TV on standby around the clock and consumed energy.
Take two carbons dioxide

LEARNING
ABOUT
FORESTS

Προστασία της Φύσης
1951
ΕΛΛΗΝΙΚΗ ΕΤΑΙΡΙΑ ΠΡΟΣΤΑΣΙΑΣ ΤΗΣ ΦΥΣΗΣ

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