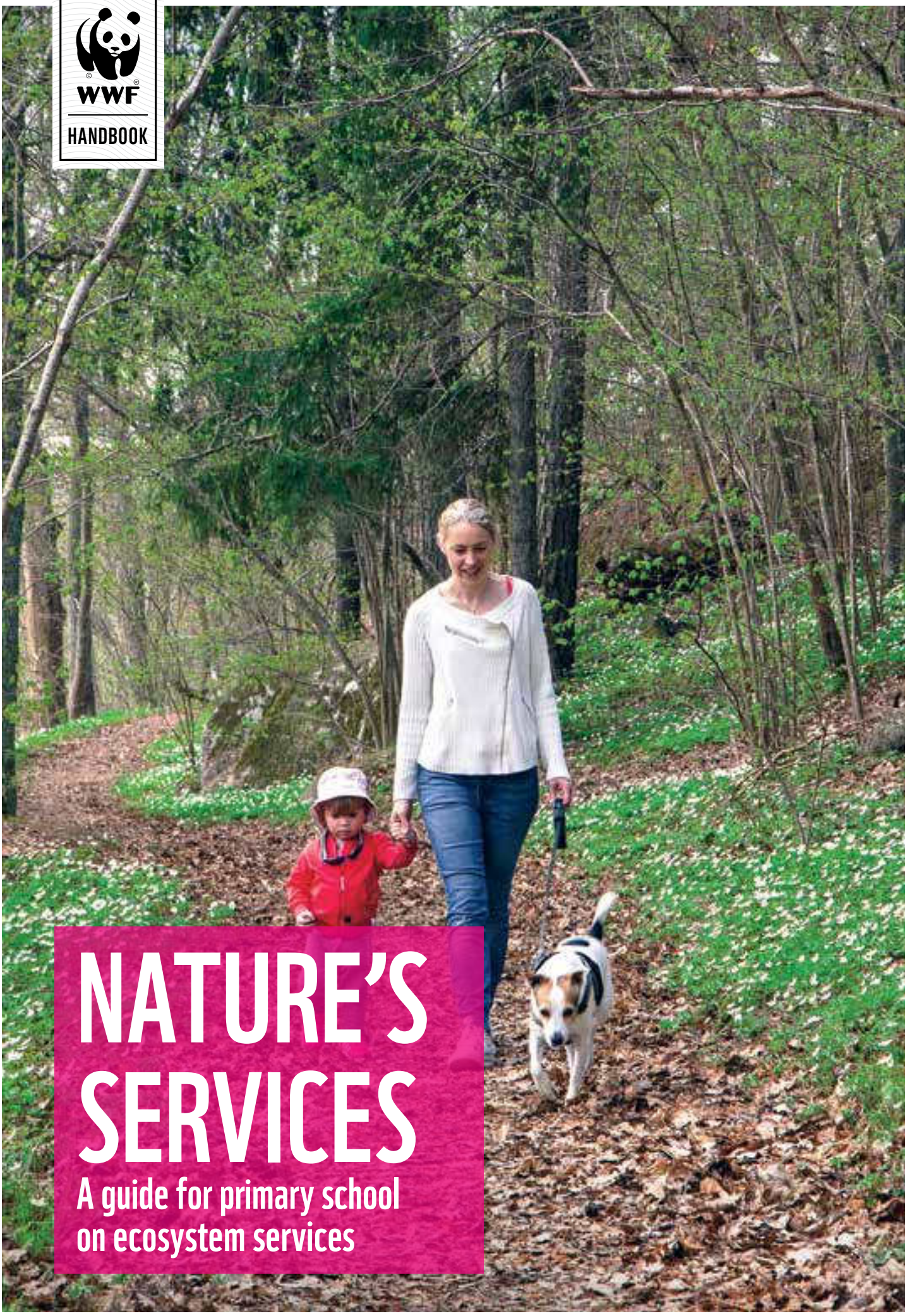
WWF

HANDBOOK



NATURE'S SERVICES

A guide for primary school on ecosystem services

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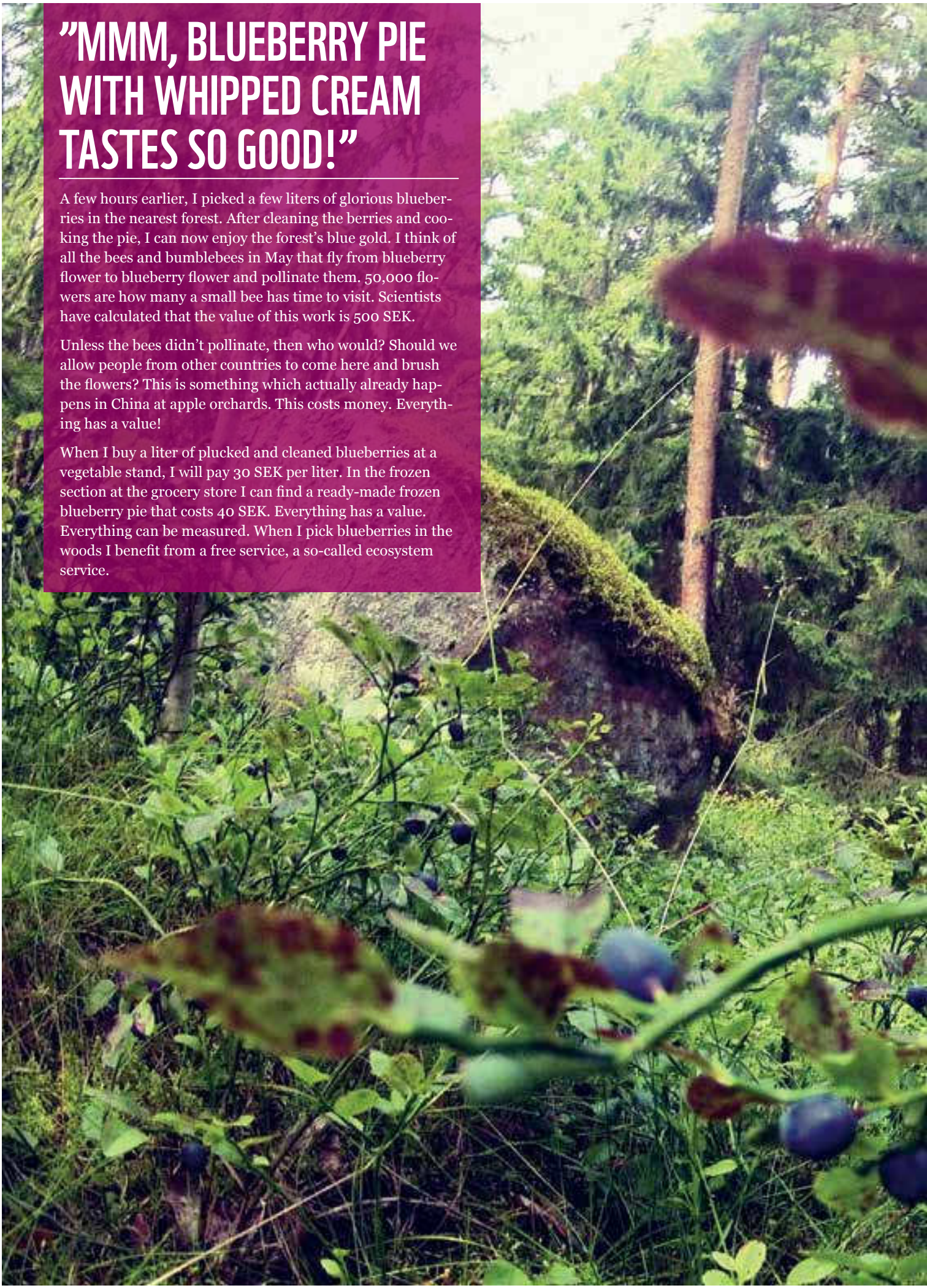
”MMM, BLUEBERRY PIE WITH WHIPPED CREAM TASTES SO GOOD!”

A few hours earlier, I picked a few liters of glorious blueberries in the nearest forest. After cleaning the berries and cooking the pie, I can now enjoy the forest’s blue gold. I think of all the bees and bumblebees in May that fly from blueberry flower to blueberry flower and pollinate them. 50,000 flowers are how many a small bee has time to visit. Scientists have calculated that the value of this work is 500 SEK.

Unless the bees didn’t pollinate, then who would? Should we allow people from other countries to come here and brush the flowers? This is something which actually already happens in China at apple orchards. This costs money. Everything has a value!

When I buy a liter of plucked and cleaned blueberries at a vegetable stand, I will pay 30 SEK per liter. In the frozen section at the grocery store I can find a ready-made frozen blueberry pie that costs 40 SEK. Everything has a value. Everything can be measured. When I pick blueberries in the woods I benefit from a free service, a so-called ecosystem service.



NATURE'S SERVICES

Ecosystem services are the functions of the ecosystem that in some way benefit mankind. The services we receive are ”free” from nature such as wild fish, pollinating insects, water, natural pesticides and fertile soil. Plants, animals and micro-organisms perform a myriad of tasks that we depend on for our survival and prosperity. Many of these so-called ecosystem services are impossible to replace with technology.

Ecosystem services purify air and water, mitigate flooding, help with water and food, and protect biodiversity. They also reduce noise, improve people's physical and mental well-being, regulate the local climate, absorb carbon and provide renewable energy.

NATURE'S SERVICES

- a working paper on ecosystem services

A. About the material - Nature's services

Vital!

Snow flying outside the window. I enjoy the white winter landscape.
It feels good to stand here and look out over the snow-covered trees.
Stress also drains out of me.
Take a deep breath of the fresh air.

Place a log into the open fireplace.
It burns. The heat spreads.
Think for a moment:
Where does all the heat come from that spreads when I light a fire?

Stored solar energy. The green plants, the world's largest solar collectors.
Photosynthesis of course. Carbon dioxide from the air is converted to carbohydrates.
Each chemical bond is a piece of stored solar energy, transported 150 million kilometers at a dizzying speed of 300,000 miles per second.
How in the world can that work?
How many carbon dioxide molecules are stored by a tree in a year?

Serve meatballs and mashed potatoes on a plate. Put on the lingonberry jam. The potatoes grew well in the summer. Compost helped.
Pour a glass of apple juice and wonder where the bumblebees and bees are now. I'm grateful to all who have made sure that I have food.

Why should we care about ecosystem services?

In our daily lives we use a variety of goods, services and experiences that nature offers us, and that we take for granted that they exist. Lots of living organisms' 'silent work' and interaction provides us with an amazing and complex machinery of food, water, clean air, energy, clothing, housing and medicine, as well as cultural and aesthetic experiences. Everything that is vital for us humans to live on planet Earth.

MAKE THE INVISIBLE VISIBLE!

Much of these vital factors are invisible to our eyes, and therefore relatively unknown and poorly appreciated, even though we are completely dependent on their existence and functioning. Biodiversity and the services that ecosystems provide are too poorly protected in our society's physical and economic planning. What one is not aware of one does not care about.

The purpose of Nature's services is to make the invisible visible in an enjoyable and engaging way. By arousing curiosity and a desire to discover the diversity of nature and the value of functioning ecosystems provides the material knowledge and insights that are essential in promoting sustainable development.

Nature's services will help the younger generation to understand the benefits we gain from ecosystem services, but equally the joy and pleasure they can give us if we treat them with knowledge, respect and wisdom.

What does the curriculum say?

According to the Lgr 11 curriculum, the school's teachers and students from grades 4-9 are to work with the key concepts of ecosystem services and sustainable development. Ecosystem services are described as a central concept in biology. For grades 4-6 under the heading "Nature and Society", there are examples such as decomposition, pollination and purification of water and air. For grades 7-9, Lgr11 talks about photosynthesis and combustion (energy flows and matter's cycles).

In comments for the curriculum in biology, both producing (such as food and raw materials) and supporting services (such as water and circulation of nutrients) are mentioned. There is also talk of regulatory services (such as pollination of plants and water purification). The cultural ecosystem services (such as recreation and nature experiences) are linked to sustainable development and ecosystem management.

Who should use this material?

Naturens tjänster vänder sig till pedagoger i grundskolan och elever i åldern 10 – 15 år.

Enjoyable learning with focus on the student

By assuming a holistic view of nature and ecosystems, the material wants to contribute to an overall understanding of ecosystem services and how we, through different choices, affect the ability of ecosystems to provide these services.

The material's content is designed with the goal of creating awareness and understanding of how nature's free services provide us humans with things we can use. It also stimulates discussion about what are important needs in life. The concept of ecosystem services is presented by:

- brief and explanatory factual texts
- ecosystem service cards, or so-called E-cards
- exercises/tasks

"Children whose view of nature is based on a philosophical and emotional connection with the environment are much more likely to make sacrifices and to strive to 'save nature' than those who lack this outlook."

Nils Holgaard Sørensen, Copenhagen

The tasks are meant to arouse student curiosity and their desire to explore the complex relationships via a creative and investigative approach. The exercises will lead to insight and reflection and provide a basis for learning and tools for own actions. The tasks include both individual and group-adapted tasks and they are different in scope and difficulty level. More tasks are suitable to use one after the other and in many interacting subjects. Different experiences are an asset!

It is also important to ensure that workflows are carried out with a democratic tone. Recording of the learning moments is a way to deepen their learning and consider life from different perspectives. We believe that dialogue leads one further than discussion.

It is hoped that the material, in an enjoyable manner, motivates students and teachers to make conscious choices that increase the capacity of ecosystems to provide us with these free services. Nature's services want to contribute to a learning process in which students learn with educators about how to protect nature for the mutual benefit of all of us – who are in turn a part of it.

Learning with all senses

Work with all your senses! To fully gain insights into how nature works also requires a commitment on a different plane than absorbing the purely factual. We learn more effectively when we use multiple senses simultaneously. If we actively bring in colours and shapes, sounds, music, movements, we gain emotional experiences and insights that enhance and deepen learning. A study in the 1990s at the Danish Teacher's College showed that children who have a view of nature that is based on a philosophical/emotional relationship with nature are much more likely to make sacrifices and efforts to "save the environment" than those who have a different view of nature. (Source: Nils Holgaard Sørensen, Copenhagen). The feeling of well-being that arises in people who spend time in nature is an important ecosystem service itself.

B. What are ecosystem services?

"Ecosystem services is a rather complicated term that points to a very simple truth. That mankind is dependent on nature and the services it provides."

Lena Ek, ministry of the environment

Ecosystem services are what nature produces without the help of humans, yet that humans benefit from, and often completely for free too! The concept includes items such as food and water, and services such as pollination and climate regulation, but it is also about human well-being. How we feel depends on ecosystem organisms, processes and functions.

This educational material on ecosystem services has been named Nature's services. The concept of ecosystem services can be regarded here as an educational tool to better understand the values we humans gain from nature and incorporate this knowledge into our consciousness as an important part when we purchase and act for a long-term and sustainable society.

From small to large - how is it all tied together?

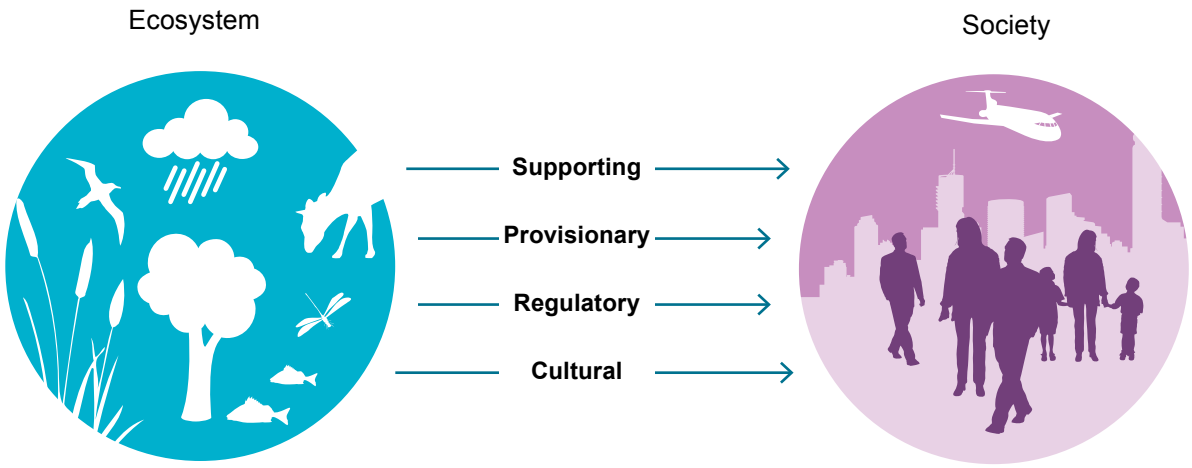
To try to understand the concept of ecosystem services, we need to put it in a context where a "system" can be described at different levels. A cell is one level, an organism is another. Organisms build up ecosystems that in turn create a biosphere consisting of a variety of ecosystems that interact with each other and exchange services. In each level, processes are developed that combine forces to create a working system at that particular level. All systems strive to evolve and stay alive. Each level also contributes so that the entire system in turn is a part and can develop. Everything is connected.

Invisible or visible services

The ecosystem and biodiversity provide services to us humans which are often not visible to the naked eye. Services may consist of insect pollination of crops and orchards, water in sandy ridges or storage of carbon in green plants. We humans are both affected by and affect ecosystems. A negative effect occurs through over-use and extensive changes in the use of land and water. Emissions of pollutants, fertilizers, climate change, acidification, introduction of foreign species, and a growing population's needs means that we are approaching the limits of what the ecosystem can deliver.

The flow from nature to the human

There is a flow of services from ecosystem to society.



THE MORE TOOLS YOU HAVE AND THE GREATER YOUR EXPERTISE AND ABILITY TO USE THEM, THE BETTER ECOSYSTEM SERVICES ARE SERVED

Biodiversity is important for the functioning of ecosystem services

Ecosystems with high biodiversity may perhaps be compared with the skill that an accomplished professional displays. The more tools, the more experience and knowledge to use them to get the job done – and thus the better the services will be that are carried out.

Nothing is lost, everything is spread and nature produces no waste.

Cycle

Both in the more limited ecosystems and in the enormous system that is planet Earth, everything is done in cycles. In addition, all living processes run on energy and different types of raw materials. This means that living systems are interconnected processes where products, services and waste from different species or systems always constitute important resources for others. Resources and waste products must be part of a continuous cycle for the systems to work long-term.

Ecosystem services distribution

In research, ecosystem services have been divided into different categories depending on how they affect us humans. Below is a selection that is also found on the e-cards (look at page 87)

SUPPORTING SERVICES

”Supporting services” are called the services from the ecosystems that help other processes in nature to work. They are essential for life on Earth.

Supporting services are:

- Photosynthesis
- Soil Formation
- Nutrition in nature
- The water cycle
- Habitats for different species
- Biodiversity

PROVISIONARY SERVICES

Provisionary services are nature’s services that we humans can directly use and need to survive - such as food and water. There is often a viable market that exists in which goods are bought and sold.

The provisionary services are:

- Drinking water
- Food
- Fuel
- Medicine and health resources
- Raw materials

REGULATORY SERVICES

Regulatory services are the natural services that allow nature to resists or fix temporary problems and also protect humans from some difficulties.

The regulatory services are:

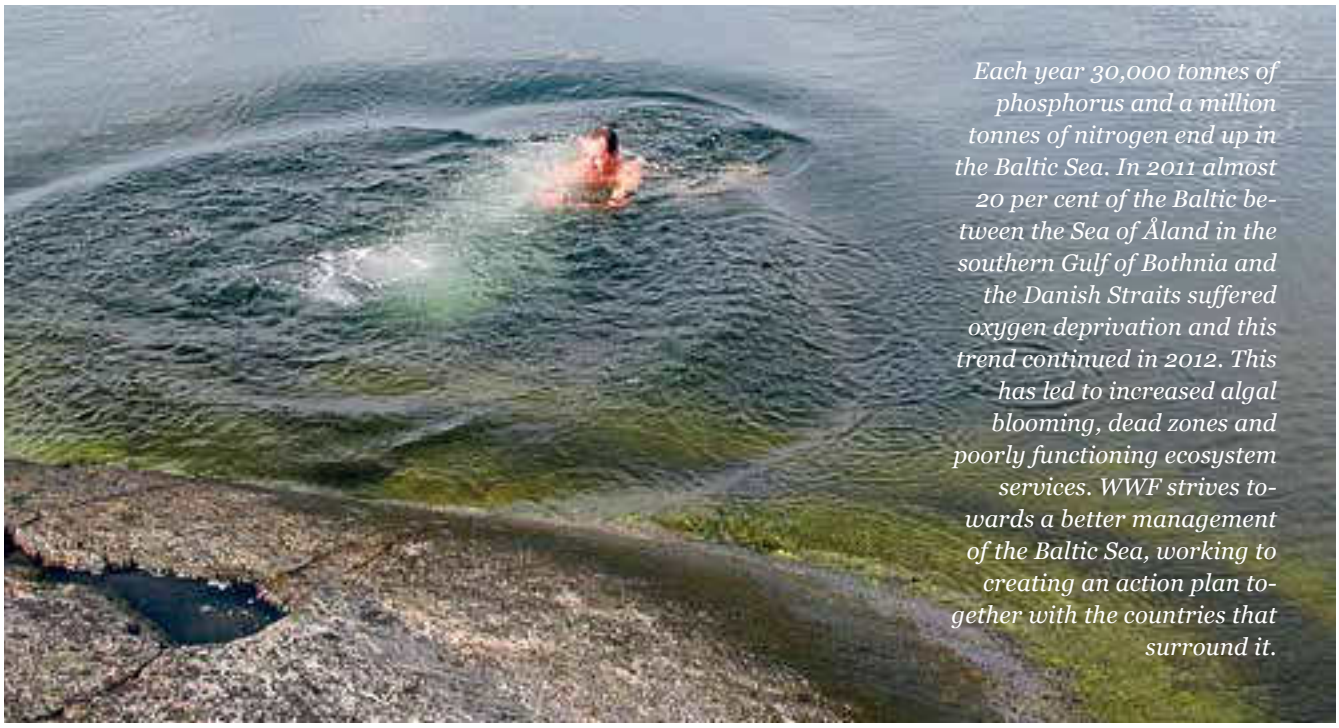
- Control of erosion
- Water purification
- Protection against disease
- Protection against pests
- Protection against natural disasters
- Better climate
- Purification of the air
- Polination

CULTURAL SERVICES

Cultural services are that in nature which makes us humans glad, happy and give meaning to life. Culture is about lifestyle and wellness.

We have chosen to divide cultural services as follows:

- Beauty and spiritual values
- Outdoors and tourism
- Nature inspires and provides knowledge
- Health and relaxation



Each year 30,000 tonnes of phosphorus and a million tonnes of nitrogen end up in the Baltic Sea. In 2011 almost 20 per cent of the Baltic between the Sea of Åland in the southern Gulf of Bothnia and the Danish Straits suffered oxygen deprivation and this trend continued in 2012. This has led to increased algal blooming, dead zones and poorly functioning ecosystem services. WWF strives towards a better management of the Baltic Sea, working to creating an action plan together with the countries that surround it.

Threats to ecosystem services

Various human activities threaten and affect ecosystems in many ways.
A few examples:

- Landscape and ecosystem changes as we build cities on farmland or when we cut down entire forests in search of timber and fuel.
- Too large resource extraction due to poverty, ignorance or short-term gain, for example, when we catch too much fish from the sea.
- Pollution, both wastes and toxins in general, in particular make it harder for organisms to survive. Example: when emissions of petrol and boat underside paints in marinas make it impossible for mussels to survive and thus is lost the ecosystem service of water purification.
- As we move species between different ecosystems, they can crowd out other important species and completely take over an ecosystem. Example: bamboo in the rainforest or the great oyster in Bohuslän.
- Climate change stresses many ecosystems and makes them less effective. Examples: coral reefs are dying and desertification.

Putting value on nature

Ecosystems and the services they produce have been around and harnessed interactively by a variety of species long before humans. But it is based on human need of ”a good life” and the risk that our over-exploitation will reduce the benefits we depend on as we start valuing ecosystems in a more conscious way. In order for an ecosystem service to deliver a benefit, it requires a functioning ecosystem where there are living organisms that have a positive living environment for them.

ECOSYSTEM SERVICES ARE UNDERVALUED ALMOST ALWAYS IN DECISION-MAKING

Because ecosystem services are considered as public goods for which economists find it difficult to set realistic values, they are undervalued almost always in decision-making processes. In modern society, the emergence of human ecosystem management had the sole purpose of maximising the benefits that can be sold in a market, such as food or timber. This has led to important ecosystem services being reduced or entire ecosystems having been lost. Yet economic systems depend on social and ecological systems, and nature’s full value is not easy to clarify in a market.

What is a tree really worth? Putting a price tag on a tree leads to a more profound understanding and impels us to act faster.

The purpose of the valuation of ecosystem services is not to put price tags on nature so that someone can make money from it, yet it is because we can better understand how dependent we are on nature's complex functions and processes and how expensive and difficult it would be to replace them otherwise. When we see a price tag, we can then understand and can act faster. Then we can make better decisions about how we plan our society and our lives and embrace wiser economic priorities.

Riksbyggen, a cooperative organisation of building trade unions and housing associations, and the consulting firm Sweco have jointly developed a method for determining how ecosystem services can be preserved and enhanced in new housing developments.

To evaluate the ecosystem services economically, one must know:

1. How much the ecosystem produces of the service - such as tonnage purification or number of persons using an ecosystem for recreation
2. The value per unit of the service, for example, how much tonnage of nitrogen a wetland cleanses and what it would cost to clean it otherwise, or how much people appreciate the value of being in nature

The theory is simple, but in practice it is enormously difficult. A few examples:

- Nature's services from all of the world's ecosystems are worth about 38 trillion U.S. dollars per year. 24 trillion comes from the oceans and 14 from land ecosystems. By comparison, the entire global GDP in 1997 was also 38 trillion (one trillion = one million millions, a one followed by 18 zeros). Source: Costanza et al, 1997, Nature
- Pollination of the earth is considered to be worth 200 billion U.S. dollars per year. That's what it would cost if we were to try to pollinate all the crops by hand or bring up domestic bees to replace all wild pollinators.
- The global economy is losing more money because of forests disappearing than from the global banking crisis. Forest for the value corresponding to 14,000 – 35,000 billion SEK is lost every year through human mismanagement of ecosystems. Source: TEEB - The Economics of Ecosystems and Biodiversity
- 35,000 SEK per pair of jay birds is the value of the service when jays hide the acorns in the ground. Some are never found and grow up instead to be new oak trees. Source: Beijerinstitutet in Stockholm, Cajsa Hougner..
- China has invested heavily around the river Yang-tse to plant a variety of trees to protect against flooding and soil erosion. Source: Gretchen Daily, professor of environmental sciences at Stanford University in San Francisco.
- A honey pot that is bought for 50 SEK is probably really worth 5,000 SEK as the bees have visited thousands of flowers and then brought home the nectar to produce honey, a considerable effort. Source: MittBi

China has invested heavily in the area around the Yangtze River, planting an assortment of trees to shield against flooding and soil erosion.Source: Gretchen Daily, Professor of Environmental Science, Stanford University, San Francisco.

Today, many people believe that natural resources are free. But if clean air and pollination are monetised awareness of the value of nature is heightened. This may impact calculations and budgets and as a consequence affect priorities and behaviours.

Stockholm has protected a large contiguous green space in the heart of the city by giving it status of a national urban park.

Auckland has developed a model for eco-friendly urban planning where greenways shield against flooding and increase biodiversity.

Chicago has become a leader in green roofs and is planning 6000 installations by 2020.

Research on ecosystem services and their value

Influencing nature too much gets expensive in the long run. Ecologists and scientists for 40 years have noted that natural resources for human survival decrease when ecosystems are exploited too much and it will be expensive to replace nature's free services if they are destroyed. Society has, however, difficulty in valuing nature's services in relation to the traditional economic system. The concept of ecosystem services has been created to try to measure and evaluate the benefits of nature's free services and many researchers are currently working on this globally important issue.

- In the UN's Millennium Ecosystem Assessment, scientists are working from 95 countries, including Sweden, on the largest study ever on the state of global ecosystems and their impact on society and the economy. The reports show that the state of ecosystems and their ability to produce ecosystem services has become increasingly worse over the past 50 years. More than 60 percent of all ecosystem services are used too much. The negative trend can be reversed by better understanding and wise management of the common resources. Link
- Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) is a UN entity with the task of calculating the value of biodiversity in ethical, social and economic terms. Link
- The Economics of Ecosystems and Biodiversity (TEEB) is a large study with about 200 economists and ecologists from 26 countries analysing the increasing costs to society due to the loss of ecosystems and biodiversity. Link

What can we do?

Actually there is only one answer; appreciate the value of nature and avoid disturbing or destroying the natural ecosystem services that have evolved through millions or billions of years. We must imitate nature's way of taking care of itself. This insight can also give us a sense and understanding of how people, through all ecosystem services, are linked with nature right down to the level of our cells.

How can we support ecosystem services?

1. reduce the population growth
2. reduce the consumption of goods
3. efficient and environmentally sound protection

These three solutions are easy to say but very difficult to implement. We can all ask ourselves: What can I do?

A couple of examples: In order to help ourselves to get more out of ecosystem services, we can work to increase soil fertility – by supplying nutrients in the right place and in the right quantity to ensure that the ground is full of life, air and enough water. These are some of the challenges of farmers.

We who do not farm for a living can help by thinking about how we consume, that is, how the products we buy affect nature, diversity and its benefits, or how and where we leave our waste.

C. About the work of students

For the actual work, the material contains XX exercises and XX facts cards (E-Cards) that guide students in the work and help them as the work goes on to catch up and understand how events and relationships create a whole.

E-cards

Each card presents an ecosystem service overview, how it contributes and how it works. They act like a deck of cards with four different ”families”; Supporting, Provisionary, Regulatory and Culture - which the different ecosystem services are sorted into. The division follows the structure proposed by various scientific publications and is a way to give structure to our understanding of ecosystem services. In reality, services are closely interdependent and interconnected with each other.

The cards are a tool with which to solve tasks. Usage is flexible and based on the knowledge level the students have. In working with the cards, dialogue and explanation models arise. You as a teacher will surely find other ways to use them.

Tasks

The tasks can be introduced/run by teachers or used as stand-alone material of the students depending on the group’s abilities and knowledge.

The tasks have different scopes and severities. Here the teacher may need to be available during the task with the students to evaluate the work and balance the instructor-led and individual workflows.

The tasks primarily follow a common structure, and conclude with a summary report proposal.

Education for sustainable development

WWF’s vision surrounding education for sustainable development is about developing students’ action competencies for a sustainable society. This means to develop knowledge and skills for sustainable development - to be motivated and to see and seize the opportunities to act. Ecosystem services are an important concept in this context.

CAPTURE NATURE'S SERVICES

Nature is full of so-called free services but they are often invisible to the eye. You have to wear the right glasses and discover the work of bumblebees, the water cycle and the decomposition of leaves.

CAPTURE NATURE'S SERVICES

Objectives of the work

Learning the new concept of ecosystem services and how it can be categorised, and discover some ecosystem services in nature.

Purpose

To be curious about ecosystem services and motivated to learn more about them.

Description of the task and preparation

This is an initial inspirational exercise.

Workflow

1. Memory

Copy E-cards as duplicates and use them as a memory game.

2. Group

The teacher goes through the various ecosystem services based on the E-cards. Write the four categories on the board: supporting, provisionary, regulatory, cultural. Then place the E-cards under each heading.

3. Play

Be outdoors. Stand in a large circle. All participants have their own E-cards. The teacher describes an ecosystem service using an E-card. When some participants feel that they have a card that corresponds to the teacher's description, they then run one round counter-clockwise. The one who comes back to their place first gets to talk about their E-card. If it corresponds correctly to what the teacher described, then the student gets to take two steps forward.

4. What do I need?

Be outdoors. Ask the question "What do I need to live a good life?"

Students will probably respond saying things like food, water, music, love, siblings, school, mobile phone ... e.g. both primary and secondary needs.

5. Are my needs in nature?

Be outdoors. Students walk around for five minutes and look for things that can satisfy the needs of the students in the previous task. Pick a pair of natural objects that show this. For example: a leaf for oxygen and sorrel for food.

6. Are ecosystem services in nature?

Be outdoors. Use the E-cards. Students work best in pairs of two. They get two E-cards per group. They go around looking for concrete examples in reality of the E-cards' ecosystem services.

7. Photograph ecosystem services

Be outdoors. Use an appropriate camera phone or digital camera.

Go for a walk in nature with eyes on the lookout. Look for ecosystem services that can be photographed. See example on page 18.

8. Put a price tag on nature

As a closing task they can try to evaluate a walk in nature in terms of money. If we had to pay an entrance fee to take advantage of all ecosystem services, what would you want to pay then? Motivate your answer.

Evaluate the work:

- How did it go?
- Was it a fun/interesting task?
- Did you realise something that you didn't know already about you and nature?
- What did you learn? Is it is an important piece of knowledge?

Ecosystem services - a day in February

These nine ecosystem services was photographed a day in Februari

Impression: In the snow you see the wing imprint of a magpie.
Ecosystem service: habitats for species and biodiversity.

Gnawing: A hare has gnawed at a rowan tree and found food.
Ecosystem service: habitats for species and biodiversity.

Blackbird: It makes me happy hearing their song.
Ecosystem service: beauty value and biodiversity.

Water: Open water by the lake.
Ecosystem service: water purification.

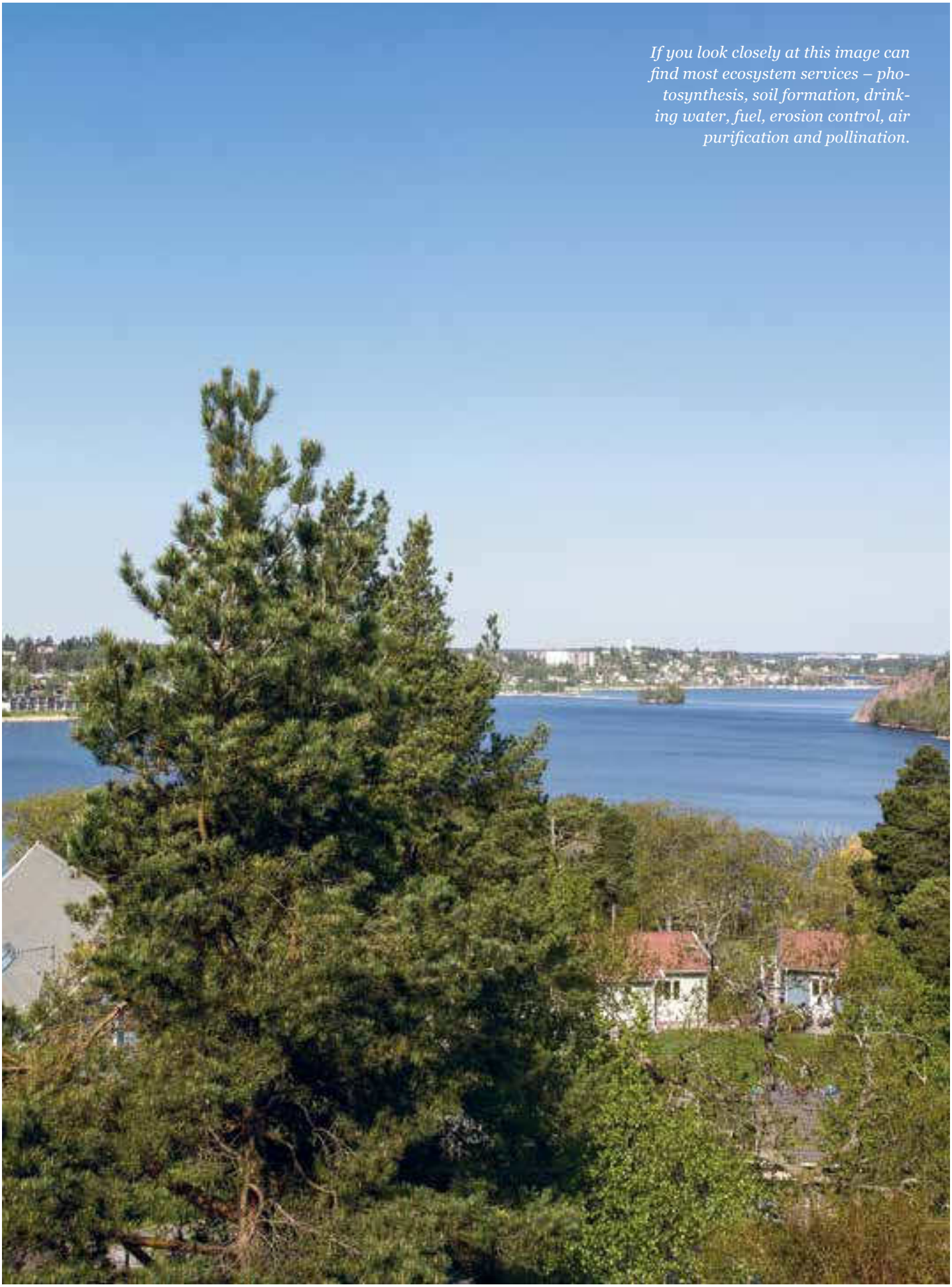
Human: The warm February sun is wonderful.
Ecosystem service: spiritual values.

Moss: It is soft and beautiful.
Ecosystem service: beauty value and biodiversity.

Reed: The reeds contain seeds that birds like to eat.
Ecosystem service: habitats for species and biodiversity.

Pine: It maybe produces a little oxygen and contains beneficial vitamin C.
Ecosystem service: photosynthesis, medicine and biodiversity.

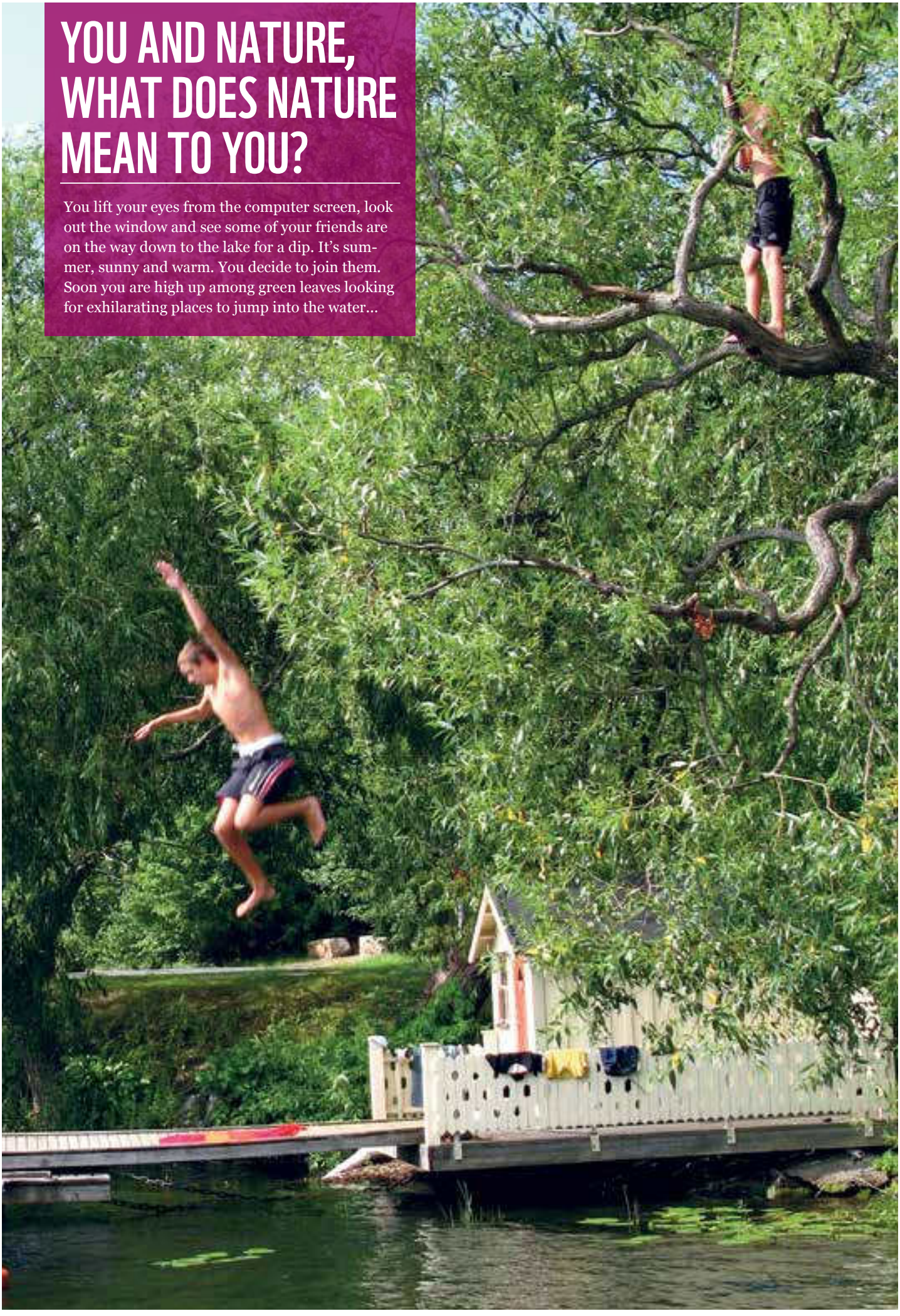
Deer tracks: Think that there was a deer during the night that crossed over this plot of land.
Ecosystem service: Biodiversity.



View: The view is beautiful. It makes me happy. The view raises the value of the houses. **Ecosystem service:** beauty value.

YOU AND NATURE, WHAT DOES NATURE MEAN TO YOU?

You lift your eyes from the computer screen, look out the window and see some of your friends are on the way down to the lake for a dip. It's summer, sunny and warm. You decide to join them. Soon you are high up among green leaves looking for exhilarating places to jump into the water...



YOU AND NATURE, WHAT DOES NATURE MEAN TO YOU?

Objectives of the work

Develop insights and knowledge about nature's values and ecosystem services.

Purpose

"The scent of hawthorn hangs heavy in the air and you are filled with that feeling of being free."

To gain an insight into the nature's values for an individual based on their own experiences of nature, to get to know some ecosystem services, and via words and/or images, express their own experience and feelings towards nature.

Description of the task and preparation

The task is based on your own reflections - expressing them in words or pictures and to discuss them in groups. In this way one becomes aware of one's own relationship with nature and what one uses nature for.

The task can be performed in three different ways, with option C requiring a little more.

1. Begin the work by gathering materials:
   Drawing and writing paper
   Paints, pencils, crayons, charcoal pens and brushes
   E-cards, one deck of cards per group.
2. Form good-sized groups – not too big, not too small.
3. Ideally go outdoors in nature to optimise closeness to nature.
4. Pick one natural object that you like and that means something to you completely.
5. Discuss: What do you mean by the term "natural." Where is nature in your close surroundings? Are there different kinds of nature? What nature does the group want to discuss?

"Nature is enormous important otherwise I would not live. Otherwise I would not be able to write this."

Louise 9 years.

Workflow

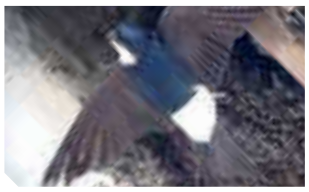
Paragraphs 1-4 below are preparations for a summary/illustration or text in paragraphs 5-6. Example: In paragraph 5, you can read on three pieces of paper – fish, play and swim. On three others can be read – produces food, provides air, induces a feeling of wellbeing. A person fishing might be used to represent this.

Option A

1. The teacher asks the question What does nature mean to you?
   Students reflect and document the answer in their own way in writing and/or pictures. A way to do this can be that each student chooses a natural object which will be the foundation for the discussion.
2. Lead a discussion about students' reflections and their various ways of reflecting on nature.
3. Bring up in the discussion about whether nature is good for us humans and in which ways.
4. Let the students gather into groups. Introduce E-cards with ecosystem services and explain them. Distribute the cards so that each group gets a few each. Let students share their experiences and knowledge about their own experiences of each ecosystem service.









Option B

Hand out slips of paper in postcard size to everyone. Five slips per person.

1. Ask the question: *What can one do in nature?*
   Ask everyone to write as many things they can think of. Write one word on each slip.
2. Give one or more examples to trace their thoughts: *Picnics, barbecues, walking, speed walking with poles, running, orienteering, skiing, skating, mountain biking, canoeing/ kayaking, horseback riding, building shelters, camping, picking berries, mushrooms, picking flowers, fishing, hunting, hiking, mountain trekking, bird watching, nature studies, photography, swimming, climbing, hide and seek, playing role-playing games, lying on your back, meditating, just being…*
3. Gather and put all slips in one place. Sort the slips in piles with similar content.
4. Hand out five new slips to each person.
   Ask the question: *What is nature good for?* Ask everyone to write as many things as they can. Write each word in a different colour on each slip.
5. Gather and put all slips in another place and sort them in piles with similar content.
6. Ask the question: *What does nature mean to you?*
   Let everyone now choose three slips from each pile which describes something that nature means to them.
7. Hand out paper to write, draw or paint on. Make sure that they all have a place where they can work without interruption. Have paints, pens, pencils, crayons, charcoal pencils or brushes at hand. Everyone writes, draws and paints on their own reflecting their answer to the questions *What does nature mean to you?*

Option C

1. Choose an animal and a plant that you like. Find it in nature, find it in a book, draw it or tell about it verbally.
2. Present it in a group or in front of the whole class and explain why you like them.
3. Everyone in the group/class thinks together about one or more ecosystem services that are connected to that particular animal or plant that is presented. Use the E-cards to help.

Some examples

- *reindeer - meat and leather*
- *oak - furniture and wooden floors*
- *blueberries - jam, juice, pie*
- *maple - shade, shelter from wind*
- *meadowsweet - headache medicine*
- *dragonfly - beauty, experiences*
- *house martin - mosquito eater, beauty, experiences*
- *hedgehog - snakeeater, creates a pleasant environment*
- *spruce - firewood, Christmas tree, experience, shade, shelter from wind*

Summary report proposal

The summary report proposal is adapted to the task that students worked with - A, B or C.

Option A

1. Make an exhibition with the drawings.
2. For older students, hand out E-cards to each student. Students go around in pairs and look at the exhibition and place the cards where think they are suited best.
3. For younger students, the teacher goes through the cards with them (or a selection of them) one by one with students. Then discuss together if anyone has described the service.

Option B

1. Tape the slips, or a selection of them, up on the wall.
2. Discuss together why nature is important and what value it has for us humans

Option C

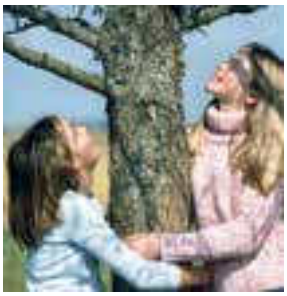
1. Make a simple exhibition: tape up pictures on the wall of some selected animals and plants. Make a list of the ecosystem services that come into question. Set up the list next to the animals and plants. Connect the animal/plant and service with a piece of string and needles.
2. Discuss how it looks. Is there a service that connects to many animals and plants? Is there any animal or plant associated with multiple services?

Evaluate the work:

- How did the work go?
- Was it a fun/interesting task?
- Did you realise something that you didn't know already about you and nature?
- What did you learn? Is it an important piece of knowledge?

"I get various things from nature. You get oxygen from trees and shrubs. Otherwise I don't know."

Ida 10 years



"The forest, the solitude and tranquility is always protected and comforts me when I felt bad. Nature is a safe hug that is just there."

Emma 18 years

"In the woods I find a down to earth presence that gives me extra energy in the grey everyday life. At the same time, I realise how important it is to protect our natural heritage even though I'm bad at taking initiatives."

Jonni 18 years

"A big lovely playground."

Karl 10 years

"Nature has no requirements, it just is, and I enjoy its existence."

Robert 19 years

"When I go on winding forest paths and hear the water murmur in any stream, I get the feeling that one belongs here instead of in crowded city streets with exhaust fumes and noise."

Girl 12 years

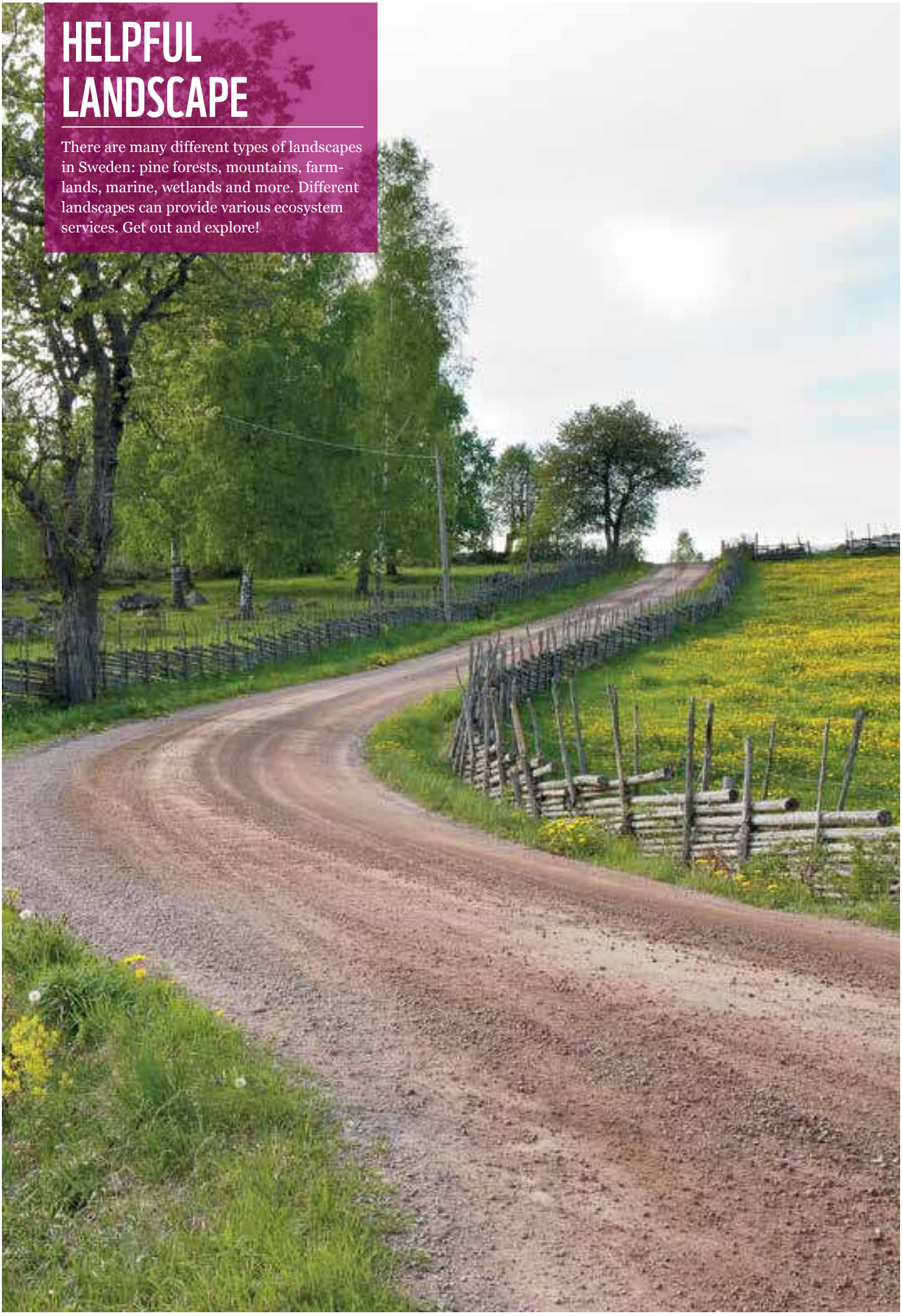
"Finally, the horses came. I jumped up on Appis' back and threw myself on her neck. There I sat in just a nightgown but I was not alone.

Appis and I rode through the gate. We rode down the road, through the woods and on the trail up to the pond. I hopped off to sit down by a tree and looked out over the pond's shiny water. The sun was shining at its highest point in the day. I was not alone. I had all of nature to comfort me."

Girl 12 years

HELPFUL LANDSCAPE

There are many different types of landscapes in Sweden: pine forests, mountains, farmlands, marine, wetlands and more. Different landscapes can provide various ecosystem services. Get out and explore!



HELPFUL LANDSCAPE

Objectives of the work

To develop the ability to see different values in a landscape such as biodiversity and ecosystem services.

Purpose

To see and understand the similarities and differences in different habitats and landscapes, linking the concept of ecosystem services with the landscape and to begin to realise how the planning of communities affects the landscape's ability to deliver ecosystem services.

Task 1: Reality in pictures

Description of the task and preparation

Using different pictures of different landscapes and habitats, try to find the different ecosystem services provided by different habitats. Use the E-cards (ecosystem services cards) to help identify the different ecosystem services. It is advisable to have images both from your community, from other parts of Sweden, as well as the rest of the world. It is also important to have images on both landscapes with rich biodiversity and pictures of monocultures or heavily impacted landscapes. The following needs to be prepared:

- Divide the class into groups of 4
- Pictures of different landscapes (printed or presented on SmartBoard or as images on a projection screen)
- One deck of E-cards per group

Workflow

First look at one or two pictures and go through the exercise together. Then distribute different images to the groups (see images below).

Task A

1. Look at the landscape images as a group. What kind of landscape is it? Where in the world do you think it is? Is there anything in particular you notice in the picture?
2. Discuss the ecosystem services that are created in this landscape. Use the help of the E-cards. Read one card at a time and discuss the ecosystem services that you believe are created in the landscape in the image. Place out the cards that you agree on and put away those cards you cannot relate to in the picture.
3. Try to describe how you think that the various ecosystem services you have found appear in the image. (e.g. ”it results in better harvests (pollination), it is a beautiful landscape that people enjoy (mental & physical health), wetlands can purify dirty water (water purification), birds can find food there and raise their young (habitats), and so on ...
4. Do you think there is any threat to this landscape? If so, what?
5. If the landscape in the picture is not that good for creating ecosystem services, propose various measures to protect or enhance ecosystem services in the landscape image.

Comments

This task can also be done outdoors and thus in a modified way: Which ecosystem services can you see/discover in the landscape?

Task B

- Study the image of a river in a forest landscape below
- Which ecosystem services can you discover? Place e-cards to show them.
- If the forest is cut down, which ecosystem services are then affected?
- If there is an oil spill upstream in the river, which ecosystem services are then affected?
- If salmon disappear in the river, which ecosystem services are then affected?

Summary report proposal

1. The entire class. Two groups at a time present for everyone else. If you can use a SmartBoard or images on a screen it is easier to view.
2. Share:
   - What did you have for a landscape?
   - Where do you think it is in the world?
   - Was there anything in particular you noticed in the picture?
   - Let the group that you are presenting with guess what ecosystem services are in your group’s picture. Do they find the same services that you did?
   - Tell about some of the ecosystem services you found – how do they provide benefits?
   - How do you think that you should protect your landscape?
3. What did you learn? Is this an important piece of knowledge?

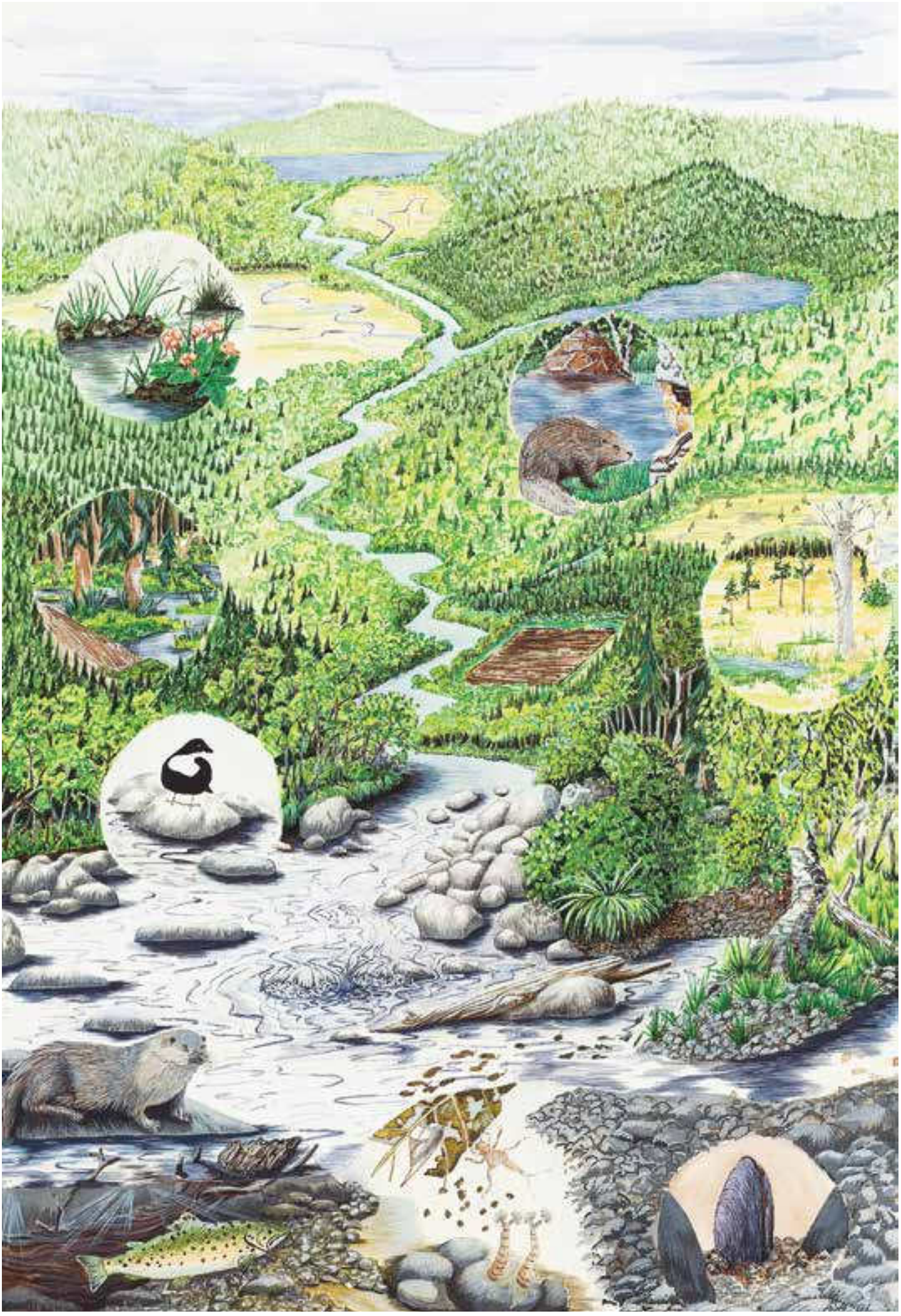


Illustration: Åsa Karlsson

Task 2 - Images of reality

Description of the task and preparation

You should make a trip to a few different types of nature and try to find the different ecosystem services provided in each location. The location and ecosystem services must be documented with six photos. The images will be sent to the teacher. The groups will prepare a summary with these images. You will work in groups. Every group needs a deck of E-cards as an aid. Have the groups visit some places in your community. It may be near the school or further away in the community. Customise the task based on the age of the students, their abilities and think about safety. It is appropriate to prepare which locations the different groups will visit and present them on a map. Only let the group visiting a certain place know where they are going.

The following needs to be prepared:

- Find places in the community/around the school where there are different habitats: coniferous forest, deciduous forest, parks, meadows, fields, gardens, lakes, streams, cold springs, boulder ridges, residential areas, industrial areas .... Mark these locations on a map.
- Divide the class into groups of 2-4 students
- One deck of E-cards per group
- Flower sticks, tape to attach the E-cards on them
- One mobile phone camera/digital camera per group (minimum of one).
- A mobile phone/computer /e-mail address to receive and process the images.

1. Find the location that your group has been given using the map...
2. Take photos at the location with your mobile phone camera and make sure they turn out as best as possible. Also take a photo of your group at the location.
3. Take out the E-cards. Read them one at a time
4. Look around you if you can find any place where one can see the ecosystem service as described on the card. Mark the place by attaching the E-card on a flower stick and place it in the right place. Take a picture.
5. Take four images showing at least four ecosystem services you found such as photosynthesis, pollination, decomposition, air purification ...
6. Send all six pictures (including the one of your group) to your teacher.
7. When the task is completed, go back to school, process the results and prepare your summary report proposal.

Summary report proposal

You must present your investigation for three other groups. Each group will also provide feedback to the groups that will present their work in the areas of: science, presentation and knowledge.

1. Make a presentation using the map, your photos and your E-cards.
   Assessment: Assess yourself and other groups on a scale of 1-6 based on each of these areas:
   - Scientific: Can you describe what it was you were going to investigate, what methodology you used, what results you had and what conclusions you made based on your investigation?
   - Presentation: Was your presentation clear and in line with the task? Did you gain the knowledge you acquired? Was the presentation interesting to listen to?
   - Knowledge: Is the knowledge that you gained shallow or deep? Can you explain what you learned in your own words or are you just reading out loud what someone else has written?
2. Think together about:

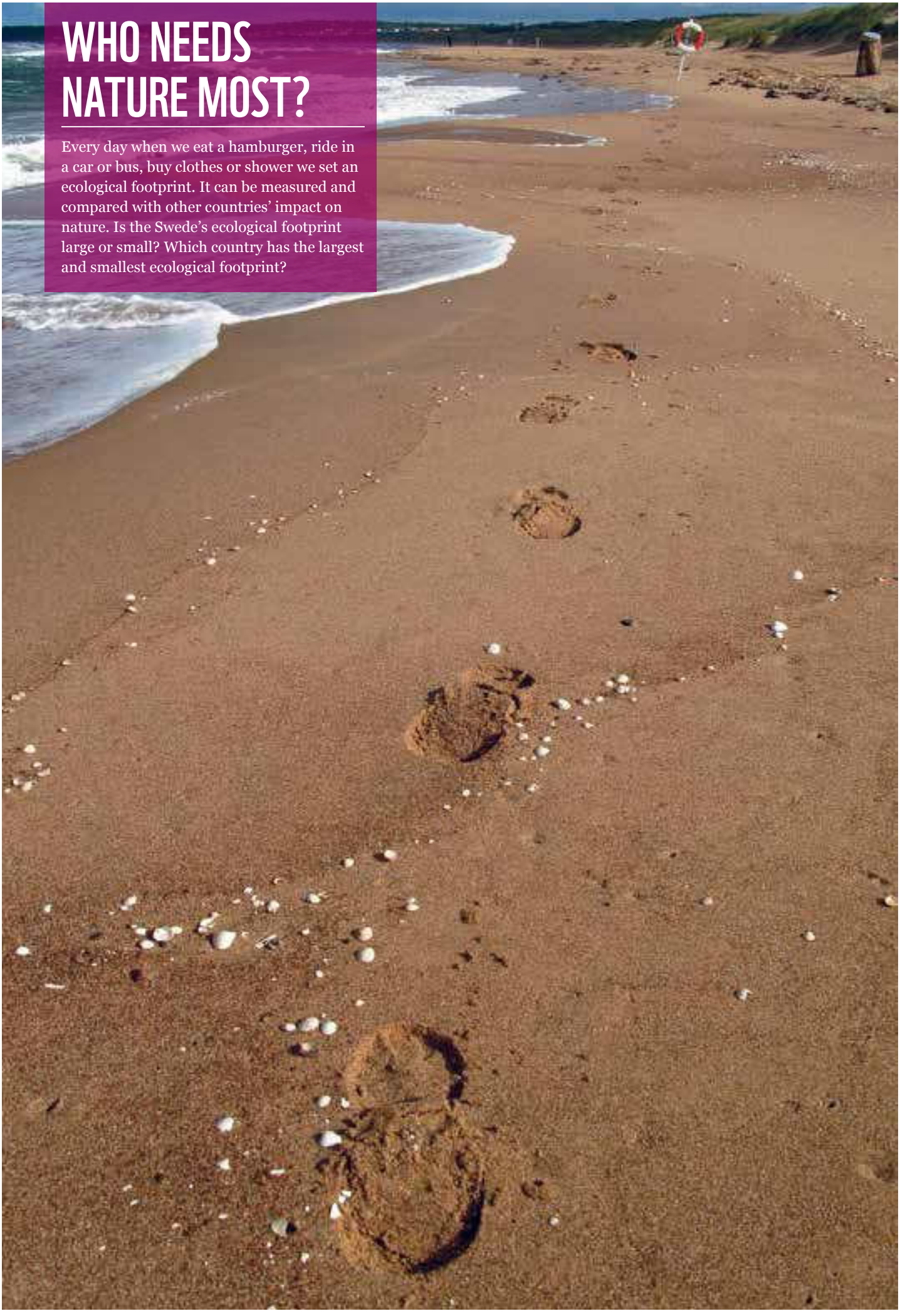
   Was it a fun task? Why/Why not?

   Have you learned something new?

   If you think of the location you visited, what do you think the people who live in your community should be thinking about? How can ecosystem services at the site be preserved, strengthened or improved?

WHO NEEDS NATURE MOST?

Every day when we eat a hamburger, ride in a car or bus, buy clothes or shower we set an ecological footprint. It can be measured and compared with other countries' impact on nature. Is the Swede's ecological footprint large or small? Which country has the largest and smallest ecological footprint?



WHO NEEDS NATURE MOST?

Objectives of the work

Increase awareness of our large-scale impact on our earth and the concept of ecological footprints.

Purpose

Understanding our impact on the Earth's environment and natural resources by knowing the concept of ecological footprints and to know how to go about calculating this and to become aware of different people different sizes of footprints.

Photodisc

Description of the task

1. Who needs nature the most?

Discuss and answer the following questions:

- Study the two pictures: one man and one woman. Where do you think these people live?
- How old are they? Where do they live? Do they have families? Describe what a typical day might look like for them. What do the man and woman need to live a good life?
- Who do you think needs nature the most? Who has the largest ecological footprint? Why?
- Make a list for each of them as to the needs they get help with from nature.
- Use the E-cards to check out off the ecosystem services these people use to meet their needs.

Consider together:

- What are the threats each person has to getting their needs met?
- How can they preserve, protect and develop the ecosystem services they depend on?
- Carry out a valuation exercise, stand on a line. Place 6 figures on the floor with three meters between them (1-2-3-4-5-6). Overall question: Who needs nature the most? Number 1 = needs nature a little, number 6 = needs nature very much.
  Let the boys in the class be the man in the picture and let the girls be the woman.
  a. Firstly, consider quietly and individually the question "Who needs nature the most?" and which number should be set to illustrate the answer.
  b. Everyone stands at the selected number. All the "ones" present their ideas and discuss their choice, all the "twos" does the same, etc.
  c. Discuss in a large group the different choices.

Ecological footprints

The total water and land area needed to:

a. provide humans in an area with natural resources and ecosystem services

b. absorb the waste that they produce

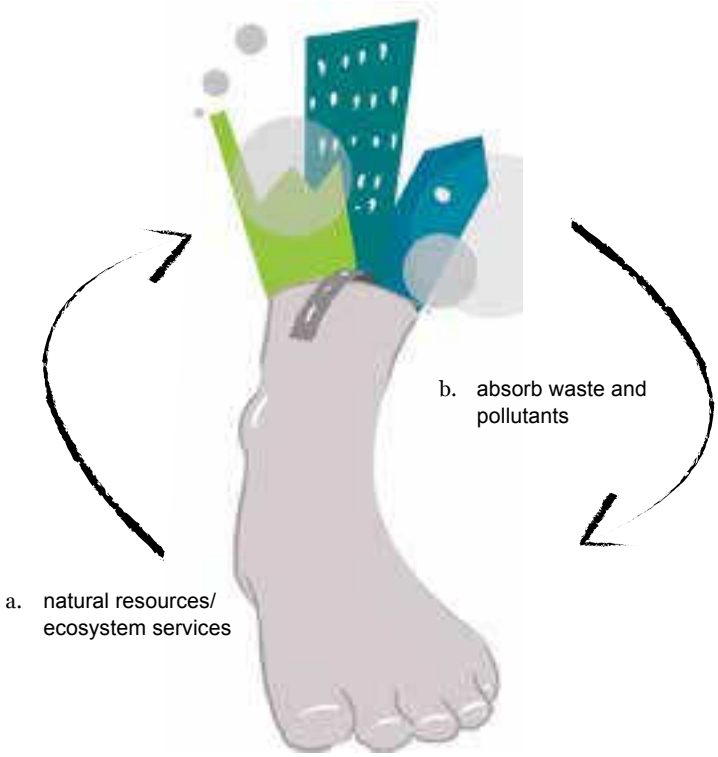
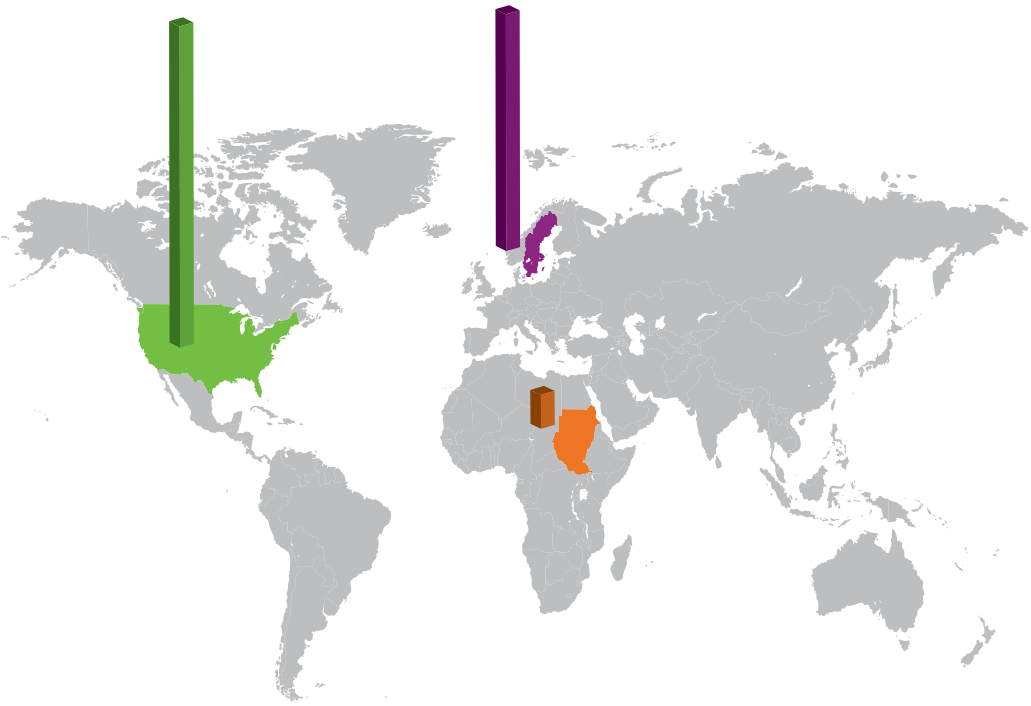


Illustration: Pernilla Albinsson

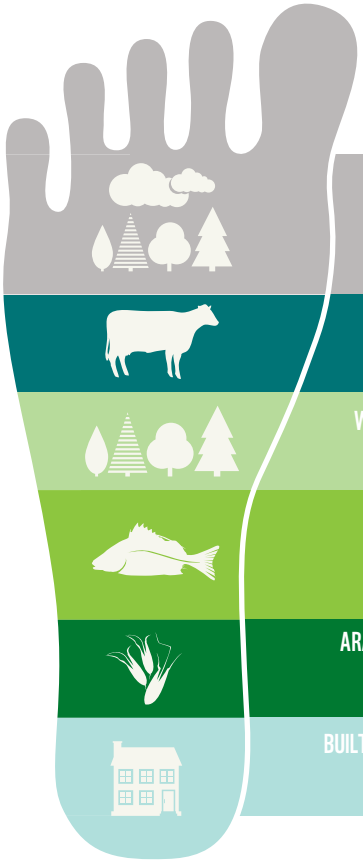
2. Ecological footprint

The planet's biological diversity and its ecosystem services are essential elements for our survival and prosperity. By driving a car, flying to other countries, eating lots of meat, living in over-sized houses etc., we are setting down a so-called ecological footprint that directly impacts biodiversity and ecosystem services.

In 2008 the world's inhabitants required 1.5 planets to satisfy their needs. The ecological footprint measures the biologically productive area necessary to exploit renewable resources, build infrastructures or for the absorption of carbon dioxide. Quite simply we are living beyond our means.Introduce the concept of ecological footprint by studying and discussing pictures on this page. More information is available on www.wwf.se/vrt-arbete/ekologiska-fotavtryck/1127697-ekologiska-fotavtryck



Different countries on the planet leave ecological footprints of varying sizes. The developed countries have larger footprints than the developing countries. When I eat my breakfast consisting of a cup of tea, a cheese sandwich, a glass of orange juice, buttermilk and banana I leave an ecological footprint not only in Sweden but also in the countries my breakfast comes from. For example, the tea I drink is imported from India and the orange juice from the U.S.A.



COMPONENTS IN THE ECOLOGICAL FOOTPRINT

CARBON UPTAKE AREA:	Calculated as the extent of forest area needed to absorb carbon dioxide emissions from the burning of fossil fuels and emissions resulting from land use change and chemical processes. The role of the oceans as a carbon dioxide sink is not taken into account.
PASTURE:	Calculated from the area used by animal husbandry for the production of meat, dairy products, leather and wool.
WOODLAND:	Based on the amount of timber, pulp, lumber and firewood consumed annually.
FISHERY:	Calculated from the primary production (organisms further down the food chain) needed to support the volume of fish, shellfish and other aquatic animals harvested.
ARABLE LAND:	Calculated from the area used to produce foodstuffs and fibres for human consumption and animal fodder, oilseed crops and natural rubber.
BUILT-UP AREAS:	Calculated from the area occupied by transport infrastructure, housing, industries and power dams.

SOURCE: Living Planet Report 2010, SUMMARY, WWF

When we use nature's services and resources, and when nature takes care of our waste, we affect the environment and the amount of resources available. We make a footprint. When we calculate our ecological footprint, we know the total water and land area used to:

a. provide us with our daily use of food, water, clothes, energy and more

b. take care of the waste that we produce

The ecological footprint can be calculated by using the calculator on the WWF website www.wwf.se / fotavtryckskalkylator. A sustainable/fair level is calculated at approximately 1.8 gha /person (gha = global hectares).

We Swedes can reduce our excessive ecological footprint in many ways. By using renewable resources such as wind energy, by conserving energy and materials and by consuming less and recycling.

Summary report proposal

1. Report the results of the image discussions (man and woman), for example do a role-play where the man and woman come together and talk about their lives and needs.
2. Write down your calculation of your own ecological footprint on a large sheet. Tape the sheets on the wall. Compare your calculations and discuss any differences. Correct any mistakes.
3. Brainstorm together about how you can reduce your ecological footprint.
4. Discuss which proposals are most realistic. Make a neat list, illustrate it, and tape it on the wall.

Evaluate the work

- How did the work go?
- Was it a fun/interesting task?
- What did you learn? Is it an important piece of knowledge?
- Did you get the urge to act in some way?

THE NATURE AT MY HOME

Which ecosystem services do we use in our community? What benefits do we gain from them? Do the same ecosystem services exist in the city as in the countryside?

THE NATURE AT MY HOME

Objectives of the work

A deeper understanding of the ecosystem services we need and use in our region.

Purpose

Identifying ecosystem services where you live and to know what benefits you gain from them in regards to them existing around you, to get a feel for the landscape, nature and ecosystem services in the local environment, to understand the relationships between ecosystem services and our human needs and the link between non-urban and city.

Description of the task and preparation

Take out a (topographical) map of your community, your neighborhood or your town. Via Google maps it is quite easy to find both a map and a picture. Please use the school SmartBoard.

In the fact box a series of questions are listed that form the basis for analysing ecosystem services in a community setting. For example, when a municipality develops a sustainable community plan, similar questions are used.

Copy the list of questions or make it otherwise available to the students so that they can work with them.

Divide students into groups.

Workflow

1. The groups choose and work with one to three of the questions on the list.
2. Work with the map. Try to find areas in the list of questions on the map and describe where they are. If it is difficult, you can ask for help from any other group, from adults in the school or from parents. Please contact the municipality as they can help with the answers.
3. Describe which ecosystem service(s) that exist(s) based on the questions.

Summary report proposal

1. Be an ecosystem activist!
   Make signs describing various ecosystem services and add a short explanatory text as to what the Ecosystem service Decomposition is and what it is good for. Put up signs in a place where people pass. For example, like this: ”A constant decomposition is happening here, please do not disturb it by littering”.
2. Make a report
   Take pictures/make a short film/write and tell the ”governing” body in the municipality/city what you have come up with.
   Invite a community planner to the school and ask them to tell you about or how to work with ecosystem services.
3. Create a show
   Make an exhibition of the ecosystem services that are available in the school’s proximity and how they work.
   Invite parents/the general public to an ecosystem exhibit.
4. Visit some areas. Go out and let some groups show their locations and tell them about the ecosystem services that are available.

Evaluate the work

- How did the work go?
- Was it a fun/interesting task?
- Did you learn anything new about your neighbourhood in terms of nature's services?
- Which ecosystem services did you encounter? Are they important? Why?

List of questions

- Is there a location in the community where people grow food, fish or hunt?
- Are there farms that rely on the income from that which is grown?
- Are there any allotment gardens in the community? Some greenhouses?
- Are any raw materials such as wood, bio-fuel or fiber produced anywhere in the community? If not, where do you think that those materials come from to your community?
- Where does drinking water come from to the community? Groundwater or lakes?
- Where are the lakes, rivers or other bodies of water in the city which supply irrigation water?
- Can you see on the map where the water flows?
- Where in the community are there forests or natural areas where wildlife can live?
- Where in the community are there parks that people can visit?
- Is there anywhere that trees have been planted for shade, to retain water or for air purification?
- Are there any wetlands or other ecosystems that can take care of the effect of extreme
- weather conditions such as droughts, fires, floods or high water levels?
- Does the community use some place to filter water through sand or through wetlands to save on the cost of artificial purification of water and sewage treatment plants?
- Are there steep slopes in the community where vegetation makes the flow of rain water slow down and protect the soil?
- Is there somewhere to grow fruit or vegetables that need insects for pollination?
- Can wild animals move between different natural areas in the city, or are natural areas enclosed and surrounded by buildings and asphalt?
- Are there any nature reserves or recreational areas in the community?
- Is there a place where rare plants or animals live in the community and are therefore protected?
- Where do people in the community tend to go when they want ”go out in nature”?
- Does the natural beauty of the community attract visitors to the area? Do tourists come and watch nature in the community?
- Is there any artist who uses nature in the community?
- Is there somewhere in the community which is traditionally visited (in nature) any part of the year?
- Is there somewhere in the community that people consider as ”holy”?

Go outdoors to learn!

A hundred years ago eight of ten people lived in the countryside. For the first time in human history more people now live in built-up rather than in rural areas. Europe is one of the most urbanised continents, about 75 per cent of its population living in cities. Today's children and young people grow up in an increasingly urban world full of paved surfaces, residential complexes and shopping centres. Society is losing touch with nature and its services. At the same time we are completely dependent on functioning ecosystems every second of our lives.

Where is the best place to learn about ecosystem services? Outdoors in your own neighbourhood, naturally. This might be in the countryside, but it can just as easily be in an urban area. You could investigate cultural services such as outdoor activities and nature experiences, studies of water and air purification and erosion prevention measures in a city. In a learning situation an outdoor pedagogical approach is preferable, that is, an interaction between experience and reflection in real life, where the first-hand involvement of each individual is at the centre.

Outdoor education crede

I believe in a life full of learning
in going outdoors to learn
in sunshine, rain and wind.

I believe in wanderlust,
in the unforeseen and tangible.

I believe in a wind;
an unexpected gust of intense presence.

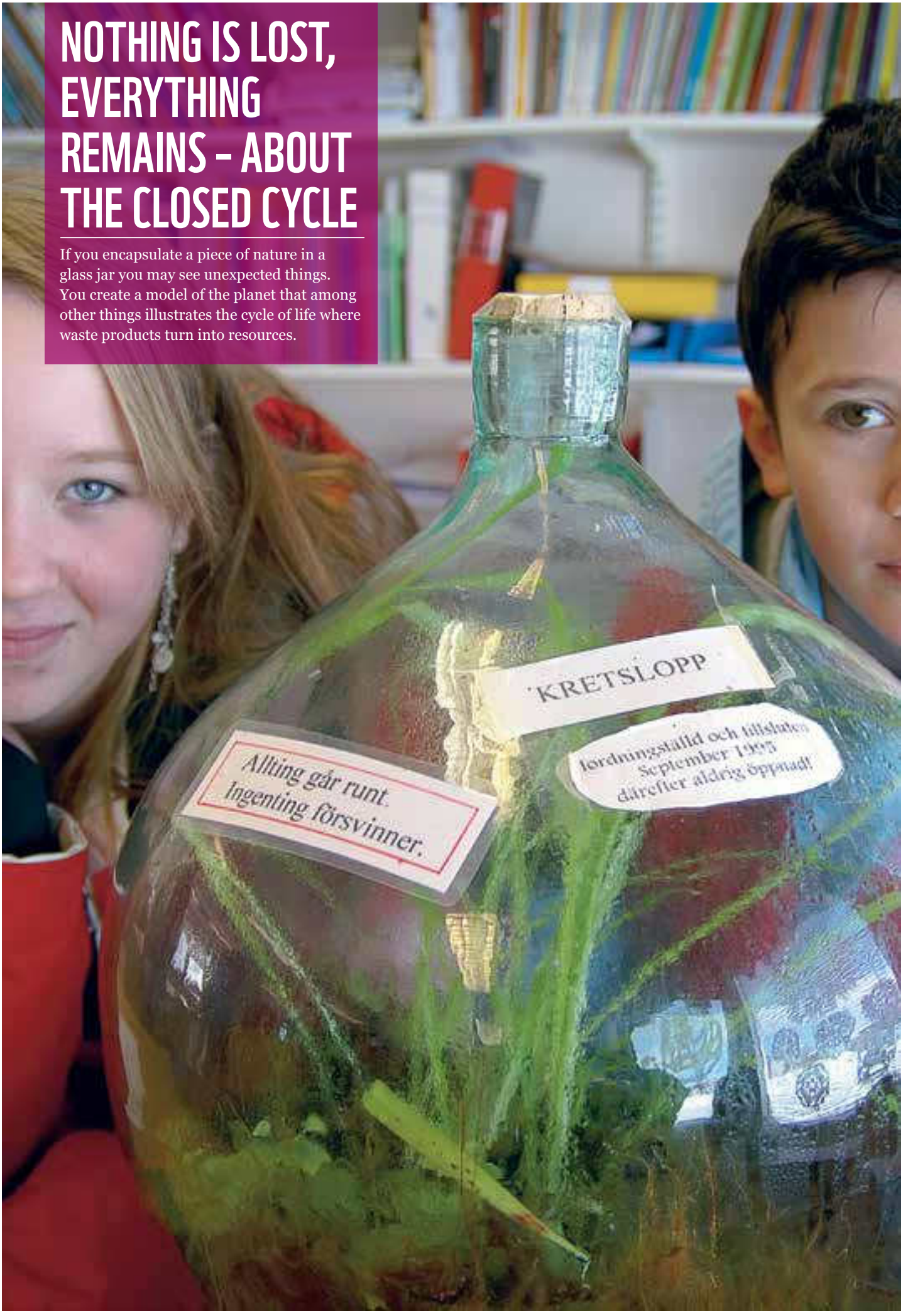
I believe in the afterimage cast by reflection;
in the shadows thrown in high relief by afterthought.

I believe in a life full of learning,
in going outdoors to learn.

Germund Sellgren, Nature Education, 2003

NOTHING IS LOST, EVERYTHING REMAINS – ABOUT THE CLOSED CYCLE

If you encapsulate a piece of nature in a glass jar you may see unexpected things. You create a model of the planet that among other things illustrates the cycle of life where waste products turn into resources.



NOTHING IS LOST, EVERYTHING REMAINS – ABOUT THE CLOSED CYCLE

Objectives of the work

Understanding the link between cycle, ecosystem services and the human.

Purpose

To understand nature's cycle, to identify ecosystem services that contribute to the cycle working and to reflect on what these ecosystem services mean.

Description of the task and preparation

Joseph Priestley, 1733-1804, English scientist, carried out an experiment with a mouse under a dome. He placed a mouse under a glass dome. What happened? Well, it died pretty quickly. He did the same experiment but also placed a plant under a glass dome. What happened? Well, the mouse survived. Why? The mouse was breathing out carbon dioxide absorbed by the plant. The plant produced oxygen that the mouse breathed. The plant produced an ecosystem service. It purified the carbon dioxide laden air and produced oxygen.

"The closed cycle" is described in many places. Some links/references can be found at the end of this task. If you as a teacher are unfamiliar with this basis, it is recommended to take a look at these and other links/references. There are also English-language sources so that the exercise can be a part of the subject of English.

For this task you will need:

- a "closed cycle" or a picture of a closed cycle
- large glass jars or clear canisters with lids/film, tape
- bucket, small shovel, leca balls or pebbles to put in the bottom
- plants that can survive in the closed system
- Notebook/small booklet in which to follow/note down the development of the system.

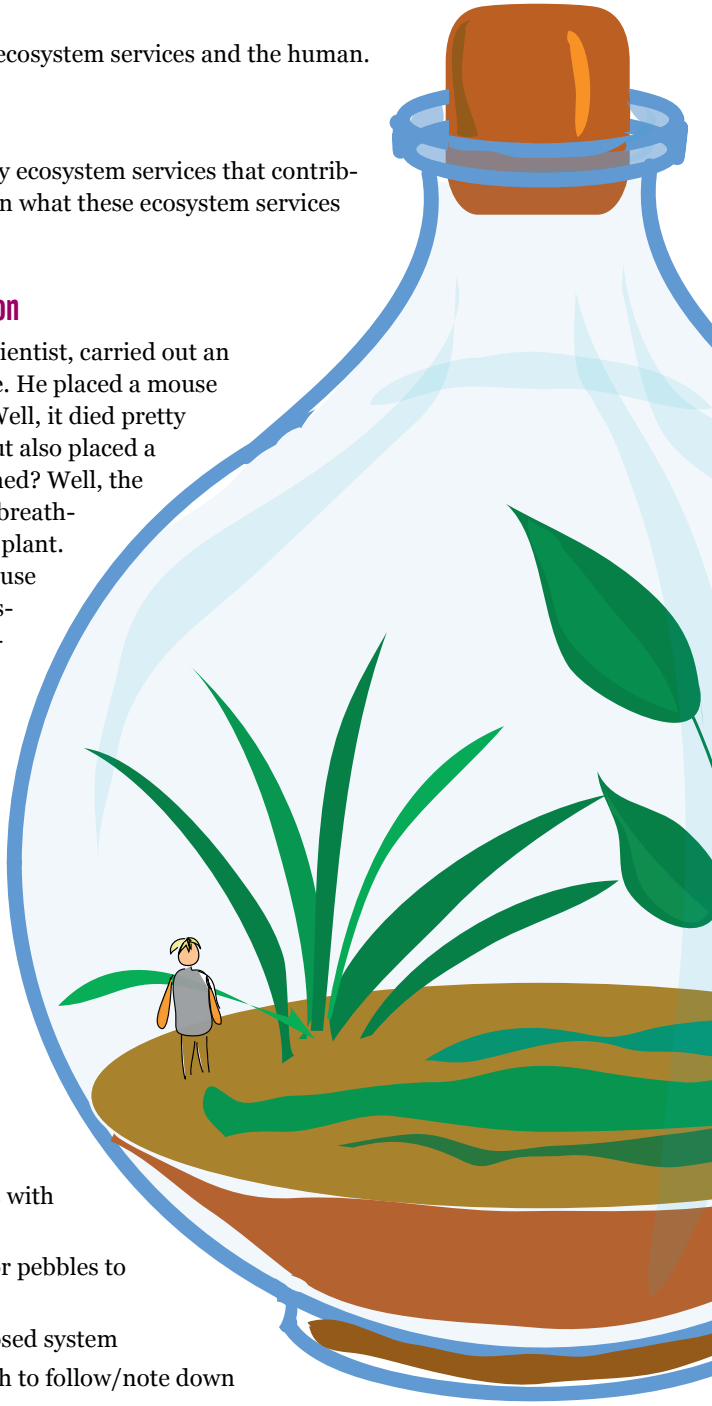


Illustration: Eva-lena Larsson

The notion of the cycle needs to be explained so that students understand it before they start working. To illustrate a cycle, you can use various tools. It is suggested that the teacher can explain and discuss cycles with students in one of the following ways:

Option 1: Present a complete, functioning mini-ecosystems ("cycle can"). Show a closed system that has been closed for many years. Tell about how it started. Imagine being in the system so that all students gain an understanding of what it is about and how it went about. Tell how many years it has been closed, it can manage on its own and that "We have never opened it, nor let in air or water!"

Reflect together on what must get in there for it to work (solar energy). Without it, nothing works - solar energy is the engine of all cycles in nature.

Option 2: Present a mini ecosystem with a picture, yet otherwise follow the rest of the workflow as in option 1.

Workflow

1. Tell about the experiment with the mouse under the glass dome.
2. Tell about the task of creating a closed cycle with plants, soil and water. Inspire students to ask questions such as: How does it work? What various cycles must function in this kind of closed system?
3. Consider: What do you need yourselves to make a "closed ecosystem"?
4. Students are divided into groups and choose which cycles they want to work with. Vad behövs det för hjälpmedel för att skapa ett kretslopp och åskådliggöra det? Write down a workflow plan and a list in the booklet and draw up how the cycle shall be built up. See fact box.
5. The booklet can be used as a diary. Note the following:
    - Name your cycle and the date when it was closed.
    - What was put in the jar?
    - Describe your workflow/how you made your jar.
    - Where will the jar be placed?

Instructions how to build an ecosystem

- Use a large glass jar with a lid, like a canister or similar that is possible to close well. This shall be your ecosystem, your own little biosphere.
- Add a few centimeters of coarse gravel or leca balls to act as a draining function in the bottom.
- Load with fertile soil e.g. soil that you have gathered from the outdoors in a garden or in nature (not sterilised potting soil from a bag).
- Add water to fill the space between the sand grains in the drain so that it just reaches, and just humidifies, the earth above. This is your groundwater.
- Plant a couple of plants with the help of a couple of long sticks. Spider plant, water fichus and moss are good plants. If you have a little more space, ferns, bird's nest ferns, golden creepers or a small philodendron thrive. Do not plant them too close together and not too many. Remember that they need room to grow for several years.
- Insert a small plastic toy man with green around him.
- Put a label on the canister and note the date of the creation of the biosphere.
- Seal the jar or canister.
- If you want to, and if the container is really big, you can put in a couple of small earthworms, a few woodlice and other insects, but it is not necessary. There are thousands of small micro animals, fungi and bacteria in the soil that can get your system to work anyway.
- Place your ecosystem in a bright area, like on a window ledge, but not so it can be reached by direct sunlight. It must not get too hot.

Write down what you think will happen. Will the plants in the jar die? Will they grow so that the jar cracks? Will it look the same? Will it change? How? You do not need to agree on a single proposal, but think about what is most likely of the various possible outcomes.

- Describe the ecosystem services involved in the closed cycle. What benefits does one get from them?
- Study the finished result. What has happened? Compare with your theories and modify them if necessary. Study your little biosphere. Imagine a person in there. Do they seem ok? Do they seem satisfied? Does the biosphere affect the human? How does the human affect the biosphere? Are there any ecosystem services in the closed cycle that humans use in any way? If you were to put a price tag on three of these ecosystem services, what do you think they would cost?
- If the biosphere should reflect the entire globe, the real biosphere, are there any environmental problems? What will happen to the biosphere in 1 year, 10 years, 100 years?

Summary report proposal

One group at a time describes their work in front of classmates and the teacher:

- How did you do it?
- What did you discover?
- What conclusions did you make?

To discuss: What different cycles have students discovered in their ”cycle cans/jars”. How do these cycles help us to create products and services from ecosystems? How do we get drinking water, food, clothing, paper, computers, etc.?

Evaluate the work

- How did the work go?
- Was it difficult? Why?
- Did you have fun? What was the most fun?
- What did you learn? Is it an important piece of knowledge?

Information developed from data in the book; ‘Att lära in ute för hållbar utveckling’ (English translation: To learn and teach sustainable development), (to be published in autumn 2013, Outdoor Teaching Förlag AB.)

Resources/Other sources:

http://www.buf.kristianstad.se/kick/not/kretsloppsburken/mojligheter/mojligheter.htm

http://www.nynashamnsnaturskola.se/naturskolanNynas_y_laromedel.php?naturskolan_id=82&naturskolanKat=L%C3%84ROMEDEL

http://www.bioresurs.uu.se/bilagan/pdf/Bi_lagan_1_2009_odla.pdf

http://swedesd.se/images/stories/PDF/ESSA/Mini_Ecosystem_eng_for_web.pdf (English)

http://www.swedesd.se/images/stories/PDF/ESSA/mini_ecosistema_web.pdf (Spanish)

NATURE'S INTIMATE MOMENTS - ABOUT POLLINATION

One of the clearest and most interesting ecosystem services is pollination. Imagine how useful a small bee is that moves pollen from one flower to another!

Photo: Sven Ängermark

NATURE'S INTIMATE MOMENTS - ABOUT POLLINATION

Objectives of the work

Increasing knowledge about ecosystem service pollination and how to protect it.

Purpose

To understand the importance of pollination and how it works, to know some important pollinators, to know how to help, protect and enhance pollinators in our surroundings by building a nest, and to know how, in other ways, to support these natural heroes and a rich variety of plants that can feed them.

OF 115 OF THE WORLD'S MAJOR AGRICULTURAL CROPS 87 ARE FERTILISED BY POLLINATORS.

Description of the task and preparation

Pollination is one of the most visible and distinct ecosystem services. It is an important part of generating our food. It has a great economic value for those who produce food, for example, growers of apples and producers of honey. Pollination is a sexual reproduction of plants that is not entirely unlike humans which also gives the pollinators – bumblebees, bees and many others - food for both themselves and to feed their "babies", the larvae. This is an exciting and beautiful phenomenon in our rich nature.

First read the text "Pollination is Big Business" before you dive into the tasks.

Workflow

There are three tasks of varying difficulty and scope presented here. One tip is to start with the first one as an orientation exercise, and then follow with one of the more extensive, practical proposals.

Task 1: Locate pollinators

Go out with cans and nets and try to find some pollinators such as bees. Study a few of these insects closely. How do they manage to spread the pollen from one flower to another? Also look at some flowers. Look for stamens and pistils. Is there any pollen? How does a conception take place? Make a "pin-image" of a pollinator e.g. by magnifying an insect and try to recreate it using natural objects.

Task 2: Be a pollinator

A bumblebee is attracted to a flower because it is colourful and hides sweet nectar. When the insect flies around the flower, pollen sticks to the bumblebee's body. Try to illustrate this as a little drama sketch.

Task 3: What is pollination?

Describe by writing, drawing or painting a chain of connections - how pollination is an important ecosystem service.

Start with one of these characters:

- A blooming plant
- An apple tree
- A bird eating seeds
- A deer that enters a yard
- A teenage girl or boy
- A farmer who cultivates clovers and rapeseed
- A grandfather/grandmother who grow apples in the yard
- A man or woman who sells honey and marmalade at the square

Pollination is big business

Animals that help plants to move pollen between flowers are called pollinators. Bees and bumblebees are the main pollinators. Besides all the wild bees and bees, there are honeybees that humans have used a long time to get honey, which does the job. A pound of honey requires 60,000 flights in and out of the hive. A single bee can have more than 15,000 pollen grains on their body and have time to visit more than 10 flowers in a minute. Honey is a great eco-product. Besides water and sugar, it contains enzymes, minerals, amino acids, trace elements, vitamins, aromatics and bacteriostatic substances.

A cheeseburger

Think of a fast food lunch, such as a cheeseburger with strawberry milkshake. Cows gave the meat for the hamburger and produced milk for the milkshake and cheese for the cheeseburger. The cows probably ate feed containing clover or rapeseed pollinated by many different insect species. The oil we get also comes from rapeseed or colza. The wheat in the hamburger bun pollinated itself or via the wind, yet the mustard, tomatoes in the ketchup, cucumber, onion and lettuce were all pollinated by insects.

Bees are the bee's knees

Bees and other insects do a great job helping all who grow food. Without their efforts, there would not be much to harvest. Over 90 percent of all flowering plants, more than two thirds of the world's most important food crops and three-quarters of all food produced in Europe are dependent on pollination by bees. Bees' free work is worth big money. Scientists have calculated that the direct economic value of the pollination ecosystem service from all of the world's pollinators amounts to 400 billion U.S. dollars a year. In 1996, a researcher in Sweden calculated that pollination of just rapeseed or colza amounted to an economic value of 25 million SEK - certainly worth even more today.

Everything is connected

For bees to do their work there must be many different flowering plants throughout the summer. Bees, bumblebees, butterflies, flies and many other insects thrive in an environment of biological diversity - it can be in a forest, meadow or pasture where there are different types of flowers, plants and insects. Pollinators are of great benefit to both plants and animals as they help seeing to it that there are more seeds and berries that are eaten by birds and other animals. And the animals are eaten by the other animals ... Good harvests of both raspberries and blueberries we can thank bees and bumblebees for. Everything is connected.

There must be food all the time for bees and bumblebees

In our part of the world, the honey bee is especially important. Since they spend winters in large communities, there are plenty of bees early in the year. If they have good food from early spring until autumn, pollination of agricultural crops that we humans want to eat works much better.

When cultivating e.g. clover or rapeseed in large fields, there are lots of flowers with lots of food for bees in the form of pollen and nectar for a short time. But before and after flowering, there might be almost no food at all. If there is no food, then the bees stop looking for food. They hide inside the hive and feed on the nectar and pollen they have already collected. The queen of the colony senses that there will not be enough food in the community and stops laying eggs. The bees are starving, many bees are dying and there is no new honey and no pollination. When bees that are out and scouting for food and go to the hive and say that there is food again, it takes three weeks for the queen to start laying eggs again, in other words until there are worker bees who can go out and pollinate and get nectar and pollen. It is therefore important to have a high biodiversity of plants whose blooming periods follow each other so that they can provide pollen and nectar from early winter to late autumn. Willow is a tree that is an especially important plant for bees because it blooms in early spring and provide a lot of pollen and nectar.

These words may be included in the description:

Pollen, Seeds/Fruit, Income, Bees/Bumblebees, Honey, Plant (or name of plant), Ecosystems, Biodiversity, Spring, Summer, Autumn, Ecosystem Services

Task 4: Learn more about bees!

Check out Jonas & Lotta's bee school at (in Swedish):
http://www.svtplay.se/klipp/53063/jonas-biskola-med-lotta

What did you learn about bees that you didn't know before? Write this down or tell it verbally.

Interview a beekeeper about bees and pollination, how do they get bees to thrive and how do they make sure they have food all year round? Firstly, write down the questions you want answers to. You can get in contact with beekeepers via www.biodlarna.se

Task 5: Put a sting in the schoolyard!

Building nests of wild bees and bumblebees will help you get more pollinators. They do not compete much with the "tame" bees that live in hives and they can withstand the rigors of a little bad weather. Bumblebees are fewer in number but a bit "tougher" than bees - therefore they complement bees in an important way. The result is more fruits and berries.

A. Build a "bee-battery"

Bee-battery made by bamboo sticks.

Model 1:

1. Obtain bamboo sticks, reeds or other hollow plants in as many different thicknesses as possible. Between a 3 and 15 millimeter holes is about right. You also need something to attach them together with such wire or strong tape.
2. Cut the sticks into pieces of 20-30 cm so they all have a partition in the middle or the end.
3. Some bamboo is not hollow but has a soft marrow in the middle. You can push it out with a nail or drill, but not all the way through. The insects do not build in the sticks where they can see right through. Please leave a stick with marrow left because some wasps like to remove it themselves.
4. Gather your sticks in bundles of 10-30 pieces each and fasten them together with wire, strong tape or similar. You may instead figure out another way to put them together in bundles. Hang them up horizontally in a suitable location such as a buildings wall. They are to be in sunlight as much as possible yet protected from rain. See the picture.
5. Make many bee-batteries. Please contact an allotment, a farmer, or someone who grows in their garden and give away or sell the bee-batteries. At the same time inform them about what you know about pollination and its value.

Bee-battery made of wooden block.

Model 2:

1. An easy way to make a bee-battery is to drill a lot of holes in a wooden block. A diameter of 4-8 mm is a suitable size, and depth of the holes should be about 7-10 cm. It is ideal if you drill many holes close together. Mark the size by the holes (see picture). In the picture you can see how it looks when some insects have covered over holes using different materials. When the female has filled the hole with pollen and a larva, she covers over the hole again. It is therefore clearly visible if the bee in charge of covering over has visited or not. Grey is clay, yellowish is resin and green is chewed leaves. Inside the holes live the larvae! Isn't it amazing!

B. Build a wasp stump

A wasp stump is a peeled log placed upright that is 1-1.5 m high. In it, holes are drilled with different diameters. The minimum should be 3 mm and the most 8-13 mm. A cover prevents the stump from getting wet - then is lasts longer. The cover also protects the nests from a great deal of rainwater.

Reference

Read more about bee-batteries:
http://www.naturochtradgard.se/naturtradgard_solitarbin.html

http://www.bioresurs.uu.se/myller/stad/stadutou_stekel1.htm

C. Build a simple bumblebee nest

When the spring sun begins to warm the garden, the bumblebee queens wake up from their winter hibernation. They fly out and start looking for food. Then they look for a place to nest in order to lay eggs and raise their young. Bumblebees often live down in the ground, ideally in old field mice and mice burrows. Help the bumblebees get a nice nest, a flowerpot nest.

1. Take a flowerpot of clay that is about 15 cm wide. Ensure that there is a hole in the bottom of the pot.
2. Dig a hole in the ground so that the pot can fit upside down and the bottom is level with the ground. A good location is sunny and sheltered, preferably with high grass around.
3. Fill the pot halfway up with nesting material. The best material is from field mice or mice burrows! Loosely packed hay or wood shavings are also good. A tip: Ask a pet shop if you can get chips that have been in the mice cages.
4. Place the pot in the hole and pack soil around it. Add some beautiful rocks that protect the entrance to the nest so it looks more like a natural hole.

A little more advanced way to make a bumblebee nest is this: Build a bumblebee nest of wood, like a birdhouse. The hole should be no more than 12-15 mm in diameter. The side of the nest can be 10-15 cm. The nest can be buried in a hillside or placed in a wall.

You can have one of the walls or ceiling made of plexiglass so you can peek in on the bumblebees. Then you have to have something to cover the plexiglass with when you are not looking at them - a little tar paper for example.

Task 6: What plants do bees like?

Beekeepers are good at recognising plants that bees like. They also know which plants provide the most nectar and pollen. Sometimes they make a list of when different plants bloom where they have their hives to know if the bees have enough food. The list is called the ”Pull Calendar” Here you can see how this looks: http://hem.bredband.net/tuunur/daggen/nektar.htm

A community with a variety of trees, shrubs and flowers in gardens and parks means that there are usually good places for bees to live in. Learn to recognise some plants that are important to bees. Here is a list of trees, shrubs and plants that bees like and roughly when they bloom. Look up images on the internet. How many can you find near the school or where you live?

Summary report proposal

Show your work to your classmates and tell how it works. Take the opportunity to talk about what great helpers we have, the flying pollinator bees, bumblebees, wasps and butterflies.

Feel free to invite a beekeeper to work with you on you summary. The beekeeper can then tell a bit about bees and beekeeping, and you talk about your work to help more bees to work for the good of us all.

Discuss what you can do to support the ecosystem service called pollination:

- Buy organically grown vegetables, fruit and other food.
- Make sure there are plants that bees like so they get food during the greater part of the year.
- Make sure there is good habitat for bees, bumblebees and wasps.
- Avoid all toxins and pesticides in gardens.

Evaluate the work

- How did the work go? Was it difficult? Why?
- Did you have fun? What was the most fun?
- What did you learn? Is it an important piece of knowledge?

Hazel (blooms in late March in the southern parts of Sweden, and at the end of April in southern Norrland)

Alder (blooms in March to April)

Coltsfoot (blooms in late March to early April)

Sallow (blooms in middle to- end of April)

Gooseberry (blooms in late April or early May)

Wood anemone (blooms in late April to mid-May)

Maple (May)

Blueberries (May)

Dandelion (blooms in May and June, and after-blooming in late summer)

Fruit trees - apple, pear, cherry, plum (May)

Raspberries (June-July)

Cornflower (June-July)

White clover, red clover (June-July)

Fireweed or **willow-herb** (July-August)

Lind (July)

Heather (August)

Alder

Hazel

Sallow

Heather

Raspberry

Coltsfoot

Dandelion

Maple

Blueberries

Fireweed

Lind

VWood anemone

300 kinds of bees

We have nearly 300 different species of bees in Sweden. One of these is the well-known honey bee (the tame bee). The majority of the Swedish bees are solitary, in other words the female alone gathers pollen in cavities in the ground or in the woods where she lays an egg which then must fend for itself. Honey bees have the biggest communities and they can be many tens of thousands of individuals in a hive.

There are about 40 species of bumblebees in Sweden. At least ten of these can be found in the garden or in a flowery meadows. Among the other species, most nest in the ground where they dig such nests in sand. All real bumblebees are social. They have communities where workers take care of duties in the hive and where the queen lays eggs. The size of these communities varies from a few to thousands of individuals.

Many of the wild bees get up to lots of exciting things. **Upholstering bees** bite off small pieces of leaf and transport them away to narrow cavities where they build cells of the leaves (upholstery). In each cell the pollen collects and the female then lays an egg. Then she builds more cells so the ”nest” in the end looks like a long cigar.

Wool bees like woolly plants. Stachys lanata often found in gardens are popular. The males guard the stachys lanata plants and scare away anyone who comes near. When he gets hungry, it is close to the pantry, that is to say the stachys lanata’s flowers. But if there is a female on a visit, he becomes interested and entices her to get an invitation to mate with her. The female comes to the woolly plants to collect ”wool” that she takes home with her to decorate the nest in a similar way as an upholstering bee.

Most wild bees live in burrows in the ground. A whole generation is called **sand bees** because they live in sand where the females burrow in and decorate a nest. In spring, you can be lucky and see willow sand bees as thousands arrive in things like old sand covers. The males arrive first and then it will be wrestling matches when the first female hatches. Females then keep busy by collecting willow pollen and build new burrows for next year’s bee production.

For the **willow sand bee** and other springtime bees, willow is necessary for them to survive. You should therefore ensure that there are many willows where you live because then it will help many good pollinators to get a good start the year. Not least important is it for bumblebee queens who wakes up after hibernation. A hearty ”breakfast” of willow nectar and many loads willow pollen means the queen can start her colony and thus the pollination of thousands of plants thus making them ready for the summer!

The different bumblebee species have different lengths of snouts so they have specialised in plants that suit their snouts. **The garden bumblebee** has a very long snout, about 15 mm, and she can visit the deepest flowers. If you look at a bumblebee on something like a honeysuckle, you can almost certainly say that it is a garden bumblebee even from a long distance!

Earth bumblebees have the shortest snouts, only about half a centimeter. They visit flat flowers or they cheat by biting holes in the deep flower spouts and ”steal” nectar without pollinating the flower.

READ MORE

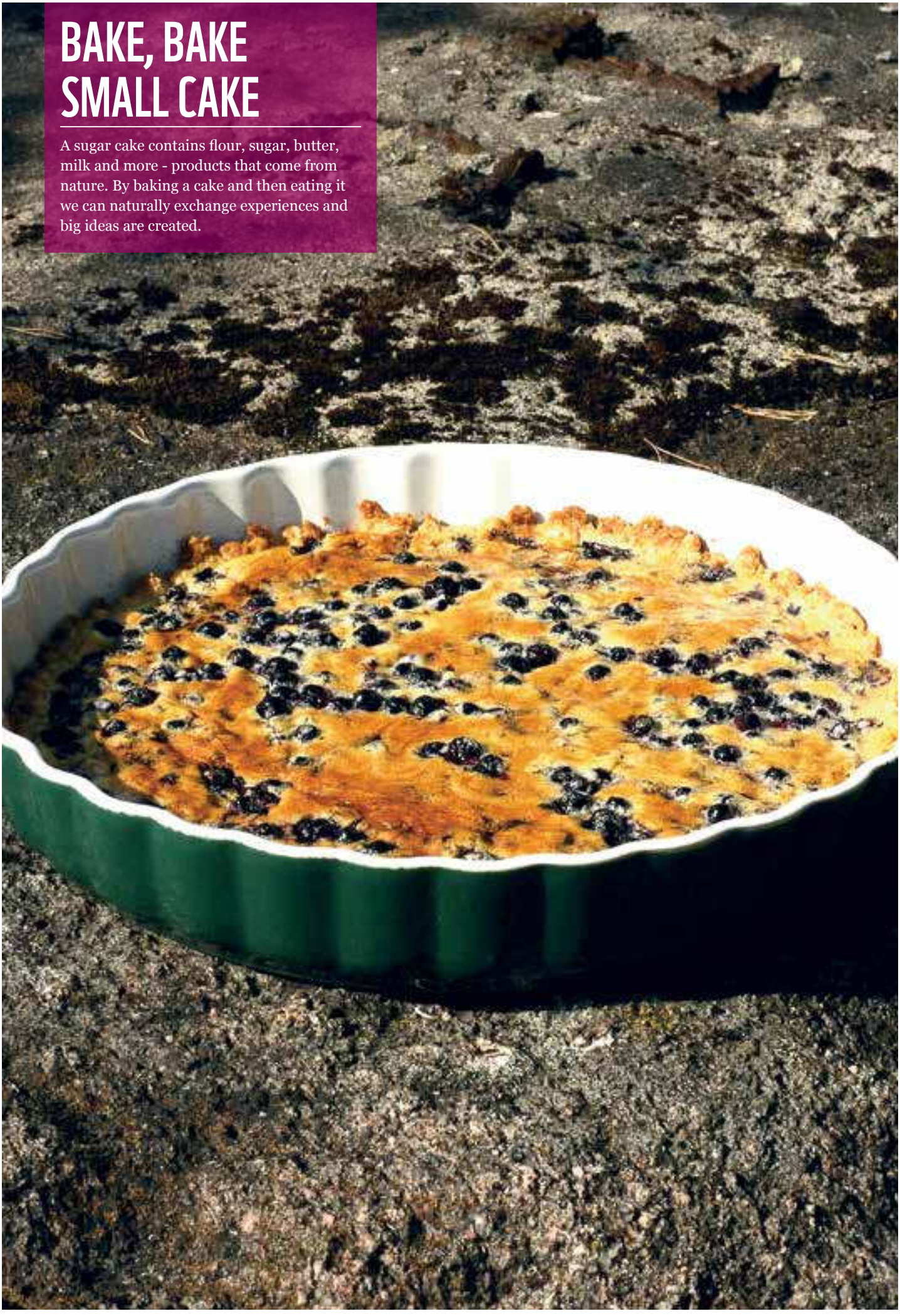
ABOUT BUMBLEBEES ON
WWW.WWF.SE
KEYWORD: BUMBLEBEES

Earth bumblebee

Wool bee

BAKE, BAKE SMALL CAKE

A sugar cake contains flour, sugar, butter, milk and more - products that come from nature. By baking a cake and then eating it we can naturally exchange experiences and big ideas are created.



BAKE, BAKE SMALL CAKE

Objective of the work

Increase understanding of ecosystem services through a taste sensation.

Purpose

Being able to bake a cake made of the fruit from your surroundings and to understand how nature has helped so the fruit is big and tasty.

Description of the task and preparation

This task is best to do in the fall when there are lots of apples in our gardens. Of course you can also bake a cake made of gooseberries, currants, cherries or pears. Or why not make it from wild berries such as blueberries or raspberries.

Arrange the kitchen. Look up a recipe for apple cake. Get the ingredients needed. They should preferably be organic (KRAV-labeled) for the benefit of biodiversity.

Workflow

Bake an apple cake according to the recipe.

You probably need to make several cakes to be able to feed the whole class. It may be fun to try different kinds of apples or different fruits/berries to compare how the cakes will taste differently. We have such a rich variety of fruits and berries.

While the cakes bake in the oven, you discuss which of nature's services have resulted in you being able to bake this cake. Flour, eggs, milk, fruits - how do they come about and what organisms in nature help? Read on the E-cards. Write a list.

Summary report proposal

Arrange a snack break in the classroom or arrange a coffee break in a parent meeting. Once everyone has been served cake, tell the guests:

- What is in the cake and where you got the ingredients
- The ecosystem services that you benefited from
- Why it is important to conserve biodiversity and promote these services

Evaluate the work

How did the work go? Was it difficult? Why?

Did you have fun? What was the most fun?

What did you learn? Is it an important piece of knowledge?

HOW DOES SOIL COME ABOUT?

Take a handful of soil in your hand and think about how it was formed. What ingenious collaboration that has occurred between worms, beetles, millipedes, fungi, bacteria and others in working with a handful of leaves.

HOW DOES SOIL COME ABOUT?

Objectives of the work

Increase knowledge about soil and its formation and the link to ecosystem services.

It takes several hundred years to build up new topsoil so we must ensure that we nurture the topsoil we already have and that we do not damage its ability to help us grow food.

Purpose

To discover and understand soil formation and nutrient supply, to gain insight into the concept of decomposition and soil's important in producing food and to gain practical experience in making soil and cultivating in it.

Description of the task and preparation

Start with a reviewing together what living soil is. Please study the ground outdoors and be attentive bugs present in the soil.

Workflow

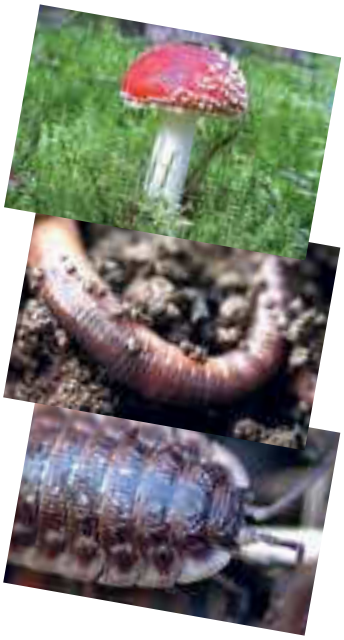
Fill your hand with soil. Study it carefully: colour, odor, moisture. Think about how it is made.

Tell about soil facts.

Task 1: Photograph the ecosystem services soil formation and nutrient supply

Go out in the neighbourhood with a camera/mobile phone camera and take pictures. Try to take three pictures showing soil formation and nutrient supply. It may be e.g. leaves decomposing, compost, worms, small animals that eat plants or anything else.

Three photo items:



1. **Mykorrhiza**
   Mycorrhiza means fungal root and provides an important interaction between a plant and a fungus to exchange nutrients. Mycorrhiza consists of fine roots underground, especially in coniferous forest soil - reminiscent of cobwebs just below the soil surface. The fungus' fine rootlets (mycelium) help the plant to absorb nutrients from the soil, such as phosphorus and trace elements. At the same time, the fungus protects the plant from other harmful fungi. The fungus itself gets sugar (= carbohydrates = energy) in exchange from the plant and is completely dependent on the plant to survive.
2. **Earthworms**
   Earthworms are incredible at making soil. They pull down plant debris from the surface and dig long passages in the soil. When they stir and loosen up the soil it results in oxygen and water being able to more easily penetrate and enter into the ground. They also fertilize the soil so that it becomes more fertile and nutritious. There are many more earthworms in cropland than in woodland. In a healthy farmland area there can be up to eight million earthworms in a single hectare! (A hectare is one football field, 100x100 meters). There they turnover 50 tonnes of soil per hectare per year.
3. **Other decomposers**
   Woodlice, centipedes, springtails, protozoa, nematodes and other insects help to break down dead plant and animal parts and make new soil from them. Look at the soil surface or just below a layer of old leaves and you will find some. Do you have time to photograph them? Many are too small to be seen with a regular camera.

Task 2: Make your own soil - and grow in it!

For this task you will need:

- A scale
- A container to mix soil in
- Ingredients for soil (see list below)
- Plants, e.g. tomato plants

2: Make your own soil

You will now try to make your own soil mixtures. Write down on paper exactly how much of each ingredient you take.

Option 1: Here is a blend that works well as a starting point:

- You will now try to make your own soil mixtures. Write down on paper exactly how much of each ingredient you take.
- Option 1: Here is a blend that works well as a starting point:
- 30% compost: Maybe one of you has some compost at home? Make sure the compost is ready-made. It should look like dark soil and smell fresh of ”earth”.
- 30% horticultural peat: Peat can be purchased in bags - it comes from old bogs where it has ”composted” for many years.
- 30% (horse) manure: Maybe you have some stables nearby? Do not use fresh manure! It should ideally have been laying around for at least three months so that it is composted and should be dark in colour. You can also buy manure in bags.
- 9% sand: It should not be too fine and should not contain salt.
- 1% chicken manure: Do you know anyone who has chickens? Buy this otherwise as well.

Option 2: Another way to make good soil but it takes longer, at least two months:

This soil is called ”Eco-mixture”, and consists only of grass and sand.

- Mix 5-10 liters of 50% fresh, green, freshly mown grass and 50% sand with grain size 0-8 mm during summer. This soil can be used in flower beds and plants in pots. If you plant seeds, you have to mix in more sand, so that it is about 75 % sand and 25 % grass. Otherwise, the mixture will provide too much nutrition for most plants.
- Let stand in dark and airtight plastic sacks bags for at least two months, preferably a year or longer.
- When the soil is to be used it is very important that the contents of the bags are emptied and air for 4-6 days before use.
- If you want to improve the moisture retention capacity of the mixture, either 20 % compost or 10 % peat moss can be mixed in. But this is just so the plants do not have to be watered as often. They grow and bloom just fine without this variation. If you mix in more compost or peat moss, the result will be worse.

2b: Grow on your own

Buy plants, such as tomatoes, and plant in pots with different soil mixtures. Try to collect soil from a few different places in the neighbourhood and plant in these soils too. Set the plants in the same place, e.g. on a window ledge with good access to sunlight. Do you have a greenhouse, or school garden? If you grow in the fall-winter then you need extra plant lighting. Water every day, the same amount, for a few weeks. Which tomato plant is the longest? If you grow in the spring before the summer holidays, please take them home over the summer and continue to grow at home. Who gets the most tomatoes?

Photograph the results!

Summary report proposal

1. Describe your growing results for each other. Hand out tomatoes if there are any left. Show pictures from the growing step-by-step. Compare soil mixtures. Which mixture was easiest to make? Which seemed to provide the best growing results? Which gave the tastiest tomatoes?
2. Think and discuss:
   - What are threats to soil formation? In your surroundings? Globally?
   - How can this vital ecosystem services be protected in the community?
   - What you can easily do yourself to avoid damaging the ecosystem services of nutrient supply and soil formation?
   - Make a list and tape it up in the classroom. Vote for the three things you should all do.

Evaluate the work:

- How did the work go?
- Was it difficult? Why?
- Did you have the fun? What was the most fun?
- What did you learn? Is it an important piece of knowledge?

Some facts about soil

In order to grow food, we are entirely dependent on the very thin layer of topsoil that covers parts of the earth's surface, usually it is only 25 centimeters thick. The topsoil has most nutrients that our cultivated plants need. They are there because of nature's amazing ecosystem services, soil formation and nutrient supply.

Topsoil is teeming with life. A single gram of soil may contain up to one billion microorganisms such as bacteria, fungi, algae and amoebae! These microorganisms and larger animals like earthworms, springtails and millipedes are all involved in the decomposition of materials and development of soil. They break down plant and animal residues, together with sand, mud and minerals from the soil, by eating, digesting and then excreting them out in a more degraded form. The larger land animals begin to process the material and the smaller organisms take over gradually as the material becomes more disintegrated until it is so fine that the plants can absorb nutrients in their roots.

When there is plenty of living organisms in the soil it becomes loose and can retain water and provide oxygen to plant roots. A living soil also provides plants with a moderate amount of nutrition with a balanced content to keep the plants healthy and at good growth levels. In organic farming, it is an adopted notion to "fertilize the soil and not the plants." By this it means that you should provide the soil's organisms with materials so that they in turn can release nourishment to the plant roots. When you fertilize the plants directly with e.g. cow manure or chicken manure, an imbalance easily arises in nutrient supply so that a lot just goes to waste and pollutes the water while the plant "over-consumes" nourishments which makes it weaker and more susceptible to diseases.

There are many companies that sell ready-mixed soil. They usually use a combination of horticultural peat, cow manure, sand, limestone and maybe some clay into good-sized, yet secret, quantities. Some also mix in compost. Compost is ready-fertile soil with manure and plant residues broken down by living organisms. Compost is good to use because it contains both nutrients that plants can easily pick up and living organisms that continue to work. You simply gain ecosystem services for free!

To build new topsoil takes several hundred years so we must ensure that we nurture topsoil that exists and do not impair its ability to help us grow food. With the information below, the students gain an insight into what soil looks like and how it is made.

(Sources / references: Mat & Klimat (Food & Climate), J. Björklund, P. Holmgren, S.Johansson, 2008 Medströms bokförlag, Article from Natur & Trädgård 2/07, Nils Åkerstedt, Google - search words and Wikipedia)
Link to PDF about soil (in Swedish):
http://www.dengoda-jorden.se/wp-content/uploads/2011/02/Hopp-for-jorden.pdf
(From the website; http://www.dengodajorden.se/)

HOW MUCH OF THE PLANET CAN BE FARMED?

This exercise shows how thin the layer of topsoil on the planet really is. You will need an apple and a knife to carry out the demonstration.

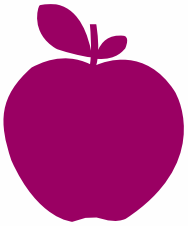
Take an apple. This is a model of the earth.

Is it possible to utilise the topsoil all over the globe? No! Divide the apple in four. Three segments represent the parts of the Earth covered by water and the fourth the actual land mass.

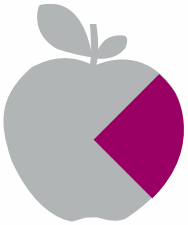
Take hold of the piece that represents land. Is it possible to grow crops on all of this? No! Divide it in two. One half represents possible arable land; the second represents the areas covered by ice, mountain ranges and desert tracts.

Now take hold of the first piece. Is it possible to grow crops on all the land this represents? No! Divide it in four pieces. Three of these pieces cannot be used for cultivation because they are too dry or too wet or covered with built-up areas with houses and roads. In the south of Sweden, for example, communities have been established on very fertile farmland. Only a quarter of the available space is arable – the part that is possible to grow food on – a mere 1/32nd of the globe. Peel the piece of the apple that represents this arable land to visualise the topsoil, which is only around 25 cm thick.

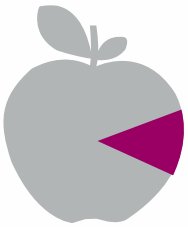
What feelings does this exercise provoke?



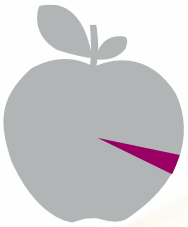
1 planet



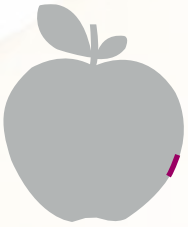
3/4 water, 1/4 land mass



Land mass = 1/2 = arable land, 1/2 mountains and deserts



Arable land - 3/4 dry, swampy or built-up.



Topsoil – the topmost layer on the remaining 1/32nd.

THE STRUGGLE FOR FISH

Fish is not only good to eat. Fish support multiple ecosystem services. Fish balance nutrient levels, close loops, transport energy, function as environmental indicators and give us pleasure when we observe them in aquariums or in the wild.

THE STRUGGLE FOR FISH

(Translated and developed games from: The Parts and the Whole, SWEDESD)

It is not possible to understand how fish are able to provide an ecosystem service without understanding the processes in the ocean that make fish possible. It is these processes we need to understand better, and above all appreciate more.

Lena Ek Minister for the Environment

Objectives of the work

Highlight the complex relationship that exists in the management of fish stocks in a sea.

Purpose

Being aware of global resources, to consider and discuss sustainable fishing and to discuss solutions for resource management also in other contexts.

Description of the task and preparation

Divide participants into groups with a game master and 5 players. (A-E)

Each group will need:

- A large piece of white paper where they draw the shape of a lake.
- A large box of matches, or at least 200 small sticks.
- A protocol (proposal for copying is in the task).

Workflow

A. Heating: Values in the sea

1. In the sea there are a variety of values known as ecosystem services. Give some spontaneous examples!
2. The table below lists a number of values in the sea. Try to sort them into base categories that exist for ecosystem services: producing, supporting, regulatory and cultural. Read more on page XX.

- fish
- bath
- algae
- plankton
- research purposes
- fertilizer
- salt
- inspiration for artists (music, painting, literature)
- knowledge bank
- oxygen
- seafood
- wave energy
- purification
- biodiversity
- carbon reduction
- relaxation
- regulation of temperature
- waterways (transport)
- beauty

2. Fish game

The players (and game master) read the instructions for the first game. Without talking to each other, they decide themselves on a strategy for the game.

Games master's task

Game master adds 50 matches = 50 tonnes of fish in the lake and gives names to the players A-E.

The game master must ensure that all players follow the rules. The game master is also responsible for fish reproducing in the right way by adding the correct number of sticks after each round of play.

In the first game, players or the game master cannot talk to each other or make suggestions about how someone should act.

The game master should also keep a protocol of each game round. Protocol proposal is further down on the page.

Rules for the first game

A game consists of 8 rounds.

The player that starts the first round must be last in the next round. Then switch the order clockwise. All will thus be first at least one round.

You fish by catching fish (taking sticks) from the lake. One player at a time until everyone has fished once.

You decide how much you want to catch every time, but you must consider the following conditions:

Maximum catch per person for a round is six sticks = six tonnes of fish.

DID YOU KNOW THAT THE PRODUCTION OF FISH SUCH AS PIKE, PERCH AND ZANDER IS A FREE SERVICE PROVIDED BY NATURE?

The cost of the boat and the equipment you are fishing with is one stick = one tonne of fish to be able to fish, no matter how many fish you catch. This is to be paid to the game master at the end of each round. This applies even if you do not catch anything at all (thus you cannot choose not to fish, but you can choose to not catch anything).

After each round the fish reproduce. Reproduction speed is the number of fish remaining in the lake multiplying to double (if e.g. there are 20 fish left there will be 40 after reproduction).

The game master must ensure that all players follow the rules. Game master is also responsible so that the correct number of fish have been multiplied in the right way by adding the correct number of sticks after each round.

In the first round, the players or game master cannot not talk to each at all other or make suggestions about how someone should act.

The winner of the game is the player with the most fish after eight rounds.

Rules for second game

This time you don't compete alone, yet instead compete against the others. You compete as a group against the other groups in the class. Within your group (even the game master joins in), you will talk about what strategy you are going to have to compete as best as possible. You may discuss, agree and cooperate as much as you want.

After eight rounds, there must be at least 50 tonnes of fish left in the lake.

Besides this, the same rules as in game 1 apply.

Winner of game two is the group after eight rounds that has the largest total catch.

A valuation exercise

Who should decide over fishing in the Baltic Sea.
Perform a four corner drill. Use the four corners and name them: A. The government is responsible B. Personal responsibility C. Taxes D. Own proposal. Students first think on their own and silently. Thereafter they go to the corner they have individually selected. In every corner, students talk together about their common arguments. The exercise concludes with a general discussion in a large group. Maybe someone wants to change corners? Read more in section 6 below.

Summary report proposal

3. Compare the total catch between the first and second games. Are the results different? What result is the best? Why? Think about why it is so.
4. What is needed to be able to care for and evaluate a resource that is common?
5. What is the ideal fish population to use the ecosystem service ”Fish” in a sustainable way?
6. When does a fish population decrease or disappear?
7. Tell each other amongst the groups what you have been up to and what you've learned from the task. Continue to think of other examples where you might be able to learn something from this task. Examples:
    - Traffic jams are an example that a public resource is overused. Everyone chooses the car to shorten their own journey but the journey time is longer than if passengers had taken the bus instead.
    - A number of farmers in the area own fields. In addition, there is a common field, a field that is jointly owned. Each farmer farms their own fields, but nobody wants to take care of the common field because they would get too little out of their own working hours.
    - In a sea, a number of fishermen fish. They fish too much and catches decline. Every fisherman then fishes more hours to maintain their income, causing the fish to run out even faster.
8. Discuss possible solutions to these problems:
    - Private ownership – distribute common e.g. fields in pieces to each one.
    - Governmental or supranational governance - state powers legislate what you can do and what you must do, which takes into account the common interests.
    - Taxes - because people do not voluntarily want to do everything that needs to be done in the community, the community takes out taxes and employs people to do such jobs.
    - Via administration rules - which are set up by all those who use the common interests. They also decide on sanctions or penalties for those who violate these rules. It assumes that the users of the common interests can and want to talk to each other and have an interest in or benefit from deciding on optimal solutions together.

In-depth: Read more together about ”The tragedy of the commons” e.g. via information on Wikipedia, or search ”the tragedy of the commons”, ”YouTube” and also see links on the WWF's website.

Evaluate the work

- How did the work go? Was it difficult? Why?
- Did you have fun? What was the most fun?
- What did you learn?
- Is it an important piece of knowledge?

The protocol looks like this:

Total catch for the entire group - round 1: .....

Total catch for the entire group - round 2: .....

Player	A		B		C		D		E		Number of fish left in the lake	
Round	1	2	1	2	1	2	1	2	1	2	Game 1	Game 2
1												
2												
3												
4												
5												
6												
7												
8												
Total:												

Many important ecosystem services can be found in and around the world's oceans

More than a third of the world's population lives on or near a coast. Hundreds of millions of people depend on fish and other marine resources for their livelihoods. More than 38 million people are directly employed in the fishing industry. Fishery thus fulfils a very important socio-economic function. Coastal tourism is another major source of income in many countries. In the Florida Keys (U.S.A) tourism along the barrier reef generates about 1.2 billion dollars each year. In Sweden, Gotland, the Koster islands and the archipelago are examples of popular recreation areas.

Mankind is dependent on a number of ecological services provided by the world's oceans:

- The sea's ability to supply fish and other valuable natural resources
- Coastal ecosystems such as coral reefs, kelp beds and mangrove forests offer ecologically important spawning grounds and shield inhabitants against storms and heavy flooding
- Ecosystems maintain the water quality of the ocean
- The ecosystem and its aesthetic values, from tropical coral reefs to the Swedish archipelago, creates the conditions for tourism and outdoor activities
- Climate – the oceans act as an important carbon sink
- The sea delivers energy in the form of wave power


FRIDA
KR 18
KR 37

MY LOCATION

Many of us have different favourite places that we gladly return to. It can be a beautiful cliff in the archipelago or a lake with many different species of birds. Some even call nature a kind of church, a sacred place, which strengthens the inner self and spiritual dimensions in us.

MY PLACE

Objectives of the work

Gain a deeper contact with nature and yourself.

Purpose

To ”see” nature in a deeper way, to feel what nature provides us for the soul and to discover cultural and spiritual dimensions of nature - the cultural ecosystem services.

Description of the task and preparation

Humans have always had places where one can meet one’s external and internal nature, alone or with others. Shamans or medicine men are people who, in a special way, have been able to understand or have contact with nature. Places that have been important to humans have over time been called holy places, or places of worship. Often it is places that also have special values from other angles.

In many indigenous communities they have for hundreds and perhaps thousands of years experienced becoming an adult by searching in themselves and finding their way of life by being alone in nature, sometimes for a long time.

Even in our modern society, man seeks a relationship to nature to feel good. Often it is described in words, ”I find peace in nature, the stress disappears out of me, here I can be myself, I see clearly, it’s nice to walk in nature because it is so quiet.” Having one’s own place in nature that one feels is undisturbed is one of man’s deepest needs. A place you go to in order to gather strength, relax, explore your relationship to everything or just be. In nature, creativity is often set free.

Read the E-cards together that describe the cultural ecosystem services. Talk about these dimensions of nature together.

Plan a trip to a natural area or a larger park. It’s good with varied and magnificent scenery - with forest, open land and water. But often, nature near the school would suffice. Even on a small scale one can experience the greatness, such as an ant’s struggle with a pine needle.

Bring:

- information and invitations (proposal for copying is last in the task description)
- pencils and a surface to write on
- seat mats and something to drink

Workflow

- Determine which of the tasks you will work with, or if you will do both tasks. Plan time accordingly based on your choice.
- Hand out pens and the task as well as the invitation cards below to each participant.
- Walk in a long line - a leader first and another in the back.
- In equal increments of time, the leader stops – ideally in places that appear to be suitable to sit for half an hour.
- If you want, choose the place you will stay by raising your hand.
- When the first place is chosen, the leader starts to keep time - 30 minutes is about right.
- Continue by letting participants look to find a place to sit. Several can choose a place in the same area, but they cannot sit closer than ten meters to each other.

”We are human, only in contact, and conviviality, with what is not human”

David Abram, Alliance of Wild Ethics

- They should all be able to see each other if they stand up – this is a good density.
- After thirty minutes have passed, the leaders begin to gather the group together again. Tell them that they should be quiet while you are gathering everyone together.
- Instructions once at your place: After selecting a place, you have to stay there until the leader comes back and picks you up. You shall not interfere with anyone else. You should be as quiet as possible. You must solve the task on the paper that you have with you. Before leaving your place, consider what you can do for your place, or for your place you ”interviewed”. Maybe you can hug a tree or send grateful thoughts to animals and plants at your place because they give you experiences. Giving something back to ”nature” is a way to show appreciation for all the services that you get from it.

“All 7 billion people on earth have their economic, spiritual and physical health tied to forests.” Jan L.Macalpine, UNEP

After everyone has gathered together again:

- Put half of the ”invitations” in a hat, bag or a basket.
- Let those who have their cards remaining pick up a card. Then each one looks for the author of the card they received - thus forming pairs of two persons (if there is an odd number in the group, a ”pair” can consist of three persons).
- Within the pairs, tell each other about your location, or if the group is old enough for it and time permits, visit each other’s places and present them and tell each other ”on location”.
- Gather the entire group again. Sit down in a ring and let everyone say the name of their place in succession.
- Discuss ecosystem services, ideally based on the E-cards. Choose some of them that you think may be visible in places, not just the cultural services. Ask those who believe that they had the service somewhere at their place to raise their hand.

Summary report proposal

Tell your friends about your site and your experiences with nature. You can do it with images and music. You can also do it as a role-playing game where you let a classmate ask the questions to you. You can also just tell them your thoughts directly.

Do not be afraid to get personal and show your emotions and awe about what you experienced.

Evaluate the work

- How did the work go? Was it difficult? Why?
- Did you gain any new insight? What?
- Has it changed your own view on nature in any way?
- Is it an important piece of knowledge?

Tasks (proposal for copying)

Task 1: My place:

Description

Once you find your place: Pick a comfortable spot where you can sit down. Take a few moments to just experience and enjoy. Then look around at the place and answer the questions:

What was it that caught your interest?

.....

What things did you discover at your place?

.....

Is there something at your place that you think is particularly beautiful or exciting?

.....

How does it feel to be here?

.....

Choose a name for your place - then it may help to feel that it is your own.

I choose to name my place:

.....

Some things in one place arouse our interest in a particular way.
Look, listen, feel or smell around for a while in your place and let a tree, a rock or something else attract your interest. What was it that caught your interest that appealed to you in particular?

.....

You should also fill out an invitation card that you have with you.

You will have to tell about your place for someone who you invite.

Invitation card:

You are invited to: ..... (Name of the place)

Your guide's name is: ..... (You who examined the place)

Task 2: Interview with nature

Pick out something at your place that you think has an interesting story to "tell": a rock, a tree, a plant or an animal. Ask some questions about what you found. Think about what it would answer if it could talk.Write down your questions and answers you can think of. You can choose some of the questions here, or make up your own.

How old are you?

Have you always had the size and shape you have now?

Where are you from?

How is it to be here?

Who will come and visit you?

Who benefits from you?

Who helps you?

Are there any dangers you have to watch out for? Are you afraid of something?

What do you live off of? How do you find what you live off of?

Where do you live? Do you live alone or with others?

What would you like to tell me about yourself?

CLEAN WATER

You lower the cup into the mountain brook and drink cold and good water. Moreover, it is absolutely free! But how is water purified?

CLEAN WATER

Objectives of the work

Increased knowledge of nature's water purification processes and how humans can purify water in an emergency

Purpose

Gaining insight about different ecosystems' purification abilities and the importance of planning wisely for good water quality.

Description of the task and preparation

Ecosystems help us to purify the freshwater we use. Both before and after we have used water, it is filtered and purified using different ecosystems. It also helps bacteria and microorganisms to remove toxins and other impurities from the water. Maintaining well-functioning ecosystems around lakes and streams is an important and profitable way to make sure we can get clean water. Using this information, you should learn a bit about how water can be purified naturally. Work in pairs.

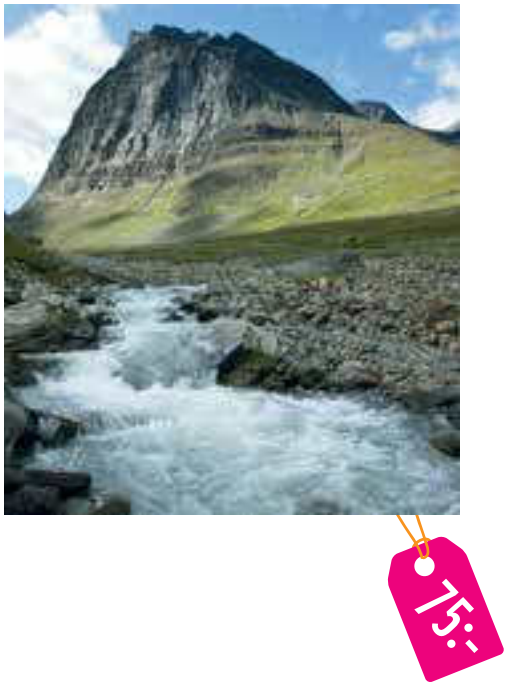
This is needed for each group:

- Water, soil and a spoon
- Three cups per group - at least 1/2 litre in size. Ideally larger and preferably with decilitre markings
- A decilitre measure
- Soda bottles that are cut in half to form a funnel
- Sphagnum moss, (available in nature - in a wetland or marsh)
- Unfertilised peat (available in plant stores)
- Carbon powder (can be obtained by crushing charcoal)
- Pebbles, washed gravel, or washed sand
- A stopwatch

Ilustration: Pernilla Albinsson

Workflow

1. Fill a cup with water to three quarters. Put in a few spoons of soil and stir. Now you have some dirty water that nobody probably wants to drink.
2. Pour over half of the dirty water into the second cup. It will serve as a comparison so you can see if there is a difference between the dirty water and the water you are going to try to purify.
3. Now make the filter. Use the can, but cut it so that it is open at the top, or use a divided soda bottle so that it resembles a funnel. Make 8-10 holes in the bottom.
4. Firstly add about a 2 cm thick layer of sphagnum moss in the bottom.
5. Mix 2/3 of unfertilized garden peat, 1/3 crushed charcoal and soak up the mixture with clean water. It is very important that the carbon powder is finely divided and thoroughly mixed with the peat!
6. Pour the mixture of peat and charcoal in the can and fill so that at least half the can is filled. You can clean about 50 times as much water as the filter volume of peat/coal.
7. Add a centimetre thick layer of sphagnum moss on top of the pebbles in order to push down the filter mass. Press a little cautiously.
8. Time to test! Set the can/funnel above an empty cup and carefully pour the dirty water into the filter and let it run through it. The filter shall be packed so that the flow rate through the filter is approximately l dl/minute. Test by pouring in a couple decilitres of water and keep time of how long it takes to get a decilitre.
9. Now compare the purified water with the dirty water. If you are not completely satisfied with the purification you can redo it and be a little more careful when you pack the filter itself.
10. Do you dare to drink the purified water? How is it?
11. Compare results of your group with the other groups. Which group do you think was most successful? Interview each other to figure out how to purify water in the best way.
12. Try to find facts on the internet about ecosystem services and water purification.



Value of water

In the mountains you dip a cup in the creek and drink good and cold water for free. In the shop you can buy carbonated, flavoured water for 40-50 SEK per liter. We put, in other words, different prices on water.

Investigate

- How much does a litre of water we get from the tap at home cost?
- What is the most expensive bottled water in the store you can find? Why does it cost so much?
- If you were to put a price on being able to drink water directly from the stream or lake, what would it be? How did you conclude this?

Summary report proposal

Which group managed to get the cleanest and tastiest water?

Water is one of the most important ecosystem services that are available. Try to answer the following questions:

- What are the various tasks of the different ingredients in your purification can? Sphagnum moss? Peat? The charcoal? The gravel/sand?
- How is water purified in nature?
- How would you evaluate nature's free service of purifying water: no value, low value, high value?

Discuss and explore together.

1. Do you know where your own drinking water comes from? How is it purified? Is it groundwater or seawater? Are there any sources where you can drink the water directly in your community? Wetlands, sand and gravel ridges, land along streams and within communities and streams/rivers that wind their way downstream are particularly important for water purification in nature. Can you use Google Maps or maps of your community to find places where the water is purified naturally in your municipality?
2. How is wastewater purified? Watch a film about sewage plants or visit a sewage plant in the municipality. In a sewage plant, wastewater is purified usually in three or four steps: mechanical, biological and chemical (2 steps). What happens if the drains did not lead to the sewage plant? Can you take care of wastewater through nature's own purification? How did people manage in the past? What can happen to rivers, lakes and groundwater if purification does not work? What must we not flush down the toilet? What does it cost for a household to have the municipality purify wastewater?

Evaluate the work

- Describe what you learned from the experiment.
- How did the work go? Was it difficult or easy?
- Did you gain any new insight? What?
- Is it an important piece of knowledge to know how water is purified in nature? Why/Why not?

Suggestions for in-depth learning

1. Working further with an example about good handling of drinking water in New York in the material Eco-8. www.eco8.se.
2. In Kristianstad's Water reserves, they have planned to use nature as a water purifier. Historically, the wetlands around Kristianstad have been very useful. This has changed over the centuries. Channels and lakes were drained. When the modern city expanded, the wetlands became a storage space for municipal waste. After decades of hard work, the balance is starting to be partially restored in the area. They use the wetlands' ecosystem services to, among other things, purify water.

Link: http://www.nyfikengron.com/dokument/Ekosystemtjanster_verktyg_hallbar_utveckling_Nyfiken-Gron.pdf

WATER PURIFICATION IN THE LANDSCAPE

Many contribute to the purification of the water. For example a mussel that is 3cm filters about 3 liters of water per hour!

Photo: Sven Ängermark

WATER PURIFICATION IN THE LANDSCAPE

Objectives of the work

Increase knowledge of valuable water ecosystems.

Purpose

Through practical tasks, to get a feel for the value of natural water purification.

Description of the task and preparation

Most water pollutants are invisible to us humans. It can be difficult to see that the lake contains too much mercury or phosphorus. The task of this chapter is threefold. Start first with clean water in a drinking glass. Then move on to understanding how water travels in the landscape and is naturally purified. End with building a model outdoors and thinking about the value of nature's water purification.

Workflow

Ideally be outdoors.

What you need:

- a glass of water
- some soil
- sponges
- coffee filters
- two wooden boards
- pieces of cardboard, scissors, pencil

A. A glass of water

1. Fill the glass with plain drinking water. Where does this water come from originally? Describe the path from source to tap. How is drinking water purified? Does it cost anything? How much does a cubic meter of drinking water cost in your community?
2. Pour in some soil or the like that "dirties" the water. Where do pollutants come from that contaminate rivers, lakes and oceans?
   Some are visible from industries. But they can also come from "invisible" sources like surface water and precipitation, or from agriculture. Try and purify the water using a sponge and a coffee filter.
   How does water purification work in nature?

B. Watershed

1. Water always flows downhill

Go out in a landscape or study a map. The highest point in the area is a watershed. When rain falls, it runs along the highest point's sides. Water carries pollutants. What pollutants can you imagine that the water brings in your landscape, in your hometown? Where it is conceivable that over-fertilization takes place? Pesticides? Other pollutants?

2. Water on a slope

Water occurs naturally in a variety of ways. It's about stopping the flow of water so that nature has time clean it. Different ecosystems purify water naturally.

Create a slope made from a wooden board. Place the board on the table at a slight incline. Pour 1 cup of water from the highest point. What is happening? Place a layer of moss on the board. Pour 1 cup of water. What is happening?

Water is purified in an ecosystem because e.g. a spruce slows the flow of water. Forests, wetlands and natural grasslands act as sponges and slow the flow of water. The longer it takes the water to follow its path through the landscape, the greater the chance that biological processes have time to purify the water.

Paved surfaces are thus not good for water purification. The water runs too fast on an asphalt surface.

How much does water cost?

Water purification by nature is worth a lot. But how much is it worth?

Build a water landscape of natural objects.

C. Build a model of a river basin

1. Create a landscape

Build a fantasy landscape or a model of your hometown with the help of natural objects. Work in small groups.

Choose a light, sloping field in nature approximately 2 x 3 square meters. The following must be included in the model: lake, river, sea, water reservoir, roads, agriculture, housing and some chemical plants.

Start by creating a lake with a tributary - stream or river and then an outflow.

Continue to build the scenery around - forests, fields, meadows, mountains, streams etc.

Then it's time to build urban area with homes.

Natural water purification

Water is purified when an ecosystem such as a spruce forest act as runoff barriers. Forests, wetlands and natural grasslands act as sponges and slow the flow of water. The longer water takes in its path through the landscape, the higher the chance that biological processes will have the time to clean it.Paved surfaces are not good for water treatment. Water flows too fast over asphalt.

2. Ecosystem services

Which ecosystem services are or should be in the model landscape? Pick out five.

Place out small signs telling you where they are. Here are some examples of ecosystem services that are certainly in a landscape: photosynthesis, soil formation, nutrients in the cycle, the water cycle, water, food, pollination, tourism and so on. See the E-cards.

3. What does it cost?

An industrial plant has released toxins into the lake. It makes the water is unsuitable for drinking. This ecosystem service is thus destroyed. The municipality must solve this in a different way. What solutions are there? What does it cost to arrange drinking water in other ways? The price is a value for ecosystem service consumption. Learn more about water management in New York in SNF's material called Eco 8.

4. Summarise and reflect

Describe each other's models for each other. Discuss the good and mediocre solutions.

5. Pour water over the model

Finish the exercise by gently pouring a bucket of water in the model's slope to see where the water ends up flowing.

Evaluate the work

- Describe what you learned from the experiment.
- How did the work go? Was it difficult or easy?
- Did you gain any new insight? What?
- Is it an important piece of knowledge to know how water is purified in nature? Why/ Why not?

The city
as classroom

WWF's new tutorial "SUSTAINABLE CITIES - Working with sustainable urban planning in Secondary Schools" highlights the ecosystem services to be found in a city. It poses questions such as: What is an ecosystem service and is the concept related to sustainable development in the city? How can you help reduce the city's carbon footprint and increase and maintain ecosystem services?

Exercise: What is a tree worth?

For example there is an exercise in the tutorial that illustrates the city's ecosystem services.

The teacher acts as auctioneer and asks students to bid on a tree. How much is it worth? What might they be prepared to pay? Students must motivate their bid.

A tree in London is estimated to be worth €943,500 (London Tree Officers, 2008). The teacher then introduces the notion of "willingness to pay" and the importance of trying to put a price on nature and thus include an economic perspective. Discuss whether ecosystem services really are free.

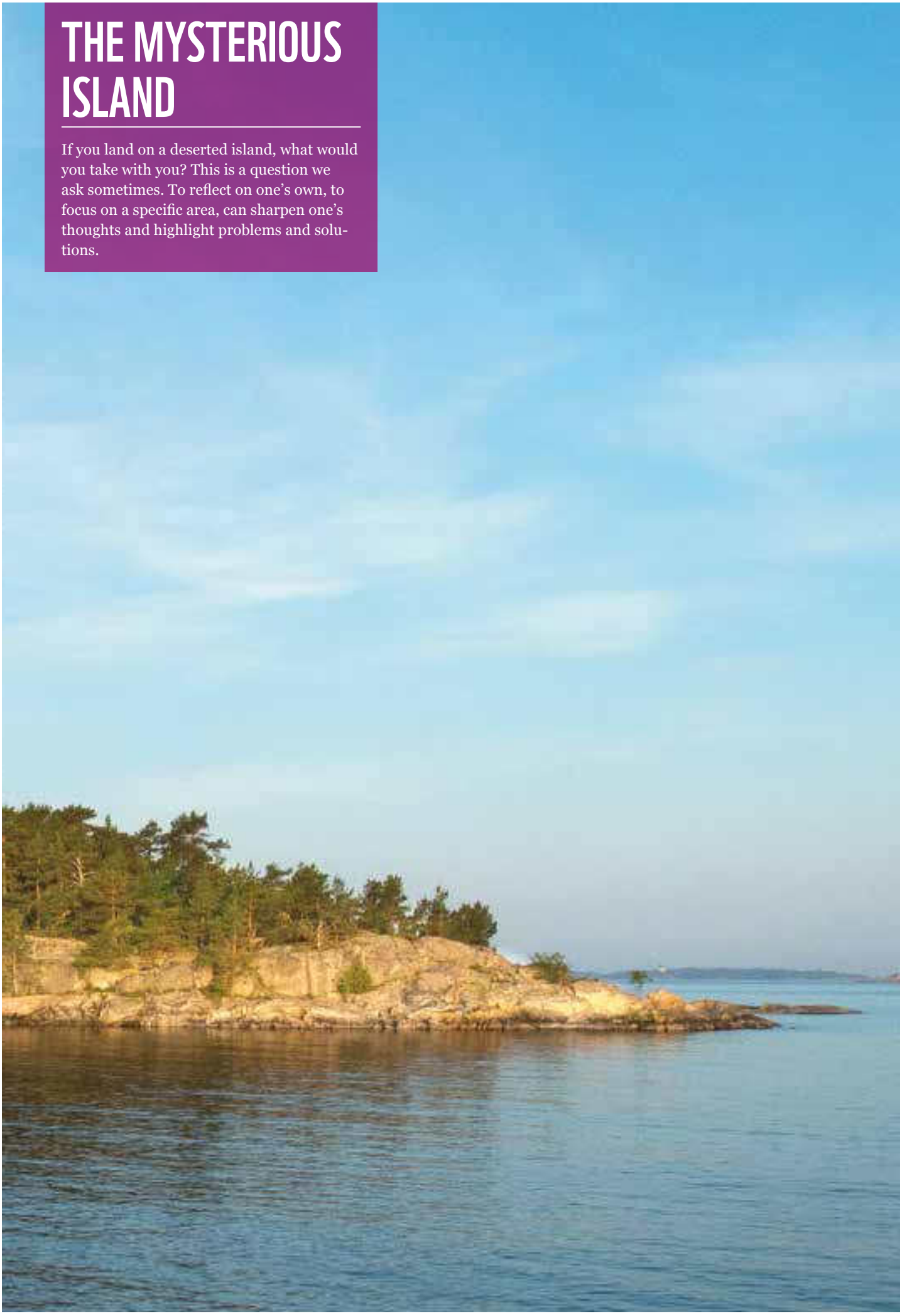
Why should we attach price tags to nature?

Can we put a price on a tree? What is Lake Mälaren worth? (The city of Stockholm is virtually situated on water where this lake meets the Baltic.) How much should decomposers in the park be paid per hour? Putting a price tag in dollars and cents on ecosystem services is not easy. It is a way to generate interest and discussion among social actors on the functions, services and values nature provides, and allows us to discuss environmental issues based on what would happen economically and socially if the ecosystem were to fail.

Download the Sustainable Cities tutorial from wwf.se/utbildning

THE MYSTERIOUS ISLAND

If you land on a deserted island, what would you take with you? This is a question we ask sometimes. To reflect on one's own, to focus on a specific area, can sharpen one's thoughts and highlight problems and solutions.



THE MYSTERIOUS ISLAND

Problem-based learning

(Problem Based Learning, PBL) is a pedagogical method where learning is based on case studies and problem solving, rather than lectures. Pupils search for information themselves without the help of a teacher. They work in groups with reality-based problems. Some steps in the process:

Explain terms and concepts.

Identify problems to be formulated so that upon summation they can be answered.

Produce ideas. You can ”brainstorm” which allows everyone in the group to come up with words that they associate to the problem.

Create hypotheses e.g. qualitative guesses of solutions to the fundamental problem.

Acquire knowledge. Each team member is responsible for obtaining the knowledge that he or she considers necessary with which to resolve the problem.

Problem solving. Here, the new knowledge shall be able to explain the hypotheses that were generated and solve the problem using the in-depth knowledge. The new knowledge should be able to be used in similar situations elsewhere.

Source: Wikipedia

Objectives of the work

Examine how a sustainable community can be created through wise and informed decisions.

Purpose

To develop one’s knowledge of man as part of nature.

Overall, to understand how a community is dependent on ecosystem services.

To gain an understanding of ecology and recycling.

To gain insight about how the ability of ecosystems to provide us services is affected by how we affect nature.

To experience that conflicts can arise that need to be resolved surrounding the view of nature and about the various ways to use nature.

Description of the task and preparation

”The mysterious island” is based on a PBL and a solution-focused work approach. The exercise is deliberately openly designed for the teacher to be able to adapt its complexity to students’ prior knowledge and available time. Set aside at least one full day for this exercise, or distribute the same time over several occasions.

At the end of the task there are two appendices:

Appendix 1: A detailed teacher’s guide.

Appendix 2: Background information.

Feel free to copy these and have them at hand to help you as a teacher while working.

Workflow

1. Divide students into groups of 4-6 students. Distribute the following materials for each group:
   - Large paper (flip chart size), 1-2 per group
   - A4 paper, approximately five sheet per group or smaller pieces (about ¼ A4) five to ten pieces per student
   - Pens, paints, crayons, brushes
   - E-cards – one deck per group (distributed later, when work starts)
2. Introduce the task. Each group is given a piece of paper with the task. Let the groups reflect a moment based on their own ideas about how the island will be built.

Task: to plan for a good life on ”The mysterious island”.

Conditions

The island lies in the middle of a vast ocean, without contact with other islands or the mainland.

You and your fellow humans are going to stay on the island for at least 10 years.

When you leave from there, others should be able to continue living on the island.

You should try to live so that nature is not damaged.

The climate on the island is about the same as where you live, with seasonal changes; years, summer, autumn and winter etc.

You can bring the people you want to bring, except those in the group - it can be friends, siblings, relatives, parents, acquaintances or strangers that you have met.

You can use known technology, yet have no ability to obtain outside assistance such as food, repairs and so on while you are on the island.

Four sub-tasks that must first be resolved:

- Population: How many are going to stay on the island? Who should stay on the island? How and where will you live? How will you take care of your waste?
- Supply: What will you live off of on the island? What will you do? What must you be able to know how to do? How do you get water, food, clothes, furniture, etc.?
- Transportation: How will you transport yourself and the things you want to bring?
- Energy: How are homes heated? What do you need electricity for and how do you get electricity?

What do you take with you?

What should the island look like for you to have good opportunities to live there?

1. Reflect together on the four sub-tasks in the exercise. Brainstorm! Write down all the issues you need to resolve relating to the sub-tasks. Write clearly on the flip chart.
2. Collect all groups' questions and tape them up on the wall. Help each other to find answers to the questions = collaborative problem solving.
3. Draw your island. Use a large sheet of paper, one or two flipchart pages large. Start by sketching in pencil. Are there lakes, mountains, forests, swamps, beaches, fields, meadows, roads, paths, houses?
4. Get the E-cards out. E-cards tell about different services that nature provides. Deal the cards around the table in the group so that everyone has about the same number. Read one card at a time - where on the island are the ecosystem services? Do you have to ensure that certain services are on the island in any way? How? Where?
5. Work further on the island. Remember that all or most of the ecosystem services must be on the island.
6. Presentation. When the time for the task is up, you should present your island to the other groups. Tell us about the island and how you solved the various issues.

Tell us about three ecosystem services you think were important to ensure that they were on the island. How did you make sure they were there and how did you use them?

Are there any experiences/pieces of knowledge from your problem-solving work that could be used in our surrounding environment?

How would your mysterious island function without the existence of nature in and around it?

What can you do to ensure that nature's free services will continue to function as well as possible?

Evaluate the work

- Discuss together with the class;
- How did the work go? Was it difficult? Was it fun? Why?
- Did you gain any new insight? What?
- Have you learned something important?

Appendix 1
The mysterious island: Teacher's guide

Prerequisites

The Island lies in the middle of a vast ocean, without contact with other islands or the mainland.

You and your companions are to stay on the island for at least ten years.

When you leave others must be able to continue living on the island.

You should try to live in a way that does not harm the natural surroundings

The climate on the island is similar to where you are living now, with seasonal changes; spring, summer, autumn and winter.

You can bring anyone you want along with you, in addition to members of the group, friends, siblings, relatives, parents, acquaintances or strangers you have met.

You may use any established technology, but while you are on the island you will have no way of getting outside help with food, repairs and so on.

The task called The mysterious island is conveniently presented in various stages for students/groups of teachers. The groups need to be confronted with their own issues and problems. Provide support and assistance in their work when needed.

Workflow

1. Divide students into groups of 4-6 students. Each group will receive:

- Large paper (flip chart size), 1-2 per group
- A4 paper, approximately five sheet per group or smaller pieces (about ¼ A4) five to ten pieces per student
- Pens, paints, crayons, brushes
- E-cards – one deck per group (distributed later, when work starts)

2. Introduce the task

Each group is given a piece of paper with the task, or the task is written on one/several flipchart paper(s) and taped up on the wall. Have the groups reflect a moment based on their own ideas about how the island will be created.

Initial questions:

How many do you think should live on the island? How big should the island be to cope?

You can expect that about 2 hectares (one hectare is 100x100 meters) is needed for every person on the island. Of this, about 0.5 hectares is farmland, 1.5 hectares is grass/pasture and 2 hectares is forest.

3. Consider the four sub-tasks in the exercise

See Appendix 2: Background information

- Population: How many are going to stay on the island? Who should stay on the island? How and where will you live? How will you take care of your waste?
- Supply: What will you live off of on the island? What will you do? What must you be able to know how to do? How do you get water, food, clothes, furniture, etc.?
- Transportation: How will you transport yourself and the things you want to bring?
- Energy: How are homes heated? What do you need electricity for and how do you get electricity?

Ask each group to write down any questions they think relate to the task. Feel free to use a flip chart so that the questions are clearly presented.

Try to answer the questions. Each group can be helped by the teacher or the other groups.

Some questions that certainly need to be discussed:

- How will we get food?
- How do we grow things?
- How do we store the food?
- How do we get drinking water?
- How do we get clothes?
- Where should we stay?
- What do we do with the waste?
- Where do we go to the toilet?
- Do we need energy for something? Heat? Electricity? How do we get energy? Biogas? Wind? Solar warmth/solar energy? Wood /trees? Digging up oil?

- What will you do on the island?
- What can you get for free from nature on the island?
- What do you need to create yourselves? Where do you get those resources?
- What do you do to feel good and have a good life together?
- Should everyone work or just a few? What will you do in your spare time?
- What skills and occupations do you need on the island? Is there anyone you can get help from who has more knowledge and experience than you do?
- What happens if there is a disturbance on the island? Perhaps the sewer breaks? Maybe an oil spill?

Questions that may arise, and must be spoken about, but where possible should have less focus placed on them:

- Will there be children born on the island? How do we take care of them?
- Will someone be injured/get sick?
- What do we do with those who are too old to take care of themselves?
- What do we do if someone dies?

4. Collect all the questions and tape them up on the wall

Try to help and lead the students towards concluding reasonable answers to the questions. As a teacher it is good to give a little information at a time based on the issues that come up among student groups. A good way is to use open-ended questions that lead to clarification or deepening. For example: ”What (exactly) does it mean?”, ”Can you give me an example of what you mean?”, ”Why do you say that?” Confirm thoughts that seem sustainable, expand on/clarify thoughts that seem unsustainable.

5. Draw your island

Use a really big paper - one or two large flipchart sheets is good. Sketch in pencil. Please specify a scale for your drawing. Are there lakes, mountains, forests, swamps, beaches, fields, meadows, roads, trails, buildings and so on?

6. Get out the E-cards

Deal the cards around the table in the group so that everyone has about the same number.

a. Read one card at a time and think together about whether the ecosystem service exists on your island or if you need to make sure that it is included in some way.

b. Go around the whole group until all the cards are read and discussed.

c. Was there any ecosystem service that you hadn’t thought of?

7. Let groups work for a long time with their islands

Help pedagogically and encourage, resolve conflicts, clarify and confirm the reasonable, sensible or sustainable solutions.

8. Presentation/summary

a. Present your island for the rest of the class. You who present stand in front the others and have with you your island and show it. Tell us about the island and how you solved the various issues.

b. Tell about three ecosystem services that you think are important to ensure that they are on the island and how you use them.

What have you learned from ”The mysterious island?

9. Evaluate the work

The summary dialogue in learning about ”The mysterious island” could be about how the world’s population will be able to use ecosystem services in a way that is sustainable from both an environmental and resource standpoint. ”Ecological footprint” is a concept that, in addition to ”ecosystem services”, can provide greater understanding of the resources and distribution perspective. Facts and student data on the ecological footprint can be found on the WWF website.

Discuss together with the class:

- How did the work go? Was it difficult? Was it fun? Why?
- Did you gain any new insight? What?
- Have you learned something important?

How would an island like yours work without nature in and around it?

What can you yourself do to ensure that nature’s free services will continue to function as well as possible?

Are there any experiences/pieces of knowledge from your problem-solving work that could be used in our surroundings?

10. To pursue further

What would you like us humans to do to ensure that ecosystem services are preserved as well as possible?

Write suggestions on sheets of paper and tape up on the wall:

What should we as all people on earth:

- continue with?
- stop doing?
- start doing?
- look out for?

What can you as a group do?

What could you do in school?

What could everyone in the community where you live do?

Appendix 2
The mysterious island: Background information

Background information for the work with the four main tasks: Population, Supply, Transport and Energy.

Population

How many are going to live on the island? Who should stay on the island? How and where will you live? How will you take care of your waste?

Issues that come up during this section include:

- How many should we be on the island? Distribution of males/females? Connect this to the question of how much land is needed to support a person, how many should there be so it is fun, how many are needed to help out?
- Should there be both young and old? Why/why not?
- What skills and occupations should be included?
- How do we live? Building houses that last for ten years. Choice of materials related to the ecosystem service ”Raw materials”. What is renewable, what is the easiest to build with?
- Where should we build? To the south protected from winds, near the beach with the risk of flooding, near the water, and so on. Discussions about needs are connected to smart, sustainable solutions and ecosystem services.

Food

Supply: What will you live off of on the island? What will you do? What must you know how to do? How do you get water, food, clothes, furniture, etc.?

From experience, we know that much of the discussions will end up being about ”how we get food?” This is also the main focus of this exercise. This is because most ecosystem services, in different ways, can be connected to this need.

Grow food - or ”pick in the forest?”

Since the task assumes that the climate is like where we live, the task of solving food needs is more complicated than just saying ”we go out into the woods and pick fruits from the trees or berries on the ground.” The self-catering, which characterised many hunter-gatherer societies, is based on close use of ecosystem services and on a very resource-stringent life. Exploiting nature’s free services in this way can be an important part of managing, but is hardly realistic as a general approach to this task. Ecosystem services combined with human efforts in the form of cultivation will be an important part of island life.

A question before ”fixing food” is the connection between the food we choose to eat, how much surface area is needed to grow the food, and the impact this may have on ecosystem services.

- Potatoes and other root vegetables as well as bread and other flour products will be important as a staple food.
- Those that live on the island must ensure that they have sufficient amounts stored for the winter and spring. Potatoes, turnips, carrots, beets, etc. are easy to store in things like a root cellar for the winter. Wheat and rye are also easy to store as well as dried peas and beans. Besides root vegetables being staple foods, they are also significant vitamin-C sources.
- For other vegetables and any herbs that can be grown outdoors or in a greenhouse, there is flexibility for widely varying suggestions from the students.
- Diet based on seasonal variations is another stance.

Eating animals or only vegetarian food can lead to discussions. Balance these and introduce the issue of resource and ecosystem perspectives.

- Animals need a lot of feed. Of the energy that a warm-blooded animal eats, 80-90% goes towards life processes. 10-20% can be used by humans as meat or milk.
- Free grazing animals require pastures, yet do not compete directly with human need for arable land. Furthermore, you can get manure for your fields.

To figure out exactly how much arable land is needed to grow food for one person is quite complicated, but we calculate in the exercise that there is needed at least 1/3 hectares of arable land per person. (On the island, you can probably get 3,000 kg of wheat per hectare. 10% will be needed to seed. The remainder can be used for food or animal feed). Don’t get stuck on too many calculations. It is the overall understanding of ecosystem services that is important.

Suggested questions regarding cultivation:

- What plants can be grown in our climate in the open? Which can be grown in a greenhouse?
- What plants should you grow to cover the entire year’s food needs (think of energy, vitamins and other nutrients, and to be able to cook good food)?
- Do you need to think about growing food for some animals?
- Do you need to think about growing plants to make clothes? (For simplicity, you can just cover this part briefly)
- What is needed in order to cultivate? (seeds, plants, light, water, nutrients, heat, pest control ...)
- Which ecosystem services are used in the growing of food?

Facts about some animals

Pigs

A pig sow gets about ten piglets twice a year. Pigs need about the same food as humans. To grow enough feed while the pigs must have feed can be difficult. Can the pigs roam freely and seek their own food by rooting in the soil, or by eating acorns and food waste from households?

Cows

Cows can be brought up on ”grass, clover and leaves.” A cow with a growing calf needs about 5 tonnes of grass in a year. It requires approximately one hectare (100x100 meters) farmland for this. Some of the fields on the island can be used to grow clover, but most of the feed must be taken from grasslands and forests. The cow can graze on grassland and forest in the summer. It takes a lot of work to gather food for the winter from the forest. Maybe you need to grow hay and clover? A cow on the island, which only eats grass, gives 3,000-5,000 liters of milk per year (much smaller than a cow in a ”normal” farming setting). An adult drinks a gallon of milk a day. Can you save or preserve the milk in any way? Cheese, butter?

Sheep or goats

Sheep and goats are a good alternative to cows or pigs. They can be fed on grass and woodlands. A sheep or a goat needs 1-2 kg of feed per day (more if there is fresh feed). A goat that lives on grass can produce 1-2 liters of milk per day from March to December. With a little more grain and peas, it can be 2-3 liters a day (milking sheep can produce 0.5-1 liters of milk per day during the period from March to December, but it is unusual to be able to be used for milk production). During January-March, a goat gives birth to 1-2 offspring, a sheep: 2-3 lambs.

Laying hens

The hen requires about the same type of food as humans. A laying hen needs approximately 130 grams of grain per day. It is fine to feed the hens with a mixture of grass and food waste, supplemented with some grain. If you let the hens roam freely throughout the summer, they themselves look for and find most of their nutritional needs. A hen that lives under these conditions will lay at least one egg every other day.

Wild animals

The wild animals are in our country make up a very small part of the diet, except for the families who themselves hunt. In the island perspective, hunting can be inserted as an ecosystem service from several perspectives, but in the perspective of ”food”, it plays the same role as ”spice” or ”picking berries and mushrooms”. The wild animals can contribute in several ways. Discuss this.

Fish, mussels, crustaceans, algae?

The food council’s advice in Sweden regarding fish consumption is: ”Eat fish often, ideally three times a week.” Is that a reasonable level if the sea’s marine ecosystems are to be preserved? There is no definite answer to the question, but worth considering. Can the sea and its content of fish, clams, shellfish and algae be the solution for a large part of supplying the food needs on the island? It is reasonable and a way to deepen our knowledge about the coastal ecosystem’s significance. Perhaps one meal of fish a week is sustainable if we translate ”island” to the total fish stocks on planet Earth. Fish stocks in the sea are also often used to produce animal feed. WWF has, on its website, a list of which fish are OK to eat from the perspective of a sustainable ecosystem service.

The material ”Food on a Sustainable Path”, from WWF, is a resource that can be used if you want to immerse yourself in energy issues.

People, food and recycling

An adult in Sweden eat 600-700 kg of food per year. Each person excretes 100-150 kg of feces and 300-350 liters of urine per year. Urine contains about 7 grams of nitrogen and 3 grams of phosphorus per day - plus a lot of other nutrients. Taking care of all the excrement from people and the depth of the island is a key to having a good cycle. To separate urine from feces is a way to minimise the spread of disease. Urine contains no bacteria. Easy from humans, difficult from animals ...

About boys and girls, male animals and female animals.

One issue that may come up is whether male animals are needed on the island, and if so, how many? They are necessary for new calves, piglets, lambs, children, etc.., yet they require a lot of resources in relation to their ”benefit”.

How do you ensure that there will not be inbreeding? Concepts such as biodiversity, population size, ethics, insemination, etc.. often arise in these arguments.

Transportation

Transportation: How will you transport yourselves and the things you want to bring?

Moving around is a necessity in society - and one of the major environmental problems. On the island the students think about which services are needed. Walking, cycling, paddling, sailing or using animals as a means of transport will surely come up. Some teams would surely want to have cars, tractors and trucks. Then it will be necessary with roads, which is entirely possible. Connect the issue of fuel for cars. Electric vehicles, which are powered by electricity from water, wind or solar power, biogas, ethanol or bio-diesel may be possible. Creative proposals such as hot-air balloons, ropeways etc.. should be encouraged. It is important to connect the need for transport to the question of resources, renewable fuels, and lead reflections towards which free services from nature we can use.

Energy

Energy: How will houses be heated? What do you need electricity for and how do you get electricity?

Energy is needed for heating, cooking, lighting, electrical appliances, etc.. Focus on how it can be produced in a sustainable manner. Heat is easier to produce than electricity.

Is it possible to store energy in any way? In wood through photosynthesis, by collecting water at high altitude by producing biogas, and so on. Immersing themselves in how solar collectors and photovoltaic cells work, or how to produce biogas, or how a wind turbine works can be a task for any group. The material ”Energy on a Sustainable Path” from the WWF is a resource that can be utilised if you want to immerse yourself in energy issues.

Exercise ”The mysterious island” is complex. Try to keep the focus on ecosystem services and accept, as a basis, simple explanations of technical solutions based on these, without reading analysing them too much.

Read more/inspiration/sources:

The mysterious island, Recycling Operations, Keep Sweden Tidy Foundation

Eco-island, Eco-8 www.eco8.se

3 years on the island, LRF School Contact, www.lrf.se (> We work with> School)

Fish for dinner? WWF’s consumer guide for more environmentally friendly purchasing of fish and seafood products, www.wwf.se

SUPPORTING SERVICES

”Supporting services” are called the services from ecosystems to help other processes in nature to work. They are essential for life on Earth.

Supporting services are:

1. Photosynthesis
2. Soil formation
3. Nutrition in nature
4. The water cycle
5. Habitats for various species
6. Biodiversity

PROVISIONARY SERVICES

Provisionary services are nature’s services that we humans can directly use and need to survive.

The provisionary services are:

1. Drinking water
2. Food
3. Fuel
4. Medicine and health resources
5. Raw materials

REGULATORY SERVICES

Regulatory services are the natural services that allow nature to resist or fix temporary problems and also protect humans from difficulties.

The regulatory services are:

1. Control of erosion
2. Water purification
3. Protection against disease
4. Protection against pests
5. Protection against natural disasters
6. Better climate
7. Purification of air
8. Pollination

CULTURAL SERVICES

Cultural services are those services in nature that make us humans glad, happy and give meaning to life. Culture is about lifestyle and wellness.

The cultural services we have chosen are divided as follows:

1. Beauty and spiritual values
2. Outdoors and tourism
3. Nature inspires and provides knowledge
4. Health and relaxation

The water cycle

How are clouds, rain, lakes and drinking water formed?

The water circulates through the countryside in a large loop between the rivers, lakes, the sea, plants and animals. The water in the lake evaporates, it becomes cloudy, it rains, the rainwater becomes lakes ... Water is essential for all life. The water cycle also serves as means of transport for different substances.

Nutrient supply

I need different substances for my body like fats, vitamins and proteins, but what does a plant need?

Plants, animals, fungi and microorganisms break down the waste in the environment, releasing nutrients to plants. This occurs in a cycle. Nutrients such as nitrogen and phosphorus move in a large cycle. Everything goes around.

Soil formation

How is soil formed that plants grow in?

Soil forms when living animals (insects, worms, bacteria) break down and mix dead plant and animal parts and animal manure with sand, clay and minerals that erode from the ground. Nutrients are then set free and the soil becomes loose and can retain water and provide oxygen to plant's roots.

Photosynthesis

Where does the oxygen to my lungs come from? Why are the apple and carrot sweet?

The green plants are solar panels. They capture the energy in the sunlight's rays. All green plants collect solar energy thanks to the green pigment chlorophyll found in plant cells. With the help of carbon dioxide from the air and water, the plants convert solar energy into carbohydrates (sugars). This causes the plant to live and grow. Photosynthesis also provides oxygen to all life on earth. Photosynthesis is the foundation of most ecosystems.

Food

Food is essential, but how does nature help us with food?

For us to grow potatoes, wheat and apples it requires functioning ecosystems. We get all our food from plants and animals. We grow strawberries, we have dairy cows, we hunt moose and we fish cod and so on. We must ensure that the ecosystems that give us our food are not destroyed or impaired.

Drinking water

Every day we drink water, but where does the drinking water come from?

Drinking water is essential for life. If we do not drink we die within a few days.

In nature, there is plenty of water in lakes, rivers, clouds and more. Nature receives rainwater. It is purified and stored as groundwater in the ground. We can pump up this clean water.

There is also water in lakes, rivers, streams and in ice. The entire cycle of water through different ecosystems is a major and essential free service from nature. The water that is not fit to drink we can still use to irrigate potato fields and more.

Genetic and biological diversity

Why are there so many different kinds of birds and fish?

Nature likes diversity. Different colours and shapes, sizes and looks. Many different kinds of genes and species mean that there are many solutions for ecosystems to work, evolve and resist change. In the rainforest, for example, there are millions of plants and animals. It is hardly noticed if a lizard becomes extinct.

Different habitats, plants and animals also mean that we appreciate nature for its beauty. TV's nature programs are so popular. Is it because you get to see so many strange plants and animals?

Habitats

A "slug" crawling on the grass, why is it so content there?

A garden is perfect for the slug. There is food and moderate humidity.

A functioning habitat contains everything a plant or an animal needs to survive – such as food, water and shelter.

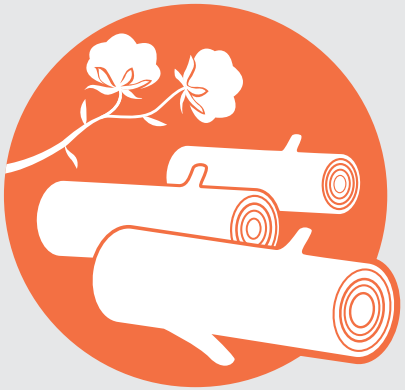
Examples of similar habitats: sandy beach, rocky shore, seabed, spruce forest, swamp forest, farmland, ditch.

Control of erosion

Can nature help us to protect ourselves against landslides?

When it is raining or very windy, soil and sand can be transported away. It is called erosion.

It is quite natural, but it may be too much. Soil erosion is a major problem in many areas where nature is being used too much. Plants and their roots stop soil erosion. Allowing forests to remain or planting new trees are important measure to help reduce erosion. Especially where the ground slopes it is important with grass and trees that bind the soil.



Raw materials

Where do the materials in rubber boots and the fabric in pants come from?

We humans get a lot of raw materials from nature. The list is endless on what we use from plants and animals in nature. Fibers for clothing, paper, upholstery, furniture, rubber, wax, oils and glues are just a few examples. Nature is like a giant shopping mall where we get material almost for free.

Today we are about 7 billion people on the globe who all need a lot of clothes and things. Nature's ecosystem services are working hard!

Medicine and health resources

Can dandelions and lady's mantle cure diseases?

Humans have always used plants from nature as medicine. Some plants can be used to cure or mitigate disease or to protect us from insects.

Many of today's medicines, health resources and cosmetics have evolved from substances in plants or animals in the wild. Perhaps 40% of all the medicine comes from the rainforest. A large biodiversity is like a pharmacy for the future.

Fuel

Every day we need to heat our homes and need energy to cook, but where does all the fuel for this come from?

Today we use a lot of oil to heat our homes and to supply electricity to our cookers. In poor countries a lot of wood is used, which means forests disappear. Wood that is gathered is the most common energy source in the world.

We need to use fuel from renewable resources instead of oil and coal. Wind and solar power are good.

Biogas is a good fuel source that can be obtained by letting waste decompose without oxygen.

Protection against natural disasters

Can nature protect us from hurricanes and floods?

If nature works well then it can protect people from natural disasters. Natural disasters are becoming more common, affecting more and more people.

Plants hold soil and moisture and prevent soil from being blown or washed away.

Wetlands can capture and delay water masses.

Forests and other vegetation along slopes hold in soil and nutrients and slow up downpour rains.

Forests near the coast and coral reefs in the ocean can hold water, stop the wind and waves and prevent flooding during hurricanes.

In cities, it is important with plants as protection against the wind. Green land can take care of overflowing water.

Protection against pests

How can we protect ourselves from mice and other pests?

In nature, it is a constant struggle between different species for food and habitat. If there is plenty of food and good protection for a species, it increases in numbers.

Almost all animals have natural enemies e.g. ladybirds. Both the larvae and adults eat aphids. Spiders, hoverflies, ground beetles, birds, bats, hedgehogs, frogs and toads are our friends. They ensure that pests do not increase too much.

These friends mean that the need for chemical agents reduces!

Snow and cold are great fighters of many pests.

Protection against disease

Can nature protect us against diseases?

Diseases affect humans, animals and plants. Some serious diseases for humans that are spread by animals are malaria, sleeping sickness, bilharzia and dengue fever. We use both medications and toxins to fight diseases.

Almost all animals and plants have a natural enemy. Both insects, fish, birds and other animals can prevent a serious disease from spreading by eating the animals that spread the disease.

Snow and cold are great fighters of many diseases.

Moreover, if the water purification works in nature, this reduces the risk of diseases spreading even more.

Water purification

How does nature purify dirty water?

When water flows through nature, it can be slowed down. It's good because then it gets purified. It flows through the earth, or lakes, and then gets filtered. Sludge and waste is captured by plants and animals. Bacteria and microorganisms help to "eat dirt", take care of the organisms that can cause disease and "filter away" toxins. Nutrients such as nitrogen and phosphorus are cleaned and absorbed by plants.

Beauty and spiritual value

Is nature God?

Nature provides us with aesthetic experiences and inspires artists and performers. Think of all the beautiful paintings and fine summer songs.

For many people, everywhere in the world, nature is something that we are a part of. Nature is something bigger than us. It provides security, comfort and a feeling of belonging.

For example, for native Indians, nature is very important. One respects and worships it. This is the same for many other cultures. Many places in nature are special and have a special meaning for people. People who live a good life by appreciating nature's services often want to protect it.

Pollination

What if bees and bumblebees were to disappear?

For blueberries to reproduce, pollen must be transferred from one flower to another. Otherwise there will be no good blueberries. Poor pollination equals poor harvest. Bees help pollinate blueberry flowers.

Over 90% of all flowering plants and more than two-thirds of the most important crops that we grow for food need the help of bees, bumblebees and other pollinators to reproduce. The rest pollinate themselves or with the help of the wind. Pollination allows harvests to become larger, there will be more flowers and more animals that can live on the seeds and fruits that plants provide.

Purification of air

What benefits do trees provide in a city?

Trees and parks provide a more even and pleasant temperature in cities. They see to it that the temperature does not change too much.

Trees and other plants are also important for air quality because they remove pollutants from the atmosphere. They act as filters for pollutants. Dust and the like get trapped in the leaves. Some plants and ecosystems can even take care of toxic or harmful gases.

Better climate

Can forests make the climate better?

Trees and other plants take care of the greenhouse gas carbon dioxide. Even the ocean stores carbon dioxide. When you cut down a forest and maybe burn it up without planting new trees, this increases the greenhouse effect. This is because the stored carbon dioxide is released and because the forest's ability to absorb and store carbon dioxide decreases

Health and relaxation

Can I feel better if I'm out in nature?

Being out in nature, hiking or playing sports is both good for physical exercise and to help people to relax. Research shows that green nature causes people to handle stress, get well faster after illnesses and can maintain their health and happiness.

There are even doctors who write prescriptions to be outdoors.

Nature inspires and provides knowledge

Can I learn something from nature?

Nature, biodiversity and natural landscapes are a source of inspiration for musicians, poets, painters, dancers, sculptors and other artists.

To understand how things work and to find new solutions to problems we can study nature.

Industry is sometimes inspired by nature's solutions and uses ecosystem services to develop products and services.

Outdoors & tourism

Can I make money from nature?

Tourism can provide much revenue for tourist operators. Think of rafting, camping and mountain hiking. We want to visit exciting places and experience nature. Through outdoor recreation and nature tourism, we get our own experiences and understand that it is important with biodiversity and protecting ecosystems. Beautiful scenery and well-functioning ecosystems with animals and plants are important for tourism to work.

NATURE'S SERVICES

A handbook for primary school about ecosystem services

MIXED SOURCES

ECOSYSTEM SERVICES

The services that nature provides without human assistance are called ecosystem services. They are often essential for our survival. They cost nothing; they are a kind of a free lunch.

FOUR CATEGORIES

Ecosystem services can be divided into four categories: supporting, provisioning, regulating and cultural. They provide a wide range of benefits including soil formation, oxygen production, access to firewood, water purification and tourism.

CURRICULUM

For the first time the Swedish curriculum Lgr 11 as introduced the concept of ecosystem services. This is to be taught as early as grades 4-6.

PRICE TAGS ON NATURE

It is possible to estimate the value delivered by ecosystem services such as pollination. A price tag makes it clear that we are dependent on nature and that the relationship has a palpable value.

THE PURPOSE OF THIS TUTORIAL

The purpose of Nature's Services is to make that which is invisible visible in an enjoyable and inspiring way. The material targets educators and students aged 10-15 years. It is designed to promote student action competence. Knowledge about ecosystem services engenders motivation – the desire to do something active for a sustainable future.

WWF

Why we are here
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

www.panda.org/earpo

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